THE INTERNATIONAL SOCIETY
OF UNIFIED SCIENCE

Periodicals Collection

Reciprocity

Volumes XXI – XXV
1992-1996

The Journal of the International Society of Unified Science
Notes on the Periodicals Collection

Bruce Peret, Editor

As an aid to locating a specific article, I have added a uniform page numbering system to the lower corners of each periodical. Each page number is composed of 4 components, the Collection “Set” letter, the Volume and Number of the issue, and the page number as it appears in that issue.

Reciprocity Format

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ISUS News Format

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This numbering system allows you to flip through the bottom corner of the set to locate a specific article, without having to locate the cover and then locate the page. ISUS News issues, being published much later but having the same Volume.Number-Page format, are preceded with an “I:” to distinguish them from a Reciprocity issue.

Some issues of Reciprocity began page numbering starting with the cover page, while others began with the first article page. The latter will not have page numbers on the cover pages. Also, the last page was usually a short catalog of books. These have been replaced with a blank page, to avoid confusion with the current catalog.

There is also quite a variety of type styles and sizes. Many of the early issues were printed on 8½ x 11 paper, and folded in half, making the text very difficult to read because of the small size. These smaller issues were enlarged with a photocopier and I did the best I could to fill in many of the blurred and missing words and letters.

There are a number of places where there are handwritten corrections, which were sent to me by the authors. I corrected as many of these errors as I could, but there are undoubtedly many more—and many more yet to be made. As the former Editor, I have noticed that mistakes are invisible until you get several hundred copies made—then they stand right out. If you would like to report any errors you find, please report them via the ISUS website, www.rstheory.com.

Bruce Peret
Editor, Secretary, Webmaster
The International Society of Unified Science, Inc.
May 15, 1998; revised February 10, 2008
This Collection is dedicated to the Memory of

*Dewey B. Larson*

for having the courage and determination to conceptually “go where no man has gone before,” and

*Dorothy E. Larson*

for her patience, understanding and steadfast support.
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A physical location in space is a point or segment of the line of the space progression at a given time.

Dewey B. Larson

... overcome the difficulty of never being able to decide, from physical phenomena, whether space which is supposed to be stationary, may not be after all in a state of uniform translation.

21 Dec, 1908 at Cologne, "Space and Time" - Herman Minkowski

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Motion Prior To Rest
Frank H. Meyer

(The gist of this paper, titled "Motion Absolute; Rest Relative", was presented April 25 at the University of St. Thomas in St. Paul to the 1992 Joint Meeting of the Minnesota Area Association of Physics Teachers with the Minnesota Academy of Science.)

Introduction

Does space permanently rest at zero speed with time progression, as Einstein\(^1\) and Newton\(^2\) say, and remain always the same?

Or does space progress with time progression at the unit speed of one natural unit of space (4.55 x 10\(^{-6}\) cm) and one natural unit of time (1.52 x 10\(^{-16}\) sec) equal to the "speed of light", as Larson\(^3\) says?

A closely related question: "Is Space Extending or are Galaxies Moving Apart?"\(^4\)

Traditionally, space at mathematical zero speed or some other specious state of rest has been preferred. Some state of presumed absolute or relative rest is chosen as the origin of a reference frame thought to be most appropriate for expressing any motion of the physical universe.

However, mathematical zero speed is not necessarily the only choice or the better choice of initial criterion for measuring and graphing motion. Di Marzio\(^5\) reports that: "There exists in all of nature velocities of only one magnitude. The numerical value of this magnitude is that of light in free space."

Ignorance of this fact has led to the modern misconception that all motion is only relative and that space and time and mass are always relative to the motion of matter.

If available, a better choice of reference frame origin would be an absolute finite speed, which absolute zero speed is not. Absolute zero speed, like infinite speed, depends upon space and time being continuous. More of this later.

That mathematical zero speed is not necessarily the only or the better choice of reference frame origin for representing the meaning of physical phenomena has been proposed by Larson. He has discovered that after all the physical universe has its own preferred natural system of reference. The origin of the natural system of reference is unit speed, more suitably depicted by mathematical unity, the physical zero, instead of mathematical zero.

Mathematical unity denotes the three-dimensional absolute outward uniform finite unit speed of space-time progression. Unity connotes the steady or equable united outward progression of all physical locations whether or not occupied by photons, neutrinos or other massless particles.

Larson further identifies the primary outward progression of the natural reference system relative to the stationary reference system as the "expansion of the universe", reported by the astronomers.

His explanation of the source of the expanding universe is more credible to me than the popular "Big Bang" hypothesis. As Silk\(^6\) has indicated, "The central thesis of Big Bang cosmology is that about twenty billion years ago, any two points in the observable universe were arbitrarily close together. The density of matter at this moment was infinite." Thus, the "Big Bang" hypothesis introduces infinity into a subject where it has no business.

Rest Cannot and Does not Physically Exist

Not until recently, according to the best of my knowledge, did any physicist ever point out that experimentally rest or zero speed, like infinite speed, has not ever been found to exist throughout the physical universe. The wise Nobel Laureate physicist, Max Born, alluded to this fact when he remarked how odd it is that there is a word for something which, strictly speaking, does not exist—namely rest.

The reason for the non-existence of physical rest is that while humankind is infinitely malleable and valuable, the physical universe, as a whole and in all its parts, is not. Infinity, strictly speaking, is excluded from the physical universe. Infinity includes infinitely divisible motion, infinitely divisible space and/or infinitely divisible time as well as infinitely divisible light, infinitely divisible electricity, infinitely divisible magnetism, infinitely divisible matter, infinitely divisible multiplicatively inverse matter(co-matter), etc. Thus, the space-time continuum postulate
of Einstein is at best only a virtual reality, an unconfirmed hypothesis without experimental support.

All physical entities and phenomena are manifestations of discrete units of motion in the Reciprocal System of Larson. Their speeds are measured in terms of $1/n$ and $n/1$, where $n$ is finite, but not zero. No infinity is possible. The Reciprocal System identifies all motion as the relation between a time magnitude and a space magnitude and implies that the quantity of motion is finite.

Motion in the Reciprocal System is defined as the relation between two uniformly progressing reciprocal quantities, space and time. The definition accounts for Larson calling his physics the Reciprocal System. It is revalued and unified physical science, which removes the contradiction between Einstein's affirming that the physical universe is finite and postulating that motion, space and time are continua. Motion, as defined, is measured by speed, the scalar magnitude of the relation between space and time.

Further experimental evidence is available to indicate that rest or zero motion is not prior to finite motion, since rest does not physically exist. Reexamine the essential relation between motion and temperature in the light of quantum physics.

It is well-known that with increasing temperature molecular motion increases and that with decreasing temperature molecular motion decreases. If infinite temperature does not exist, then probably neither infinite speed physically exists, even in Hell, nor has Hell any physical location. Zero speed or rest requires that at least a minimum temperature exists and that at the minimum temperature all motion ceases. Such a minimum temperature experimentally has been found, theoretically established and validated. It is absolute zero on the Kelvin scale; -273.16° on the Celsius scale. However, the consensus among physicists is that while molecular motion ceases at absolute zero Kelvin, all motion does not cease.

Priority of Rest in Traditional Physics

Our European and American predecessors in natural philosophy and physics usually have preferred arbitrarily to commence from one or another state of rest when endeavoring to reconstruct virtually the making of the various sectors of the physical universe. Aristotle and Ptolemy proposed as their physical zero an absolutely immovable Earth, located at the center of the Universe. Copernicus postulated an unmoving Sun as his physical zero. Kepler, Galileo, Barrow and Newton posited an absolutely immovable Space remaining always the Same. Einstein and Minkowski followed by most quantum and relativistic physicists, assumed, as their physical zero, a Four-Dimensional Space-Time Continuum, to which it is forbidden to apply the Idea of Motion.

Evidence has been submitted that motion is absolute as well as relative, that motion is prior to rest and that rest is relative to motion. It is simply not true that rest or zero motion is absolute in physical actuality, while finite, non-zero motion is relative to rest. Therefore, it is more meaningful to measure all finite speeds as displacements from the speed of light magnitude than from the mathematical zero magnitude. To suppose that these two procedures are equally acceptable is to teach ambiguity instead of truth. It is like the answer offered by the job-seeking teacher to the question asked by the prospective superintendent employer: "Do you teach that the Earth is flat or that the Earth is round?" "Oh, I can teach that either way." Similarly, it does make a difference when the mode of the expanding universe is taught either way: the galaxies are moving apart through a stationary space at a speed proportional to distance or space-time is uniformly progressing with gravitational motion acting against the outward motion.

Priority of Motion in Larson's Physics

"The physicist who speaks physics with us, inviting us to see that the things we thought were there are not things at all. By learning new limitations from such a person, we learn not only what to look for with them but also how to to see the way we use limitations. A physics so taught becomes poiesis."

It is not possible to begin to understand Dewey B. Larson's new light about motion and space-time without realizing that he does not acknowledge the physical universe to be only a world of things, a universe of matter. He also does not see space-time only as a mere medium, container and/or stage for things to
act in or on. Nor does he see time as "a mysterious illusion of the intellect." Nor does Larson see motion merely as a property of things, of matter. Rather or instead, Larson sees matter, magnetism, electricity, light, etc. as speed displacements of various kinds of motions from the unit speed of the primary motion: space-time motion or progression. All physical entities and phenomena are complex combinations of simple, elementary instances of motion: translations, translational oscillations, rotations, rotational oscillations, etc.

Larson's physics introduces two new concepts into physical science: the concept of physical location and the concept of scalar motion.

The nature of these new concepts can be illustrated by a consideration of the "expansion of the universe" that is postulated in the astronomers' latest theory of the recession of the distant galaxies. As explained by Paul Davies, "The expanding universe is not the motion of the galaxies through space...but is the steady expansion of space." Since the galaxies, on this basis, are not moving through space, each galaxy remains in what Larson calls a physical location in space. This physical location is moving outward in the context of the stationary spatial reference system, carrying the galaxy with it. While only the galactic motion can be observed, all physical locations necessarily participate in the outward motion, irrespective of whether or not they are occupied by galaxies.

Inasmuch as all galaxies and the physical locations that they occupy, are moving uniformly outward from all others, each is moving in all directions. A motion distributed uniformly over all directions has no specific, or inherent, direction; that is, it is scalar. Thus, the expansion can be described as a positive scalar motion of all physical locations (represented as outward in the spatial reference system). Larson's theory defines a universe of motion, in which scalar motion of physical locations is not a unique phenomenon, confined to the expansion recognized by the astronomers, but is the basic form of motion from which all physical entities and phenomena are derived.

Its account of the reasons for the universe expanding the way it does is just one particular among many achievements already credited to the Reciprocal System of Dewey B. Larson. What distinguishes the Reciprocal System of Theory from the Relativity Theory of Einstein, the Theory of Mechanics of Newton and the Quantum Physical Theory of Bohr is that it is not at all a particular but at last a General Theory of physics, whose aim is to put together the bits and pieces of the specialists of modern physics in order to unify the science.

Larson has remembered what both Aristotle and Leonardo da Vinci enunciated: Who would understand Nature must endeavor to understand Motion.

The Reciprocal System of Physical Science is a unified general theory and practice, predicated upon some of the most commonplace, near-at-hand, yet most ignored and misunderstood facts about the structure of the physical universe: that it is a three dimensional universe of discrete units of motion, in which motion is the relation between two uniformly progressing reciprocal quantities, space and time and in which motion or its equivalent, space-time, is prior to matter and energy.

Primary motions in the Reciprocal System are defined as those which can exist independently of the existence of motions of other types. Space-time progressions are primary motions; motions of matter are not. The primary motions are absolute; The motions of matter do not exist independently of the primary motions, but relatively to them in coordinate space, while the primary motions exist in clock space.

By reason of the postulated reciprocal relation between space and time, each individual unit of motion is a relation between one unit of space (4.55 x 10^-6 cm) and one unit of time (1.52 x 10^-16 sec), a motion at unit speed.

A physical location in time is defined as a point or segment of the line of the time progression at a given place.

A physical location in space is defined as a point or segment of the line of the space progression at a given time.

Inasmuch as we postulate that the universe is three-dimensional, we may represent the scalar progression of time by a line in a stationary three-dimensional temporal reference system, measuring the
Summary of the Advantage of Larson's Reciprocal System So Far

At this point Larson has arrived, by deduction from his basic premises, at an explanation of the general background of the physical universe that is essentially in agreement with the astronomer's assumption. (Larson's derivation leads to a uniform outward speed, rather than a speed that varies with the distance, as produced by the kind of an expansion assumed by the astronomers, but this difference is easily accounted for, because there is a known force, gravitational motion that acts against the outward motion, with a magnitude varying as an inverse function of the distance.)

The advantage of deriving this explanation of the universal background from a set of general premises, rather than merely assuming its existence, lies in the fact that further deductions can be made from these same premises. Instead of a single process involving the universe as a whole, the explanation that Larson has derived from the premises of his theory of the universe of motion identifies the expansion as the result of outward expansion of individual physical locations. This opens the way for the existence of other scalar motions of the same physical locations. Larson calls these other motions independent motions and they include photons of low and high frequency, electrons and positrons, atoms of matter and their multiplicative inverses, cosmic matter, etc.

I will conclude for now with a brief summary report about how the Reciprocal System of Larson fully accounts for the way the universe is actually expanding by properly taking into account one of the physical universe's principal independent motions: namely, gravitational motion.

At relatively short distances gravitation predominates, and the net motion is inward. Since the gravitational motion decreases with distance, while the outward progression remains constant, the opposing motions reach equality at some greater distance, which Larson calls the gravitational limit. Beyond this distance the net motion is outward, increasing with distance and approaching unity (the speed of light) at extreme limits.

(This theoretical pattern of net speeds is verified observationally by measurement of the Doppler shift in the radiation received from the distant galaxies.)

corresponding progression of space by a scalar device, a clock.

Inasmuch as we postulate that the universe is three-dimensional, we may represent the scalar progression of space by a line in a stationary three-dimensional spatial reference system, measuring the corresponding progression of time by a scalar device, a clock.

The initial point of the progression of an individual unit of motion is zero. As the distance between two points cannot be less than zero, it follows necessarily that the primary motions are necessarily outward, increasing the distances relative to the initial points.

Any two physical locations are progressing outward from each other at unit speed; that is, their separation is increasing at the speed of one unit of space per unit of time.

Larson sanctions that reference frame in which the primary motions do not cause any change in the positions of physical locations as the natural reference system.

From the foregoing it follows that the natural reference system is progressing outward at unit speed, relative to the spatial reference frame.

Larson identifies unit speed as the speed of light. (The various features of the theoretical universe emerge from the deductive development without labels. It is therefore necessary to identify the physical phenomena to which they correspond. The correlation is usually quite evident, as in this instance. In any event, it is self-verifying, as any error would quickly show up as a discrepancy in the subsequent development.)

Since Larson's postulate specifies that nothing exists other than discrete units of motion, and the natural reference system is a direct consequence of the existence of the primary units, this reference system is the framework, or background, of the universe of motion, and does not represent any activity in that universe. The natural reference system, as defined, is therefore the physical zero, or datum level, from which all physical activity extends.
References and Notes

1. Einstein, A. Sidelights on Relativity Dover 1983 Reprint of 1923 E.P.Dutton Edition p.23-24 “Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory space without ether is unthinkable... But this ether may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time. The idea of motion may not be applied to it.” (Italics mine)

2. Newton, I. Principia, Vol. I. U. of Calif. Press 1962 Reprint of 1729 English Translation, p.6 I. Absolute, true and mathematical time, of itself and from its own nature, flows equally without relation to anything external, and by another name is called duration. (My italics) p.6 :II. Absolute space, in its own nature, without relation to anything external remains similar and immovable. (Italics mine)

   Nothing But Motion (1979)
   Basic Properties of Matter (1988)
   The Universe of Motion (1984).


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From the very beginning there has always been present the attempt to find a unifying theoretical basis for all these single sciences consisting of a minimum of concepts and fundamental relationships, from which all the concepts and relationships of the single discipline might be derived by logical process. This is what we mean by the search for a foundation of the whole of physics... some physicists, among them myself, can not believe that we must abandon, actually and forever, the idea of direct representation of physical reality in space and time; or that we must accept the view that events in nature are analogous to a game of chance.

A. Einstein

From Out Of My Later Years, 1950

pg. 96

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From the quantum phenomena it appears to follow with certainty that a finite system of finite energy can be completely described by a finite set of numbers (quantum numbers). This does not seem to be in accordance with a continuum theory, and must lead to an attempt to find a purely algebraic theory for the description of reality. But nobody knows how to obtain the basis of such a theory.

A. Einstein

The Meaning of Relativity, 1955

pg. 165-166

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It springs to the eye that the tendency of living organisms is to organize their surroundings; that is to produce “order” where formerly there was disorder. Life then appears in some way to oppose the otherwise universal drive to disorder.

Percy Bridgman

***
Birotation and Doubting Thomas
K.V.K. Nehru

This is a response to Thomas Kirk's article in Reciprocity, XX (3), p. 14.

In the course of the study of the Reciprocal System we find that there is a class of persons who are not merely intelligent but very intelligent -- but unfortunately are not intelligent enough. Most of us, perhaps all of us, belong to this category, the average scientist included. Let me explain. It must be recognized that, over ages of tradition and habit, the human mind, in its endeavor to understand the universe, develops what may be termed a 'frame of mind,' which is really a viewpoint. Every concept, old or new, is reckoned or interpreted from the background of this frame of mind. Anything that does not fit into the existing frame is summarily rejected; it cannot be felt as understood. The mind complains that 'it cannot swallow it.'

Paradigm Shifts

In the course of the development of science any new idea or concept that may be proffered would be usually greeted with great enthusiasm and praise if that idea or concept is in conformity with the popular, prevailing frame of mind. On the other hand, once in a while there comes some scientific development which is not merely a new concept but involves a new frame of thinking. Suffice it to cite the examples of the Copernican revolution and Planck's discovery of quanta. Such a development, though it marks real breakthrough and progress, is never readily accepted by the intelligentsia of the time. They commit the mistake of trying to understand the new concepts from the background of the previous frame of thinking whereas, in reality, they must be evaluated from the new frame engendered by the development. The result, of course, would seem to be absurd or contradictory.

In the present case, the viewpoint we have all been addicted to for the past millennia is the one that is germane to the concept of a universe of matter, namely, the inveterate habit of positing every thing as existing in a framework of space and time. We may call this the viewpoint of Container Space. With the advent of the Reciprocal System this viewpoint could be seen to be no more valid. Space and time, according to the Reciprocal System, happen to be the content of the physical universe. The majority of difficulties in understanding my presentation or Larson's can be seen to stem from the inability to relinquish the slavish allegiance to the Cartesian reference frame, namely, the container space, even when the new theory demands it. We shall refer to this as the Fallacy of the Incongruous Viewpoints.

Direction of Rotation

Larson has shown that space in general is not limited to the spatial aspect of linear motion, which alone could be correctly represented in the three-dimensional spatial reference system. He points out that the reference system is deficient in more than one way. It cannot, for example, represent truly the spatial aspect of rotational motion. The rotational space of the electron is such, for instance.

Some experience difficulty in following the nature of rotation. Since a rotating line segment sweeps a disk they imagine that (i) rotation is two-dimensional, and (ii) that in rotation the direction is changing continuously and hence it cannot be scalar. In item (i) there is confusion between the dimensions of space and the dimensions of motion, and they don't realize that one-dimensional rotation utilizes two dimensions of extension space. A quantity is one-dimensional if only one magnitude can completely specify it. Insofar as a rotation as above can be so specified by the number of revolutions per unit time, a single magnitude, it is only a one-dimensional motion. And it is also scalar if the orientation (in three-dimensional space) of its axis of rotation is not specified. From the point of view of motion it is on par with the one-dimensional scalar speed given in, say, cm/sec. The direction relevant is the direction of this one-dimensional quantity, the number of revolutions per unit time, which, however, cannot be represented in any direct way in the extension space, while the one-dimensional quantity, cm/sec, could be so represented.
The difficulty experienced in this connection is due to the unconscious, mistaken assumption that the extension space is all-comprehensive and represents rotation truly. Since the fallacy of container space regards everything to be existing in the extension space and time, it perpetuates the belief that anything not so represented in space and time is unreal, unthinkable or nonexistent. Therefore, one is unable to see that the direction -- which deems it scalar or vectorial -- in the context of rotation is not the changing direction of its radius, but its changed sense of rotation. As Larson amply points out[2], rotation can be represented in the conventional reference system only with the aid of an auxiliary device. For example, using the righthand corkscrew notation we might represent a rotation by a vector of appropriate length pointing in the direction of its axis. Direction, in the context of the one-dimensional rotation then becomes the direction of this vector.

There is nothing new in this representation. We generally adopt it in common engineering practice to denote angular momenta and torques. We may call it 'rotational vector.' As far as any mathematical operation on the rotational vectors is concerned they can be treated as identical to the ordinary vectors. For example, we can vectorially add two rotational vectors as we do with ordinary vectors, or decompose a rotational vector into components. However, we cannot combine ordinary vectors and rotational vectors in any operation. This is because, while ordinary vectors are correct representations, rotational vectors are artificial constructs employed by us to circumvent the limitations of the three-dimensional reference frame. Hence the rotational vector deserves a separate name, something like roctor. Their usefulness lies in the fact that within the domain of the rotational vectors we can carry out all the vectorial operations and hence while they are only artificial representations they, nonetheless, correctly represent the interrelations between them.

When we said that one could be very intelligent but not intelligent enough, we meant that one is unable to see the limitations of the viewpoint of the extension space and is unable to recognize that he is attempting to view all phenomena, whether they fit this viewpoint or not, only from such a viewpoint. Once this is realized, all the points that have been raised can be understood. A re-reading of the articles on birotation without losing the awareness of this fact might now be able to convey correctly what I meant there about rotation and birotation.

Other Objections

I did not elaborate on my use of the word 'fictitious' in connection with the space time progression because I was only paraphrasing Larson's explanation, which follows: "The sphere generated by the motion of the natural reference system relative to the point of origin has no actual physical significance. It is a fictitious result of relating the natural reference system to an arbitrary fixed system of reference."[5] And, "... the postulates require the existence of real units of motion, units that are similar to the units of motion involved in the progression of the natural reference system, except that they actually exist, rather than being fictitious results of relating motion in an arbitrary reference system. These independent units of motion ..."[6]

If one is really concerned about truth, one makes sincere attempts to follow the author, communicate with him for possible enlightenment, or discuss with others. We all have done that with Larson and with each other. Merely launching into a tirade at the slightest conceptual difficulty does not lead one very far. Patience, perseverance, and if we may point out respectfully, lack of conceit are important. They give the higher intelligence a chance to operate. Of course, in the present instance, it never occurred to me that some reader might miss the obvious and fail to discern from the context that the rotation under consideration is the rotation of the atom and not the rotation that constitutes the atom.

Back to the Bivector

Knowing the difficulty one may experience with the analysis of the nature of rotation, we started our original explanation with linear translational motion.[7] We tried to show how the representation of a scalar in the conventional reference frame would be a bivector and not a vector. This explanation proceeds logically and directly from Larson's
treatment of the nature of scalar motion as against vectorial motion. Reading the passage on pp. 33-34, Nothing but Motion and then my article on The Law of Conservation of Direction should establish that we are only carrying out Larson's development to its logical end, rather than indulging in 'free inventions'. The analysis is next extended logically to rotation.

Any way we would like to try once more to see if we can be of help. Let us dwell on linear motion since this does not bring the limitation of the reference frame into the picture and is consequently easier to grasp. Now the first thing we would like to emphasize is that the bivector is tantamount to a scalar. Imagine a bivector XAXB as shown in Fig. 1. Next consider two mutually perpendicular lines making an arbitrary angle $a$ and $90 + a$ respectively with the line AB. Let the two components of the vector XA along these two directions be $X_{A_1}$ and $X_{A_2}$ respectively. Similarly $X_{B_1}$ and $X_{B_2}$ are the two components of the vector XB along these two directions (Fig. 2). On cross-combining the components of the vector XA and XB, such that $X_{A_1}$ is combined with $X_{B_2}$ and $X_{B_1}$ with $X_{A_2}$, we arrive at the resultants $X_{A_1}$ and $X_{B_1}$ as shown in Fig. 3. Thus the original bivector can be transformed into a new bivector $X_{A_1}X_{B_1}$ whose line of action is at an angle $2a$ to that of the original. Since the angle chosen, $a$, is totally arbitrary, this proves that the bivector $XAXB$ is equivalent to any other bivector of the same magnitude extending in any direction (actually, bidirection) in the three-dimensional reference frame. Or what comes to the same, the bivector is tantamount to scalar. Thus when the scalar motion is placed in the context of a spatial reference frame it manifests as a bivector, and not as a vector.

It might be noted that while all the first order quantities connected with the bivector (like momenta) cancel each other out (like mv and -mv), the second order quantities remain additive (like mv$^2$ and m(-v)$^2$).

All that has been said above the characteristics of a bivector is also true of the birotational vector (or bicrot, if one prefers to call it so). While a rotational speed has a one-dimensional magnitude and a rotational direction, and hence is a (rotational) vector, a birotational vector is a pure scalar. Hence if scalar motion manifests in a reference frame as rotation, it would do so as a birotation and not rotation. Manifestation as a rotation would entail the creation of a quantity of angular momentum not existing previously, whereas there is no such need in the case of the birotation.

Finally, I have produced the proof of the pudding in a Paper entitled 'Photon as Birotation' presented at the 1991 Convention (waiting to be published in Reciprocity), wherein I demonstrated how the manifold phenomena connected with radiation do follow logically from the birotational nature of the photon.

The difficulty is shared by all of us who fail to realize that we might be making the mistake of adopting the inappropriate conceptual frame in studying the Reciprocal System. In fact it is fatally easy to slip back into the Fallacy of the Incongruous Viewpoints and not realize it. I have separately made a careful analysis of this and other difficulties we might encounter, in a Paper entitled 'The Quasar Paradox?' sent to Reciprocity for publication.

We must, however, see that discussions like this have done a great service by showing us alternate responses to the Reciprocal System. These latter provide us with valuable insights as to the ways in which an intelligent, well-meaning scientist might misunderstand discussions of the Reciprocal System and end up passing wrong verdicts.

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6. Ibid., p. 45

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The editors of *Reciprocity* welcome papers, especially from new contributors. The requirements that a contributed paper must meet in order to qualify for publication are clarified below. Editorial assistance is available in those cases where a limited amount of revision will enable a paper to meet the requirements.

As stated in the by-laws of the International Society of Unified Science, the objective of the Society is the advancement of the Reciprocal System of physical science. This theory, as it is defined, consists of two fundamental postulates, together with everything that can be derived from those postulates by logical and mathematical processes, without introduction from any other source.

The unitary character of the theory, resulting from the derivation of all its conclusions from the same set of premises, is its most essential feature. It is this status of this theory as a general physical theory - the only thing of its kind - that enables extension of the theory into areas inaccessible to observation.

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1. All items must have relevance to the stated objective of the International Society of Unified Science.
2. Original technical articles must deal with the Reciprocal system of theory, as defined above, or aspects thereof; that is, the propositions supported must purport to be derived from the postulates of the Reciprocal System, or from previously published reached on that basis, without introducing further assumptions.
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The Case Against Reciprocal Symmetry
by Thomas Kirk

In all of his works, Larson adopted the principle that time and space are similar, but with inverse properties, or essentially symmetrical. This concept really should precede his postulates, in that it deals with the nature of time and space. The nature of time and space is not presented in the postulates, though their names are used. Under these circumstances, it is not possible to present reasons, i.e. a deductive development, for a "non-symmetrical" reciprocal relation. Such reasons lie outside of the system of theory as presented by Larson, and a conclusive argument is therefore impossible within RS theory as it is now structured. Until a broader theoretical structure is developed, which is complete and self supporting in this extended area of theory, arguments will only create controversy.

However, the available evidence and also a better definition of the problem can be presented at this time.

The Problem and The Hypotheses

That which is given is the postulates, and they state that motion is three-dimensional, exists in discrete units and has two reciprocal aspects. Using the names time and space for these aspects is really not acceptable, because they are completely undefined. In fact, motion is not defined either, unless we assume a complete understanding of space and time. Unfortunate though it is, we do not fully understand time, nor space. So actually all we really have to go on is the aforementioned properties of motion. In a previous article, I presented a definition for motion which is acceptable, because it does not bring in any other undefined entities:

Unless otherwise specified, motion is one single independent most fundamental physical magnitude.

I have added the word physical to the one originally published, because there may exist more than purely physical "entities". Though these would be outside the physics arena, the distinction may be important to some people.

Before going further, on the cover of Reciprocity, Autumn, 1991, appears a definition purported to be the "Reciprocal System Definition of Motion". This definition does not appear in any of Larson's texts, and if it did, it would be improper, because space and time are undefined, and therefore cannot be used to define another entity. On the same line of argument, the "Physical Location Definitions" published on page 19 of the same issue, have no clarification from whence they came or why they would be the final word on the nature of location. As discussed further on, the nature of location is more elusive than either of these definitions indicate. I feel it is unfortunate that publishing these definitions, has put the entire following of RS theory at risk of seeming perfunctory by association with dogmatic pronouncements about physical principles that are less than fully understood. Larson certainly never made a pronouncement that shifted the responsibility for it to others. These items should be clarified as to their specific source. I am certain that I am not the only one in pursuit of the truth within RS who finds these pronouncements tentative at best.

Putting aside any preconceived notions and with an open mind, we can now proceed with our search for the proper hypothesis. Since time and space are essentially undefined by the postulates, the word reciprocal immediately becomes crucial, as it tells us something about the interrelation between space, time and motion. However, a reciprocal relation between two undefined entities is not enough information to provide much further definition. Still, it is the word reciprocal that is our primary clue.

In actuality, there is not enough given in the problem, unless we add what is common knowledge; space is three-dimensional and time progresses. With these two additional facts we have a chance to proceed, and I believe this was Larson's intention.

With this understanding, the word reciprocal then leads to two possibilities.

Larson's position:
Time and space have the *same* properties, with each property having an inverse nature to its counterpart.

The alternate simpler argument:
Time has an inverse property for each property of space.

Using the latter argument, we could hypothesize that the progression of time is the inverse of the three dimensions of space, a very simple relationship. Simplicity is valued at this level of development, because unit motion is actually physical zero. Space and time have even less reality, since only motion actually exists. Time and space are purely abstractions of the real entity motion. Space and time have no existence whatsoever, they would seem to be purely creations of the mind, when the mind applies a fixed reference system to motion.

This is where we have so much difficulty understanding Larson’s presentation. We do not understand motion, because we only understand it in relation to our fixed spatial and temporal reference system. But to understand space and time requires an intimate understanding of motion. This is the vicious circle in which we are caught up. The only motions that we can hope to understand from this basis are those closely tied to our accustomed reference systems. All motion in time, the photon, motion composing atoms and subatomic particles, and so on will never be understood until we intimately understand space and time, and motion.

Such an understanding must begin with the natural progression, as all other motions are distortions of this one, and so retain the nature of the one. Such an understanding we do not have. For example, what are the three scalar dimensions, the three independent scalar magnitudes that all motions have? There are many questions like this about motion that are unanswered. The answers lie in the true properties of space and time.

The nature of space has always been assumed understood, and time in RS was only known through its being symmetrical with space. Actually neither space nor time are well understood. What we as scientists assume as their reality is only an obscure impression of a much deeper set of principles.

Dealing with time as simply the mirror image of space is not reliable. A much more fundamental understanding of space and time must be developed. What does “location” in time really mean, if in fact it has any meaning at all? My contention is that coordinate time probably does not exist.

It must be realized that even if space and time are not symmetrical, this does not undermine the foundation of RS. Actually the foundation of RS is the postulates and they remained unchanged. The symmetry concept would have to be derived from the postulates but was not so rigorously derived at any point in Larson’s development. The only place he came remotely near a derivation is in the first paragraph on page 13 of Quasars and Pulsars:

"v=s/t...could equally well be written in the reciprocal form, ...time divided by space. ... it is thus evident that space and time are similar entities...any property that may apply to one likewise applies, in the reciprocal form, to the other."

I submit that similarity between space and time does not immediately follow directly from the fact that the equation s/t can be inverted to t/s. Larson himself recognized that v does not equal t/s, but that t/s = E, an entity of a quite different nature. Thus, the inversion is not symmetrical. He must have eventually realized the invalidity of this argument, because he did not repeat it in his later work, Volume I of his summary series of texts, Nothing But Motion. In fact, he presented no such derivation of reciprocal symmetry at all in that volume or any later work.

The alternate simpler hypothesis for the reciprocal relation may not need derivation at all. It essentially only restates the postulates, that a reciprocal relation exists between space and time, or one is the inverse of the other basically. Together, through this relation, they constitute motion. The only thing missing is, what is space and time, which Larson left as common knowledge. This latter circumstance is the area that needs work, not the simple reciprocal relation.

Before proceeding with the evidence, one corollary of the postulates can be established. Since motion is always a relation between space and time, all motion has the characteristics of both space and time in full.
Motion in space does not eliminate time from the equation, time still is part of the motion, carrying with it all of its properties. This is how under the simple reciprocal relation, all motion has three dimensions whether it be motion in time or in space. On the other hand, under the symmetrical relation, all motion would have six dimensions under this corollary, as the evidence will show.

THE EVIDENCE

The first piece of evidence we should review is the manifestation of the natural progression in space, 1/1 pure motion. Clearly as evidenced by the propagation of photons and also the galactic recession, the natural progression is a motion three-dimensionally in space. We would expect that the natural progression would manifest as motion relative to a time reference system also, there being no indication of a preference to one side or the other of the reciprocal relation. However, if that time reference system had three dimensions, there would be three-dimensional motion in space and three-dimensional motion in time coincidentally. This is six-dimensional motion which contradicts the postulates.

This problem does not exist with the hypothesis that time has a property which is inverse of three dimensions, not three dimensions of an inverse nature as with the symmetry hypothesis. Motion in time is a motion characterized by that inverse property, not the property of three dimensions.

The second piece of evidence is the inverse motion, i.e. energy level, of electrons in a crystal lattice. The Pauli Exclusion Principle tells us that no two electrons (with the same spin direction) can occupy the same energy level, regardless of spatial position within the lattice. We see that electrons, essentially particles composed of net space, occupy a location in three-dimensional space and have this energy "location", or progression level, in time. If the reciprocal relation were symmetrical in the exact inverse circumstance, material particles would occupy a location in three-dimensional time and none would occupy the same speed level in space. However, there is no indication of atoms or other subatomic particles having exclusive speed levels in space under any circumstances.

Again this is not a problem for the simpler hypothesis that motion is three-dimensional in space and only progresses in time. The electrons are located in time, since they are essentially particles. Their "location" in time is their progression level or energy level. No two can occupy the same "location" in time, though they can also occupy a location in three-dimensional space. Inversely, no two material atoms can occupy the same three-dimensional space location, but there is no such restriction on their progression level, which is their speed or kinetic energy.

There remain four more pieces of evidence, which are all of the same general type. These are motions in time of objects which retain their one-dimensional spatial direction as they move in time. Again, if time were three-dimensional, such a motion in time would be six-dimensional. The specific direction in space (a one-dimensional motion) in three-dimensional space requires three dimensions for complete definition) of the retained one-dimensional motion is a three-dimensional space property, and then additionally, motion in time would encompass three more dimensions. This contradicts the postulates. Violations of other basic principles by the symmetrical relation will be discussed for each piece of evidence further on.

Motion of Electrons through Matter (1/n motion of n/1 objects moving in time):

Movement of electrons in matter is motion of space particles through space, the inverse of motion of material atoms through space. Such a motion of electrons should be in three-dimensional time if the reciprocal relation was symmetrical, yet again clearly the motion of electrons, current, has a specific direction in three-dimensional space. Is this motion in three dimensions of six? The symmetrical hypothesis would mandate that the motion manifested in space should be non-specific if the object was moving in time, thus avoiding six dimensions. However, this is evidently incorrect.

Photon Displacement (1/n pure motion within unit space):

We see the polarization of the photon is a specific direction in three-dimensional space, retained at all times unless rotated by a magnetic field or other outside influence. Here
again we have a three-dimensional space manifestation of the motion in a specific spatial direction. Yet the motion is always subject to the interregional ratio, clearly indicating that it is a motion bound within the reciprocal region, that of time. We should see this motion in time as completely non-specific in space, since a hypothesized motion in three-dimensional time has not dimensional relation to three-dimensional space. So again we have a motion with six dimensional characteristics for the symmetrical theory. The truth is that every motion has at least one unit of space associated with it, and that unit retains the three-dimensional space attribute, while the motion in time is a progression level, with no specific direction, or non-dimensional.

Motion of Quasars: (n/1 motion of 1/n objects outside unit space)

The motion of quasar aggregates is in excess of 2 units of speed. The first unit above unit speed, the 2/1 unit, brings the quasar to rest in three-dimensional space. This first speed unit in time, the 2/1 unit, acts to take the place of the original unit speed which had a specific direction. Acting in this manner to reduce the speed along a specific alignment is an action in a single direction in three-dimensional space. Once again, there is a clear indication that motion in time retains its three-dimensional space direction, at least for the first unit about unit speed in this phenomenon.

Additional units of speed in time above 2/1 manifest in the total red shift $z + 3.5z^{1/2}$, where $z$ is the recession speed. Exactly the nature of the speed manifestation is beyond the scope of this work, but there is clear indication that a two-dimensional distribution occurs for the $3.5z^{1/2}$ component. This is the portion of the motion contributed by the motion in time above two units of speed.

Larson saw this distribution being in two scalar dimensions, without much elaboration on the concept. However, if we review his writing on pages 287 and 289 of Universe of Motion, he clearly states that the distribution of photon radiation is two-dimensional for pulsars and quasars. This is one of the explanations for the incredible quantity of radiation received from quasars. This makes no sense in a practical sense unless more photons are radiated in certain directions of space than in others. In essence, light from quasars must be emitted radially in a plane instead of radially in a sphere. Otherwise, it is nonsensical that more radiation would be received at a particular point in space from a two-dimensional distribution than a three-dimensional distribution. Unless the radiation is concentrated in a spatial plane, the distribution of radiation in space would remain three-dimensional.

Once we accept this undeniable fact, we are left with the conclusion that quasars emit radiation in a plane primarily. Such a plane has a specific orientation or axis in space, which logically has some relation to its original root translation direction in space. It is unlikely that the axis is dependent on the recession direction speed, because in all cases, that direction is coincident and opposite in direction to the path of the light being received. The recession speed would tend to reduce the ability of the light to reach a point in the opposite direction, rather than orient or focus it in that direction. Also, the direction of the recession varies between observers, while the axis of the plane of radiation does not vary. Further, the idea that the axis is strictly random also is improbable in light of the distinct factors which should have some relevance to the orientation.

Once again, there is clear indication of a definite spatial orientation rooted in the original translation direction for all units of the motion in time of the quasar aggregate.

Though the contradiction of six dimensions keeps coming up in each piece of evidence, there are other fundamental principles violated under the symmetry hypothesis:

1. The latter three items clearly display that besides having a spatial direction in motion in time, the originating motion in a specific direction in space is specifically retained and continues to manifest in the same direction. Based on the reciprocal symmetry argument, all direction in space would be at least non-specific when motion transcends into time. All direction spatial properties should become directional in time and completely non-specific in space. This would yield at best a random direction for motion manifested in space.

2. The second item, electron exclusive energy levels, on the other hand, clearly shows that
there is a property of motion in time which is not shared in motion in space. This evidently is the exact inverse of directional properties that would not be found in motion in time. The lack of symmetry is evidenced here.

3. The third item, current through matter, is in most cases equivalent to cosmic gravitational motion, just coincidentally manifesting in space in a specific direction. This just violates via the six-dimensional problem again. However, in one case, where the current motion is provided specifically linearly by a magnetic field oriented in space to produce motion in a specific spatial direction, the motion produced in time is specific to the originating spatial orientation. Here again we have a motion in time that has an inherent root direction in space.

THE THEORY

We have now exhausted the phenomena available to us for this investigation. All other phenomena are unavailable for one or more of the following reasons:

1. n/1 motion of n/1 (cosmic) particles (motion wholly originating in time)

These motions have no original root direction in space. Their motion in space is non-specific due to its origination, though if we could identify such a motion with a one-dimensional direction, there again would be indication of six-dimensional motion based on the symmetrical hypothesis.

2. 1/n motion within unit space that is three-dimensionally distributed in space originally, e.g. mass/gravitation displacements.

No specific direction in space is tied to the underlying motion. Again however, where such a motion manifests one dimensionally in space, as it always does, this indicates a motion in six dimensions under the symmetrical hypothesis.

3. Motion of 1/n (material) atoms moving at n/1 speeds within unit space.

These phenomena exist in such places as in white dwarf stars where it is difficult (or perhaps impossible) to ascertain exactly the manifestation of motion.

The alternate simple hypothesis has no difficulty with any of the evidence. In every case, the three-dimensional aspect of motion is the motion in space (motion relative to a spatial reference system) and the progression level is the motion in time (motion relative to a time reference system). The inverse aspect is retained for motion in either reference frame. Therefore, as with any hypothesis which agrees with all of the available evidence, a theory for the properties of motion can be structured, subject to verification by all forthcoming evidence:

Motion is the relation between two directly inverse aspects, one being directional and the other progressive.

It immediately follows that at the one to one level, two directly inverse aspects will neutralize each other and the result will be nothing at all, agreeing with the principle that unit motion is the natural reference.

It is possible now to make some meaningful headway into the mechanics of atomic motion and the many other motions in time or within unit space. Unfortunately, a complete understanding will continue to elude us until we fully understand time and space. Though we now have the correct reciprocal relation, we still do not know the complete nature of the two inverse aspects. However, as we have done herein and in basically all previous development, studying physical phenomena sheds light on space and time, and the resultant increased understanding of them reflects back as insight on the phenomena. This is our path.

It is exciting, and at the same time somewhat depressing, to imagine how far Larson might have gone if he had adopted two simple concepts rather than his more complex ones. The simplest phenomenon that he derived was passed by and a more complex one was substituted as the photon. This impacted all later development, when actually, the simpler one was the correct concept. Just as fundamental was the decision to assume that time and space are symmetrical, where as discussed above, the simpler concept is actually correct.
The Quasar Paradox?
K.V.K. Nehru

Paradoxes Galore

Paradoxes bring to light flaws in the logical structure of a theory. We have had the famous twin paradox of the Special Theory of Relativity. In our attempts to understand the Reciprocal System of theory some paradoxes seem to be coming up for consideration. One such paradox, which we will name the Quasar paradox, has recently been mentioned by a student of the Reciprocal System, in a privately circulated communication. Since the correspondent opines therein that this paradox requires revision of Larson’s theory, it might be educative and worthwhile to discuss the issue with a hope to see the truth.

Simply stated the paradox is as follows. Larson[1] establishes that the total redshift of a quasar is the sum of the recession redshift \( z \), and that due to the explosion that created the quasar amounting to \( n \cdot z^{1/2} \) (where \( n \) is normally 3.5). As the distance increases and the recession redshift reaches the value 0.326 the explosion redshift arrives at the 2 unit limit. At this juncture, according to Larson, the gravitation inverts and ceases to be inward in space, resulting in the final disappearance of the quasar into the cosmic sector of the physical universe. Now, in the words of the correspondent, "The problem is that an observer closer to the quasar would see the relation \( z + 3.5 \cdot z^{0.5} \) as less that that seen by a more distant observer (\( z \) being less) and so the speed (in the explosion dimension) would be less than 2 for the closer observer. I ... feel that a quasar cannot both fly apart and not fly apart at the same time depending on one's point of observation." (words in the braces are supplied by me.)

The New Paradigm

We submit that before undertaking an analysis of the paradox it would be fruitful to draw attention to certain factors which act as preconditions for an unbiased appraisal of the Reciprocal System. The first thing to be recognized is that the Reciprocal System involves a fundamental change in our viewpoint concerning the basic constituent of the physical universe. Its principal tenet is that the universe is constituted entirely of motion. The previous viewpoint regards it as a universe of matter. The most important implication of this new viewpoint is that motion (space-time) is the content of the universe, whereas the concept of the universe of matter regards space and time as the background or setting on which matter plays. Throughout the ebb and tide of scientific thinking for the past 3000 years, Larson points out, the one unchanging element has been the 'setting' concept of space and time. This has become a thoroughly entrenched habit in the thinking of scientists and laymen alike.

Man's endeavors to understand Nature have always been impaired by his limited and local viewpoints. He has tended to extrapolate what he perceived and experienced of the local and peculiar environs by merely enlarging their extent, without in the least suspecting that he might not be the centre of the universe. (As somebody remarked, the dog's conception of God would be that of a large ferocious dog gnawing luxuriously at a mountain-size bone.) Only the increased power and scope of his observations have brought to light the fact that his global view is vitiated by his local viewpoint. He first thought the earth flat before realizing it is spherical. Then he went on thinking that his earth is the centre of the universe. The cropping up of innumerable epicycles eventually led to the discovery that it is the sun that is the real centre and so on. Every time such fundamental revolution in the viewpoints had occurred it encountered bitter antagonism and cold reception because the old and new viewpoints were so disparate that the common man and the common scientist of the day could not grasp the truth.

We can now see history repeating itself as Larson discovers that our viewpoints about the most fundamental aspects of the physical universe, namely, space and time, have been, after all, local and limited. The view that space is stationary and three-dimensional and that time is one-dimensional and progressive is only apparently true and applicable only to the gravitationally bound system. Emancipating from this anthropocentric view and recognizing that both space and time are three-dimensional in their own right and
progressive and that they are reciprocally related comprise the new revolution in human thought.

Larson states: "Previous investigators have not realized that the "setting" concept is a creature of the "matter" concept; that is exists only because that basic concept envisions material "things" existing in a space-time setting. In attempting to construct a theoretical system on the basis of the concept of a universe of motion while still retaining the "setting" concept of space and time, these theorists have tried to combine two incompatible elements, and failure was inevitable. ... what is needed is to discard the "setting" concept of space and time alone with one general concept of a universe of matter, to which it is intimately related, and use the concept of space and time that is in harmony with the idea of a universe of motion."[2] Realizing this, Larson has repeatedly cautioned in his works that the findings of the Reciprocal System ought to be adjusted from the standpoint of its basic premise(s) and that endeavors to evaluate the new concepts from the viewpoint of the untenable matter concept of the universe (and the associated "setting" concept) are going to lead to absurd results. We shall term the practice of using this old viewpoint in the context of the new theory the Fallacy of Incongruous Viewpoints.

The danger is especially strong for all of us who happen to live at the junction of the new paradigm of the universe of motion and the old untenable one of the universe of matter existing in a framework of space and time. Since none of us is in a position to maintain that we are absolutely infallible, it becomes imperative, whenever we encounter a difficulty or paradox in the Reciprocal System, to first establish that we have not unconsciously fallen prey to the Fallacy of Incongruous Viewpoints, before we can legitimately conclude that the logic of the theory is faulty.

**Content versus the Container**

Now the crucial point to see is that it is not legitimate to imagine that the quasar is located 'out there' in our co-ordinate space. When we picture the large-scale universe we tend to imagine that the stationary coordinate reference frame—namely, the container space—-as extending indefinitely in the three spatial dimensions and picture quasars and other distant galaxies as studded at specific locations in that stationary reference frame. This, of course, is an unconscious habit of thought carried over from the previous paradigm of 'container space' belonging to the concept of the universe of matter.

On examining we find that the stationary reference frame is an artifact applicable only to a gravitationally bound system of material aggregates. The very existence of the stationary reference frame requires unit inward motion to counter the ever-present unit outward motion of the natural reference system. Otherwise we cannot have a stationary reference frame. This needed inward motion is supplied only by a material system that is gravitationally bound. Therefore, whether we explicitly acknowledge or not, the stationary reference frame can exist only in conjunction with a gravitationally bound system[3].

Since the domain of the net inward motion of a gravitationally bound system ends at its gravitational limit, each such system has its own stationary reference frame. Beyond the gravitational limit the domain of the familiar three-dimensional space does not exist: it is, thereafter, a domain of equivalent space.[4] The familiar three-dimensional space, the space adopted in all our visualizations, ends at its gravitational limit of the gravitationally bound system to which the stationary reference frame is anchored.

The truth that there cannot be one universal stationary co-ordinate reference frame and that each gravitationally bound system has its own stationary reference frame is not immediately and sufficiently recognized. Larson denies "that all spatial locations could be defined in terms of an absolute spatial reference system, and that time could be defined in terms of a universal uniform flow."[5] "In order to get the true picture," Larson remarks, "it is necessary to realized that no single reference system is capable of representing the whole of physical reality."[6]

**The Two-Galaxy Paradox?**

Imagine two galaxies A and B of unequal masses, each beyond the ambit of the
gravitational limit of the other, and two stationary reference frames attached to each respectively. The spatial separation between the two stationary reference frames need not, in general, be the same as measured from A and B individually. This is because each such stationary reference frame is reckoned from the background of the gravitational motion of the gravitationally bound system to which it is anchored and the magnitude of this (the gravitational motion) is contingent on the mass of the gravitationally bound system. The estimate of the intervening distance according to the observers belonging respectively to either stationary reference frame need not be the same since the observer is observing from the background of the gravitational motion in which he is situated, and this differs for both of them.

In fact, this distance is proportional to the recession speed and the reciprocal of the Hubble constant. "... the astronomers have assumed that the Hubble constant is a fixed characteristic of the physical universe..." Larson explains, "The Hubble "constant" ... like the gravitational limit ... is a property of each individual mass aggregate. In application to the galactic recession this so-called constant is a function of the total galactic mass ..."[7] More specifically, we have shown elsewhere[8] that the Hubble constant is inversely proportional to the fourth-root of the galactic mass. We have shown there how the consideration of the mathematical relations that are applicable to the region beyond the gravitational limit directly leads us to the observed linear relationship between the recession speed and the distance that Hubble's law states. More recently we have also shown[9] how the large-scale structure of the distribution of galaxies and voids that has emerged from the latest astronomical observations follows from the theory---both qualitatively and quantitatively---by considering the limitation of the conventional three-dimensional spatial reference frame and applying the mathematical relations appertaining to the region beyond.

Thus, if \( v_{AB} \) is the velocity of recession of galaxy A, as measured by the observer belonging to the stationary reference frame anchored to B; and x and H represent the distance and Hubble's constant respectively, we have

\[
v_{AB} = H_B \times x_{AB} \quad \text{and} \quad v_{BA} = H_A \times x_{BA} \tag{1}
\]

and

\[
(x_{AB}/x_{BA}) \times (v_{BA}/v_{AB}) = H_A/H_B \tag{2}
\]

Then all that we can say about the intervening distance is that \( x_{AB} \) need not, in general, equal \( x_{BA} \). Seeing that the basic constituent of the universe is motion, a plausible assumption is that these two galaxies are connected by the common speed of recession, rather than by a common intervening distance (which would probably be more appropriate to assume in the context of the concept of container space). Then

\[
x_{AB}/x_{BA} = H_A/H_B = (M_B/M_A)^{0.25} \tag{3}
\]

where M represents the mass of the galaxy. This might seem an absurd result, but only if looked at from the unacceptable viewpoint of the "setting" concept.

**Resolution of the Quasar Paradox**

Eq.(2) gives enough clue to resolve the quasar paradox. Whatever happens to the quasar due to the 2-unit explosion speed happens to it in an objectively real manner. But since each observer is making his observation from within his gravitationally bound system, the phenomena pertaining to the excess speed components that cannot be directly represented in his 'absolute space' and 'absolute time' frames manifest variously depending upon the local gravitational motion. It must be realized that the inversion of gravity that marks the entry of the quasar into the cosmic sector is relative to the *local* spatial coordinate frame—not relative to the natural reference frame.

An analogy might help. Imagine an object of mass \( m \) situated on the surface of the earth and two scientists located vertically below the object at depths \( d_1 \) and \( d_2 \) and estimating its potential energy. They would measure it to be respectively \( mgd_1 \) and \( mgd_2 \). Then it would seem that the object has a potential energy \( mgd_1 \) and also not have \( mgd_1 \) at the same time, depending on which observer's standpoint one takes. The paradox disappears as soon as it is recognized that the
datum levels from which the potential energy is regarded are different.

The term "at the same time" occurring in our statement of the quasar paradox can now be seen to be referring to a concept that is not applicable to the quasar situation under consideration, since this turns on the assumption of the existence of a universal, unique co-ordinate frame. What has given rise to the quasar paradox is the committing of the Fallacy of Incongruous Viewpoints: it is not, after all, as contended, due to any flaw in the structure of the Reciprocal System. The quasar paradox typically demonstrates (i) how difficult it is for us to cast off our allegiance to the concept of a universal container space and a uniform absolute time that pertain to the concept of universe of matter that no longer is admissible in the context of the concept of the universe of motion; and (ii) consequently, how we might be misled to wrong evaluations of the Reciprocal System.

Perhaps it is not out of place here to note how rashly and caustically the correspondent condemns Larson’s theory, in the communication in which he refers to the quasar paradox, and discredits his monumental work. It would seem that one tends not only to underestimate Larson’s calibre but also to overestimate one’s own infallibility. Sure and faster progress in the study and research of the Reciprocal System will be accomplished only if we are seeking truth and thoroughly understand the pitfalls a student might encounter. Therefore it might be of some value to dwell on a few more items, in the context of the Reciprocal System, and examine how the unconscious slipping into the old habit of positing everything in the container space might confound our thinking.

Other Conceptual Difficulties

The Time Region. One concept that led some students astray has been that of the time region, the region inside unit space. Since the Reciprocal System asserts that less than a (natural) unit of space does not exist, some tended to interpret that the time region is some kind of pseudo-space. The principal mistake, however, has been to conceptually locate the time region in the frame of the container space. It is not realized that what it really alludes to is a region (or domain) of physical action. The inside of a unit of space, to which the concept refers, is still a region of space, not of any pseudo-space. This example typically illustrates how desperately we tend to hang on to the known concept of space by some stratagem of using such terms as ‘pseudo-space.’

Travel through Time. Another concept that might mislead students is the manner in which the radiation from an object moving away from us at a speed greater than unity reaches us. Larson[1] points out that such radiation reaches us through time rather than through space. Any conclusion that might be reached by inadvertently and unwarrantably assuming universal reference frames is bound to create mischief.

The Spatialization Syndrome. In the speakers of English (and of languages of kinder grammatical structure), unfortunately, there is a strong tendency to spatialize everything, even those items that have no noticeable spatial structure (such as thoughts and emotions, say). This, therefore, predisposes the speaker of such language to visualize/localize all items of knowledge in the container space. This language habit is so thorough that it requires the utmost detachment and awareness to recognize its illegitimacy whenever such is the case.

Moreover, our sentence structure divides reality into 'actors' and their 'actions' largely due to the occurrence of the grammatical categories of substantiative and verb. This practice is so ingrained that we are assisted to imagine that there is necessarily an 'actor' in each fact which, in reality, is only the necessity of a substantiative in the sentence structure. For example, our sentence structure requires us to say 'it is raining' while, in truth, 'raining' is sufficient. Another example: we seem to be regarding 'the thinker' as distinct from the 'thinking,' while in reality there is no separate thinker disassociated with thinking.

Larson explains at length in his unpublished manuscript Beyond Space and Time, that we divide the reality into two categories, answering respectively to the two questions 'what it is' and 'what it does.' In the context of the old paradigm of the universe of matter suppose one asks these questions, say,
about the earth, one would answer 'what it is' by 'matter' and 'what it does' by 'moves.' However, from the point of view of the Reciprocal System, the answer to both these questions is 'motion.' Therefore one has to be wary not to fall prey to the attitude of misreading characteristics of reality. We may call this attitude the Fallacy of Misplaced Categories.

The Space-Time Progression. Another source of potential misconception is the space-time progression, the background or datum of physical action. It would be educative to enquire as to how we visualize the uniform ubiquitous space-time progression. Do we visualize it as empty space spread out to infinity and ever expanding? Do we tend to miss (or misunderstand) the significance of the concomitant expansion of time? Since space and time are reciprocally related, the expansion in space is nullified by the expansion in time, and each unit of space is not separated by other units of space but all are connected by the unit speed. The space-time progression is a speed manifold—not a space manifold, as is commonly visualized. The entire background of the space-time progression without displacements is a 'point' in the speed manifold—not an expanse in the space manifold (the container space).

In the stationary reference frame all spatial locations are at the same time. But this frame is not valid for the entire universe. Larson states: "... It follows that the motions can be represented in the conventional fixed system of reference only by the use of multiple reference points ... further elaboration of this point is necessary in order to avoid misunderstandings. The principal stumbling block seems to be a widespread impression that there must be some kind of a conceptually identifiable universal reference system to which the motions of photons and other objects that remain in the same absolute locations can be related. The expression "natural reference system" probably contributes to this impression, but the fact that a natural reference system exists does not necessarily imply that it must be related in any direct way to the conventional three-dimensional stationary frame of reference."[10]
New Periodic Table

This New Periodic Table has been based on the tables of elements found in *Structure of the Physical Universe* by Dewey B. Larson. Rather than setting it up after the traditional format with alkali metals on the left and noble gases on the right, the New Periodic Table places the noble gases in the center as they are the fundamental elements according to the Reciprocal System. The lower levels should, given room, extend to each side of the table.

The table is also expanded at the top to include the subatomic particles as identified in the original development. The elegance of the chart can be seen as it comes to a peak at the basic unit of “motion”, the photon.

Thus the table is not simply a periodic table of the elements, but a periodic table of all combinations of motion, from the simplest 0-0-0 to the largest possible 5-4-(1).

This table also sheds light on the identity of the 1-1-1 particle for which Larson had no name. Paralleling the case of carbon, having two possible forms [2-2-(4) and 2-1-4], this unnamed particle could perhaps be the alternate form of hydrogen. Going further, there would then be a similar relationship between the positron and the neutrino.

The pyramidal shape of the table forming a pinnacle at the photon also indicates intriguing possibilities when considering the cosmic sector of the universe. According to RS theory, photons (which travel at unit speed) are natural components of both the material and cosmic sectors. It is at this unit boundary that the two sectors meet.

Likewise, one could conceive of the cosmic half of the New Periodic Table forming an inverse pyramid with its base the photon, and the cosmic elements progressing through C-117. The combined table is illustrated below.
ISUS NEWS

March 31, 1992

Volume IV, Number 1

ANNouncing:

THE SEVENTEENTH ANNUAL CONFERENCE
OF THE
INTERNATIONAL SOCIETY OF UNIFIED SCIENCE

All members and interested persons are invited to attend the Seventeenth Annual Conference of the International Society of Unified Science, to be held at the University of Utah in Salt Lake August 7-8, 1992.

Air-conditioned dormitory rooms will be available in Austin Hall to conference participants for $20/single room or $25/double room. Rooms will be available Aug. 6-9 for all participants. Those planning to arrive earlier or stay later should so indicate. The Salt Lake International Airport is located approximately 20 miles west of the campus. Transportation to and from the airport will be provided to those who furnish their arrival and departure information.

We request that you make your plans to attend known to the conference facilitator as soon as possible. Please indicate if you wish to share a room or prefer a private room. Detailed information will be available upon request at least two months prior to the conference.

CALL FOR PAPERS

Quality papers are an essential element of a successful conference. In the past we have witnessed substantial advances in the development of the Reciprocal System presented through conference papers. We invite everyone to submit papers for presentation to the conference. We request that all papers be received by the conference facilitator no later than July 1, 1992.

Please address all correspondence and papers to:

Dr. Rainer Huck
Conference Facilitator
1680 E. Atkin Ave.
Salt Lake City, Utah 84106
"...I believe that the theory that space is continuous is wrong, because we get these infinities and other difficulties, and we are left with questions on what determines the size of all the particles. I rather suspect that the simple ideas of geometry, extended down into infinitely small space, are wrong."

Richard Feynman

"It is true that the concept of three-dimensional time is in direct conflict with the ideas of homo sapiens, but it is only conflicts with facts that are fatal, and human ideas as to the dimensions of time are not factual. As brought out previously, the long-standing concept of time as one-dimensional is based on a misunderstanding of the nature of time dimension. A dimension of time is not a dimension in space, nor is it anything space-like; it is a property of time itself. The scalar nature of the time term in the equation of motion is not a result of time being one-dimensional; it results from the fact that time has no direction in space, regardless of how many dimensions or directions of its own it may have. Thus there is nothing at all in our observations that precludes time from being three-dimensional, as required by the conclusion that time has all of the properties which we observe in space.

Dewey B. Larson

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EXECUTIVE ORDERS FROM ISUS PRESIDENT

Year: 1992-1993

1. The president rules that Nehru's paper on the birotating photon does not meet the qualifications established by ISUS for publication. It presents a completely different theory of the photon, not an extension or revision of the RS concept. In our system there are four possible basic scalar motions: uniform linear motion, linear vibratory motion, uniform rotational motion, and rotational vibratory motion. We identify units with linear vibratory motion as photons. There can be no rotation before the existence of the photon, where only the uniform space-time progression exists (and this can in no way be caused to rotate). The rotations of the sub-atoms and the atoms exhaust all the possible dimensions for rotation.

2. The president rules that Kirk’s article claiming that space-time is equivalent to nothing be thrown out, as it is not in keeping with the elementary rules of logic. A is A and not non-A. Space-time is space-time and not nothing. In the context of a universe of motion, nothing means zero motion (and is non-existent). But space-time is unit motion (and is an existent—in S. Alexander’s phrase it is the "stuff" of all existents). Therefore space-time is not nothing. Q.E.D.

3. The president has requested Ronald Blackburn to add the first paragraph of chapter one of Larson’s New Light on Space and Time to the brochure to replace the removed section on prices.

4. The president rules that quality is far more important than quantity in regard to the number of pages or issues of Reciprocity. The president is intent on enforcing a stricter interpretation of the publishing policy of ISUS to ensure the continued integrity of the Reciprocal System. It is important to remember that ISUS is a scientific organization and not a writers’ club. The president does not want ISUS to be embarrassed if a well-known establishment figure picks up a copy of Reciprocity and reads it.

On November 22, 1992, signed

[Signature]

ISUS President
National Science Foundation  
Small Business Innovation Research Program  
PROJECT SUMMARY

<table>
<thead>
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<th>NAME OF FIRM</th>
<th>Transpower Corporation</th>
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<tr>
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PRINCIPAL INVESTIGATORS (NAME AND TITLE)

<table>
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<tbody>
<tr>
<td>Ronald W. Satz</td>
<td>Ph.D., Systems Engineer &amp; President</td>
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TITLE OF PROJECT

A Crucial Experiment: Scattering with Neutralized Alpha Particles

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TECHNICAL ABSTRACT (LIMIT TO 200 WORDS)

On p. 360 of *Intermolecular Forces: Their Origin and Determination* (Oxford: Clarendon Press, 1981), authors Geoffrey C. Maitland, Maurice Rigby, E. Brian Smith, and William A. Wakeham state "These observations lead inevitably to the conclusion that none of the potential models used for these tests has been a good representation of the entire, true intermolecular function." So not all is well with the conventional electrical theory of matter originated by Ernest Rutherford.

Rutherford's experiments of 1911 did, of course, disconfirm Thomson's "plum pudding" atom model, and if Rutherford's model were the only alternative left, we would have to conclude that it is correct. But there are always alternatives. Another type of force could be causing the repulsion of the alpha particles. To verify that electrical forces are causing the scattering, one would have to bombard the gold foil with the same atoms, helium, without the charges, and verify (by some means) that no scattering (or at least considerably different scattering) took place. The conditions of the experiment would have to be identical to that of the original except for the lack of the charges.

Transpower Corporation proposes to carry out the experiment with the help of a world-wide expert in alpha particle scattering and detection (employed at Victoreen). The key innovation will be the technology required to neutralize the alpha particles.

KEY WORDS TO IDENTIFY RESEARCH OR TECHNOLOGY (8 MAXIMUM)

Scattering, Alpha Particles, Neutral Particle Scattering, Electrical Theory of Matter

POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH

The experiment will be discussed in Transpower's forthcoming commercial software package on the design and analysis of experiments. Longer term, the knowledge gained from the experiment should enable the synthesis of new materials.
More Calculations with the Reciprocal System Scattering Equation

by Ronald W. Satz

In my previous paper on Rutherford scattering, I worked out the Reciprocal System equation for the scattering constant, \( K_s \):

\[
K_s = K_G^2 / (16 \times s_0^4 \times E_k^2) \text{m}^2 / \text{sr} \tag{1}
\]

where

\[
K_G = \left[ \frac{F_{ps}^4 / (156.44)^4}{\ln^4(t_{eff}) / \ln2(t_{eff})^2} \right] \tag{2}
\]

\[
F_{ps} = 3.27223 \times 10^{-3} \text{ Newtons}
\]

\[
s_0 = 4.558816 \times 10^{-8} \text{ meters}
\]

\[
\ln^2(t_{eff}) = 1
\]

(because helium has no electric displacement)

\[
E_k = 7.03 \times 10^{-3} \text{ J}
\]

(for alpha particles from polonium 210)

Simplifying eq. 1 with the above constant values yields

\[
K_s = 1.63 \times 10^{-29} \times \ln^8 t_{eff} \times \text{m}^2 / \text{sr}
\]

This leaves the value of \( t_{eff} \) to be determined. Let the principal specific rotation of the atoms of the target foil be designated \( t_1 \), let the subordinate specific rotation be designated \( t_2 \), and let the specific rotation of the helium atoms be designated \( t_{He} \). Recall that the principal rotation of an atom is effective in two dimensions and the subordinate in one. Also recall that for combinations of unlike atoms the geometric mean is used to calculate the effective rotation. Finally, recall that the rotation of helium is effective in only one dimension. So the equation for \( t_{eff} \) is

\[
t_{eff} = \left[ \left( t_1 \times t_2 \right)^{1/3} + t_{He} \right]/1^{1/3}
\]

The values for \( t_1 \) and \( t_2 \) for all chemical elements are given in Reference 2 and are the same as those used in the calculations for interatomic distance in the solid state. The value for \( t_{He} \) is 3.

The scattering equation based on conventional Coulombic theory is

\[
K_s = z^2 Z_2^2 e^4 / (256 \pi^2 \varepsilon_0^2 E_k E_k^2) \tag{4}
\]

where

\[
z = 2 \text{ (for helium)}
\]

\[
e = 1.602 \times 10^{-19} \text{ coulombs}
\]

\[
\varepsilon_0 = 8.85 \times 10^{-12} \text{ coulombs/N-m}^2
\]

\[
E_k = 7.03 \times 10^{-13} \text{ J}
\]

With the above values, eq. 3 reduces to

\[
K_s = 2.694 \times 10^{-32} Z^2
\]

Now let's tabulate the results of calculations with the two theories for a representative sample of elements most like to be used in scattering experiments.

Note: In Reference 1, I rounded gold's \( t_{eff} \) to 4.2 and calculated 2.93 \times 10^{-28} for the scattering constant, rather than 2.956 \times 10^{-28}.

The table reveals the considerable difference in the results of the two theories, particularly for the elements with lower atomic number. In the Reciprocal System, elements having the same magnetic displacements have the same value for scattering constant, because with helium the electric displacement doesn't enter into the situation; if a "non-inert" beam of particles were used, the electric displacement would matter. In the Coulombic theory, each element has a different value of scattering constant because each successive element adds a proton to the alleged nucleus.

Another important distinction between the theories is that the values of the scattering constant in the Reciprocal System are the same whether the helium beam is charged or not. The Coulombic theory would predict no scattering for a beam of neutralised alpha particles. This difference in theories is the basis for my proposed crucial experiment.

As with the electrical theory of matter, the Reciprocal System needs more work on its
"fine structure." For instance, it's not clear from the theory at this time whether or not different isotopes of the same element would have the same equilibrium interatomic distance and the same scattering constant; indications are that the isotope effect, if present at all, would be minor. The Coulombic theory ignores the isotope effect, too.

Additional quantitative work needs to be done on the theory of interactions of atoms at much lower energy levels. In the limit, at zero temperature (vibratory motion) and zero translational motion, an atom at a distance of \( s_0 \) from another atom will be repelled by the reverse gravitational force that exists at the boundary, and thus no compound will be formed. If an inward translational motion exists such that the atom gets within \( s_0 \) of another atom, and no outward thermal motion exists, the cohesive force of the space progression will overcome the repulsive force of gravitation, and a compound will be formed (assuming the valences are right). In the Reciprocal System, state of matter is a property of the individual atom or molecule and not the aggregate. At room temperature, helium is a gas, whereas gold and most other metals are solids, and thus no compounds can be formed between them; the thermal vibration of the helium atoms keeps them from staying within \( s_0 \) of the gold or other metallic atoms. (This is the situation in the Rutherford scattering experiments; just one thermal vibration of the helium atom or alpha particle brings it back to \( s_0 \), where the repulsive force at the boundary kicks it out to the time-space region in due course.) At much lower temperatures—when helium atoms are individually in the solid state—the outward effect of the thermal vibration and the repulsive force could be less than the inward effect of the cohesive force of the space progression, making the formation of compounds with other elements possible. Here, with the further conditions of neither too much nor too little translational motion of the helium atoms, no scattering would take place.

References:


HOW SPACE AND TIME ARE INSEPARABLE

Frank H. Meyer

(The essence of this paper, titled "How Space and Time Are Inseparable", was presented October 24, 1992 at Winona State University to the Fall Meeting of the Minnesota Area Association of Physics Teachers.)

INTRODUCTION

The careful way at MAAPT Meetings we budget time, allowing each speaker a total of 15-20 minutes, reminds me of a startling comment of Benjamin Franklin in his AUTOBIOGRAPHY:

"Don’t squander time, for it is the stuff life is made of."

I much prefer Dr. Franklin’s definition of time to the operational definition that time is what you measure with a clock. This physicists’ definition of time concerns only the absolute component of time and does not respond to the challenge that relative time is a major daily constituent of human lives. Nothing is more certain than death; nothing is more uncertain than the hour.

The operational definition of time is not only ambiguous about time, but also does not provoke us to inquire whether time is the only stuff our lives are made of. If Franklin is right, our lives are composed of increments of time from birth to death. Are we not then, as finite physical beings, also composed of increments of space, the stuff of our finite height, surface area, volume and weight? And so far as each of us is another physical being, the motions of our mouths, ears, eyes, lungs, hearts, nerves, psyches, and other organs of our bodies and minds, strongly suggest that we are physically made entirely of quantized space-time and/or motion increments.

For time and space together evidently are motion and nothing but motion, whether in the stars and planets or in us, other animals and plants. This is why Aristotle and Leonardo da Vinci remarked each in his own time that who would understand Nature must seek to understand Motion. In more recent times D.B. Larson has confirmed that the unity of the entire finite physical universe lies in the Conservation of Motion rather than the Conservation of Matter or Energy.

As motion, space and time invariably are related in a very special way; time and space are always reciprocally related. Motion reasonably accounts for how space and time, while relatively independent, are absolutely inseparable. In this respect time and space are like the two blades of a scissors, so long as it remains a scissors. Larson, discoverer of this fundamental physical law, first published its truth in 1959. Thereafter, he ceaselessly proposed to natural scientists that they put the lawful fact and verity of space-time reciprocity to the test. He promised that with its aid physicists would be able to revalue and at last unify the science of physics.

Humankind has begun already to verify, can and does daily verify the motional fact and law of space-time reciprocity. We have done and do so in all of the few space-time realms of the finite physical universe immediately accessible to us. For instance, we routinely measure motion as speed. Speed is the scalar magnitude of the relation between space and time as motion. Less space and/or more time invariably mean slower speed. More space and/or less time mean faster speed. Space-time reciprocity means that more space can be equivalent to less time and/or more time can be equivalent to less space.

Space-time reciprocity invariably is found to exist throughout the few realms of space-time daily and nearly accessible to us. Therefore, it is by far the most conservative and rational postulate about the general and universal nature of space-time that we can extrapolate and adopt for examining the nature of space-time and/or motion throughout all the many space-time realms less frequently and more remotely accessible to us. We feel justified in assuming that the general hypothesis of a reciprocal relation between space and time, which holds good in the known region also holds good in the unknown, in general.

SPACE AND TIME ARE QUANTIZED AND EQUAL, NOT IDENTICAL. Time cannot be reduced to space; time has no dimensions in space.

Space cannot be reduced to time; space has no dimensions in time.

The reciprocal relation between space and time, invariably found when measuring
motion, implies that both time and space exist in finitely divisible units. This means that space and time are quantized. This means that neither space nor time is continuous; neither is infinitely divisible, contrary to some modern and ancient belief.

If you think it far-fetched for the Reciprocal System to question the truth of the space-time continuum postulate of Relativity Theory, remember that the principal modern author of the latter theory, A. Einstein, himself came to doubt the verity of the continuum postulate: "I am tending to the belief that it is impossible to advance further with the continuum theory."

By reason of the postulated reciprocal relation between space and time, each individual unit of motion is a relation between one unit of space and one unit of time, a motion at unit speed.

Unit speed equals the ratio of one space unit to one time unit. The magnitude of this speed is the magnitude of the absolute speed of light in vacuo. This magnitude, designated as c, has been carefully measured and is well-known. The absolute speed, c, is known to be equal to 2.9979 x 10^{10} cm/sec.

Since the value of c is reliably known, it becomes feasible to compute both the smallest time duration unit, t₁, and the smallest space length unit, s₁.

A physical location in space is a point or segment of the line of the space progression at a given time.

A physical location in time is a point or segment of the line of the time progression at a given place.

Unit speed, c, is the speed of the physical location in which any photon originates and in which it remains, so long as it remains a photon.

Unit speed, c, is a function of absolute finite minimum time duration, t₁, and absolute finite minimum space length, s₁.

Larson¹ chose after due inquiry to tag the Rydberg fundamental frequency constant, v, as that frequency among all other measured frequencies that enables human-kind to disclose the metric CGS value of t₁, the minimum time duration unit. The magnitude of v is well-known to atomic physicists, amounting to 3.288 x 10^{15} cycles/second. Larson shows that the photon is a compound motion and that frequency is the name physicists have adopted to refer to and distinguish the velocity of a photon's oscillatory motion from that of the rectilinear motion of its physical location, that we call the velocity or speed of light in vacuo. In frequency measurement the cycle per second is taken as the unit on the assumption that frequency is a function of time only.

The natural unit of frequency, being a velocity, is one unit of space divided by one unit of time. For the Rydberg fundamental frequency, v, this is equivalent to one half-cycle per unit of time instead of one full cycle, as a full cycle involves one unit of time in each direction. Hence the measured value of v must be expressed as 6.576 x 10^{15} half-cycles/second.

Expressing the frequency v this way in terms of reciprocal time is equivalent to using the natural unit of space, s₁, in combination with the CGS unit of time, t₁, to represent the CGS unit of frequency. Thus, leaving the space term out of account is equivalent to giving it unit value. The smallest time duration unit t₁, or what Larson calls the natural unit of time in CGS terms, is the reciprocal of the Rydberg fundamental frequency, 1/v = 1.52 x 10^{-16} second.

Now to obtain s₁, the smallest space length unit, or what Larson calls the natural unit of space, multiply t₁ = 1.52 x 10^{-16} second by c = 2.9979 x 10^{10} cm/sec. Therefore, s₁ = 4.55 x 10^{-6} cm.

Larson's careful novel approach to examining the structure of motion, space-time and the photon in the light of observed space-time reciprocity has yielded an abundance of new promising results: that space and time are quantized, that the magnitudes of the space quantum and the time quantum have been computed and that the space quantum and the time quantum are physically equal but not identical. Perhaps the most important and startling result of Larson's work is its implication that the speed of light is not the speed of light traveling through space and time but is instead the absolute universal uniform speed of the three-dimensional scalar progression of space with time progression. That is, the speed of light is the uniform speed of physical locations, whether or not occupied by photons, neutrinos, other massless particles or even galaxies.

Throughout the twentieth century others have proposed and tried unsuccessfully to resolve the light wave-particle paradox. Though unsung and unexamined by the physics profession until now, the offered
solution by Larson compares favorably with answers given by the best of the profession of scientists. A typical practical answer was provided that came near to the solution offered by Larson’s Reciprocal System:

“Our only way out … seems to be to take for granted the fact that space has the physical property of transmitting electromagnetic waves, and not to bother too much about the meaning of the word.”

“From the quantum phenomenon it appears to follow with certainty that a finite energy can be completely described by a finite set of numbers (quantum numbers). This does not seem to be in accord with a continuum theory and must lead to an attempt to find a purely algebraic theory for the description of reality. But nobody knows how to obtain theory.” (my italics)

**ABSOLUTE SPACE IS NOT IMMOVABLE. SPACE PROGRESSES UNIFORMLY OUTWARD WITH UNIFORM TIME PROGRESSION AND THE EXPANDING UNIVERSE BETTER CHOICE OF REFERENCE FRAME ORIGIN.**

Absolute zero speed has been a popular but poor choice for origin of reference frames used to graph motion. For this purpose the planet Earth is not immovably located at the center of the physical universe. Nor is the Sun. Nor is Absolute Immovable Space.

Neither absolute zero speed nor infinite speed occurs nor can occur and has not been observed to occur anywhere or anymore than perpetual motion throughout the physical universe. No stationary ether, no absolute rest can be found, because infinity is excluded from the physical universe and motion is conserved. The total quantity of motion is finite. Since all physical quantities and phenomena are manifestations of motion, they are measured in terms of 1/n and n/1, where n is finite but not mathematical zero. No infinities are possible.

Larson has proposed a more suitable candidate as preferred origin for reference frames used to graph motion: unit speed, the speed of light in vacuo. Larson attributes the background of the physical universe to undisplaced motion at unit speed. Such motion is formed by the three-dimensional uniform outward scalar space quanta progression with three-dimensional scalar outward time quanta progression of physical locations at the rate of one space quantum to one time quantum. All physical things come out of no thing but unit motion instead of something else, such as quarks, air, water, earth or fire.

This undifferentiated, one to one (1/1) space-time motion, a primary consequence (but certainly not the only consequence) of the reciprocal character of the relationship, by itself is motion with no thing moving (for this space-time in itself is no thing) and does not represent any activity in the physical universe.

No supporter of the Reciprocal System denies the existence of quantized units of motion. Larson goes so far as to affirm that discrete units of motion are the only physical existents. He then goes on to show how all physical things are formed by speed displacement from unit speed of assemblies of these units. But it is also essential to note that these fundamental units of motion themselves are not things; the units of motion are motions (no thing at all moving); nothing but motion.

In other words I think that the above fairly describes what Dewey Larson⁴ meant in the following affirmation: “The significant point here is that the ‘basic undifferentiated motion outward at unit speed, one unit of space per unit of time, is the physical equivalent of nothing at all, the datum from which all physical activities extend, the reference system to which all such activities, or phenomena, can be related. In order that there may be physical phenomena there must be some deviation from this basic uniformity, some displacement, as we will call it, of the one-to-one space-time ratio either in the direction of more space or of more time, and the amount of this displacement determines the magnitude of the phenomenon. The basic physical quantities are not measured from the mathematical zero, but from this unit space-time ratio.” (Italics Larson’s)

Thomas Kirk⁵ agrees with Dewey Larson that undisplaced space-time is the physical equivalent of nothing at all. Ronald Satz reports⁶ several recent errors published in RECIPROCITY. “The worst example is the contention that undisplaced space-time is equivalent to nothing at all.” Are Mr.Kirk and Mr. Larson in error? Dr. Satz contends: “Undisplaced space-time … is not equivalent to nothing, which is zero motion.” Are Messrs Larson and Kirk contending then that Motion at Unit Speed is Motion at Zero Speed? Evidently not. In his haste to convict his peers of negligence, Ronald Satz overlooked another obviously relevant denotation of the word ‘nothing’: nothing also means no thing. Dewey Larson and Thomas Kirk and Frank
Meyer are only saying that undisplaced space-time is no thing; undisplaced space-time is motion without any thing moving, motion at unit speed. Physical entities, including gravitating things, electrons, photons, other massless particles, etc., happen only subsequently due to speed displacement from unit speed.

Independent motions, according to the Reciprocal System, resulting in the existence of some physical things, such as photons, electrons, atoms, etc. are only brought into existence themselves, subsequent to the happening of the primary undifferentiated outward motions at unit speed. These primary motions constitute the background, the framework, the natural system of reference of and for the physical universe.

**THE NATURAL SYSTEM OF REFERENCE**

The primary motions are those which can exist independently of the existence of motions of other types. Primary motions are constituted by undisplaced space-time scalar motion at unit speed.

Independent motions of the material sector are the result of speed displacements from unit speed in the direction of more space.

Inasmuch as we postulate that the universe is three-dimensional, we can represent the scalar progression of space by a line in a stationary three-dimensional reference system, measuring the corresponding progression of time by means of a scalar device, a clock. In this reference system, a positive motion is represented as outward from a reference point, and a negative motion as inward.

Independent motions of the cosmic sector are the result of speed displacements from unit speed in the direction of more time.

Inasmuch as we postulate that the universe is three-dimensional, we can represent the scalar progression of time by a line in a stationary three-dimensional temporal reference system, measuring the corresponding progression of space by the means of a scalar device, a clock. In this reference system, a positive motion is represented as outward from a reference point, and a negative motion as inward.

The initial point of the progression of an individual unit of motion is zero. As the distance between two points cannot be less than zero, it follows that the primary motions are necessarily outward, increasing the distances relatively to the initial points.

The progression is scalar. It is simply outward without any inherent direction.

Motion outward from the initial point of progression is therefore outward from all points of reference.

Therefore, any two physical locations are progressing outward from each other at unit speed; that is, their separation is increasing at the rate of one unit of space per unit of time.

The natural reference system is that system in which the primary motions do not cause any change in the position of physical locations.

Thus, it follows that the natural reference system is progressing outward at unit speed relative to the spatial system of reference.

Unit speed is the speed of light.

(The various features of the theoretical universe emerge from the deductive development without labels. It is therefore necessary to identify the physical phenomena to which they correspond. The correlation is usually quite evident, as in this instance. In any event, it is self-verifying, as any error would quickly show up as a discrepancy in the subsequent development.)

Since the postulate specifies that nothing exists other than discrete units of motion, and the natural system of reference is a direct consequence of the existence of the primary units, this reference system is the framework, or background, of the physical universe of motion, and does not represent any activity in that universe. The natural reference system, as defined, is therefore, the physical zero, or datum level, from which all physical activity extends.

The outward progression of the natural reference system relative to the stationary system of reference is identical with the "expansion of the universe", reported by the astronomers.

**EXISTENCE OF INDEPENDENT MOTIONS BEIDES THE PRIMARY MOTIONS**

At this point we have arrived by deduction from our basic premises, at an explanation of the general background of the physical universe that is essentially in agreement with the astronomers' assumption. (Our derivation leads to a uniform outward speed, rather than to a speed that varies with the distance, as produced by the kind of an expansion assumed by the astronomers, but this difference is easily accounted for, because there is a known force, gravitation, that acts against the outward motion, with a
The advantage of deriving this explanation of the universal background from a set of general premises, rather than merely assuming its existence, lies in the fact that further deductions can be made from these same premises. Instead of a single process involving the universe as a whole, the explanation that we have just derived from the premises of the theory of the universe of motion identifies the expansion as the result of outward scalar motions of physical locations. This opens the way for the existence of other scalar motions of the same physical locations, independent motions, as we will call them.

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2. Einstein, Albert. The Evolution of Physics. Simon & Shuster 1938, p. 159
6. Satz, Ronald. RECIPROCITY, XX, 4

Corrigenda for Reciprocity, XXI (1), Spring 1992
(p-page No; pr-para No.; lc/rc - left/right column; 1 - line No.)

p.6: The title should be “Birotation and the Doubts of Thomas”
p.8, lc 1.4 from bottom: “1992” should be “1991”
p.15, lc 2.1 from bottom: “[z being less]” (should be “[z being less]”) p.16, lc pr 2.1.3: “is” should be “it”
1.13: “alone” should be “along”
1.14: “one” should be “the”
1.20: “adjusted” should be adjudged”
p.16, rc pr 3.1.2: “its” should be “the”
pr 4.1.1: “realized” should be “realize”
p.19, lc pr 1.1.7: Between words “misreading” and “characteristics”, insert “what in truth are only the necessities of English grammar as the”

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“The conclusion that all properties of either space or time are properties of both space and time would be immediately demolished if any of the properties extrapolated from one to the other turned out to be inconsistent with established facts and in view of the great differences which appear to exist between space and time as we ordinarily envision them it would seem off hand that discrepancies of this kind should be easy to locate. But we will find on close examination that this is not the case; there is no conflict or inconsistency anywhere.”

“Since the conclusion that both space and time have all of the properties observed in either space or time individually has been derived by means of processes which are entitled to a high degree of confidence, and since there is no factual evidence that is inconsistent with this conclusion, whereas there is strong evidence supporting the validity of the innovations which it introduces into physical relations we are justified in considering this conclusion as correct.”

“Every conclusion that we derive from the original hypotheses offers us an opportunity to test the validity of the entire system of hypotheses plus derivatives. Such a test cannot give us a positive result; that is, even if the conclusion is found to agree with the observed and measured facts in all respects, this does not assure us that the system is valid, since there is still a possibility of conflict with other facts at present unknown, a possibility that can be eliminated only by complying with some much more stringent requirements. But any test can give us a negative result. If the conclusion conflicts with any positively established fact, this is sufficient for disproof.”

- Dewey B. Larson

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Periodic Table, Revisited
Thomas Kirk

A recent article in Reciprocity made an attempt to show relationships between elements represented in the conventional periodic table but not in the table structured by Dewey Larson. In that article, a periodic table showing the pattern of elements radically skewed to the electronegative was presented as a reconciliation of the apparent lack of correspondence in Larson’s table. However, if we take a closer look at Larson’s periodic table, we find that all of the missing relationships actually are present. In addition, many other very important relationships are represented that are not shown in either the skewed of the conventional table.

Periodic Table A is Larson’s table with the only modification being the addition of shading in the region that is the “Transition Elements”. These are the elements that can be either n electronegative or n electropositive. This is one of the most profound aspects of Larson’s table in that it provides the mechanism or link for the progression of atom development. Without this link, to achieve the element 2-2-(1), atom building must somehow achieve 2-2-0 and then gain a unit of negative displacement. How the atom reaches 2-2-0 from the 2-1-2 state is a critical question.

The answer lies in the transition elements, which under proper conditions undergo a reorientation of their displacements. For example, it is possible that when carbon of the form 2-1-4 is placed under the proper heat and pressure conditions, it transforms from ordinary black carbon to diamond, 2-2-(4). From this new level, additional mass units are added and the atom building process continues to 2-2-0 and on up to the next transition element 2-2-4, Silicon, where the cycle continues.

This is perhaps the most important and unique aspect of Larson’s table. Yet, if we realize that the shaded zone in Table A is actually no separation at all, then the rows are fully continuous from left to right and from right to left, as shown in Table B and C, respectively. The situation is that a simple two dimensional array of elements can not directly represent all of the relationships, thought the columns only line up when the transition gap is eliminated by sliding the elements to the right or left. This is sort of a three dimensional array, with the third dimension being the position based on displacement separation both above and below the reference level, instead of just one or the other.

The similarities of elements in columns n units above or below the inert level, ending at the transition element, are relationships shown in Table A, Larson’s table. Relationships of elements in contiguous rows without the transition gap of Table A, extending further below or above inert levels, as shown in Table B and C, also have similar validity.

Table B represents the extension below the inert level, and this fully encompasses all of the relationships considered by the author presenting the skewed table. These are the ones shown in the conventional periodic table, that are proposed by that author to be reconciled in his skewed table. Larson’s table provides these relationships when the transition gap is deleted, and also provides the crucial link for atom building as described above.

The other author’s table expands the gap greatly between the maximum mass electropositive element and the next inert level. For example, atomic number 56, element 4-3-2, must somehow make the incredible leap of 30 atomic numbers (60 mass units or 120 displacement units) to 4-4-0 and then build down 29 negative atomic numbers (58 mass units or 116 displacement units) to 4-4-(29), the next element in the series. This is a very awkward situation.

The other major advantage of Larson’s table over the others is that connecting the rows across the transition elements to the electropositive side (Table C) establishes a new set of relationships, heretofore unrecognized. A review of the properties of the most closely related elements, beginning with 46 in the upper row and 64 in the lower, and extending to 51 and 67, respectively, reveals that the properties of softness, malleability and ductility of these metals transition in a corresponding manner along their rows for elements in the same columns in Table C.

The other author provides specific examples of elements with similar properties that are shown in the tables, as indicated below:
Aluminum (13) and Gallium (31) Table B, Periodic & Skewed
Aluminum (13) and Scandium (21) Table A
Zirconium (40) and Strontium (90) Table A, Table C
Molybdenum (42) and Tungsten (74) Table B, Skewed
Molybdenum (42) and Uranium (92) Table A, Table C

Only the expanded view of Larson's table represents all relationships, the others are severely lacking.

The other author mentions that there seems to be some sort of special status for the 14 and (14) electric rotations. The Larson derived tables show that this 14 level has a coincidental relation with the very stable inert level. This can be seen in Table B for level (14) and in Table C for 14.

One point that is presented in the other author's article is that his table shows the "rare earth" elements on a leg removed from the table as a whole. "Elements are forced into positions that are beyond this range only with difficulty, and by virtue of the pressure of the electron flux. The inherent improbability of this arrangement is what engenders the anomaly of the rare-earths, including the one for which they are named - their rarity." ¹ Actually there is no value in this, because these elements are not rare in the first place. "The least abundant rare-earth or lanthanide element, Thulium, is believed to be more plentiful than silver, cadmium, gold or iodine." ² There is nothing compelling that sets them apart from the remainder of elements. Aside from the erroneous rarity, the author fails to elucidate on the alleged "anomalous properties".

The idea that a group of elements should be removed from the table and set aside in a separate block is not advantageous. There is no reason to expect such a complete lack of continuity in nature, and what continuity there is can only be gleaned from showing them in their proper position relative to the remainder of elements.

To substantiate the concept of a radically biased electronegative distribution of elements, the author presents an entirely new atom building scheme. He fails to mention that the atom building process derived by Larson was by neutrino absorption. The new one presented is by absorption of electrons, which are actually negative mass units and would reduce the mass of an atom and not increase it. Further, electrons are single units of such rotational displacement and a mass unit is two units. Absorption of electrons would have to involve two at a time or the atom would be imbalanced, an unacceptable condition, whereas a neutrino is a complete potential mass unit.

Larson's atom building process is well founded and logical and relies on the proven passage of neutrinos through the environment. The idea of an "electron flux" is not factual science. Uncharged electrons as far as we know can not move through space, so the flux would more likely be charged electrons. These should be more easily detected than neutrinos, but evidently do not exist. Still, there exists speculation that if an uncharged electron where to exist in space, it would propagate much like a photon.

The proposed electron flux concept besides being undetectable has serious theoretical flaws as well. If such a flux were to be effective on the environment as proposed, then electrons must strike objects of mass. Once in contact with the mass, the electron would be completely trapped, since it is clear that electrons can not move through space and always remain within the net time structure of the mass. This would lead to an unlimited build up of electrons in any matter, unless it is postulated that once electrons are absorbed to a certain capacity, no more can enter the mass even if they contact the mass. Since there is no charge to this "electron flux", they would have no difficulty in contacting a mass filled with electrons. However, it is clear that matter does have the capacity to hold very large quantities of electrons at high voltages, much higher than the state of ordinary matter. Therefore, there would seem to be no specific mechanism to deny entry of a new electron into a material object. The objects in a region say billions of years old, should have very high voltages. There is no evidence of this sort of potential difference in the cosmos, for example huge lightening bolts between old and stars and young stars as a globular cluster is absorbed by a galaxy.

The discussion in the other author's work continues with the concept of positron absorption which has the same flaw that it is one displacement unit, not the required 2 for a mass unit. Further, the author calls for absorption of positrons into the magnetic
displacement. One increment of magnetic displacement requires $8n^2$ displacement units. How enough positrons would be available for say 32 mass units is not made clear. Also, long before a positron ever gets to the proper conditions for absorption by an atom, it would be neutralized by an electron within matter.

There should be some very serious consideration, before we throw out Larson's periodic table and his atom building process. Presented in Table D is a compilation of all three Tables A, B, and C, representing all of the relations revealed by each of these tables. I would recommend that we consider utilizing Table D and see what secrets it may hold. Again, Table D actually is Larson's table, but with more relations represented through linkage provided within the transition elements.

**References:**

### Table A

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | H |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

#### Transition Elements

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### Table B

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | H |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

#### Electropositive

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### Table C

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

#### Electropositive

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
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D 21.2-12
Conceptual Fundamentals

The Reciprocal System Theory introduces two new concepts into physical science: the concept of physical location, and the concept of scalar motion.

The nature of these new concepts can be illustrated by a consideration of the "expansion of the universe" that is postulated in the astronomers' latest theory of the recession of the distance galaxies. As explained by Paul Davies, "the expanding universe is not the motion of the galaxies through space... but is the steady expansion of space." Since the galaxies, on this basis, are not moving through space, each galaxy remains in what we will call a physical location in space. This physical location is moving outward in the context of the stationary spatial reference system, carrying the galaxy with it. While only the galactic motion can be observed, all physical locations necessarily participate in the outward motion, irrespective of whether or not they are occupied by galaxies.

Inasmuch as all galaxies, and the physical locations that they occupy, are moving uniformly outward from all others, each is moving in all directions. A motion distributed uniformly over all directions has no specific, or inherent, direction; that is, it is scalar. Thus the expansion can be described as a positive scalar motion of the all physical locations (represented as outward in the spatial reference system). Out new theory defines a universe of motion in which scalar motion of physical locations is not a unique phenomenon confined to the expansion recognized by the astronomers, but is the basic form of the motion from which all physical phenomena are derived.

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Physics Outline of the Reciprocal System

(For centuries the profession of natural philosophers and/or physicists knew beyond any reasonable doubt that the physical world is and must be continuous, not quantized, not finitely divisible. The atomic theory of Leucippus and Democritus was remembered only in the writings of those correct physicists who, like Aristotle, dismissed it. Their followers, such as Epicurus and Lucretius, were put down as mere poets and 'metaphysicists'. Even today the scientific profession has still to learn how it is that the physical world is entirely quantized; that light, electricity, magnetism, matter and 'antimatter' are quantized, because motion, time and space are quantized. Conventional science with its logical positivism and pragmatism has not progressed further in its quantum mechanics and electrodynamics investigation by neglecting to unite theory with practise and experiment. Dewey Larson's Reciprocal System of revalued and unified science has stepped into and over this breach. Editor's note.)

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How The Physical World is Quantized

Dewey B. Larson and ISUS, Inc.

Basic Premises

The basic premises of the Reciprocal System theory consist of certain preliminary assumptions, a postulate and a definition.

A. In order to make science possible, some preliminary assumptions of a philosophical nature must be made. We assume that the universe is rational, that the same physical laws apply throughout the universe, that the results of experiment are reproducible, etc. These assumptions are accepted by scientists as a condition of becoming scientists, and are not usually mentioned in purely scientific discourse.

B. We assume that the generally accepted principles of mathematics, to the extent that they will be used in this development, are valid.

C. We postulate that the universe is composed entirely of one component, motion, existing in three dimensions and in discrete units.

D. We define motion as the relation between two uniformly progressing reciprocal quantities, space and time.

Deductive Development

Each of the following statements is a deduction from the postulate and the preceding statements. The objective of this deductive development is to determine what can exist in the theoretical universe defined by the premises of the theory. In most cases it will be evident that the entity or phenomenon that theoretically can exist is identical with one that does exist in the actual physical universe, and there are no definite conflicts in any case. To the extent that the outline has been carried, the theoretical universe is thus a correct representation of the observed physical universe.

1. Motion, as defined, is measured in terms of speed, the scalar magnitude of the relation between space and time.

2. By reason of the postulated reciprocal relation between space and time, each individual unit of motion is a relation between one unit of space and one unit of time, a motion at unit speed.

3. We define the primary motions as those which can exist independently of the existence of motions of other types.

4. According to our definition, motion involves a uniform progression of both space and time. We define a point, or segment, of the line of the space progression at a given time as a physical location in space.
5. Inasmuch as we postulate that the universe is three-dimensional, we may represent the
scalar progression of space by a line in a stationary three-dimensional spatial reference
system, measuring the corresponding progression of time by means of a scalar device, a
clock. In this reference system, a positive motion is represented as outward from a
reference point, and a negative motion as inward. The terms "outward" and "inward" will
be used in preference to "positive" and "negative" to avoid possible confusion with another
use of the latter set of terms.

6. The initial point of the progression of the individual unit of motion is zero. As the distance
between two points cannot be less than zero, it follows that the primary motions are
necessarily outward, increasing the distance relative to the initial points.

7. The progression is scalar. It is simply outward without any inherent direction. Motion
outward from the initial point of the progression is therefore outward in all directions.

8. From the foregoing, any two physical locations are progressing outward from each other at
unit speed; that is their separation is increasing at the rate of one unit of space per unit of
time.

9. We define the natural system of reference as that system in which the primary motions do
not cause any change in the positions of physical locations.

10. From (8), it follows that the natural system of reference is progressing outward at unit
speed relative to the spatial system of reference.

11. We identify unit speed as the speed of light.
    (The various features of the theoretical universe emerge from the deductive development
without labels. It is therefore necessary to identify the physical phenomena to which
they correspond. The correlation is usually quite evident, as in this instance. In any
event, it is self-verifying, as any error would quickly show up as a discrepancy in the
subsequent development.)

12. Since the postulate specifies that nothing exists other than discrete units of motion, and the
natural reference system is a direct consequence of the existence of the primary units, this
reference system is the framework, or background, of the universe of motion, and does not
represent any activity in that universe. The natural system of reference, as defined, is
therefore the physical zero, or datum level, from which all physical activity extends.

13. We identify the outward progression of the natural reference system relative to the
stationary system of reference as the "expansion of the universe" as reported by the
astronomers.

At this point we have arrived, by deduction from our basic premises, at an explanation of
the general background of the physical universe that is essentially in agreement with the
astronomers' assumption. (Our derivation leads to a uniform outward speed, rather than a
speed that varies with the distance, as produced by the kind of an expansion assumed by the
astronomers, but this difference is easily accounted for, because there is a known force,
gravitation, that acts against the outward motion, with a magnitude varying as an inverse
function of the distance.)

The advantage of deriving this explanation of the universal background from a set of
general premises, rather than merely assuming its existence, lies in the fact that further
deductions can be made from these same premises. Instead of a single process involving the
universe as a whole, the explanation that we have just derived from the premises of the theory
of the universe of motion identifies the expansion as the result of outward scalar motions of
individual physical locations. This opens the way for the existence of other scalar motions of
the same physical locations, independent motions, as we will call them.

14. Once the primary units of motion are in existence, units of inward scalar motion can be
superimposed on the outward units. The net magnitude of two such motions is zero, and
the combination has no physical properties in a spatial reference system, but it constitutes
a base upon which other combinations can be formed.

15. As stated in our definition, motion is a progression. Thus it is not a succession of jumps,
even though it exists only in discrete units. There is progression within the units, as well
as unit by unit, simply because the unit is a unit of motion (progression). The significance
of the discrete unit postulate is that discontinuity can occur only between units, not within a
unit. But the various stages of the progression within a unit can be identified.
16. The continuity of the progression within the units enables the existence of another type of scalar motion of physical locations. This is a motion in which there is a continuous and uniform change from outward to inward and vice versa; that is, a *simple harmonic motion*. At this stage of the development only continuous processes are possible, but a continuous change from outward to inward and the inverse is just as permanent as a continuous outward or inward motion.

17. In the two-unit complete cycle of the simple harmonic motion the net change of the spatial position is zero. As represented in the spatial reference system, the two-unit combination remains stationary in the universe of motion.

18. From (10), it follows that the physical location occupied by that motion combination (17) moves outward at the speed of light in a second dimension.

19. The path of the combined progressions then takes the form of a sine curve.

20. We identify such scalar motion combinations as *photons*. A system of photons is *electromagnetic radiation*.

   (This derivation shows why radiation has the properties of a wave as well as those of particles. It is composed of particles (discrete units), but the motion (progression) of these particles is wave-like.)

21. The outward movement of physical locations due to the motion of the natural reference system relative to the stationary spatial system carries with it *not only* the photons *but also* any other physical entities that occupy such locations.

   (In addition to the photons, there are certain other massless particles that have no known motion-producing mechanism, and must therefore remain stationary in the natural system of reference, unless acted by some outside agency. There are also objects——very distant galaxies——that do have a motion-producing mechanism (gravitation), but are so far away that the gravitational motion toward our location has been reduced to negligible levels. All of these objects behave exactly as required by the theory; that is, they move outward relative to the spatial reference system at the speed of light.)

22. There is no inherent relation between the time magnitudes involved in the two different dimensions of the photon motion. One is the time of the progression of the natural reference system. The other is independent of the progression. Thus the *frequency* of the radiation, the number of cycles per unit of the linear progression, can take any value, subject only to the capability of the process whereby the radiation is produced.

23. The postulate that the universe is three-dimensional means that three independent magnitudes are required for a complete definition of each of its basic quantities. Thus three dimensions of scalar motion are possible. In order to distinguish these purely mathematical dimensions of motion from the dimensions of *space*, which are geometrical, as well as mathematical, in the context of a spatial reference system, we will refer to them as *scalar dimensions*.

24. Only one dimension of motion can be represented in a three-dimensional spatial system of reference. Each motion shown in such a system is represented by a vector, a one-dimensional quantity having both magnitude and direction, and any combination of such motions can be represented by the vector sum, which is likewise one-dimensional.

25. A scalar motion has magnitude only, and no inherent spatial direction. It therefore has to be given a direction in order to be represented in a spatial reference system.

26. To give directions to the members of a system of scalar motions, it is necessary to couple some one of the moving locations to the stationary reference system in such a way that it is represented as motionless. The directions imputed to the other motions of the system are then determined by their relation to this assumed motionless *reference point*.

   (For example, if we designate out galaxy as A, the direction of the motion of distant galaxy X, as we see it, is AX. But observers in galaxy B see galaxy X as moving in a very different direction BX because they use a different reference point. This contrasts sharply with the directions of the motions of our ordinary experience—vectorial motions——which are the same regardless of the location from which they are being observed. In this vectorial case the direction is the property of the motion.)

27. From (25) and (26), it follows that the factors which determine the direction of a scalar motion are independent of those which determine the magnitude. The direction is a result of the nature and location of the coupling of the motion to the reference system. It may be a *constant* direction, as in the outward travel of the photons of radiation, or it may be a *rotationally distributed* direction, one that is continually changing.
28. From (27), the translation motion of a photon, instead of being unidirectional, as in (18) may be rotationally distributed in the reference system. The motion thus distributed, which we will call a \textit{scalar rotation}, is a linear progression with a constant magnitude but a continually changing direction.

29. From (23), scalar rotation can take place coincidentally in three dimensions. From (25), however, it can be represented in a spatial reference system only on a one-dimensional basis. The magnitudes of the motions in the three dimensions are additive, and can be represented as a total, but the directions of the different distributions cannot be combined. The representation in the reference system therefore indicates the correct magnitude (speed) of the three-dimensional motion, but shows only the directions applicable to the one dimension of the motion that is parallel to the dimension of the reference system.

30. In the absence of any specific restrictive factor, rotationally distributed scalar motions are distributed over all spatial directions. The magnitude of such a motion toward a point in any given direction is therefore inversely proportional to the second power of the intervening distance. (This is the origin of the "inverse square law."

31. Inasmuch as the natural reference system progresses outward at unit speed relative to the spatial reference system, no further increment of outward speed is possible, because of the discrete unit postulate. The net total magnitude of a rotationally distributed motion must therefore be inward.

32. If the scalar rotation is less than three-dimensional, the basic photon will move outward as radiation in a vacant dimension, and the motion combination will disintegrate. In order to be stable, the rotationally distributed motion must therefore be three-dimensional.

33. The three-dimensional combination of vibrational and rotationally distributed motions appears in the reference system as an identifiable object moving inward in all directions. We identify such an object as an \textit{atom}, or a \textit{sub-atomic particle}. Collectively, the atoms and particles constitute \textit{matter}.

34. We identify \textit{mass} as a measure of the net magnitude of the rotationally distributed scalar motions of matter. We identify the observable inward-directed effects of this motion as \textit{gravitation}. The magnitude of the gravitational effect is therefore directly proportional to the mass.

35. The inward gravitational motion of the atoms results in the formation of material aggregates of various sizes. In these aggregates the atomic motions (and masses) are independent and additive.

36. The outward motion due to the progression of the natural reference system always takes place at unit speed, regardless of the size of the aggregate or the distance that is involved (8). Then \textit{net} relative motion of any two gravitating objects with no additional motions is the algebraic sum of the unit outward motion and the inward gravitational motion.

37. At relatively short distances gravitation predominates, and the net motion is inward. Since the gravitational motion decreases with distance, while the outward progression remains constant, the opposing motions reach equality at some greater distance, which we call the gravitational limit. Beyond this distance the net motion is outward, increasing with distance, and approaching unity (the speed of light) at extreme distances.

(This theoretical pattern of net speeds is verified observationally by measurements of the Doppler shift in the radiation received from the distant galaxies.)

***

\textbf{Albert Einstein on How the Physical Universe is Quantized}

"From the quantum phenomena it appears to follow with certainty that a finite system of finite energy can be completely described by a finite set of numbers (quantum numbers). This does not seem to be in accordance with a continuum theory, and must lead to an attempt to find a purely algebraic theory for the description of reality. But nobody knows how to obtain the basis of such a theory."

***
Clock Space, Coordinate Space; 
Clock Time, Coordinate Time; 
What is the difference?

by

Ronald W. Satz

At last year's ISUS convention, a number of individuals expressed difficulty in comprehending the difference between clock space and coordinate space and the difference between clock time and coordinate time. This note will review these concepts to aid the understanding of these individuals.

Larson states [1]: “We begin with one-dimensional space s and one-dimensional time t....Dividing space by time we obtain velocity s/t...” Space and time do not exist separately; they exist only as aspects of motion. Motion in the most general sense is thus a relation of space to time, and in the Reciprocal System space and time have no properties other than what they have as aspects of motion. In defining motion, we can start with units of space and time, as Larson did in the quotation, or with units of motion and define space and time as the two aspects of that motion; the definitions are equivalent.

The basic space-time unit is thus one-dimensional and is a progression. We reject the Relativity doctrine that space and time are joined in four-dimensional continuum and that space and time magnitudes are purely relative. From the postulates of the Reciprocal System we compute the absolute natural unit of space to be $4.558816 \times 10^{-6}$ cm and the absolute natural unit of time to be $1.520655 \times 10^{-16}$ sec. Their ratio is $2.997930 \times 10^{10}$ cm/sec, the speed of light. The progression originates everywhere and is thus omnipresent. Larson stats [2]: “Unit velocity is a ... true physical datum with a finite magnitude.” Thus we begin with clock space-time, rather than with coordinate space or coordinate time (or a combination of coordinate space with clock time). Conventional physicists (and individuals new to the Reciprocal System) keep trying to start with some type of 3-D or higher metric; we reject this approach entirely.

Coordinate space and coordinate time result from clock space and clock time. Larson explicitly states [3]: “There is a general framework of the universe, an extension space, generated by translational motion...”; likewise, there is an “extension” time, generated by translational motion, the progression. This motion is scalarly outward in all directions and thus the overall distribution of the 1-dimensional progressing units is 3-dimensional. In The Unmysterious Universe [4], I wrote “...with respect to any particular progressing unit, coordinate space and coordinate time include all other progressing units.... The progression of a single unit of space is one-dimensional, but the progression of all space units is distributed in three-dimensions.” Stationary coordinate space (or stationary coordinate time) can arise only in the context of a gravitationally-bound material system (or cosmic system), in which the atoms of matter (or c-matter) have neutralized the space progression (or time progression).

When Larson states [5] that “undisplaced space-time is the physical equivalent of nothing” he means that a unit of space-time is not a photon, a subatom, an atom, or an electric or magnetic charge. These other entities are interchangeable, either directly or indirectly, but a unit of space-time is not. It cannot be changed into something else, and it cannot be used as an energy source. But this does not mean that space-time is “nothing”; it is unit motion, not zero motion, and is every bit as much an existent as anything physical. Larson says [6] “In terms of [a] building analogy, [space and time] correspond to the bricks of which the building [i.e., the universe] is to be constructed.”

REFERENCES:

2. Ibid, p. 83.
Theory Without Practice is Sterile

There is a kind of thought that is more or less a representation of what is there, like a map. However, thought has a creative function as well, to create what is there. In fact, almost everything we see around us in the world was created from thought, including all the cities, all the buildings, all the science, all the technology, and almost everything we call nature. Farmland was produced by thought, by people thinking what they’re going to do with the land and then doing it....

What prevents us from stopping our present unintelligent sort of growth is ultimately the thought that the continuation of such growth is absolutely necessary and that we can’t live without it. But we can live without it, as long as we don’t make these material products the main point of life. For example, we have to reorganize life fundamentally so that we don’t flood our roads with cars. We have to have other ways of getting around, or perhaps we may not even get around so much.

David Bohm & Mark Edwards, "Changing Consciousness"

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Detailed Steps for the Design and Performance of the Proposed Crucial Experiment

by

Ronald W. Satz, Ph.D.

In previous papers [1], [2], [3], [4], I’ve proposed a new twist on Rutherford scattering: neutralize the alpha particles before they impact on the gold (or other metal) foil. In this paper I present the necessary physical steps to accomplish the experiment.

I. Design Steps

1. Decide whether the detector should be moveable (Fig. 1, from [5]) or the chamber should be moveable (Fig. 2, from [6]). The chamber (a cylindrical vessel) must have a glass window and cover, a knob to rotate the detector relative to the source or a means to rotate the chamber relative to the source, a 360° dial (so angles can be measured precisely), a microdot feed through, a source holder, a source holder stand, two beam collimators, a bottom mounting plate, a target holder (or frame), a detector mount, and a vacuum pump connection. In my modification of the experiment, an opening (vacuum-sealed) in the chamber behind the source is necessary to accommodate the electron gun, which will inject electrons to neutralize the alpha particles from the source. Purchase the appropriate chamber from an instrument supply house (such as Oxford Instruments in Tennessee). Make alterations to it as necessary.

2. Decide the radioactive source of alpha particles. Choose, for example, Po²¹⁰ or Am²⁴¹, as convenient. The primary alpha energy from Po²¹⁰ is 5.2 MeV, whereas from Am²⁴¹ it is 5.586 MeV. Note: gloves must always be worn when handling the source. Choose the amount of the source: 250 μCi to 1 mCi. For example, choose .5 mCi. (1 Ci = 3.7 x 10¹⁰ disintegrations/sec.)

3. Decide the target metal and size. For example, choose gold foil of thickness .00025 cm. The foil should be as thin as possible but self-supporting within its holder.

4. Choose the detector. For example, choose a thin slab of scintillon B (Pilot B from Pilot Chemicals of Massachusetts), of width .565 cm, height 1.55 cm, and thickness .15 cm. This may be mounted to a photomultiplier tube (such as 6192 DuMont), which is then connected to the electronics (Fig. 2); or it may be connected via microdot vacuum to the PRE-AMP (Fig. 1).

5. Choose the electronics for the experiment. Fig. 1 shows a PRE-AMP (with BIAS and PULSER), an AMP, and an MCA. Fig. 2 shows an HV supply, a PM, HV divider, HV meter, Preamplifier, RCL discriminator, Oscilloscope, and Scaler. Purchase the items from an electronics supply house or a company such as Oxford Instruments.

6. Choose the vacuum pump. During the experiment, the chamber should have a pressure in the range of 1e-11 torr to 1e-4 torr. (1 torr = 1 mm mercury, or 133.322 pascals [N/m²], or .001316 atm).

7. Choose the electron gun. For example, choose Kimball Physics EFG-7/EGPS-7 Electron Flood Gun and Power Supply (Fig. 3). This unit provides controls for beam energy, beam current, beam focus, and cathode heating voltage. It is commonly used in vacuum physics experiments and charge neutralization. Calculate the required electron energy and current, as follows. Electron velocity should match alpha particle velocity. Alpha particles have a mass of 6.62*10⁻²⁷ kg and so if their energy is 5.2 MeV (8.327 J), their velocity is 15,860,990 m/sec. At this same velocity, electrons (which have a mass of 9.109*10⁻³¹ kg) have an energy of 1.14578*10⁻¹⁶ J, or 715.196 eV. There must be a minimum of 2 electrons injected for each alpha particle. The number of alpha particles in the incident beam is given as 1.1*10⁵ counts/min ([2]). So this amounts to needing 2.2*10⁵ electrons/min, or 3666.66 electrons/sec. This represents a current of 5.870*10⁻¹⁶ amperes. The specs for the above gun indicate a range in beam energy of 50 eV to 1500 eV and a range in beam current of 1 nA to 100 μA, so the gun is more than adequate for the job. (Perhaps it could be customized to have a current closer to what is needed, so as to avoid excess electrons.) It should be mounted behind the source so that the electrons go around the source and converge on the alpha particle beam. Perhaps a tube should be placed around the tip of the
gun and extended to include the source, which would be mounted inside. The collimators would be placed after this neutralization section. Electrons and non-neutralized alpha particles should be prevented from striking the target, by appropriately oppositely charged sections of the chamber.

II. Performance Steps

1. Assemble all the components selected in the design steps.

2. Remove the source (if it is in the chamber), place the target foil in its holder, turn the electron gun off, evacuate the chamber, and measure the background counting rate, denoted \( R'' \), at the angles shown on Table I (although this should be largely independent of angle). \( R'' \) is due to contamination of the chamber with bits of the source that have broken away, contamination of the foil, and to noise in the detector or electronics. Clean the chamber thoroughly to minimize this background count. If the target is contaminated, replace it.

3. Place the source in the chamber, but remove the target foil (it is in in the chamber), turn the electron gun off, evacuate the chamber and measure the counting rate at the same angles as above. This counting rate, denoted \( R' \), is due to the source, but not produced by scattering in the target foil itself. \( R' \) is mainly due to poor beam collimation, slit scattering, and scattering off residual air molecules. It should contain \( R'' \). Angular dependence may be expected.

4. Repeat step 3, but with the electron gun turned on. Gun controls should be adjusted so that nearly all of the alpha particles are neutralized, with few excess electrons. This background count, denoted \( R''' \), should not be appreciably greater than \( R' \). If it is, the gun controls will have to be adjusted until \( R''' \) approaches \( R' \).

The true counting rate, when the experiment is run with the electron gun off, is

\[
R_{\text{true}}(\theta) = R(\theta) - R'(\theta)
\]  

(1)

where \( R \) is the counting rate with both source and target in place. When the experiment is run with the electron gun on, the true counting rate is

\[
R_{\text{true}}(\theta) = R(\theta) - R''(\theta)
\]  

(2)

5. Take the target foil out, evacuate the chamber, and move the detector (or the chamber) to \( 0^\circ \). Measure the counts from the source, at this angle and at small angles on either side. Note where the peak number of counts occur. This indicates the true position of the beam axis. For instance if the axis is located at \( \theta_0 = -0.25^\circ \), then all scattering angles must be corrected accordingly. The angle beyond which counts will be due to scattered alpha particles is the angle where counts from the source are zero. This could, for instance, be \( \theta \geq 6^\circ \).

6. If, in the vertical direction, the beam size is larger than the dimension of the detector, then only a fraction \( F \) of the incident beam reaches the detector. Let \( h = \) detector height, \( s = \) beam slit height (last collimator), \( r = \) distance from source to last collimator, and \( I = \) distance from last collimator to detector. Then, by geometry,

\[
F = \left( \frac{h}{s} \right) \left( \frac{r}{r + l} \right)
\]  

(3)

If \( h = 1.55 \) cm, \( s = 1 \) cm, \( r = 5 \) cm, and \( I = 6.66 \) cm, then \( F = .665 \). If \( I_0 \) is the peak counting rate obtained from the beam profile, then the total incident beam \( I_0 \) is given by

\[
I_0 = \frac{I_0}{F}
\]  

(4)

If \( I_0 \) is 74000 counts/min, then \( I_0 \) is 110000 counts/min. It would be better to have \( F = 1 \).

7. Now measure \( I_s \) (in counts/min) as a function of angle, for the angles in the table. Make one set with the electron gun turned off, and one set with the electron gun turned on. Subtract the appropriate background counts.

8. For the observed yields of scattered particles, obtain the differential cross-section of the target, from the expression

\[
\frac{d\sigma}{d\Omega} = \frac{I_s}{(\Delta \Omega) I_0 N}
\]  

(5)

where \( N \) is the number of gold atoms/cm\(^2\) and \( \Delta \Omega \) is the solid angle of the beam, approximated by

\[
(6)
\]
If \( h \), the height of the detector, is 1.55 cm, and \( w \), the width of the detector, is .565 cm, and \( I \), the distance to the target, is 6.66 cm, then \( \Omega \) is .0197 sr (steradian). \( N \) is computed to be 1.4744 \* 10^{23} (from [1] or [6]). Place the values of the differential cross-section in the proper columns of the table (one column with the electron gun turned off and one with the electron gun turned on).

9. For each value of \( \theta_{\text{corr.}} \), compute the factor

\[
1 / \sin \left( \frac{\theta_{\text{corr.}}}{2} \right)
\]

and place in the proper column of the table. Both the conventional theory and the Reciprocal System make use of this factor.

10. The observed scattering factor, \( k \), is then the ratio of the differential cross-section of the factor computed in step 9. Record \( k \) in the table for each angle, for the situation with the electron gun turned off and with it turned on.

11. By least squares, obtain the best fitting value of \( k \), for both situations. (Use a computer program (such as [7]) with which one can specify no intercept in the regression equation. The \( Y \) values are the differential cross-sections, and the \( x \) values are the factors computed in step 9. The computed slope, \( m \), is the value of \( k \).) Compare with the theoretical values computed from the conventional theory and from the Reciprocal System (see [1], [3], [4]).

12. From [3], it will be necessary to repeat steps 1-11 201 times with the alpha particles charged and 251 times with the alpha particles neutralized, in order to have at least 99% assurance that the results will disconfirm one of the two theories. The actual repetitions can begin only when we are confident that the electron gun is working properly to neutralize the alpha particles.

13. Equations 17-24 of [3] should then be evaluated. (I will write a program to do the calculations automatically.) The difference in the sample means (Values of scattering constant \( k \)) of all the trials is then compared with the criterion. If the difference in sample means turns out to be less than the criterion, then the null hypothesis, my proposal, based on the Reciprocal System, will have to be accepted.

References


APPENDIX: Estimated Prices for the Hardware Items of the Experiment from Oxford Instruments, I received the following quotation:

1. Ion-Implanted Silicon Detector * $375.00
2. FET Spectroscopy Preamplifier  795.00
3. Detector Power Supply  995.00
4. Fast Pulser  1095.00
5. Spectroscopy Amplifier  1295.00
6. NIM Bin and Power Supply  1340.00
7. PCA Multiport, Multichannel Analyzer for PC  3750.00
8. PC Interface Card  495.00
9. Vacuum Pump  1250.00
10. Rutherford Scattering Chamber  3550.00

TOTAL  $14940.00

A spare PC can be used for the experiment. If one is not available, then approximately another $2000.00 will be needed to purchase one.

From Kimball Physics, I received the following quote:

1. One EFG-7 / EGPS-7 Electron Flood Gun and Power Supply  $7500.00
2. Customizing the Gun for the Necessary Current

TOTAL $15000.00

TOTAL HARDWARE $29940.00

I expect to contract with Arthur C. Lucas of Victoreen, Inc. to carry out the experiment. He will be quoting me a labor charge shortly, after which we will seek funding.

* Will have to be modified to detect neutral particles

Figure 1

Figure 2
Figure 3.

EEG-7/EGPS-7
ELECTRON FLOOD GUN/POWER SUPPLY

50 eV to 1500 eV Standard
100 eV to 5 keV Optional
UNIFORM WIDE-ANGLE LOW ENERGY ELECTRON BEAMS

FOR USE IN:
SURFACE PHYSICS STUDIES
VACUUM PHYSICS EXPERIMENTS
CHARGE NEUTRALIZATION
ELECTRON DESORPTION
SURFACE SCRUBBING
PHOSPHOR TESTING
IONIZATION EXPERIMENTS
SEMICONDUCTOR PROCESSING

FEATURING:
WIDELY CONTROLLABLE
PARAMETERS
FLOOD BEAMS OR
NARROW ANGLE BEAMS
COMPUTER CONTROL / REMOTE CONTROL

The Kimball Physics EEG-7 Flood Electron Gun, with its matching EGPS-7 Power Supply, is intended for use in a variety of UHV, Surface Physics, and Processing applications. It is a complete subsystem ready to attach and turn on. Both beam energy and beam current are adjustable over wide ranges. Beam divergence is also directly controllable. The gun uses a space charge limited refractory metal cathode to generate a uniform flood beam, and the design allows generation of this beam down to medium low energies, and very low currents. An energy range of up to 5 keV is an option. An external connector allows control of all gun power supplies, including the floating supplies, via 0 to 10 V analog inputs at ground potential (optional deflection supplies use -10 V to +10 V analog inputs). All common interface bus types can be accommodated, by use of appropriate D to A converters. A pulse grid option allows slow beam pulsing using a pulse generator.

UHV technology is used throughout. The cathodes are not damaged by repeated exposure to atmospheric gases or water vapor when cold. The gun can be run in vacuums from 1 E-11 torr to 1 E-4 torr. It is bakeable up to 350° C with cables removed. Firing units (containing cathode, control grid, triode structure with ceramic insulators, and electrical connections) are user-replaceable; spare firing units may be returned to the factory for rebuild. The electron gun itself may also be sent back to the factory for complete disassembly, cleaning, and/or installation of a new cathode.
EFG-7F ELECTRON GUN SPECIFICATIONS

**BEAM ENERGY**
- 60 eV to 1500 eV
- Optional: 100 eV to 5 keV

**BEAM CURRENT**
- 1 nA to 100 µA

**ENERGY SPREAD**
- Approximately 0.4 eV plus
- Space Charge Well

**SPOT SIZE**
- Variable 1 mm to 70 mm

**WORKING DISTANCE**
- 25 mm to 200 mm

**BEAM DEFLECTION**
- Optional: +/- 3° at 1500 eV
- Optional: Down to 100 µsec
- +/- 20% with appropriate Drive
- Potentials and Clean System

**CATHODE**
- Replaceable Refractory Metal; not harmed by repeated exposure to atmospheric gases while cold

**MOUNTING**
- 40 mm Conflat Flange
- +/- 20° with Optional Port Alginer

**GUN LENGTH**
- 120-180 mm Range (Set at 160 mm if no preference indicated)

**GUN DIAMETER**
- 25.4 mm at Gun Flange; Necks down to 19.1 mm at 100 mm from flange

**FEEDTHROUGH CONNECTOR**
- Metal to Metal Shell, Mating
- Connector and Cable Furnished

**CABLE**
- Multiconductor Triaxial High Voltage
- 3 m Cable to connect Gun to Power Supply; Optional Length: 5 m

**BAKEOUT TEMP**
- 350°C Maximum (cable removed)

---

EGPS-7H ELECTRON GUN POWER SUPPLY SPECIFICATIONS

**OUTPUTS**
- All Necessary Voltages, to drive
  - EFG-7F Electron Gun Including:
    - Cathode Heating and Control Grid, which float at Beam Energy, and Beam Focus

**ENERGY STABILITY**
- 0.1% at Full Output

**CURRENT STABILITY**
- 10% Drift per hour after Warmup

**DEFLECTION**
- Optional: Centering Deflection
- Optional: Faster Capability
- Deflection Voltages: +/- 100 V

**CONTROLS**
- Controls provided for Beam Energy, Beam Current, Beam Focus, and Cathode Heating Voltage

**COMPUTER REMOTE CONTROL**
- 0 to 10 V Analog Programming at
  - Ground Potential: Optional
  - Deflection Supplies use +/- 10 V

**METERING**
- Digital Meter monitors Beam Energy, Focus, Deflection/Raster Voltages; Analog Meters monitor Cathode Voltage, Cathode Current, Grid Voltage, and Beam Current

**INPUT**
- 105 to 125 VAC, 47 to 63 Hz,
- 150 W; 210 to 240 VAC available

**DIMENSIONS**
- 432 mm Wide, 178 mm High, 483 mm Deep, Rack Mount Kit included

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**CURRENT vs ENERGY**

**SPOT SIZE vs FOCUS / ENERGY**

Kimball Physics manufactures a variety of electron and ion sources for many applications. For further information contact Sales.

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D 22.2-6
ALPHA PARTICLE SCATTERING EXPERIMENT RESULTS

Date: _______  Start Time: _______  End Time: _______

Source: ______________
Energy (J): ______________
Amount (curies): _______

Electron Gun Energy, when on (ev): _______
Electron Gun Current, when on (A): _______

Peak Counting rate (counts/min), $I_{\theta=0}$: _______
Fraction, $F$, Reaching Detector: _______
Total Incident Beam, $I_0$ (counts/min): _______
Target Material: _______
$N$ (no. atoms/cm$^2$): _______
Solid Angle of Beam, $\Delta\Omega$ (sr): _______

| $\theta_{\text{dial}}$ | $\theta_{\text{corr.}}$ | $R_{\text{counts/min \ e.g. off}}$ | $R_{\text{counts/min \ e.g. on}}$ | $R - R^{(-1)}_0$ | $\frac{d\sigma}{d\Omega}$ (obs.) | $\frac{d\sigma}{d\Omega}$ (calc.) | $\frac{1}{\sin^2(\theta_{\text{em.}})}$ | $k_{e.g. \text{ off}} \times 10^8 \text{ cm}^2/\text{sr}$ | $k_{e.g. \text{ on}} \times 10^8 \text{ cm}^2/\text{sr}$ |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 10              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
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Best fitting $k_{e.g. \text{ off}}$: _______
Best fitting $k_{e.g. \text{ on}}$: _______

Conventional theoretical value of $k_{e.g. \text{ off}}$: _______
Conventional theoretical value of $k_{e.g. \text{ on}}$: 0.00

Reciprocal System theoretical value of $k_{e.g. \text{ off}}$: _______
Reciprocal System theoretical value of $k_{e.g. \text{ on}}$: _______
The Wave Mechanics in the Light of the Reciprocal System

K.V.K. Nehru

One of the large areas to which the Reciprocal System is yet to be applied in detail is spectroscopy. The need is all the more urgent as vast wealth of empirical data is available here in great detail and a general theory must explain all the aspects. To be sure, this was one of the earlier areas which Larson explored.[1] But he soon found out, he writes, that there were complications too many and too involved that he decided to postpone the investigation until more basic ground was developed by studying other areas.

Coupled with this is also the fact that the calculation of the properties of elements like the lanthanides is still beyond the scope of the Reciprocal System as developed to date.[2] The question of the appropriateness of the Periodic Table as given by Larson is still open.[2-5]

Under these circumstances it is certain that there is lot more to be done toward enlarging the application of the Reciprocal System to the intrinsic structure of the atom. Perhaps it is time to break new ground in the exploration of the mechanics of the time region, the region inside unit space. Breaking new ground involves some fresh thinking and leaving no stone unturned. In this context, it may be desirable to examine, once again, such a successful theory as the Wave Mechanics in the light of our existing knowledge of the Reciprocal System.

The Fallacies of the Wave Mechanics

The fundamental starting point of the Wave Mechanics is the correlation, which Louie de Broglie advanced originally, of a wave with a moving particle. Like every wave has a corpuscular aspect., as shown by Planck’s analysis of the blackbody radiation, the photoelectric effect and the Compton effect (the scattering of photons by particles), it is hypothesized that every particle has a wave aspect. Since the characteristics of waves and particles are mutually exclusive in many ways, this concept of associating a wave with a particle had been beset from its inception with a contradiction that had been euphemized by stating that the two are ‘complementary’ aspects. This led to many an epistemological difficulty: the quantum theorists concluded that the phenomena (particles) inside the atom are not localized in physical space, that the electron in the atom does not exist in an objectively real manner, that it is but a mathematical symbol, and that the world is not intrinsically reasonable or understandable in the realm of the very little. One may refer to The Case Against the Nuclear Atom[6] by Larson for a critical appraisal.

While this is so, it must be noted that the Wave Mechanics was successful in explaining the vast wealth of the spectroscopic data. The several quantum numbers, n, l, m, etc. come out in a natural way in the theory. Even the ‘selection rules’ that govern the transitions from one energy state to another could be derived. The fine and hyperfine structures of the spectra, the breadth and intensity of the lines, the effects of electric and magnetic forces on the spectra could all be derived with great accuracy. In addition, it predicts many non-classical phenomena, such as the tunnelling through potential barriers or the phenomena connected with the phase, that found experimental verification. Thus we can see that the mathematical success of the Wave Mechanics is accompanied by a gross misinterpretation of the physical concepts involved. It is the latter which Larson points out and condemns in his criticism of the conventional atomic theory.[6]

It might be worthwhile to examine if the Wave Mechanics could be purged of its conceptual errors, drawing from our knowledge of the Reciprocal System, and to see if the transformed version could be integrated into the Reciprocal System scheme with advantage. After all we have seen this happen in the case of the Special Theory of Relativity. Some of its mathematical aspects—like Lorentz transformations or the mass-energy equivalence—could be adopted by the Reciprocal System after purging the theory of the wrong interpretations.

Reinterpretation of the Physical Concepts of the Wave Mechanics

Let us take a look at the original points linking the concept of the wave with that of the moving particle. The frequency $\nu$ and the wavelength $\lambda$ of the wave are respectively given by

$$\nu = E/h = M c^2 / h$$

(1)
\[ \lambda = \frac{h}{p} = \frac{h}{(Mv)} \quad (2) \]

where \( E \) is the energy, \( p \) the particle momentum, \( M \) the mass, \( v \) the particle speed, \( c \) the speed of light and \( h \) Planck's constant. Now the product of \( v \) and \( \lambda \) gives the wave velocity

\[ u = v \lambda = \frac{c^2}{v} \quad (3) \]

That is, measured in the natural units, the propagation speed of the wave associated with the particle is the inverse of the particle speed:

\[ u_{\text{nat}} = \frac{u}{c} = \frac{1}{(v/c)} = \frac{1}{v_{\text{nat}}} \quad (4) \]

As the speed of the particle increases from zero upwards, the corresponding speed of the associated wave decreases from infinity downwards.

It is at this juncture that our knowledge of the Reciprocal System helps clarify the physical situation. In particular, we recall that while speed is reckoned from the standpoint of a three-dimensional spatial reference system, inverse speed is reckoned from the standpoint of a three-dimensional temporal reference system. While the speed of the origin of the three-dimensional spatial reference system is zero in that system, the inverse speed of the origin of the three-dimensional temporal reference system is zero in the latter system, or the speed of the temporal zero would be infinite in the spatial reference system. It can easily be seen that a particular speed \( v_{\text{nat}} \) reckoned from the spatial reference system is identical to the inverse speed \( 1/v_{\text{nat}} \) reckoned from the temporal reference system. Therefore it follows that the switching from the particle speed \( v_{\text{nat}} \) to the associated wave speed \( u_{\text{nat}} = 1/v_{\text{nat}} \) is tantamount to the shifting of the reckoning from the three-dimensional spatial reference system to the three-dimensional temporal reference system.

This is exactly what needs to be done at the juncture where the phenomena (motion) under consideration enter the time region (see Appendix I). In the time region there could be only motion in time, and the relevant reference frame to represent the motion would have to be the three-dimensional spatial reference frame. Since changing from the corpuscular view to the wave view has the significance of shifting from the three-dimensional spatial reference frame to the three-dimensional temporal reference frame, the theorists have unknowingly adopted the right procedure in connection with the calculations relevant to atomic dimensions. But it is no longer necessary to maintain, as the theorists do, that an entity is a particle as well as a wave at the same time, since these two views are irreconcilable. The truth is that the particle viewed from the three-dimensional spatial reference frame is the wave viewed from the three-dimensional temporal reference frame. While the particle has a definite location in the former reference frame, the associated wave, being monochromatic has infinite extent. In the temporal reference frame it appears as infinite repetition.

We often come across situations where a change of the coordinate frame, say, from the rectangular to the polar, facilitates the mathematical treatment. In such cases, the same geometrical form—or more generally, the space-time configuration, namely, motion—takes on different mathematical forms in the different coordinate frames. In the present context we have the converse situation, wherein different coordinate frames engender different space-time configurations from the same underlying reality (see Appendix II). In other words, a change of coordinate frames transforms one physical object (space-time configuration) into an apparently different physical object.

Time and again we find the theorists being compelled to resort to similar transformations (without, of course, the benefit of the insight given by the Reciprocal System). Consider, for example, the phenomenon of diffraction of particles/waves by crystal lattices. Here they customarily work out the interaction in terms of the wave vector \( \lambda \) and the reciprocal lattice, instead of the wavelength \( \lambda \) and the direct lattices respectively.

The quantity \( k = 2\pi/\lambda \) is called the wavenumber. The vector with modulus \( k \) and an imputed direction is the wave vector \( k \). From Eq.(2) it can be seen that the wave vector represents momentum. If \( a_1, a_2 \) and \( a_3 \) are the sides of the unit cell sides \( b_1 = 2\pi/a_1, b_2 = 2\pi/a_2 \) and \( b_3 = 2\pi/a_3 \) is called the reciprocal lattice. Without genuine insight, it is regarded as an invariant geometrical object whose properties are fundamental in the theory of solids. However, from the Reciprocal System we know that in solids the motion equilibrium is in the time region, where space is replaced by equivalent (reciprocal) space. Therefore we can readily see the rationale in adopting the
wave vector (reciprocal wavelength) and the reciprocal lattice in place of the wavelength and the direct lattice respectively.

The Uncertainty Principle

The quantum theorists, being uninformed about the existence of the time region, naturally thought that these waves, associated with the particles, exist in the space of the conventional reference system, while the truth is that they exist in the equivalent space of the time region. Now a particle is localized whereas its associated wave is spread out infinitely. Since the theorists have been mistaking that both the particle and the associated wave exist in the space of the conventional reference frame, they thought if \( \Delta x \) is the region in which the particle is located then it is reasonable for the wave too to be limited in the same extent \( \Delta x \), equal to the 'size' of the particle. They then identify the wave packet, rather than the original monochromatic wave, with the particle. The so-called uncertainty principle stems from this procedure, because the range of size \( \Delta x \), and the range of wave numbers \( \Delta k \), of the waves composing the wave packet, are inversely related as could be seen from Fourier analysis.

\[
\Delta x = 1/\Delta k \quad (5)
\]

Using Eq.(2) we have

\[
\Delta x \cdot \Delta p = \hbar/2\pi \quad (6)
\]

which is the conventional statement of the uncertainty principle.

But now, one realizes that while the particle is localized in space, it does not entail that the associated wave is also to be somehow localized in space, since the latter is to be reckoned from the point of view of the three dimensional temporal reference frame and not the spatial reference frame.

It may be a practical difficulty to measure both the location and the momentum of a system of atomic dimensions with unlimited accuracy simultaneously. But the conclusion drawn by the theorists from the uncertainty principle that a system of atomic dimensions does not possess these properties of precise location and precise momentum simultaneously can be seen to be invalid. As Larzon rightly points out, conclusions such as these are applicable only to the theorists' model, not to the actual system. The uncertainty principle is merely the statement of the fact that the characteristic length belonging to space, namely \( \Delta x \) cm, and the characteristic length belonging to equivalent space, namely \( \Delta k \) cm\(^{-1}\) are reciprocally related (Eq. 5).

The Probability Interpretation

The second point to be recognized is that the wave information is not to be visualized as mapped out on the space of the conventional spatial reference system. The reference frame for the wave is a temporal manifold. As creatures of the material sector we have no direct access to the three-dimensional temporal reference frame; we are rather anchored to the three-dimensional spatial reference frame. But fortunately, we can accomplish the equivalent of the transformation from the spatial to the temporal frame by the contrivance of adopting the wave picture in place of that of the particle. It must continually be borne in mind that the three-dimensional spatial manifold being used in this context is so used as a temporal analogue. This is why the wave function (specifically, the square of the amplitude) takes on the probability interpretation. The action itself is unambiguous and precise, but since it takes place in the temporal reference frame, the outcome in the three-dimensional spatial reference frame is governed by chance and therefore statistical.

The randomness of the radioactive disintegration is another example to the point. When the total mass (rotational + vibrational) of the atom builds up to the upper zero point for rotation, the time-zero as we might call, the (excess) motion reverts to the linear status and is jettisoned as radiation or other particles. Since it is the result of reaching the time-zero point the action is in time instead of in space. The radioactive disintegration proceeds continuously and contiguously in three-dimensional time. But since locations in the three-dimensional spatial frame, the apparent disintegration of the atoms (as observed from the conventional spatial standpoint) seems utterly random.

Again the interference of light is another example. The crests and troughs of the resultant wave in the two-slit experiment coincide respectively with the regions where the maximum and the minimum number of photons reach. But if the beam intensity is very low, say only a few photons are passing the slits, then all that we can say is that a photon
has a greater likelihood of arriving at the location indicated by the wave crest rather than at any other place. In other words, the wave (square of the amplitude) takes on probability interpretation.

This is also precisely the reason why the theorists find some of these forces to be non-local in nature—a totally non-classical phenomenon—namely, that they originate in the time region and the connection between the locations in three-dimensional time and the locations in three-dimensional space is random. We have discussed this point in connection with the phenomena of ferromagnetism and superconductivity.

Wave Mechanics Without the Nucleus

In The Case Against the Nuclear Atom Larson advances arguments to establish that the concept of the nucleus of the atom is untenable. He points out that, in fact, the ‘size’ of the nucleus obtained by the scattering experiments is rather the size of the atom itself. Our calculations in the next section corroborate this. While Larson’s confutation of the nuclear concept proceeds from his original arguments, his criticism of the Quantum Theory, given in the same work, was based entirely on citations from other experts in the field, including those of the pioneers of the Theory. Larson himself does not directly analyze or comment upon any part of the Quantum Theory or the Wave Mechanics. And all those criticisms he quotes deal with the epistemological difficulties only—such as the ‘lack of rationality,’ etc. which we mentioned at the outset—none deal with the mathematical aspects.

Now since we realize that the entire confusion in the area arises from the fact that the theorists do not distinguish between the space of the conventional reference system and the equivalent space of the time region (of which they do not know), if we set this right by explicitly recognizing that the associated wave is reckoned from the three-dimensional temporal reference frame, we would have achieved much progress.

Since according to the Reciprocal System there is no nucleus, we need to give new interpretation to the energy term occurring in the Schrodinger equation for the wave. It cannot be regarded as the energy level of an orbiting electron. But as we shall see below, this can be treated as the energy level of the atom itself.

The Size of the Atom

Larson has pointed out that as the three-dimensional motion that constitutes the atom extends in the time region, its measured size in the time-space region (namely, the conventional three-dimensional spatial frame) would be much smaller than one natural unit of space, \( s_{\text{nat}} \). It is reduced by the inter-regional ratio, 156.44, which was calculated earlier as the number of degrees of freedom in the time region, and 8, which is the number of degrees of freedom in the time-space region. Since the atomic rotation is three-dimensional, the cube of 156.44 is the applicable value. So the measured atomic radius would be the following

\[
s_{\text{nat}}(8 \times 156.44^3) = 14883 \times 10^{-13} \text{ cm}
\]

(adopting \( s_{\text{nat}} = 4.558816 \times 10^{-6} \text{ cm from Larson}^\text{10}.). Since actually it is the volume with which the equation is concerned, rather than the length (radius), there is an additional geometrical factor, \( f \), relating the volume of a cube (of side \( f^3x \)) with that of a sphere (of diameter \( x \)) given by

\[
(f^3 x)^3 = x^3 x^{3/6}
\]

which gives \( f = 0.806 \). Adopting this, the measured radius, based on the natural unit of volume concerned, would be

\[
f^3 \times 1.4883 \times 10^{-13} \text{ cm} = 1.1995 \times 10^{-13} \text{ cm}
\]

But this is specifically the measured radius of an atom of unit atomic weight. If the atomic weight of the atom is \( A \) units, then the measured radius of the atom turns out to be

\[
r_A = 1.2 \times A^{1/3} \text{ fm} \quad (7)
\]

As can be seen, this agrees well with the results obtained from the scattering experiments for the so-called nuclear radius. This therefore confirms Larson’s view that the experimenters are confusing the atom with the nucleus.

The Region of One-dimensional Motion

We recall that the atom is constituted of three rotations a-b-c, ‘a’ and ‘b’ are two-dimensional rotations (three-dimensional motion) in two of
the scalar dimensions, and 'c' is a one-dimensional reverse rotation in the third scalar dimension. Since this one-dimensional rotation is not the basic rotation of the atom, the inter-regional ratio applicable to this is the purely rotational factor 128. As the degrees of freedom in the time-space region is 8 as already pointed out, the range of sizes associated with the one-dimensional rotation in the time region is

\[ s_{\text{net}}/(8 \times 128) = 4.45 \times 10^{-9} \text{ cm} \]  
(8)

Hence we can expect the discrete speeds which exist within this spatial range, as far as the one-dimensional type of rotation is concerned, to be part of the atomic structure and the origin of the energy levels that explain the line spectra. Our preliminary study suggests that further prospects for the understanding of the spectroscopic data lie in this zone of one-dimensional rotation of the time region.

Conclusion

It is shown that while the Wave Mechanics has been very successful and accurate mathematically, it is fraught with some fundamental errors. A review of the latter in the light of the Reciprocal System of theory shows that the principal stumbling block was the ignorance of the existence of the time region and its peculiar characteristics.

Knowledge of the Reciprocal System enables us to recognize two crucial points: (i) that the wave associated with a moving particle, in systems of atomic dimensions, exists in the equivalent space of the time region; and (ii) that the switching from the particle view to the wave view is equal in significance to shifting from the standpoint of the three-dimensional spatial reference frame to that of the three-dimensional temporal reference frame. This recognition not only throws new light on the intriguing wave-particle duality, but also corrects the conceptual error that eventually led the theorists to the wrong conclusion that the world of the very small does not conform to the rational laws that are applicable to the macroscopic world.

It is shown that the uncertainty principle does not stem from the intrinsic nature of the atomic phenomena, as the theorists would have us believe, but is rather the result of gratuitously assuming that the wave associated with a moving particle is spatially co-extensive with the particle.

The probability connotation of the wave function is shown to arise from the two facts that the wave is existent in the three-dimensional temporal manifold, and that locations in the three-dimensional temporal manifold and the three-dimensional spatial manifold are randomly connected. The non-local nature of the forces in the time region also follows from the above.

Calculations based on the inter-regional ratios applicable confirm Larson's assertion that the measured size of the atom is in the femtometer range and hence the actual atom is being confused with the non-existent nucleus.

It is suggested that investigation of the one-dimensional motion zone of the time region, in conjunction with the adoption of the Wave Mechanics corrected of its conceptual errors, will lead to greater understanding of the atomic structure and thereby pave the way for the complete explanation by the Reciprocal System, of the spectroscopic data, as well as the other recalcitrant problems connected with the properties of rare-earths etc.

References


7. K. V. K. Nehru, "Is Ferromagnetism a Comagnetic Phenomenon?" *Reciprocity*, XIX (1), Spring 1990, pp. 6-8


**Appendix I**

According to the Reciprocal System space and time occur in discrete units only. If two atoms approach each other in space, they cannot come any nearer than one natural unit of space, \( s_{\text{nat}} \). Within one natural unit of space no decrease in space is possible since one natural unit is the minimum that can exist. However, since the basic constituents of the physical universe are units of motion or speed in which space and time are reciprocally related, an increase of time \( t \) with space constant is equivalent to a decrease of space \( 1/t \). This is referred to as the equivalent space in the Reciprocal System. Therefore, though the atoms cannot approach each other nearer than one natural unit of space, they can do so in the equivalent space by moving outward in time. As all changes in this region inside unit space are in time only, it is referred to as the time region.

**Appendix II**

Consider, for instance, a wave motion in the three-dimensional temporal reference frame, of amplitude given by

\[
\sigma = A + B \cdot \cos \nu
\]

with \( A \) and \( B \) as constants, and \( \nu \) as the time coordinate. In order to return to the spatial reference frame, we (i) transform the time coordinate \( \nu \) into \( \phi \), a rotational space coordinate---rotational because all our time measurements are based on cyclical processes; and (ii) transform \( \sigma \) into \( 1/r \), since equivalent space and actual space are reciprocally related. We then find that the above equation (of the wave configuration) becomes the equation of an ellipse (or hyperbola) that represents the locus of a planetary mass point revolving around a central force.

\[
1/r = A + B \cdot \cos \phi
\]

where \( A/(A^2 - B^2) \) is the semimajor axis and \( B/A \) the eccentricity. (It must be cautioned that though the above example illustrates the point in question, it is not a complete analogy.)

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Minkowski vs. Einstein on Space Translation

Frank H. Meyer

Space at Rest or in Uniform Translation?

The four-dimensional space-time theory of H. Minkowski, mathematician, is usually considered equivalent to or even identical with the space-time continuum theory of A. Einstein, physicist. However, a physical difference in the space-time conceptions of these two men probably will prove more significant than their previously noted mathematical similarity. The theories differ in an important physical respect, namely in the different view each offers about the probable relation of space-time to motion. The one affirms that uniformly translating space is compatible with Newtonian mechanics; the other denies that space progresses with time progression.

Einstein expresses the conventional attitude toward space when he writes that “the idea of motion may not be applied to it.” The context of this statement makes clear that he intends “it” to refer to physical space, as viewed in the light of his general relativity theory. Einstein thus agrees with Newton that space is immovable. Einstein says that space cannot and does not translate with time progression.

Compared with that of Newton and Einstein, the attitude of Minkowski toward the probable relation of space to motion is unconventional. He expresses a novel probability, which he considers valid, however, in the light of Newtonian mechanics. This is the probability which both Newton and Einstein ignore in the development of their theories about the nature of space and motion. In Minkowski’s opinion, three-dimensional physical space can be and is just as likely to be “in a state of uniform translation” or constant scalar progression as to be “stationary” in time. Minkowski declares clearly that there is no way he knows “to decide” between these two alternatives, whose truth he considers to be equally probable.

Time at Rest or in Uniform Translation?

The stationary character of space, presumed by both Einstein and Newton, implies a stationary time and the representation of motion as static.

In Newton’s physics the stationary character of time, though less evident, is no less intended. Unlike Einstein, Newton assumes that space and time exist quite independently of one another. Newton explicitly postulates the stationary (“space is immovable”) character of space, but not of time. Newton’s opinion that “time flows equably without any relation to anything external” appears analogous to Minkowski’s paradigm that space may be in uniform translation. If river flow is motion, then are not equable time flow and uniform space translation likewise motion? No, neither to Newton nor to Einstein. Strange as this may appear to subsequent thinkers, flowing time to Newton and Einstein is compatible with assigning to time a stationary or static character.

The telling evidence that time flowing implies no motion of time for Newton is the declared position of Isaac Barrow, Newton’s teacher. Newton essentially accepted and adopted Barrow’s theory of time. In his Geometrical Lectures Barrow rejects the proposition of Aristotle that time “is an aspect of movement”:

“But does time not imply Motion? Not at all, I reply, as far as its absolute intrinsic nature is concerned; no more than rest; the quality of time depends on neither essentially; whether things run or stand still, whether we sleep or wake, time flows in its even tenor. Imagine all the stars to have remained fixed from their birth; nothing would have been lost to time; as long would that stillness have endured as has continued the flow of this motion.”

Does motion include or exclude space-time?

Barrow’s claim that time does not imply motion and the claims of Newton and Einstein that space does not imply motion are grounded on a further unproved claim that motion is impossible unless something is moving and neither space nor time is any thing. On this baseless ground uniform scalar outward quantized space progression with uniform quantized time progression has been excluded from most conventional physics for centuries by the physics profession.

Einstein delimits the finite speed of absolute uniform quantized space progression with absolute uniform quantized time progression.
from unit speed to zero speed. With his theory of relativity he substitutes for the absolute unit speed of uniform scalar three-dimensional space-time progression, the absolute speed of light in vacuo in a stationary or static four-dimensional space-time continuum.

Since he postulates the speed of equable time progression to be zero, this dimension is equated with the dimensions of the conventional three-dimensional zero speed of absolute space progression as a fourth dimension of space. This serves for all practical purposes of measuring the motion of moving things with rigid rods and clocks. In this way the relativity theory has masterfully obscured the physical fact that the speed of light is the absolute uniform unit speed of three-dimensional outward scalar space-time progression or the speed of the physical locations of photons and other massless particles, as viewed in the above contrived stationary "four-dimensional" space-time reference frame.

Though predicated on the untruth that space and time are immovable, the static space-time continuum of relativity theory has several pragmatic advantages. The theory proposes that space and time are related in having the same zero rate of passage and corrects Newton's mistaken scholia that they are unrelated.

This relativistic space-time continuum model introduces one new and one old economy into science. By proposing to treat time as a fourth dimension of space, relativity theory eliminates any further consideration of time and motion in time in favor of space and motion in space. This has the effect of ruling the speed of light not only the only absolute speed, but also the maximum speed allowed to the physical universe.

By proposing without further examination that space-time and motion, unlike light and matter, are infinitely divisible, which is the meaning of continuum, the model leaves out of account the question whether space, time and motion may not be, like light and matter, quantized?

The creator of the static four-dimensional space-time continuum model initially was quite pleased with his solution of the problem, which Einstein\(^\text{5}\) characterized thus:

"Our only way out seems to be to take for granted the fact that space has the physical property of transmitting electromagnetic waves, and not to bother too much about the meaning of this statement."

Taking for granted that it is a fact that space (and time) have the physical property of transmitting electromagnetic waves, does it follow that our only way out is to agree that this space must be the motionless or stationary continuum of Einstein's relativity theory?

Another way out worth trying is the Minkowski\(^1\) and Larson\(^8\) proposal that space uniformly translates with time progression at the speed of light and that space, time and motion are quantized rather than infinitely divisible. What can be retained of Einstein's relativity theory is his commendable hunch that Newton is mistaken in supposing that space and time are quite unrelated.

While Einstein did a great public service during the twentieth century calling attention to the fact that space and time are somehow naturally and essentially related and inseparably united, he did not discover to the time of his death the physical character of this relationship and unity in the uniform outward unit speed of one discrete unit of space per discrete unit of time, the translating speed of physical locations, whether or not occupied by photons or other massless particles. This was rather the discovery of Dewey B. Larson\(^8\), first published in 1959.

How Space Translates with Time Progression

A flaw of the theory of relativity is its space-time continuum postulate. It is no wonder that Einstein\(^9\), who was an uncommitted investigator, in his later years came to question his and Minkowski's continuum postulate:

"I am tending to the belief that it is impossible to continue further with the continuum theory."

To examine the proposal of Larson that space translates with time progression calls at the start for discarding this arbitrary continuum postulate that space and time are infinitely divisible in favor of adopting instead the contrary postulate that space and time are quantized or finitely divisible.

Einstein and his followers of the relativity theory have taught uncritically that there is no other way or at least nobody has found any other way to account for and measure the absolute constancy of the speed of light in
vacuo than the unquantized, motionless or stationary, four-dimensional space-time continuum reference frame system. Here are some examples of this relativity teaching:

"......we shall assume without examination..... the unidirectional, one-valued, one-dimensional character of the time-continuum."\textsuperscript{10}

"Both space and time are assumed to have to be infinitely divisible-to have no ultimate structure."\textsuperscript{11}

"While fields and particles come and go, space and time lie inert, providing the stage upon which the actors play their roles."\textsuperscript{12}

"From the quantum phenomenon it appears to follow with certainty that a finite energy can be completely described by a finite set of numbers (quantum numbers). This does not seem to be in accord with a continuum theory and must lead to an attempt to find a purely algebraic theory for the description of reality. But nobody knows how to obtain the theory."\textsuperscript{13} (italics mine)

It cannot be denied that as early as 1959 Larson\textsuperscript{14} explained the existence of light, electricity, magnetism, matter, etc. in quantized (finitely divisible) form as caused by the quantized existence of motion, space and time. In this theory, the reciprocal system of physical theory, the absolute constancy of light speed is accounted for as the unit speed, one natural space unit per one natural time unit, the uniform rate of outward scalar progression with time progression of the physical locations of all photons and other massless particles.

**New Definition Excludes Absolute Rest**

Hitherto scientists have always supposed that some stationary body must somewhere exist and can be found as the basis of building a most suitable reference frame for examining, thinking about and understanding motion. Thus, Aristotle and Ptolemy chose the stationary Earth; Copernicus and Kepler, the stationary Sun; Newton and Maxwell, Immovable Space or a Stationary Ether; Einstein and Minkowski, an Inert Space-Time. Larson finds rather that the most natural reference system for understanding motion is the three-dimensional outward scalar uniform space-progression with time progression of physical locations at unit speed. In this reference system photons and other massless particles remain stationary, each in the physical location in which it originates. Most physical locations are unoccupied, whether unoccupied or occupied, each location progresses at the same unit speed.

Among others Aristotle and Leonardo da Vinci counsel that to understand Nature, try to understand Motion. Previously, however, scientists have ignored motion as the primary, fundamental term of physics.

The modern conjecture about an, inert, stationary space-time is a corollary of the postulate that the physical universe is a universe of matter, of things and energy, and that motion, space and time are functions of matter. According to this conjecture, matter is primary to motion, space and time. Space is not considered as an aspect of motion, but of matter by Einstein: "Now as regards the concept of space: this seems to presuppose the concept of the solid body." Also, "According to the general theory of relativity, the geometrical properties of space are not independent, but are determined by matter."\textsuperscript{2a}

The reciprocal system of Larson introduces a new postulate about the universe, a new definition of motion, unit of motion and physical location:

The universe is composed entirely of one component, motion, existing in three dimensions and discrete units.

Motion is the relation between two uniformly progressing reciprocal quantities, space and time.

By reason of the postulated reciprocal relation between space and time each individual unit of motion is a relation of one unit of space and one unit of time, motion at unit speed. The magnitude of unit speed is identified with the speed of light.

According to our definition, motion involves a uniform progression of both space and time. A physical location in space is a point or segment of the line of space progression at a given time. A physical location in time is a point or segment of the line of time progression at a given place.

The future will reveal whether the reciprocal system of physical theory is the way to the reevaluation of physics for achieving unification of our science.

The past as early as 1881 already has brought in its verdict concerning both the special and
general relativity theory to the extent that it is irrevocably committed to the immovable four-dimensional space-time, also known as the stationary ether.

In an Address delivered on May 5th, 1920, in the University of Leyden, Dr. Einstein summarized his theory of relativity:

"Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), ..... But this ether may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time. The idea of motion may not be applied to it."

In 1881 Michelson conducted a famous experiment at Potsdam, Germany. He explained the unexpected outcome of this experiment:

"The interpretation of these results is that there is no displacement of the interference bands. The result of the hypothesis of a stationary ether is thus shown to be incorrect, and the necessary conclusion follows that the hypothesis is erroneous." (my italics)

References


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Excerpt from Dewey B. Larson's book, Nothing But Motion, pages 15-16:

The simple concept of a universe of motion, without additions or modifications-the concept utilized in this present work-is that of a universe which is composed entirely of motion.

The significant difference between these two viewpoints lies in the role that they assign to space and time. In a universe of matter it is necessary to have a background or setting in which the matter exists and undergoes physical processes, and it is assumed that space and time provide the necessary setting for physical action. Many differences of opinion have arisen with respect to the details, particularly with respect to space - whether space is absolute and immovable, whether such a thing as empty space is possible, whether or not space and time are interconnected and so on - but throughout all of the development of thought on the subject the basic concept of space as a setting for the action of the universe has remained intact. As summarized by J. D. North:

Most people would accept the following: Space is that in which material objects are situated and through which they move. It is a background for objects of which it is independent. Any measure of the distance between objects within it may be regarded as a measure of the distance between its corresponding parts.

Einstein is generally credited with having accomplished a profound alteration of the scientific viewpoint with respect to space, but what he actually did was merely introduce some new ideas as to the kind of setting that exists. His "space" is still a setting, not only for matter but also for the various "fields" that he envisions. A field, he says, is something physically real in the space around it. Physical events still take place in Einstein's space just as they did in Newton's space or in Democritus' space.
The principal obstacle that stands in the way of acceptance of the idea of a finite universe is the observed outward motion of the photons of light and other electromagnetic radiation. On first consideration, it would seem that regardless of what the aggregates of matter may be doing, the radiation is being dispersed outward into space, and is eventually lost from the universe as we know it. But we now find that this apparent outward movement of the photons is an illusion due to the inward movement of the gravitationally bound system from which we are doing the observing. The photons actually have no capability of independent motion. This is why the physicists have never been able to find a mechanism for the "propagation of radiation." There is no such propagation, and therefore no need for a mechanism. The prevailing impression is that Einstein provided an explanation for this phenomenon, but, in fact, what he did was to dismiss the problem as too difficult. --Dewey B. Larson in THE UNIVERSE OF MOTION.

Our only way out seems to be to take for granted the fact that space has the physical property of transmitting electromagnetic waves, and not to bother too much about the meaning of this statement. We may still use the word ether, but only to express some physical property of space. --Albert Einstein in THE EVOLUTION OF PHYSICS.

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How Light Speed is Constant

Frank H. Meyer and Rainer F. Huck

[The essence of this essay about How Light Speed is Constant has been presented to the Fall, 1993 Annual Meeting of the Minnesota Area Association of Physics Teachers, held Saturday, October 30, at St. Cloud University.]

This inquiry presents evidence that the theory of relativity does not offer a cogent physical reason for the established fact of the absolutely identical constant light speed of all photons in vacuo, measured to be \( c = 2.9979 \times 10^{10} \) cm/sec. A reasonable explanation of this fact questions the claim of the conventional theory that space-time essentially is continuous and motionless. The new theory affirms rather that motion is quantized and identical with space-time. The three-dimensional nature of time controls the constancy of light speed, \( c \). Hence the theory identifies \( c \) with the outward uniform scalar rate of progression of physical locations, whether or not occupied by photons or other massless particles. Space-time progression helps to account for the expansion of the universe. The essence of this different theory about the absolute constancy of light speed of all photons in vacuo is associated with the names of Dewey Larson and Herman Minkowski.

**Outward Uniform Space Translation with Equable Time Flow at Unit Speed**

A probable better way than that of Einstein\(^1\) to explain the absolute constancy of the speed of light in vacuo is to postulate with D.B. Larson\(^8\) and H. Minkowski\(^6\) that space is a three-dimensional, outward, uniform finite scalar translation and to postulate with D.B. Larson\(^8\) and I. Newton\(^4\) that time is a three-dimensional, outward, equable finite scalar flow. From this follows that the absolute translatory component of the speed of light is the unit speed of space-time progression of all physical locations, whether or not occupied by photons or other massless particles.

As explained by Larson\(^9\), "The photons actually have no capability of independent motion. This is why the physicists have never been able to find a mechanism for the 'propagation of radiation.' There is no such propagation, and therefore no need for a mechanism. The prevailing impression is that Einstein provided an explanation for this phenomenon, but in fact, what he did was to dismiss the problem as too difficult."

Larson\(^8\) has proposed that each photon is a compound motion, constituted of its intrinsic vibrational speed, its frequency, and an extrinsic translational speed, the speed of its physical location, in which it originates and ever remains, so long as it continues to exist. That what Einstein\(^1\) did was to dismiss the problem of the absolute identical speed of light as too difficult is evidenced by the quoted statement of his that appears later in this paper as well as on the masthead page of this issue of *Reciprocity*. Mr. Larson has discovered that the absolute constancy of the translatory speed of light is identifiable with the unit speed of the scalar quantized uniform translation of space with the scalar quantized equable flow of time, the speed of the space-time progression. The 'force' behind the space-time progression is *as universal* as and is *primary* to the universal gravitational 'force'.

Before the case for space-time progression as the valid explanation of the absolute identical uniformity of the translatory speed of light in vacuo can be further advanced, another conventional dogma of modern physics about space-time nature can be and is questioned: namely, that while light, electricity, magnetism and matter now are acknowledged to be quantized, motion, time and space are not. When space-time is thought not to be quantized, space-time is said to be a four-dimensional continuum. Continuum means infinitely divisible; that no smallest unit of time exists; that no smallest unit of space exists. Motion is quantized means motion is finitely divisible; when motion is
quantized, a smallest unit of motion exists. Too few physicists have dared to question the infinite divisibility of space; one who has is Richard Feynman\textsuperscript{10}: "I believe that the theory that space is continuous is wrong, because we get these infinities and other difficulties, and we are left with questions on what determines the size of all particles."

In this connection it is of interest that Einstein in the last period of his life is reported to have remarked:

"I am tending to the belief that it is impossible to continue further with the continuum theory."

In spite of the theoreticians following Einstein, reason leads those of us who realize we breathe and move a finite time in the material sector of the physical universe, to recognize that clock time does progress uniformly. Recognition that space uniformly progresses and is not absolutely immovable is more difficult. In this connection it is worthy of note that one of the very few thinkers even to contemplate the possibility of "space in a state of uniform translation" has been the distinguished mathematical physicist and close collaborator of Albert Einstein: Herman Minkowski\textsuperscript{6}.

Of course, space does not exist in a state of uniform translation by itself. Space, like time, is an aspect of motion. Space cannot and does not exist apart from time, which exists also as motion's other reciprocal aspect. On the issue whether space and time are inseparable and related, Newton now is acknowledged to have been mistaken and Einstein to have been closer to the truth. To the issue of whether motion, space and time are finitely divisible or quantized, Newton and Einstein gave little attention. The closest Einstein\textsuperscript{13} came to considering the implication of all the physical universe being finite and finitely divisible is in the following:

"One can give good reasons why reality cannot at all be represented by a continuous field. From the quantum phenomenon it appears to follow with certainty that a finite energy can be completely described by a finite set of numbers (quantum numbers). This does not seem to be in accord with a continuum theory and must lead to an attempt to find a purely algebraic theory for the description of reality. But nobody knows how to obtain the theory. " (ours).

A typical textbook example well illustrates how modern physicists have gone along with the continuum theory of space-time or motion to the present:

"Both space and time are assumed to be infinitely divisible-to have no ultimate structure."\textsuperscript{11}

\textbf{How Space-Time Progression Is Quantized At The Speed Of Light (Unit Speed).}

By 1959 Larson\textsuperscript{8} found a purely algebraic theory for the description of physical reality. This theory is not in accord with a continuum theory and is in essence an extension of quantum theory from light, electricity, magnetism and matter to motion, space and time. To make this point Larson is committed to define finite units of motion, time and space. This is a formidable challenge, which nevertheless, we think, he meets.

Motion, as Larson\textsuperscript{8} defines it, is measured by speed, the scalar magnitude of the relation between space and time. Larson postulates that the universe is composed of one component, motion, existing in three dimensions and in discrete units. He defines motion as the relation between two uniformly progressing reciprocal quantities, space and time. He defines unit speed as the speed of light.

By reason of the postulated reciprocal relation between space and time, each individual unit of motion is a relation between one unit of space and one unit of time, a motion at unit speed.

Since the unit of speed is the speed of light in the reciprocal system of Larsonian physics, the velocity of light in a vacuum corresponds to unit velocity. This finite velocity has been accurately measured and so Larson\textsuperscript{8} starts his proposed computations of the natural units of space and time with the natural unit of velocity equal to 2.9979 \times 10^{10} centimeters/second.
Larson defines the units of space-time progression as the primary units of motion and he defines the primary motions as those which can exist independently of the existence of motions of other types.

Inasmuch as Larson postulates that the universe is three-dimensional, he proposes to represent the scalar progression of space by a line in a stationary three-dimensional spatial reference system, measuring the corresponding progression of time by means of a scalar device, a clock. In this reference system, a positive motion is represented as outward from a reference point, and a negative motion, as inward.

Inasmuch as Larson postulates that the universe is three-dimensional, he proposes to represent the scalar progression of time by a line in a stationary three-dimensional temporal reference system, measuring the corresponding progression of space by means of a scalar device, a clock. In this reference system, a positive motion is represented as outward from a reference point, and a negative motion as inward.

The initial point of the progression of an individual unit of motion is zero. As the distance between two points cannot be less than zero, it follows that the primary motions are necessarily outward, increasing the distances relative to the initial points. The progression is scalar. It is simply outward without any inherent direction. Motion outward from the initial point of the progression is therefore outward from all points of reference.

Hence any two physical locations progress outward from each other at unit speed; that is, their separation is increasing at the rate of one unit of space per unit of time. Larson defines the natural system of reference as that system of reference in which the primary motions do not cause any change in the positions of physical locations. The natural reference system is progressing outward relative to the spatial reference system and/or the temporal reference system at unit speed, whose magnitude is the speed of light in vacuum.

Since Larson’s reciprocal system postulate specifies that nothing exists other than discrete units of motion, and the natural reference system is a direct consequence of the existence of the primary units, this reference system is the framework, or background, of the universe of motion, and does not represent any activity in that universe. The natural system of reference, as defined, is therefore the physical zero or datum level, from which all physical activity extends.

Larson identifies the outward progression of the natural reference system relative to the stationary system of reference as the “expansion of the universe”, reported by the astronomers.

At this point Larson has arrived, by deduction from the basic premises of his reciprocal system of theory, at an explanation of the general background of the physical universe that is essentially in agreement with the astronomer’s assumption. (Larson’s derivation leads to a uniform outward speed, rather than a speed that varies with the distance, as produced by the kind of expansion assumed by the astronomers, but this difference is easily accounted for, because there is a known force, gravitation, that acts against the outward motion, with a magnitude varying as an inverse function of the distance.)

An advantage of deriving this explanation of the universal background from a set of general premises, rather than merely assuming its existence, lies in the fact that further deductions can be made from these same premises. Instead of a single process involving the universe as a whole, the explanation Larson has provided from the premises of his concept of the universe of motion identifies the expansion as the result of outward scalar motions of individual physical locations. This opens the way for the existence of other scalar motions of the same physical locations, which Larson names independent motions.

Photon. of Light is First of the Independent Motions

Units of inward motion can be superimposed on the outward units, once the primary units are in existence. The net...
magnitude of two such motions is zero, and the combination therefore has no physical properties in a spatial reference system, but it constitutes a base upon which other combinations can be formed.

Motion is a progression. Thus it is not a succession of jumps, even though it exists only in discrete units. There is progression within the units, as well as unit by unit, simply because the unit is a unit of motion (progression). The significance of the *discrete unit postulate* is that discontinuity can occur only between units, not within a unit. But the various stages of the progression within a unit can be identified.

The continuity of the progression within the units enables the existence of another type of scalar motion of physical locations. This is a motion in which there is a continuous and uniform change from outward to inward and vice versa; that is, a *simple harmonic motion*. At this stage of the development only continuous processes are possible, but a continuous change from outward to inward and the inverse is just as permanent as a continuous outward or inward motion.

In the two-unit complete cycle of the simple harmonic motion the net change of the spatial position of the physical location is zero. As represented in the spatial reference system, the two-unit combination remains stationary in the dimension of the motion.

Since the natural reference system is progressing outward relative to the spatial reference system, the physical location occupied by the two-unit motion combination moves outward at the speed of light in a second dimension.

The form of the combined progressions then takes the form of a sine curve.

Larson identifies such motion compounds as photons. A system of photons is electromagnetic radiation. [This explanation shows how radiation has the properties of a wave as well as the properties of particles. Radiation is composed of particles (discrete units of motion), but the motion of these particles is wave-like.]

There is no inherent relation between the time magnitudes involved in the two different dimensions of the photon motion. One is the progression of the natural reference system. The other is independent of this progression. Thus the frequency of the radiation, the number of cycles per unit of linear progression, can take any value, subject only to the capability of the process whereby the radiation is produced.

**Derivation of the natural units of time & of space from the basic frequency unit**

Before Larson could measure Nature's smallest unit of time and smallest length of space, he had to learn how to express the meaning of the place of a photon. When in 1949 Eugene Wigner and T.D. Newton looked for the place to position a photon, they found this quantum particle different from other elementary particles, such as electrons, neutrons, protons or mesons. They did not find a place of the photon within the formalism of quantum mechanics, predicated on the assumption of an inert space-time.

Larson proposes to express the meaning of a photon's place in Nature by redefining the conventional relativity notion of physical location. According to the reciprocal theory:

A physical location in space is a point or segment of the line of space progression at a given time.

Reciprocally, a physical location in time is a point or segment of the line of time progression at a given place.

Physical locations are the result of the existence of discrete units of motion. The reciprocal theory defines a universe of motion in which scalar motion of physical locations is not a unique phenomenon confined to the expansion recognized by the astronomers, but is the basic form of the motion from which all physical phenomena are derived.

Mathematical unity, not mathematical zero, is the true physical zero. Unit speed involves equivalence between quantized space and quantized time, both as to magnitude and dimensionality. That is, the dimensions of
motion being three, the dimensions of space are three and the dimensions of time are three. Time cannot be reduced to space; time has no dimensions in space, and vice versa. The ratio of the natural unit of space to the natural unit of time gives unit speed, because the two units are equivalent. This equivalence and the three dimensions of time and the status of mathematical unity as the true physical zero result from the reciprocal character of the relation between space and time.

Mathematical unity or the speed of light is the true physical zero, because the reciprocal character of the space-time relation also implies that all physical phenomena, beginning with the photon of radiation, emerge and result only from a speed displacement from unit speed below or above unit speed. Because space and time are reciprocal, associations of n units of one component must exist under certain conditions and under these conditions the n units of this kind are equivalent to 1/n units of the other kind of component. These speed displacements can and do exist, because of a difference between space (or time) as a constituent of space-time and space (or time) as a separate entity. The difference is that direction is a property of space (or time) individually, but not of space and time together as constituents of space-time; hence space-time is directionless or scalar.

The natural unit of time can be obtained, provided information is available about a photon whose oscillatory motion involves one outward unit and one inward unit of motion constituting a full cycle of oscillation. If the frequency of such a photon has been measured in the cgs unit of cycles per second, the natural unit of time in fraction of a second can be computed from this datum as follows:

When cycles/second is chosen as the unit of frequency, it is assumed that frequency is a function of time only. Frequency is equivalent to velocity, a ratio of space to time. Therefore, the natural unit of frequency is one unit of space divided by one unit of time. This is equivalent to a half-cycle per unit of time, since a full cycle involves one unit in each direction. Larson thinks that the frequency of the above photon has been measured by Rydberg and is reported in the literature as having a value of $3.2889 \times 10^{15}$ cycles/second. As specified previously, the measured value of the Rydberg fundamental frequency for this purpose will be expressed as $6.576 \times 10^{15}$ half-cycles/second.

"Expressing the frequency, which is actually a velocity, in terms of reciprocal time in this manner is equivalent to using the natural unit of space in combination with the cgs unit of time as the cgs unit of frequency. In other words, omitting consideration of the space term in selecting the unit of measurement has the same effect as giving it unit value. The natural unit of time in cgs terms is therefore the reciprocal of the Rydberg frequency or $1.52 \times 10^{-16}$ second.

"We may now multiply this figure by the natural unit of velocity, $2.9979 \times 10^{10}$ cm/sec, to obtain the natural unit of space, $4.55 \times 10^{-6}$ cm.$^8$

How is Light Speed Constant?

The theory of relativity does not lead to a reasonable answer to this question. The author of relativity, Albert Einstein$^1$, has contributed the following suggestion about how to approach the answer:

"Our only way out seems to be to take for granted the fact that space has the physical property of transmitting electromagnetic waves, and not to bother too much about the meaning of this statement."

It will be helpful to recognize that the physical space alluded to is affirmed not to progress, to be motionless and to be continuous with an unprogressive time continuum.

Einstein$^2$ explicitly reports that his notion of motion is inapplicable to space. Also the space-time continuum is a postulate of the relativity theory. The conventional consensus has adopted as a truth, beyond reasonable doubt, that the space-time continuum remains inert while all photons come and go roaming through this continuum somehow or other with an identical speed.

Furthermore, the quantum physicists with few exceptions have not bothered too much.
about the conceptual meaning of the absolute identical speed of light and generally endorse the Einstein model. According to this conceptual model, photons, passing through an unquantised motionless space-time continuum, all manage somehow to come and go with the same absolute identical speed.

The one absolute finite light speed is a fact, first well-established by the Michelson and Morley experiment with many subsequent verifications and this unit speed may well be the only sensible measure of space-time motion itself. However, does the accepted, conventional conceptual account, invented to explain this fact, do so? Is this proposed account “our only way out?”

The theory of relativity is mathematically compatible with the Lorentz transformation equations. So must any other conceptual theory that purports to explain the absolute constancy of light in vacuo, since the equations are empirically derived. A more adequate explanation of light speed constancy would be one that is not only compatible with the Lorentz equations but also allows that which the relativity explanation does not: retention of absolute as well as relative components of space and time magnitudes.

Does Motion Exclude or Include Space-Time?

Einstein’s four dimensional space-time continuum does not progress; relativity space-time of Einstein allegedly is inert, motionless, stationary, static, inactive, still, passive, at rest. This conventional approach to the role of space and time, that they are facilitators of, but not participants in the motion of other physical entities and objects, has long been taken for granted by the physics profession as true beyond reasonable doubt. A typical textbook accepts as beyond need for further inquiry the notion that motion is inapplicable to space and time:

“While fields and particles come and go, space and time lie inert, providing the stage upon which the actors play their roles.”

Einstein teaches this conventional attitude toward space when he writes that “the idea of motion may not be applied to it.” The context of this statement discloses that ‘it’ refers to physical space, as viewed in the light of his general relativity theory. Einstein thus agrees with Newton that space is immovable:

“Absolute space, in its own nature, without relation to anything external, remains always similar and immovable.”

Thus, in the conventional science of physics the definition of motion excludes space, by agreed definition of Isaac Newton and Albert Einstein. Most theoretical and mathematical physicists have left this definition unquestioned & untouched. Previous to the above quote, Newton tells his readers:

“I do not define time, space, place, and motion, as being well-known to all.”

What about time? Is motion defined in conventional physics to exclude time? The answer turns out to be Yes, although Newton as well as Einstein are more ambiguous about their attitude toward time than toward space. Both Newton and Einstein disagree with Aristotle, who believes that time is an aspect of motion.

Time at Zero Speed or a Uniform Progression with Space at Unit Speed?

At first glance Newton’s definition of time appears to involve motion of time: “Absolute, true and mathematical time, of itself, and from its own nature, flows equably without relation to anything else, and by another name is called duration”

Nevertheless, the immovable character of space clearly adopted by both Newton and Einstein, implies an immovable time and the representation of motion as static. In Newton’s physics the immovable character of duration, though less obvious, is no less intended. Unlike Einstein, Newton implies that space and time exist quite independently of each other. Einstein allows that space and time are somehow interdependent, together forming a four-dimensional continuum, time having only
one dimension and space, three. Newton explicitly postulates the immovable character of space, but not of time.

Newton's opinion that "time flows equably without relation to anything external" appears analogous to Minkowski's paradigm that "space...may be in a state of uniform translation." If river flow is motion, then is not equable time flow and uniform outward space translation likewise motion? No, neither to Newton nor to Einstein! Strange as this may appear to subsequent thinkers, flowing time to Newton as well as to Einstein is quite compatible with assigning to time a motionless or static or inert character, when using time in setting up the reference frames physicists habitually have to use and do use.

That time flowing in its even tenor is compatible with no progression of time is the declared position of Isaac Barrow, Isaac Newton's teacher and predecessor: "But does not time imply motion? Not at all, I reply, as far as its absolute intrinsic nature is concerned; no more than rest; the quality of time depends on neither essentially; whether things run or stand still, whether we sleep or wake, time flows in its even tenor."

Newton essentially agrees with Barrow in rejecting the proposition that time is related to motion. "Flows in its even tenor" equals "flows equably." The theorists of relativity and quantum physics, agreeing with Newton and Einstein that the speed of space translation with respect to time flow is zero, attribute the absolute uniform speed of light in vacuo, not to space-time motion, but rather to a postulated uniform self-movement of each photon through an inert or immovable infinitely divisible space-time.

**Larson's Space-Time Definition Excludes Absolute Rest and Infinite Speed**

Larson's reciprocal theoretical system excludes infinity from the physical universe. Since he defines motion to be equivalent to space-time, all physical entities and phenomena are manifestations of motion and are measured in terms of 1/n and n/1, where n is finite but not zero. Hence the quantity of motion is finite and no infinities are possible. Although notions of infinite divisibility have been entertained by natural philosophers in the past, neither absolute zero speed nor absolute infinite speed has been observed to occur in the physical universe.

Philosophical scientists hitherto often have supposed that some stationary body must exist somewhere and will someday be found as the proper basis for constructing the more suitable reference frame for examining, thinking about and understanding motion. Aristotle and Ptolemy chose the presumed stationary Earth; Copernicus and Kepler, the presumed stationary Sun; Newton and Maxwell, the presumed Immovable Space or Stationary Ether; Einstein and Minkowski, the presumed Inert or Static Space-Time.

Larson finds rather that a more natural reference system for understanding motion is his discovered three-dimensional outward scalar uniform space progression with three-dimensional outward uniform scalar time progression of physical locations at unit speed or the speed of light. In this reference system photons and other massless particles remain stationary, each in the physical location in which it originates. However, most physical locations are unoccupied. Whether unoccupied or occupied, each location progresses at the same unit speed.

The modern conjecture about an inert, stationary space-time continuum is a corollary of the postulate of a universe of matter theory, in which motion or space-time, like things and energy, are functions of matter. According to this conjecture, matter is primary to motion, space and time. Space-time is not considered as an aspect of motion, but rather as an aspect of matter by Einstein: "Now as regards the concept of space: this seems to presuppose the concept of the solid body." Also, "According to the general theory of relativity, the geometrical properties of space are not independent of but are determined by matter."
Summary of theory that accounts for constancy of light speed

In the reciprocal theory Dewey B. Larson proposes that the physical universe fundamentally is a universe of motion rather than a universe of matter. For the reciprocal theory he introduces a new postulate about the universe and new definitions of motion, unit of motion and physical location:

The universe is composed entirely of one component, motion, existing in three dimensions and in discrete units.

Motion is the relation between two uniformly progressing reciprocal quantities, space and time.

By reason of the postulated reciprocal relation between space and time, each individual unit of motion is a relation of one unit of space and one unit of time, motion at unit speed. This unit magnitude is identified with light speed.

According to Larson’s definition, motion involves a uniform progression of both space and time. Hence a physical location in space is a point or segment of the line of space progression at a given time. A physical location in time is a point or segment of the line of time progression at a given place.

The future will reveal whether the reciprocal system of physical theory of Dewey B. Larson is or not a better way to attain the revaluation of physics for achieving unification of physics with natural science and with the human spirit.

Experimental refutation of the conventional physics account of light speed constancy

The past as early as 1881 already has brought in its verdict concerning an aim of the special and general theory of relativity to explain the identical constancy of the translatory speed of all photons in a relatively stationary vacuum. This account proposes that the electromagnetic waves are transmitted at the speed of light by space, to which we are to take for granted that the idea of motion is inapplicable, or transmitted by space-time, assumed to be at rest, inert, static.

The space and/or space-time of the relativity theories of Einstein are essentially indistinguishable from the stationary aether or ether of Isaac Newton and James Clark Maxwell.

In an Address delivered on May 5th, 1920 in the University of Leyden, Dr. Einstein\(^2\) summarized his relativity theory’s conception of space:

“Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; In this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense. But this ether may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time. The idea of motion may not be applied to it.”\(^2\)

In 1881 Dr. Michelson\(^1\) conducted a famous experiment at Potsdam, Germany and explained the unexpected outcome of his experiment:

“The interpretation of these results is that there is no displacement of the interference bands. The result of the hypothesis of a stationary ether is thus shown to be incorrect, and the necessary conclusion follows that the hypothesis is erroneous.”


5. Aristotle Physics, Great Books, 8, IV, 11, 14.


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**Corrections in RECIPROCITY, Vol. XXII, No. 2, Autumn, 1993.**

for K.V.K.'s Wave Mechanics in Light of the Reciprocal System

[p - page no.; 1c, rc - left / right column; pr - para no.; L - line no.]

1. p. 8, rc, pr. 2, L. 4: “n, 1, m,” should be “n, 1, m,”

2. p. 9, 1c, L.6 from bottom: “spatial” should be “temporal”

3. p.9, rc, pr 2, L. 7: “teh” should be “the”

4. P.9, rc, pr.4, L. 6: Between the words “cell” and “sides” insert the following: “of a crystal lattice, then the array of points drawn with the unit cell”

5. p. 10, 1c, pr 2, L.15: “in” should be “to”

6. p. 10, 1c, pr.2, L.15: Between the words “extent” and “Δx” insert the following: “Δx. So they took recourse to the concept of the wave packet. The latter is a superposition of plane waves, with their wavenumbers in the range Δk centered around the de Broglie wave number k = (2π /λ) and producing a resultant wave whose amplitude is non-zero only for a space of”

7. p. 10, rc, pr 3, L. 13: “frtame” should be “frame”

8. p. 10, rc, pr. 3, L. 13: Between the words “:“dimensional” and “spatial” insert the following: “temporal frame locations are only randomly connected to the locations in the three-dimensional”

9. p. 11, rc, pr 2, L.9: “degeres” should be “degrees”

10. p. 11, pr. 2, L. 16: “14883: should be “1.4883”
A MODIFIED EXPLANATION OF
THE RECIPROCAL SYSTEM OF THEORY

Larry Denslow

Rationale

As a consequence of attempting to discuss the basics of the Reciprocal System of theory with many people at various degree or non-degree levels, I have come to two major conclusions. First, it is much easier for a person who has not been brain-washed by the presently accepted theoretical concepts concerning the nature of motion to grasp the basic ideas of scalar motion. Second, for a person who is quite familiar with the presently accepted way of thinking in either Physics or Chemistry, it has been necessary to discuss the nature of mathematics and how that discipline can be used to analyse the nature of any phenomena before the basic concept of pure scalar motion can be grasped.

As a result of these observations, I am suggesting that most, if not all, discussions with new audiences leading to the Reciprocal System of theory begin with a short discussion of the nature of the mathematical systems by which analysis of variables can be made. The ordinary system of arithmetic and the extensions into the abstractions of algebra, Euclidean geometry, trigonometry, calculus, and basic concepts of probability should be reviewed. Depending on the sophistication of the audience, more or less time spent in each area may be required. Major differences between systems consistent with Euclidean geometry and some of the nonlinear geometries may be considered, but are not always necessary as part of the preliminary discussion.

By reminding the student of the properties of the mathematical system by which any analysis is to be made, I have found it unnecessary to dwell on certain parts of the postulates as presently stated, thereby achieving a, perhaps, simpler development of the consequences of the theory for a Universe of Motion. In a different context and always in a formal numbered course setting, several possible starting concepts including the currently used matter based approach are considered for carrying out an analysis. All starting concepts considered, other than motion, are shown to give erroneous results, due either to untenable consequences or the continual requirement to add additional data as given information that is not derivable from the initial variable, or that is contradictory to the initial properties of the initial variable.

The Requirements for Analysis

The first step in any analysis is to define the parameters of the system by which the analysis is to be conducted.

A mathematical system is required that has a well defined sequential logic for dealing with ways of relating quantities and deriving the consequences of manipulating the variables being analysed. Because of the size and nature of the environment of this planet, and the most abundant substance on the surface and its properties, magnitudes of various constants are arbitrarily defined. The structure of the bodies which we use and the number system based on the number of phalanges on our hands and the simple arithmetic derived therefrom has allowed the following characteristics to have become the most acceptable to use.
1. This system has numerals that represent numbers and other symbols that represent operations.

   a. The numbers in this system correspond to the normal whole counting numbers and their negatives; i.e., the real numbers.

   b. Zero is the reference position from which numerical quantities are counted. Zero is not considered to be a legitimate value for any quantity being analysed, but by so doing numerous inconsistencies have crept into acceptable usage which have subsequently led to unrecognized erroneous results. It should not be a legitimate value since it can be shown to lead directly to those errors. By not allowing the legitimacy of zero as a starting quantity, it cannot be a legitimate value as a result for any calculation. By this recognition, unit value of whatever item is to be analysed becomes the obvious minimum quantity as well as thereby requiring the analysable quantity to be unitary.

2. Any system that utilizes the idea of dimensions by which to describe positional relations between and among numerical values must describe the nature of the assumed coordinate system. The system of mathematics used for the derivation of a Universe of Motion based on the Reciprocal System of theory uses the following characteristics.

   a. Three mutually perpendicular linear directions and their opposites define three mutually perpendicular dimensions.

   b. The dimensional system defines positions by assigning relative values of displacement from a specific position, the point of intersection of the three mutually perpendicular dimensions. Any point within the entire system can be called a reference point by translation and/or rotation of axes.

3. Rules for using and operating on the system of numbers and dimensions are categorized under six main headings.

   a.1. The category called arithmetic defines addition and multiplication as commutative properties. Division is commutative only in the sense that it is defined as multiplication by the multiplicative inverse, the reciprocal of the value used as the divisor. Multiplication is explained as repeatedly adding one factor called the multiplicand the number of times specified by the value of the other factor called the multiplier, multiplicand and multiplier being interchangeable. Subtraction is described as the reverse of the addition operation or as the addition of an oppositely directed value which must be carried out in a specific sequence and is therefore not commutative. Division is described as repetitive subtraction, which may result in a remainder at any specific point in the operation, but is not defined in this way. Familiarity with the various operations and the names of the factors involved are gained as the necessary math skills are learned, if not already known.

   a.2. Additional Rules for manipulating values involving relative notational positions define the arithmetical behavior of fractional notation and permitted values intermediate between whole counted positions. The notation expressing a numerator quantity divided by a denominator quantity does not imply that either notational position can be eliminated by reduction to zero. Carrying out the indicated operation merely reduces the denominator whole number value to 1, which is the minimum
quantity of the available analyzable component allowable in any system.

d. The category involving rules for manipulating non-specific quantities is called algebra. Algebra is a generalized way of following the rules of arithmetic so that numerical values can be obtained from the result of the manipulations.

c. The category of rules for using a combination of numbers and dimensional positioning of the numbers for relative shapes resulting from specific values and arrangements is called geometry.

d. The category of relations among specific geometrically related values derived from certain three sided figures is called trigonometry.

e. The category of relations involving small incremental differences derived from various shapes resulting from specific values and positional arrangements is called finite calculus.

f. The category of rules derived from the patterns of occurrence of numbers in various positional relations is called probabilities. (Probability distributions of quantities of the analyzable components combine to form representable compound structures. These result from the analysis of the analyzable component having a preset or built-in bias at the value one, 1/1.)

The second step of any analysis requires identifying one or more variables from which other variables and/or specific consequences can be derived. The variables to be analysed by the mathematical system must have demonstrable and/or definable properties that can be dimensionalized and/or, at least, quantized. The simpler the starting variable, of course, the more likely the consequences are to be consistent.

Derivation of Consequences

Arithmetical consequences define quantitative, statistically defensible relations and quantities from a static point of view. Seldom do quantitative results give any indication of the necessary dynamic point of view by which to derive an active picture of a system that is obviously dynamic. Equational results often point out the direction an interpretation should take, but it is the properties of the variables being analysed which really dictate interpretations of both static and dynamic results.

As a direct consequence of these requirements for any analysis, we find that the variable being analysed, motion, consists of quantities represented relative to specific reference points in a three dimensional system of coordinates; i.e., it is dimensionalizable as well as being quantizable. Several consequences tie together at this point. The directions in which a reference system can be oriented is completely random. Units of motion must be represented relative to reference points and thus can have values oriented in either the positive or negative direction relative to that one or any other specific reference point. The basic concept of progression embodied in the definition of the variable being analysed by a dimensionally analytical system requires the geometric direction of both outwardly and inwardly oriented progressions to be randomly directed linearly relative to any specifiable reference point.

All units of motion have two principal characteristics:
continuity within each unit of motion and between contiguous units of motion. (2) progression with respect to a reference point in any reference system in which the motion is to be represented.

For the purpose of definition and analysis all units of primary motion progress outward from all points of reference in three-dimensional reference systems in randomly selected directions. All units of motion oriented inward toward a reference point are said to be displacement units of motion. Since these displacement units of motion must be distinct and separate from the primary units except by contiguity, they can be called independent units of motion.

Because of the dimensional system of reference being used for the analysis and the sequentiality by units of the number system, both the quantities and dimensionalities of the units of motion being compounded have a specific order of probability in which the various quantities will be compounded. The order of appearance of different effects and the required representation for the units of motion involved in each effect is limited by the mathematical system being used and the quantities of motion that must be represented at each specifiable point of reference identified with a specific phenomena.

In order for localized events or phenomena to occur in a theoretical universe of motion, things composed of independent motions must be present because the natural progression of primary motion is a uniform and featureless background that cannot be observed independently. Therefore any observed phenomena must of necessity involve displacement motion.

In the reality of either dimensional system, space or time, all available dimensions are required for adequate representation of any one direction of any motion in that system; that is the purpose of specifying the dimensionality of the system. For use in a multi-dimensional reference system, the order in which the modes of dimensional motion and their directionalities can be taken follows the same order as the number of directions and dimensions required for representation of the modes of dimensional motion possible. In a three-dimensional system the modes, number of directions, and number of dimensions required are

- Euclidean mode directions dimensions
- Linear translation One direction one dimension
- Linear oscillation Two directions one dimension
- Unidirectional rotation One direction two dimensions
- Rotational oscillation Two directions two dimensions

Since linear outward can be in either of two directions in any one dimension and no two identifiable points can be closer than having no separation of reference points.
i.e., zero separation; normal progression is taken initially as linear outward from each and every representable point of reference. This does not violate the previously discussed idea of quantity since any position in a progression can be taken as the reference point from which to make an analysis. A mathematical device for analysis is not the same as specifying a quantity of something to be analyzed.

So far in this analysis, I have referred to motion as though it is a single item. It is, but it is also analyzable with respect to its two reciprocal aspects. The first consequence of analysing those aspects revealed by the definition of the single item, motion, is that both space and time are representable as having three dimensions. Their dimensions are exactly alike except that the dimensions of time are the three dimensional reciprocal of the three dimensions of space. Because of their reciprocity, the dimensionality of either other aspect cannot be directly represented in the three dimensionality of the one that is being represented as having three geometric dimensions. All that can be represented is the scalar value in the reciprocal dimensions. (Note here that the use of the term scalar is absolutely no different than the way it is treated in the currently used theoretical systems, geometric direction is simply being ignored because it cannot be directly represented.) The second consequence of the analysis of these aspects is that both space and time must be represented as having an outward progression identifiable for all primary units of motion. The outward progression of one aspect is the reciprocal of the outward progression of the other, not the opposite, nor the same.

The reciprocal of one is one, 1/1, and therefore a unit of space is equivalent to a unit of time; it is not equal to or identical to a unit of time, it is only equivalent to a unit of time. The difference between having equivalent quantities in a numerator position of an analyzable unit or in the corresponding denominator position cannot be perceived except by their orientation with respect to that reference point. Therefore, outward is always positive with respect to each and every reference point for the measurement of both aspects of primary motion.

It should be obvious that for a universe constructed entirely of motion, there can be no quantities less than one unit of motion and therefore no less than one unit of space for each one unit of time. However, the representation of quantities of motion oriented both inwardly and outwardly from the same reference point must lead to a representation of quantities of compounded motion in space or in time, one or the other of the three dimensional aspects, as being effectively less than unit primary motion in that aspect. Primary motion has both aspects outwardly oriented while displaced motion has one aspect oriented inward and the other outward.

The basic concept by which the word motion is defined implies continuous change, not discontinuous change, and therefore both space and time must have a continuously progressive characteristic, not a unit by unit jumping. Even though quantities of space are measured unit by unit because space seems to be infinitely divisible, space must have a smoothly flowing characteristic similar to the smooth flow of time because it is the reciprocal not the opposite of time. Since primary motion must be outward from
a reference point, the progression of the spatial aspect of primary motion in space must be outward from all points of reference in space. For there to be even a theoretical universe of motion, there must be at least one unit of primary motion, therefore the outward progression from any reference point must be outward from unity, unit value of motion. Likewise, each unit of displacement motion is oriented inward toward unity because the inward progression must be oppositely directed from that of primary motion. This requirement has some very interesting consequences to be discussed later.

The outward progression of the spatial aspect of primary motion must be rendered as being linear due to the limitations imposed by the analytical system used for representing motions in either three-dimensional aspect. In order to represent any direction both a reference point and a chosen orientation for the three-dimensional axes must be given with respect to the reference point. Once done for a given reference point, the randomness of orientational direction of the scalar outward direction and the orientation of the axes in the three-dimensional aspect coupled with the basic definition of progression lead to apparent expansion of a sphere around the reference point at the speed of progression of the aspect being represented as having three dimensions. This is the most probable condition and therefore there should be more of this great expansive progression between identifiable reference points than any other kind of motion. All compound motion structures must therefore be widely dispersed and separated from each other by some amount of primary motion or its equivalent, measurable either as the aspect called space or as time.

So far, the necessity for being able to represent motion as an outward progression in all directions from every identifiable point in both space and time has been shown to be a natural result of the analytical system and therefore a required characteristic of a universe of motion. It has also been shown that inwardly oriented units of motion are a requirement, and that these inward or independent units of motion must be oriented inward with respect to all identifiable points of reference. The analytical system does not provide a mechanism for converting primary units of motion into independent units of motion although it does require them to be available. Any mathematical device proposed to convert undifferentiated units of motion into units of motion having identifiable characteristics is for the convenience of mathematical manipulation and does not imply an analyzable characteristic of motion. The fact that there is no conversion mechanism available in the system by which to create or destroy units of motion leads to a necessity to conserve all independent units of motion; i.e., they can neither be created nor destroyed. This fundamental conservation requirement built into the system of analysis leads directly to many subsidiary conservation laws.

The next steps in the development and analysis of the consequences of the postulates for a universe of motion require identification of possible ways of combining units of motion, determination of the directional and magnitudinal characteristics of those combinations, and determination of resulting probabilities for the stability of those combinations.

Each succeeding level of complexity of compound motions deval-
oped as consequences of these postulates for the Reciprocal System of theory involves either of two modifications, (1) a simple unitary shift in the value of the net motion represented, by a change of magnitude of displacement from the primary background or the previous compound motion structure, or (2) alternation of the scalar direction characteristic that is modified so as to change the magnitude of net displacement. In every case, the shift by compounding of motions is always toward the equivalent of pure undifferentiated motion whether as scalar motion in one, two, or three dimensions, or as reciprocal primary motion.

Scalar motion has a magnitude; a unit of scalar motion, whether primary, positively displaced or negatively displaced is measurable. The net effect of a compound motion is outward or inward relative to an identifiable reference point. Structures composed of displaced scalar motion in one dimension coupled to primary scalar motion in another dimension are characterized by the phenomenal behavior with respect to one or more reference points used for that purpose. Structures composed of scalar motions in two or three dimensions are stabilized by distribution in all three dimensions of one of the three dimensional aspects and are identified as atoms or sub-atoms within that aspect.

The reference for all identifiable motion is primary motion and therefore starts from unit motion, analysed as one unit of space progressed for one unit of time progression; i.e., $s/t = 1/1$. From the mathematical analysis of this type of notation, either or both aspects, space or time, $s$ or $t$, can have either a positive or negative sign signifying the direction of the progression in at least one dimension of that aspect relative to the primary motion of all reference points in that aspect. Both aspects having a positive sign is assigned to primary motion so that outward is the positive direction. Both aspects, $s$ and $t$, having a negative sign is equivalent to reciprocal primary motion which cannot be visualized as being different from primary motion.

A unit of motion in which the spatial aspect, $s$, is oriented inward while the temporal aspect, $t$, is oriented outward relative to the specified reference point is referred to as positive displacement. Likewise, units of motion in which the spatial aspect, $s$, is oriented outward while the temporal aspect, $t$, is oriented inward are referred to as negative displacements. These units; primary, positive displacement, and negative displacement; are the units of scalar motion. Scalar motion does NOT have any geometrically dimensional characteristic unless specifically represented as one of the modes of observable motion. Each unit may be thought of as if one dimensional (progressive in a line), two dimensional (expansive or contractive in a disc), or three dimensional (point expansive or contractive in all directions) depending on the mode of representation of that unit of scalar motion. When thought of as if two or three dimensional, the scalar motion involved is being thought of as a distributed motion.

As a result of three dimensional geometric representation and the relations among one dimensional, two dimensional, and three dimensional representations of progressions, the summation of units of displaced motions eventually reach oppositely directed equality with a three dimensional point expansiveness of primary motion. This condition constitutes an age limit
in a spatially three dimensional system, the material sector, and a corresponding limit to the quantity of space in a temporally three dimensional system, the cosmic sector.

In a universe of motion, primary motion must be represented in some manner and therefore representing a motion that offsets the primary motion in one of the possible dimensions merely shifts the dimensional representation of primary motion relative to the dimension in which displacement is being represented. One unit of displacement motion in any one representable dimension will exactly offset the primary motion in that dimension and therefore cannot exist as a separate existent because two other representable dimensions exist in which primary motion can be represented. Since two directional motion cannot be directly or simultaneously represented in one dimension, it becomes necessary to represent the two directions as though in one direction at a time repeatedly traversing the same path in opposite directions. This is most easily depicted as units of primary motion and units of unidirectionally displaced motion following in a sequential manner. Since a unit of primary motion is represented with or for each displaced unit of motion in the same dimension, compounded motions of this type in one dimension that completely offset the primary motion in that dimension must be represented as progressing in another geometric dimension; i.e., perpendicularly. These compound motions are thereby represented as oscillational units of motion in one dimension progressing linearly in a perpendicular dimension. It must be understood that this manner of representing these units of displacement as a combination of primary and displaced motions does not imply any necessity to count the units of primary motion in obtaining the number of units of motion in the perpendicular but unrepresentable dimension. In fact, they would be ineffective as measurable motion in any case.

There is no intrinsic requirement for a specific numerical relationship between numbers in different dimensions and therefore all possible combinations have a definite probability for existence. Identifying the number of units of displacement motion in one dimension with each unit of primary motion in the second dimension as the frequency of change or oscillation gives rise to an extremely large number of possibilities. All of these possible frequencies progress at a constant rate regardless of which three dimensional frame of reference is chosen, either space or time, because of the equivalence of a unit of primary space with a unit of primary time.

Correlation of this description with essential descriptions of measurable phenomena identify these structural representations as photons of electromagnetic radiation. It is obvious that neither electric nor magnetic phenomena are required for the identification of photons either experimentally or theoretically and therefore they should no longer be referred to as electromagnetic. Photons of radiant energy are just photons; the word photon is itself adequate without modifiers.

Representing the displacement in a dimension mathematically representable in a three dimensional system only as perpendicular to the represented progression is due to limitations in the ability of any dimensional system to represent simultaneous quantities of the same kind of thing in any one dimension.
It is impossible to represent simultaneously two directional motion and primary motion in the same dimension, therefore the perpendicular representation. It is also impossible to represent motion in two dimensions simultaneously in spite of the mathematical device of resolving vectors; these are not vectors.

Continuity of change, the basic concept from which motion is derived, requires a mode of representation which embodies the basic concept and dimensional characteristics by which the combination can be identified. The effective displacement, "a", from the line of progression in one dimension is equivalent to the sine or cosine of an angle of deflection, sin u@ or cos u@, where @ is the instantaneous magnitude of angular progression around an origin relative to the direction of linear progression in the required primary motion direction. u is a whole number value associated with the number of cycles the oscillation is represented as having with each unit of primary motion represented. This is approximately the same as requiring rotation through a dimension perpendicular to the dimension of progression and around the third dimension also perpendicular to the dimension of progression. The apparent rotation is not real in that it is not a rotation of a unit of motion, it is a mathematical device used to represent the magnitude of the effect of a displacement in a non-representable dimension relative to the dimension that must be directly represented.

No dimensional system can represent in a direct manner simultaneous multidirectional or multidimensional change in one dimension, thereby all multidirectional and multidimensional representations of motion cause the necessity of defining special kinds of reference points for the effects of motions that cannot be directly represented. The kinds of reference points encountered in the case of photons is two fold; designation of the point of origin of the photon as a type of reference point for emission or interaction and designation of the point of primary progress of the photon as a reference point for the effect of the oscillation in a dimension describable only as perpendicular.

Larson has proposed calling the first type a negative reference point because the progression of the photons is always outward in both space and time; i.e., positively directed, thus my choice is the cosine function to represent the differentiated form of the oscillation. Having to name the second type of reference point with consistency within the system, I propose the name "energy reference point" from Planck's equation e = hv and the possibility of both high frequency and low frequency photons relative to undisplaced scalar motion. A "high" energy reference point is involved in high frequency photon radiation, f = s/t > 1, a negative displacement. Conversely for low frequency photon radiation, f = s/t < 1, a positive displacement.

Thus, the questions concerning rotation or birotation prior to linear representation are shown to be merely the requirements of the system of mathematics by which analysis is being made. Nothing is being implied concerning the required order in which units of motion can be represented by the use of the system of mathematics. It is an auxiliary means of representation resulting from limitations of the mathematical system and has nothing to do with the nature of motion, the quantity being analysed.
by this system of mathematics. This is exactly the kind of situation that gives rise to the required use of all kinds of reference points.

The various characteristics which photons of different frequencies seem to exhibit is due to characteristics of the atoms and sub-atoms with which they interact. All photons of all frequencies progress outward in three dimensional space from the reference point, the specific atom, from which they are emitted, thereby producing a 4 pi radiation pattern. The frequency, polarization, and direction of emission of the photons is random or specific depending on the characteristics of the material device emitting the photons.

Further development requires showing the use of two or more possible dimensions in order to have a representable compound motion. It involves numbers of units of motion, their orientations, number of dimensions and directions required, along with probabilities of various combinations and the randomity of specific directionality of the set of dimensions used to specify quantities involved. Those familiar with the Reciprocal System may be able to do this for themselves. Those who require assistance are invited to see the original works of D.B. Larson or either of the simplified versions available through ISUS.

Respectfully submitted:

Lawrence E. Denslow

Revised Jan. 10, 1994 as a result of communications from several of those to whom the original draft was sent.
Towards the Advancement of the Universal Society

Physical Universe

Physical Universe

Towards the Advancement of the Universal Society
null
The third assumption of [the reciprocal system of physics] is that space and time exist in discrete units. This, too, is an extrapolation from known facts into the region that is unknown. In the early days of science it was generally believed that all of the primary physical phenomena were continuous and infinitely divisible, but as knowledge has grown during the succeeding centuries one after another of these phenomena has been found to exist only in units. The atomic structure of matter was the first to be demonstrated. Later the unit of electricity was isolated and still more recently the work of Planck made it clear that radiant energy follows the pattern...........

... Since experience shows that as our knowledge widens more and more physical phenomena are proved to exist only in discrete units, it is merely a reasonable extrapolation to assume that if all the facts were known, this would also be found to be true with respect to the basic entities, space and time.

Dewey B. Larson, 1

I am tending to the belief that it is impossible to continue further with this continuum theory.

Albert Einstein, 1

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THE LIQUID STATE IN THE RECIPROCAL SYSTEM:  
THE VOLUME/TEMPERATURE RELATION,  
A CONTEMPORARY MATHEMATICAL TREATMENT

by  
Ronald W. Satz, Ph.D.

This paper provides a step-by-step procedure for the calculation of liquid specific volume as a function of composition and temperature, based on the Reciprocal System of D. B. Larson\(^1\). In this theory, each individual molecule may be in the solid, liquid, or gaseous (or vapor) state, regardless of the state of the majority of molecules of the substance.

First let's define some terms:

\[ V_L = \text{overall specific volume of liquid (cm}^3/\text{g)} \text{ (total volume/total mass)} \]
\[ V_1 = \text{specific volume increment at 0 °K and that due to the solid molecules in solution of the liquid (solid volume/total mass)} \]
\[ V_2 = \text{specific volume increment due to the liquid molecules of the substance, temperature above 0 °K (liquid volume/total mass)} \]
\[ V_3 = \text{specific volume increment due to the critical (gaseous or vapor) molecules in solution of the liquid (gaseous volume/total mass)} \]

Then,

\[ V_L = V_1 + V_2 + V_3 \] \hspace{1cm} (1)

The initial values of these three components are designated \( V_{01}, V_{02}, V_{03} \). These differ only by a geometric factor (designated \( k_1, k_2, k_3 \)) applied to a base initial value, \( V_{00} \), determined as follows.

Just as the volume of a gas is determined by the number of molecules, so the volume of a liquid is determined by the number of volumetric groups which it contains. In an organic compound, for instance, each of the common interior groups, such as CH\(_2\), CH, or CO, constitutes one volumetric group. The CH\(_3\) groups in the end positions of the aliphatic chains occupy two units each. So hexane, represented as CH\(_3\)CH\(_2\)CH\(_2\)CH\(_2\)CH\(_2\)CH\(_3\), has 8 volumetric groups. Let \( n_r \) be the number of volumetric groups and recall that the factor .707 expresses the geometric reduction obtained by the close-packed arrangement of the liquid groups because of their flexibility of movement. Then, in natural units, the base initial volume is directly proportional to the number of volumetric units, reduced by close-packing:

\[ V_{00} = .707n_r \] \hspace{1cm} (2)
Let $m$ be the molecular weight (non-dimensional) of the molecule of the substance, $m_w$ be the value of the natural unit of atomic mass in g, and $\nu_u$ be the value of the natural unit of liquid volume expressed in cm$^3$. Then, in conventional units, the basic initial value is

$$V_{\infty} = \frac{707n_r \nu_u}{m} \text{ cm}^3/\text{g}$$

(3)

$\nu_u$ is not the cube of the natural unit of space in the time-space region, which is applicable only to the gaseous state. Rather, $\nu_u$ is the cube of the natural unit of space in the time region, which is $1/156.45$ (the inter-regional ratio) of that in time-space region, or $2.9139 \times 10^{-8}$ cm. Cubing this we get

$$V_{\infty} = 2.47417 \times 10^{-21} \text{ cm}^3$$

- The natural unit of mass is 1 atomic mass unit, so $m_w$ is $1.65979 \times 10^{-24}$ g. Putting these values in eq. 3, we get

$$V_{\infty} = \frac{10.5389n_r}{m} \text{ cm}^3/\text{g}$$

(4)

For hexane, $n_r$ is 8 and the molecular weight is 86.18. Therefore,

$$V_{\infty} = .9783 \text{ cm}^3/\text{g}$$

For the critical (gaseous or vapor) specific volume increment, the geometric factor $k_{G}$ is always 1.00. For the solid specific volume increment, the geometric factor $k_s$ is $.891$ (the cube root of $.707$) where close-packing in the solid state can be achieved. Where such packing cannot be achieved, the geometric factor $k_s$ is 1.000. The same applies to the geometric factor for the liquid specific volume increment, $k_l$. Therefore, the initial values of the three volume components may be expressed as

$$V_{1} = V_{\infty}k_1$$

(6)

$$V_{2} = V_{\infty}k_2$$

(7)

$$V_{3} = V_{\infty}k_3 = V_{\infty}$$

(8)
In a multi-group molecule, the value of the geometric factors $k_n$ and $k_{nt}$ represent averages, since some groups may be at .891 while others at 1.000. Let $n_a$ = the number of close-packed groups per molecule in the solid state, and let $n_{a1}$ = the number of close-packed groups per molecule in the liquid state. Then

$$k_{n1} = \frac{(n_{a1} \times 0.891 + (n_v - n_{a1}) \times 1.000)}{n_v}$$  \hspace{1cm} (9)

$$k_{n2} = \frac{(n_{a2} \times 0.891 + (n_v - n_{a2}) \times 1.000)}{n_v}$$  \hspace{1cm} (10)

For hexane, for instance, $k_{a1}$ is .9864 (with 1 group at .891 and 7 groups at 1.0000, the average is 7.891/8 or .9864) and $k_{a2}$ is .9728 (with 2 groups at .891 and 6 groups at 1.0000). Therefore, for hexane, the initial values of the specific volume increments are

$$V_{o1} = .9783 \times .9864 = .9650 \text{ cm}^3/\text{g}$$

$$V_{o2} = .9783 \times .9728 = .9517 \text{ cm}^3/\text{g}$$

$$V_{o3} = .9783 \times 1.0000 = .9783 \text{ cm}^3/\text{g}$$

From eq. 10 it's clear that ordinarily $n_v \geq n_{a1}, n_v \geq n_{a2}$. However, for lower group elements, hydrogen through fluorine, closer packing than normal can be achieved because of inactive dimensions of the gravitational repulsion force. This means that, in effect, for lower group elements the geometric factors can be less than .891. We can still use eq. 10, though, if we allow the value of the number of solid groups to exceed the number of volumetric units.

Now that we have the initial values as a function of composition, we can determine the values of the three components as a function of temperature. The solid specific volume increment not only includes the initial volume at 0 °K but also a factor proportional to the number of solid molecules in the substance at any temperature, $\Delta s$, which can be determined by probability considerations.

$$V_1 = V_{o1} + \Delta s$$  \hspace{1cm} (11)

To use the normal probability function or table we need to know the value of the normal random variable $z_s$, applicable. It should be proportional to the difference between the liquid temperature $T'$ and the melting point $T'_m$ in degrees K, divided by the melting point. The coefficient and the intercept have unfortunately not been worked out theoretically, but are given empirically by Larson (Ref. 1) as follows:

$$z_s = \frac{4(T - T_M)}{T_M} + .40$$  \hspace{1cm} (12)
We want the right tail of the distribution, so we subtract the value of the normal function, denoted by $\text{erf}(z_s)$, from 1 and then multiply by the average difference in specific volume between solid and liquid molecules, denoted by $\Delta v$:

$$\Delta s = (1 - \text{erf}(z_s)) \Delta v$$  \hspace{1cm} (13)$$

Larson uses an average value of $\Delta v$ of .080 for paraffin hydrocarbons ($C_{14}$ and below) and .084 for paraffins above $C_{14}$ (rather than computing the individual values). For hexane, $T = 178$ K (-95 °C). At $T = -50$ °C, $z_s = 1.41$ and from the normal probability table, $\text{erf}(z_s) \approx .9207$. Subtracting this from 1.0000, we get .0793, which means that 7.93% of the molecules in the liquid hexane aggregate at -50 °C are in the solid state. Multiplying this figure by the approximate difference in specific volume between solid and liquid molecules, .080, we get .0063 cm$^3$/g for the value of $\Delta s$.

The thermal motion beyond the initial point of the liquid (considered as starting at 0 K) is the one-dimensional equivalent of the thermal motion of a gas, and thus the volume generated is directly proportional to the temperature, $T$. Let $T_{\text{nu}}$ be the natural unit of temperature in the time region (for the condensed states of matter) and $n_T$ be the temperature factor. Then

$$V_2 = \frac{T}{n_T T_{\text{nu}}} V_{\text{nu}}$$ \hspace{1cm} (14)$$

In Ref. 2, Larson derived the value of $T_{\text{nu}}$ to be 510.8 K. For simple substances, $n_T$ is 1. More complex or more electropositive substances have values of $n_T$ of 2 up to 16. Hexane has a value of 1; water, 2; silver, 16. Compounds of electropositive and electronegative elements have intermediate values (some with half-integral values, which are averages), as would be expected.

The gaseous or vapor increment of specific volume depends on the proportion of critical molecules existing in the aggregate at each temperature, which can be computed from probability considerations. Larson uses two random variables for this computation, both a function of the critical temperature, $T_c$:

$$z_{c1} = \frac{9(T_c - T)}{T_c + T_{\text{nu}} / 2}$$ \hspace{1cm} (15)$$

$$z_{c2} = \frac{27(T_c - T)}{T_c + T_{\text{nu}} / 2}$$ \hspace{1cm} (16)$$
Then the specific volume increment due to critical molecules in the substance is

\[ V_3 = (2 - (\text{erf}(z_{c_1}) + \text{erf}(z_{c_2})))V_0 \]  

(17)

For hexane, \( T = 508 \) K. At \( T = 210 \) °C, \( z_{c_1} = .2947 \) and \( z_{c_2} = .8106 \). The corresponding values of the normal probability function are .6144 and .8109. Then, from eq. 17,

\[ V_3 = (2 - (.6144+.8109))(.9783) = (.5747)(.9783) = .5622 \text{ cm}^3/\text{g} \]

The .5747 factor means that 57.47% of the molecules at this temperature are in the critical state.

Having determined \( V_1', V_2' \), and \( V_3' \) we can now calculate \( V_4' \) from eq. 1.

To automate the task of comparing the theoretical values with those observed, I've prepared a computer program and run it on most of the same liquids Larson used in the original series of papers: hexane, hexadecane, benzene, acetic acid, ethyl acetate, ethyl chloride, ethanethiol, fluorine, hydrochloric acid, sulfur dioxide, carbon tetrachloride, and water. Printouts from the program for all of these liquids follow. The observed values come from the same sources Larson used: Timmermans' *Physico-chemical Constants of Pure Organic Compounds*, the American Petroleum Institute, and the *International Critical Tables*.

Most of the computer results are in harmony with Larson's manual calculations. The two seeming exceptions are for acetic acid and water. For acetic acid, Larson used a value of initial liquid specific volume of .5469, which is .7795 that of his base initial volume, .7016; but .891 is supposedly the smallest allowed fraction. For water, Larson used a value of .7640 for both the initial solid and liquid specific volumes, but this is only .8713 that of his base initial volume, .8769, not .891. Actually, these differences are due to "hydrogen bonding", which can allow closer packing than normal. In a second calculation for water, I input 1.78 for \( N_1 \) and \( N_2 \) so as to get the initial volumes to be .7640. The theoretical results computed came out to be much closer to the experimental ones than the previous run.

To compute the specific volume for any liquid of your choice, follow these steps:

1. Determine the formula of the compound and its molecular weight.
2. From the formula, determine the number of volumetric units and number of temperature units.
3. Use equation 4 to obtain the base initial volume.
4. Use equations 9 and 10 to compute the geometric factors; some iteration here may be required to get the right values.

5. Compute the initial volumes with equations 6, 7, and 8.


7. Use equation 14 to compute the liquid specific volume increment.

8. Using equations 15 and 16, compute the critical specific volume increment, equation 17.

9. Sum the results to get the final value, from equation 1.

References:

1. D. Larson, The Liquid State, privately circulated series of papers on the liquid state, circa. 1960-1964. Note: I made use of the papers numbered I, II, IIsupplement, and III. I've reorganized all of the equations and changed some of the symbols for the sake of clarity. I've also used the latest values of the conversion constants. The computer program is entirely original.


Appendix: The Computer Program

The following pages show the input screens of the program. The data base language is filePro Plus and the computation language is TrueBasic. This is the first of what will be a comprehensive series of programs for the calculation of all properties of matter based on the Reciprocal System of theory. Eventually the programs will be made available for purchase.
**LIQUID SPECIFIC VOLUME AS A FUNCTION OF TEMPERATURE**

**CHEMICAL NAME:** Hexane

**Representation:** CH₃CH₂CH₂CH₂CH₃

**Melting Temperature:** -95.00

**Critical Temperature:** 234.84 deg. C

**Mol. Wt.:** 86.17848

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| Delta Vol. | .0800 | Temperature Factor: | 1.0 | Corr. Coef.: | 1.0000 |

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*** LIQUID SPECIFIC VOLUME AS A FUNCTION OF TEMPERATURE ***

CHEMICAL NAME: Fluorine  
Mol. Wt.: 18.99840

Representation: F  
Melting Temperature: -219.62 deg. C  
Critical Temperature: -155.00 deg. C

Volumetric Units: NV: 1.00  
NS1: .50  
NS2: 1.00

Geometric Factors:  
KS1: .9455  
KS2: .8910  
KS3: 1.0000

INITIAL VOLUMES: V00: .5547  
V01: .5245  
V02: .4942  
V03: .5547

Delta Vol.: .0000  
Temperature Factor: 1.0  
Corr. Coef.: .9958

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Using the standard critical temperature—poor results.
**LIQUID SPECIFIC VOLUME AS A FUNCTION OF TEMPERATURE**

CHEMICAL NAME: Fluorine  
Mol. Wt.: 18.99840

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Critical temperature is given in handbooks as -155°C, but -131°C works better!
**LIQUID SPECIFIC VOLUME AS A FUNCTION OF TEMPERATURE**

**CHEMICAL NAME:** Carbon Tetrachloride  
**Representation:** CCl₄  
**Melting Temperature:** -23.00°C  
**Critical Temperature:** 283.10 deg. C  
**Mol. Wt.:** 153.81000

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**LIQUID SPECIFIC VOLUME AS A FUNCTION OF TEMPERATURE**

CHEMICAL NAME: Hexadecane  
Representation: CH3(CH2)14CH3  
Mol. Wt.: 226.45000  
Melting Temperature: 18.20  
Critical Temperature: 454.84 deg. C

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*** LIQUID SPECIFIC VOLUME AS A FUNCTION OF TEMPERATURE ***

CHEMICAL NAME: Ethyl Chloride
Representation: CH3CH2Cl
Melting Temperature: -136.40
Critical Temperature: 187.20 deg. C
Mol. Wt.: 64.52000

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**LIQUID SPECIFIC VOLUME AS A FUNCTION OF TEMPERATURE**

**CHEMICAL NAME:** Ethyl Acetate  
**Mol. Wt.:** 88.10000  
**Critical Temperature:** 250.10 deg. C

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### Liquid Specific Volume as a Function of Temperature

**Chemical Name:** Acetic Acid  
**Molar Wt.:** 60.05000

**Melting Temperature:** 16.70  
**Critical Temperature:** 321.60 deg. C

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Poor results using usual values of NS1 and NS2.
**Liquid Specific Volume as a Function of Temperature**

Chemical Name: Acetic Acid  
Representation: CH₃COOH  
Mol. Wt.: 60.05000  
Melting Temperature: 16.70  
Critical Temperature: 321.60 deg. C

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Much better results using NS2=8.00; must be because of hydrogen bonding.
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**Representation:** H2O  
**Mol. Wt.:** 18.01530  
**Critical Temperature:** 374.15 deg. C

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Rather poor results using usual NS1 and NS2 values.
The statement on lines 5 & 6 [of the "Outline of the Deductive Development of the Theory of the Universe of Motion"] that "the expanding universe is .... the steady expansion of space" really threw me. I was not prepared for that. I had found, in teaching special relativity and Maxwell’s equations during the 1960’s that I could derive SR based on only one assumption: space has no properties at all. I am obviously wrong, but I don’t really understand why. Now I am asked to understand that space and time don’t form Einstein’s space-time continuum but that they do not exist at all apart from motion, and that they are completely reciprocal aspects of motion. I ask if there is an easier way to help someone understand that. I would like to, but frankly at this moment I don’t. Getting this fundamental postulate across obviously requires that an overwhelming number of valid conclusions can be derived from it and I understand that that is what Dewey Larson has done. I have an enormous amount of respect for someone who has worked in such great detail as he has on the most fundamental of physical problems.

I look forward to hearing more about the progress of RS.
J. Edward Anderson, Professor. RECIPROCITY, XVIII, 1, Winter, 1988

Our only way out......seems to be to take for granted the fact that space has the physical property of transmitting electromagnetic waves, and not to bother too much about the meaning of this statement.
Albert Einstein and Leopold Infeld EVOLUTION OF PHYSICS, 1938, p.153

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Are Motion and Space-Time Quantized? 1
Frank H. Meyer and Rainer F. Huck

Correspondence Between Editor, AJP and Editor, ISUS, Inc. 15
Are Motion and Space-Time Quantized?

Frank H. Meyer & Rainer F. Huck
International Society of Unified Science, Inc.

(Some of the gist of this paper has been contributed to the Fall Meeting of the Minnesota Area Association of Physics Teachers, October 29, 1994 at Gustavus Adolphus College, St. Peter, MN.)

Plato is my friend, Aristotle is my friend, but my better friend is truth.

-Isaac Newton, While an Undergraduate Student, University of Cambridge, 1666.

ABSTRACT

This inquiry offers evidence that motion and space-time are one and that since motion is quantized, so are space and time. Furthermore, the inert, static space-time continuum postulate of relativity theories and classical mechanics is shown to be irremediably flawed. Our new general theory, named by its builder, 'the reciprocal system of general physics', defines motion in a new, more adequate way: as the relation between two uniformly progressing reciprocal quantities, space and time. Motion, as defined, is measured in terms of speed, the scalar magnitude of the relation between space and time. By reason of the postulated reciprocal relation between space and time, each individual unit of motion is a relation between one unit of space and one equivalent unit of time, motion at unit speed. All physical entities are compounds, formed from such units of motion and constituted by finite speed displacements from unit speed, measured in terms equal to 1/n and n/1, when or where n is respectively an integral number of time quanta or of space quanta. When n is 1, unit ratio equals unit speed. The reciprocal system identifies unit speed as the speed of light. D.B. Larson's reciprocal system of physics discloses that the 'expansion of the universe' is the equable scalar unit time progression at the speed of light with the outward scalar unit space progression of physical locations, whether or not occupied by photons and/or galaxies, unevenly balanced when or where galaxies are involved, by the inward scalar gravitational motion of matter, accelerated in proportion to the inverse distance squared.
I. INTRODUCTION

It has been usual for physicists to affirm tacitly that no smallest length of space and no shortest interval of time appears to exist\(^1\). Another way of saying this is that space and time are infinitely divisible. A short way of saying the same is to say that space and time appear to be continuous. To take for granted that space and time may be continuous or infinitely divisible can be to think that space and time may **not** be quantized, as our ancestors once 'knew' matter and energy to be unquantized or continuous, not finitely divisible.

When originating and developing his theory of relativity, Einstein\(^2\) and his followers taught that both space and time are better to be thought of as together unquantized and preferably represented as inert\(^3\) in the reference frame of a four-dimensional continuum, one of time, three of space. Many physicists, including the quantum physicists, have followed Einstein, agreeing with him that, however applicable quantization may be to light, electricity, magnetism, matter, "anti-matter" etc., no evidence or reason can be discovered for seeking whether space and time or motion may be similarly quantifiable.

An exception has been the talented quantum physicist, Feynman\(^4\): "I believe that the theory that space is continuous is wrong, because we get these infinities and other difficulties, and we are left with questions on what determines the size of all particles. I rather suspect that the simple ideas of geometry, extended down into infinitely small space, are wrong."

A rather more remarkable exception is Einstein\(^5\), a learner in his later years from mistakes of his earlier career: "I am tending to the belief that it is impossible to continue further with this continuum theory." Einstein\(^6\) came closest to acknowledging that all sides of the physical universe may be quantizable in the very last paragraph of an Appendix to the end of his 1955 revision of his book, *The Meaning of Relativity*, published by Princeton University Press in the year of his death:
"One can give good reasons why reality cannot at all be represented by a continuous field. From the quantum phenomenon it appears to follow with certainty that a finite energy can be completely described by a finite set of numbers (quantum numbers). This does not seem to be in accord with a continuum theory and must lead to an attempt to find a purely algebraic theory for the description of reality. But nobody knows how to obtain the theory." (our italics)

Does nobody know how to obtain a theory that more truthfully describes the physical universe as entirely finite and quantized? Evidently nobody Einstein knew during his lifetime. However, somebody, a contemporary of Albert Einstein, did quietly work and try to obtain and did publish such a theory as early as 1959. The person's name is Dewey B. Larson and his 1959 publication is entitled THE STRUCTURE OF THE PHYSICAL UNIVERSE. For thirty one years more he worked to test and elaborate and publish the first revalued general theory of physics in human history, aimed at unifying physics. Mr. Larson was professionally a practicing mechanical engineer, rather than a physicist, who nevertheless chose physics as his hobby, as a physicist might choose music or golf for his or her hobby. He died May 25, 1990, 91 years young.

One of us is a PhD in electrical engineering; the other has been a practising research physicist in medicine, industry and education for half a century and a long-time member of the American Physical Society, the American Association of Physics Teachers and the American Crystallographic Association. We think that Dewey Larson is of interest to physicists in that his sustained inquiry probably sheds light on how it is that twentieth century physicists have not yet learned how better to unify our science.

II. THERE MAY BE NO NECESSARY TRUTHS.

The special and general theories of relativity and Newtonian mechanics have included among their essential premises two propositions: 1.) that motion is inapplicable to physical space and time and 2.) that physical space and time are infinitely divisible or continuous. Both propositions are invented; neither has been discovered nor proved to be necessarily true.
The dogma that motion is inapplicable to space and time may not be a necessary truth. By the way of a scholium to be found in Newton's PRINCIPIA, this doctrine entered the science of physics some time ago without proof. Newton in effect declared categorically that space absolutely remains always the same and absolutely immovable, independently of time progression. Newton in effect also declared categorically in another scholium that time, independently of immovable space, flows equably and by another absolute name is called duration. This, however, did not mean that Newton agreed with Aristotle that time is an aspect of motion; more probably, he held with his predecessor at Cambridge, Isaac Barrow, that the progression of time is not an aspect of motion.

The Newtonian creed that space, time and motion exist independently of each other and are unrelated physically was accepted uncritically by many physicists throughout the eighteenth and nineteenth centuries. The dogmas taught by this creed that space and time are essentially unrelated to each other, that matter is prior to motion and that motion is definable essentially in terms of matter rather than in terms of space and time, may not be necessary truths. If not, then it may not be impossible for moving to occur without some thing or object moving. If not, then it is possible for space to progress outward with time progression at the absolute uniform speed of light in vacuo.

Physicists no longer uncritically accept the Newtonian dogma that space and time are essentially unrelated. Einstein did physics a service by questioning this dogma. He had a hunch that so far from being unrelated to each other, space and time probably are more closely related than Newton ever dreamed. Just how space and time are related physically Einstein left unresolved; Einstein's answer being entirely mathematical. Furthermore, that physical space is non-Euclidian is not necessarily true anymore than that physical space is Euclidian is necessarily true. In Einstein's opinion this space is not Euclidian; in Larson's opinion, it is Euclidian, as Newton believed.
The dogma that space and time are infinitely divisible is not a necessary truth. The dogma that motion is unrelated and inapplicable to space-time is not a necessary truth. The dogma that matter is quantized, while motion is not, is not a necessary truth. The dogma that matter exists prior to motion is not a necessary truth. There appear to be no necessary truths.

III. MOTION APPEARS TO BE ONE WITH SPACE-TIME.

When Larson postulates that the physical universe is composed entirely of one component, motion, existing in three dimensions, in discrete units, and with two reciprocal forms, space and time, he possibly but not necessarily is reporting a new truth. This Larson proposition is full of meaning. Its meaning includes the claim that space and time are quantized or finitely divisible, because motion is quantized or finitely divisible. This means that, if Larson's reciprocal system of physical theory be true, then a smallest length of space and a shortest interval of time exists and can be discovered. Larson calculates the smallest spatial length to be in the order of magnitude of \(4.55 \times 10^{-6}\) cm and the shortest time interval to be \(1.52 \times 10^{-16}\) sec. See Larson's calculations later.

When Larson alleges, in contrast to Einstein, that space and time are quantized or finitely divisible, he probably, but not necessarily, is reporting a truth. When Larson identifies space-time with motion, he appears to be reporting a probable truth. The oneness of motion with space-time, implies, as does Newton's space & time theory, that both space and time possess not only relative(coordinate) components but also absolute(clock) components. Space-Time Progression in the reciprocal system of physics involves the absolute uniform progression of both space and time at the finite speed of light in vacuo. For those who still consider uniform space progression with time progression unnatural, you may wish to cope with the conjectural difficulty of Michelson and Minkowski "of never being able to decide, from physical phenomena, whether space, which is supposed to be stationary, may not be after all in a state of uniform translation." You may wish also to confront the difficulty Einstein experienced trying to fit the speed of light together with an imponderable stationary ethereal space: "Our only way out seems to be to take for granted the fact that space has the physical property of transmitting
electromagnetic waves, and not to bother too much about the meaning of this statement. We may still use the word ether, but only to express some physical property of space."(p.153)

When Aristotle alleges, in opposition to Leucippus and Democritus, that matter is continuous, he reports his opinion true and that of his adversaries false, and for centuries generations of natural philosophers go along with Aristotle in thinking that matter therefore could not be atomic. Evidence recently has accumulated to show that matter appears not to be continuous, not infinitely divisible, as Aristotle inventively imagined, but is instead finely divisible or atomic. Similarly, evidence accumulated by Larson⁷ and Feynman⁴ and others now indicates that motion, space and time also appear to be finely divisible and quantized rather than infinitely divisible or continuous.

IV. MOTION APPEARS TO EXIST PRIOR TO LIGHT AND MATTER.

Those who have been taught that matter is prior to motion do not readily conceive the possibility that space-time, space and time could be forms of the existence of motion rather than of matter. They are more inclined to believe that motion, space and time must be forms of the existence of matter. The Newton-Einstein⁹ dogma against any direct relation between space-time and motion also has prejudiced members of the physics profession to accept without proof that matter is the only possible origin and source of all motion. However, contrary to the dogma that motion must be a form of the existence of matter, it has not been ruled out at all forever that matter and energy may be, like space-time progression and the energy of light, electricity, magnetism and "anti-matter", simply additional forms of the prior existence of motion.

They who take for granted the priority of matter to motion deny the possibility of the existence of any case of motion unless something material is moving. In terms of the definition of motion implicit in his reciprocal system of physics, Larson discovers that before physical entities, such as photons of light and atoms of matter, may exist, motion in the reciprocal forms of space and time can have existed. Note that by ‘reciprocal’ Larson is meaningfully defining motion as always nothing more than a multiplicatively inverse relation between space and time.
According to this definition, motion involves a uniform progression of both space and time. Larson defines a point, or segment, of the line of the space progression at a given time as a physical location in space. He defines a point, or segment, of the line of the time progression at a given place as a physical location in time.

V. EXAMPLES OF SPACE-TIME PROGRESSION

Larson's reciprocal system of physics implies that the speed of light in vacuo is the constant magnitude of the scalar three-dimensional uniform outward space-time progression of physical locations, whether or not occupied by photons of light. If the reciprocal system be true, the speed of light means not a photon's speed through space, but rather is the speed of its physical location, in which the photon originates and remains, so long as it continues to exist.

Every individual physical location is constituted by a unit of motion. Each individual physical location is a relation between a unit of space and a unit of time, motion at unit speed. The universe begins with the scalar outward space-time progression of physical locations. These are the primary motions, the motions which may and can exist independently of the existence of motions of other types.

Because Larson postulates that the universe of motion is three-dimensional, he may represent the scalar progression of space by a line in a stationary three-dimensional spatial reference system, measuring the corresponding progression of time by a scalar device, a clock. In this reference system, a positive motion is represented as outward from a reference point, and a negative motion as inward.

Similarly, Larson represents the outward and inward scalar progression of time by a line in a stationary three-dimensional temporal reference system, measuring the corresponding progression of space by a scalar device, a clock. Just as the spatial reference frame is useful for counting finite speeds less than unit speed for motions in space of the familiar material sector, so the temporal reference system is useful for counting finite inverse speeds more than unit speed of motions in time of the less familiar cosmic sector of our universe.
The initial point of the progression of an individual unit of motion is zero. As the distance between two points cannot be less than zero, it follows that the primary motions are necessarily outward, increasing the distance relative to the initial points.

Therefore, if the reciprocal system of physics be true, any two physical locations are progressing outward from each other at unit speed; that is, their separation is increasing at the rate of one unit of space per unit of time.

Larson defines the natural system of reference as that system in which the primary motions do not cause any change in the positions of the physical locations.

If the reciprocal system of physics be true, then the natural system of reference is progressing outward at unit speed, that is, the speed of light, relative to the spatial and/or temporal systems of reference.

The postulate of Larson's reciprocal system of physics specifies that nothing exists physically other than discrete units of motion. The natural reference system is a direct consequence of the existence of the primary units. Thus, this reference system is the framework, or background, of the universe of motion and does not represent any activity in that universe. The natural system of reference, as defined, is therefore the physical zero, or datum level, from which all physical activity extends.

A very important macroscopic manifestation of space-time progression is 'the expanding universe', reported by astronomers, which some have tried to account for with the hypothesis referred to as the Big Bang. The Big Bang is not a necessary truth. The hypothesis is a good example of "these infinities and other difficulties" quantum physicists get by avoiding all consideration of the possibility that light, electricity, magnetism, matter, etc. are quantized, because motion, space and time also are quantized. Briefly, the Big Bang theory has been well
stated by Joseph Silk:11: “The central thesis of Big Bang cosmology is that about 20 billion years ago, any two points in the observable universe were arbitrarily close together. The density of matter at this moment was infinite.” A relevant question may be asked: Before, during and after this moment, when the density of matter was allegedly infinite, were time, space and motion infinitely divisible?

Larson identifies the outward progression of the natural reference system as “the expansion of the universe.” According to Larson’s physics, the galaxies do not move through space. The expanding universe is rather the uniform scalar expansion (outward progression) of space with time progression at the speed of light, balanced by the inward scalar gravitational motion of the matter of the galaxies with speed varying as inverse distance squared.

While only the galactic motion can be observed, all physical locations participate in the outward motion, irrespective of whether or not they are occupied by galaxies. All galaxies and the physical locations that they occupy, are moving uniformly outward from all others. Hence each is moving in all directions. A motion distributed uniformly over all directions, has no specific, or inherent direction; that is, it is scalar. Thus, the expansion of the universe is described by the reciprocal system as a positive scalar motion of all physical locations, represented as outward in the spatial reference system.

VI. SPACE-TIME PROGRESSION VERSUS GRAVITATIONAL MOTION

Larson’s reciprocal system defines a universe of motion in which scalar motion of physical locations is not a unique phenomenon confined to the expansion recognized by the astronomers, but is the basic form of the motion from which all physical phenomena and entities are derived.

Larson’s theory probably provides a satisfactory answer to a question asked by Newton in Query 20 (28 in the second edition) of his OPTICKS: “What hinders the fix’td stars from falling upon one another?”
At this point Larson has arrived by deduction from his basic postulate at an explanation of the general background of the physical universe that is essentially in agreement with the astronomers' **assumption**. (Larson's derivation leads to a **uniform** outward speed, rather than a speed that varies with the distance, as produced by the kind of **expansion** assumed by the astronomers, but this difference is easily accounted for, because there is a known force, **gravitation**, that acts against the outward motion, with a magnitude varying as an inverse function of the distance.)

The reciprocal system of Larson's physics proposes that uniform outward space-time progression is what hinders the fix'd stars as well as the galaxies from falling upon one another. Space-Time Progression also perhaps is what hinders gravitational collapse and black holes.

The advantage of deriving this explanation of the universal background from a set of general premises rather than merely assuming its existence, lies in the fact that further deductions may be made from these same premises. Instead of a single process involving the universe as a whole, the explanation that Larson has derived from the premises of his theory of the universe of motion identifies the **expansion**, as previously mentioned, as the result of **outward scalar motions** of **individual physical locations**. This opens the way for the existence of other scalar motions of the same physical locations, called by Larson **independent motions**.

Such a well-known independent motion is gravitational motion, the characteristic motion that produces matter and the perceived motion of all matter. All well-known physical entities, including low and high frequency light photons, electrons and positrons, etc. as well as material and cosmic ("anti-material") atoms, are produced, according to the reciprocal system, by distinctive compounds of translational, vibratory and/or rotational **independent motions**.

Independent motions originate from the same source as do the primary motions: the reciprocal character of the relation between the two essential aspects of physical motion, space and time. This means, to begin with, an **equivalence** between the individual unit of space and the
individual unit of time, resulting in the already noted absolute uniform unit speed of scalar three-dimensional space-time progression. For physical entities and phenomena to emerge from the reciprocal character of motion, equivalence between the quantum space and time units is essential to provide Nature's standard speed measure, unit speed, the space-time ratio of unity, the initial level of all physical activity, the measure from which all physical entities and phenomena may be counted. No independent motion, no physical entity, no physical phenomenon appears to exist except as a speed divergence from this one to one correspondence, a speed displacement from the unit speed ratio.

The reciprocal character of motion includes beyond equivalence (beyond one to one correspondence), the further implication that under certain conditions associations of n units of one of the two components of motion appear to exist and that under those conditions the n units of this kind are equivalent to 1/n units of the other motion component.

Larson has discovered that what makes speed displacements for forming physical entities compatible with the one to one correspondence of the space and time quanta of unit speed is the existence of a difference between space (or time) as a separate entity and space (or time) as a constituent of space-time. The difference, one that the theory's postulate allows, is one of direction.

If the reciprocal system be true, and motion, space and time be quantized, then space-time progression interacts with gravitational motion in orderly but quite different ways, depending on whether the interaction occurs outside or inside a unit of space. The case of outside is illustrated by the macroscopic expanding universe, in which scalar gravitational motion plays the familiar role of the attractive force, while scalar space-time progression constitutes the repulsive force. The sense of space-time progression is always scalar outward away from unity; that of gravitational motion, scalar inward toward unity. At relatively short distances gravitation predominates, and the net motion is inward. Since the gravitational motion decreases with distance, while the outward progression remains constant, the opposing motions reach equality at some greater distance; which Larson calls the gravitational limit. Beyond this distance the net
motion is outward, increasing with distance, and approaching unity (the speed of light) at extreme distances. (This theoretical pattern of net speeds is verified observationally by measurements of the Doppler shift in the radiation received from the distant galaxies.)

The case of inside is illustrated by submicroscopic solid cohesion, in which scalar gravitational motion plays the unfamiliar role of repulsive force, while scalar space-time progression plays its reversed role of attractive force. Space-time progression is always scalar away from unity; however, within a unit of space, away from unity is toward zero. It follows that the progression within the space unit, as seen in the spatial reference system, is inward. Gravitational motion is always scalar toward unity. Within a unit of space gravitational motion is therefore outward in the spatial reference system. Within the unit of space the effect of a change in separation of atoms due to an unbalance of the opposing motions reduces the unbalance, and eventually results in the establishment of a stable equilibrium, which accounts for the existence of the crystalline state of matter.

VII. LARSON’S CALCULATIONS OF MOTION, SPACE AND TIME QUANTA

Larson learned how to measure Nature’s smallest time interval and shortest space length after he learned how to express the place of a photon. He has discovered that a photon’s place is in a uniformly translating physical location, moving with unit speed, whether or not occupied by the photon. Like Newton and Wigner, he found a photon’s place to be different from that of an electron, neutron, proton or meson. Within the formalism of quantum mechanics, predicated on an assumed inert, continuous space-time, they did not find a place to position the photon.

Mathematical unity, unit speed (the speed of light), not mathematical zero, is the true physical zero, the reference origin Nature prefers. Unit speed involves equivalence between space and time quanta, both as to magnitude and dimensionality. Mathematical unity is the true physical zero, because the reciprocal character of the space-time relation also implies that all physical entities, beginning with the photon of radiation, result and emerge only from speed displacement below or above unit speed.
Larson\(^7\) thinks that the natural quantum of time can be computed, when the following information is available about a photon whose oscillatory translation involves one outward unit, followed by one inward unit, constituting a full cycle of oscillation in a measurable time interval. If the frequency of such a photon has been counted in the cgs unit of cycles per second, the time quantum may be calculated as follows:

When cycles/second is chosen as the frequency unit, it is assumed that frequency is a function of time only. Frequency is equivalent to velocity, a ratio of space to time. Thus, the natural unit of frequency is a quantum of space divided by a quantum of time. This is equivalent to a half cycle per time quantum, since a full cycle includes one motion unit in each direction. Larson has found that the frequency of the specified photon was measured by Rydberg\(^{14}\) and is reported by Larson\(^7\) as having the value of \(3.2880 \times 10^{15}\) cycles/second. As previously indicated, this measured value of the Rydberg fundamental frequency will be expressed for the present purpose as \(6.576 \times 10^{15}\) half-cycles/second. Larson\(^7\) says:

"Expressing the frequency, which is actually a velocity, in terms of reciprocal time in this manner is equivalent to using the natural unit of space in combination with the cgs unit of time as the cgs unit of frequency. In other words, omitting consideration of the space term in selecting the unit of measurement has the same effect as giving it unit value. The natural unit of time in cgs terms is therefore the reciprocal of the Rydberg frequency or \(1.52 \times 10^{-16}\) second.

"We may now multiply this figure by the natural unit of velocity, \(2.9979 \times 10^{10}\) cm/sec, to obtain the natural unit of space, \(4.55 \times 10^{-6}\) cm."(The Structure of the Physical Universe, p.25.)

Thus, unit speed, the speed of light, appears to be formed by the ratio of a space quantum to a time quantum. Neither absolute zero speed nor infinite speed appears to exist in the physical universe. Since all physical entities are manifestations of motion, they are measured in terms of \(1/n\) and/or \(n/1\), when or where \(n\) is a finite integer and not zero. The speed of all individual units of motion is unit speed, which occurs when \(n\) is unity. No infinities are possible. The physical zero is unity, rather than the mathematical zero.
REFERENCES:

   "Both space and time are assumed to be infinitely divisible-to have no ultimate structure."


   "While fields and particles come and go, space and time lie inert, providing the stage upon which the actors play their roles."


   "But does time not imply motion? Not at all, I reply, as far as its absolute, intrinsic nature is concerned; no more than rest; the quality of time depends on neither essentially; whether things run or stand still, whether we sleep or wake, time flows in its even tenor. Imagine all the stars to have remained fixed from their birth; nothing would have been lost to time; as long would that stillness have endured as has continued the flow of this motion."

   "Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable; for in such space there would not only be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense. But this ether may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time. The idea of motion may not be applied to it."
   (our italics).


   "The interpretation of these results is that there is no displacement of the interference bands. The result of the hypothesis of a stationary ether is thus shown to be incorrect and the necessary conclusion follows that the hypothesis is erroneous."

November 14, 1994

Dr. Frank H. Meyer
1103 - 15th Avenue. S.E.
Minneapolis, Minnesota 55414

Dear Dr. Meyer:

We have reviewed your paper, "Are Motion and Space-Time Quantized?" (our manuscript number 6398), and I am sorry to report that it would not be an appropriate paper for this Journal.

Sincerely yours,

[Signature]

Robert H. Romer

RHR/kk
November 22, 1994

Dr. Frank H. Meyer
1103 - 15th Avenue. S.E.
Minneapolis, Minnesota 55414

Dear Dr. Meyer:

Thank you for your letter of November 17, concerning MS #6398. To answer your curiosity, I have to say that it was unfortunately all too easy to realize that your paper was not an appropriate one for this Journal. I think that if you had looked at some recent issues of the Journal, and/or read our "Statement of Editorial Policy", you would have realized that fact before you sent it to us. I refer in particular to the sentence beginning: "Papers announcing new...". That policy is hardly a new one at this Journal; that sentence has been part of AJP's editorial policy for decades.

Sincerely yours,

Robert H. Romer

RHR/kk
Dear Dr. Romer,

Thank you for your Letter of November 22, which satisfactorily answers my curiosity. MSP #6398 is inappropriate for AJP, because "Papers announcing new theoretical or experimental results or papers questioning well-established and successful theories are more appropriately submitted to one of the archival research journals for evaluation by specialists."

Everybody sees according to his or her own light. The reciprocal system of physics describes "original research that clarifies past misunderstandings" about the divisibility of space-time, space and time and "allows a broader view" of the established subject of quantum physics. The reciprocal system of physics "demonstrates new relationships" between the nature of motion and space-time. In both classical and relativistic mechanics, space-time are traditionnally represented as apparently unrelated. The finite equal speed of time progression cannot be specified at all independently of acknowledging that space also progresses uniformly outward with the same finite speed. The reciprocal system finds this finite speed of space-progression with time progression to be the unit or quantum of speed equal in magnitude to the speed of light in vacuo. The reciprocal system of physics shows "new ways of understanding, demonstrating or deriving the familiar result" of the 'expansion of the universe' that is postulated in the astronomers' latest theory of the recession of the distant galaxies.

"The third assumption [of the reciprocal system of physics, Dewey B. Larson affirms] is that space and time exist in discrete units. This, too, is an extrapolation from known facts into the region of the unknown. In the early days of science it was generally believed that the primary physical phenomena were continuous and infinitely divisible, but as knowledge has grown during the succeeding centuries one after another of these phenomena has been found to exist only in units. The atomic structure of matter was the first to be demonstrated. Later the unit of electricity was isolated and still more recently the work of Planck made it clear that radiant energy follows the same paths........Since experience shows that as our knowledge widens more and more and more physical phenomena are proved to exist only in discrete units, it is merely a reasonable extrapolation to assume that if all of the facts were known this would also be found to be true with respect to the basic entities, space and time."

The reciprocal system of physics is as old as Leucippus and Democritus and predicated on the same experience that led them to discover that matter probably is composed of discrete units, atoms.

Sincerely,

Frank H. Meyer

D 23.3-17
Nature has been defined as a 'principle of motion and change' and it is the subject of our inquiry. We must therefore see that we understand the meaning of 'motion'; for if it were unknown, the meaning of 'nature' too would be unknown. Now motion is supposed to belong to the class of things which are continuous and the infinite presents itself first in the continuous. Besides these, place, void and time are thought to be necessary conditions of motion. Again, there is no such thing as motion over and above the things. The fulfillment of what exists potentially, insofar as it exists potentially, is motion. Aristotle.

Motion is nothing but change of place. Thomas Hobbes.

We postulate that the universe is composed entirely of one component, motion, existing in three dimensions and in discrete units. We define motion as the relation between two uniformly progressing reciprocal quantities, space and time. Motion, as defined, is measured by speed, the scalar magnitude of the relation between space and time. By reason of the postulated reciprocal relation between space and time, each individual unit of motion is a relation between one unit of space and one unit of time, motion at unit speed. We identify unit speed as the speed of light. Motion, according to our definition, involves a uniform progression of both space and time at the speed of light. We define a point, or segment, of the line of the space progression at a given time as a physical location in space.

From Outline of the Larson Theory About The Universe of Motion.

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'Quantum Mechanics' as the Mechanics of the Time Region

K.V.K. Nehru

The preliminary results of a critical study of the Wave Mechanics carried out in the light of the knowledge of the Reciprocal System of theory have been reported earlier[1]. Some of its important findings are as follows. While the Wave Mechanics has been very successful mathematically, it contains some fundamental errors. The principal stumbling block has been the ignorance of the existence of the time region and its peculiar characteristics. The crucial points that need to be realized are that the wave associated with a moving particle, in a system of the atomic dimensions, exists in the equivalent space of the time region; and that switching from the particle view to the wave view is equal in significance to shifting from the standpoint of the three-dimensional temporal reference frame that is germane to the time region. To imagine that even gross objects have a wave associated with them is a mistake; the question of the wave does not arise unless the phenomena concerned enter the time region.

One corollary is that the theorists' assumption that the wave associated with the moving particle is spatially co-extensive with the particle is wrong since the former exists in the equivalent space, not in the extension space of the conventional spatial reference system. The 'Uncertainty Principle' stems from the theorists' practice of resorting to wave packets.

It has further been shown that the probability connotation of the wave function arises from the two facts that the wave is existent in the three-dimensional temporal manifold, and that locations in the three-dimensional temporal manifold are only randomly connected to locations in the three-dimensional spatial manifold. The non-local nature of the forces (motions) in the time region also follows from these facts.

Calculations based on the inter-regional ratios applicable confirm Larson's assertion that the measured size of the atom is in the femtometer range and hence what is found from the scattering experiments is the size of the atom itself -- not of a nucleus.

From the above study it became abundantly clear that the critics' comments that the small-scale world is not intrinsically rational, and that the Quantum theory cannot be understood intuitively were wrongly founded. What was really missing was the knowledge of the existence and characteristics of the time region, the region inside the natural unit of space, where only motion in time is possible. Since our knowledge of the Reciprocal System helped straighten some of the conceptual kinks of the Wave Mechanics and has indicated that its original basis has been rightly (though unconsciously) founded, an attempt has been made to inquire into its mathematical aspects in order to see whether they are valid in the light of our understanding of the Reciprocal System. The results of this inquiry are reported in this article.

1. Where Do We Stand

Before proceeding further it would be desirable to take a stock of the atomic situation from the point of view of the Reciprocal System.

Firstly, Larson[2] asserts that the atom is without parts, that it is a unit of compound motion, motion being the basis constituent of the physical universe. This means that both the nucleus and the so-called orbital electrons are non-existent.

Secondly, he argues that there is no electrical force either, involved in the atomic structure. This, therefore, leaves gravitation and the space-time progression as the only two motions (forces) that operate inside the time region with, of course, the appropriate modifications peculiar to the time region introduced into them.

Under these circumstances the question of a 'nuclear' force does not arise at all. But it is perfectly legitimate to inquire what forces (motions) are encountered by a particle as it approaches the vicinity of an atom, and indeed, as it enters the very atom itself. Equally important is to inquire into the mechanics of the converse process of the emission of a particle by the atom.

2. The Wave Equations

The most fundamental starting point for the mathematical treatment in the Quantum Mechanics is the wave equation. The wave equations in the Quantum theory govern the wave functions associated with the particles, and correspond to Newton's laws of classical mechanics. From our earlier study we have seen that changing from the particle picture to the wave picture is a legitimate strategy that needs to be adopted on entering the time region, as it is tantamount to shifting from the conventional three-dimensional spatial reference frame of the time-space region to the three-dimensional temporal reference frame of the time region. Therefore the next logical step is to examine how the governing equations of the wave phenomena have been arrived at, and see if it is in consonance with the Reciprocal System.

Since it is always possible to constitute a wave of any shape by superposing different sinusoidal waves of appropriate wavelengths and frequencies, we shall limit our discussion to these elementary sinusoidal waves. The relation between the wavenumber $k$ and the wavelength $\lambda$ on the one hand, and that between the angular frequency $\omega$ and frequency $\nu$ on the other, are as follows
\[ k = \frac{2\pi}{\lambda} \quad \omega = 2\pi v \]  
(1)

The wave speed \( u \) is given by

\[ u = \frac{\lambda \cdot v}{\omega} = \frac{\omega}{k} \]  
(2)

The general functional forms of sinusoidal waves are

\[ \sin(kx \pm \omega t) \quad \cos(kx \pm \omega t) \]  
(3)

and in complex exponential form (see Appendix I)

\[ e^{i(kx \pm \omega t)} \]  
(4)

where the imaginary unit \( i \) is defined by \( i^2 = -1 \).

Complex functions involve a real part and an imaginary part. Since at this stage in our discussion the nature of the wave function of particles is yet unknown, there is no theoretical reason to exclude complex functions. Let us bear in mind that the criterion of judgment is what is possible in the time region, not what is possible in the time-space region. To be sure, observable quantities in the time-space region ought to be real. However, by virtue of the second power relation between corresponding quantities in the time region and the time-space region, the observable value of a time region quantity would still be real even if it were to be imaginary in the time region (e.g.: a quantity in the time region would appear as \( i \cdot \nu \)), that is, \( -\nu^2 \) in the outside region.

2.1 Radiation Waves

Let us derive the governing equation for the wave propagating at constant speed, like that of radiation. First we note the relation between the momentum \( p \) of the wave and the wavenumber \( k \), and the energy \( E \) and its angular frequency \( \omega \),

\[ p = \hbar k \quad E = h \omega \]  
(5)

where \( h \) is Planck's constant divided by \( 2\pi \).

From the energy-momentum relationship of the wave, \( p^2 c^2 = E^2 \), (\( c \) being the constant wave speed) we have

\[
\begin{align*}
    p^2 &= \frac{1}{c^2} E^2, \\
    \hbar^2 k^2 &= \frac{1}{c^2} \hbar^2 \omega^2, \\
    k^2 &= \frac{1}{c^2} \omega^2.
\end{align*}
\]  
(6)

Assuming the simplest wave form, that of a sinusoidal wave, we write the wave function in complex exponential form as

\[ \Psi(x, t) = A \cdot e^{i(kx - \omega t)} \]  
(7)

where \( A \) is an arbitrary constant. For such a function,

\[
\begin{align*}
    \frac{\partial \Psi}{\partial x} &= ik \cdot \Psi, \\
    \frac{\partial \Psi}{\partial t} &= -i \omega \cdot \Psi.
\end{align*}
\]  
(8)

That is, taking the derivative with respect to \( x \) is equivalent to multiplying by \( ik \), and taking the derivative with respect to time is equivalent to multiplying by \( -i \omega \). Thus

\[
\begin{align*}
    \frac{\partial^2 \Psi}{\partial x^2} &= (ik)^2 \cdot \Psi = -k^2 \cdot \Psi, \\
    \frac{\partial^2 \Psi}{\partial t^2} &= (-i \omega)^2 \cdot \Psi = -\omega^2 \cdot \Psi.
\end{align*}
\]  
(9)

Substitute these in the last of Eq. (6) we obtain

\[ \frac{\partial^2 \Psi}{\partial x^2} = \frac{1}{c^2} \frac{\partial^2 \Psi}{\partial t^2} \]  
(10)

which is exactly the wave equation we are seeking (see Appendix II).

2.2 Matter Waves

At the instance of his mentor Peter Debye, Erwin Schrodinger made a detailed study of the wave hypothesis advocated in 1924 by de Broglie. Schrodinger noted that the energy-momentum relationship of a free particle (not acted by forces) of mass \( m \)

\[ \frac{p^2}{2m} = E \]  
(11)

leads to the wave number-angular frequency relation

\[ \frac{\hbar^2 k^2}{2m} = \hbar \omega \]  
(12)

From Eqs. (2) and (12) we see that the wave speed in this case is given by

\[ u = \frac{\hbar k}{2m} \]  
(13)

Therefore the speed of the matter waves is not constant like that of the radiation waves, but is a function of the wavenumber \( k \). Eq. (12) could be rearranged as
\[ \frac{-h^2}{2m}(ik)^2 = i\hbar(-i\omega) \]

Multiplying both sides by \( \Psi \), we can at once see from eqs. (8) and (9) that

\[ \frac{-h^2}{2m} \frac{\partial^2 \Psi}{\partial x^2} = i\hbar \frac{\partial \Psi}{\partial t} \]  \hspace{1cm} (14)

which is the governing equation for the wave associated with the free particle that we are looking for. This is the Schrödinger equation for the free particle. It is the equation in the time region which corresponds to Newton's first law of the time-space region.

In order to include interactions of the particles with the environment we note that the total energy of such a particle consists of the kinetic energy and the potential energy. The latter could be taken to be dependent only on position and represented by a potential energy function \( V(x) \). Thus for a conservative system we have the constant total energy \( E \) given by

\[ \frac{p^2}{2m} + V(x) = E \] \hspace{1cm} (15)

The corresponding wavenumber-frequency relation, associating frequency with the total energy is

\[ \frac{\hbar^2 k^2}{2m} + V = \omega \hbar. \]

Adopting Eqs. (8) and (9) as before, we arrive at the Schrödinger wave equation with interaction,

\[ \frac{-h^2}{2m} \frac{\partial^2 \Psi}{\partial x^2} + V(x)\Psi = i\hbar \frac{\partial \Psi}{\partial t} \] \hspace{1cm} (16)

This corresponds in the time region to Newton's second law in the time-space region.

As can be seen from the foregoing derivations, nothing against the principles of the Reciprocal System has been introduced so far. Hence the Schrödinger equations can be admitted as legitimate governing principles for arriving at the possible wave functions of an hypothetical particle of mass \( m \) traversing the time region, with or without potential energy functions as the case may be. We may note in the passing that often considerable mathematical dexterity is required in solving these differential equations, though computer-oriented numerical methods are fast replacing closed-form solutions.

Any wave corresponding to a state of definite energy \( E \) has a definite frequency \( \omega = E/\hbar \). Therefore from eq. (7) we can write

\[ \Psi(x,t) = A e^{\frac{iEt}{\hbar}} \psi(x) \] \hspace{1cm} (17)

where \( \psi(x) \) is a function of space variables only. Inserting the above into eq. (16), and dividing out the factor \( e^{\frac{iEt}{\hbar}} \) throughout, we get the differential equation to be satisfied by \( \psi(x) \)

\[ \frac{-h^2}{2m} \frac{\partial^2 \psi}{\partial x^2} + V(x)\psi(x) = E\psi(x) \] \hspace{1cm} (18)

which is referred to as the time-independent Schrödinger equation. This equation is less general and is valid only for states of definite total energy.

3. States of Negative Energy

It is instructive to see what the solutions of the Schrödinger equation turn out to be. Firstly, in any region of constant potential energy \( V \), we see that the solution of eq. (18) is a sinusoidal function,

\[ \psi(x) = A \sin(kx) \text{ or } A \cos(kx) \]

\[ k^2 = 2m(V-E)\hbar^2 \] \hspace{1cm} (19)

\( V-E \) being the kinetic energy.

3.1 The Step Function

In Fig. 1(a) we picture a step-function potential energy, which is constant at \( V_1 \) and \( V_2 \) respectively in two different regions. A possible wave function corresponding to this case is shown in Fig. 1(b). The particle's greater kinetic energy \( (E-V_1) \) in the region \( x<0 \) is reflected in its larger wavenumber (smaller wavelength) in this region. Also since its speed in this region is greater, it spends comparatively smaller time in this region, and this reflects as its smaller amplitude in this region.

An interesting case occurs when the potential energy \( V \) in any region is greater than the total energy \( E \). Here the kinetic energy, \( E-V \), becomes negative! This is physically impossible in the time-space region and the particle can never enter such a region. However, the situation is different in the time region: eq. (18) has valid solutions in this region, with \( k \) from eq. (19) taking on imaginary values.

\[ \psi(x) = A e^{\pm bx} \]

\[ b = i k \] \hspace{1cm} (20)

This sign of the exponent is so chosen as to see that \( \psi \) tends to zero for large \( x \). Fig. 2 illustrates this case: in the region \( x>0 \) we see that \( E \) is less than the potential energy. The wave function is sinusoidal in the region of positive kinetic energy and is exponential in the region of negative
kinetic energy. Both functions join smoothly at $x=0$ with a first order continuity. The penetration of the wave function into the region of negative kinetic energy has no classical analog and is purely a phenomenon of the time region.

3.2 Explanation of the Negative Energy States

When we turn to the Reciprocal System for an explanation of the possibility of the existence of negative energy states, what we find is as follows. In the time-space region, that is, in the context of the three-dimensional spatial reference frame, speed (space/time) is vectorial, that is, can have direction in space and therefore could take on positive or negative values. This is because in this case space is three-dimensional and time is scalar.

In this frame, energy, which is one-dimensional inverse speed (time/space), is scalar, and can take on zero or positive values only. On the other hand, the time region is a domain of the three-dimensional temporal reference frame. In this case time is three-dimensional and space is scalar. Consequently the inverse speed (namely, energy) is the quantity that is 'directional,' that is, can take on a 'temporal direction' in the context of the three-dimensional temporal reference frame, and therefore it is perfectly possible for it to take on negative values also. (It must be cautioned that 'direction in time' has nothing to do with direction in space; it is to be understood that we are only speaking analogically.) Further, in the time region, speed is the quantity that is scalar, an example being the net total displacement of the atom, namely, $Z$ (the atomic number).

Further, the possibility that even potential energy (being an inverse speed) could be 'directional' in the three-dimensional time, and hence be representable by complex numbers in the time region, cannot be overlooked. Indeed the Quantum theorists find it necessary to adopt the complex potential $V+iW$ in place of $V$ in scattering theory. Here the wavenumber $k$ becomes complex and is written as $k + iq$, $b$ of eq.(20) becomes $b = i(k + iq) = -q + ik$, and we have

$$\Psi = (Ae^{iqx})(e^{ikz}) \tag{21}$$

We can at once see that this is the wave function of a traveling wave of whose amplitude decreases as it advances, and therefore represents a beam of particles some of which are getting absorbed.

3.3 The Potential Energy Barrier

An interesting situation arises when two regions of positive kinetic energy occur separated by a potential energy barrier that is higher than the total energy as shown in Fig. 3(b). At either boundary the function and its first derivative are continuous. From this it is apparent that the particle represented by the wave has a non-zero probability of appearing on the other side of the barrier! While this is a real time region phenomenon that has been observed ('tunneling'), it has no analog in the time-space region (classical mechanics).

3.4. The Potential Energy Well

The last case of interest we wish to consider is that of a potential well as shown in Fig. 4(a), wherein the total energy $E$ is less that the potential energy $V_1$ in the outer regions. As before, we find that the wave function is sinusoidal in the (central) region of positive kinetic energy, and is exponential in the (outer) regions of negative kinetic energy, maintaining first order continuity at the boundaries. But here a new factor emerges, namely, that if we choose an arbitrary value of $E$, it might become necessary to adopt growing exponentials in the outer regions (for example, $e^{+bx}$ for $x>L$) so as to satisfy the continuity conditions at the boundary. This therefore leads to an unreal state of affairs. The physical requirement is that the wave function goes toward zero with increasing space co-ordinate in the outer regions. This necessitates the choice of shrinking exponentials in the outer regions (for example, $e^{-bx}$ for $x>L$). This requirement, coupled with the continuity constraints at the boundary, limits the possible energies to a series of distinct levels, each with its own wave function. Thus well-type potential energy functions give rise to a set of possible discrete energy levels. This fact can be seen directly to lead to the explanation of several observable facts including the atomic spectra.

4. Origin of the Pauli Exclusion Principle

The so-called exclusion principle was originally promulgated by Wolfgang Pauli. This is an empirical law to which no exception was ever found. It has been a heuristic guiding rule for understanding many an important quantum phenomenon. In spite of its important role, the explanation of its origin has defied the theorists. Therefore that this explanation is now forthcoming from the Reciprocal System is a point in favor of the general nature of the latter theory.

4.1 The Spin

But first we must recognize a point that we have been emphasizing[3,4], namely, that rotational space is as fundamental as the linear (extension) space. Larson explains: "... the electron is essentially nothing more than a rotating unit of space. This is a concept that is rather difficult for most of us when it is first encountered, because it conflicts with the idea of the nature of space that we have gained from a long-continued, but uncritical, examination of our surroundings. ... the finding that the "space" of our ordinary experience, extension space, as we are calling it in this work, is merely one manifestation of space in general opens the door to an understanding of many aspects of the physical universe ..."[5] He points out that an atom, for example, can exist in a unit of rotational space as it can in a unit of extension space.

In a paper entitled 'Photon as Birotation'[6] we have derived that the basic unit of angular momentum is $(1/2)\hbar$. Now we find that the Quantum theorists have been referring to this basic unit of rotational space as the spin.
In addition to the three space co-ordinates spin is treated as a fourth co-ordinate. Thus two different particles can occupy the same location in extension space at the same time if their spin co-ordinate differs.

4.2 Indistinguishability

In connection with a class of elementary particles, we know that any two individual particles (say, two electrons) are absolutely alike. In the time-space region, the fact that two particles are identical presents no complications since they can be kept distinguished by their respective locations. But in the quantum phenomena, because of the non-local nature of the time region, no such distinction is possible. This intrinsic indistinguishability gives rise to some special constraints. Let us take \( \psi(1,2) \) to be the wave function of two indistinguishable particles with particle 1 at location \( r_1 \) (whose co-ordinates include the spin co-ordinate also) and particle 2 at location \( r_2 \). Then \( [\psi(1,2)]^2 \) represents the probability distribution for particle 1 to be at \( r_1 \) and particle 2 to be at \( r_2 \). Since we cannot distinguish between the particles, the wave function should be of such a form that it results in the same probability distribution if we interchange the two particles in \( \psi \). That is

\[
[\psi(1,2)]^2 = [\psi(2,1)]^2
\]

This can be satisfied in two ways,

\[
\psi(1,2) = + \psi(2,1) \quad \text{or} \quad \psi(1,2) = - \psi(2,1)
\]

(22)

This first type of wave functions are referred to as the symmetric and the second as the antisymmetric functions.

Now the empirical finding is that the wave functions of particles like protons and neutrons which are known to have half-integral spin (\( h/2 \)) are antisymmetrical, and those of particles with integral spin (like the photons) are symmetrical. The most fundamental statement of Pauli exclusion principle goes somewhat like this: "Any permissible wave function for a system of spin -1/2 particles must be antisymmetric with respect to interchanging of all co-ordinates (space and spin) of any pair of particles." But enunciating a principle is quite different from explaining its origin, and the fact is that no theoretical explanation has been found for this empirical finding. One author writes: "For reasons that are not clearly understood, for electrons, protons, neutrons, and all other spin -1/2 particles, the minus sign is chosen ..."[7]

4.3 The Two Types of Reference Points

From the Reciprocal System we have now the explanation. Let us recall that in the universe of motion there are two types of reference frames---the conventional, stationary three-dimensional spatial reference frame (or its cosmic analog, the three-dimensional temporal reference frame) and the moving natural reference frame. We also have two kinds of objects, those having independent motion like the gravitating particles and those having no independent motion of their own and hence are stationary in the natural reference frame, like the photons and those particles having potential mass[8] only. The reference point for the scalar inward motion of the gravitating particle is itself. Thus if there are two locations A and B in the three-dimensional reference frame with this particle situated at A, say, its gravitational motion appears in the direction BA, because it is inward toward itself. If now the particle is shifted to location B, the direction of its gravitational motion seems reversed, being in the direction AB. This is the origin of the antisymmetry of the wave functions of such particles.

As already remarked a unit of one-dimensional rotation carries unit spin (\( h/2 \)). The resultant spin of a two-dimensional rotation with unit spin in each dimension is \( 1 \times 1 = 1 \) (that is, \( h/2 \)) or \( 1 \times (-1) = -1 \) (that is, \(-h/2\)). On the other hand, the resultant spin of a birotation (like the photon) is \( 1 + 1 = 2 \) (that is, \( h \)) or \( -1 - 1 = 0 \). Since gravitation arises out of the two-dimensional rotation, we can see that a gravitating particle carries spin -1/2. Thus the wave functions of spin -1/2 particles turn out to be antisymmetric.

On the other hand, the reference point for the motion of particles like the photons is the location in the natural reference frame, or what Larson calls the 'absolute location.' The natural reference frame is not a spatial manifold; nor is it a temporal manifold. It is a speed manifold: each location in it is moving at unit speed, one unit of space per unit of time. Suppose that the spatial separation between two locations in this frame (the 'absolute locations') increases by \( n \) natural units of space. Because of the unit speed criterion, there is a concomitant increase in the separation in time by \( n \) natural units of time (making \( n/n = 1 \)). The expansion in space is completely nullified by the expansion in time by virtue of the reciprocal relation between space and time, and from a space-time point of view there is no separation between absolute locations.

In the context of the three-dimensional reference frame, photons appear to move outward from the point of their origin. But we have already seen that the photon is stationary in the absolute location. Its apparent motion is the outward motion of the absolute location (on which it is located) away from all other absolute locations. The crucial point that should now be recognized is that outward from one absolute location is still outward from any other absolute location because of the equivalence of these absolute locations as explained above. Therefore, interchanging the location of the photon between two such absolute locations has no effect on the sign of its wave function. That is, the wave function of such particles is symmetric. One final word is in order: all that has been said above is also true in the time region, except that the scalar direction outward in the time-space region manifests as inward in the time region and vice versa.
5. Potentials in the Time Region

Finally it might be of interest to explore the nature and type of potential energy functions $\mathbf{V}$ (see eq.(15)), in the time region. In view of the maiden nature of the investigation and the insufficient time available, the results reported in this section may have to be treated as tentative.

5.1 Dimensional Relations Across the Regions

Discussing the effect of the inversion of space and time at the unit level on the dimensions of inter-regional relations, Larson\cite{10} shows that the expressions for speed and quantities related to speed in the time region are the second power expressions of the corresponding quantities belonging to the time-space region. This is because an increase of time $t$, with space remaining constant at unity in the time region, is equivalent to a decrease $1/t$ of space, and results in a speed of $(1/t)t = (1/t)^2$; that is, the square of the corresponding speed $1/t$ of the time-space region.

In an earlier article\cite{11} we have identified two different zones of the time region, namely, the one-dimensional and the three-dimensional. The second power relation mentioned above could be seen to apply specifically to the one-dimensional zone. On the other hand, for the three-dimensional zone---where the compound motions constituting an atom exist---the situation is different: here an increase of time $t$, with space remaining constant at unity, is equivalent to a decrease in space of $(1/t)^3$. This therefore results in a time region speed of $(1/t)^3/t = (1/t)^4$, which is the fourth power expression of the corresponding time-space region speed $1/t$.

5.2 Potentials in the Time-Space Region

At this stage of our study we have only two scalar motions (forces) to consider: the space-time progression and gravitation. In the outside region (the time-space region), the forces due to the space-time progression and gravitation are respectively given by

\[
\begin{align*}
F_{PO} & = K_{PO} \\
F_{GO} & = -K_{GO}/t^2
\end{align*}
\]

(23)

where all the quantities concerned are in the natural units, the $K$'s are positive constants and $r$ the distance factor. Suffix $G$ refers to gravitation, $P$ to the space-time progression and $O$ to the outside region. From the definition of potential, $F = -\partial V/\partial r$, we obtain the expressions for the corresponding potentials due to the space-time progression and gravitation, in the outside region respectively as

\[
\begin{align*}
V_{PO} & = -K_{PO}t \\
V_{GO} & = -K_{GO}/t^2
\end{align*}
\]

(24)

The potential due the space-time progression is repulsive while that due to gravitation is attractive as can be seen.

5.3 Potentials in the One-Dimensional Zone of the Time Region

Potential energy being inverse speed, the expressions for the potentials in the one-dimensional zone of the time region would be the second power expressions of the corresponding ones in the time-space region (section 5.1). Consequently the space time progression and gravitational potentials in this zone could be written as

\[
\begin{align*}
V_{P1} & = K_{P1}t^2 \\
V_{G1} & = K_{G1}/t^2
\end{align*}
\]

(25)

with suffix 1 referring to the one-dimensional zone. We can at once verify that gravitation is repulsive and the space-time progression attractive in this region. In addition there could be a constant term $K_{11}$, representing the initial level of the time region potential. Thus the total time region potential in the one-dimensional zone turns out to be

\[
V_{T1} = K_{P1}t^2 + K_{G1}/t^2 \pm K_{11}
\]

(26)

The values of $K_{G1}$ and $K_{11}$, and possibly $K_{P1}$, are functions of the displacements of the atom in the three scalar dimensions.

It is instructive to see what the expressions for the corresponding forces would be: differentiating with respect to $r$ and taking the minus sign, we have

\[
\begin{align*}
F_{P1} & = -2K_{P1}t \\
F_{G1} & = 2K_{G1}/t^3
\end{align*}
\]

(27)

Larson\cite{10} however, while calculating the inter-atomic distance in solids, basing on the equilibrium of the time region forces, adopts

\[
\begin{align*}
F_{P1} & = -1 \\
F_{G1} & = K/r^4
\end{align*}
\]

(28)

where $K$ is a function of the several atomic rotations. These expressions can be seen to differ from eqs.(27) above. But whether we take eqs.(27) or eqs.(28), the force equilibrium equation, $F_{P1} = F_{G1}$ can be seen to lead to the same fourth power dependence on the distance.
factor. Consequently, even if we find that eqs. (27) are to be adopted in preference to eqs. (28), Larson's original inter-atomic distance calculations would remain unaltered.

The time region potential eq. (26) results in a potential well and therefore the solutions of Schrodinger's eq. (18) yield a set of discrete energy levels for the atomic system (see section 3.4). It remains to be verified whether these truly correspond to the values inferred from the spectroscopic data.

5.4 Potentials in the Three-Dimensional Zone of the Time Region

Turning now to the potentials in the three-dimensional zone, following our earlier analysis of the dimensional situation (section 5.1), we adopt the fourth power expressions of the corresponding outside region quantities eqs. (24):

\[
\begin{align*}
V_{P3} &= K_{P3}r^4 \\
V_{G3} &= K_{G3}r^4
\end{align*}
\]

(29)

with suffix 3 denoting the three-dimensional zone.

We know that the space-time progression acts away from unity. In the time-space region away from unity is also away from zero (the origin of the conventional reference system), whereas in the time region away from unity is towards zero. This is the reason why the space-time progression is an outward motion in the outside region while it is inward in the time region. This is true in the one-dimensional zone of the time region as much as in the three-dimensional zone. But the 'unity' of the three-dimensional zone does not coincide with the 'unity' of the one-dimensional zone. Its boundary is decided by the size of the atom in question. This is because the atom and the three-dimensional zone are one and the same thing. (We must avoid falling into the trap of imagining that first there is an atom, and that it 'occupies' the three-dimensional zone!) In eq. (7) of the article on Wave Mechanics[1] we have derived the expression for the size of the atom,

\[
r_A = 1.2 \times 10^{-10} \text{ femtometers}
\]

where A is the atomic weight. Expressing this in the natural units as \( r_{An} \), we now note that the reference point for reckoning distance in the case of \( V_{P3} \) is not the origin of the reference system, but the point at \( r_{An} \). Finally, since the potential due to the progression has to be attractive a minus sign has to be introduced. Thus the expressions for the two potentials are

\[
\begin{align*}
V_{P3} &= -K_{P3}(r_{An} - r)^4 \\
V_{G3} &= K_{G3}r^4
\end{align*}
\]

(30)

Adding a constant term \( K_{13} \) to take care of the initial level of the potential energy, we have the total expression for the potential of the three-dimensional zone of the time region as

\[
V_{T3} = -K_{P3}(r_{An} - r)^4 + K_{G3}r^4 \pm K_{13}
\]

(31)

We note that this corresponds to what the conventional Quantum theorists would call the nuclear potential. Our study indicates that eq. (31) bears a remarkably close qualitative resemblance to the potentials arrived at through the scattering experiments. An unexpected feature of the experimental data analysis was the occurrence of a repulsive core of small radius. The Reciprocal System, on the other hand, actually predicts this repulsive core, namely, \( V_{G3} \).

6. Conclusions

Let us summarize the highlights. Having resolved the riddle of the wave-particle duality in an earlier article[1] and finding the legitimacy of the wave picture in the Quantum theory, attempt has been made to examine the foundation of its mathematical formalism, with the benefit of our knowledge of the Reciprocal System. This proved beneficial in two ways: firstly it clarified the situation in connection with the Quantum Mechanics, identifying some of its conceptual errors; secondly it gave scope to expand our knowledge of the Reciprocal System in the form of new insights, while applying it to areas of the Quantum theory, which would hardly have been thought of in its own context.

(i) The Schrodinger equations were found to be valid general rules for the exploration of the wave functions in the various situations.

(ii) In the time-space region, speed can be vectorial (that is 'directional') in the three-dimensional spatial reference frame, whereas inverse speed (like, energy) is scalar. In the time region, speed is found to be scalar, whereas inverse speed is 'directional'—directional in the three-dimensional temporal reference frame. The latter type variables, therefore, could take on inherently negative values and be represented by complex numbers.

(iii) The penetration of the wave associated with particles into the regions of negative kinetic energy resulting from potential energy barriers is found to be a genuine time region phenomenon.

(iv) In a similar vein, it is found that the occurrence of a well type potential energy function in the time region leads to the limiting of possible values of the total energy to a discrete set.

(v) Such an important empirical law as the Pauli exclusion principle, which has no theoretical explanation in the context of the conventional Quantum theory, could easily be understood from the knowledge of the positive and negative reference points brought to light by the Reciprocal System.
(vi) Reasoning from the principles of the Reciprocal System the possible potential energy functions of the time region connected with an atomic system are surmised. While they evince a close qualitative resemblance to the empirically found potentials, detailed further study needs to be carried out to see if they lead to the correct prediction of the properties connected with spectroscopy, radioactivity and the scattering experiments.

On the whole there seems to be a prima facie case in favor of adopting the Quantum Mechanics after purging it of its conceptual errors.

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Appendix I: Euler's Relations

Often calculations are facilitated by adopting exponential functions with imaginary arguments in place of the sine or cosine functions, making use of Euler's relations:

\[ e^{ia} = \cos a + i \sin a \]
\[ e^{-ia} = \cos a - i \sin a \]

which directly follow from the series expansions of these functions.

A number containing imaginary as well as real parts is called a complex number. Complex numbers may be represented graphically on a rectangular co-ordinate system, with the real part corresponding to the horizontal axis and the imaginary part to the vertical axis. Any complex number can then be represented by a vector originating from the origin and inclined at the angle \( \alpha \) to the real axis. Thus \( A e^{ia\omega} \) represents a (radial) vector of magnitude \( A \) rotating at the angular speed \( \omega \) (\( t \) being time).

It may be noted that each of the inverse relations,

\[ \sin a = \frac{e^{ia} - e^{-ia}}{2i} \]
\[ \cos a = \frac{e^{ia} + e^{-ia}}{2} \]

represents a birotation.

Appendix II: The General Equation of a Constant Speed Wave

Let a wave of arbitrary but unchanging shape be traveling in the X-direction of the stationary reference frame X-Y at a constant speed \( u \). This wave appears stationary in a reference frame X1 - Y1 which moves at the same speed \( u \) along the X-direction. We can then write

\[ x_1 = x - ut ; y_1 = y \]  \hspace{1cm} (i)

If the wave shape in the co-moving frame is given by \( y_1 = f(x_1) \), we have from eq. (i)

\[ y = f(x - ut) \]  \hspace{1cm} (ii)

By the chain rule for derivatives we have

\[ \frac{\partial y}{\partial x} = \frac{dy}{dx_1} \cdot \frac{\partial x_1}{dx} = \frac{dy}{dx} \cdot \frac{1}{1}, \]
\[ \frac{\partial y}{\partial t} = \frac{dy}{dt_1} \cdot \frac{\partial x_1}{dt} = \frac{dy}{dx} \cdot (-u). \]

Therefore the relation between the two derivatives is

\[ \frac{\partial y}{\partial x} = \frac{1}{u} \cdot \frac{\partial y}{\partial t} \]  \hspace{1cm} (iii)

Similarly for a wave traveling in the -X direction we obtain

\[ \frac{\partial y}{\partial x} = \frac{1}{u} \cdot \frac{\partial y}{\partial t} \]  \hspace{1cm} (iv)

Now a repeated application of the above procedure yields

\[ \frac{\partial^2 y}{\partial x^2} = \frac{1}{u^2} \cdot \frac{\partial^2 y}{\partial t^2} \]  \hspace{1cm} (v)

which is the governing equation of the wave function; and it is the same for waves traveling in either direction.

***
Fig. 1 Potential Energy Step

Fig. 2 Negative Kinetic Energy

Fig. 3 Potential Energy Barrier

Fig. 4 Potential Energy Well
The universe is composed of matter, and, as a system, is sustained by motion. Motion is not a property of matter, and without this motion, the solar system could not exist. Were motion a property of matter, that undiscovered and undiscoverable thing called perpetual motion would establish itself.

- Thomas Paine

The principal obstacle that stands in the way of acceptance of the idea of a finite universe is the observed outward motion of the photons of light and other electromagnetic radiation. On first consideration, it would seem that regardless of what the aggregate of matter may be doing, the radiation is being dispersed outward into space, and is eventually lost from the universe as we know it. But we now find that this apparent outward movement of the photons is an illusion due to the inward movement of the gravitationally bound system from which we are doing our observing. The photons actually have no capability of independent motion. This is why the physicists have never been able to find a mechanism for the "propagation of radiation." There is no propagation, and therefore no need for a mechanism.

- Dewey B. Larson

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Reciprocity

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Time is the Essence

DEWEY B. LARSON

Dewey B. Larson is an anachronism in the modern scientific world. Whatever else may be said of modern science, it is generally true that it has become, and is further becoming, less and less controversial. The great success of science seems to have instilled, into the man in the street and scientist alike, an exaggerated respect akin to religious reverence. Most scientists preoccupied as they are with the obscurities of their own narrow field, rarely, if ever, question the underlying assumptions on which science rests. Larson does. He advances in this article the belief that the basis of our scientific thought, namely our conception of space and time, is at fault, and provides some alternative ideas.

"To attempt a definite statement as to the meaning of so fundamental and underlying a notion as that of time is a task from which even philosophy may shrink," says Richard Tolman in his classic treatise on Relativity. But the "notion" of time is basic in every field of science. In legal documents we often see the expression "Time is the essence of the contract." It is no less the essence of physical theory - without the symbol and all that it stands for, there would be little left in physical science. In order to make a definite and meaningful statement about any physical phenomena it is therefore necessary to define the concept to which the name "time" is to be attached. This definition may not actually be expressed--indeed is seldom expressed except in such basic works as Tolman's--but in any work that lays claim to scientific accuracy, the exact meaning of the concept must be specified, implicitly if not explicitly. Those who use the concept without defining it are not evading this requirement; they are simply accepting a definition set up by someone who has preceded them. How then does science meet this serious challenge at the very base of its theoretical structure: the absolute necessity of a precise and unequivocal definition of an entity that is so difficult to grasp that the mere thought of trying to understand it appalls the scientist? Tolman tells us frankly how he and his colleagues have met this issue: "we shall assume without examination the unidirectional, one-valued, one-dimensional character of the time continuum."²

Physical science justifiably prides itself on the "rigor" of its treatment of the subject matter which it covers: precise definitions, clear-cut distinctions, careful and critical development of theory by exact logical and mathematical processes. But when we examine the foundations of this work, we find that the entire structure of carefully developed theory rests upon nothing more substantial than three items which are "assumed without examination." Scientific precision has here taken the form of precise formulation of pure assumptions: the most unreliable of all instruments of thought. Unfortunately, precision is no substitute for validity; an assumption is no less uncertain and speculative because it is expressed in definite and exact language. As matters now stand we have not grasped the essence; we see it only through a thick veil of uncertainty. And without a solid foundation which only a clear understanding of the true properties of time can give us, all of our vaunted logical and mathematical precision is spurious; indeed, if the premises are false, the more precise the logical development the more certain we are to arrive at the wrong conclusion. The physicist who fills pages of the Physical Review with complex mathematical calculations may be giving us a development that, in itself, is faultless, but if any of the properties of time that have been "assumed without examination" are not valid, then he is introducing some kind of an error every time he uses the symbol t and, in spite of its impeccable outward appearance, the work as a whole may be completely wrong.
If physical science had been uniformly successful in building up a consistent, integrated structure of theory, fully capable of meeting all demands upon it, this serious defect in the underpinnings of the structure could well be viewed with equanimity, on the ground that the assumptions are justified by the results thereof. It is admitted on all sides, however, that in spite of the spectacular successes that have been achieved in many areas, physical science is still far from having a comprehensive and satisfactory basic theory. In fact, many scientists have given up in despair, and no longer consider the construction of such a theory to be within the range of possibility. C.N. Yang, for instance, was quoted in a recent news item as "expressing some doubts about the ability of the human brain in general and his in particular to accomplish this task," and Henry Margenau admits that "To the outsider the conclusions reached by a modern physicist seem almost like a declaration of the bankruptcy of science".

In the light of this situation it would seem that science has now reached the point where it can no longer avoid facing the issue as to just what the properties of time actually are. Of course, we have no positive knowledge that errors in the assumptions regarding these properties are responsible for, or contributed to, the failure to construct a satisfactory theory, but when the best efforts of the most competent investigators over a long period of years have failed to produce the expected results, it is certainly much more likely that the fault lies in basic premises that have been assumed arbitrarily and "without examination" than in any lack of "ability of the human brain" to apply logical and mathematical processes to these premises. A thorough and painstaking examination of the validity of the assumptions that have been made concerning the properties of time is therefore very much in order.

The question then arises as to how this issue can be approached. The scientific profession has hitherto believed that there is no alternative to the use of pure assumptions of the kind listed by Tolman, but the investigations that I have carried out have disclosed that it is possible to apply a much more reliable process to this problem, and thereby to arrive at some different conclusions as to the properties of space and time which eliminate most, if not all, of the basic difficulties that physical science now faces. This new approach substitutes a process of extrapolation for the arbitrary assumptions heretofore utilized. It is true that extrapolation is also, in a sense, a process of assumption, but the extrapolation assumption, the assumption that the situation or relation existing in the known region also exists in the unknown region, is inherently vastly superior to any other assumption that can be made, with a far greater possibility of being a true representation of the physical facts, and in any case where extrapolation is possible, it is obviously sound policy to give the consequences of such an extrapolation a complete and thorough examination before anything else is even considered.

As a general proposition, the superiority of this approach is not open to serious question, but a direct extrapolation does not appear feasible in this case, as we have no positive knowledge as to what the properties of space and time actually are anywhere, and consequently there is no adequate base from which to extrapolate. All previous investigators have therefore relied upon assumptions--some related to our rather vague general impressions of space and time, others wholly conjectural--not because they preferred to do so, but because they had no option. The method which I have employed to overcome the existing difficulties is to approach the question indirectly, beginning with an examination of the relation between space and time. This relationship is one that has never been adequately explored hitherto. In the days of Newton, its existence was not recognized at all, the two entities being regarded as completely independent. Since then there has been a growing realization that they are not independent and that basically we must deal with space-time, not with space and time.
individually. Thus far, however, it does not appear to have been suspected that the existing concepts of the fundamental nature of space and time may be in error—that time, for instance, may actually be something other than a "unidirectional, one-valued, one-dimensional continuum"—and the hypotheses that have been advanced as to the character of the space-time relation, such as Minkowski’s concept of a four-dimensional continuum, have retained these basic assumptions and thus have simply piled speculation upon conjecture.

Instead of starting with arbitrary assumptions, the first move in the present investigation has been to extrapolate to the universe as a whole the relation between space and time which we find existing in the known region of the universe. In this known region the relation between space and time is motion, and in motion space and time are reciprocally related. This is not surmise or assumption, nor is its accuracy in any way open to doubt. It is positive knowledge from which we can extrapolate. Irrespective of the nature and properties of space and time individually, the method of extrapolation leads directly to the conclusion that we should postulate a general reciprocal relation between space and time effective throughout the universe.

Of course, any new viewpoint that conflicts with long-standing beliefs concerning space and time, no matter how firmly based it may be, will seem strange and hardly credible on first consideration, but nothing that we actually know about space or time is inconsistent with this reciprocal postulate. The truth is that we know very little about either of these entities. Time has always been mysterious and elusive, but even space, which seems so much more understandable, has been a difficult problem for those who have sought to discover its true nature, and no general agreement on this score has ever been reached. To Aristotle space was merely a relationship between physical objects: to Democritus and his fellow atomists it was a container in which such objects exist; to Einstein it was a medium connecting these objects.* Certainly it cannot be claimed that there now exists any positive knowledge to which a new theory must conform. On the contrary, the conclusion of this current investigation, which in effect asserts that space is merely an aspect of motion, has a much greater a priori probability of being correct than any of its predecessors, since it has been reached by way of a more reliable process. Nevertheless, the proof of the pudding must be in the eating; that is, we must develop the consequences of the new concept and see whether they give us a more logical and consistent picture of physical relations than the currently accepted idea.

*Einstein specifically uses the word "medium" in this connection, contrary to the assertions of writers who claim that his system dispenses with mediums. See his book Sidelights on Relativity, P. Dutton & Co., New York, 1922, page 23.

It will not be possible in a short article of this kind to describe all of the results that have been obtained in the application of the reciprocal hypothesis to a wide variety of physical phenomena during the many years that this investigation has been under way, but the general nature of the results can be demonstrated by a typical example. And in the discussion that follows, the consequences of the reciprocal postulate will be developed far enough to produce an explanation of gravitation, something that no other physical theory has been able to do. The gravitational findings are particularly interesting because they not only demonstrate the ease with which this new development surmounts the difficulties that have stood in the way of progress in such areas as this, but also show why we get a distorted view of space and time from our everyday experience, and why most of the inferences as to the nature of these entities that we draw from such experience are erroneous and misleading.

No doubt many readers will be surprised at the assertion that gravitation still remains
unexplained, as there is a very common misconception that Einstein’s General Theory of Relativity supplies such an explanation. But, as Willem de Sitter has pointed out very clearly no hypothesis thus far advanced to explain gravitation “has ever had the least chance, they have all been failures.” Einstein’s contribution, de Sitter says, is to make gravitation identical with inertia, and thus to put it into the category of “one of the fundamental facts of nature, which have to be accepted without explanation, like the axioms of geometry”.5 After fifty years, the inadequacy of this treatment is clearly apparent. As R.H. Dicke puts it, gravitation is still an “enigma” and “It may well be the most fundamental and the least understood of the interactions”6. A recently published review of the proceedings of the First Soviet Gravitational Conference confirms this opinion with the following comments: “.............the gathering seemed painfully perplexed with endless questions, nearly all of which remained unanswered”.7

The crux of the gravitational problem is the dilemma which no previous theory has been able to avoid: the apparent necessity of postulating either action at a distance, which is philosophically unacceptable to most scientists, or propagation through a medium, which is completely lacking in observational support and is faced with seemingly insurmountable practical obstacles. After three hundred years in which it has been agreed that these are the only two possibilities, the new development based on the reciprocal postulate now produces a third alternative that has been completely overlooked by previous investigators; one in which gravitation acts in a perfectly natural and understandable way, instantaneously, without an intervening medium or a medium-like space, and in such a way that it cannot be screened off or modified in any way; all of which are exactly in accord with what our observations have always indicated.

To begin the explanation of how these results were obtained, let us now return to the basic assumption of a reciprocal relation between space and time. It is evident that this assumption necessitates a further postulate that space and time have the same dimensions, since quantities of different dimensions cannot stand in a reciprocal relation to each other. We can recognize three dimensions of space; and the simplest assumption that is consistent with both the reciprocal postulate and the observed properties of space is that both space and time are three-dimensional. Limitation of both space and time to discrete units is also necessary in order to make the reciprocal postulate mathematically workable. Extrapolation of the relation between space and time that is observed in the phenomenon of motion thus leads directly to three conclusions about the properties of time and space which can replace the assumptions that physicists have made “without examination”. Together with the further assumption that space-time as thus defined is the sole constituent of the physical universe, these can be combined into one comprehensive postulate as follows:

FIRST FUNDAMENTAL POSTULATE:
The physical universe is composed entirely of one component, space-time, existing in three dimensions, in discrete units and in two reciprocal forms; space and time.

In addition to this First Postulate, which defines the physical universe, some further assumptions as to mathematical behavior will be necessary, and since this present development does not get into any difficulties of the kind that have forced modern physics to resort to the use of complex and abstruse mathematics, it will be possible to formulate the following simple postulate:

SECOND FUNDAMENTAL POSTULATE.
The physical universe conforms to the relations of ordinary commutative mathematics, its magnitudes are absolute, and its geometry is Euclidean.

On examination of these two postulates, it is apparent that they require a progression of space-time similar to the progression of time as ordinarily visualized. Let us consider some
location A in space-time. When one more unit of time has elapsed, this location has progressed to A + 1 in space. Since one unit of time is equivalent to one unit of space, according to the First Postulate, this location has also progressed to A + 1 in space. At the very outset, therefore, the new development confronts us with an important basic phenomenon which has not hitherto been recognized: a progression of space similar to the observed progression of time. We thus have an immediate opportunity to test the validity of the new system by observation of the actual physical universe. If space-time actually progresses, as the new theory contends, then we should be able to recognize some phenomena in which identifiable objects without inherent motion of their own are being carried along in space by the progression of space-time.

In order to simplify the question of a reference system, let us assume that a large number of such objects originate at the same space-time location, which means that they originate at the same space location simultaneously. Due to the progression of space-time these objects immediately begin moving outward, but outward in space-time is a scalar direction, and the spatial motions of the individual objects will be distributed over all possible directions in accordance with the probability principles. Hence if there actually is a progression of space-time, we should observe objects of this kind originating at various spatial locations and moving away from the points of origin in all directions and at a constant velocity. We do not have to look very far to find physical entities which display exactly this behaviour. Throughout the physical universe there are sources of light or other electromagnetic radiation from which photons emanate in all directions and recede from the points of emission at a constant velocity. This radiation phenomenon therefore furnishes the definite independent evidence that is necessary to demonstrate the reality of space-time progression.

Additional confirmation is provided by the motions of the external galaxies. All galaxies except our immediate neighbors are receding from us in exactly the same manner as the photons of light that originate in our galaxy except for the fact that the relative galactic velocity is a function of the distance, and has only reached about one-fourth of the velocity of light at the extreme range of our optical telescopes, and perhaps one-half of the velocity of light at the greatest distances accessible to radio observation. The lower velocities of the galaxies as compared to the velocity of the light photons are quite obviously due to the modifying effect of gravitation which, even at these enormous distances, still exerts a small force of attraction that operates against the progression. Thus the reality of the space progression, a basic feature of the new theory that has no counterpart in any other physical theory, is substantiated by two independent lines of evidence.

Space limitations preclude a detailed discussion of the development of the consequences of the Fundamental Postulates to the point where they require the existence of matter, but for present purposes it should be sufficient to say that this development indicates that the atoms of matter are rotating units in which the direction of the rotation is opposite to that of the space-time progression; that is, irrespective of the spatial direction in which the atoms are moving, their scalar space-time direction is always inward, directly opposite to the outward motion of the space-time progression. Whereas the progression is continually carrying all physical objects outward away from each other, the inherent rotational motion of the atoms is carrying them inward toward each other. This is the phenomenon that we call gravitation.

As an aid to visualizing how gravitation operates, according to this theory, let us assume that a violent explosion has taken place and that we are looking at the results shortly thereafter without any knowledge of what has happened. We will see a cloud of flying
particles apparently exerting a force of repulsion upon each other, and we will observe that this force has some peculiar characteristics: it acts instantaneously, without an intervening medium, and in such a way that it cannot be screened off or modified. According to the new development, gravitation is a force of the same general nature, except that it acts in the inverse direction: inward instead of outward. Like the apparent force which the particles of debris exert on each other, gravitation merely appears to be an action of one mass upon another; in reality each mass is pursuing its own course independently of all others.

Inasmuch as the motion of the progression originates everywhere and is constant regardless of location, whereas the gravitational motion originates at the location which the atom happens to occupy, and the component directed toward any other atom therefore decreases with distance in accordance with the inverse square relation, there is a point at which the two velocities are equal. Inside this equilibrium distance the gravitational distance is greater, and there is a net gravitational effect. Beyond the equilibrium point the motion of the progression is greater, and objects move away from each other, the net outward velocity increasing with the distance as the gravitational effect decreases. The actual behavior of the universe is exactly in accord with these predictions of the new theory.

Throughout the physical realm the new viewpoint as to the nature of space and time derived by the relatively straightforward and dependable process of extrapolation similarly resolved the dilemmas and difficulties which have resulted from basing physical theories on pure assumptions. It is evident from these results that space and time are actually entities of the same nature and that great differences which we seem to see in them are merely the result of the gravitational motion of matter. Gravitation conceals the effect of the space progression in our immediate vicinity, and the progression is observable only at extreme distances; hence the most evident property of space is its three-dimensionality. The progression of time, on the other hand, is unchecked by gravitation, and the velocity of the progression is so high that any motion in three-dimensional time is negligible (relatively) except at extreme velocities. We therefore recognize only the progression. But science now is penetrating the regions of extreme distance and very high velocities, where the progression of space and the three-dimensionality of time play significant roles, and in order to remove serious obstacles to a clear understanding of phenomena in these regions it will be necessary to take heed of the salient point disclosed by the extrapolation process of the present investigation: the fact that both space and time actually have all the properties that have hitherto been attributed to either of them individually.

REFERENCES

2. Tolman, Richard, ibid., page 27
From thermodynamics\(^1\), the general equation of state of a pure substance is

\[
\frac{dV}{V} = \beta dT - \kappa dP \tag{1}
\]

where

\[
\beta = \frac{1}{V} \left( \frac{\partial V}{\partial T} \right)_P = \text{volume expansivity} \tag{2}
\]

and

\[
\kappa = -\frac{1}{V} \left( \frac{\partial V}{\partial P} \right)_T = \text{isothermal compressibility} \tag{3}
\]

(Of course, \(V\) = volume, \(P\) = pressure, \(T\) = temperature.)

From my previous paper\(^2\) (and Larson's original work\(^8\)),

\[
V_L(T) = V_1 + V_2 + V_3 \tag{4}
\]

where

\(V_L\) = overall specific volume of liquid (cm\(^3\)/g) (total volume/total mass)

\(V_1\) = specific volume increment at 0\(^0\)K and that due to the solid molecules in solution of the liquid (solid volume/total mass)

\(V_2\) = specific volume increment due to the liquid molecules of the substance, temperature above 0\(^0\)K (liquid volume/total mass)

\(V_3\) = specific volume increment due to the critical (gaseous or vapor) molecules in solution of the liquid (gaseous volume/total mass)

In this paper we will consider the effect of pressure on a liquid at temperatures below the liquid natural temperature unit, 510.8 \(^0\)K. At low temperature, \(V_3 \approx 0\). Pressure has a different effect on \(V_3\) than it has on \(V_2\). Also, pressure has a different effect on a liquid at a temperature above, rather than below, 510.8 \(^0\)K. These differences will be handled in another paper.
For a solid under pressure, the volume is multiplied by \( \sqrt{\frac{P_o}{P + P_o}} \), where \( P_o \) is the internal pressure and \( P \) is the external pressure. For a liquid under pressure, the volume is multiplied by the square of the solid factor, or simply \( \frac{P_o}{P + P_o} \). So,

\[
V_L(T, P) = V_1 + V_2 \left( \frac{P_o}{P + P_o} \right)
\]

(5)

It follows that isothermal compressibility is

\[
\kappa = \frac{1}{V_L} \left( \frac{\partial V_L}{\partial P} \right)_T = \left( \frac{1}{V_1 + V_2 \left( \frac{P_o}{P + P_o} \right)} \right) \left( -V_2 \right)(P_o) \left( \frac{1}{(P + P_o)^2} \right)
\]

(6)

It's often easier to work with the bulk modulus, \( B \), which is the inverse of \( \kappa \).

\[
B = \frac{1}{\kappa} = \frac{V_1 + V_2 \left( \frac{P_o}{P + P_o} \right)}{V_2 P_o} (P + P_o)^2
\]

(7)

From my previous paper,

\[
V_1 = V_\infty k_{z1} + \Delta s \approx V_\infty k_{z1} \text{ cm}^3/\text{g}
\]

(8)

since \( \Delta s \) is negligible for most liquids above the melting point.

\[
V_2 = V_\infty k_{z2} \frac{T}{n_i T_{nu}} \text{ cm}^3/\text{g}
\]

(9)

\[
V_\infty = \frac{10.5389 n_v}{m} \text{ cm}^3/\text{g}
\]

(10)

where \( n_v \) is the number of volumetric units.
The internal pressure of a liquid is obviously different from that of a solid. The natural unit of pressure in the Reciprocal System is $15,538,642$ atm. To calculate the internal pressure of a solid we divide this number by the interregional ratio, 156.45. For a liquid, we divide by the square of the interregional ratio. Because liquid cohesion is two-dimensional rather than three-dimensional we must also multiply the expression by 2/3. Therefore,

$$P_{\text{in}} = \frac{2}{3} \times \frac{15538642}{(156.45)^2} = 423.22437 \text{ atm}$$ (11)

This expression is then multiplied by the number of pressure units, $n_p$, and divided by the ratio of the base volume to 1, raised to the 2/3 power. (The solid expression just uses volume, or $V_o^3$.) Therefore,

$$P_o = \frac{423.22437n_p}{\left(\frac{V}{V_o}\right)^{\frac{2}{3}}} \text{ atm}$$ (12)

Substituting eq. 10 in eq. 12, we get

$$P_o = 88.045482m^{\left(\frac{2}{3}\right)} \frac{n_p}{n_V^{\left(\frac{2}{3}\right)}} \text{ atm}$$ (13)

$n_p$ is the number of atoms effectively acting against the external pressure. It is sometimes, but not usually, equal to the number of volumetric units, $n_V$. Using eq. 8, 9, and 10, $B$ can be expressed as

$$B = k_{11}n_{11}T_{11}\left(\frac{P^2}{P_o} + 2P + P_o\right) + P + P_o \text{ atm}$$ (14)

Now let's turn to calculating the volume expansivity.

$$\beta = \frac{1}{V_L} \left(\frac{\partial V_L}{\partial T}\right)_P = \frac{k_{12}}{n_{11}T_{11}k_{11} + k_{12}T\left(\frac{P_o}{P + P_o}\right)} + \beta_o \text{ K}^{-1}$$ (15)

where $\beta_o$ is the value of the expansivity at the end point of the solid.
One could plug $\kappa$ (or 1/B) and $\beta$ into eq. 1 and integrate, but the resulting equation is more complex than eq. 5 and thus not useful.

In summary, to calculate bulk modulus and volume expansivity of a liquid, it is necessary to determine

- $m$, the molecular weight
- $n_v$, the number of volumetric units
- $\kappa_{S1}$, geometric factor
- $\kappa_{S2}$, geometric factor
- $n_t$, the number of temperature units
- $n_p$, the number of pressure units

**Example Calculations and Comparisons with Experiment**

I selected four important liquids: acetic acid, carbon tetrachloride, ethyl acetate, and water. Here are the results, in table format.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Formula</th>
<th>$m$</th>
<th>$\kappa_{S1}$</th>
<th>$\kappa_{S2}$</th>
<th>$n_v$</th>
<th>$n_t$</th>
<th>$n_p$</th>
<th>$P_{atm}$</th>
<th>$T_{0K}$</th>
<th>$B_{atm}$ $\times 10^3$</th>
<th>$B_{atm}$ $\times 10^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic Acid</td>
<td>CH$_3$CO$_2$H</td>
<td>60.05</td>
<td>.9046</td>
<td>.7820</td>
<td>4</td>
<td>1.0</td>
<td>7</td>
<td>1</td>
<td>288.16</td>
<td>11441.303</td>
<td>11279.014</td>
</tr>
<tr>
<td>Carbon Tetrachloride</td>
<td>CCl$_4$</td>
<td>153.81</td>
<td>1.0</td>
<td>.9183</td>
<td>6</td>
<td>1.0</td>
<td>5</td>
<td>1</td>
<td>250.26</td>
<td>12334.317</td>
<td>11878.218</td>
</tr>
<tr>
<td>Ethyl Acetate</td>
<td>CH$_3$CO$_2$C$_2$H$_4$</td>
<td>88.10</td>
<td>.9818</td>
<td>.9818</td>
<td>6</td>
<td>1.0</td>
<td>6</td>
<td>1</td>
<td>293.16</td>
<td>8687.0274</td>
<td>8733.6283</td>
</tr>
<tr>
<td>Water</td>
<td>H$_2$O</td>
<td>18.0153</td>
<td>.8707</td>
<td>.8707</td>
<td>1.5</td>
<td>2.0</td>
<td>9</td>
<td>1</td>
<td>273.16</td>
<td>19697.992</td>
<td>19698.877</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical</th>
<th>$\beta_{calc}$ $\times 10^{-3}$</th>
<th>$\beta_{obs}$ $\times 10^{-3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic Acid</td>
<td>1.1377x10$^{-3}$</td>
<td>1.2069x10$^{-3}$</td>
</tr>
<tr>
<td>Carbon Tetrachloride</td>
<td>1.240x10$^{-3}$</td>
<td>1.2987x10$^{-3}$</td>
</tr>
<tr>
<td>Ethyl Acetate</td>
<td>1.24989x10$^{-3}$</td>
<td>1.304x10$^{-3}$</td>
</tr>
<tr>
<td>Water</td>
<td>7.7238x10$^{-4}$</td>
<td>7.992x10$^{-4}$</td>
</tr>
</tbody>
</table>

(The values of $\beta_o$ have not yet been determined, which explains the discrepancy between $\beta_{calc}$ and $\beta_{obs}$.)

The $n_p$ values are easy to understand. In acetic acid, the CH$_3$ contributes 3 units and the CO$_2$H contributes 4. In carbon tetrachloride, each atom contributes 1 unit. In ethyl acetate, each volumetric group contributes a unit. In water, 3 molecules of 3 atoms each act against the external pressure, for a total of 9. All values of $n_v$, $n_t$, and $n_p$ are integral or half-integral, as required by the nature of the Reciprocal System. This is very different from the empirical correlations used by other investigators.

In the coming years I hope some member of ISUS will calculate the results for thousands of liquids following the equations given here.
References:


2. R. Satz, "The Liquid State in the Reciprocal System: The Volume/Temperature Relation, a Contemporary Mathematical Treatment," *Reciprocity*, Vol. XXIII, No. 2, Autumn 1994. Incidentally, the normal function should have been denoted by $\Phi$, not $\text{erf}$.

\[
\Phi(z) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z} e^{-t^2} dt
\]

\[
\text{erf}(z) = \frac{2}{\sqrt{\pi}} \int_{0}^{z} e^{-t^2} dt
\]

(The numerical results of the paper do not change, because $\Phi$ was actually used.)


6. *American Institute of Physics Handbook* (New York: McGraw-Hill Book Company, 1972). $\beta$ values are difficult to find. If you know the volume at temperature $i$ and temperature $f$ (and the pressure is constant), then from equation 1, $\beta \approx \frac{\ln \left( \frac{V_f}{V_i} \right)}{T_f - T_i}$.


8. D. Larson, *The Liquid State*, privately circulated series of papers on the liquid state, circa. 1960-1964. Note: for this work, I made use of his paper IV. Larson used the semi-empirical value 415.84 atm for the liquid natural pressure unit. My derivation of $P_{\text{inu}}$ is unique.
Updated Values for Unit Space and Unit Time

Bruce M. Peret

The basis of measurement in the Reciprocal System of Theory requires an accurate measurement of unit space and unit time. These values were computed by Dewey B. Larson back in 1959 from the speed of light and the Rydberg frequency of hydrogen.¹

Today, the speed of light is now considered an exact value, defining the meter as “the length of path traveled by light in vacuum in 1/299,792,458 second.”² Therefore, the speed of light has unlimited precision, as it now defines the system of measurement.

Instead of using the Rydberg frequency of hydrogen to determine unit time, the Rydberg Constant (R∞) can be utilized to determine unit space. This value is available to 11 significant digits.

The Rydberg Constant has units of “per meter”, thus the inverse of the Rydberg Constant, the meter, can be considered the wavelength of space. Unit space, as defined in Reciprocity, consists of the half-cycle. Thus, a very accurate measurement of unit space can be found by taking the reciprocal of the Rydberg Constant (the length of a full cycle) and dividing by 2 to obtain the half cycle.

Unit time can be determined by the division of unit space by the speed of light.

**Constants (1986 CODATA set, mks)**

<table>
<thead>
<tr>
<th>c</th>
<th>Speed of Light</th>
<th>299,792,458 m s⁻¹ (exact)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R∞</td>
<td>Rydberg Constant</td>
<td>10,973,731.534 ±0.013 m⁻¹</td>
</tr>
</tbody>
</table>

**Unit Values Derived from Constants (cgs)**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Space</td>
<td>4.5563352671 ×10⁻⁶ cm</td>
<td></td>
</tr>
<tr>
<td>old unit space</td>
<td>4.558816 ×10⁻⁶ cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Time</td>
<td>1.5198298508 ×10⁻¹⁶ s</td>
<td></td>
</tr>
<tr>
<td>old unit time</td>
<td>1.520655 ×10⁻¹⁶ s</td>
<td></td>
</tr>
</tbody>
</table>

Though the difference between old and new values is approximately 0.05%, it should be noted that, “Since the 1986 adjustment, new experiments have yielded improved values for a number of constants, including the Rydberg Constant R∞, the Planck constant ħ, …”² and because of this, these constants are only valid until the next CODATA publication.

**References**

Subatomic Mass Recalculated

Bruce M. Peret

Having recently received a copy of PHYSICAL REVIEW, which contains everything known about subatomic particles, I decided to put Reciprocity to the test—to see if Larson’s original calculations would still hold up under the scrutiny of today’s accurate measurement systems. The results, some of which are related here, have been quite interesting.

All observed particle measurements were taken from PHYSICAL REVIEW D, Particles and Fields. Values were calculated with “C” programs, compiled with SAS/C, version 6.51, using standard, double precision floating point with an accuracy of 15 significant digits. The code was executed on an Amiga 3000 computer under AmigaDOS version 2.1.

Mass Components

The calculated values for subatomic particle mass, in terms of natural units, are listed in Table 1. In keeping with Larson’s original tabular format, not all the significant digits are shown (though they are used in all computations).

<table>
<thead>
<tr>
<th>Table 1 - Mass Components (natural units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
</tr>
<tr>
<td>m</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>E</td>
</tr>
<tr>
<td>e</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>c</td>
</tr>
</tbody>
</table>

Observed Mass

The observed mass values for the various subatomic particles have changed since the publication of Nothing But Motion, and tentative neutrino and “massless neutron” mass now exist.

The observed neutrino mass is taken from the electron neutrino, which is listed with a “formal upper limit” of 5.1 eV, and a “95% certainty level.”3 To maintain consistent units in the table, this value was converted to unified atomic mass units (u) with the conversion factor of 931.49432 MeV/u.4

The mass of the “massless neutron” is taken from the muon neutrino, as suggested by Larson: “...and the logical conclusion is that the particle now called the muon neutrino is the particle required by the theory: the massless neutron.”5

The mass of the muon neutrino is inferred from measurements of muon momentum in the decay of a π+ particle, and results in a mass of 105.658389 MeV (0.11342891388 u).6

The observed proton is included in both the charged and uncharged proton entries, for comparison. (The uncharged proton is listed as “unobserved” in Nothing But Motion.)

Table 2 lists the subatomic mass in natural units, as compared to the unified atomic mass units based on the 12C isotope.
Table 2 - Calculated Mass (natural) vs Observed Mass (u)

<table>
<thead>
<tr>
<th>Composition</th>
<th>Particle</th>
<th>Calculated</th>
<th>Observed</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>e+c</td>
<td>charged electron</td>
<td>0.00054874099</td>
<td>0.00054857990</td>
<td>0.00000016109</td>
</tr>
<tr>
<td>e+c</td>
<td>charged positron</td>
<td>0.00054874099</td>
<td>0.00054857990</td>
<td>0.00000016109</td>
</tr>
<tr>
<td>e</td>
<td>electron</td>
<td>0.00057870370</td>
<td>massless</td>
<td>massless</td>
</tr>
<tr>
<td>e</td>
<td>positron</td>
<td>0.00057870370</td>
<td>massless</td>
<td>massless</td>
</tr>
<tr>
<td>e</td>
<td>neutrino</td>
<td>0.00057870370</td>
<td>0.00000000548</td>
<td>0.00057869823</td>
</tr>
<tr>
<td>p+m+e</td>
<td>massless neutron</td>
<td>1.00697074916</td>
<td>0.11342891388</td>
<td>0.89354183528</td>
</tr>
<tr>
<td>p+m+2e</td>
<td>proton</td>
<td>1.00754945286</td>
<td>1.00727647000</td>
<td>0.00027298286</td>
</tr>
<tr>
<td>p+m+2e+C</td>
<td>charged proton</td>
<td>1.00759439693</td>
<td>1.00727647000</td>
<td>0.00031792693</td>
</tr>
<tr>
<td>p+m+3e</td>
<td>hydrogen (1H)</td>
<td>1.00812815657</td>
<td>1.00794000000</td>
<td>0.00018815657</td>
</tr>
<tr>
<td>p+m+3e+E</td>
<td>compound neutron</td>
<td>1.00899621212</td>
<td>1.00866490400</td>
<td>0.00033130812</td>
</tr>
</tbody>
</table>

The values calculated for the neutrino and “massless neutron” are considerably out of line with the observed values. Given that the observed values were deduced indirectly from the decay of other particles, there are undoubtedly numerous factors involved that were not taken into account. I have no explanation for the differences.

The calculated values for the charged electron/positron, proton, 1H isotope, and the compound neutron are reasonably close, but not as close as they should be, given the number of significant digits in both the calculations and the observed values. This is due to the measuring system involved, that of the unified atomic mass unit (u). The observed values are based on the 12C isotope. Larson uses observed values in the 16O scale, which are closer to the natural mass units of the Reciprocity system, but still not exact.²

Applying Conversion Factors

Instead of converting values from the 12C to 16O scales, it may be prudent to avoid both scales, and determine a conversion factor from natural mass units to unified atomic mass units based on an isotope-free, easily measured particle—the charged electron. Of all the particles there are mass values for, the charged electron is, in all probability, the most accurate. Also, the charged electron mass is known more precisely in unified atomic mass units than in any other unit.⁴

Thus, the conversion factor between natural (n) and 12C (u) mass units can be determined by the ratio between the measured and calculated charged electron:

\[ \frac{0.00054857990 \text{ u}}{0.00054874099 \text{ n}} = 0.99970644 \text{ u/n} \]  (1)

Applying this factor to Table 1, the mass components in “unified atomic mass units” are obtained:

Table 3 - Mass Components (u)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>primary mass</td>
<td>0.999706441403</td>
</tr>
<tr>
<td>m</td>
<td>magnetic mass</td>
<td>0.006390169015</td>
</tr>
<tr>
<td></td>
<td>gravitational mass</td>
<td>1.006096610417</td>
</tr>
<tr>
<td>E</td>
<td>electric mass (3 dim.)</td>
<td>0.000867800730</td>
</tr>
<tr>
<td>e</td>
<td>electric mass (2 dim.)</td>
<td>0.000578533820</td>
</tr>
<tr>
<td>C</td>
<td>mass of normal charge</td>
<td>0.000044930876</td>
</tr>
<tr>
<td>c</td>
<td>mass of electron charge</td>
<td>-0.000029953917</td>
</tr>
</tbody>
</table>

Recalculating Table 2 with the values in Table 3 results in:
Table 4 - Calculated Mass \((u)\) vs Observed Mass \((u)\)

<table>
<thead>
<tr>
<th>Composition</th>
<th>Particle</th>
<th>Calculated ((u))</th>
<th>Observed ((u))</th>
<th>Difference ((u))</th>
</tr>
</thead>
<tbody>
<tr>
<td>e+c</td>
<td>charged electron</td>
<td>0.00054857990</td>
<td>0.00054857990</td>
<td>0.00000000000</td>
</tr>
<tr>
<td>e+c</td>
<td>charged positron</td>
<td>0.00054857990</td>
<td>0.00054857990</td>
<td>0.00000000000</td>
</tr>
<tr>
<td>e</td>
<td>electron</td>
<td>0.00057853382</td>
<td>massless</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>positron</td>
<td>0.00057853382</td>
<td>massless</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>neutrino</td>
<td>0.00057853382</td>
<td>0.000000000548</td>
<td>0.00057852835</td>
</tr>
<tr>
<td>p+m+e</td>
<td>massless neutron</td>
<td>1.00667514424</td>
<td>0.11342891388</td>
<td>0.89324623036</td>
</tr>
<tr>
<td>p+m+2e</td>
<td>proton</td>
<td>1.00725367806</td>
<td>1.00727647000</td>
<td>-0.00002279194</td>
</tr>
<tr>
<td>p+m+2e+C</td>
<td>charged proton</td>
<td>1.00729860893</td>
<td>1.00727647000</td>
<td>0.00002213893</td>
</tr>
<tr>
<td>p+m+3e</td>
<td>hydrogen ((^1H))</td>
<td>1.00783221188</td>
<td>1.00794000000</td>
<td>-0.00010778812</td>
</tr>
<tr>
<td>p+m+3e+E</td>
<td>compound neutron</td>
<td>1.00870001261</td>
<td>1.00866490400</td>
<td>0.00003510861</td>
</tr>
</tbody>
</table>

With the exception of the neutrinos, the calculated values are now extremely close to the observed values. The error for hydrogen is only 0.011%. The error in the compound neutron is 0.0035%.

Notice, however, the proton. The difference between the calculated and observed mass in the uncharged proton is almost the same as the charged proton, but in the opposite direction. This is rather suspicious, and one could theorize that the observed proton in the laboratory may actually be a 50/50 mix of charged and uncharged protons. Calculating the atomic weight based on a 50/50 mix yields:

Table 5 - Mixed Sample Protons

<table>
<thead>
<tr>
<th>Composition</th>
<th>Particle</th>
<th>Calculated ((u))</th>
<th>Observed ((u))</th>
<th>Difference ((u))</th>
</tr>
</thead>
<tbody>
<tr>
<td>p+m+2e</td>
<td>proton</td>
<td>1.00725367806</td>
<td>1.00727647000</td>
<td>-0.00002279194</td>
</tr>
<tr>
<td>p+m+2e+C</td>
<td>charged proton</td>
<td>1.00729860893</td>
<td>1.00727647000</td>
<td>0.00002213893</td>
</tr>
<tr>
<td>50/50</td>
<td>mixed protons</td>
<td>1.00727614350</td>
<td>1.00727647000</td>
<td>-0.00000032650</td>
</tr>
</tbody>
</table>

Which is 0.000032% from the observed value (though still outside the stated error of ±0.000000012 \(u\)).

This calculation indicates that there is a high probability that the values obtained for the observed proton are a mix of both the charged and uncharged states, if Reciprocity is correct. Back calculating for this set of data, the proton sample would be 50.72668125% charged, and 49.27331875% uncharged (which reproduces the observed value exactly.)

Summary

1. After compensating for differences in measuring systems, Reciprocity’s “1959” calculations of mass agree quite closely with the 1993 observed values.

2. The massless neutron (muon neutrino) and neutrino are several orders of magnitude outside of the calculated values. It is stated that these measurements are inferred from the decay of other particles, and are not measured directly. This seems to be yet another principle of impotence, and thus makes the observed data questionable.

3. The observed proton appears to be a near-even mix of charged and uncharged protons. If this is actually the case, other measurements may also be adversely affected, such as electric dipole moments or polarizability.

4. Because physics does not recognize the charged and uncharged states of subatomic particles, observed values may become increasingly unreliable, tending to be more of a statistical distribution than a direct measurement. This will undoubtedly play havoc with any proposed unified system of theory.
Conclusion

To paraphrase Dr. Leonard McCoy of classic *Star Trek*, “I’m a farmer, not a physicist!” And, unfortunately, I do not have access to the intimate details of particle accelerators and measurement techniques.

It would be interesting, however, if someone familiar with particle measurement techniques could examine the process of determining proton mass, and propose a method to eliminate either the charged or uncharged protons in the sample. The results should precisely match the values obtained from *Reciprocity*, when corrected for unified atomic mass. This could lead to the acceptance of the charged and uncharged states of subatomic particles (of the proton at least), and maybe even an objective look at Larson’s work.

References


4. *ibid.*, page 1396, note on electron mass precision.


CHARACTERISTICS of ORDINARY MATHEMATICS as revealed in the RECIPROCAL SYSTEM of THEORY

by Lawrence E. Denslow

Development of any theoretical system requires starting with a fundamental premise or concept, whether expressed or unexpressed. Of all the observations that have been made of this physical universe, the most pervasive feature has been motion. The "Laws of Mechanics", as we presently understand them, were developed to explain the observed relationships among the movements of material objects in this physical universe.

The Reciprocal System of theory uses the concept of motion as a starting point from which to develop all of the relations causing the appearances of things in this physical universe. D.B. Larson developed the first statement of principles and consequences from a set of postulates for a universe of motion and has published an analysis of the deductive development of the concepts involved in that theory.1 The first few items in that development show that the presently recognized characteristics of the ordinary system of mathematics were assumed and that no further analysis of the characteristics of the ordinary system of mathematics were deemed necessary. But there are hints in the development of the Reciprocal System about certain characteristics of ordinary mathematics that are not a part of normal everyday thought. These must now be addressed.

Before just flatly stating what those characteristics are, it seems proper to review the characteristics of scalar motion and certain points in the development of the consequences of the postulates for the Reciprocal System. The three principal characteristics of scalar motion are: (1) continuity between contiguous units of motion, as well as within individual units of motion; (2) All motion progresses with respect to a reference point in whatever reference system the motion is to be represented; All units of primary motion progress outward from points of reference in any dimensional reference system; All units of displaced motion progress inward with respect to reference points in dimensional reference systems; (3) Primary motion causes no change of location in the natural reference system. This, of course, means that so far as analysis and explanation of physical phenomena are concerned, primary motion is only a scalar value reference from which all displacement is evaluated.

The principal limitation that a generalized dimensional reference system experiences is that it cannot represent separately the outward and inward directions. All motion relative to any reference, either a point or a line, in the generalized three dimensional system is confined to being linearly or rotationally one directional movement. ALL generalized dimensional reference systems fail to differentiate between coexisting primary motion of the natural reference system and any opposition or displacement from the primary progression.

In Larson's development each reference point was recognized as having an individual, specifically oriented, three dimensional coordinate system, randomly oriented with respect to every other reference point coordinate system. The necessity of having multiple reference points automatically requires specific recognition of the concept that each and every atom, sub-atomic particle, and photon, is its own reference point and has its own randomly oriented three dimensional system of coordinates.

The basic definition for motion does not specify either directionality or dimensionality. only quantity; therefore, the fundamental concept of motion could only
be scalar. By being scalar, one is stating that in space the relationship of the motions at or within any two locations has no dependence on directionality or dimensionality.

What the Postulate and definition for motion also mean is that scalar motions in different scalar dimensions can be represented in a three dimensional system only by representationally placing them in geometrically perpendicular dimensions.

It is with respect to the concept of "inward" being unitarily in opposition to "outward", rather than merely being a direction relative to a reference point, that the postulated definition of motion becomes demonstrably quantitative.

The quantities of motion being compounded must come in a specific order. The only possibilities for quantitative variation that could have immediate bearing on which is to be incremented are the number of directions and the number of dimensions. To control this, two factors come to mind: first, the remaining possibilities for representation of primary motion within the individual system; and second, the distribution of motions within the individual system.

Every reference point must have at least one direction that is being specified as the direction for the progression of the natural reference system. This meant that a dimension had to be left open. for as long as possible, for primary motion in the individual coordinate system, in order to minimize distribution of the actual motions over as few dimensions, not directions, as possible while maximizing the outward progression. Then move the point of thought to the more generalized system obtaining randomness of directional orientation of the individual coordinate system for maximum distribution of the effects of the displacement motion. This is what makes the motions in each reference point have an overall scalar effect with respect to each other.

The order in which motions may be represented in an individual reference point system is not necessarily a function of either of the two factors that affect maximizing the distribution of effects having dominance or priority. Effects within an individual system that are not reflected by representation directly or as an effect, in a generalized system are of little or no value. Thus, the order for compounding the directionality and dimensionality of motions within an individual coordinate system follows the rules of mathematical logic; the mathematical order of one, two, three, is not open for debate. Larson has already shown the results of compounding scalar motions to be in a particular order; all that is being proposed here, is some possible reasons why that order is required.

The difference of meaning for the word "inward" as being in opposition to "outward" not only hinted at conceptual isolation of individual reference points, but directly required isolation of the scalar dimensions for each individual coordinate system from each other. This concept of "inward" not merely being a direction allowed thinking within an individual coordinate system without being at all concerned about the idea of representation with respect to anything other than that specific system.

Then came the realization that motions within a specific coordinate system need not be restricted by any of the necessities of representation with respect to other coordinate systems. Motions within a specific coordinate system may be one directional or two directional in one dimension or in two dimensions, all concurrently. There is no a priori requirement for a unit of motion in an individual reference point system to be limited to one direction under any conditions other than sequence of representation. The first result of this is that there is no a priori requirement for motion to alternate directions within a specific coordinate
system. It is my contention that the idea of requiring alternation of direction is a carry over from our biased position in a generalized coordinate system. That biased position is no more logical than the matter based universe concept.

The requirement for representation in a generalized system is subordinate to representation in the individual system. Sequential directionality for general representation of the effect of a scalar motion at a reference point as one direction followed by the opposite is subsequent to the representation at the reference point as 1D2d motion. Whatever is going on in a scalar dimension has absolutely nothing to do with how it is represented in a dimensional system nor how many directions or dimensions may be required; nor do all the limitations of generalizing the reference system for being able to have multiple reference points and effects among them.

Equal probability of both directions of one dimension in the generalized system of coordinates has two results. One result is choice of direction of progression, the other causes the effect of a one dimensional two directional reference point motion to be represented by first one direction and then the opposite. This must be a sequential occurrence in the generalized system, otherwise there would not be equal probability of representation of the effect of a 2d motion. Equal probability requires sequentiality of the effect of the 2d motion between the two directions of one dimension, if any representation of the motion or an effect of the motion is to occur, at all.

Specific attention is drawn again to the representation requirements of photons. Because motion within the photon reference point is self-sustaining and precedes the representation of its effect in the generalized system, representation for the effect of the two directional motion alternates apparent directionality in the generalized reference system as a result of an equal probability and sequentiality requirement.

To adequately represent each photon requires two methods: a reference point for representation of the photon effect at the point of progression in the generalized system which I have called the "energy reference point" AND a reference point specified for the point of origin or point of interaction in the generalized reference system which Larson calls a "negative" reference point. This may be considered by some to be a conceptual departure from Larson's explanation, but I don't think it is.

To represent the photon effect in a generalized system of coordinates, it makes no difference which direction one starts with for the progression of the emitted photon; it takes both directions of one of the perpendicular dimensions to adequately represent the effect. One must have an even number of units of primary progression in order to have equal probability for representation, and thereby, to represent the photon effect in the generalized system, at all, regardless of its frequency. This is the primary reason for taking two (2) units of primary motion to define the fundamental or natural units of representable space and time, and thereby, the reason for the sizes of all things. The actual rates of progression are totally immaterial; the ratios generated by representation are what controls how each aspect is perceived.

Experimental simple harmonic motion is not self-sustaining, and thereby, can only be an experimental approximation to the concept of true simple harmonic motion. Simple harmonic motion needs only to satisfy the relation \[ a = \sin \phi \]. Dewey Larson was absolutely correct in stating that photons are a simple harmonic motion. The only thing he didn't say was that a true simple harmonic motion is the effect of a motion that is not directly observable because the motion causing the effect is a scalar motion.
represented as one dimensional two directional motion in a dimension other than that of the progression.

Numerous comments about photons are possible at this point, but that is not the purpose of this discussion. The main idea here is that representation of motion at individual reference points is NOT limited in the same manner as in a generalized reference system.

The results of the sequential requirement for compounding motions at a reference point are:
1D,1d1, the normal progression and translational motion in the generalized reference system;
1D,2d1, photons, sinusoidal effects progressing outward from generalized reference system points;
2D,1d1, rotational bases and the main structural feature of sub-atomic and atomic structures;
1D,1d2, the differentiating feature for sub-atomic and atomic structures;
1D,1d1, translational movement (vectorial velocity))
1D,2d2, heat effects;
2D,2d2, magnetic charge effects;
1D,2d2, electric charge effects.

The ONLY motion directly represented is PRIMARY motion, everything else is an effect of displaced motion, requiring the use of definable reference points. It is the three dimensionality of the reference points that ultimately resolves to the three dimensionality of the generalized system of everyday existence.

The BIG reason why unidirectional motion is the only mode by which motion can be directly represented is tied up with the basic idea of this system of theory: primary motion must exist and the simplest way by which that can be represented is unidirectional.

References:

OUTWARD EQUABLE SPEED OF S-T PROGRESSION

The Larson reciprocal theory of the universe of motion introduces two new concepts into physical science: the concept of physical location, and the concept of scalar motion.

This theory finds that each light photon is a compound unit of motion, which remains throughout its lifetime in the same physical location in which it originated. Thus, every photon's outward, equable translatory speed in vacuo is the speed of its physical location, its light speed in vacuo.

Two main opposed forces of scalar motion govern the behavior of all physical entities and phenomena of the macrocosmic universe of motion: the primary steady outward force of space progression with time progression and the independent inverse square inward force of gravitation.

The nature of these new concepts of scalar motion and physical location can be illustrated by a consideration of the "expansion of the universe" that is postulated in the astronomers' latest theory of the recession of the distant galaxies. As explained by Paul Davies, "The expanding universe is not the motion of the galaxies through space.....but is the steady expansion of space.

Since the galaxies, on this basis, are not moving through space, each galaxy remains in what Larson calls a physical location in space. This physical location is moving outward in the context of a stationary reference frame, carrying the galaxy with it. While only the galactic motion can be observed, all physical locations necessarily participate in the outward motion, irrespective of whether or not they are occupied by galaxies.

Inasmuch as all galaxies and the physical locations that they occupy are moving steadily outward from all others, each is moving in all directions. A motion distributed uniformly over all directions has no specific, or inherent, direction; that is, it is scalar. Thus the expansion can be described as the positive scalar motion of physical locations (represented as outward in the spatial reference system). Larson's reciprocal space-time theory defines a universe of motion in which scalar motion of physical locations is not a unique phenomenon confined to the expansion recognized by the astronomers, but is the basic form of motion from which all physical phenomena are derived.

At relatively short distances gravitation predominates, and the net motion is inward. Since the gravitational motion decreases with distance, while the outward motion remains constant, the opposing motions reach equality at some greater distance, which Larson calls the gravitational limit. Beyond this distance the net motion is outward, increasing with distance, and approaching unity (the speed of light) at extreme distances.

(This theoretical pattern of net speeds is verified experimentally by measurement of the Doppler shift in the radiation received from the distant galaxies).
Is there anything outside (that is, independent of) the universe of motion?

The findings of the extension of the investigation of the physical universe into the non-physical region are much too voluminous to be included with the physical results, and will be described in a separate publication, but it would not be appropriate to conclude the discussion in this volume without calling attention to the manner in which the clarification of the properties of the physical universe sets the stage for a confirmation of the reality of existence outside that universe. The more complete understanding of physical existence opens the door to an exploration of existence as a whole, including those non-physical areas that have hitherto had to be left to religion and related branches of thought. It is now evident that our familiar material world is not the whole of existence, as modern science would have us believe. It is only a part—perhaps a very small part—of a greater whole.

-Dewey B. Larson

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THE SPACE-TIME UNIVERSE

K.V.K. Nehru

(Reprinted from the Theosophy-Science Group Bulletin, XX, 3, June, 1981. This essay is an example of activity in India & the Far East, teaching the Reciprocal System of revalued physics, created by Dewey B. Larson, through Dr. K.V.K Nehru, Director, Institute of Post Graduate Studies and Research, Jawaharlal Nehru Technological University, Hyderabad. Dr. Nehru, an Editor of Reciprocity and a Director of ISUS, Inc will be with us at our 21st ISUS Conference 8/12-13, Denver.)

The last years of Einstein were spent in pursuing his cherished dream of evolving a general theory of the universe. He never succeeded. Nor anyone else did, so far. The body of knowledge which we call physical science is at present only a loose collection of numerous different theories, each constructed to explain a particular domain of facts and not applicable to another set of facts. There has not been a general theory covering all physical phenomena, from the microscopic to the macroscopic.

Indeed the experts in the field—those who studied not only in depth but also in breadth—are beginning to realize that modern science reached the end of a blind alley (the nature of this blind alley will be explained later). The proliferation of concepts like the neutron stars, the black holes, the gravitational waves, the vacuum interactions and quarks—Dr. Philips' *ESP of Quarks* is not the final word on *Occult Chemistry* and we must always have an open mind—are the results of frantic attempts to save the sinking boat of modern science. Unfortunately, it is not recognized that all of these are pure speculations and are never observed.

The object of this article is to introduce to the general theory of the universe, now available by the researches of Dewey B. Larson and called the Reciprocal System of Theory, to outline its remarkable accomplishments and also to show how closely it resembles the occult view delineated in *The Secret Doctrine*. But first it is necessary to take a look at the pandemonium in modern science and to realize that all is not well with it.

**Failures of Current Science**

We will briefly trace some of the important short-comings of the prevalent world-view of the modern science—which, of course, does not mean to deny the fact of its impressive achievements.

1. *The nuclear atom and the electronic structure of matter.* From the fact that in certain atomic reactions, like radioactivity, beta rays (electrons) were found among the products, it is concluded that electrons are constituents of atoms. But the equally probable alternative of the electrons coming into existence *during* the process is overlooked. For example, in atomic disintegration photons are also found in the products. However, the previous logic is not applied here: the photons are not taken to be parts of the atoms in the manner in which the electrons are supposed to be.
The postulated electron in the atom is then imputed with strange characteristics as compared to a free electron—such as the lack of definite location, jumping from one orbit to another without traversing the intervening space, etc.

As the atom itself is found to be electrically neutral, the negative charge of the electron is assumed to be neutralised by an equal amount of positive charge in the nucleus. But in actuality a negative and a positive charge brought into mutual contact do not merely neutralise each other: they destroy each other, as is amply demonstrated (by the same science) in the annihilation reactions between matter and anti-matter!

Further, the assumed positive charges of the protons in the nucleus are confined to extremely small dimensions, of the order of $10^{-13}$ cm. Therefore, the force of repulsion among these positive charges is tremendously large (due to the inverse square variation with distance) and the nucleus must come to pieces. To counteract this, therefore, it is assumed ad hoc that there is an attracting ‘nuclear force’ to hold the nucleus together. Since there is absolutely no observation support for the existence of this hypothetical nuclear force, it is further assumed that this force exists only in the nucleus.

Another fly in the sore is the case of neutron, which is also supposed to be a constituent part of the nucleus. It is a known fact that the free neutron is not a stable particle and spontaneously disintegrates with a half-life of about 13 minutes. However, since the atom itself is stable, the scientists are obliged to attribute strange characteristics to the neutron as part of atom.

It is assumed that the recalcitrant nature of the inert gases results from the occurrence of 8 electrons in the outer orbit, which is thought to be a stable configuration. In fact, the covalent bond, such as in CuCl, is thought to be the result of the respective atoms assuming this supposedly stable configuration of 8 electrons in their outermost orbits. If this is true, it is not clear why, for example, an atom like that of chlorine, having 7 electrons in its outer orbit, does not convert to a stabler structure and turn into ‘inert chlorine’, by absorbing an electron when placed in an environment of negative charges.

The view that electric current consists of a flow of negative charges cannot be true since the observed behavior of the flow of static negative charges is not the same as that of an electric current. For example, the current-carrying conductor is electrostatically neutral, which is not true in the case of accumulated static electric charges.

The property that distinguishes matter from antimatter is taken to be the charge conjugation. For example, the particle conjugated to electron with its negative electric charge is positron, which is an electron with positive electric charge. On this basis, it is hard to see what are the conjugate antiparticles of electrically neutral particles, like neutrons. Indeed, it is contended that this particle itself is its conjugate.

Then there is the proliferation of the elementary particles. Their number grew from the original three of electron, proton and neutron to more than a hundred now. It is evident that they can no more be treated as elementary. In addition, there is no explanation of the electric charge itself. It is simply taken to be one more of the given items of Nature, as irreducible and as incomprehensible as gravity. We must realize that having lived with these irreducibles, the given items of physical knowledge, for generations has lulled us into the false belief that they do not require explanation or that no explanation is ever possible.
The final blow, however, to the concept of the fundamental role of matter comes from the interconvertibility of matter and radiation. There should, therefore, be an entity more fundamental to both—the common denominator, as it were.

2. Relativity, gravitation and the macrocosmos The mathematics of the Relativity theory, like the Lorenz transformations, the Riemannian geometry, etc., far antedate the Relativity theory. While its mathematics proved to be correct, the Relativity theory is not internally consistent in its conceptual foundations. One of these logical inconsistencies is the clock paradox. According to Relativity a moving clock runs slow. But since (again according to Relativity), motion is relative, if you consider the case of two clocks in relative motion, each clock runs slower than the other. This paradox has never been resolved, except by resorting to arguments which automatically confute Einstein's views.

Einstein's dictum that $c$, the velocity of light is the highest speed that is possible in the universe has no real observational support. It may be recalled that the experimental situation which led him to reach this conclusion is the observed decrease in the acceleration of electrically accelerated charged particles at high speeds. Since from Newton's law, Force = mass x acceleration, Einstein concluded that for this to happen, the mass must increase with velocity. His formula predicts, in fact, that the mass increases and approaches infinity as its speed approaches $c$ But the theory is silent as to any increase in the gravitation pertinent to this increasing mass.

Obviously, Einstein overlooked other alternatives, equally valid mathematically, which explain the decrease in acceleration with increase in speed. One alternative, for example, is that the effect of the apparently constant electric charge that is forcing the acceleration may decrease with speed. The equation, Force = mass x acceleration, still holds good. If this is true, as Larson points out, there will never be infinite mass and consequently there will not be any upper limit to the speed attainable to the mass. The speed, then, is limited only by the capabilities of the process. Indeed there is visible evidence—like the quasar red shifts—that point to these ultralimit speeds; but unfortunately, the evidence is being misinterpreted because of the unquestioned servitude to Einstein's authority.

Einstein's concepts in the General Relativity too are equally questionable. Larson points out: "gravitational energy is purely an energy of position But energy of position in space cannot be propagated in space."(Beyond Newton, p. 23, 1964). Thus gravitation can never be propagated, In fact, astronomers disregard Einstein here and make their calculations as though gravitational action is instantaneous in order to arrive at correct results.

In short, one finds that there has been no understanding of many important cosmological phenomena like gravity or its relation to nuclear and electromagnetic forces, quasars, pulsars, origin of cosmic waves, the 2.7 K background radiation, the 'constants' of nature, etc. except with the use of ad hoc hypotheses. That there has not been a general theory hitherto explaining all the realms of the physical universe is no surprise since the individual theories of modern science each applicable to only a limited range of physical phenomena, themselves are either unsound or not self-consistent or are replete with hypotheses bolstered up for the occasion[TO BE CONTINUED]
Finitude of the Physical

Frank H. Meyer

(This paper was presented to the Spring, 1996 Meeting of the Minnesota Area Association of Physic Teachers, April 27 at Hamline University, St. Paul, MN.)

We are hurt in physics not so much by what we don’t know as by what we know that isn’t so. Until quite recently professional natural philosophers and/or physicists preferred to take for granted without examination that the physical universe is an all-inclusive continuous infinite whole, a universe of continuous matter and energy in a continuous space and time.

The mistaken guess that the physical universe must constitute an infinite whole ensued historically from the unproved assumption that matter and energy, motion, space and time are all infinite in the sense of all being infinitely divisible. According to Aristotle motion is supposed to belong to the class of things which are continuous and the infinite presents itself first in the continuous. From assuming that motion and time are continuous, Aristotle went on to postulate that matter and the universe of matter are continuous. Aristotle also believed the physical world to be finite in the sense of being bounded.

For more than twenty centuries the proposition that matter is quantised, not simply continuous, was dismissed without examination by the consensus of the scientific profession. It was not that nobody thought about the alternative. During the fourth century B.C., the scientist Aristotle disputed the proposition of Leucippus and Democritus earlier in the fifth century B.C. that matter is quantised. They named the finitely divisible particles ‘atoms’ or ‘atomos’. The word ‘atomos’ comes from the Greek, ‘a’ meaning not and ‘tomas’ meaning cut. For more than twenty centuries most natural philosophers and their descendants knew with Aristotle that matter and light, motion, space and time must be continuous or infinitely divisible; they could not possibly be quantised or finitely divisible.

As late as the middle of the nineteenth century the physics profession of Europe as a whole, believed what most of their predecessors taught: that matter and energy must be continuous or infinitely divisible rather than discontinuous or quantised (finitely divisible.) particles of matter and energy.

The possibility that Nature or Nature’s God, S(he), would permit both alternatives was ruled out as illogical and unreasonable. In order to silence a few dissidents, including the dead Issac Newton, the profession agreed on an experiment to decide where the truth lay. Newton believed that even if space and time had to be continuous, light might not be continuous or infinitely divisible. The rival theorists agreed that if light sped faster through air than through water, then this would prove that light must be continuous, not finitely divisible. However, if light sped faster through water than through air, then this would prove that light is finitely divisible, not continuous. Actually light appears to speed faster through
air than through water. Therefore, it was concluded that since light appeared to be a continuous wave motion, it could not be a quantised particle motion. If the experiment had turned out differently, the consensus probably would have been that since light appears quantised, light could not be a continuous wave motion. During 1905 Einstein published a paper about the photoelectric effect which showed evidence that each party of physicists was correct in what he affirmed, but not in what he denied: light evidently can behave like a wave & also like a particle motion.

In the history of physics a long time after the word ‘atomos’ was invented atoms were out of everyday physics, even long after the stationary flat earth ‘truths’ were dismissed. To-day atoms and quantum mechanics are in. This result is partly due to Albert Einstein’s 1905 papers on the photoelectric effect and on Brownian motion and also to Dewey Larson’s 1959 publication, The Structure of the Physical Universe.

Instead of the space-time continuum postulate of relativity theory, Larson teaches that matter and light are, in fact, finitely divisible, because space, time and motion also are quantised or finitely divisible.

As a consequence, Larson teaches that infinity is excluded from the physical universe, because all motion is a relation between a time magnitude and a space magnitude and the quantity of motion is finite.

Hence Larson’s reciprocal system of physics predicts that neither absolute infinite speed nor absolute rest (absolute zero speed) does or can occur within the physical universe, because excluded by the finitude of the physical. Therefore, a better choice for speed unit than zero speed is unit speed, whose magnitude is the speed of light in vacuo. Unit speed can & does occur in the physical universe.

Larson also teaches that motion is prior to matter, while matter and motion are, like space and time, inseparable. Matter in the reciprocal system theory is inseparable from motion, because matter is only one of many forms of motion and because space and time are inseparable from motion.

Dewey Larson newly defines motion as nothing more nor less than the relation between two uniformly progressing reciprocal quantities, space and time.

Motion, as defined is measured in terms of speed, the scalar magnitude of the relation between space and time. HERE LET US PAUSE A MOMENT to recognize that Larson does not seek and find the fundamental postulate of the physical universe of motion in the wild blue yonder beyond space and time, but extrapolates it from the everyday close-to-hand traditional well established routine of measuring motion as speed, disclosing that motion is the reciprocal relation between space and time in practice as well as theory.

By reason of the postulated reciprocal relation between space and time, each individual unit of motion is a relation between one unit of space and one unit of time, motion at unit speed.
The universal primary motion is the outward, uniform, scalar space progression with time progression, at unit speed. All physical nature is composed entirely of one component, motion, existing in three dimensions and in discrete units. Since all physical phenomena are manifestations of motion and displacements from unit speed, they all are measured in terms of 1/n and n/1, when n is finite (but never zero). No infinities are possible.

As previously mentioned, the Larson reciprocal system of physics identifies unit speed with the speed of light. Larson agrees in practice with what conventional modern physics means by "the speed of light", but not in theory. The speed of light is not the translative speed of a photon through a stationary space-time continuum, but is rather the translation rate of its physical location, in which the photon stays from its origin. Larson rejects the mistaken idea of Einstein\(^2\) that motion does not apply to space. Einstein appears to have borrowed this unproved guess from a scholium of Newton\(^3\), which postulates that absolute space remains always the same and is immovable. Newton probably fixed on absolute space to stay put for calculating in an heliocentric cosmology as a substitute for a postulated immovable earth located at the center of the geocentric cosmology, recently overthrown by Copernicus. Larson also rejects the misguided idea of Issac Barrow\(^4\), the contemporary menter of Newton, that the idea of motion is inapplicable to time. Aristotle\(^5\) was ahead of Barrow in recognizing that time is an aspect of motion.

Larson builds on Einstein's and Minkowski's attempted correction of Newton's mistaken notion that no relation exists between space and time. Their proposed correction is a purely mathematical correction, premised on the arbitrary assumption that space-time is continuous, & the corollary that space-time is a four-dimensional continuum, through which all photons translate with the same uniform speed. How? Einstein and Minkowski do not say, although Minkowski\(^6\) does suggest the possibility of space progression. Einstein\(^1\) eventually did not know how and says so in this report:

"Our only way out seems to be to take for granted the fact that space has the physical property of transmitting electromagnetic waves, and not to bother too much about the meaning of this statement."

In the reciprocal system neither continuous nor quantised space by itself is called upon to transmit electromagnetic waves. Rather quantised units of motion, involving both space & time, in the ratio of one unit of space\((=4.5563352671\times10^{-6}\text{cm})\) to one unit of time\((=1.5198298508\times10^{-16}\text{sec})\) transmit physical locations, whether or not occupied with photons, at this 1/1 ratio, called by Larson 'unit speed'. This unit speed is an absolute constant \(=299,792,458\) meters per second equal to the best measured translative speed of light.

All photons are assemblies of these same units of motion. Thus, every photon is a compound motion unit with at least two speeds associated with it: 1) a translative speed in vacuo, already reported, which it has in common with all other photons in vacuo, the speed of its physical location. Each photon remains throughout its existence in the physical location in which it originated. 2) Every photon in vacuo
consists of more than the uniform translation of its physical location at unit speed. It has a second speed, a speed displacement from unit speed of its oscillatory motion, involving either n time units associated with one space unit or n space units associated with one time unit. To distinguish its oscillatory speed from the translative speed, the oscillatory speed is called its frequency.

All physical entities from photons to atoms of matter and “anti-matter” (reciprocal or cosmic matter) are compound motion products of speed displacements from unit speed.

Verification of the finitude of the physical, including the finite divisibility and quantisation of motion, space and time, by the reciprocal system of physics, is now sufficiently evidenced to use as a reliable criterion to rule out the correctness of a number of established ancient as well as modern theories of physics.

Dr. Richard Feynman\(^7\) has questioned the infinite divisibility of space:

“I believe that the theory that space is continuous is wrong, because we get these infinities and other difficulties, and we are left with questions as to what determines the size of all particles. I rather suspect that the simple ideas of geometry, extended down into infinitely small space are wrong.”

Dr. Albert Einstein\(^8\), creator of the space-time continuum postulate of relativity theory has questioned during his later years the whole idea of a continuous field:

“One can give good reasons why reality cannot at all be represented by a continuous field. From the quantum phenomenon it appears to follow with certainty that a finite energy can be completely described by a finite set of numbers (quantum numbers). This does not seem to be in accord with a continuum theory and must lead to an attempt to find a purely algebraic theory for a description of reality. But nobody knows how to obtain the theory.” Nobody?

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6.) Minkowski, H. *Space and Time in The Principle of Relativity* pp 75-76 Dover, 1913


Subatomic Mass Recalculated Update

Bruce M. Peret

Correction to Muon Neutrino Mass

In my paper, "Subatomic Mass Recalculated" (Reciprocity XXIV, Number 1), in the last paragraph on page 13:

"The mass of the muon neutrino is inferred from measurements of muon momentum in the decay of a \( \pi^+ \) particle, and results in a mass of 105.658389 MeV (0.11342891388 u)."

The value listed is for the muon, not the muon neutrino. The correct value is <0.27 MeV, or 0.00028985683 u. Tables 2 and 4 also require these corrections, which are supplied.

Rethinking Neutrinos

Considering how close Larson’s calculated values are to the observed values for subatomic particles, it seems incongruous that both the muon and electron neutrinos should have such enormous error. In checking into the mass measurement procedure, I found that the observed values for both neutrinos should be correct, and concluded that there may be conceptual problems in Larson’s interpretation of mass for these two particles.

Muon Neutrino (massless neutron) Mass

The logic Larson uses to determine mass is, "The massless neutron muon neutrino, the \( \frac{1}{2} - \frac{1}{2} - 0 \) combination, has no effective rotation in the third dimension, but no rotation from the natural standpoint is rotation at unit speed from the standpoint of a fixed reference system. This rotational combination therefore has an initial unit of electric rotation, with a potential mass of 0.00057850, in addition to the mass of the two-dimensional basic rotation, ...".1

As I understood the convention, a displacement of zero means a scalar value of unity—uniform motion, the natural datum. If "no rotation from the natural standpoint" is "rotation at unit speed" with potential mass, then every location not occupied by matter should exhibit a mass of "e", that of the electron or positron. This is not observed, and I submit that no rotation in any dimension is exactly that, no rotation, and no potential mass. Thus, since the muon neutrino has no rotation in the 3rd dimension, it contributes no mass to the particle.

Secondly, when Larson adapts the \( \frac{1}{2} - \frac{1}{2} \) convention over the 1-0 convention for the description of the massless neutron, he states, "If the addition to the rotational base is a magnetic unit rather than an electric unit,..." and "...half units do not exist, but a unit of two-dimensional rotation obviously occupies both dimensions."²

This makes the massless neutron, or muon neutrino, the two-dimensional version of a positron, having a single two-dimensional temporal rotation instead of a single one-dimensional temporal rotation, not necessarily occupying both dimensions, but distributed over both
dimensions, and resulting in the appropriate \( \frac{1}{2} - \frac{1}{2} - 0 \) notation.

Since \( 1^2 = 1 \), the applicable mass is "e", not "p+m." And because this mass is distributed over two dimensions, the potential mass for the muon neutrino is \( e/2 \).

The new calculated mass is therefore \( e/2 \) times the conversion factor of natural units to unified atomic mass units (\( nu\rightarrow u \)):

\[
\frac{e}{2} \times (nu\rightarrow u) \\
= \frac{0.00057870}{2} \times 0.999706441403 \\
= 0.00028926691 \text{ u}
\]

Or, approximately 0.26945 MeV. Comparing to the observed value of "less than 0.27 MeV (CL = 90%)," is as close to perfect as can be expected, given the uncertainty of the observed value.

Electron Neutrino Mass

The electron neutrino, \( \frac{1}{2} - \frac{1}{2} - (1) \), is the muon neutrino with an additional 1-D spatial (electric) rotation. This gives the particle no net motion, and hence no potential mass. Larson indicates, "But since the electric mass is independent of the basic rotation, and has its own initial unit, the neutrino has the same potential mass as the uncharged electron or positron, 0.00057870."\(^1\)

I disagree with this statement for the neutrino. It may be true for the "p+m" mass conditions, but here we have "e-e", akin to a stable positron-electron combination due to the additional rotation in time on the positron component, and hence is massless.

But, the electron neutrino does have an observed mass of 5.1 eV. The measurement process deals primarily with charged particles, and I believe this observed mass is the mass due to the interaction of a charge on the neutrino with the charge on the atoms of the detector.

The charged neutrino has a mass of "c", the normal electron charge. The charge of atoms in the detector have a mass of "C", the mass of normal charge. Their interaction will be "C+c" (where "c" is positive, because we are on the same side of the unit boundary)\(^4\).

Because charge is an effect of a "third region"\(^5\), the charge needs to be brought across the unit boundary to measure the mass effect. This is a relation similar to "equivalent space", and results in the effect being the square of the value, "(C+c)\(^2\)."

The observed electron neutrino mass, due to charge interaction, is:

\[
(C+c)^2 \times (nu\rightarrow u) \\
= (0.00004494 + 0.0002996)^2 \times 0.999706 \\
= 0.00000000560
\]

Or, approximately 5.21 eV. The observed value is 5.1 eV, again, extremely close to the calculated value.

* Full article in next issue.

(To be continued)
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The Physical Nature of Space
Dewey B. Larson
London, June 1966

Even at best it is a difficult task to convey a clear understanding of a basically new scientific concept. Regardless of how simple the concept itself may be, or how explicitly it may be set forth by its originator, the human mind is so constituted that it refuses to look at the new idea in the simple and direct light in which it is presented, and instead creates wholly unnecessary difficulties by insisting on placing the innovation within the context of previous thought, rather than viewing it in its own setting. As Freeman J. Dyson recently observed,

The reason why new concepts in any branch of science are hard to grasp is always the same; contemporary scientists try to picture the new concept in terms of ideas which existed before.

There is no easy way of overcoming this obstacle and creating a more favorable climate for unbiased consideration of the nature and merits of the innovation. About the most that one can do is to define the new concept clearly: to explain specifically just what it is, where it is introduced into the previously existing system of thought, how it differs from previous patterns of thinking, and above all, to make it clear that however strange this concept may seem to first acquaintance, it is nevertheless logical and rational. Before taking up any questions of detail, therefore, I want to make a few comments of this kind about the new ideas that I am introducing.

The basic innovation in my new theoretical system, the Reciprocal System, as I call it, is a new concept of the nature of space and time which has emerged from a long and intensive study of basic physical processes. In present-day thought, a location in space is generally conceived as an entity that can be described by means of Cartesian coordinates. Of course, we cannot see a location in space, but we can see an object which may occupy such a location and we apply the coordinates to the object. If this object remains in the same spatial location its coordinates, according to the usual concept of space, are considered to remain unchanged. It should be realized, however, that this generally accepted concept of spatial localization is not something that has been derived from physical observation or measurement; it is a geometrical concept—purely a human investigation—and there is no assurance that it has any physical meaning or that it corresponds to anything that exists in the physical universe.

For example, if a physical object existing in physical space has no independent motion of its own and must therefore remain stationary with respect to that physical space, we have no assurance whatever that its geometrical coordinates will remain constant. It is normally taken for granted that such will be the case, and it must be conceded that established habits of thought make it rather difficult to visualize anything different. Einstein, for instance, says that it took him seven years of study and reflection to see this matter in a clear light and to realize that a physical location might not necessarily be capable of representation by a fixed geometrical coordinate system. After coming to this realization, however, he recognized its importance and he eventually utilized it as the basis of his General Theory. In that theory the coordinate system of reference is just as impermanent and subject to modification as the measurements with respect to the reference system are in the Special Theory. As explained by Moller in his textbook on Relativity,

the spatial and temporal coordinates thus lose every physical significance; they simply represent a certain arbitrary, but unambiguous, numbering of the physical events.

What I have done in distinguishing between physical space and geometric space is thus not entirely without precedent. Einstein has already made it clear that the common assumption that they are identical is untenable. But the relation between Einstein’s physical system of reference and the geometrical system of coordinates is rather vague and dependent on local factors. There is no reason, he contends, why there should be any specific relationship between differences of coordinates and measurable lengths and times. As a result his system is extremely complex mathematically and almost impossible to check against observational data except in certain artificially simplified situations. On
the other hand, the relation between my physical system of reference and the geometrical system is specific and definite under all conditions, and it is therefore possible to convert values from one of these systems to the other by relatively simple mathematical processes.

When viewed from the standpoint of a fixed geometrical system of reference, each location in the physical space defined by my postulates moves outward from all other locations in space at unit velocity—one unit of space per unit of time. Any physical object without an independent motion of its own remains in the same location in physical space permanently, but the spatial locations themselves move with respect to the geometrical coordinate system, carrying with them whatever objects exists at these locations, hence such objects move steadily outward away from each other when viewed from a fixed reference system.

According to this new concept, a location in physical space is a specific and definite entity, but it cannot be defined by static coordinates in the manner in which we define positions in geometric space. Physical space, the space which actually exists in the physical universe, and which enters into physical events and relations, is a dynamic entity, analogous to an expanding balloon, or more accurately, since it is three-dimensional, to an expanding solid rubber ball. Physical objects that are located in that physical space may have independent motions of their own, just as particles might move about on the surface of a balloon or through the voids in the structure of a rubber ball, but irrespective of whether or not they are moving in this manner, each of the objects is continually moving away from all others because of the continuous expansion of space.

Of course, this new concept of physical space as an entity in motion is so foreign to current thinking that it seems very strange on first acquaintance, but it is nevertheless obvious that it is a wholly rational hypothesis. Furthermore, the postulated expansion, or progression, of space is something that can be observed directly. As pointed out earlier, the identification of physical space with geometric space in current practice is not something that has originated from physical observation; it is purely hypothetical. To be sure, there are objects in the local environment which for extended periods remain stationary with respect to a geometrical system of reference, but these are not objects without independent motion. On the contrary, each of them has a whole system of motions. They participate in the rotation of the earth, in the earth’s motion around the sun, in the motion of the solar system around the center of the galaxy, and in an unknown amount of motion of the galaxy itself, in addition to which they are subject to the influence of gravitation, which affects the motion of these objects to an unknown degree. It is possible, however, with the aid of today’s powerful instruments, to see objects which are so distant that any motions of this nature which they may possess are negligible (that is, unobservable) and the effect of gravitation is attenuated to the point where it is no longer a significant factor. Under these conditions the new theory says that we should find these objects being carried away from us and from each other at extremely high velocities by the progression of physical space. This is exactly what the astronomers tell us that they see when they observe the most distant galaxies within reach of their giant telescopes.

It is important to realize that the motion due to the progression of space is something of an entirely different character from the independent motions of the objects that exist within the expanding system. If there are three objects A-B-C in a line, an object B moves away from A in the normal manner, it moves toward C. This is a directional motion: a vectorial motion in three-dimensional space. But if there are three objects that are being carried outward by the progression of space—three galaxies, let us say—then the motion which carries object B away from A moves it away from C as well. In the case of the motion is outward away from all other locations, hence it is scalar: a motion with no specific direction.

Astronomers recognize that the motion of the distant galaxies has this scalar character, and they frequently use the analogy of the expanding balloon, but in current thought this galactic motion is regarded as a unique phenomenon requiring a special explanation of its own, whereas in the Reciprocal System this is merely one manifestation of a general phenomenon which is encountered in a wide variety of circumstances throughout the universe. According to this new system of theory, any physical object which has no independent motion of its own will move outward in the same manner unless it is restrained in some way. Many of the most important of the new conclusions reached in the development of the Reciprocal System have originated from the discovery that certain phenomena hitherto regarded as involving ordinary vectorial motion are actually manifestations of scalar motion of the progression type.

A related point of major significance to physical
theory that is brought out clearly by the balloon analogy is that the datum from which all physical activity extends is not zero but the speed of the expansion. It is evident that if we are concerned with the magnitude of the independent motion of a particle on the surface of the balloon, it is not the measured speed that is significant; the meaningful quantity is the difference—plus or minus—between this measured speed and the speed of the expansion. Similarly, the significant quantity in the physical universe is the deviation from the speed of the expansion (the speed of light), not the deviation from zero.

Here is one place where the new theory leads to some modification of previous mathematical relations, but it should be understood that the essential difference between the new theoretical system and previous scientific thought is conceptual, not mathematical. The requests that are frequently made for a mathematical statement of the new theory are therefore meaningless. To illustrate this point, let us give some further consideration to the outward movement of the distant galaxies—the galactic recession. There are two theories of this recession currently in vogue among the astronomers: the “big bang” theory, which attributes the existing galactic velocities to a gigantic explosion that is presumed to have taken place billions of years ago, and the “steady state” theory, which postulates that the galaxies are being pushed apart by new matter that is being created in intergalactic space. To these I have now added a third. My new theoretical system says that the galaxies are actually stationary in physical space (except for some random motions that are too small to be observed), but that they are being carried outward with reference to fixed geometrical coordinates because physical space itself is an expanding system.

So far as the galactic recession itself is concerned, there is no significant mathematical difference between these explanations and hence there is no mathematical basis for preferring one of them over another. The real test of the relative power of these different hypotheses is the extent to which they are able to throw additional light on related questions, and for this purpose it is the interpretation that we put upon the mathematical expressions—our concept of the physical nature of the recession—that is significant. Mathematical reasoning or manipulation of symbols cannot take us beyond the bounds that are set by our concepts of the physical realities that are represented by the mathematical expressions or symbols, and in the case of present-day theories of the galactic recession these boundaries are narrow indeed.

But when we turn to the new concept of the recession that is supplied by the Reciprocal System we find that this opens up an immense new field for investigation. One very important point which immediately becomes obvious is that on the basis of this concept both the recession and the inverse of this phenomenon may occur coincidentally. This is not possible in a universe that behaves in accordance with current cosmological theories. We obviously cannot have the explosion postulated by the “big bang” theory and the reverse process—an “implosion” as it is sometimes called—going on simultaneously. Before the idea of concurrent inward and outward motions could be conceived at all, it was necessary to have a totally new concept of the nature of the recession, such as that which has been provided by the Reciprocal System.

If, as that system contends, objects with little or no independent motion, such as the distant galaxies, are being carried outward by the progression of space itself, then it is clearly possible for objects which do have substantial independent motions to move in the direction opposite to the progression of space, and thus move steadily inward toward each other. Such objects will then appear to be exerting forces of attraction upon each other, but because they are actually independent scalar motions rather than forces they will have some extraordinary characteristics, quite unlike those of the forces of our everyday experience. In particular, they will act instantaneously, without an intervening medium, and in such a manner that they cannot be screened off or modified in any way. All of these are, of course, the observed characteristics of gravitation, and it is apparent that the behavior of aggregates of matter in the observed physical universe agrees exactly with the theoretical behavior of objects that have independent motions in the direction opposite to that of the space progression.

We thus find that by a purely conceptual change—a modification of our ideas as to the fundamental nature of space—without any alteration of previously established mathematical relationships, we are able to extend our explanation of the galactic recession to apply to gravitation as well, thus bringing these two important physical phenomena within the scope of the same general theory. So it is throughout the universe. Each advance of this kind that we make with the aid of the new concept of the nature of space opens the door to further advances in related fields. Identification of gravitation and the galactic recession as two manifestations of the same basic phenomenon leads immediately to complete and consistent answers for many of the most serious problems that now confront the
astronomers—explanations of the origin of galaxies, the stability of the globular clusters, the immense distances between the stars, and so on. Then further development along the same lines enables clarification of relations in areas that lie farther afield, such as the cohesion of solids and liquids, for instant. Thus a whole theoretical universe gradually emerges as we build item by item on the new conceptual foundation.

HUBBLE VIEWS A STARRY RING WORLD BORN IN A HEAD-ON COLLISION

[Right] A rare and spectacular head-on collision between two galaxies appears in this NASA Hubble Space Telescope true-color image of the Cartwheel Galaxy, located 500 million light-years away in the constellation Sculptor. The new details of star birth resolved by Hubble provide an opportunity to study how extremely massive stars are born in large fragmented gas clouds.

The striking ring-like feature is a direct result of a smaller intruder galaxy—possibly one of two objects to the right of the ring—that careened through the core of the host galaxy. Like a rock tossed into a lake, the collision sent a ripple of energy into space, plowing gas and dust in front of it. Expanding at 200,000 miles per hour, this cosmic tsunami leaves in its wake a firestorm of new star creation. Hubble resolves bright blue knots that are gigantic clusters of newborn stars and immense loops and bubbles blown into space by exploding stars (supernovae) going off like a string of firecrackers.

Hubble’s new view does not solve the mystery as to which of the two small galaxies might have been the intruder. The blue galaxy is disrupted and has new star formation which strongly suggests it is the interloper. However, the smoother-looking companion has no gas, which is consistent with the idea that gas was stripped out of it during passage through the Cartwheel Galaxy.

[Top Left] Hubble’s detailed view shows the knotlike structure of the ring, produced by large clusters of new star formation. Hubble also resolves the effects of thousands of supernovae on the ring structure. One flurry of explosions blew a hole in the ring and formed a giant bubble of hot gas. Secondary star formation on the edge of this bubble appears as an arc extending beyond the ring.

[Bottom Left] Hubble resolves remarkable new detail in the galaxy’s core. The reddish color of this region indicates that it contains a tremendous amount of dust and embedded star formation. Bright pinpoints of light are gigantic young star clusters.

The picture was taken with the Wide Field Planetary Camera-2 on October 16, 1994. It is a combination of two images, taken in blue and near-infrared light.

Credit: Kirk Borne (ST ScI), and NASA (PHOTO RELEASE NO.: STScI-PRC95-02)
Glimpses Into a New Paradigm

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For centuries on mankind has held implicitly the view that we live in a universe of matter contained in space and time. All scientific theories hitherto have been built on this paradigm. Now Larson introduces the new paradigm that motion is the basic and sole constituent of the physical universe, and space-time is the content—not the container—of the universe. We review in this article some of the highlights of his theory, the Reciprocal System, which he develops from the new paradigm.

Introduction

The objective of this article is to introduce to the physical theory being called The Reciprocal System. Its originator, Dewey Larson, starting from two Postulates as regarding the nature of the basic constituents of the physical universe, and the mathematics applicable thereto builds a cogent theoretical structure that lays claim to a general theory. As it is impossible to outline the whole theory in the short space of an article, attempt has been made to present only those salient features that do not require lengthy explanation and have a broad-enough scope to enable the interested reader to appreciate its potentialities. More esoteric features of the Theory have been intentionally omitted from this preliminary treatment. They are, of course, available in the published works of Larson17.

The Conceptual Roadblock

The view that the physical universe is made up of basic units of matter, embedded in a framework of space and time, has been held by the common man and the scientist/philosopher for over the entire period of recorded history. Every new century has brought new and revolutionary ideas about the Universe that shook and changed our earlier views, but the concept of matter contained in a space-time background has remained unquestioned. Larson finds that it is this concept—which we shall call the concept of the universe of matter—that stood in the way of development of a truly general physical theory, one that explains all domains of physical facts—from the atomic to the astronomical—from the same set of fundamental premises. He has carried out the needed review of the concepts of space and time and finds that the introduction of the new paradigm, that the fundamental and the sole constituent of the physical universe is motion, leads us to the understanding of all the physical phenomena, and makes possible the construction of the long-sought after general theory.

To be sure, there have been earlier thinkers who attempted to build a general theory basing on motion as the fundamental constituent. Larson points out that the lack of success in all earlier attempts was due to the fact that these thinkers failed to realize the crucial point that in a universe based on motion (which is a relation of space and time), space and time cannot have independent existence (or definition), that they cannot be regarded as a background (or 'container') for themselves. No matter whatever conceptual reforms these thinkers have introduced into physical theory they all alike continued to subscribe to the container view of space and time, and blocked themselves from true progress.

Space, Time and Progression

The first of the two fundamental Postulates of the Reciprocal System from which Larson derives every aspect of the physical universe is

"The physical universe is composed entirely of one component, motion, existing in three dimensions, in discrete units, and with two reciprocal aspects, space and time."

Larson considers speed, which is the relation of space and time, s/t, as the measure of motion and points out that a unit of speed is the minimum quantity that can exist in the universe of motion, since fractional units are not permitted by the Postulate of his theory. Since one unit of speed is the minimum quantity admissible, both space and time have to be quantized: unit speed must therefore be the ratio of a unit of space to a unit of time, each of which is the minimum possible quantity. Certain corollaries follow. Cor. (1): Firstly, we see that space and time are reciprocally related to speed: that doubling the space with constant time, for example,
has the same effect on speed as halving the time at constant space. As a recognition of the far-reaching significance this reciprocal relation holds for the explanation of all the physical facts Larson names his theoretical structure The Reciprocal System of theory. Cor. (2): At unit level, not only one unit of space is like all other units of space but a unit of space is equivalent to a unit of time. Larson postulates a total uniformity in the properties of space and of time, except for the fact that they are reciprocal aspects of motion. Thus he concludes that time is three-dimensional as space is, and that space also progresses like time does.

At this juncture it may be pointed out that in order to understand (or evaluate) the new ideas engendered by the new paradigm, namely that the physical universe is a universe composed of units of motion (speed), it is necessary to view them in their new context. On the other hand, the most frequent mistake committed by the novice is to view the new concepts from the habituated viewpoint of the previous paradigm, that the universe is a universe of matter, embedded in a framework of space and time. Such an attempt leads one, often, to seemingly absurd, impossible or incredulous conclusions. To avoid slipping back involuntarily into the old and inadmissible frame of mind, while evaluating the Reciprocal System theory is one of the most difficult tasks that a critic has to accomplish constantly.

Now it is important to recognize that there is absolutely nothing space-like in the three dimensions of time: they are entirely temporal parameters. The common belief that time is one-dimensional is an unwarranted conclusion drawn from the fact that time enters our experience as a scalar quantity. The real reason why time appears as a scalar quantity in the equations of motion lies in the fact that no matter how many dimensions of time do exist, they have nothing to do with directions in space.

The idea that space progresses like time does might look more weird than the idea of multi-dimensional time. Our immediate experience is that of stationary space. But history has repeatedly shown that our immediate experience of space has always proved to be a bad guide in understanding the true nature of the universe. We first thought that the earth is flat. Then we made the mistake of thinking our earth to be the center of the universe and ended up in the maze of epicycles. Larson draws our attention to the fact that the increased scope of our scientific observations has brought us to the point where too many epicycles have once again been accumulated in the field of science in the form of unresolved old questions, fresh new puzzles and ever-increasing complexity of physical theory. He questions whether our anthropocentric view of space is not the culprit once again that is barring the progress.

He points out that our experience of space as stationary is valid only locally (that is, in the context of a gravitationally bound system). The true nature of space is to progress, to expand ceaselessly outward. Wherever gravitation (an inward motion) becomes negligible, weakened by distance, the inherent progression of space becomes apparent. The observed recession of the distant galactic systems stems directly from this space progression, not from any hypothetical 'big bang.' In fact, the observed Hubble's law could be derived from the postulates of the Reciprocal System.

Since a universe of motion cannot exist without the existence of motion, the most primitive condition of the universe is the steady progression of space coupled with the progression of time: in other words, a motion at unit speed. Beginners usually encounter here the difficulty of imagining the existence of motion without it being the motion of anything. But a little reflection should show that in a universe of motion the most fundamental constituent is motion, and all 'things' are derivatives of motion. Since every space unit is like every other space unit, and every unit of time is like every other unit of time, such a condition appears to our view as a featureless uniformity in which nothing is happening and constitutes the null background. Thus unit speed, and not zero speed, turns out to be nature's starting point. Larson refers to this background space-time progression as the 'natural reference frame,' and identifies the unit speed with the speed of light, c.

Emergence of Physical Phenomena

By virtue of the fact that either the space unit or the time unit could progress inward, rather than outward as it does in the case of the space-time progression, speeds other than unity become possible. Larson points out that it is these deviations (or 'displacements') from the unit speed that constitute observable phenomena, namely, radiation, gravitation, electricity, magnetism and all the rest. These are autonomous, independent motions in contra-distinction to the ever-present background progression.

This gives rise to two possibilities. Suppose \( k \) number of reversals occur in the space component, and suppose the unit speed of space-time progression contains \( n \) space units per \( n \) time units
(n/n = 1). Such a situation produces less than unit speeds, (n-k)/n. Since such a motion detaches itself from the space-time progression in its spatial aspect, we find it to be a motion in space. The second possibility is that the reversals occur in the time component of the motion. This results in greater than unit speeds, n/(n-k). In this second case it is the time component which gets detached from the background progression and we note that it constitutes what might be termed a motion in time (not 'time travel'). This is the reason why unit speed (c, the speed of light) is the upper limit for motion in space. It does not mean, as concluded in Relativity, that speeds greater than c are impossible in the physical universe: it only means that such speeds do not manifest in our conventional, stationary reference frame of three-dimensional space as displacements in space. These greater than unit speeds (namely, the motion in time) can be represented truly only in a 'stationary' reference frame of three-dimensional time.

Our state of knowledge so far has disposed us to assume tacitly that motion means motion in space; the possibility of motion in time has never been imagined, much less investigated. Such motion, though cannot be truly represented in the conventional, spatial reference frame, has nevertheless some observable features by virtue of the inverse relationship between space and time. For example, in a supernova explosion, if sufficient energy is available, Larson points out that some of the constituent matter of the star gets propelled to greater than unit speeds. The less than unit speed component manifests as a cloud expanding in space. On the other hand, the greater than unit speed component manifests as a cloud expanding in time (since it is a motion in time). In view of the reciprocal relation between space and time referred to above, this expansion in time manifests to us as contraction in space and we observe this component as a superdense and compact star. Thus we have the red giant/white dwarf combination so frequently found as supernova product.

Larson's theoretical investigations show that the same concept of motion in time can explain every other type of superdense astronomical phenomena, not just the white dwarfs. He shows that as age advances, the central regions of massive galaxies keep on accumulating motion in time (since greater than unit speeds do not involve movement in space, this matter does not leak out). When enough energy accumulates, it results in a stupendous explosion in which the central part(s) of a galaxy gets ejected and is found as a superdense star system, which, of course, is observed as a quasar. All the strange and unconventional characteristics of quasars—like their high density, large redshift, stupendous luminosity, jet-structure, peculiar radiation structure, evolution—can be deduced from the theory.

We have seen that the null condition of the Universe of motion is the unit speed and that the 'displacement' from this condition takes the form of either less than unit speed (s/t) or greater than unit speed (the latter being equivalent to less than unit inverse speed, t/s). Larson identifies this displaced speed with radiation, and the speed displacement with its frequency. While the photon gets detached from the background space-time progression in the dimension of the oscillation, it does not have any independent motion in the dimension of space perpendicular to the dimension in which the vibratory motion occurs. Thus the photon is permanently situated in the space unit of the space-time progression in which it is created. But from the context of the stationary spatial reference frame any location of the space-time progression appears to progress outward (away) at unit speed. Thus, while actually the photon is stationary in the natural reference frame, ostensibly it appears to move away at unit speed. Incidentally we might note that, when in a single process a photon pair happens to be created, while the individual photons seemingly appear to fly off in space in opposite directions, they continue to be connected in time. This results in a correlation between them that is not representable in three-dimensional space (the EPR paradox).

Once photons are available, the possibility of a compound motion appears wherein the photon could be subjected to a rotational displacement in two dimensions (covering all the three dimensions of space). Larson identifies such units of compound motion with atoms of matter. Because of the two facts that the maximum possible speed is unity and that the background space-time progression is already taking place at that speed in the outward (away from each other) direction, all autonomous (independent) motions (speeds) have to take place in the inward (toward each other) direction only. Thus the units of rotational displacement start moving in the inward direction, reversing the pattern of space-time progression. Larson identifies this inward motion with gravitation. We now see that there is no propagation involved in gravitation, nor it can be screened off: it is the inherent motion of each atom toward every other atom—in fact, toward every other location of the space-time progression, whether or not occupied by an atom. The non-existence of propagation time and the seeming action-at-a-distance, both owe their origin to the above fact.
Theoretical analysis reveals that elements with atomic numbers 1 through 117 can all exist in young matter. In old matter, however, elements with the higher atomic numbers start turning radioactive, by a process identified by Larson.

**The Regions of the Physical Universe**

An interesting fact that needs special mention is that the rotational displacement that constitutes the atoms could be either of the less than unit speed type or the greater than unit speed type. In either case gravitation acts inward only (in opposition to the outward progression of space-time). But in the case of the former type of atoms, since less than unit speeds produce motion in space, gravitation acts inward in space, resulting in the formation of aggregates in the three-dimensional spatial reference frame. Larson calls this portion of the universe the *material sector*. On the other hand, the atoms constituted of greater than unit speeds manifest motion in time. The resulting gravitation acts *inward in time*, and produces aggregates in the three-dimensional temporal reference frame. Larson refers to this matter as *cosmic matter*, their inward motion in time *cosmic gravitation*, and this portion of the physical universe the *cosmic sector*. We therefore discover another half of the physical universe where all the phenomena pertaining to our sector are duplicated, but with the roles of space and time interchanged. Even though cosmic matter occurs as ubiquitously and abundantly as ordinary matter we do not encounter it readily. Firstly, the atoms of the cosmic stars and galaxies are aggregated in three-dimensional time but are randomly distributed in space, so that we see a cosmic star not as a spatial aggregate but *atom by atom*. Secondly, while the cosmic gravitation moves the cosmic atoms *inward* in time, our own matter progresses *outward* in time. Thus, even the chance of encounters of atoms with cosmic atoms do not last for more than one natural unit of time (about one-seventh of a femtosecond).

Larson identifies all the exotic particles that abound in the high-energy environment of the particle accelerators with the ‘cosmic atoms,’ with some additional features acquired under the artificial environment.

A further fact of interest is that while the radiation emitted by the stars of our sector is at a high temperature, that emitted by the cosmic stars would be at a high inverse temperature, that is, at a low temperature. Since radiation moves at unit speed, unit speed being the border between both the sectors of the universe, it is observable from both the sectors, in whichever sector it originates. Therefore, the radiation emitted by the cosmic stars, as it comes from a region not localized in space, is received in the material sector (that is, the three-dimensional spatial reference frame) with an absolutely uniform and isotropic distribution. We observe this as the low-temperature, cosmic background radiation, of course. In the Reciprocal System, we find no necessity to reconcile the absolute isotropy of this background radiation with the clumpiness of the spatial distribution of the material aggregates.

**The Grand Cycle of the Universe**

We have already mentioned that quasars are the high (greater than unit) speed explosion products of aged galaxies. When gravitation in space is attenuated by distance (time) and becomes negligible, the quasar as a whole shifts from the region of less than unit speed (conventional spatial reference frame) to the region of greater than unit speed (the three-dimensional temporal reference frame). Gravitation ceases to act in space and starts acting in time. This leaves the outward progression of space-time without check (as there is no inward progression of gravitation in space) and the constituents of the quasar start flying out in space at unit speed. Eventually the quasar ceases to exist as a spatial aggregate and disappears altogether from the material sector. In other words, the atoms of the erstwhile quasar emerge into the three-dimensional temporal reference frame of the cosmic sector at totally random locations (in time).

The corollary is that similar set of events occurs in the cosmic sector—cosmic atoms aggregate in three-dimensional time forming cosmic stars and galaxies, parts of which explode on attaining a size limit and eject cosmic quasars, which eventually exit the cosmic sector and end up entering the material sector. Since they come from a region not localized in space, these incoming cosmic atoms would be uniformly and isotropically distributed throughout the three-dimensional space. Since the transfer occurs at the unit speed we ought to observe these particles at unit or near-unit speed. These, of course, are the observed cosmic ray primaries.

The Reciprocal System traces out in detail how these cosmic atoms, being greater than unit speed structures in a less than unit speed environment, promptly decay ejecting speed (energy) and 'cosmic mass' (that is, inverse mass), finally ending up as the most primitive atomic structures of the material sector, namely, hydrogen. Then the entire cycle of aggregation in space and eventual ejection begins. In the long run, as much matter comes from the cosmic sector as it leaves the material sector. Thus the dual...
sector universe as a whole is in equilibrium and steady state, while each sector continues to expand in space or in time as the case may be. There is no necessity to assume the singularity of a 'big bang' nor to break any conservation laws as in 'continual creation.'

**The Solid State**

Because of the fact that the minimum space that can occur in physical action is one natural unit of space (the quantum of space), if two atoms are made to approach each other they cannot come any nearer than one unit of space. However, by virtue of the reciprocal relation between space and time, these atoms can accomplish the equivalent of moving inward in space by actually moving outward in time. This they promptly do until a force (motion) equilibrium is achieved, giving rise to the solid state of matter. Since less than one unit of space does not exist, within the unit of space all motion could be in time only. The inside of unit space is therefore referred to as the time region by Larson. The space-time progression always acts away from unity. In the outside region away from unity is also away from zero (outward). But in the inside region away from unity is toward zero. Therefore the space-time progression is inward in the time region. Since gravitation always opposes space-time progression, it acts outward in the time region (repulsion). Further, while the space-time progression is constant at unit value, gravitation attenuates with distance. The two motions (forces) therefore reach a stable equilibrium at some distance in the time region and produce the configuration of solid state. Larson finds that a single theory of cohesion explains all kinds of bonds. Basing on purely theoretical computations he is able to calculate quantitatively the various solid state properties of hundreds of elements and compounds accurately.

**New Light on Quantum Phenomena**

Since in the time region only motion in time can truly exist, the appropriate reference frame that ought to be adopted for the description of the phenomena is the three-dimensional temporal reference frame, and not the conventional, spatial reference frame. The origin of the conventional reference frame is at zero speed, whereas the origin of the temporal reference frame is at zero inverse speed, which is tantamount to infinite speed in the context of the conventional spatial frame, and consequently a location pertaining to the temporal reference frame is found not localized in the conventional reference frame. This is the origin of the nonlocality characteristic so perplexing in quantum theory. This reciprocal (inverse) relation between these two types of reference frames also explains why a localizable particle in the context of a temporal reference frame needs to be regarded as an endless repetition, namely, as a wave, in the context of the spatial reference frame. Thus the Reciprocal System throws new light on the concepts of quantum theory. As the time region is a region of motion in time, it requires the adoption of a temporal reference frame for the description of particle phenomena. But, being irrevocably wedded to the spatial reference frame of the material sector, we are unable to accomplish this. However, we are able to accomplish the equivalent of adopting the temporal reference frame by resorting to the expedient of adopting the wave picture in the place of the particle picture.

This insight resolves the problem of the wave-particle duality. It further clarifies that the question of adopting the wave picture arises only on entering the time region, the region inside the unit of space. To associate a wave with every gross object is unwarranted.

There are yet unforeseen insights brought to light by the Reciprocal System. In the outside region, that is, in the context of the three-dimensional spatial reference frame, speed (s/t) is directional (vectorial). However, in the time region, that is, in the context of three-dimensional temporal reference frame, inverse speed (t/s) is the quantity that is 'directional' while speed appears scalar. But it must be cautioned that this 'direction' pertains to the realm of three-dimensional time and has nothing to do with direction in space. Thus inverse speed, though it could be 'directional' in time, is not a vector. In the universe of motion all physical quantities can be reduced to space-time terms. Larson, in a major overhaul of the dimensions of various physical quantities, arrives at the conclusion that the dimensions of energy are those of inverse speed, namely, t/s. Consequently, energy needs to be represented by complex numbers in the time region and negative energy states are as natural in the time region as negative speeds (velocities) are in the spatial reference frame.

**Conclusion**

We have endeavoured to sketch out some of the important contributions of the Reciprocal System to the understanding of the physical universe starting from a new paradigm—the concept of a universe of motion, in place of the current one of a universe of matter embedded in a framework of space and time. The examples cited here are expected to convey the
broad-enough scope of the theoretical system and establish that a prima facie case exists for a general theory. It is only fair to record that some of the more esoteric aspects of the Theory, like multidimensional motion, the scalar region of the universe, etc. have entirely to be omitted for pedagogical reasons and hence interesting questions concerning two large and important fields, namely, of electricity and magnetism, could not be considered in this article. Mention must also be made of the fact that Larson finds the basic constituent of the universe according to the new paradigm, namely, motion, to be scalar motion. Even though the existence of this kind of motion has been recognized, it has played a very minor and insignificant role in physical theory hitherto. So, Larson carries out a full-scale investigation of the properties and possibilities of scalar motion and discovers that this type of motion plays the central role in the drama of the physical phenomena. He finds, for example, that some of the unexplained physical facts are really the unfamiliar features of certain types of scalar motion. In this preliminary article we have refrained, for practical reasons, from dwelling on this important contribution of the Reciprocal System.

Surely one might question the rationale of omitting some of these important contributions of the Theory when at the same time emphasizing its all out nature. The real reason is--as has been hinted at the outset--no matter however simple and logical the new conclusions are from the viewpoint of the new paradigm, since one is habituated to the old paradigm some of them might look unimaginable or utterly unscientific. Having invested one's entire professional career in the existing paradigm, one's mind does not take kindly to the prospect of a basic paradigm change. The first few contacts are the most difficult ones as Kuhn points out. One would not be inclined even to pay attention to the new conclusions, much less evaluate them on their own merit.

References

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In Appreciation

The members of ISUS and indeed all students of the Reciprocal System owe a debt of gratitude to Dr. K.V.K. Nehru for his recent work in Salt Lake City.

He willingly undertook the arduous task of reading and organizing the many boxes of manuscripts, notes, calculations, and other papers that were left to ISUS after the passing of Dewey Larson.

For nearly two months, he worked tirelessly to accomplish this massive yet fundamentally important task. As a result, we now have a highly organized file, providing easy access to significant information, much of which has yet to be published.

One cannot help but be amazed by the prodigious quantity of creative work produced by Dewey Larson in his long but short lifetime. We are fortunate indeed to be the beneficiaries of his unique insights, now made more available to us by the selfless and extraordinary efforts of Dr. Nehru.

Rainer Huck
Executive Director, ISUS
Six Representational Modes and the Structure of Photons

Lawrence E. Denslow

As students of the Reciprocal System of Theory we have become used to a somewhat different set of paradigms than those held by all other students of the physical sciences, and by each of us prior to our acceptance of the concepts embodied within the Reciprocal System. The rest of the scientific community accepts without question the primacy of the observed characteristics of this physical plane of existence. To the community at large, mass is a fundamental characteristic of anything to be called matter and matter is the fundamental building block of the universe. To the establishment it is totally unthinkable to even conjecture that motion could exist unless matter is moving. That is the biggest stumbling block or hurdle to be overcome. Our thought patterns are still inhibited by our previous habitual use of that paradigm, resulting in such extreme difficulty in taking “an old set of data” for interpretation “from a new perspective” that we do not recognize our use of those old habits. By perspective I mean totally new set of concepts as outlined by D.B. Larson in his presentations of the fundamental concepts for a “Universe of Motion.” Even Larson had difficulty turning loose of many of the undeclared assumptions hidden in our observations of the physical universe from this region of Time/Space.

Larson has outlined for us an order of complexation of units of displacement motion and given us some of the new representational modes required for many of the phenomena observable in a physical universe of motion; such as two dimensional rotations. Invoking the rules of ordinary mathematics in all regions, including the representational requirements of Euclidean geometry and the concepts of probability relations for any representation of the concept of motion, requires us to really understand exactly what the rules of ordinary mathematics are and also what they imply. It is this requirement for knowing, not only how ordinary mathematics is used, but what its rules imply, that has led to the requirement for six possible modes of representation at three dimensional reference points, not just the familiar four of the Time/Space region.

In a multiple reference point Universe of Motion only the point coordinate axes for any specific reference point combination of representations of the concept of motion is important for that combination representation, regardless of how complex the final representation may become. Critical examination of the idea of a multiple reference point universe reveals that only the individual set of coordinate axes of each and every reference point need ever be considered with respect to any individual reference point. Every photon, every sub-atomic particle, every atom, cosmic or material, is its own reference point.

For the existence of any reference point phenomena, no other reference point is of any importance, so far as the representation of motions or effects of motions at that reference point are concerned. The only possible subsequent importance any reference point may have to another comes about when, and only when, they share the same unit of primary motion and, thereby, become a new reference point for a different reference point phenomena. There are at least two possibilities for this situation: atoms in chemical orientation and photon interactional phenomena. The two interacting components become not two phenomena at the same reference point; they become a new phenomena at a new reference point because the new reference point phenomena is a different combination of motions.

The resulting mathematical expression for this concept must reflect this reality even though the new reference point effect may be measurable in terms of each of the previous reference point phenomena. Conceptual and mathematical consensus for any expression of the effective reality of a reference point phenomena causes the requirement for the concepts embodied in the algebraic expression relating magnitude and direction to be coherent with the magnitudes of the arithmetic. A numerical sequence is required for any expression of quantity, whether that quantity is of substance or direction. One is followed by two and then three.

Let us now consider, “What is it that makes a unit of displacement be a displacement? Is it its opposition to primary motion in whatever required representation primary motion must have, or is it
something else?" Since primary motion is the very first possible motion that can be represented, primary motion must be given the very first possible mode of representation in the three dimensions available for its representation. That representation is one Dimensional and one directional in any one of the three dimensions. What must be next? Is it two Dimensional and one directional, or is it one Dimensional and two directional? Can primary motion be directly represented in more than one way? If it could, would there be any consistency among subsequent combinational representation? I have played with as many possibilities as I could think of and have always come back to one and only one possible way of directly representing primary motion: one Dimensional, one directional linear. Any other possibility led to so many possible second steps that it became almost impossible to calculate a required sequence for a third step.

In answer to these questions about displacements and primary motion, it seems clear that since primary motion can be represented in a direct manner only as one Dimensional one directional linear, a displacement must first be able to oppose that kind of representation before a generalization can be considered. With primary motion directly representable only as one Dimensional one directional linear, and that one direction being in either of the two directions of one dimension in any conceivable three dimensional coordinate system, an opposition to primary motion in that dimension has to be represented as one Dimensional two directional linear. It can not be in just one of those directions, because primary motion would be left free to be expressed in the other direction and nothing would have been accomplished and nothing could be represented! That is why the first representable displacement motion must be one Dimensional two directional linear in one of the three dimensions, which thereby leaves both directions of both remaining dimensions open in which to represent primary motion. Once the direction of primary motion is selected, it is done, and that's that, so far as that reference point is concerned. Any effects of displacements remaining with that unit of primary motion will seem to have straight line movement relative to any reference system of coordinates. The first possible reference point phenomena must have a structure represented as a combination of a one Dimensional two directional linear displacement and a unit of primary motion in a perpendicular dimension. We call these reference point structures photons!

The question for these photon reference points concerning now the effect of their structure is to be expressed relative to a whole bunch of other reference points of whatever kind must have an answer related to, or given in terms of, the mathematics used for their representation. This requires consideration of the meaning of directionality as it applies to the idea of dimensional systems.

Random orientation of reference point coordinate systems with respect to all other reference point systems requires the use of probabilities for sameness among all such coordinate system. Use of probabilities is limited by the arithmetical system and, thus, the question of which must come first: substantive quantity or direction. An obvious question is: "Is it obvious that the quantity being represented must exist before it can be given direction?" This question is, for us, similar to the question for most physicists of whether motion can exist without the presence of matter; specifically, can there be direction without something (even a concept of something) to have a direction? If so, we have a universe of motion, not direction. This conclusion seems to be the same as that derived by present day physicists; matter, not motion. If a quantity (e.g., the concept of a unit of motion) must be available before directionality can be specified, then the effect of the quantity being analyzed must be one directional, two directional, or multi-dimensional. Since one directional can be in either of two directions, the effect of a two directional linear displacement is equally probable in either of the two directions possible. To maintain equality of probability, two such units of displacement must be sequentially related in order to complete the probability function for the representation of either one of the units of displacement.

Considering all the mathematical functions capable of fulfilling the conceptual requirements for representation of the one Dimensional one directional linear primary motion and the one Dimensional two directional linear displacement perpendicular to the primary motion, it is found that only the sine and cosine functions can satisfy those conceptual requirements in an unambiguous manner; i.e., an effect that is linearly positioned and continuously variable and has two directions of possible effect.

By this convoluted path it has been shown that photons must be conceptually represented as a combination of 1D2d, displacements with perpendicularly primary motion and mathematically as sine wave functions. It has been implied that the next step of complexation must be similarly related thru appropriate application of probabilities for the
ideas of dimensionality and directionality.

The idea of rotational representation of directionality around an axis causes all linear directions to become partially accessed and thereby related in the resultant effect. Possibilities for subsequent representations require primary motion to be represented with rotational directionality. Direct representational probability of this possibility is so small as to be non-existent. However, it is the augmentation of the concept of directionality for the representation of primary motion that allows for a displacement motion to be represented rotationally and development of the generalization for displacement to be an opposition to primary motion as previously questioned.

Chart 1 indicates what the six modes of representation for units of displacement motion must be at sufficiently compound motion reference points. That which is observable in a generalized three dimensional system is only the effect of Notational Reference Point representations of displacement motions other than $1D1_{d_L}$. Primary motion is the one dimensional velocity observed for photons and some subatomic particles. Equivalent primary motion is the maximum resultant one dimensional velocity for all atomic and the remaining subatomic structural representation. The order of complexation among the six modes of representation at individual reference points is as shown in Chart 2, increasing complexity from the bottom up. The final Chart shows the resultant physical universe composed of seven principle regions in Three Sectors.

### Chart 1

<table>
<thead>
<tr>
<th>Motion</th>
<th>Symbol</th>
<th># Dimensions</th>
<th>#directions</th>
<th>directionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear translation;</td>
<td>$1D1_{d_L}$</td>
<td>One Dimension</td>
<td>one direction</td>
<td>linear</td>
</tr>
<tr>
<td>Linear oscillation;</td>
<td>$1D2_{d_L}$</td>
<td>One Dimension</td>
<td>two directions</td>
<td>linear</td>
</tr>
<tr>
<td>Unidirectional rotation;</td>
<td>$1D1_{d_R}$</td>
<td>One Dimension</td>
<td>one direction</td>
<td>rotational</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Two Dimensions</td>
<td>one direction</td>
<td>rotational</td>
</tr>
<tr>
<td>Rotational Oscillation</td>
<td>$1D2_{d_R}$</td>
<td>One Dimension</td>
<td>two directions</td>
<td>rotational</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Two Dimensions</td>
<td>two directions</td>
<td>rotational</td>
</tr>
</tbody>
</table>
Chart 2

Order of Complexity of Phenomena as sequenced by adding the Next Displacement Representation

<table>
<thead>
<tr>
<th>#</th>
<th>Equivalent primary motion</th>
<th>Effective Sector Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Explosion phenomena</td>
<td>Full units of displacement in addition to NRP dimensions; Galactic (pulsars and quasars) and Stellar (novae and white dwarfs)</td>
</tr>
<tr>
<td>6</td>
<td>Stellar interior phenomena</td>
<td>Sunspots and prominences</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thermal, electrostatic, and gravitational charges exceed mass limit, causing Radioactivity of unstable atomic structures</td>
</tr>
<tr>
<td>5</td>
<td>Rotational Oscillational Phenomena</td>
<td>$2D2d_p$ to specific particles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>magnetostatic effects</td>
</tr>
<tr>
<td>4</td>
<td>Complex Linear and Oscillational Phenomena</td>
<td>$1D2d_p$ to most kinds of particles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>electrostatic effects</td>
</tr>
<tr>
<td>3</td>
<td>Atoms and Atomic Interactional Phenomena</td>
<td>$2D1d_p$ &amp; $1D1d_n$; atoms $\ll$ atoms to form molecules and crystals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sub-atomic Particles with or without mass</td>
</tr>
<tr>
<td>2</td>
<td>Simple Oscillational Phenomena</td>
<td>$1D2d_L$; Photons of Radiation exist in Interface</td>
</tr>
<tr>
<td>1</td>
<td>Background Natural Reference System</td>
<td>That which precedes all representations of motion in a dimensional system and must coexist as primary motion as part of all reference points.</td>
</tr>
</tbody>
</table>

Continued on Page 27...
Sub-Atomic Particle Array
A Revised Hypothesis

Thomas Kirk

A slightly different derivation of the Reciprocal System of Theory leads to a different hypothesis as the basis of the subatomic particle array. The nature of charge plays a major part in the revised development. This new hypothesis is well founded in basic RS principles and, due to the foundational level from which it extends, will stand as a new view on physical theory in general.

The photon is the simplest association of space and time; a 1:1 relation, s:t. There is no argument among Reciprocal theorists as far as this goes. Larson envisioned a one dimensional association as this original simplest association, and this work proceeds from that basis. After all, simple space is s, not s3, and an s3:t3 relation would have a greater magnitude, whereas the universe would tend to develop by minimum increments. Without getting too involved with the detailed structure of the photon, which is not the focus here, it is important to establish a few more principles about the photon that are necessary for development of more complex objects.

In the association of the photon’s space coordinate unit with its time coordinate unit, it is in this same unit of progression or 3-d time that the object forms. Yet after the object forms and takes its final form, there is a second unit of general progression time in which the object manifests. There is the spatial manifestation, basically the wave length, which will not be a topic here, and then there is the time manifestation, which manifests as the progression of the object. This is the singular point where the derivation varies from Larson’s; one time unit is required for the association with space, yet the time for manifestation of the resultant object is a different separate and distinct unit.

All objects have this in common, their second time unit.

With this concept in mind, the next step in development of a more complex object is the addition of another coordinate or 1-d association of space with time, within the same 3-d space unit and time unit of the original object. This is the requirement for a singular object. If the time and space units are not the same, a second object will emerge. The original association of s:t was one dimensional, but the space and time units of which s and t are a part are 3 dimensional in nature. Therefore another association is possible within the same space-time unit. This, as Larson maintained, yields a rotation of the photon, a 2-dimensional structure.

Larson also pointed out that there are two possibilities at this stage of object development, material and cosmic. These two objects will be designated here as:

Material
Cosmic
1-0
(1)-0

The second number in this coding is the potential for a rotation of the original 2-d rotation of the photon. This will yield a 3-d structure, the maximum level of distribution within 3-d space and 3-d time.

The structure and dynamics of these space:time associations are more involved than in the photon, but the purpose here is only to lay out a base pattern for the array of subatomic particles extending from the Reciprocal System. Therefore, these two objects will simply be taken at face value as the 2 dimensional objects with the next higher incremental level of time-space association above the photon. The precise dynamics within the structure of these two particles are not absolutely certain at this time, and the intent here is to present only those concepts that have very high reliability as being ultimately correct. This will provide for a solidly based hypothesis in the final subatomic array; a structure inherently consisting of many inter-relationships between particles that will guide exploration of principles of motion within the particles.

These 2-d objects will have the same general association with the second time unit as the photon. They will have an incremental one unit time progression due to this association (plus of course an incrementally enforced unit of space envelope coincident with the unit wavelength sphere of the original 1/2:2/1 photon).
Since the material object (1-0) will have some gravitation, its progression will be restricted from motion in space, yet the unit progression will still be effective as it is a unit shift in time. The time shift progression unit is 3-dimensional in time (1-d in space), due to its origination at the zero space reference. The T locus shifts from the zero speed state towards conformance with the time reference state, unit speed, and as such is non-specific in time. A space or time reference point is 3-d by nature; only that which extends from the reference is coordinate and 1-dimensional. This is a motion inward in time towards the unit speed reference. Gravity is inherently 1-d in time by its nature (this is understood best or possibly only through an understanding of coordinate time which is beyond the scope here) and opposes the time shift providing a residual 2-dimensional motion in time. This motion is circulatory in space and therefore only manifests in a relative way between two objects with the same motion form. (Relative motion between objects due to charge is beyond the scope here.) It should be noted that this motion is not really a part of the object as is inertia or gravity. It is a motion of the object in time, not a motion that is the object. This motion in time will be identified as charge, or positive charge, more precisely.

The cosmic object will experience the same one unit time shift, but its inertial reference initially is time or unit speed progression. The time shift will again be inward in time, the precise same action as for positive charge, but beginning from the unit speed state, yielding the n/1 speed form in the cosmic sector. Motion inward in time from this reference extends towards zero speed in time, or n/1 where n>>1. The shift will be one unit inward to 2 units bringing the object to zero speed in space. Speed 2/1 is zero speed in space in conformance with Larson’s findings. This shift will be one dimensional in time and is in this case fully manifested in time, through the shift to zero speed in space. A cosmic object moved away towards n/1 speed from the coordinate time zero reference, i.e. unit progression, will manifest 1-dimensionally in time, just as an object in space always manifests 1-dimensionally in space under the same space reference circumstances at speed 1/n. However, inertial cosmic mass is 3-dimensional in time by nature, acting in opposition to the one-dimensional time shift. The residual 2 dimensions of inertial mass manifest as charge motion, but in a certain inverse way to the charge on its material sector counterpart.

The inverseness pervades the comparison throughout. A positive charge begins at zero speed and acts outward in space, 3 dimensionally in time, against a one-dimensional time restraint, material gravity (3-d in space). A negative charge begins at unit speed progression and acts inward in space, one dimensionally in time, against the outward 3-d inertial progression of cosmic inertia (3-d in time). Note the inversion of gravity and inertia between the 2 sectors. The inverseness is so great that a negative charge is a component of inertial cosmic mass, not the time shift itself as for positive charge.

Larson defaulted charge to be a rotational vibration, in that rotation was reserved as a property of mass, and vibration a property of the photon. This was convenient but rather inductive rather than deductive, and getting close to the "only way left" possibility that he so abhorred in other scientist's works. Another reason that Larson did not see other possibilities was that he had also inductively or even arbitrarily taken space and time to be symmetrical. If the above analysis of charge is studied closely, space and time take on very revealing inverse characteristics, not symmetrical.

The cosmic and material particles developed above can be identified as an electron and a positron respectively, with their negative and positive charges.

They lose their charges when completely encompassed within a cosmic mass or mass structure, respectively. In the case of the positron, just being at the progression of the speed of light, which is the inertial state of the cosmic sector eliminates the mandate for charge. Being at unit speed, fully manifests the charge motion and also eliminates gravity, as Larson maintains. The all-encompassing association with the cosmic mass aggregate, maintains the continuity of the zero inertial time state (unit progression). Without such protection, the slightest speed decrease would actuate gravity beginning a vicious circle of gravity causing slowing and more slowing causing more gravity and so on. The mandated charge would quickly return.

The electron charge motion is as discussed, 2-dimensional in time, and at all times orthogonal to the outward progression (which is restrained by the time shift in the orthogonal dimension). This forms a circulatory motion conforming to the form of motion that originates mass through photon rotation. The portion of cosmic mass within the electron that is the direct inverse of material mass is neutralized by the charge shift. The cosmic inertial, and coincident gravitational, progression inward in time
to the 1/1 zero time state is neutralized leaving the residual 2-d time motion charge.

This remainder is a circulatory motion. The circulatory motion of the positron charge acts outward in space, in opposition to mass; the electron charge acts inversely to the positron charge, therefore the electron charge acts a conformance to mass. The electron charge is absorbed by matter, not in opposition to mass but as an addition to mass. Already in our study of the array, an important concept has come to light; the fundamental motion that adds mass to a particle is the same in the material and cosmic sectors. The inverse aspect of mass is derived from within the inner component that is rotated, not the circulatory motion itself. Recall that the inverse charge in the positron yields a reverse circulatory motion, that would in fact neutralize the circulatory motion of mass or cosmic mass. Within a cosmic aggregate, a positron has no charge, but imparts an increment of cosmic inertia from it's progression in time.

One fundamental axiom of the universe, extending from simple logic, is that compound motion develops incrementally in minimum increments. This simply says that there are no gaps; where an increment could exist between two motion levels, it will exist.

The next increment will therefore involve an additional space:time association, but one that actually reduces the previous magnitude of manifestation:

<table>
<thead>
<tr>
<th>Material</th>
<th>Cosmic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-(1)</td>
<td>(1)-1</td>
</tr>
</tbody>
</table>

It is not possible to directly initiate an inverse association within the structure formed by the s:t association that rotated the photon. Each incremental association is always the same in either sector, it is the inner structure, i.e. the positron or electron rotational bases, that determine the outcome of the increased association. However at this 2-d level of development, an association oriented to align with the original axis of photon rotation is possible. In 3-d structures, this axis is itself rotated and a direct correspondence of orientation is not possible. This corresponding alignment will not neutralize the original 2-d structure, but just add to it, pushing it beyond the zero point one unit back to the inverse reference. The net effect is neutralization of the mass component while maintaining both associations intact. This structure could actually be classified as the 2-0 or (2)-0 structure. The next levels of 3-0 and (3)-0 just push the structure further to higher levels of n without the inversion that occurs when crossing the zero reference. Since the internal structure at this stage (2-0 or (2)-0) is at the zero state, there is nothing to rotate or otherwise manifest in connection with an additional s:t association, and so such a particle does not exist.

This 2-0 or (2)-0 structure has some degree of neutralization of its predecessor’s manifestation. In fact, the neutralization of mass manifestation in the material object, both inertial and gravitational, eliminates the object’s charge, by allowing it to proceed to a unit progression state. This is the essential state of the photon, wherein the shift to a second time unit manifests as progression.

On the cosmic side, the additional association will neutralize the increment of inertial cosmic mass which was the source of the charge in that particle. The inverse cosmic mass association of space:time will directly eliminate the cosmic inertial and gravitational mass of the object and return it to the same progression status as its material counterpart, i.e. that of the photon. Both objects will be massless and uncharged and progress at unit speed, as the manifestation of the time shift. We identify these as the neutrino and the anti-neutrino.

The difference between these 2 particles is very slight. It is that the original inner base rotation is a positron in the neutrino and an electron for the anti-neutrino, though the net motion of both objects is essentially the same, once the effective neutralization of circulatory motion is effective. Conventional science describes the difference as purely a difference in direction of spin. This conforms well to the findings here, in that the particles are inversely derived, while having the same net outcome. However, the findings indicate that there is no spin involved, but only an inverse set of t:s associations. This is a parallel to motion of charge, where positive and negative charge seem to have the same properties, but in a different direction somehow.

The next higher incremental level structure therefore involves rotation of the preceding 2-d rotational structure:

<table>
<thead>
<tr>
<th>Material</th>
<th>Cosmic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>(1)-(1)</td>
</tr>
</tbody>
</table>

This is a major step of association to 3 dimensional mass. These objects would be the proton and the anti-proton. In the 1-1 structure, there is still a unit progression (time) shift for the space-time location,
again offset by gravitation, and the same form of resultant charge. The charge has a quite different equivalent mass manifestation due to the powerful effect of the 3-dimensional structure of the last mass increment on the time shift. This powerful effect also exists in the cosmic object, where the cosmic inertial 3-d mass will sustain the object at unit progression speed, thereby eliminating the usual form of charge motion, altering it to a different form. The structure of the cosmic charge of this type will be of an entirely different form, that is a charge at unit speed. Analysis indicates a 1-dimensional motion in time (magnetic field) will be the result instead of an electric field (2-d time).

Anti-protons are as rare in the cosmic sector as protons are in the material sector. Considering that our exposure to cosmic mass is extraordinarily limited, detection of anti-protons has extremely remote potential. It is very difficult to verify derivations related to anti-protons.

One concept is clearly showing itself, that is the cosmic sector, the region conforming to time coordinates, is not symmetrical with the material sector. The irrefutable evidence is that both a positron and its cosmic counterpart (electron) exist at rest in space in the charged state. The electron should, in a symmetrical state, be at rest in coordinate time, i.e. at unit progression speed. What is emerging is a view of two sectors that are entirely inverse and parallel, but far from symmetrical.

Breaking away from the cosmic sector for reasons just presented, there exist other possibilities for subatomic particles. These extend from a second subatomic particle occupying the second time unit, of the original particle. That is, combinations of subatomic particles occupying the same space-time location, but in alternating time units.

Neutrinos and anti-neutrinos progress through the environment constantly in large numbers. A proton has a high propensity to have one of these take up residence in its second time unit. In fact, this is a more stable state than the singular proton, in that a better balance between sequential time units is established.

If a proton acquires a neutral-anti-neutrino, the occupant of the second time unit has a cosmic matter basis, namely the electron structure at its core. The 3-d proton structure will retain the mass of its core positron, since the shift to the second unit is not required due to its stabilization by the anti-neutrino. There will be a small net gain in the mass for the overall particle due to the outer mass type association in the anti-neutrino. This outer mass component of the anti-neutrino will have the relatively strong tendency to attain a time shift into the proton's time unit, due to its ability to assimilate into that mass structure. This particle will in many cases be charged.

If the proton acquires a neutrino, the neutrino mass based structure will balance the proton in the second unit, fully eliminating the charge mandate. There will be a significant gain in mass due to the contribution of the mass based structure. However this particle will be unstable, because mass has a high propensity to absorb anti-neutrinos, (for reasons that will not be addressed in detail here) and when the proton makes such an acquisition, there is a spontaneous inter-reaction with the neutrino in the second unit and the particle breaks down.

These two combination objects are the neutron (proton with neutrino) and the hydrogen single mass particle (proton with anti-neutrino). This is the reverse interpretation of Larson's. This finding within the hypothesis leads to the conclusion that atom building occurs by absorption of anti-neutrinos not neutrinos, as envisioned by Larson. Since anti-neutrinos would be distributed uniformly as are neutrinos and both progress at the speed of light, the only factor favoring one over the other would be the propensity for absorption.

Other combination particles should be explored besides the proton/neutrino and proton/anti-neutrino and their cosmic counterparts. In all cases, the two particles would be sharing the same space unit, though in alternate time units. These are of four basic types. Type 1 would be a pairing of two 2-d inverse particles. The annihilation of an electron and positron in such a close association would result, eliminating this possibility. The same would be true of a neutrino/anti-neutrino coupling.

In Type 2, the pairing of two 2-d particles of the same kind. A double positron association (or its inverse, a double electron association) and a double neutrino (or double anti-neutrino) account for these. The positron has only 2-d inertia so the former would be very difficult to form because of the strong repulsion of the two charges. There would appear to be no clear reason to eliminate the possibility, though bringing the two components together would be a very rare event. The two neutrinos would not form a viable connection, because the two particles manifest their 2nd time unit shift fully and continuously progress outward from each other.

Type 3 options are combinations of a electron and anti-neutrino and an electron and neutrino (and their
cosmic counterparts). There would appear to be no clear reason to eliminate the possibility of the former, though bringing the two components together would be a rare event. The situation where this might occur would be in a radioactivity event. Preliminary investigation indicates that the muon neutrino suits the parameters for a electron/anti-neutrino particle. There would be no charge due to the second time unit being occupied by a particle with a cosmic mass component of the same increment of cosmic mass as the electron. There would be a mass less than the positron since there are no base mass increments, but only the secondary mass of the anti-neutrino being effective. Mass contains huge numbers of free electrons, and a second electron only needs to absorb an increment of isotopic mass to be ejected as an anti-neutrino. The close association existing between the two particles in a mass could yield such a muon neutrino from a high energy event. The positron/neutrino should be the cosmic counterpart with residual cosmic mass, and would have a relatively high mass value.

The other Type 3 counterparts, the positron/anti-neutrino and the electron/neutrino, would not have proper correspondence of their inertial status. The positron is based at the zero space reference system, while the anti-neutrino is based at the unit progression state. The positron, not being 3-d, would not have the potential to restrain the anti-neutrino from progressing outward in the remaining free dimension.

Type 4 combinations would include the proton/proton particle, which from all indications is actually the deuterium atom, the first real atom with the same mass structure in both time units, having a mass of two units. All other atoms are of the same form with identical structures in each time unit, sharing a single space unit in alternating units of time.

This development brings out an array of subatomic particles in Table 1.

One remaining question as to the possibility of other members of the subatomic array is whether there could exist subatomic objects of greater mass than one unit, such as 2-1. Preliminary study does not indicate any reason to specifically rule out such a particle, but due to the mechanisms for atomic growth, the chance for this particle to form is realized only in the rarest of circumstances. The 1-1 particle has a very high probability of absorbing an anti-neutrino and becoming an H³ atom, and in turn, two H³ atoms have a high probability of uniting as an H² molecule. As such, the remotely plausible 2-1 subatomic particle does not have a reasonable opening to form.

**SUBATOMIC PARTICLE ARRAY**

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>COSMIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positron</td>
<td>Electron (1)-0</td>
</tr>
<tr>
<td>Neutrino</td>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
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<td>H³</td>
<td>H³ Cosmic (1)-1</td>
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</tbody>
</table>

Table 1

---

**In Appreciation**

Upon accepting the resignation of Daeron Meyer from his voluntary position of Associate Editor of Reciprocity and ISUS News, we wish to express our deep appreciation and thanks to him for his splendid contributions to improving the computer format and readability of our periodicals.

*Delegates of the Twenty-First Annual Meeting of ISUS*
Denver, Colorado
August 12-13, 1996
We have seen in the previous article that the present state of the theory in physical sciences requires a re-examination of the validity of the most fundamental of the scientific concepts. This is the task to which Dewey Larson, an Engineer-scientist from Oregon, U.S.A., has addressed himself to. To be sure, this is an enterprise of immense arduousness since it requires an open mind, which means the ability of the mind to step out of the inveterate patterns of thinking—to do this without transgressing rationality. His researches reveal to us a most unexpectedly simple theory that encompasses all physical phenomena of the universe from atomic to galactic magnitudes. He shows in his work how his predictions completely agree with the present observational knowledge in all different domains, answers the long-standing scientific puzzles, and take us into regions as yet unexplored by current science. His theory explains the origin of gravity and the nature of radiation, the galactic recession, the atomic structure, cohesion, electricity, stellar evolution, radioactivity and cosmic rays among other things. What is more striking is an extraordinary propinquity of the theory to the viewpoints of occultism.

A brief survey of the development of his "Reciprocal System of Theory," as Larson calls it, is presented below with a view to appraise its comprehensive nature and to show how it throws fresh light on Occult Chemistry.

**Space and Time**

The author points out that space and time are the most fundamental concepts, the correct understanding of whose nature and characteristics should precede any theoretical development. Basing solely on what is revealed in direct observation—and not on any interpretation—the following can be said of them as being true in the local environment:

*Space* is three-dimensional, homogeneous, and isotropic.

*Time* progresses uniformly and (perhaps only locally) unidirectionally.

The *scalar relation* between space and time is reciprocal (that is, speed = space / time), and this relation constitutes *motion*. (NL, page 35)

He takes pains to clarify the meaning of ‘dimension’ and that time has no dimension in space. "...time enters into the mathematics of the physical processes... as a scalar quantity. From this the physicists have jumped to the conclusion that time is one-dimensional. The point that the physicists have overlooked is that ‘direction’ in the context of physical processes which are represented by vectorial equations in present day physics always means ‘direction in space’." (NL, page 33) Then he reminds us that, "...no matter how many dimensions it may have, time has no direction in space... There is nothing in the role which time plays in the equations of motion to indicate specifically that time has more than one dimension. But a careful consideration... does not show that the present day assumption that we know time to be one-dimensional is completely unfounded." (NL, p 35)

Then he makes the important assumption that the relation which we find in the region accessible to observation also holds good in the inaccessible region of the universe. The first, and the most important, conclusion that can be drawn now from the extrapolated relation is that,"...inasmuch as this specifies the existence of a general reciprocal relation between space and time, there must be complete scalar symmetry between these two entities." (NL, page 61) Hence he calls his theory the *Reciprocal System*. Basing on further observational trends, on the existence of discrete quanta, two postulates are arrived at, from which and which alone the entire theory is developed:

**First Fundamental Postulate:** The physical universe is composed entirely of one component, motion, existing in three dimensions, in discrete units, and with two reciprocal aspects, space and time. (Cf. SD, ii, p.260; ML, p.341)

**Second Fundamental Postulate:** The physical universe conforms to the relations of ordinary commutative mathematics, its
primary magnitudes are absolute and its geometry is Euclidean (NBM, page 30).

The validity of these postulates is established by comparing the logical inferences drawn from them with actual facts observed in nature. The domain of the predictions ranges from the heart of the atom to the farthest reaches of the universe and not one single case of discrepancy with facts seems to be present while there is much light thrown on phenomena that have so far not yielded to the present day science.

In view of the symmetry between space and time, it turns out that any property of one of these is also the property of the other. More specifically, this leads us to the conclusions that time is also three-dimensional and that space too progresses like time.

It must again be pointed out that the dimensions of time are properties of time and do not have anything space-like. Though the three-dimensionality of time may look strange, nothing in our experience contravenes this possibility, even though it may not point out to this possibility. In fact, C.W. Leadbeater speaks of three-dimensional time in his book The Monad. More bizarre may look the concept of progression of space similar to the observed progression of time. But the fact is that we have actual observational evidence of the progression of space in the recession of the distant galaxies. Further, "...when we analyze the motion of the distant galaxies, this... turns out to be scalar... the motion actually has no specific direction. It is simply a scalar motion, outward from all other galaxies." (NL, page 62).

It is important to clearly understand the nature of the scalar motion. It is either outward from all other locations, or inward toward all other locations. A scalar motion has no inherent direction, unlike the motions of our everyday experience. As an example, consider an expanding balloon. The different points on the surface of such a balloon move outward from each other. The movement of any particular point, as far as the balloon itself is concerned, has no inherent direction—its motion is scalar; simply away from all other points. The direction is acquired only if the balloon is related to a stationary reference frame like the room in which it is situated.

In the light of the above we must revise our view of 'running of time' as a unidirectional flow. It is, rather, a scalar progression, that is, "...each location in time is continually moving outward away from all other locations in time." (NL, page 82)

Now, if space also is progressing scalarly, that is, expanding outward incessantly, why we are not aware of it just as we are cognizant of the progression of time? The reason is that in our environment this outward progression of space is counterbalanced by a scalar inward motion engendered by matter and we seem to see a stationary space.

This concept thus leads us to the view that both space and time progress, expand continually toward infinity and there is no progression of time divorced from an equal progression of space. However, since an increase in space is equivalent to a decrease in time and vice versa, the expansion of space is counterbalanced by the expansion of time. Thus space-time prior to any physical manifestation is eternal motion. This appears as expanding toward infinity when regarded from the standpoint of our human mind—which looks at the space progression in artificial isolation from the concomitant progression in time. It is this anthropocentric alienation of space and time that is responsible for a lob-sided appraisal of the universe, that has led science astray, to its present predicament. Larson demonstrates how the emancipation from this one-sided view of the universe beautifully simplifies the physical theory—most of which is unnecessarily complicated at the present moment—and makes possible extraordinary insights. It is not known history to us that all the serious stumbling-blocks that beset the progress either in philosophy or in science have been the results of treating—consciously or unconsciously—our earth, our viewpoint or our mind as the most fundamental!

It may also be noted at this juncture that in a way it is not correct to envision space and time as the primordial Duality; for there is no space progression without accompanying time progression and vice versa, and no space and time per se without being related as motion. There is only a primordial Trinity. This is what Pythagoras had always upheld.

In order to allay the doubts of the conventional thinker regarding the possibility of validity of the above postulates it may be necessary once again to point out that by them Larson not only provides explanations of qualitative nature but also arrives at the actual values of the physical properties of matter and the numerical magnitudes of natural constants like the gravitational constant, molar gas constant, or Planck's constant, etc. from theory alone.

Radiation

An important consequence of the progression of
space-time is that unit speed, one unit of space per unit of time, is the condition of rest in the physical universe. Thus, unit speed and not zero is the datum level from which all physical manifestation starts. In other words, unity is Nature's zero-point. This, I think, is a most remarkable discovery.

Here we should be careful not to fall prey to, what A.N. Whitehead used to call, 'the fallacy of simple location', which is to imagine, as the prevalent world view of science does, that material particles are situated in (or superadded to) a setting of space and time; as though matter is embedded in a receptacle of four-dimensional space-time. Larson points out that space and time "...cannot constitute a setting or background for motion, because motion is not a background for itself. Everywhere in a universe of motion, space and time are the two reciprocal aspects of that motion, and they have no other significance anywhere." (QP, page 11) This is where previous thinkers like Descartes, Eddington and Hobbes, who endeavored to develop a general theory on the basis of the motion concept have failed by not recognizing that in a universe of motion, space and time cannot have independent definitions.

Aside from this ceaseless progression, the ever-present motion, a universe in the neutral condition would be one vast domain of featureless uniformity in which nothing ever happens and nothing could happen. (Cf. ML, page 135, 246 & 341) This gives us a fresh insight as to how we should regard the condition of Pralaya. In order that there may be events or phenomena in the universe, there must be deviations from unity; a displacement of motion from the unit level. Such a displacement is possible by the periodic directional reversal of the prevenient unidirectional unit motion in one of the three dimensions. When this happens, this periodic motion becomes detached from the ever-present background progression in that particular dimension; it now becomes a physical entity, the first manifestation. Moreover since this oscillation has no other independent motion, it gets carried away by the background motion at unit speed in either of the remaining two dimensions.

Larson identifies these oscillating units as the photons of electromagnetic radiation (the basic particles of light), with the space-time ratio of the oscillation (the number of space unit reversals per one time unit) as the frequency of the radiation and the unit velocity of the progression as the velocity of light.

Thus, according to the theory, light (radiation) is the first “thing” that emerges out of the primordial perfect uniformity, which is nonentity from our standpoint. Are not these vibrating units identical with the SOUND mentioned as the starting point of creation? The Secret Doctrine unequivocally portrays light as the First Born. (SD, ii, pages 303-304)

One of the outstanding achievements of the Reciprocal System is the complete and logical explanation of the dual particle/wave nature of radiation that is so intriguing. “The photon acts as a particle in emission and absorption because it is a single independent unit; it travels as a wave because the combination of a linear oscillation and a translatory movement in a perpendicular direction produces a wave-like motion.” (NL, page 86)

Outstanding achievement number two of the theory is the explanation of the transmission of radiant energy without any medium which remained without explanation hitherto. “The answer here is that radiation is not transmitted at all. The photon remains permanently in the space-time location in which it originates, but space-time itself progresses, carrying the photon with it, and the photon is therefore able to act on any object which is not carried along by the progression and which are therefore encountered enroute.” (NL, page 87)

(to be continued)

References Cited:

NL  New Light on Space and Time by D.B. Larson, North Pacific Publishers, Portland, OR, USA, 1965
QP  Quasars and Pulsars by D.B. Larson, North Pacific Publishers, Portland, OR, USA, 1970
NBM Nothing But Motion by D.B. Larson, North Pacific Publishers, Portland, OR, USA, 1979
ML  The Mahatma Letters to A.P. Sinnett, T.P.H., Madras-20, India, 1972
Subatomic Mass Recalculated Update
Bruce M. Peret

Correction to Muon Neutrino Mass

In my paper, “Subatomic Mass Recalculated” (Reciprocity XXIV, Number 2), in the last paragraph on page 13:

"The mass of the muon neutrino is inferred from measurements of muon momentum in the decay of a $^+\mu$ particle, and results in a mass of 105.658389 MeV (0.11342891388 u)."

The value listed is for the muon, not the muon neutrino. The correct value is <0.27 MeV, or 0.00028985683 u. Tables 2 and 4 also require these corrections, which are supplied.

Rethinking Neutrinos

Considering how close Larson’s calculated values are to the observed values for subatomic particles, it seems incongruous that both the muon and electron neutrinos should have such enormous error. In checking into the mass measurement procedure, I found that the observed values for both neutrinos should be correct, and concluded that there may be conceptual problems in Larson’s interpretation of mass for these two particles.

Muon Neutrino (massless neutron) Mass

The logic Larson uses to determine mass is, “The massless neutron [muon neutrino], the M $\frac{1}{2}$-$\frac{1}{2}$-0 combination, has no effective rotation in the third dimension, but no rotation from the natural standpoint is rotation at unit speed from the standpoint of a fixed reference system. This rotational combination therefore has an initial unit of electric rotation, with a potential mass of 0.00057850, in addition to the mass of the two-dimensional basic rotation, ...”.

As I understood the convention, a displacement of zero means a scalar value of unity–uniform motion, the natural datum. If “no rotation from the natural standpoint” is “rotation at unit speed” with potential mass, then every location not occupied by matter should exhibit a mass of “e”, that of the electron or positron. This is not observed, and I submit that no rotation in any dimension is exactly that, no rotation, and no potential mass. Thus, since the muon neutrino has no rotation in the 3rd dimension, it contributes no mass to the particle.

Secondly, when Larson adopts the $\frac{1}{2}$-$\frac{1}{2}$ convention over the 1-0 convention for the description of the massless neutron, he states, “If the addition to the rotational base is a magnetic unit rather than an electric unit,...” and “...half units do not exist, but a unit of two-dimensional rotation obviously occupies both dimensions.”

This makes the massless neutron, or muon neutrino, the two-dimensional version of a positron, having a single two-dimensional temporal rotation instead of a single one-dimensional temporal rotation, not necessarily occupying both dimensions, but distributed over both dimensions, and resulting in the appropriate $\frac{1}{2}$-$\frac{1}{2}$-0 notation.

Since $1^2 = 1$, the applicable mass is “e”, not “p+m.” And because this mass is distributed over two dimensions, the potential mass for the muon neutrino is e/2.

The new calculated mass is therefore e/2 times the conversion factor of natural units to unified atomic mass units (nu-u).3

\[
e / 2 \times (\text{nu-u}) = 0.00057870 / 2 \times 0.999706441403 = 0.00028926691 \text{ u}
\]

Or, approximately 0.26945 MeV. Comparing to the observed value of “less than 0.27 MeV (CL = 90%),” is as close to perfect as can be expected, given the uncertainty of the observed value.

Electron Neutrino Mass

The electron neutrino, $\frac{1}{2}$-$\frac{1}{2}$-(1), is the muon neutrino with an additional 1-D spatial (electric) rotation. This gives the particle no net motion, and hence no potential mass. Larson indicates, “But since the electric mass is independent of the basic rotation, and has its own initial unit, the neutrino has
the same potential mass as the uncharged electron or positron, 0.00057870.\""

I disagree with this statement for the neutrino. It may be true for the \"p+m\" mass conditions, but here we have \"e-e\", akin to a stable positron-electron combination due to the additional rotation in time on the positron component, and hence is massless.

But, the electron neutrino does have an observed mass of 5.1 eV. The measurement process deals primarily with charged particles, and I believe this observed mass is the mass due to the interaction of a charge on the neutrino with the charge on the atoms of the detector.

The charged neutrino has a mass of \"e\", the normal electron charge. The charge of atoms in the detector have a mass of \"C\", the mass of normal charge. Their interaction will be \"C+c\" (where \"c\" is positive, because we are on the same side of the unit boundary).\n
Because charge is an effect of a \"third region\", the charge needs to be brought across the unit boundary to measure the mass effect. This is a relation similar to \"equivalent space\", and results in the effect being the square of the value, \"(C+c)\".

The observed electron neutrino mass, due to charge interaction, is:

\[
(C+c)^2 \times (\text{nu} \rightarrow \text{u}) = \\
(0.00004494 + 0.00002996)^2 \times 0.999706 \\
= 0.0000000560 \text{ u}
\]

Or, approximately 5.21 eV. The observed value is 5.1 eV, again, extremely close to the calculated value.

**Corrected Tables**

The corrected tables from \"Subatomic Mass Recalculated\" are:

(Note: (C+c) appears as (C-c) because c is negative.)

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<tr>
<td>p+m+2e</td>
</tr>
<tr>
<td>p+m+2e+C</td>
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<tr>
<td>p+m+3e</td>
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<td>e</td>
</tr>
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<td>(C-c)^2</td>
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<tr>
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<tr>
<td>p+m+3e</td>
</tr>
<tr>
<td>p+m+3e+E</td>
</tr>
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Conclusion

1. The mass effects of the structure of neutrinos appear to be conceptually incorrect as presented in Nothing But Motion.

2. The mass of the muon neutrino (massless neutron) is one-half of the electric mass, being distributed over two dimensions, and having a mass of 0.27 MeV.

3. The mass of the electron neutrino is zero.

4. The observed mass of the electron neutrino is due to the interaction of a charged electron neutrino with a charged atom in the detector instrumentation, producing an apparent mass of 5.2 eV.

Towards the Future

Upon electing Bruce Peret to the position of Associate Editor to replace Daeron Meyer, we have good reason to look forward to further improvement in both the form and content of our periodicals with the continuing goal of revaluing and unifying the science of physics and our new goal of revaluing and unifying the human science of ethics with the eternal aid of our teacher, Dewey Larson.

Frank Meyer, Editor

Continued from Six Representational Modes and the Structure of the Photon, page 16...

Chart 3: The Physical Universe

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</tbody>
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References

2. *ibid.*, page 141.
5. *ibid.*, page 163.
Research Programme for ISUS

Ronald W. Satz, Ph.D.

ISUS Research Director

A tremendous amount of information is contained in Larson's works and issues of Reciprocity. The problem is that to extract a particular bit of data can be quite time-consuming, especially for a newcomer to the system.

The solution, of course, is to put all the quantitative information (both calculated and observed values) on a computer database system. I propose five files, or registries, as follows:

1. Registry of Photons
2. Registry of Subatoms
3. Registry of Atoms
4. Registry of Chemical Compounds
5. Registry of Astronomical Phenomena

Ideally, ISUS would find an "angel" who would provide funding for the design of the database system and the typing in of all the data. Pending that, my company, Transpower Corporation, will do the work, whenever I can make time available. It looks as if it is going to be a slow process. The resulting software product would be offered for sale.

A preliminary design of the four screens for the Registry of Atoms (file RSATOM) follows. Field numbers are shown with an asterisk in front.

Comments are welcome.

Nov 6, 1996 File Name: RSATOM Screen Name: 1

*** ELEMENTS–MATERIAL & COSMIC–IN RECIPROCAL SYSTEM ***

Symbol: *1
Atomic No.: *4
Crystal: *56
Name: *2
Division: *8
G: *57
Alt. Name: *3
Group: *9
Thermal Groups: *53

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<td>Tot. Resistance Factor</td>
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And if the holy man refused
Toil save for a price,
Would not his heart become confused,
Corrupting his advise?
Lao Tzse, Tao Teh Ching
### ISOTOPES

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### VALENCE

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### PROPERTIES-CALCULATED & OBSERVED

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Outline of the Deductive Development of the Theory of the Universe of Motion

Dewey B. Larson

Section Four

In the preceding Sections we have presented a step-by-step deduction from the fundamental Postulates of the Reciprocal System of theory of the phenomena of the physical universe pertaining to the atomic domain. We carry forward, in this Section, these deductions to the astronomical field and show how phenomena, some of which have not had proper explanations in the conventional theory, emerge logically from these deductions. This Section, therefore, serves to demonstrate the general nature of the Reciprocal System of theory.

143 At this point we will need to take into account the concentration of energy in the vicinity of matter subject to electrical ionization, and some consideration of the nature of this concentration will be required. As long as atoms or aggregates are free to move unidirectionally, there can be no significant spatial (volumetric) concentration of their kinetic energy. Such a concentration is accomplished by containment. Initially, the spatially restricted motion, thermal motion, as we will call it, is contained within the individual units of space. When the energy level is high enough to permit the atoms to escape from the spatial units, a force, exerted either by the walls of a container, or otherwise, is required for containment.

144 The level of containment outside unit space is measured by the pressure, the force per unit area, dimensions \( t/s^2 \times 1/s^2 = t/s^4 \). The product \( PV \) of the pressure and the volume is the energy of the contained thermal motion, dimensions \( PV = t/s^4 \times s^3 = t/s \). We identify the thermal energy level as the temperature.

145 From (144) it follows that atoms of matter that are not confined, and therefore not subject to any pressure, cannot have temperatures above the very low levels at which they are able to escape from the individual spatial units. Free translational motion of an aggregate of matter likewise has no temperature effect. The motion of this aggregate as a whole is independent of the thermal motion of its constituents.

(Temperatures of millions of degrees are currently reported as applying to individual atoms and molecules in the vicinity of certain astronomical objects. From the foregoing it follows that these temperature estimates are erroneous. Temperatures of unconfined matter are in the range of a few degrees, not in millions of degrees.)

146 Ionization is produced by a transfer of speed displacement to rotational vibration from some other form of motion, under appropriate circumstances. Thermal motion is one such source. The degree of ionization of the atoms of an aggregate increases with the temperature of the environment in which the aggregate is located, and at extremely high temperatures all elements are completely ionized.

147 From (95), the translational motion of masses, including the confined thermal motion, is outward. From (115), the electric ionization is also outward. Thus a further increase in temperature beyond the level of complete ionization ultimately brings the atoms up to a limiting level at which the sum of the outward ionization and the outward thermal motion is equal to unity. This unit outward motion then neutralizes one unit of the inward rotational motion. As indicated in (91), both units revert to the linear status, converting the rotational vibration and a unit of the rotation to kinetic energy. Mass \( t/s^3 \) becomes energy \( t/s \).

148 The conversation factor relating a unit of mass to a unit of energy has the dimensions \( s^2/t^2 \) (the dimensions of the second power of speed) and unit magnitude. The energy equivalent of a mass is therefore the product of the mass and the second power of unit speed (the speed of light).

149 For an answer to the question as to the result of further additions of thermal motion beyond the limiting point defined in (147), the destructive temperature limit of the particular element under consideration, we first return to (59), where we deduced that the maximum addition to the speed of a motion combination in any one dimension—that is, the amount that can be added to a zero base—is two units. In these terms of reference, the range is from
zero to +2. In terms of displacement from the natural
datum at unity, the range is from +1 to -1 (or from -1
to +1, as the identification of the conventional zero
with +1 rather than -1 is purely arbitrary). The first
added unit of speed eliminates the unit of speed
displacement (+1), and the second adds a unit of
time displacement (-1).

150 Since there are no fractional units of speed,
the reduction of linear speeds to levels below unity
in the manner described in (44) can be accomplished
only by introduction of units of inverse speed. This
is motion in time, but the atom is moving
gravitationally in space and in the other two scalar
dimensions, and the net total scalar motion is
therefore in space. It follows, in accordance with
(47), that the increments of motion in time in the
range between zero and unit speed act as motion in
equivalent space.

151 Elimination of displacement in space (increase
of speed) can continue only up to the unit speed
level, at which point all displacement has been
canceled. A speed greater than unity therefore
cannot be attained by means of this process.

(This is the explanation of the observed
inability to accelerate material objects to
speeds in excess of the speed of light by
application of electrical forces.)

152 As noted in (157), the limit at the unit level is
on the capability of the process, not on the speed
itself, and it does not preclude an increase in the
speed above the unit level by means of a different
process. Where speed is available in full units, it
may be added directly, up to the absolute limit,
which, as stated in (59), is two one-dimensional
units. Because an increment of speed above unity is
a scalar motion in time (equivalent space), the
extension of the linear motion in space into the
second unit is distributed over all three time
dimensions. As in the rotational situation of (91),
the existence of three-dimensional units of speed then
makes intermediate speeds between unity and two
full linear units possible.

153 The aggregation of matter under the influence
of gravitation noted in (34) applies to objects of all
sizes. Because of the diversity of conditions there is
no uniform aggregation pattern, but since gravitation
is omnipresent, the average mass of all major classes
of physical objects necessarily increases with
advancing evolutionary development—with the
evolutionary age, we may say.

154 The process of aggregation results in the
conversion of gravitational motion into thermal
motion (heat). Coincidentally, there is a loss of heat
from the surface of each aggregate, due to radiation.
But the mass, which determines the rate of heat
production, other things being equal, increases more
rapidly than the surface area. The temperature of a
large aggregate is therefore a function of the mass,
as long as the aggregation process continues.

155 Extremely high temperatures are reached only
in very large aggregates of matter. If the aggregate is
large enough to reach the destructive temperature
limit of the heaviest element present, this activates
the process of conversion of mass to thermal energy
described in (147). We identify such an aggregate as
a star.

156 Since the maximum degree of electric
ionization of an element is equal to its atomic
number (127), the heavier elements have a greater
content of ionization energy, and therefore require
less thermal energy to reach the destructive
temperature limit, the temperature at which the total
of these two energy components attains the unit
level (149). If the stellar temperature continues
rising, the elements reach their destructive limits in
the inverse order of their atomic numbers.

157 The principle that small numbers are more
probable than larger numbers applies to the
formation of the elements (with some modifications
due to other factors). The heaviest elements are
therefore present in the stars only in relatively small
concentrations, and the energy released in their
destruction is dissipated by radiation from the stellar
surfaces. As successively lighter elements reach
destructive limits, the concentration of the
individual element arriving at the limit increases,
and eventually this process reaches an element that
is present in quantities that produce more energy
than the radiation mechanism can handle. The
excess energy then blows the star apart in a gigantic
explosion. We identify the overabundant element as
iron, and the explosion as a Type I supernovae.

(Here the development of the theory leads
directly to an explanation of a phenomenon
for which no generally accepted explanation
has been derived from astronomical theory.)

158 From (154), the temperature limit of a star is
also a mass limit. From (153), the attainment of this
mass limit is a result of advanced evolutionary age.
The stars that explode as Type I supernovae are
therefore mature stars of approximately the same
mass. Thus all Type I supernovae have the same
general characteristics.
(The astronomers agree that all Type I supernovae are very much alike, but they have no explanation for the similarity.)

159 When the energy released in the supernovae explosion is added to the already high thermal energy level of the surviving portions of the interior structure of the star, a substantial portion of the explosion products are accelerated to speeds in excess of unity, in the manner explained in (152). From (46) and (47), the motion of these products takes place in the spatial equivalent of outward motion in time, which is inward in equivalent space. The aggregate of these very high speed products thus undergoes a drastic spatial contraction, and appears to observation as a small star with a density vastly greater than that of any aggregate of matter existing in the terrestrial environment. We identify this high density aggregate as a white dwarf star.

160 In ordinary stars (those with component speeds below unity) of a given class, the more massive stars are the larger; that is, they occupy a greater amount of three-dimensional space. From (46), the more massive white dwarf stars occupy the spatial equivalent of a greater amount of three-dimensional time, which is less equivalent space. According to the theory of the universe of motion, the more massive white dwarf stars are therefore smaller than the less massive ones.

(This deduction is confirmed by observation.)

161 In ordinary stars the spatial density gradient from the surface to the center of the star is positive; that is, the center is the region of greatest density. From (46), the temporal density gradient of a white dwarf star is also positive, which means that the center of the star is the region of greatest density in time, or least density in the corresponding equivalent space. Thus the spatial density gradient is at the surface, and the lowest at the center.

162 Little or no translational motion in space is imparted to the white dwarf by the supernovae explosion. It therefore remains in the spatial region heavily populated with low speed explosion products, and accretes a substantial amount of these products by reason of its gravitational effect. The surface layers of the younger white dwarfs thus have a composition similar to that of their environment: predominantly hydrogen, with a minor amount of helium, and minute amounts of other elements. Because of the inverse density gradient (161), the hydrogen moves downward preferentially toward the center of the star, leaving the surface layers of the older white dwarfs enriched in helium.

(This, too, is confirmed by observation. A substantial proportion of the white dwarfs are reported to have helium-rich surface layers, extending up to "nearly pure helium atmospheres." Current astronomical theory has no explanation of this reversal of the normal density relations.)

163 In the supernovae explosion (157), the speeds imparted to the outer portions of the exploding star are less than unity. These explosion products therefore expand outward in space. Their motion is, however, subject to resistance from dispersed matter in the environment, and to the gravitational effect of the exploding aggregate as a whole, including the white dwarf that does not participate in the outward movement. These opposing forces ultimately terminate the expansion and initiate a contraction. Thus most of the ejected matter is eventually recondensed into a star. The typical product of a Type I supernovae is therefore a double star system consisting of a diffuse A component on or above the main sequence and a dense B component (white dwarf or system of planets) below the main sequence.

(This deduction from the premises of our theory requires the existence of double star systems as a direct consequence of the nature of the supernovae process, and explains why so many of these systems consist of dissimilar objects. The present state of astronomical knowledge in this area is described by the following quotation from a current astronomy textbook: "Our hopes of understanding all stars would brighten if we could explain just how binary and multiple stars form... Unfortunately we cannot.")

164 Any explosive event comparable in intensity to a Type I supernovae ejects some products at speeds greater than unity. The explanation given in (159) for the extremely high density of the white dwarfs is equally applicable to these other high speed products.

This accomplishes a significant simplification of astronomical theory, as the currently accepted explanation of the white dwarf density cannot be extended to such extremely dense objects as quasars, pulsars, x-ray emitters, and dense galactic cores, and separate explanations have had to be developed for the density of each of these types of objects.
Equality of Human Worth?

The Missing Link Explaining the Dispersion of Light

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Dreams, Symbolism and Allegory

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Reveals the Reason for Dreaming
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From the Editor
A New Format for Reciprocity

Frank H. Meyer & Bruce M. Peret

We have made a number of changes to the look and content of Reciprocity, starting with this issue, in order to attract a wider audience, while reducing costs, preparation and assembly time.

The most visible change is the new cover—a graphic indication of the Reciprocal System, in both linear form (the mirrored words Reciprocity), and rotational form, courtesy of Dr. K.V.K. Nehru which draws upon both the rotational galactic image, and classic Tai Ji Tu (yin-yang) symbolism.

As a result of the 25th ISUS Conference, we were requested to evaluate existing publication policies, and come up with a broader policy to address Larson’s two other books, The Road to Full Employment and Beyond Space and Time. In accordance with the published minutes in the last issue of ISUS News (page 4), which state:

“Motion was made by Phil Porter to allow publication of papers reviewing any and all of D.B. Larson’s books and papers whether related to his views concerning economic or non-physical concepts in ISUS News until such time that a broader policy of publication becomes available and that papers related to the physical aspects of the Reciprocal System of theory be continued in Reciprocity.”

We now have a broader policy of publication, published and implemented in this issue, which includes all of Larson’s works, as well as the works of other contributors. This publication policy is the result of the work of myself, Frank Meyer, Tom Kirk, and a host of others, whom, over the course of the last 20 years, have expressed concern over the quality and content of Reciprocity.

Aside from the broader publication policy, you will also find that ISUS News is no longer a separate document, but now a feature within Reciprocity. This was done for several reasons. Originally, ISUS News was only sent to ISUS members; those with a “subscription only” membership did not receive it. However, in order to receive bulk rate mailing, U.S. Postal regulations require the contents of each piece of mail being sent bulk rate to be identical, which is why it was decided several years ago to mail ISUS News to everyone, as bulk rate is substantially less expensive than first class mail. Also, as a separate document, it takes an additional week to have it reproduced, takes twice as much manual labor to stuff the envelopes for mailing, and is more difficult to produce (having to meet 4-page boundaries, designing additional cover sheets, tables of content, filler, etc.).

Also, the inclusion of ISUS News in Reciprocity connects theory to application—proof that the Reciprocal System is more than just a good idea. Given the growing concern for the earth, its people and problems, the Reciprocal System is poised in a unique position to open a new realm of invention to address these concerns as no other theory can.

We shall attempt to publish four issues of Reciprocity per year. Submission deadlines for printed material are one month before the issue is scheduled to be mailed. Electronic submissions, which do not require manual entry, are due 2 weeks before the scheduled mailing date. Publication is dependent, of course, on available material to publish. The tentative schedule is:

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<th>Issue</th>
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<td>#1, Spring</td>
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</tr>
<tr>
<td>#4, Winter</td>
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The dates were selected so production would not occur during the major holidays. For example, the Autumn issue comes out before the Thanksgiving-Christmas holiday, and the Winter issue a month after New Years day.

Please review the new publication policy, and consider sharing your views and ideas. The most consistent thing we’ve noticed about the Reciprocal System, is that each person understands it a bit differently than everyone else. Exchanging these ideas is the easiest way to truly understand them.
Reciprocity Publication Policy
Frank H. Meyer, Bruce M. Peret and Tom Kirk

Objectives

The objective of the International Society of Unified Science (ISUS) is the advancement of the Reciprocal System of theory. This theory consists of two fundamental postulates, together with everything that can be derived from those postulates by logical and mathematical processes, without the introduction of premises or postulates from any other sources. The postulates are:

1. The physical universe is composed of one component, motion, existing in three dimensions, in discrete units, and in two reciprocal aspects, space and time.

2. The physical universe conforms to the relations of ordinary commutative mathematics, its primary magnitudes are absolute, and its geometry is Euclidean.

The unitary character of the theory, resulting from the derivation of all its conclusions from the same set of premises, is its most essential feature. It is this status as a general theory that enables extension of the theory into areas inaccessible to observation.

The purpose of the Reciprocity journal is to contribute toward the accomplishment of this objective of the organization, as stated in the ISUS By-laws, Section 1:

The objective of this organization shall be to advance in all ways deemed feasible the Reciprocal System of physical theory as proposed by Dewey B. Larson and as presently set forth in the books named below, and in other published works, and as may be set forth in future articles and books.

- The Structure of the Physical Universe (1959)†
- The Case Against the Nuclear Atom (1963)
- Beyond Newton (1964)
- New Light on Space and Time (1965)
- Quasars and Pulsars (1971)†
- Nothing But Motion (1979)
- The Neglected Facts of Science (1982)

† Currently out of print.

Other published works include:
- The Unmysterious Universe (Satz, 1971)
- The Road to Full Employment (Larson, 1976)
- Universe of Motion (Larson, 1984)
- Basic Properties of Matter (Larson, 1988)
- Collected Writings of KVK Nehru (Nehru, 1994)
- Beyond Space and Time (Larson, 1995)
- Fundamentals of Scalar Motion (Denslow, 1996)

Publication Guidelines

Because the Reciprocal System is a general theory of the universe, the range of topics that can be discussed is considerable. Overall, information on the Reciprocal System falls into several broad categories, and several distinct types of articles based on the published books.

The existing categories acceptable for publication, using published works as guidelines, are, but not limited to:

General Theory
- Structure of the Physical Universe
- New Light on Space and Time
- Unmysterious Universe
- Collected Writings of KVK Nehru
- Fundamentals of Scalar Motion

Astronomy and Cosmology
- Universe of Motion
- Quasars and Pulsars
- Collected Writings of KVK Nehru

Physics and Chemistry
- Nothing But Motion
- Basic Properties of Matter
- Case Against the Nuclear Atom
- Beyond Newton
- Collected Writings of KVK Nehru

Life Science and Metaphysics
- Beyond Space and Time

Social Science and Economics
- Road to Full Employment
Reciprocity, Volume XXV, Number 3, Winter 1996-1997

Several types of articles commonly accepted for publication are, but not limited to:

Confirmation by Observation

Observations that current theories have no clear explanation of, and are explained by the Reciprocal System.

Comparison / Derivation of Other Theories

How other theories are a subset of the Reciprocal System, or a mis-interpretation of data which is clarified by the Reciprocal System.

Extrapolation

Applying the postulates of the Reciprocal System to other areas of research, demonstrating the general nature of the theory.

Interpolation

Filling in gaps in the Reciprocal System, where "leaps of faith" are currently made.

Alternate Viewpoints for Clarification

Provides different analogies and viewpoints of existing points within the Reciprocal System for sake of clarity.

Error Correction

Identification and correction of unclear or erroneous information within the Reciprocal System.

Theory Leading to a Development/Postulate

Theory regarding the nature of space, time, discrete units, etc., that eventuate in the development of the postulates of the Reciprocal System.

Unacceptable Articles

Articles considered unacceptable for publication fall into these categories:

Insult or Harassment

Any type of insult or derogatory remark directed towards an author or group, inside or outside of ISUS. Though constructive criticism is acceptable, it should not be a psychoanalysis of an individual showing how they could come to such "ridiculous" conclusions.

Irrelevant

Any article not directly concerned with the advancement and understanding of the Reciprocal System of theory or a sanctioned project of ISUS.

Submital Guidelines

When writing an article for publication, it is necessary for the article to include:

1. Establishment of a connection to the Reciprocal System of theory by:

   a. Identify a beginning point within the commonly accepted Reciprocal System, and extend the new development from that point.

   b. Identify two points within the Reciprocal System where the connection is unclear or questionable, and either clarify the connection or provide a new development showing the connection, maintaining the basic premises of the Reciprocal System.

   c. Provide a new theory or development, which leads to a commonly accepted point in the Reciprocal System. (For example, a theory that leads to the conclusion that motion must exist in 3 dimensions).

2. The extended development follows a logical or mathematical progression, with no gaps.

3. All contradictions to the commonly accepted Reciprocal System must be clearly identified, and thoroughly explained.


The Question of Beyond Space and Time

As stated in its by-laws, ISUS is dedicated to the promotion of the physical sciences. As the information presented in Larson’s final book, Beyond Space and Time addresses some aspects of the metaphysical, question arises as to whether articles written concerning metaphysical topics have a place in Reciprocity. Whereas the physical sciences include the study of life, as in biology, and the only work of Larson that addresses the life sciences is Beyond Space and Time, the bulk of material in Beyond Space and Time is indeed, without question, concerned with the physical universe.

There is also an unclear demarcation of what is
“non-physical.” The physical universe, as commonly understood in the Reciprocal System of theory, is composed of motion of space and time—the first two sectors. However, the “control units” of the 3rd sector (discrete units), indicates that the 3rd sector has some of the same attributes as the first 2 sectors, the Material and the Cosmic do, and may also be a part of the physical universe; or at least have a manifestation within the physical universe.

Until further research is available, the reasonable conclusion is that the 3rd, Metaphysical sector deals with the physical universe—manifesting as human life, and Beyond Space and Time is in agreement with the By-laws and mission of ISUS; thus articles submitted concerning developments within Beyond Space and Time will be considered for publication in Reciprocity by the same guidelines as articles concerning the other physical sciences.

**In Consideration**

Articles exploring new realms using the postulates of the Reciprocal System are encouraged; as this would truly show the general nature of the theory, as well as widen the readership base.

Dewey B. Larson, prior to introducing New Science Advocates (now ISUS) in Nothing But Motion states:

“The scientific community is naturally reluctant to change its basic views to the degree required by my findings, or even to open its journals to discussion of such a departure from orthodox thought. It has therefore been a slow and difficult task to get a significant amount of serious consideration of the new structure of theory.” [Nothing But Motion, pg. viii]

I would hope that this statement is never made by an ISUS member about Reciprocity; for if it is, the Reciprocal System of theory has been lowered to the state of religious dogma, and is no longer science.

The Reciprocal System is the best cosmology mankind has devised to date. Researchers, as pioneers into this new realm, should never forget the value of exploring new territory—for only explored regions are settled by conventional man, and conventional science.

---

**Dr. Arnold Studtmann Has Been Found**

**Prof. Frank H. Meyer**

Our ISUS, Inc. Associate Editor, Bruce M. Peret, is a most enterprising operator. As many of you know, we have been searching for our lost colleague and friend, Arnold Studtmann, for a number of years with no success. Bruce, who with his Amiga on-line computer, has been aiming to update and clarify our Membership and Subscriber lists, has an alert, intuitive intelligence of how, when and where to turn up sought for, hard-to-find information. Sunday evening, December 8, 1996, Bruce reported to me that while searching through a Portland, Oregon computer telephone directory, he came across an Arnold and Gwen Studtmann, 5230 SW Scholls Fry Road, Portland, OR 97225-1612; (503) 297-3421.

Arnold and I became acquainted during the 1970's, while we were both on the faculties of the University of Wisconsin System. Arnold, at the time, was both a Professor of Physics and a Christian Minister. For ISUS members, Arnold, to the best of my knowledge, has the distinction of being the very first person to win a Ph.D. for choosing to do, and doing, his dissertation on his inquiry about Dewey B. Larson's Reciprocal System of Physics, and its astrophysical implications. He obtained his graduate degree from the National Graduate School in 1979. I thank Arnold for his pioneer work in reciprocal astrophysics; I have found the work a valuable asset to my learning more about the Reciprocal System.

Bruce's lead was too promising to ignore. I soon was on the phone and Ms. Gwen Studtmann, Arnold's wife, answered and identified our friend and associate, as her husband. My joy was short-lived, however, when Gwen reported that Arnold had died in 1992, four years earlier. While I believe Arnold died too young, I also think that, in the light of Dewey Larson's Beyond Space and Time, Arnold continues to thrive in the spirit of our Third, Non-Physical Sector of Human Existence.
The Conceptual Foundations of Physical Science

Dewey B. Larson

The frontiers of modern science are in the far-out regions, the realms of the very small, the very large, the very fast, the very dense, and so on. It is there that spectacular discoveries are being made, and the boundaries of physical science are being extended into the hitherto unknown. But some of these achievements that have been headlined in the press and in the scientific journals, have had collateral results of even greater significance that have been overlooked by the scientific community. These particular discoveries have given us factual information about some of the fundamental physical entities that have heretofore been accepted as being beyond the range of physical investigation. When we examine all of the implications of this new knowledge, it becomes clear that the prevailing view of the nature of the basic constituents of the physical universe will have to be drastically modified.

Physical science, as it exists today, is primarily mathematical. As expressed by Richard Feynman, "Every one of our laws is a purely mathematical statement." However, there is another aspect to this branch of knowledge. Although the mathematical expressions of the various physical relations are ordinarily all that we need to know for their practical application, the scientific community is not satisfied with this. We also want to know what the mathematical terms and relations mean; that is, we want a conceptual explanation of these mathematical laws, and an understanding of the physical relations between the various quantities. In response to this desire for something more than mathematics, much of the current research in "pure physics" is being devoted to attempts to broaden conceptual understanding. Here we encounter the problem of verification.

Mathematical expressions of physical relations can be verified by direct correlation with physical observations and measurements. If such an expression is so tested over a wide range, and no discrepancies are found, this establishes that it is valid within the limits to which the correlation has been carried, and to the degree of accuracy of the measurements. It does not necessarily follow that this mathematical expression is unique. There may be other expressions, known or unknown, that produce the same results within the limits to which the one under consideration has been tested. But mathematical expressions that arrive at the same results are merely different ways of expressing the same mathematics. Thus as soon as a valid mathematical answer is obtained, we have the correct answer. Mathematical expressions of physical relations can therefore be verified individually.

The conceptual expression of a physical relation (usually an interpretation of the previously formulated mathematical expression) likewise is not unique. In almost all cases there are known alternatives, and the possibility of the existence of unknown alternatives is always present. These different conceptual formulations are not equivalent. They are different explanations, and only one of them can be correct in each case. Thus, the conceptual explanations (theories) of physical relations cannot be verified independently by comparison with the results of observation and measurement.

The general tendency today is to regard verification of the mathematical aspects of a theory as verification of the theory as a whole, including the conceptual interpretations. The so-called "proofs" of the validity of current popular theories that appear from time to time in scientific literature are purely mathematical. But obviously, a demonstration that the mathematical expression of a physical relation is correct, does not prove that the meaning being given to the various terms of that expression are a correct description of the corresponding physical realities. Conceptual validity cannot be established mathematically.

All this boils down to the fact that the conceptual validity of a theory can only be verified logically, and relative to an assumed set of premises. A theory, or other conclusion, is valid, in this sense, and to this degree, if it is logically derivable from those premises. Unless those premises are of a
fundamental nature, however, this validity has little significance. This is the problem of present-day science. It cannot derive its conclusions from the assumptions that it makes about the basic physical entities. In every instance, additional assumptions specifically applicable to the phenomenon under consideration are required. Consequently, the total number of assumptions included in the premises of modern physical science runs into the thousands.

If the fundamental entities and phenomena are correctly identified, and the assumptions as to their nature and properties are correct, it clearly should be possible to deduce the principles and relations governing physical activity in all of the subsidiary fields without making any further assumptions. As matters now stand, however, this has never been accomplished in any of these fields. Not only does every subdivision of physical science require a special set of additional assumptions, any major addition to empirical knowledge in one of these fields necessitates adding still further assumptions, or revising the ones previously made. The universality of this inability to extend the theories into more detail, or into new areas, without making additional assumptions is a clear indication that there is some error, or errors, in the assumptions regarding the physical fundamentals.

This conclusion should not come as a surprise to anyone who realizes how little we know about the fundamental physical entities. Some of them are almost totally unknown, and definite information about the others is scarce. For instance, the physicists cannot answer the question, "What is an electric charge?" We are told that we should not ask the question, that the charge simply has to be accepted as a given feature of the universe that is unexplainable. Time is even more of a mystery.

But these, and the other fundamental entities, enter into every physical event in one way or another, and in order to formulate theories to explain those events, their nature and properties must be taken into account. Where these are not known, it is necessary to substitute assumptions for the missing knowledge. Some of these basic assumptions are pure guesses, with no tie-in to physical facts. In other cases, the assumption is made that the appearance which the item in question presents to the casual observer is a true indication of its nature. Such an assumption has a greater probability of being correct than pure guesswork, but in view of the extremely small fraction of the total range of physical conditions—temperature, pressure, size, density, etc.—that we encounter in our direct experience, the universality of any conclusion drawn from that experience is, to say the least, questionable.

The conceptual foundation of present-day physical science consists of some 30 or 40 of these assumptions about the basic entities and phenomena—the exact number depending on just what items are taken as fundamental in the construction of a particular theory. Let us then ask, "What is the probability that all of these 30 or 40 assumptions about unknown or little known basic entities are valid?" The answer clearly has to be that the probability is very low. The previous conclusion that some error, or errors, must exist in the fundamental assumptions of physical science is thus corroborated by the finding that the existence of such an error, or errors, is practically inevitable.

The only method that has been available for the correction of such errors is to make some change in the assumptions, and see whether this change improves the general theoretical picture. However, few proposed changes have been able to gain general acceptance, and the results of those that have been accepted are inconclusive. Consequently, these have not materially altered the situation described in the preceding paragraphs. The true nature and properties of the basic physical entities are essentially unknown, and the general scientific opinion apparently accepts Einstein's dictum that they are unknowable. He specifically condemned the idea that "the basic concepts and laws of physics could be derived from experience," and asserted that they could only be grasped "by speculative means."

Long-continued inability to make any progress toward connecting these basic concepts with experience has left Einstein's conclusions without serious opposition, and the issue has receded into the background, where it remains dormant. In very recent years, however, a new factor, not yet recognized by the scientific community, has entered into this picture. Continued extension of the field of scientific investigation has finally taken it to the point where empirical discoveries have provided some factual information about certain of the fundamental physical entities, and have enabled replacing some of the assumptions about these entities with actual knowledge.

One of these very significant discoveries is the finding that, under appropriate circumstances, matter can be transformed into non-matter, and vice versa. For example, matter can be transformed into radiation, or into kinetic energy. From this, it follows directly that the building blocks of the universe cannot be elementary particles of matter,
existing in a framework provided by space and time, as assumed by present-day physics. There necessarily has to be a common denominator underlying both matter and non-matter.

The idea that the primary physical entity is something more fundamental than matter, is not new. It has been a subject of discussion in scientific circles for centuries. The new element that has now entered into the situation is the discovery of the transformation phenomenon, which shows conclusively that such a common denominator must exist. Once the reality of this existence has thus been demonstrated, the nature of the underlying entity is evident. Long consideration of the problem by a host of scientists and philosophers, has established that motion is the only known physical quantity that can meet the requirements. Energy has been favored by some investigators, notably Heisenberg, but it is now generally conceded that energy does not have the necessary flexibility. The transformation processes that are now known make it clear that, unless there is some basic entity of which we have no evidence whatever, we live in a universe of motion.

It then follows that the many investigators who have attempted, without success, to construct a theory of a universe of motion must have missed one of more of the salient points that enter into this situation. As it happens, another of the modern discoveries that enables replacing assumption with fact supplies us with the key to the resolution of the problem. This is the discovery of the recession of the galaxies. Astronomical observations indicate that all of the distant galaxies are receding from us at high speeds. Unless we assume that our Milky Way galaxy is the only stationary galaxy in the universe, a hypothesis that is rejected by modern science, it must be receding from all of the others.

If these were ordinary vectorial motions, oppositely directed motions would cancel each other, and the net resultant would be little or no actual change of position. But the galactic separations are increasing rapidly, and if our galaxy is not unique, we must be participating in the changes of position that cause these increases in separation. Thus, we are actually moving outward in all directions from any initial position. This means that the motions have no specific direction. They are simply outward (that is, positive) and can be completely described by a positive magnitude. They are scalar motions.

Here, then, is the reason why the many scientists and philosophers who have recognized the superiority of motion over matter as the basic constituent of the universe, and have tried to construct the theoretical framework of a universe of motion, have been unable to make any significant progress toward their goal. They have been attempting to build a universe of vectorial motion, whereas the information now available shows that the physical universe is actually a universe of scalar motion, in which vectorial motion is a derivative phenomenon of relatively limited scope.

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The International Society of Unified Science

Presents its World-Wide Web Site!

Surfing the Internet? Stop by the ISUS Web Site for a collection of articles, reviews, books, and the latest information regarding Dewey B. Larson’s Reciprocal System of Theory. Browse the North Pacific Publishers Online page for the latest collection of books, reprints, video and audio tapes available for purchase from ISUS. Hosted by ISUS Board of Trustee member Jan Sammer (interpre@login.cz).

Computing the Gravitational Constant

Hoyt A. Stearns

In the Reciprocal System (RS), there is a consistent set of natural units. All physical constants are derived from these, usually having a value of 1. A complication is that in non-RS physics, mass is treated as an independent entity, whereas in RS, it is in units of time³/length³.

All units are in terms of space and time only. All physical units can be derived consistently in these terms, since everything is made up of combinations of actual units of space and time only, in various combinations in 3 dimensions; i.e. the fundamental particle is an actual discrete unit of space-time).

First we’ll derive some of the Reciprocal System’s natural units nu.

- Unit speed is c = s/t, s=space(length), t=time.
- Acceleration is s/t².
- Force is in units of tu².
- Unit mass in RS is t³/s³.

To convert the unit natural values to cgs, we have to equate these to some physical phenomena known in cgs. Unit speed is obviously c. Unit time is 1/2 cycle of the Rydberg Constant, R (because a full cycle includes a unit of time alternating in opposite directions to make a full cycle).

For R in Hz (sec⁻¹), unit-time t is:

1/(2R) (sec/unit-time nu).

Unit length is therefore:

\[ \frac{c}{2R} \text{ (unit-length cs/unit-length nu).} \]

Unit acceleration:

\[ 2Rc \text{ (unit-acceleration cs/unit-acceleration nu) } \]

Because mass in RS is defined in terms of space and time, and in other systems it is an independent unit, we derive hybrid conversion factors:

Define M as the mass, in AMU, of a natural unit of mass.

\[ M = 1 + \frac{1}{128*(1+2/9)} = 1.00639205 \text{ amu.} \]

The term \(128*(1+2/9) = 156.4444\) is called the Inter-Regional Ratio in RS, and is derived from the degrees of freedom the motions constituting an atom have.

\[ cs \text{ means unit expressed in cm and seconds.} \]
\[ nu \text{ means natural units.} \]
\[ gram \text{ means unit mass expressed in grams.} \]

One mole of natural mass units = M grams cgs

- M/N (unit-mass gram/unit-mass nu).

One natural mass unit in space-time units (sec³/cm³) is:

- \(1/c³ \text{ (unit-mass cs/unit-mass nu)}\)

The ratio of unit mass expressed in sec³/cm³ to unit mass expressed in grams:

- \(N/Mc³ \text{ (unit-mass cs/unit-mass gram)}\)

Using Force=ma, we must use the hybrid mass conversion factor to get the ratio Force nu/dyne:

\[ \text{dyne} = \text{unit-mass cgs \ unit-acceleration cgs} \]
\[ F\ nu = \text{unit-mass nu \ unit-acceleration nu} \]
\[ = \frac{tu²}{(128R/c²)²} = 2R/c². \]

- \(2R/c² \text{ (unit-force cs/unit-force nu)}\)

\[ \text{dynes} = \text{grams cgs cm/sec²} \]
\[ F\ nu = \text{unit-mass nu \ unit-length nu / unit-time nu} \]
\[ = \frac{tu²}{(128R/c²)²} = 2R/c². \]
\[ \text{dynes} = F\ nu \ M/N(grams cgs/unit-mass nu) \]
\[ \frac{c}{2R} \text{ (cm/unit-length nu) / (1/(2R))² (sec/unit-time nu)²}. \]

Unit force cgs is:

- \(2Rc/M/N \text{ (dynes/unit-force nu)}\)

Now that the conversion factors are defined, we’ll work with s and t, which are unit-length nu and unit-time nu.

\[ (\text{unit-force nu}) = \]
\[ = (\text{unit-mass nu}) \times (\text{unit-acceleration nu}) \]
\[ = t/s² = t³/s³ s/t² \]

Continued on Page 20...
The Photon as Birotation

K.V.K. Nehru

Introduction

In an earlier paper\(^1\), I have discussed some of the conditions under which a scalar motion manifests in the conventional spatial reference system, and shown that the simple harmonic motion (SHM) of the photon is really a birotation. While it is clear that a SHM underlies the photon from the phenomena of interference and diffraction, the genesis of SHM, given only uniform speed (as in scalar motion), is not possible except through rotation. In a subsequent paper\(^2\), I have elaborated on the characteristics of rotation and birotation, and shown how they result in observed phenomena, like circular polarization and angular momentum of photons.

In the present paper, several other characteristics of the photon phenomena that demonstrate, directly or otherwise, that the photon is basically a birotation are considered.

The Angular Momentum of Photons

We have seen\(^1\) that the photon is comprised of two equal and opposite rotations about an axis, with the axis being, normally, in the direction of translation of the photon. The total energy, \(E\), of the photon is the sum of the energy of translation, \(T\), and the internal energy of rotation, \(R\). In the absence of any biasing factor, one can see that \(E\) is equally partitioned into \(T\) and \(R\). Let

\[
\begin{align*}
\text{m} & \quad \text{apparent mass of each component of the photon} \\
\text{I} & \quad \text{moment of inertia of each component of the photon} \\
\pm & \quad \text{angular velocities of either component} \\
\text{Planck's constant, } h, & \quad \text{divided by 2} \\
\text{wavelength of the photon} & \quad \text{frequency of the photon} = \frac{1}{2} \\
\text{c} & \quad \text{the speed of light}
\end{align*}
\]

Then

\( T = R = \frac{1}{2} E = \frac{1}{2} \) \hspace{1cm} (1)

Considering both component rotations:

\( T = 2 \left( \frac{1}{2} m c^2 \right) = \frac{1}{2} \)

or

\[
m = \frac{1}{2} c^2 \] \hspace{1cm} (2)

or

\[
R = 2 \left( \frac{1}{2} I \right) = \frac{1}{2} \] \hspace{1cm} (3)

or

\[
I = \frac{1}{2} \] \hspace{1cm} (3)

Turning now to angular momentum, \( l \), of each component rotation, we obtain using Equation (3)

\[
l = I = \pm \frac{1}{2} \] \hspace{1cm} (4)

The \( \pm \) sign occurs since could be \( \pm \). The angular momentum of the photon itself works out to be

\[
L = \pm \text{ or } 0 \] \hspace{1cm} (5)

since the two component rotations could either be parallel (\( \pm I \) or \( -I \)) or antiparallel (\( I \)). It might be noted that \( L \) is independent of \( I \), and turns out to be the same for photons of all frequencies. This agrees with experimental observations.

The Doppler Shift

R. A. Waldron\(^3\) extends the above analysis to the calculation of Doppler shifts. Suppose a photon of frequency \( v_0 \) was emitted by a source that is stationary with respect to the observer, then

\[
E_0 = h v_0 = T + R = m c^2 + m c^2 = 2 m c^2 \] \hspace{1cm} (6)

since \( T = R \).

However, if the observer is approaching the source with a velocity \( v \), then the translational energy would be \( 2 \left[ \frac{1}{2} m (c + v)^2 \right] \) instead of \( 2 \left( \frac{1}{2} m c^2 \right) \), while the rotational energy remains unchanged at \( I^2 = mc^2 \). The measuring apparatus absorbs this energy; but this cannot be distinguished from the effect of absorbing a photon of frequency such that

\[
E = h = m (c + v)^2 + m c^2 \]

\[
= 2 m c^2 \left( 1 + \frac{v}{c} + \frac{1}{2} \frac{v^2}{c^2} \right) \]

Substituting from Equation (6) in the above and writing \( v/c = \), we have

\[
/ \bigg|_{0}^{0} = 1 + \frac{1}{2} \]

\[
D 25.3-11
\]
Changing frequencies to wavelengths, we have the Doppler shift formula

\[
\frac{o}{v} = \left(1 + \frac{v}{c^2}\right)^{-1} = 1 - \frac{v^2}{c^2} + \frac{3}{4} \frac{v^4}{c^4} + \ldots
\]  

(8)

which agrees well with the orthodox Doppler formula

\[
\frac{o}{v} = \left(\frac{1 - \frac{v}{c}}{1 + \frac{v}{c}}\right)^{1/2} = 1 - \frac{v^2}{2c^2} + \frac{3}{8} \frac{v^4}{c^4} + \ldots
\]  

(9)

(since is usually small, terms of order greater than 2 could be ignored).

**Dispersion**

In ordinary refraction, a light beam incident on a medium at an angle \(i\), changes direction and gets refracted at an angle \(r\) in the medium. This change in direction could be shown as being due to the reduction in the speed of light from \(c\) to \(v\) in the medium, and that the following relation holds good:

\[
\sin i / \sin r = c / v = n
\]  

(10)

This ratio \(n\) is called the index of refraction. The fall in speed is, of course, due to the additional time involved in the net time displacement of the material medium through which the photon traverses. At this juncture we would also like to note that, for a given substance, the refractive index \(n\) increases as a power function of the frequency of light, which implies that the fall in speed on entering the medium is more for higher frequencies. This, of course, results in the phenomenon of dispersion, which is defined as the change in speed of light in a medium that is engendered by a change in wavelength or frequency of the light. Larson has computed the refractive index and the dispersion coefficient of several substances from the first principles of the Reciprocal System.\(^4\)

The relation between the refractive index \(n\) of a medium and the frequency could be derived from the theory we have been developing as follows. On entering the medium, the photon is located in the time displacement of the atom, instead of the space unit of the outward progression; rather, it is the atom, which has been moving inward in space, enters the photon, the latter being stationary with regard to the natural reference system. Consequent to this, the datum (initial) level from which the photon's apparent mass is reckoned gets altered.

It might be noticed that we have been calling \(m\) the **apparent** mass of the photon. Since mass is three-dimensional inverse speed, whereas the photon is only a one-dimensional (rotational) speed, the photon does not have a true mass. However, it does have intrinsic angular momentum, since the photon is rotation **per se**, and this manifests as an apparent mass, given by

\[
m = I^2 / c^2
\]  

(11)

We may truly call it "spin mass." The reason why the translational energy of the photon equals its rotational energy (Equation (1)) should now be obvious,

\[
T = mc^2 = (I^2 / c^2) c^2 = I^2 = R
\]

The apparent mass of the photon is entirely spin mass.

Let \(I\) be the rotational speed of the atom of the medium. The reference level for the rotational energy of the photon on entering the atom gets changed since it must now be reckoned from the level of the atomic rotation, and not that of free space. Consequently, the change in rotational energy could be expressed as:

\[
I^2 - \frac{I^2}{c^2}
\]  

(12)

The introduction of the new datum level for rotation has, of course, a corresponding effect of changing the datum level of the spin mass. This we express by writing (using Equation (11)):

\[
m_i = I^2 / c^2
\]  

(13)

where \(m_i\) is the mass equivalent of the datum shift of rotation.

In the general situation, a unit of the apparent mass of the photon need not be equal in (natural) magnitude to a unit of the apparent mass pertaining to atomic rotation, since the latter has a different reference point and is contingent on the chemical composition and the crystal structure. This engenders a scale difference between the two. Let this scale factor be \(f\). Then \(m_i\) units of the apparent mass from the point of view of the atomic rotational system are equivalent to \(f m_i\) units from the point of view of the photon rotational system. Thus, the apparent mass of the photon, as reckoned from the atomic system in which it is now located, turns out to be:
With the new initial levels in the medium, the speed of propagation readjusts itself such that the rotational and the translational energies of the photon become once again equal, with reference to these new initial levels. Thus:

\[ I \omega^2 - I \omega_1^2 = (m - f m_1) v^2 \]  

(15)

where \( v \) is the speed of light in the medium. Substituting from Equations (11) and (13), and dividing throughout by \( I \):

\[ \omega^2 - \omega_1^2 = (\omega^2 - f \omega_1^2) v^2 / c^2 \]

or

\[ c^2 / v^2 = (\omega^2 - f \omega_1^2) / (\omega^2 - \omega_1^2) \]

(16)

Let

\[ a = 1 / (f - 1) \] and \[ b = 4 \pi^2 a / \omega_1^2 \]

(17)

Since \( c / v = n \), we finally arrive at

\[ n^2 = 1 + 1 / (a - b v^2) \]  

(18)

It might be noted that the relation derived from the conventional electromagnetic theory is identical to this. Comparison with data shows that the equation is quite accurate (correlation coefficient > 0.999).

In the case where there exists more than one rotation \( \omega_1 \) in the medium, we proceed as follows. Let \( n_1 \) be the refractive index calculated on the basis of a single atomic rotation \( \omega_1 \) (as though it exists alone) and let there be \( r \) such different rotations. It can be seen that the overall refractive index \( n_0 \) is the R.M.S. (root mean square) value of \( n_1 \). In other words

\[ n_0^2 = \sum_{i=1}^{r} p_i n_1^2 \]  

(19)

where \( p_i \) is the proportion of each \( \omega_1 \) among the total number of rotations, such that

\[ \sum_{i=1}^{r} p_i = 1 \]  

(20)

This is because the quantity \( n^2 = c^2 / v^2 \), being the square of the inverse speed in natural units, actually represents the time region equivalent of energy (remembering the second power relation pertaining to the time region). Consequently, Equation (19) gives simply the average time region energy, so that \( n_0 \) becomes the effective refractive index.

**Anomalous Dispersion**

Any complete theory of dispersion must also account for the so-called anomalous dispersion. Normally, the refractive index increases with an increase in frequency, but beyond some sufficiently high frequency, it is found that the refractive index becomes abnormally low. A prism made of an alcoholic solution of fuchsin (an analine dye), for example, refracts violet light less than red, although red, orange, and yellow appear in the normal order. An examination of Equation 18 reveals that this would indeed be the case when the frequency \( v \) is very near the value \( \sqrt{(a+1)/b} \), but greater than it.

**Birefringence**

This is the phenomenon of double refraction and is exhibited by optically anisotropic crystalline substances, some examples being Icelandic spar, quartz, ice, tourmaline, apatite, borax, mica, topaz, etc. If a beam of light is made to pass through such a substance, it has been found that it gives rise to two beams, one of which corresponds to the single beam which would have been transmitted, had a substance like glass been used. This beam is called the ordinary (O) beam; the other, the extraordinary (E) beam.

Now in ordinary refraction, \( n \) is found to be constant for all incident angles. This is true of the O beam in the phenomenon of birefringence. But the E beam is found to vary with direction, thus implying that the speed of the E beam is dependent on direction. In some crystals, the E beam travels faster, and in some others, slower than the O beam. Moreover, it is also observed that the O and E beams are plane polarized, with their planes of vibration being perpendicular to each other.

This behavior could readily be understood if we remember the birotational basis of the photon. If a certain quantity of rotational motion in the form of a birotation \( B(-\alpha, +\alpha) \) occurs in the crystal structure such that its axis is parallel to the E beam, and phase coincident with that of the photons of the E beam, then the component angular speeds, \( -\omega \) and \( +\omega \) of the photon get changed such that they become \( -(\omega + \alpha) \) and \( (\omega + \alpha) \). This apparent increase in frequency (relative to the medium) brings forth a corresponding fall in the translational speed, as in dispersion, causing the E beam to travel slower than the O beam. In the case that the operating birotation B compounds with the photon component speeds as \( -(\omega - \alpha) \) and \( (\omega - \alpha) \), the result would be that the E beam travels faster than the O beam.
It might be noted, in passing, that the supervening birotation $B$ does not interact with the $O$ beam as their respective planes of vibration do not coincide. It must be understood that the altered value of the $E$ beam frequency within the medium is an effect of the change of the initial (datum) level (of rotation), and not an absolute change in the magnitude of $\omega$. Consequently, on emerging from the medium, the photon frequency shows up as $\pm \omega$ only.

**Rotatory Polarization**

**Optically Active Substances**

There is a class of optically active substances which have the property of rotating the plane of vibration of light as it traverses them. Some rotate the plane of vibration to the left, and others to the right, and are consequently classified as *laevo-rotatory* and *dextro-rotatory*, respectively. It has been found that the angle of rotation is proportional to the thickness traversed, and also to the first approximation of the square of the frequency.

The explanation of the phenomenon comes out naturally from the birotational nature of the photon. Let, as before, $-\omega$ and $+\omega$ be the angular speeds of the two components of the photon. As it traverses this type of substance, it encounters a rotation, say $R(+\alpha, +\alpha)$, pertaining to the molecules, and the component rotations get modified as $-(\omega-\alpha)$ and $(\omega+\alpha)$. This decrease and increase in speed magnitudes of the two rotational components respectively engender corresponding changes in the speeds of propagation, as in dispersion. This phenomenon may aptly be called circular birefringence. This produces a phase difference between the two rotational components of the photon which is proportional to the thickness. The end result is the rotation of the plane of vibration of the photon.

From the theory we have been developing, the angle of rotation of the vibrational plane can easily be worked out as follows. Let $-(\omega-\alpha) = \omega_1$ and $(\omega+\alpha) = \omega_2$. If $t$ is the thickness of the medium, the time taken by the component $\omega_1$ to traverse it is

$$\tau_1 = t / v_1 = (t/c) n_1 \quad (21)$$

where $v_1$ and $n_1$ are the speeds of propagation, and the refractive index, respectively, of the component. Thus, the angle turned by this component during time $\tau_1$ is

$$\theta_1 = \tau_1 \omega_1 = (t/c)(n_1 \omega_1) \quad (22)$$

Considering similarly the other component $\omega_2$ of the photon, the net angle turned through by the vibration plane will be

$$\phi = (\theta_2 - \theta_1)/2 = \frac{1}{2}(t/c)(n_2 \omega_2 - n_1 \omega_1) \quad (23)$$

since $\theta_1$ and $\theta_2$ are in opposite senses.

Changing from $\omega$ to $\nu$ and adopting Equation (18) for $n$ and expanding the right hand side in series, we arrive at the following result

$$\phi = \frac{1}{2} (t/c) (A + B\nu^2 + C\nu^4 + \ldots) \quad (24)$$

where the constants $A$, $B$, $C$, *etc.*, are dependent on the material, and are functions of $\alpha$, and the powers of $\nu$ are all even. Both the dependence on $t$ and $\nu$, of $\phi$ are very accurately represented by Equation (24) as may be checked from observational values.

The parity of this rotatory polarization would be opposite to that of the above if the encountered rotation in the medium is $R(-\alpha, -\alpha)$, instead of $R(+\alpha, +\alpha)$. In this case, the photon component rotations would be respectively $-(\omega+\alpha)$ and $(\omega-\alpha)$. It should also be noted that if the beam is reversed the original rotation (of the vibration plane) is annulled.

**Rotation by Magnetic Field**

It is also known that when some substances—many solids, liquids, and gases—traversed by a beam of plane polarized light are placed in a strong magnetic field, a rotation of the vibration plane occurs. The angle of rotation is found to be proportional to the strength of the magnetic field, and also the length of travel.

This is what is to be expected, since we know that the magnetic field is a two-dimensional rotational vibration. As explained earlier, this super-imposed rotation speeds up one component of the photon birotation, and slows down the other, resulting in the phase difference and consequent rotation of the vibration plane. The dependence on the field strength and the path length are likewise understandable. But what is not so readily apparent, is the result that if the beam is reversed, keeping the field direction the same, the sense of the rotation (of the vibration plane) will be opposite to the previous. So much so, that if a beam is reflected back and forth along the lines of force, the amount of rotation should be greater for the greater the number of reversals. This, of course, is exactly established experimentally.
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Direct Measurement of the Photon’s Angular Momentum

Elsewhere,\(^1\) I had already mentioned how the angular momentum of photons could be directly measured. Richard Beth\(^2\) had devised an ingenious experimental setup that directly detected and measured the effect. The heart of his apparatus consists of a circular half wave plate of quartz, hung by a fine filament and free to rotate. Beth contrives to pass a circularly polarized light beam through this plate twice, such that each time the beam passes, its circular polarization changes from CW to CCW, and thereby imparts to the disk, four times the angular momentum which would otherwise have been given, were the beam merely to be absorbed. Avoiding absorption also eliminates the problem of heating and pressure.

The Zeeman Effect

When a light source is placed in a magnetic field, a single spectral line is replaced by a number of others. This separation of the spectral lines resulting from the action of a magnetic field on the source is called the Zeeman Effect. In the so-called normal Zeeman effect, when the direction of the light beam is perpendicular to the magnetic lines of force, instead of one spectral line, three are found; one with a wavelength the same as when the field is absent, a second with a wavelength slightly greater, and a third with a wavelength slightly less than the first. It is also found that all the three wavelengths are plane-polarized, the vibration plane of the first line being along the lines of force, and that of the other two at right-angles to this direction. This is called the transverse Zeeman Effect.

On the other hand, if the direction of the field lines is parallel to the beam direction, we have the longitudinal Zeeman Effect. In this case, the original wavelength is replaced by two, one with a wavelength slightly greater, and the other with a wavelength slightly less than the normal; the beams being circularly polarized in opposite senses.

Both these effects can be seen to follow directly from the birotational basis of photons. In Figure 1, the three mutually perpendicular dimensions of space are shown by the lines OX, OY, and OZ. The beam direction is OZ. The direction of the magnetic field is indicated by a thick arrow. The three possible orientations for the birotation in the system are shown by B1, B2, and B3. In Figure 1(a), the field direction is along OY (being perpendicular to OZ). One or the other of these three birotations can emit photons with corresponding rotational components. The magnetic field has two effects on the birotations. Firstly, since the magnetic motion is rotational, the two components of the birotation with the axis parallel to the field direction alter their speeds of rotation, ±, one component speeding up and the other slowing down. In Figure 1(a) this happens to B1. Because of this, these two circular motions of B1 appear as vibrations of two different frequencies with their plane of vibration perpendicular to the field direction. Secondly, in the case of the two birotations B2 and B3, the plane of vibration will be parallel to the field direction. Thus, the vibration emitted from these will be along ab or cd (Figure 1(a)); in either case, the vibration appears plane-polarized in the direction of the field and its frequency, , is unaltered.

In Figure 1(b), we have the field direction coincident with OZ. The first result is the change in the speeds of the components of B1, which, therefore, emit two circularly polarized photons, one in the CW direction, and the other in the CCW direction, with the respective frequencies slightly less and slightly more than . Since the vibration direction in the case of B2 and B3 (ab and cd in Figure 1(b)) is along the longitudinal direction OZ, no beam gets emitted in this direction. We therefore do not have a spectral line with the original frequency, , in this case.

Summary

We have endeavored to show that deduction from the postulates of the Reciprocal System leads one to the concept that the simple harmonic motion of the photon is really a birotation. In fact, the apparent mass of a photon is shown to arise from its angular momentum.

A complete theory of dispersion of light has been developed. Other phenomena considered to demonstrate the birotational nature of the photon were the Doppler shift, double refraction, rotatory polarization, circular polarization, and the Zeeman Effects.
References


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(a) The Transverse Effect

(b) The Longitudinal Effect

Figure 1: The Normal Zeeman Effect
The Space-Time Universe: Part III

K.V.K. Nehru

(Continued from Reciprocity XXV, Number 2, Autumn, 1996)

In the previous articles of this series, we have seen how the anthropocentric treatment of space and time has been a severe obstacle in the progress of (modern) science. We have then traced the new light on space and time brought out by Larson and have come as far as the genesis of light (radiation), as the first-born. We will continue with the development of the Reciprocal System and see how the rest of the physical manifestation unfolds.

Matter and Gravitation

We have seen that radiation arises out of the displacement of the basic motion from the one-to-one space/time ratio (i.e., unit speed) which is the neutral condition prior to physical manifestation. This displacement is a linear type. Now an examination of the properties of three-dimensional space reveals that this is not the only type of displacement of space-time that is possible, even though this is the only one that can originate first from the neutral condition of space-time. Another possibility is rotation. Thus we find that the second 'thing' manifested in the physical universe—the first 'thing' manifested being the photon, as we noted earlier—is a rotating unit: in fact, a rotating photon.

Scalar rotation differs from the familiar vector rotation of our ordinary experience in an important aspect. Scalar rotation, it is found, involves additionally a scalar, unidirectional transitory motion. (One can picture this as the forward movement of a rolling wheel.) In fact, the Theory shows how these rotating units reverse the motion pattern of free space (namely, its scalar outward progression) and start moving in the inward scalar direction: which means toward all other locations in space-time.

Larson identifies these rotating photons as atoms, atoms collectively as matter, and their inherent scalar inward motion as gravity.

The Secret Doctrine talks of 'elemental vortices inaugurated by the Universal Mind' (SD, ii, page 348). The material atoms are photons rotating in space—the photons themselves being linear vibratory time units. Thus it is literally true that matter is congealed light. It is this aspect of the Reciprocal System we will have occasion to refer to when we later consider the structures of atoms and Anu as given out in the Occult Chemistry by C.W. Leadbeater and Annie Besant as a result of their clairvoyant researches.

The explanation of gravity is outstanding achievement number three of the Theory. "The gravitational motion of each mass carries the mass inward in space-time. Since all other masses are similarly moving inward in space-time, each mass moves towards all other masses. Such a motion needs no medium, nor does it require a finite time for propagation; the inward motion is an inherent property of the atoms and there is no propagation." (NL, page 91)

Further, we can understand why our experience of time is so different from our experience of space. Our consciousness is associated with material bodies and the Reciprocal System shows that atoms of matter are time-structures (net displacement in time). Even though "...space actually progresses outward at the same rate as time, ...the outward motion which the space progression imparts to objects existing in this local environment is more than counterbalanced by the inward movement due to gravitation, and... we seem to see a stationary space." (NL, page 91) On the other hand, the progression of time is not abated since matter itself is a time-structure. Thus we experience in one second the equivalent of 300 million meters of space!

The concept of physical entities as compound motions is one of the greatest contributions which the Reciprocal System makes toward the clarification of the physical picture. This must be obvious to anyone who is familiar with the tenets of occult science. We can turn to the Mahatma Letters or The Secret Doctrine for bountiful quotations. (ML, page 136, 156, 163; SD ii, page 236-7, 241, 328)

The current scientific view that the atom is a composite structure, built up of smaller units, stems from the impression that if we can get particles out
of an atom—as in radioactivity, for example—then there must be particles in atoms. Once parts of an atom in the above sense are posited, it naturally becomes necessary to conjure up forces to hold them together, and Larson rightly reminds us that "...no clue has ever been discovered as to the nature and origin of the force that holds the 'parts' of the atom together." (NL, page 96)

The outstanding achievement number four of the Reciprocal System is to explain how the parts of the atom hold together. "There is nothing to explain, because the atom has no separate parts. It is one integral unit, and the special and distinctive characteristics of each kind of atom are not due to the way in which separate 'parts' are put together, but are due to the nature and magnitude of the several distinct motions of which each atom is composed." (NL, page 99) The original meaning of 'atom' as μ is justified, after all.

The two opposite motions, the ever-present outward scalar progression of space-time and the inward scalar progression that is gravity, govern the course of the physical phenomena throughout the universe. Since the effect of gravitation diminishes with distance while the background outward space-time progression is constant at unit speed, as it originates everywhere, we find that up to a certain distance—which Larson calls the gravitational limit—from a gravitating material aggregate, like a galaxy, the net motion is inward. Beyond the gravitational limit, the space-time progression becomes greater than gravity and the net motion is outward. This manifests to us as the recession of the distant galaxies from each other, and gives the linear relationship between the speed of recession and the distance, known as the Hubble's Law. There is absolutely no need to resort to an ad hoc hypothesis like the one popular with astronomers that the universe started from a Big Bang. The logical explanation of the galactic recession can be claimed as the outstanding achievement number five of the Reciprocal System.

The new look at gravity at once clarifies a puzzle about its nature which has, so far, not been explained by science—that it cannot be screened off, unlike other forces like electricity or magnetism. The explanation is that gravitational motion is not an interaction between one mass and another; it is the inherent motion of the individual atom (towards all other space-time units) and there is nothing that is propagated that could be screened off.

At this juncture, it may be of interest to see how the mass energy equation of Einstein arises. In the Reciprocal System, mass (inertia) is three-dimensional inverse speed while momentum and energy are respectively two and one-dimensional inverse speeds. It is already pointed out that c, the speed of light, has been identified as the natural unit of speed in the Reciprocal System. As such, one natural unit of inverse speed becomes 1/c in the one-dimensional case, and 1/c³ in the three-dimensional case. Thus, m units of mass and E units of energy, when expressed in the natural units, are respectively \( m / (1/c^2) \) and \( E / (1/c) \). We find that quantities expressed in the natural units can be equated directly and that the 'constants of nature'—like, for example, the Gravitational Constant or Planck’s Constant—are actually conversion coefficients whose numerical magnitudes are the result of choosing conventional units in an arbitrary manner. Thus we find that \( E / (1/c) = m / (1/c^3) \) or \( E = mc^2 \).

Another remarkable insight the Reciprocal System gives into the nature of gravity, which no scientist hitherto has ever suspected, is that gravitation does not always manifest as attraction; it also manifests as repulsion under certain circumstances! No doubt, students of occult literature, however, do find this intriguing concept enunciated at more than one place in The Secret Doctrine (SD, ii, pages 220-1, 238, 328; ML, page 160).

According to the discrete unit postulate, less than one (natural) unit of space does not exist. However, in view of the general reciprocal relation between space and time, an increase of time, say t natural units is equivalent to a decrease of space, of 1/t natural units. Consequently, we note within unit space, even though the space is constant at unit value, there is a progression of equivalent space. But the magnitude of this equivalent progression is a continuous decrease (i.e., 1/t decreases as t increases), which means that the progression is inward, in contradistinction to its outward progression in the region outside unit space. Since gravitation is a scalar motion always in opposition to the space-time progression, we find its scalar direction inside the unit space is outward. This manifests to us as a repulsion. In fact, the cohesion between atoms in the solid state is the result of the equilibrium between the inward progression of space-time and this outward motion of gravitation in the region inside unit space. This fact can account for all the types of atomic bonding. There is no necessity to arbitrarily resort to an assortment of explanations like the covalent bond, the ionic bond, the metallic bond, and the like. Larson demonstrates the truth of the underlying theory by calculating solely from it the values of a cohort of properties as inter-atomic distances, density, the compressibility
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According to the Reciprocal System, the liquid state of matter is reached when atomic cohesion is overcome in one of the dimensions by thermal motion, and the gaseous state is the result of overcoming cohesion in all three dimensions. Thus, the state of matter (solid, liquid, or gaseous) is shown to be the result of the state of the individual atom (or unit). Experiments on the melting point of solutions amply support this. This is an insight of great significance from the occultist’s point of view. The liquid state, for example, is regarded by modern science as a characteristic of the aggregate and not of the individual unit. In such a view, therefore, to speak of a ‘liquid molecule’, for example, is absolutely meaningless, since liquid state is regarded as the lack of long-range order in the arrangement of the individual molecules, and obviously order, or lack of it, refers to the relative arrangement of the individuals and is a group property and does not apply to a single unit by itself. However, from a study of the work of Leadbeater and Annie Besant on Occult Chemistry, we do get the impression that the change of state of matter is marked by the change in the condition of the individual unit (OC, see especially the section on Catalysis and Crystallization). The elucidation of the physical states of matter can be classed as outstanding achievement number six of the Reciprocal System.

Examination of the possibilities of the rotational motion that constitutes the atom, reveals the genesis of the Periodic Table of Elements on the basis of rotation in three dimensions. The Reciprocal System further shows that there is not only a lower limit (the positive zero) to this rotational displacement (namely, one unit) but there is an upper limit (the negative zero) too, because of the reciprocal symmetry between space and time. Thus, if the atomic rotation reaches this upper limit, the motion as rotational displacement is terminated and reverts to an equivalent amount of linear displacement (i.e., radiation). This is known to us as the phenomenon of radioactivity. As radioactivity is the result of reaching the negative zero level (as against the familiar positive zero level) the space-time relations are inverted. The order of the radioactive disintegration of the individual atoms is based on the proximity in time (unlike in the ordinary explosion where the action spreads on the basis of proximity in space). This shows up as random disintegration in space. Further, while in the familiar explosion in space the action spreads at a high speed, in radioactive disintegration, the action spreads at a high inverse speed, that is, slowly! This results in the long decay life (running into millions of years in some cases) of the radioactive elements.

Electricity and Magnetism

Since the Reciprocal System asserts that motion is the common denominator of the physical universe (cf. ML, pages 135-7, 155, 163), a question like ‘what is electricity’ does not arise. Everything in the physical universe is a form of motion; it only is necessary to see what type of motion is electricity. So far, we have considered linear translation, linear vibration and rotation. The next logical possibility is rotational vibration. Indeed, the theoretical development of the Reciprocal System shows that electricity and magnetism (or more technically, the electric and the magnetic charges) are one-dimensional and two-dimensional rotational vibrations, respectively (SD, page 241, 286; ML, pages 155-6). All the characteristics of electrical and magnetic phenomena can be deduced from this basis, including the derivation of the actual values of the material properties like electrical resistivity, susceptibility, permeability, and a host of others.

Incidentally, it will be found that electric charges are distinct from electric current. The latter comprises of the movement of uncharged electrons. An interesting feature of electrons are that they move through matter, not through the interstices. This is in view of the fact that the (uncharged) electron is effectively a rotating unit of space. Since the relation of space to space is not motion, an electron, when not carrying the electric charge, cannot move through empty space. On the other hand, matter is a time structure and since the relation of space to time is motion, electrons can move through matter. We will later again have occasion to refer to this phenomenon, in connection with the occult observations of Koilon.

The explanation of the origin and nature of electricity and magnetism is the outstanding achievement number seven of the Theory.

In a subsequent article we will endeavor to sketch the extraordinary truths brought to light by the Reciprocal System concerning the universe at large—truths which have not been suspected to exist.

(to be continued...)
Computing the Gravitational Constant

Hoyt A. Stearns, Jr.

The force of one unit-mass nu toward another at unit-length nu is 3 * unit-force nu. The factor 3 is due to gravity being effective in three scalar dimensions. Converting s and t from unity natural units to cm and seconds, we get \((c^2/2R) \text{ sec/cm}^2 = c^3\) unit-mass \(cs \sqrt{\frac{1}{2}} R \text{ cm/sec}^2\)

The force of m units of mass toward n units of mass at unit-length is just mn times the force for one mass unit (unitless m,n). The force of two masses reduces as the square of the number d of unit-lengths separating them (unitless d).

The general force equations are:

\[ F \text{ nu} = G \text{ nu} \frac{mn}{d^2} \text{ (unit-force nu)} \]; where \(G \text{ nu} = \) unitless 3, and m,n,d are multipliers of natural units.

Converting natural units to cm and seconds:

\[ F(\text{mass} cs \text{ cm/sec}^2) = 3 \frac{mn}{d^2} \text{ unit-mass} cs \text{ cm nu}/(\text{sec} nu)^2 \]

Converting mass in space-time units to grams:

\[ F(\text{gram cm/sec}^2) = F = 3 \frac{mn}{d^2} \text{ N/Mc}^3 \text{ unit-mass cm nu}/(\text{sec} nu)^2 \]

So \(G \text{ cgs} = 3\text{N/Mc}^3 = 6.66559478\times10^{-8} \text{ dyne-cm}^2/\text{g}^2\)

The gravitational constant is 3 times the ratio of natural unit mass in space-time units to unit mass expressed in grams.

The above derivation can be extended to electric and magnetic phenomena, as they are the 1 and 2 dimensional equivalents of gravity:

Electric charge in RS is t/s; Magnetic pole strength is \(t/s^2\); Coulomb’s law of electrostatic attraction is:

\[ F = k \frac{Q_1 Q_2}{d^2} \]

In natural units \(t/s^2 = k (t/s)(t/s)/s^2\), so \(k = 136670.11 \text{ cm}^2/\text{sec}\).

Coulomb’s law of magnetostatics is

\[ F = k m M_1 M_2 / d^2 \]

where \(M\) is \(t/s^2\), so \(km\) is

\[ s^4/t^3 = 1.228333\times10^{26} \]

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A Crucial Test of Pulsar Theory

Robert Tucek

Conventional Theory

pul-sar (pul'sär) n. A rotating neutron star, a source of regularly pulsing radio waves. [pulse + quasar]¹

pulsar: A rapidly rotating neutron star whose high-energy flashes of radiation sweep out into space; the energy is intercepted by terrestrial observers at regular intervals or pulses.²

Reciprocal Theory

...the ultra high speed products [of Type II supernovae] that are expanding in time and moving linearly in space are fast-moving Stage I (not optically visible) white dwarfs. Their most distinctive feature is the intermittent nature of the radiation that is received from them, and for this reason they are called pulsars.³

Background

From what I understand of the Reciprocal System of theory, pulsars are white dwarf stars that emit their regular pattern of electro-magnetic (radio) pulses as a result of the ultra-high speed of their explosion products. As such, it would seem that a pulsar's signals would be dispersed in all directions from the source and, therefore, the pulses should be detectable from any position outside the star.

Current scientific thought views pulsars as spinning neutron stars that emit their beams of radiation much like a lighthouse sending out a warning beacon. If the Earth happens to be located within the path of the beam as it sweeps through space, a pulse (or two) is recorded each time the pulsar rotates.

"...if a pulsar was a hypothetical neutron star, it should be spinning very rapidly. He [Thomas Gold] stated that as a normal star collapses, its spin rate must increase to conserve angular momentum.

"When the core of a supernova collapses to a diameter of only a few miles, it also drags in the star's original magnetic field where it is concentrated one billionfold at the surface of the neutron star. Plasma at the magnetic poles is whipped around with the spinning star, producing very strong radio emissions. If the Earth is in its direct path, observers will pick up this rapidly rotating radio beacon like the pulsating light from a lighthouse."⁴

Pulsars that are not aligned with Earth, therefore, would not be detectable as such. According to the Reciprocal System:

"In the universe of motion, the periodicity of the radiation received from the pulsars is a necessary consequence of the property that makes them pulsars: the ultra high speed motion. An object moving in the explosion dimension with a speed in this ultra high range arrives at the gravitational limit when its net speed in this dimension (the explosion speed minus the effective gravitational speed) reaches unity. At this point the effective gravitational speed, as we saw in Chapter 14, is equal to the oppositely directed unit speed of the progression of the natural reference system. On the basis of the theory of radiation set forth in the earlier volumes, this means that at the gravitational limit radiation is being emitted at such a rate that we receive one unit of radiation from each mass unit per unit of area per unit of time. At distances beyond this limit, the average amount of radiation received is less because of the further distribution over equivalent space. But radiation is a type of motion, and motion exists only in units. The decrease in the average amount of radiation received can therefore be accomplished by a reduction in the number of units of time during which radiation is being received. Radiation from a pulsar beyond the gravitational limit is received at the same strength as that from one at the gravitational limit, but only during a constantly decreasing proportion of the total time. All of the mass units of a star enter the pulsation

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zone within a very short time, only a small fraction of the observed period. Thus, even though the total radiation from the star is distributed over an appreciable time interval, it is received as a succession of separate pulses."

It seems obvious that the difference between these two scenarios could be tested to invalidate one or the other. It would, however, necessitate making observations outside the supposed width of the pulsar's beam from vantage points far removed from Earth.

If, per conventional thought, pulsars have a beam that turns with the spinning star, observations conducted outside the narrow sweep of the beam would indicate a reduction in the intensity of the pulses or no pulse reception at all.

If, per the Reciprocal System, pulsars emit omnidirectional pulses, all observations from any position would indicate similar (and synchronous) pulses.

The crucial test would involve making these observations.

The width of the pulse beam would be the determining factor for attempting any such observation. If it is as large as our solar system, the test becomes merely academic.

If, however, the beam is sufficiently narrow, space probes sent from Earth just might be used to undertake the test.

We now have two such probes in position. The Galileo probe, now investigating Jupiter, and the Ulysses probe, now orbiting the sun outside the ecliptic. If an Earth-based station were to observe a give pulsar in tandem with both probes, it might be possible to make one of the following determinations:

- Pulses are received at all three positions simultaneously—Reciprocity wins.
- Pulses are received by all three positions at different times—Conventional wins.
- Pulses are received by only one or two positions—Conventional wins. Of course, none of these outcomes actually verifies either of the theories, but it would lend support one way or the other.

I wonder if NASA would be willing to add such a test to the end of their current missions with these two probes. Perhaps even Voyager 2 could be used before it gets too far away. If anyone knows how to approach NASA with a research proposal and/or application for a research grant to conduct such a test, we would be interesting in hearing from you.

References


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The Social and Technological Implications of the Reciprocal System of Theory

Russell Kramer

Abstract

Throughout history, many scientific theories and paradigms (in the physical science, most certainly), have ushered in whole new eras of technologies. Many of these technologies have had a profound impact both in improving our standard of living, and changing the global ecology. In some instances, the technology came first, and the theory which explained it came later. The Reciprocal System of theory represents a new scientific “paradigm” with many profound implications, both socially and technologically.

Introduction

In recent times, quantum mechanics and Relativity theory ushered in the “Atomic” era, and subsequent development of “Nuclear” power for both generation of electricity, and advanced weaponry. When quantum theory and relativity were first published, the social and technological implications were scarcely a consideration.

The Social and Technological Implications

We are now faced with serious ecological concerns resulting from highly toxic nuclear waste. This is from nuclear reactors (used to produce energy for industry and the public, and for propulsion) and from stockpiles of nuclear weapons. Our present nuclear reactors, with their toxic by-products, are ultimately a result of an incomplete understanding of nature—in particular, of the atomic and subatomic processes essential to their construction.

As Larson has pointed out, the very term “nuclear” is based on an erroneous conception of atomic structure in the first place. The theories upon which our existing “nuclear” reactors are built are incomplete. The resulting mass to energy conversion process (fission) occurring within the reactor who’s construction is based on these theories is comparably incomplete, resulting in toxic radioactivity byproducts. The disasters at Chernobyl and Three Mile Island are two telling reminders of this.

The Reciprocal System of theory provides a proper theoretical foundation for the technical construction of efficient energy producing and propulsion devices. It is a complete structure upon which a complete physical theory is being developed on an ongoing basis. With this at our disposal, a technology for producing clean, abundant energy is theoretically possible. The Reciprocal System of theory, as I have come to understand it, provides this essential foundation for a complete, holistic understanding of nature, and its underlying physical processes. It is from this understanding that new energy (and propulsion) technology can be logically developed.

With a non-nuclear model of the atom, and a completely new definition of the fundamental forces (electrical, magnetic, and gravitational), as described in the Reciprocal System, an entirely new approach toward energy production is needed. The ultimate hope in the main stream thought for solving our energy needs is “fusion.” (i.e. fusing hydrogen or deuterium nuclei, creating a chain reaction with a byproduct of H2O (water)). A number of methods have been, and are begin tested, include a massive laser device at the Lawrence Livermore Lab, in Livermore, California.

To my knowledge, none of these conventional methods has succeeded in producing appreciable amounts of controlled energy, as compared with the initial energy input into the system.

The Reciprocal System of theory predicts that fusion is not what is occurring (in stars, for example) as current theories indicate. It follows that a different process is occurring. What is this process, and what is the best way to harness it for generating consumer electricity? It stands to reason that there is a different technology needed to properly harness available energy, both safely and efficiently. This technology should be based on harnessing the rotationally distributed scalar motion in one, two, and three dimensions. These are the three basic motions which constitute electricity, magnetism, and gravitation, as described throughout the Reciprocal

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System.

As theoretical physicists, we have a broad responsibility to society to point the way to this new technology, in whatever form it ultimately manifests. It is not enough that we develop and refine the Reciprocal System of theory in all its fine points, essential as this is. We must usher the Reciprocal System into the technological arena as quickly as possible. There are pressing global ecological and humanitarian matters, whose solution requires technology (and the corresponding theoretical validation) which has previously eluded our full understanding.

During World War II, many great scientists, along with entire industries and nations, were engaged directly or indirectly in the development of atomic energy technology, some of which was for peaceful applications, some of which was for awesome weapons of destruction; both of which were developed with incredible speed under urgent circumstances. The prevailing social paradigm which prompted these tireless efforts was in effect, "The preservation of freedom and defending ourselves from the enemy." This way of thinking was carried on throughout the ensuing years of the cold war. In many respects, this paradigm was the central organizing principle of our society. Both theoretical and applied physics were inextricably woven into the social fabric.

The cold war is over, and a new social paradigm is needed to reflect our changing conditions and priorities to accompany the new paradigm of the Reciprocal System. In light of the urgent state of our global ecology, Vice President Al Gore has introduced a new social paradigm, "...we must make the rescue of the environment the central organizing principle of civilization." With the same urgency under which the atom bomb and atomic energy were developed in a previous generation, we must develop and implement clean, abundant, renewable energy sources during our generation. What has to happen, for this technology to be implemented on a global scale? For one, the theoretical basis for this technology must be firmly established.

We live during an exciting, yet crucial, time in history. The preservation of our global ecology is critical, and barely within our grasp. We are equally poised to globally implement breakthrough technology, which can provide clean, abundant energy for all humanities energy, propulsion, and transportation requirements." As scientists, we have the broad responsibility to act upon this new social paradigm with the same fervor and dedication, as our predecessors acted upon the prevailing paradigm of their generation.

This means that we can preserve our global environment by acting quickly. From a social view, this means, in the short term, our civilization must, in a coordinated and decisive manner, bring to bear all of our global resources, technological and otherwise; cast aside our differences, and act in concert to preserve the ecological balance vital for our long term survival. This will allow the phasing out of fossil fuels, for most applications, world wide. This will result in a cleaner environment in which to live, including clean air and improved health for everyone, especially those living in polluted regions with heavy traffic and industry.

Contrary to popular belief, I do not think the onset of practical "cold fusion," or any other unlimited energy source, will mean "free" or cheap electricity for everyone, at least not initially. There will be a cost in the development and marketing of the technology, the distribution of the energy over the existing global energy distribution infrastructure, the development of a new infrastructure, and the maintenance of all the aforementioned. The cost will be well worth it, in any case.

All this aside, there are still a number of crucial refinements and developments of the Reciprocal System of theory (including, I suggest, developing the relationship of harmonics to rotationally distributed scalar motion), and the ongoing theoretical research at ISUS, is essential. At the same time, we must, as responsible scientists, incorporate a broader purpose to our efforts beyond the quest of knowledge, per se, and with the utmost diligence, translate this knowledge into practical technology as soon as possible; and where this technology exists, we must validate it by associating the proper theoretical explanation where little or none has existed, previously.

Critical research and development in the field of non-conventional energy technology has been ongoing since the time of Tesla, and others, and continues to this day. Many non-conventional "over unity" energy devices are denied patents because they lack a comprehensive, theoretical explanation. Those which have been granted patents are still in need of a broad, theoretical premise describing their function. This hinders their broader acceptance, in general. So far as I can determine, the Reciprocal System of theory provides a comprehensive theoretical foundation to describe the operational principles for this general category of technology."
In future articles, possible technologies for energy production, based on the Reciprocal System of theory, will be examined in detail. Also, existing "over unity" energy technologies, which can be explained in terms of the Reciprocal System, will be brought to light.

Summary

The Reciprocal System of theory is comprehensive in its scope within the physical sciences. We must implement a comprehensive approach to usher the Reciprocal System into the technological arena as quickly as possible to meet the broader needs of society.

Bibliography


Relations Between Science and Religion

Selected Quotes by Frank H. Meyer

"When we consider what religion is for mankind and what science is, it is no exaggeration to say that the future course of history depends upon the decision of this generation as to the relations between them."

Alfred North Whitehead

The claim of divine authority for all ecclesiastical pronouncements has now become a boomerang. As Whitehead puts it, "The result of the undignified retreat, during many generations, has at last almost entirely destroyed the intellectual authority of religious thinkers." If the most cherished tenets of religious belief have no more backing than these now discredited religious contentions, what credence can be given to any of them? Thus runs the thinking of an important segment of present-day thought, particularly among the youth who have been taught to draw their own conclusions rather than blindly accepting the word of authority.

"But on sober reflection, we must recognize that there is a flaw in this argument. Religious documents do not emanate directly from the Higher Authority; they are promulgated by the ecclesiastical
establishment ostensibly on the basis of written documents or oral traditions handed down from earlier times. Thus, all that the scientists have demonstrated by their iconoclastic victories is that the religious hierarchy was wrong in these specific instances and hence is not infallible, a point that the more ‘liberal’ religious leaders are quite willing to concede. This being true, the hierarchy may likewise be wrong when they assert that all of the tenets of their faith emanate from the Deity and are equally authoritative. Indeed, a very elementary knowledge of human nature is sufficient to suggest that the original religious doctrine, whatever it may be and however it may have originated, is likely to be liberally embroidered with additions and interpretations by the priesthood by the time it is officially promulgated to the laity.”

Dewey B. Larson
_Beyond Space and Time, Page 5._

One aspect of the outcome is well illustrated in a passage of Professor Whitehead’s, which would, no doubt, have horrified Plotinus and Bruno and Spinoza and even Leibniz, since it gives the name of God, not to the Infinite emanationism, not to the “Fecundity of emanationism,” but to the “principle of limitation.” “An element in the metaphysical situation,” Mr. Whitehead writes, “is that such a principle is required.” “Some particular how is necessary, and some particularization in the what of matter of fact is necessary”; otherwise the “apparent irrational limitation” of the actual world can only be taken as a proof of its pure illusoriness.” If we reject the alternative,... we must provide a ground for the limitation which stands among the attributes of the substantial activity. This attribute provides the limitation for which no reason can be given, for all reason flows from it. God is the ultimate limitation, and His existence is the ultimate irrationality.”

Arthur O. Lovejoy

“This present work has not uncovered enough evidence to determine as a matter of scientific fact whether the universe was brought into being by an act of creation. We find the Biblical account of the origin of the earth and of biological life to be an authentic revelation insofar as its account of _what happened_ is concerned, subject to the limitations of the recipients’ knowledge of physical phenomena and processes. But the investigation has thus far located nothing that would either verify or disprove any religious assertion as to the _cause_ of what happened. Similarly we have confirmed the existence of metaphysical agencies, but we have not determined whether one or more of these agencies created the universe, or even whether such a thing as creation is possible. As matters now stand, therefore, both the Reciprocal System and conventional science are silent on the creation issue. Anyone who feels that he should arrive at a definite conclusion on the subject will have to determine whether he can accept on faith some one of the many pronouncements as to the origin of the universe that have been made by the various religious bodies.

“Creation is by no means the only controversial metaphysical question on which this first scientific expedition into the region beyond space and time fails to shed much light. While this investigation has definitely established the most important fact, the reality of metaphysical existence, it has not produced much information as to the nature and characteristics (other than the ethical) of the existences, a subject on which the religions have a great deal to say, and say it in a great many different, and contradictory, ways. However, the verification of the basic religious doctrines that has been accomplished is a big step forward. There are also some broad general principles underlying both science and religion that can now be regarded as firmly based, as it is now clear that the almost universal acceptance of these principles is evidence that they have been received by a process of intuitive insight, and their validity can be tested by application of the criteria that have been developed for judging the products of of insight and revelation. All this definitely confirms Hocking’s assertion that ‘its [religion’s] basis is more substantial and less vulnerable than the fabric of speculative ideas in which it seems to consist.’”

Dewey B. Larson
_Beyond Space and Time, pages 281-282._

_Thanks to Ed Navarro_

The ISUS Editorial Staff wishes to express our pleasure and gratitude to ISUS Director Edwin Navarro for his reliable supply of address labels for circulation of ISUS periodicals via bulk mail during the past several years.

Frank H. Meyer, _Editor_
Bruce M. Peret, K.V.K. Nehru, _Associate Editors_
Dreams, Symbolism, and Allegory

The Effect of Life Units on Circulating Memory

Bruce M. Peret

"...it seems highly probable that the psychic and the physical are not two independent parallel processes, but are essentially connected thru reciprocal action, although the actual nature of this relationship is still completely outside our experience."

Carl G. Jung

Introduction

Dewey B. Larson's final book, Beyond Space and Time, provides some excellent insight into the nature of life as a natural consequence of the universe of motion. He covers a broad range of topics from the basic structures of animate matter, thru the development of ethical and moral behavior, the resulting religious values, and the workings of the human psyche. However, I disagree with him on a number of points, particularly concerning the latter because his research did not cover modern developments in psychology, stopping with Freudian concepts from the Victorian era.

My primary area of disagreement begins in Chapter 14, Thinking and Memory, regarding the concept of symbolism, and the contents of dreams. Drawing on personal information from dreams I have recorded over the course of the last couple of decades, and considering Larson's Level 2 biological structure, has led me to some interesting conclusions on the reasons for dreaming, which Larson states as, "The dreams occur not because they are needed but because they are part of the normal physiological activity during the sleep that is needed." My contention is that dreams are needed, and serve a definite purpose.

Background

Larson introduces some new terms in Beyond Space

and Time, starting with a numbering of the sectors of the universe (see Figure 1). Sector 1 is the Material sector, the realm of our everyday experience, consisting of 3-dimensional coordinate space, and scalar time (also known as duration). Sector 2 is the Cosmic sector, commonly referred to as the "anti-matter universe", consisting of 3-dimensional coordinate time, and scalar space (or clock space). Sector 3 is the "metaphysical" or "ethical" sector—a new sector of the Reciprocal System universe that exists outside of the first two sectors, yet interacts with them thru motion.

<table>
<thead>
<tr>
<th>Level of Existence</th>
<th>Sector 1</th>
<th>Sector 2</th>
<th>Sector 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>INANIMATE</td>
<td>1-Aggregation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOLOGICAL</td>
<td>2-Survival</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ETHICAL</td>
<td>3-Ethical Conduct</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Larson also introduces three levels of existence, based on a similar numbering scheme. Level 1 is inanimate existence, comprised of the photons, subatomic particles, atoms, compounds, and aggregates of both the Material and Cosmic sectors, and governed by the law of aggregation. Level 2 is biological existence, where a Material aggregate is linked to a Cosmic aggregate (and operates as a single, compound, living aggregate), and is governed by the law of survival, of both the individual and the species. Level 3 is ethical existence, where aggregates from all three sectors combine into a single, compound "ethical man," governed by ethical conduct.

The final set of new terminology concerns aggregates in each sector, referred to as units. Larson does not use a consistent term for the inanimate, material aggregate, which, in this paper, will be referred to as a Material Unit. The Material unit is strictly a Material sector aggregate, and does not include Cosmic sector aggregates, though they,
too, are inanimate. (The repercussions of a starting point of inanimate, Cosmic units, instead of Material units, will be discussed in a future paper.)

A Life Unit is a Cosmic sector aggregate that is coupled to a Material unit. Normally, a material aggregate is localized in space, and widely distributed in time. In the case of a life unit, a material unit localized in time is connected to a Life unit localized in time (akin to a material atom linked to a cosmic atom), and it is this relationship that manifests as an animate, biological structure, and the biological level of existence.

The final unit is the Control Unit, an aggregate within Sector 3 that is linked to a Life and Material unit, which provides ethical control over that composite unit.

Help or Hinderance?

If dreams do not have a purpose, why would evolution continue to allow them to occur? In the universe of motion, anything that can exist, does exist. In complex structures, only things that have a useful purpose continue to exist. The human body can produce virtually any compound required for its use; for example, during NREM sleep, motor activity is stopped with a simple chemical inhibitor. Our science has many chemicals that prevent dreaming, so it is chemically possible to inhibit dreams—and the body can generate these chemicals if needed. If dreams were not essential to the life condition, they would have ceased by now via body-produced chemical intervention, as dreams disturb the sleep cycle and potentially increase irritation, and thus threaten the survival of biological organisms. Therefore, since dreams continue to occur, there must be a good reason for dreaming.

Symbolism in Dreams

The major constituent of dreams are symbols—people, places, and things taken from a unique, worldly experience, and put to a theme. Dreams are internal to the dreamer; in essence, everything in the dream is the dreamer. Thus, to understand the purpose of dreams, it is necessary to understand the stuff dreams are made of—the symbols defined by the dreamer.

In Chapter 16, Dream Interpretation, Larson appears to have a misunderstanding regarding the nature of symbolism. He equates symbolism with “disguise,” “distortion,” or “concealment.” Psychologists define a symbol as, “The best possible expression for something unknown.”10 Noted psychiatrist Carl G. Jung also adds that, “Every psychological expression is a symbol if we assume that it states or signifies something more and other than itself which eludes our present knowledge.”

Basically, a symbol is an agreed-upon representation of a previously unknown, or unrepresentable, function or experience by a physical object, for use in communication. A pencil, for example, carries with it a complete context of both physical structure (graphite, wood body, eraser) as well as a functional description (used to write, with the ability to erase what is written). Someone who has never encountered a pencil before would only have its physical structure, and would not have the functional associations; e.g. the purpose of the graphite or eraser. This may be discovered thru experiment, or communicated by someone who already knows. If so, they will then try it and verify that it does write and erase. It is now agreed upon that it is a tool for writing, and not something to clean teeth. The pencil now has additional characteristics that make it more than a simple aggregate of atoms—it has function, and possesses symbolism as a tool for written communication.

The very characters that form these words you are reading are symbols for the various grunts and squawks produced by the human vocal tract, namely phoenemes. In specific combinations, they form words which are symbolic of objects and actions. Combinations of objects (nouns), actions (verbs), and additional qualifiers (adjectives and adverbs) produce a method of describing objects and experiences in detail, and allow additional development of larger symbolic constructs forming plot lines or motifs (for example, the “evil stepmother” of Cinderella fame). Motifs are then combined into stories and tales, eventually resulting in a general representation of the influences shaping mankind—mythology.

Each race, society and culture has its own variant of creation mythos, but basically say the same thing when the premises are understood (a pencil is for writing; Germanic “Niflheim” is the Taoist “yin” principle, etc.). The overall symbolism is simple, being the essence of the life process. Symbolism takes two general forms, depending whether it is approached from the “object” (material/particle) or “action” (cosmic/wave) viewpoint. The former results in the alpha-omega sequence, and the latter in the steady-state approach. This is symbolic of the primary, simple harmonic motion in Reciprocal System of Theory, the photon. The photon can be viewed as a particle moving as a wave, or a wave with the characteristics of a particle. Both are
correct, and depend solely on which point of view you prefer—a unit of space modified by a temporal motion, or a temporal motion inside a unit of space. Both time and space must be considered for the photon to be properly understood.

Larson favors the use of the object approach, basing his theories on the discrete unit, except for two cases—the first postulate, and the macrocosm. The first postulate states that motion, an action, is primary; and when the level of the macrocosm is reached, he again converts to the action approach, making the universe a steady-state condition of exchange between the material and cosmic sectors. Everything between this alpha-omega deals solely with aggregates of discrete units.

This object/action viewpoint is analogous to the concept of the symbol. A symbol is obviously a specific object, but often the actions implied by it are missed. It is not “concealment” or “disguise,” but a lack of simple understanding, stemming from a communication that never took place.

**Communication**

We now live in the “Information Age,” where communication (or lack, thereof) is an essential part of our lives. But what is “communication” itself? I gathered a bit of insight into this when reading K.V.K. Nehru’s paper, *The Inter-Regional Ratio,* which explains that ratio in terms of probability. In essence, the inter-regional ratio is a communication which converts all the 3-D temporal possibilities into a single, 1-D actuality in space. Applying this in a more general sense, communication is the reduction of improbability. When the amount of improbability is reduced to unity—possibility becomes actuality.

Symbols are the language of communication, and as such are the tools used to reduce levels of improbability to certainty. For example, if you must proceed immediately to the town of Powelton, in which direction would you head? Some improbability is inherently reduced by internal knowledge, such as: it is a location on the planet Earth, and on one of the land masses. But, unless you know the place, you would have to search each and every square foot of land on Earth to find it. Now, you could get “lucky” and find it right away, or it could be in the last place you look. This is analogous to finding a specific orientation of a 3-D temporal structure, while presenting its various orientations to a unit of space. For example, in his paper *The Lifetime of the Neutron,* Nehru determines the lifetime of the particle by the probability arrangement of its material (proton) and cosmic (c-neutrino) constituents:

“Now the crucial point to be recognized is that the expulsion of the c-neutrino motion (from the compound neutron) takes place only if the direction of the c-neutrino motion, interacting across the inter-regional boundary, happens to be antiparallel to the direction of the motion of the proton motion, and not otherwise. Thus the lifetime of the compound neutron is the time elapsed before the eventual occurrence of this antiparallel encounter that results in the neutron’s decay.”

If this antiparallel arrangement happens to be the very first interaction between the m-proton and c-neutrino, the neutron decays instantly—it was “lucky.” Now suppose you meet someone who has been to Powelton before. Thru communication, you can find out that it is a location in the United States, somewhere in central Georgia. The improbability has been reduced considerably, but is still not certainty. Proceeding to central Georgia, and obtaining a map, you can find its exact location, and now what was originally highly improbable, is reduced to certainty thru communication.

There are several levels of communication that can be discerned at the human level of existence, which can be considered akin to degrees of arc in a circle:

<table>
<thead>
<tr>
<th>Arc</th>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1°</td>
<td>Precise</td>
<td>Very detailed, equivalent to vectorial direction</td>
</tr>
<tr>
<td>23°</td>
<td>Effective</td>
<td>Firm opinion, detailed</td>
</tr>
<tr>
<td>45°</td>
<td>Conversation</td>
<td>Specific topic, general opinion</td>
</tr>
<tr>
<td>90°</td>
<td>Talk</td>
<td>General topics, gives general direction</td>
</tr>
<tr>
<td>180°</td>
<td>Chat</td>
<td>Polite conversation, doesn’t relate much</td>
</tr>
</tbody>
</table>

A precise communication leaves nothing to guesswork. Other “arcs” give a general direction of understanding, but require further communication from other sources to narrow the direction to precise communication.

There are also two inverse levels of communication quite popular these days, especially in political
arenas, that increase the level of improbability, and are limited to the human realm:

<table>
<thead>
<tr>
<th>Arc</th>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-180°</td>
<td>Misinformation</td>
<td>Pointing in wrong general direction</td>
</tr>
<tr>
<td>360°</td>
<td>Disinformation</td>
<td>Deliberately confusing the matter beyond all recognition</td>
</tr>
</tbody>
</table>

Not only does communication reduce the level of improbability for a specific "object," but once realized, the object itself now has the ability to reduce improbability in adjacent objects, since a net motion can be transmitted to physically adjacent units, either in space or in time. If the object possesses a degree of consciousness, this communication can be any any degree of precision, from an detailed, "vectorial" message to deliberate misinformation.

In Larson's discussion on metaphysics, one of the points he made was that metaphysical phenomenon, such as telepathy, are improbable events, where only a general meaning is often understood (a finite level of improbability). Communication occurred, but the improbability was not reduced to certainty, and the subject had to make a free-will choice on the remaining "degrees of freedom" in order to communicate the result. This free-will choice was selected from the subject's existing memory storage, based on personal knowledge and experience—thus the resulting reconstruction is often symbolic of the original message, using the internal symbols of the subject.

In Larson's "Level 2 biological existence," communication must occur between the physical unit (material) and the life unit (cosmic), between space and time, thru the inter-regular boundary (as in neutron decay), and at the aggregate level. However, communication from life units to the physical unit cannot be 100% effective, because of the dimensional reduction of the inter-regular transmission (the three dimensions of time can only be represented as one dimension in space, so temporal orientation is lost in the communication, but the net motion survives). Thus, the most effective communication will be the simplest communication, a meaning attached to a net motion; that meaning being a symbol. The net motions within an aggregate then form symbolic structures, or motifs—a pattern that can be recognized and communicated. And it is this symbolic life unit communication that Larson did not consider during his dream analysis.

Circulating Memory

"For example, if a person has an appointment at a certain time, his working memory periodically reminds him to look at a clock. Meanwhile, this memory will from time to time breaks in upon his goal-oriented thinking to remind him of other matters that need his attention, either in thought or action. This observed memory pattern can most appropriately be described by calling it a circulating memory system."  

Having used computers for over two decades, the concept of a circulating memory is not new, being equivalent to a "batch queue," "job scheduler," or "chron file" in computer systems. The concept is simple, events are placed in a queue, and are triggered for execution when certain conditions are met, such as a specific time, a day of the week, or some other external event, such as a "disk full" condition, which would execute a cleanup action. I disagree with the "circulating" concept, as a polling system is highly inefficient, especially in a preemptive, multi-tasking, massively parallel-processing system like the physical brain and body. But the basic concept is valid.

"...the non-specific nature of the circulating memory has been retained, and unlike the memory input into storage, which consists mainly of detailed experiences, most of the circulating memories are merely general ideas or impressions with only a minimum of detail, if any."  

The function of the circulating memory is to present objects in its queue for evaluation and resolution. This gives a clue as to what is actually in circulating memory—a set of basic conditions, a reference to an action to be performed, and a reference to any additional information in storage required by the action. This meets the minimum detail requirements, and is almost identical to its computer counterparts in a scheduler queue, the parts being: the basic condition(s) to activate, the file name of a program to execute, and the file name of data to pass to the executing program.

As each item in circulating memory is presented to consciousness, like its computer counterpart, the conditions are compared to current circumstances, and if matched, the item is removed from circulating memory and dispatched to the body for execution.
As an example, you must be at a meeting in Room 105 at 4pm. When this input is evaluated, certain assumptions are made such as your estimated location at 4pm, and the amount of time it will take to get to Room 105. This may resolve to a 5-minute walk, so you queue an event in circulating memory for 3:55pm to execute a change in location. When the time comes around, the event is presented from circulating memory and the circumstances are evaluated. If you are where you thought you would be, you then dispatch the event to the body, retrieve from storage the necessary path to follow, and all associated muscular movements to get you there on time.

A number of other circumstances are possible. For instance, suppose your location at 3:55pm is at the water cooler right outside Room 105, a mere few seconds walk. In this case, you may go in early and wait, or perhaps simply requeue the event for 3:59:50pm, or even change it from a time-based entry, and convert it to trigger upon the arrival of a person in Room 105. On the other hand, you may not be able to attend the meeting at all for one reason or another, and alter the action to be taken, such as attending the meeting by conference call, or rescheduling for another time.

Note that these conditions were not part of the initial entry made into circulating memory, but were retrieved from storage when that entry became active, as part of the associated action. So the evaluation process requires the additional details from storage, not just the basic conditions.

There are also several rules that circulating memory follows, namely:

1. Once an entry is made, it can only be removed by dispatching its action.
2. Conditions can be added, removed, or modified.
3. Actions can be added, removed, or modified.
4. Detailed information can be added, removed, or modified.
5. Entries can be requeued indefinitely.
6. Entries have varying degrees of priority, based on survival needs.
7. An entry cannot be deleted (forgotten), only its priority can be lowered (repressed memory).

With this information, it can be easily understood how we go about our day-to-day activities during our waking state. Larson accurately addresses what happens with the circulating memory during sleep, and its resulting dream manifestations, but did not consider the effects of the life unit, a temporal structure communicating with a spatial structure, on dream contents, nor the effects of long-term entries in the circulating memory system.

**Life Unit Influences on Dreams**

To understand the effects of the life unit, it is first necessary to understand the physical unit—our body. The primary threat to the body, a physical aggregate or gravitating mass, occurs when an oppositely directed motion occurs, and results in separation of its component parts in space; a localized increase in the spatial separation of cells—namely, a cut, bone break, or other bodily injury.

The primary threat to life units is the inverse—a separation of its component parts in time. Since space and time are reciprocally related, the net effect in space is the inverse of cellular separation—the cells move closer together, resulting in a physical “tightness” and discomfort localized in a part of the body—which we experience as an emotional injury.

To correct a physical injury, an entry is made in circulating memory with a high priority (pain), with an action to disinfect and repair the locale, and a pointer to the detailed information on bodily location. This is constantly brought to conscious attention, and after it is cleaned and bandaged, its priority is lowered and requeued for regular evaluation of health or contamination. Eventually, the conditions of normalcy are met, and actions are executed to remove bandages, etc. and the circulating memory entry is finally released.

With an emotional injury to the life units in the cosmic sector, the same sequence is followed but with a notable exception—the entry to circulating memory is made with a high inverse priority, basically put at the bottom of the queue, and during normal affairs in the waking state, can never make it to consciousness. This is why emotional injuries can take years to heal.

However, during the dream state circulating memory is not as heavily edited as it is during the waking state, and these emotional repair entries occasionally get an opportunity to be presented to consciousness, but only after days, months, years, or even decades of time have passed. Presentation and resolution are inevitable, however, as natural progression will
eventually convert the inverse priority to a normal priority, just as a cosmic atom entering the material sector must eventually convert to material status. This brings us to the second condition—the effect of long-term entries in the circulating memory system.

**Long-Term Circulating Memory Entries**

The old phrase, “Use it, or lose it” is particularly appropriate here, as this is what happens to items in long-term storage. The brain organizes itself so that the most actively used components are the easiest and fastest to retrieve. Items that are seldom accessed are generalized (“chunked” in psychology), and the details put in more remote regions, like an archive.

When an “emotional repair” entry manifests itself to consciousness, typically during the sleep state, its conditions are evaluated against current circumstances, and being a repair order, come up true (unless you are in an emotionally violent situation). The repair order is dispatched to the temporal body (an aggregate of life units, most likely akin to the emotional body, ethereal body, or spirit). Storage is then accessed to bring up the details of the repair—the temporal location and what kind of damage was done. However, because of the duration involved from last retrieval, much of this detailed information is no longer available, having been generalized and archived. The storage mechanism retrieves this generalization, and since there are no longer any specific details, satisfies the detail request from a more recent, similar experience (just as telepathic communication required the subject to fill in personal details of its generalized communication). When the emotional repair “action” is dispatched with this incongruous data, the result is often a *Nightmare*—allegory for the original damage.

**Allegory**

Allegory, or stories that have multiple meanings, are a natural outgrowth of the symbolic nature of communication, and are used as a tool to reconstruct an experience when the original information is no longer available, as in long-term circulating memory entries. The last two paragraphs of Chapter 14, *Thinking and Memory* illustrate this quite well:

“In general, the various devices that psychoanalysts use to accomplish what they regard as dredging up items from the unconscious—such things as free association, dream interpretation, and hypnotism—can equally well be regarded as means to circumvent the subject’s unwillingness to reveal his conscious knowledge of these matters. But it may be that the knowledge of which the subject is conscious is so vague and general that he is unable to reveal it. As noted earlier, experiences are not usually retained in the memory storage in such a way that they are subject to recall in their entirety on demand. Ordinarily, certain features—items of information, mainly—are abstracted and kept available for recall, while the remaining details are gradually forgotten. But the retained features are not necessarily useful items. For example, the original experience may have been accompanied by a feeling of anxiety. In the memory process, an association may be set up between this anxiety and some person or object X that played a part in the experience. Future contacts with X, or something associated with X, may then result in recall of the anxiety sensation without the individual being aware of what has happened. He simply feels anxiety without knowing why. If he is emotionally susceptible, he may prolong the memory by frequent recall even without any additional contact with X.”

Object X is one of the conditions associated with the emotional repair order, and when triggered during a situation when there are no other higher priority events, are interpreted as a day-mare, an emotional response typically of anxiety because the details cannot be retrieved.

“This view of the situation indicates that the analysts’ procedure in attempting to identify the original experience as the first step toward correcting the abnormal mental condition is probably sound. If the association between the anxiety and X can be identified, it can probably be broken by some means, so that the recurring anxiety stimulus is eliminated. But the Freudian belief that the trouble is due to items that are present in an unconscious mind does not agree with our theoretical findings. It is not what has been forgotten, our theory tells us; it is that aspect of the original experience that has not been forgotten. The original circumstances—the experience itself—may have been forgotten, but sensations are remembered as well as experiences, and a certain kind of stimulus may call up a disturbing memory that lingers on as a residue of the forgotten experience.”

There are several points I wish to address here, because this is where I started a radical departure from Larson’s conclusions, and that seems to be because I have a different understanding of the terms involved. The levels of the unconscious, and what information is revealed by free association, hypnotism, and dream symbolism are crucial to understanding the reason for dreaming.

The Unconscious

The unconscious is several concepts buried in one word. Primarily, unconscious contents can be viewed as analogous to objects located in 3-dimensional time, as viewed from the material sector. They actually exist in relation to each other in time, but all we can experience is the net effect—we cannot see the 3-D temporal orientation from our point of view in the Material Sector, even though it physically exists. The conscious, on the other hand, would be the viewable objects in 3-dimensional space.

In reference to circulating memory, the conscious events would be those with a normal priority, and the unconscious events would be those with an inverse priority, a cosmic structure.

There are also levels of collective unconscious, which amount to generalizations of motifs based on species, race, society, culture, and family. Because the symbols are agreed-upon conventions and local generalizations, the unconscious in this aspect can simply be viewed as varying levels of common symbolism, often attaching multiple functional meanings to a specific object, depending on the level of the collective.

Free association, hypnotism, and dream symbolism are all valid methods to locate and identify "emotional repair entries" in the circulating memory system. Each has attendant difficulties, namely that all are represented as allegory of the original situation, not the original situation itself, unless the emotional damage is very recent.

Tools of Damage Assessment

Free association shows the paths of connectivity between memory storage elements, and can be used to determine what generalizations have been made, though it is used mainly to locate conscious intervention within a motif. Damage, either physical or emotional, causes a localized restructuring to circumnavigate the problem until repaired. In the body, blood vessels and nerves are re-routed; with emotions, motifs are re-routed. The train of thought follows the “bypass,” which results in delays—a noticeable pause in the association response as an alternate route is selected and traversed.

Hypnotism, though an effective tool, can often cause more damage than good. When hypnotized, “...the subject’s own Sector 2 control is replaced, to some degree, by that of the hypnotist.” This means that the mere presence of a hypnotist will influence the associative mechanism—either verbally, telepathically, or both—to a pre-determined end, characterized by his or her “specialty.” The same mechanisms are at work as are in a dream, with the exception that it is not self-contained experience. A dream is an artificial experience designed to present a reasonably-consistent allegory of a past event. Hypnotism is the same thing—an artificial experience—but can be interpreted as a true-life memory because it is externally verified by another person thru communication, whom reduces the improbability normally associated with symbolic and allegorical information to certainty, though it is actually misinformation.

This situation can be very dangerous. It is particularly noticeable in three areas: UFO abductions, sexual abuse, and religious cults. The mere frequency of these supposed events is taking alarming proportions, all as a result of hypnotic recall.

This behavior is actually understandable in the context of the Reciprocal System and gives insight into the influences causing it—the Level 2 goals, defined by Larson as “Level 2 (biological) existence is directed toward survival of the individual and his species...”

Granted, some of these cases are actual events, but given their recent popularity, the majority are going to be allegory. If one examines the life of a person after they undergo hypnosis for one of these conditions, one will often find that they have arrived at a pre-fabricated solution to their emotional injury—and one common factor stands out in all cases: "I am a victim of external agents," whether that be paralyzed and taken by aliens, abused by a parent, or programmed by a cult centuries ago, waiting on a trigger word.

Victimization is very popular here in the United States. A good portion of our government bureaucracy is set up to aid victims. By being a victim, you can obtain support, money, housing, food, legal aid, and social status in a recovery group. In essence, all your basic survival needs are met for you, while simultaneously removing all danger to
yourself. The perfect Level 2 motivation. The only problem is—it doesn’t fix the original problem.

Dream symbolism is probably the most effective tool in repairing emotional damage. It is a self-contained system, and everything in the dream is you, including scenery, objects, and people. Each is selected by the storage mechanism because it best matches the detail request presented by the circulating memory system (the original detail is not available). At times, a set of information is returned instead of a single object, and results in things like a person constantly changing into other people. In this case, the detail request can be identified by the common factor of all the people presented within the dream context.

Object of Dream Analysis

Dream analysis is used as a method to recall specific details regarding an emotional injury (damage to life units), and to initiate repairs with that detailed information. It is approached by two methods, objects (symbols), and actions (allegory). Symbols are broken down into their component parts, and adjacencies are identified (interactions between people and objects). This is analogous to identifying a chemical compound by determining what atoms they are composed of, and in what structure they are arranged. Atoms can be identified by their net electric and magnetic motions, and symbols work the same way, fundamentally the masculine-feminine relationship is similar to electric polarity, and the intensity of interaction akin to magnetic mass.

The actual storyline of the dream is not as significant as the objects and actions, because it is generated by the mind to provide some sort of consistency so it will be remembered, and usually follows a classic motif, which is pounded into all of us by popular media. Because of the cosmic nature of the entry in the circulating memory system that triggers the dream, the basic theme must be one of survival. Deviations from this theme can also help to recall the original set of details from storage, which is the purpose of dream analysis. Once the original details are retrieved, the exact location of the temporal injury can be identified, and repairs can be initiated, and the entry is removed from the queue, never to return.

The most effective dream analysis must be conducted by the dreamer—for only the dreamer knows everything about themselves. Insight from other people is often helpful, but should never be accepted as fact. All too often people interpret your personal symbols in their context, and end up telling the story of their damage, instead of interpreting yours. This is a major problem with modern psychoanalysis, where the analyst and the analysis interlock neurotic structures in an attempt to help each other, without conscious knowledge:

“According to this paradigm, the analyst’s wounds, although presumed to be relatively conscious after a lengthy personal analysis, live a shadowy existence. They can always be reconstituted in particular situations, and especially when working with someone whose wounds are similar.”

A life unit injury has similar characteristics to an explosion in time; the parts of a life unit aggregate have additional time between them, and thus manifest in space in a similar manner to a temporal explosion—radioactive decay—the bits and pieces of the damage are spread out in duration, and are retrieved in dreams that can be spread years apart. Personal research indicates a cyclic recurrence of 3.5 year intervals, which can make identification and resolution a lengthy process.

Conclusion

The stuff of dreams is symbolism, and presented by allegory as an attempt to repair damage to the life unit aggregates, manifest as emotional injury in animate creatures. Communication is used to retrieve the lost details of the original injury, and to initiate the emotional repair process. Dreams therefore exist as a rational and necessary part of complex, animate creatures, and are a feature of the Level 2, Biological existence—aiding in the identification and repair of life unit injuries in the Cosmic sector, where the physical body and senses have no direct influence.

References

Continued on Page 40...
Infinitude of the Private Person
The Case for the Equality of Human Worth
Frank H. Meyer, Otto H. Schmitt and Bruce M. Peret

The Third, non-physical sector of Human Existence, discovered by Dewey Larson¹, enables us to distinguish between a physical and a non-physical world of human worth.

Your physical worth, like your performance and your longevity, is finite. This is your market worth, which exists only in relation to the global market, a finite whole of nothing but a diversity of commodity values.

The standard for expressing your worth in the market today is the money you own, earn, borrow, and save. Because everyone’s market worth is finite, even the richest person’s financial wealth is less than the total finite market value of the global market of commodities. Finite arithmetic applied to this finite whole leads to this finite result.

When the United States of America began in 1776, the institution of human slavery was prevalent, and an accepted institution of the existing anti-democratic enterprise economy. Neither the new country, except for the Declaration of Independence, nor any other human community, appeared to aim at making the Earth safe for democracy. The institution of human slavery brought in its wake an unproved postulate that private persons are inherently created finite and unequal in human worth. This happened when slave owners reduced their neighbors to the status of commodities, exchanging them for money capital, the measure only of the finite worth of capital goods. That humankind is a whole of only finite human worth, however, cannot be proven true without identifying the one among the dead, the living, and yet to be born, found to be of supreme maximum finite human worth by the consensus of all men and women. The postulate of finite arithmetic, applied to mankind, has never been verified that every private person is worth less than the whole of humankind.

In the U.S.A. enterprise economy, we are told that everyone is paid what he or she is inherently worth. The use of an unequal distribution of monetary income among our people, say among women and men, is defended on the unproved ground that private persons are presumably finite and unequal in human worth. Finite arithmetic and the commodity money for estimating finite values and worth of commodities do not server to count inherent human worth, if and when human worth is not finite. When slave owners bought their human slaves for finite sums of money, they did not prove that the inherent human worth of the private person is finite. They showed only that slave owners knew not how to count infinite wholes. Nor do free enterprises.

Adam Smith reported in 1776, “The great affair, we always find, is to get money. When that is obtained, there is no difficulty in making any subsequent purchase. In consequence of its being the measure of value, we estimate that of all other commodities by the quantity they exchange for.

“We say of a rich man that he is worth a great deal and of a poor man that he is worth very little money... To grow rich is to get money, and wealth and money, in short, are in common language, considered in every respect synonymous.”²

Thus, in 1776, An Inquiry into The Nature and Causes of The Wealth of Nations reported that the United States of America followed the rest of human society on Earth by taking for granted that private persons are created finite and unequal in human worth, kings with divine rights, masters with money rights, slaves, chattels, commoners, rich and poor. This purely political economic conception of mankind left out of account the existence of the Third Sector of non-physical inherent human worth in the people, as distinguished from government administrators.

But in 1776 a great composition appeared in the United States of America, which skillfully refuted the alleged finiteness of inherent human worth of the private person and affirmed the truth is evident that all women and men are created infinite, independent and inherently equal in human worth. This great work of political art was inspired by the American Revolution. It originally had the apt title: “A Declaration by the Representatives of the United States of America in general Congress assembled.” Then and there the author gave our country its name, the name we continue to go by. The author also
discovered something of the greatest consequence to the future of humankind in the physical world: he learned how to count the infinitude of the whole inherent, non-physical human worth of ethical humankind.

Some of this Declaration is herewith reproduced so that the reader may better understand the intelligence and evidence he provided to support his affirmation of the truth that women and men are created equal in worth.

Here is how the John Adams copy of: "A Declaration by the Representatives of the United States of America in general Congress assembled" begins: "When in the Course of human Events it becomes necessary for a People to advance from that subordination, in which they have hitherto remained and to assume among the Powers of the Earth, the equal and independent Station to which the Laws of Nature and Nature's God entitle them, a decent Respect to the opinions of Mankind requires that they should declare the Causes that impel them to the Change.

“We hold these Truths to be Self-evident; that all Men are created equal and independent; that from that equal Creation they derive Rights inherent and unalienable; among which are the Preservation of Life, and Liberty and the Pursuit of Happiness; that to Secure these Ends, Governments are instituted among Men, deriving their just Powers from the Consent of the Governed; that whenever, any form of Government, Shall become destructive of these Ends, it is the Right of the People to alter or abolish it, and to institute new Government, laying its Foundation on Such Principles, and organizing its Powers in such Form, as to them Shall Seem most likely to effect their Safety and Happiness…”

Let us at once examine whether the author of this remarkable communication can make good his claim that evidence finds the proposition ‘all men are created equal and independent’ true? Equal in what respect? Not in all respects, certainly! Not in any physical respect, since in each such respect all of us are finite and unequal! Perhaps in some non-physical, infinite human respect? May mankind be found to be a non-physical whole of infinite human worth, dignity, independence and honor? With no known contemporary to instruct him, the author of the Declaration taught himself the appropriate transfinite arithmetic for counting this infinite whole. Georg Cantor, a century later, used a similar arithmetical strategy to learn how to count the infinite whole set of counting numbers by equating the whole to a proper part, in this case, the set of the even counting numbers. If the set of counting numbers were, in fact, a finite whole, it would be impermissible to seek a part of the whole equal to the whole to count the whole, since the fundamental postulate of finite wholes is that every part of any finite whole is always less than the whole and only the sum of the parts can equal the whole.

If the non-physical set of counting numbers can constitute itself an infinite, rather than a finite whole, what is to prevent the members of mankind from constituting ourselves an infinite, rather than a finite, whole of inherent human worth? Nothing, provided I learn how to count infinite wholes in much the same way our ancestors over tens of thousands of years learned to count finite wholes, according to Thomas Paine, author of the original draft of the above Declaration.

In his own mind, Paine first had to identify the proper parts of the infinite non-physical whole of human worth. How to find a part with which to count the whole? Paine evidently asked the right question that enabled him to reach his reasonably satisfactory answer: In which part of the infinite whole of humankind is the infinitude of the whole manifested? Infinitude is manifested in the non-physical Third Sector of the Private Person. Each is a whole world of human worth in herself or in himself. A Private Woman is not worth less than the whole of humankind, since the whole is not a finite whole. Each Private Woman is equal in human worth to the whole of humankind. Since entities equal to the same entity are equal to each other, all women and men are created infinite, independent and inherently equal in human worth.

We should speak to the many who have been taught that Thomas Jefferson, not Thomas Paine, composed the original draft of the Declaration of Independence. It is true the Mr. Jefferson had a big part producing the final official version of the Declaration. To begin with, he made a copy of the original draft in his own handwriting. He did so as a duly elected member of the Second Continental Congress and a duly appointed member of a Committee of Five to produce the Declaration of Independence. After making his copy of the original draft, one of his initial responses to it was to cross out the word “Self evident” and substitute the phrase “sacred and undeniable.” Eventually, “self evident” was restored. Mr. Jefferson was the one who substituted “endowed by their Creator” for “From that equal Creation.”
What Makes the Human Universe an Infinite Whole?

Neither the material, nor the cosmic sectors, the finite physical sectors of human existence, but instead, the non-physical natural ethical sector, inhabited by humankind beyond space and time, confers infinitude on our universe. This non-physical sector is not simply visible, audible, nor tangible. It includes the meanings of words and numbers, but not the words, themselves, nor numerals. Humankind, as a whole, does learn about the being of our non-physical sector of existence by virtue of our native ability to create and reproduce adequate physical entities to represent non-physical entities essential to our well-being, meanings by words, numbers by numerals.

Humankind, as a whole and in its proper parts, the private woman and the private man, can and do participate in the infinitude of ultimate human worth only by way of our inhabiting our non-physical sector or realm of the human universe. This is the realm of meanings, including discourse, number, arithmetic, truth, moral values, beauty, humor, science, art, philosophy, and ethics of the human spirit.

The proper parts of the infinite whole of humankind are ourselves, ethical men and ethical women. Persons are the most precious of all human wealth. The proper parts of the whole of humankind are not any of the physical parts of the human organism, not human hands, not legs, not hearts, not brains, neither human bodies, nor even the biological control units that are designed to govern the temporary survival of human bodies. The proper parts of the infinite whole of humankind are our spaceless and timeless non-physical selves, our human spirits, if you like.

Man is Not Prior to Woman

It does us well to remember that during our country's historical efforts to live up to its best commitments and promises, unavoidable mistakes have been made that have been paid for by the sacrifice and serious waste of the country's most precious wealth: the common people. Some conspicuous examples have been our Civil War, to test whether the U.S.A., conceived in liberty and dedicated to the proposition that men and women are created equal, can long endure during the previous century, and our participation in the First World War and the Second World War during the twentieth century to end war and make the world safe for democracy. An incredible mistake was made fostering the policy that women should have no income or less income of their own than men. Women were expected to receive income only by way of their fathers, their brothers or husbands. Probably our country's most shameful mistake has been, from the beginning, legally denying and withholding the potential of more than half our population, American women, white, black, red, brown, and yellow, from remunerated public and private enterprise. This was not simply in flagrant violation of the commitment of the Declaration to equality of inherent human worth of men and women as proper parts of the infinite whole of humankind. It was buttressed by the lie that women, when making human babies, are not as economically productive as men making guns and atomic bombs.

During July, 1848, American women and men organized the Seneca Falls Congress and Declaration of Sentiments and Resolutions, challenging the exclusively male legislators, judges and Presidents to practice what the Declaration of 1776 professed. This was a beginning; the ending has not yet been resolved.

Without the kind of support President Abraham Lincoln gave the Declaration of 1776, neither the Declaration nor the United States of America would have a bright future: "If this country cannot be saved without giving up the principle... (of the Declaration of Independence), I would rather be assassinated on this spot than surrender it."

Another person who fought for the Declaration at least as hard as Mr. Lincoln was the author of its original draft, Thomas Paine. Here, in the original draft is Mr. Paine's indictment of King George for promoting the slave trade in America: "He has waged cruel War against human Nature violating its most Sacred Right of Life and Liberty in the Persons of a distant People who never offended him, captivating and carrying them to Slavery in another Hemisphere, or to miserable Death in their Transportation thither. This piratical Warfare, the opprobrium of Infidel Powers is the Warfare of the Christian King of Great Britain.

"He has prostituted his negative for suppressing every legislative Attempt to prohibit or to restrain an execrable Commerce, determined to keep open a market where Men Should be bought and sold, and that this Assemblage of Horrors might want no Fact of Distinguished Die.

"He is now exciting these very People to rise in Arms among us, and to purchase that Liberty of which he has deprived them, by murdering the People upon whom he has obstruded them: thus
paving off former Crimes committed against the
Liberties of one People, with Crimes which he urges
them to commit against the Lives of another."

These paragraphs of the original draft were deleted
from the printed copy by the Second Continental
Congress. They are among the reasons Ms. Abigail
Adams chided her husband, Mr. John Adams. Ms.
Adams had access to a copy of the original draft
when she received a copy of the finished, printed
version of the Declaration. She wrote under the date
of July 14, 1776 to her husband, “By yesterday’s
post I received two letters dated 3rd and 4th of July...
I cannot but be sorry that some of the most manly
sentiments in the Declaration have been expunged
from the printed copy.”

John Adams had this to say about Thomas Paine’s
part in the Revolution: “History is to ascribe the
Revolution to Thomas Paine.”

George Washington supported Mr. Paine: “Your
presence may remind Congress of your past services
to this country, and if it is in my power to impress
them, command my best exertions with freedom, as
they will be rendered cheerfully, by one who
entertains a lively sense of the importance of your
works.”

Thomas Jefferson was a friend of Thomas Paine:
“That you may long live to continue your useful
labor, and to reap the reward of the thankfulness
of nations is my sincere prayer.”

A more recent person to volunteer an evaluation of
the splendid work of Thomas Paine has been Mr.
Thomas Edison, like Paine, an inventor: “We never
had a sounder intelligence in this Republic. He was
the equal of Washington in making American
Liberty possible. Where Washington performed,
Paine devised and wrote. The deeds of the one in
the field were matched by the other with his pen. I
consider Thomas Paine our greatest political thinker.

“Paine practiced what he preached and some day
will be recognized as one of the clearest of
thinkers.”

Sources of the Human Equality Doctrine

One of the main sources through which Thomas
Paine first became interested in learning about the
human equality idea, so far as we can tell, was the
Bible, both the Old Testament and the New
Testament. Mr. Paine, like Shakespeare, was a
thoughtful, interested and careful student of the
Bible. He particularly examined the life and deeds of
the historical person, Jesus Josephson and in his
work report, The Age of Reason. Mr. Paine had this
to say about Jesus: “That such a person as Jesus
Christ existed, and that he was crucified, which was
the mode of execution of that day, are historical
relations strictly within the limits of probability. He
preached most excellent morality and the equality of
man; but he preached also against the corruptions
and avarice of the Jewish priests, and this brought
upon him the hatred and vengeance of the whole
order of priesthood.

“The accusation which those priests brought against
him was that of sedition and conspiracy against the
Roman government, to which the Jews then were
subject and tributary; and it is not improbable that
the Roman government might have some secret
apprehensions of the effect of his doctrine, as well
as the Jewish priests; neither is it improbable that
Jesus Christ had in contemplation the delivery of
the Jewish nation from the bondage of the Romans.”

Before Jesus was crucified, he was sold like a slave
by Judas, a former follower, for money to the chief
priests of the temple, who paid Judas 30 pieces of
silver, the current, finite market price for a cheap
slave.

The attitude of Thomas Paine toward Jesus Christ
was not that of King George III. Mr. Paine regarded
Jesus as a strong ally in the continuing struggle
against human slavery. George III tried to use Jesus
as his ally to make unethical practices like slave
trading and slave owning look good. The King
flouted the religious truth that, since a slave is not
worth less than the whole of humankind, his or her
human rights are equal to those of George.

The Bible reports that Jesus replied to those who
said he blasphemed by making himself God that the
Bible reports that they are Gods too. Read John
10:30-39: “The Jews again took up stones that they
might stone him. Jesus answered them, ‘Many
goods work (sic) have I shown you from my Father;
for which of these works do ye stone me?’ The Jews
answered him, ‘For a good work we stone thee not,
but for blasphemy, and because, being a man, thou
makest thyself God.’ Jesus answered them, ‘Is it not
written in your Law, ‘I said, Ye are gods?’ If he
called gods them to whom the word of God was
spoken, and the Scripture cannot be evaded, say ye
of him whom the Father hath hallowed and sent into
the world, ‘Thou blasphemist,’ because I said, ‘I am
the Son of God?’ If I do not the works of the Father,
believe me not; but if I do them, though ye believe
not myself, believe the works, that ye may know and
understand that the Father is in me and I in the
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Father.” They sought therefore again to apprehend him, and he went forth out of their hand.

Capital is not Prior to Labor

The postulate of the American individual enterprise system that the private person has no inherent non-physical human worth, but only physical or market worth, implies that all men and women are created entirely finite and unequal ultimately in human worth. A further consequence is that the measure of the finite exchange values of commodities, the commodity money, is good enough to measure and distinguish the value of diverse human capacities and their relative human worth. It follows then that the equitable division of income among men and women allegedly will be dependably taken care of by the institution and natural laws of the free and slave market.

In practice, the economy functions on the premise that capital is prior to, and independent of, labor. Labor is only the fruit of capital and could never exist, if capital had not first existed. Capital is the superior of labor and deserves much higher consideration.

Our country should practice that it professes and has professed concerning the equality of human worth among men and women. If we do not discontinue the practice of paying them less or no income, pretending that women are unproductive or less productive than men, then the men of the country will discover that “nature does not pay any attention to the dictum that ‘All men are created equal’.”

Our country’s most able leaders have not supported the idea of the priority of capital to labor.

Abraham Lincoln has, as usual, been unequivocal: “The working men are the basis of all government, for the plain reason that they are the more numerous.”

Again Lincoln: “Labor is prior to and independent of capital. Capital is only the fruit of labor, and could never exist if labor had not first existed. labor is the superior of capital and deserves much the higher consideration.”

Dwight D. Eisenhower: “[The Declaration] acknowledged that man has a soul, and for that reason is equal to every other man, and that is the cornerstone of what we call the American System.”

Thomas Jefferson: “The foundation on which all our constitutions are build is the natural equality of man.”

References

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Continued from page 34...

**Dreams, Symbolism and Allegory**

**References**

5. *ibid.*, p 178.

In 1913 George Bernard Shaw remarked: "...and that silly dream of the Nineteenth Century which began with: 'The career open to the talents,' the idea that every man could get his value: all that is the vainest Utopian dream; the most ridiculous, the most impracticable idea that ever came into the head of men. The reason it has been talked about so much, is that the people who were talking about it had no serious intention of ever bringing it into practice and never pleaded it in practice except as an excuse for giving somebody less than themselves. It would have been far more sensible to go at the question in the old religious way; when you would have immediately seen that all human souls are of infinite value and all infinities equal."
Roots of the Dilemmas

J. Edward Anderson, Ph.D., P.E.

A series of dilemmas involving growth, work roles, distribution of wealth, and control of technology combine to form a profound challenge to the industrial system. These dilemmas can be understood by examining a series of twelve root conditions that seem to have produced them. By understanding such "roots" we may be able to see what must be done to resolve the dilemmas and hence to devise sustainable social systems. The analysis presented here was originally developed for the course "Ecology, Technology, and Society," which was given at the University of Minnesota from 1970 through 1987.

The Dilemmas

Willis W. Harman, in An Incomplete Guide to the Future, focuses attention on the complex of problems facing modern society through analysis of four dilemmas:

The Growth Dilemma: The economy must grow, but too much material growth leads to conflict with the finite limits of the earth.

The Work-Roles Dilemma: Growth has increased wealth, but increased wealth has not produced enough meaningful work.

The Distribution Dilemma: Inequitable distribution of wealth leads to unrest, but equitable distribution would seem to lead to universal poverty and lack of hope.

The Control Dilemma: Uncontrolled technological development leads to intolerable side effects, but control of technology may lead to totalitarianism.

Appearing simultaneously, these dilemmas combine to form a profound challenge to the industrial system. Analysis of their nature and meaning is a powerful tool for coming to grips with the seriousness of the problems of the times, and for helping people understand that a fundamental transformation will have to come, not because we have a choice of whether on not to remain on the present path, but because the present path is not sustainable, people will either adopt new values voluntarily, or will be forced by circumstances to do so.

The statement of each side of each dilemma is a statement of the surface manifestations of the dilemma. To understand what must be done to resolve the dilemmas, it is necessary to look for fundamental conditions or concepts or root causes in society, in nature, or in individual behavior that seem to have produced the dilemmas. By understanding the roots, there is hope that we can understand what we must do.

The Roots

Following are discussions of twelve conditions that may be called "roots" in the sense used here. To qualify as a root, a condition must not be derivable from another root, i.e., a true set of roots must be a set of independent, fundamental conditions that produce far reaching consequences for mankind.

No claim is made that there are not more than twelve roots or that the twelve given will stand the test of time as true "roots." Although they often reinforce one another, they seem to be fundamental and independent. They are offered to help focus discussion. They were selected by analyzing systematically the conditions that seem to have produced the dilemmas. The first four roots

- Laissez-faire
- Usury
- Income insecurity
- Short-term political horizon

are, at least in principal, controllable through the political process. The fifth

- Natural time lags

is beyond political control. The sixth

- Over-specialization

is a structural condition of complex civilization, but may be changed through different emphasis in education. The seventh and eighth

- The ingrained concept of abundance
- Man over nature vs. man in nature

are philosophical and could be changed by education. The ninth through twelfth
Avarice
Megalomania
Fear
Fatalism

are individual traits, and hopefully could be changed by increased understanding and introspection.

Laissez-faire

Laissez-faire is the concept, expressed by Adam Smith (1723-1790), that each individual or group should be free to conduct affairs in ways that maximize self interest, and that the result will be "like an invisible hand" leading to maximum welfare of society as a whole. Another way of putting it is that laissez-faire is the governing concept that the collection of micro-decisions made in the self interest of individuals or enterprises will have the effect of macro-decisions for the benefit of society as a whole. The concept was advanced at a time of abundance in land and material resources. The question that must be raised is the appropriateness of laissez-faire in an age of increasing scarcity.

This is not to say that the opposite of laissez-faire—a society in which there is no freedom of individual choice—would be preferable. Indeed, to those who know freedom, such a society—a totalitarian society—is abhorrent. Yet, unbridled freedom of individual action is coming more in conflict with the long-term welfare of society as a whole. Can the necessary restrictions come about without over-restriction of every phase of life? The positive side of laissez-faire usually goes under the name of free enterprise—the concept of operation of a business with as little government restriction as practical. That is what we all want, but can free enterprise operate with understanding, restraint, and social conscience in an age of increasing scarcity, or will the pressures of scarcity produce decisions of destructive consequence and therefore invite increased government control? The battle between these opposing forces is already strong. Its satisfactory resolution would seem to require a more highly developed social conscience than has been common in recent years. As members of an increasingly complex society, we must not only look out for ourselves and our immediate "clan," we must have a conscience about all of humanity and about the necessary balance among all forms of life.

Usury

Usury is the lending of money at an unconscionable rate of interest. The concept of charging interest on money lent was debated for thousands of years on moral grounds (see Exodus 22:25, Leviticus 25:35-38, Deuteronomy 23:19-20). Aristotle said, "The trade of the petty usurer is hated most, and with most reason: it make a profit from currency itself, instead of making it from the process which currency was meant to serve."

Usury is forbidden by the Koran (2:275-6, 3:126, 4:159, 30:38).

Before the Reformation, charging of any interest was called usury and was illegal in Europe. Under Henry VIII the charging of interest was sanctioned by law in 1545, repealed in 1552, and reenacted in 1571. In the 1620's, Sir Francis Bacon argued

"That usury is a thing allowed by reason of the hardness of men's hearts, for since there must be borrowing and lending, and men are so hard of heart as they will not lend freely, usury must be permitted."

In England, the first nation to industrialize, the charging of compound interest on money lent or invested, i.e., of making money with money, was not fully accepted until the middle of the 19th century. As the concept became institutionalized and its implications gradually became fully understood and taught in schools, it has led more and more to the perception that the basic objective of an enterprise is to make money rather than to provide for a need of society by adding value through the application of human labor. Another way of saying this is that the criterion for the proper investment of funds has come more and more to be the maximization of return on investment. Indeed it has come about that for many enterprises short-run maximization of the return on investment sometimes appears necessary for survival, and almost always is the only explanation that will satisfy the investors. The result often is neglect of basic societal needs that appear as slower growing investments, i.e., that pay off farther into the future.

Examples are investments that appear necessary to reduce pollution, or that are needed to protect the resource base for future generations.

Pressure for maximization of return on investment is the driving force behind the growth economy. Each enterprise sees in its own growth its own well-being much more clearly than it sees the danger of continued growth of every enterprise. Even when the broader implications of continued growth are seen by some people within the enterprise, the pervasive institutionalization of the procedures of
the growth economy oppose moderation. Therein lies the "tragedy of the commons."

**Income Insecurity**

Is perfect income security a desirable social goal? Edward Bellamy thought so and developed the idea very forcefully in his famous utopia *Looking Backward*. In our society, almost every individual or group will attempt to achieve income security, while maintaining that it is not a good policy generally because the fear of loss of a job is necessary to maintain adequate performance—for others. Income insecurity occurs for many people for reasons other than individual performance—a plant is closed, a contract is canceled, a technology becomes obsolete, an election is lost. People have been attracted to large diverse corporations, government civil service, or tenured faculty positions for reasons of income security.

There are, of course, other reasons; but, when income is threatened, it is very difficult if not impossible to be objective in discussions of the cause of the threat. In Silver Bay, Minnesota, it was difficult to discuss the pros and cons of dumping 60,000 tons per day of taconite tailings into Lake Superior even though strong evidence existed that asbestos fibers in the tailings pass through filters in water purification plants and cause an unusually high incidence of stomach cancers in persons who drink the water. After an accident at the Prairie Island, Minnesota, nuclear power plant on October 2, 1979, a worker said, according to the *Minneapolis Tribune*, "I like that plant and you better not talk to me against it," and, clenching his fist, he added, "Why? Because it feeds me about 25 grand a year and I work there all day long—that's why."

How different might these attitudes have been if the individuals involved would have been secure in the belief that they would be retained and would be able to find another satisfactory job without loss of income? Many environmental battles are battles between income now and environmentally induced disease or death later, perhaps ten to thirty years later, perhaps somewhere else, perhaps to someone else—a battle between right and right, always, as the philosopher Hegel said, a tragedy. Income insecurity forces people to adopt the short-term view regardless of the long-term consequences.

**Short-Term Political Horizon**

Short terms of two, four, or six years in public office are needed to insure accountability. But they also produce income insecurity for either the individual or the political party.

How often do we hear that a politician cannot promote solutions that will take longer to solve than the term of office? How often indeed does the short-term political horizon influence the voting behavior of an elected official? Problems of pollution and resource depletion have their own characteristic time periods between initiating a correction and the desired effect.

These natural time lags cannot adjust to man-made election periods. Can an informed electorate insist that its elected officials vote in ways that may produce pain for some within the political time horizon, but none of the desired results until later, sometimes much later?

Conflicts between complex, long-range needs and the short-term political horizon are producing a crisis for representative government, the pace of which inexorably increases. Are we kidding ourselves into thinking that our interests as citizens are represented in a system that requires legislators to vote in a few months on literally thousands of issues, each of which, except for a few specialties, can occupy only a minuscule portion of their time? There is no question that we need a system of checks and balances so that no governmental group can become a captive of special interests without challenge. Would it be better to have some kind of pluralistic managerial system for essential public services in which each person rises and falls in modest steps as a result of judgments of peers? Is a political system healthy if an outsider can jump to the top position unseasoned by service in a range of increasingly responsible positions and without the first-hand knowledge gained only through experience of strengths, weaknesses, and attitudes of many people who must be dealt with? The whole question of appropriate government in an age of increasing scarcity needs fundamental reexamination.

**Natural Time Lags**

There is a time lag between the introduction of a pollutant into the environment and the major effects on people, animals, and plants. In extreme cases, the effect is very rapid. But, for the production of cancers or genetic defects the major effects may require ten to thirty years. For the introduction of plutonium into the environment, the effects may continue for hundreds of thousands of years.

The time required for development of new systems, plants, or vehicles is dependent on the time required
to understand the necessary theory, to design, to test, to accumulate materials and construction manpower, and to build. When unrealistically short time schedules are set by inexperienced managers or by managers who know better but who submit to higher authority as a result of political or economic pressures, the results are sometimes disastrous and always obtained at greatly increased cost. The crashes of two DC-10's resulting in the loss of almost 600 lives is attributed in part to speeding up the normal development cycle. Normally, it takes about seven years to take a new aircraft from concept to flight test. It takes about seven years to build a new oil refinery, and, with all of the current regulations, about ten years to build a new power plant.

Introduction of new power sources and other types of new and appropriate technology on a significant scale will be subject to even longer natural time lags because they require new infrastructures, whereas the above examples are built within industries having people already skilled in the art. Under cases of extreme emergency, the time lags have been considerably shortened, but at great expense. Mobilization for World War II is a prime example. After the Japanese attack on Pearl Harbor the required course of action was so clear that legislation could be passed with little dissent. People were convinced that the required sacrifices were both necessary and temporary. Society is much less equipped to solve problems such as those of pollution and energy shortages that creep up relatively slowly and for which there is no precedence. Crash efforts not clearly thought through may waste more energy than they save and may produce environmental consequences of tragic proportions. Too little is accomplished unless there is a crisis, but then the needed reaction time is gone.

Over-specialization

Adam Smith, in *Inquiry into the Nature and Causes of the Wealth of Nations* (1776), gave an example of the economic advantages of specialization of labor—the manufacture of pins. Given spools of wire as the raw material, one person would straighten the wire, another would cut the wire to the correct length, a third would sharpen one end to a point, a fourth would make the head, and a fifth would package the finished pins. Because specialization permitted the development of much greater skill and speed in doing one task, the result was a pin that could be purchased for much less and of higher quality than if one person made the entire pin. The drudgery of such work was not considered, and the compelling logic of specialization grew and became the basis of mass production. In science, specialization became increasingly necessary as man probed deeper and deeper into the secrets of nature. Scientists have prided themselves in being specialists, but others frequently comment that the effect seems to be to learn more and more about less and less, until eventually one knows everything about nothing.

In the management of large bureaucracies, the need for efficiency, according to now classical theories of management, requires the division of labor first into broad groups, then into specialized divisions within the groups, then into departments within the divisions, and so on. In the Soviet Union, the division of labor was carried much farther than in the United States. For example, an undergraduate engineering student could obtain a degree in heat transfer engineering; whereas, in the United States, if he is interested in heat transfer he must specialize in the broader area called mechanical engineering, of which heat transfer is one of a number of divisions. What effects does such a degree of specialization have on the future ability of a nation to solve its basic problems? While knowing more about one area, the specialist develops fewer linkages that form the basis for real innovation.

A problem society now faces is that the secondary and tertiary impacts of specific technologies require understanding of many disciplines outside the primary discipline needed to design the technology in the first place. The engineer has not been required to consider either the present or the future impacts of his or her design on society and on the environment. In the economist's terms, these impacts have been "externalities," *i.e.*, factors not taken into account in economic analysis of the present worth of the technology.

A nuclear engineer who has worked for decades on development of nuclear power with the view that he works for the benefit of mankind is embittered indeed when his work is attacked as a scourge on mankind. As we say, he is "locked in" and knows not where to turn. Would it not have been better if he had studied the whole nuclear-power cycle and its impacts as a total system with as much vigor as he studied the details of his special part of it? A military engineer immersed in the details of guidance, or control, or propulsion or missile structures faced the same dilemma when he heard talk of arms limitations. As a highly trained specialist he would have to start over from the bottom if his job were no longer needed. All of the contacts that made him valuable would be gone. He reacted by developing a rationale for continued need.
for arms production.

Can people continue to specialize as deeply as they have and retain the knowledge base required to change fields if necessary, and more important, can they take time to understand the impacts of their work? Or must over-specialization first bring us to chaos?

The Ingrained Concept of Abundance

For hundreds of years, Western society viewed the world as a vast expanse to be explored and conquered, containing untold riches waiting to be plucked. Our nation was born on a huge continent containing virtually unlimited resources of fertile soil, trees, plants, animals and minerals. The presence of native people was no deterrent to exploitation and conquest. In 1800, as a part of Thomas Jefferson’s campaign for the presidency, his supporters sang:

Here strangers from a thousand shores,
Compelled by tyranny to roam
Shall find, amidst abundant stores,
A nobler and a happier home.

The concept of laissez-faire, nurtured by the pen of Adam Smith, was conceived in these circumstances. If one patch of land was worn out, it was a relatively simple matter to move on to another. Within our economics and engineering textbooks, the concept of infinite sources of raw materials and infinite sinks for waste disposal has pervaded because of the lack of mention of limits and the tacit assumption that there would always be enough. Up to the 1970’s, most people scoffed at the idea of limits on anything. While conservation was much debated during the presidency of Theodore Roosevelt and led fortunately to the creation of many national parks, the idea of conservation of resources of the vast abundance then available affected only a few aspects of life and culture. What will it take to make the need for conservation well enough understood so that it will be taught at all levels of education?

Man Over Nature vs. Man In Nature

Upon creating man and woman in his own image, God said to them, “Be fruitful, multiply, fill the earth, and subdue it; have dominion over the fish of the sea, the birds of the air, the domestic animals, and all the living things that crawl on the earth!” (Genesis 1:28) For centuries, the Judeo-Christian tradition has been to understand by this passage that people are above nature, that they have a God-given right to exploit nature for their own needs and for the glory of God. For many people it has been repulsive to be thought of as being in nature. The idea of evolving from lower animals, i.e., from nature, was repugnant. The Biblical tradition makes it enormously difficult for Westerners to understand the extent to which their well-being depends on the complex, diverse and interconnected web of life that pervades our planet. Human beings are indeed in nature. Yet they alone, as thinking and tool-making beings, have the capacity to accommodate to the needs of the ecosystem, as they must if they are to insure their long-term future.

Notwithstanding the Ghia hypothesis that plant and animal life adjust to reduce potentially damaging changes in atmospheric and oceanic temperatures, the ecosystem may not fully accommodate. If pollution and overuse upset its balances too far, the ecosystem may, as difficult as it is to believe, no longer support humanity.

Avarice

Avarice is the excessive or insatiable desire for wealth or gain, more commonly called greed. A society that promotes, encourages, or even condones avarice will provide goods and services demanded until natural limits intercede. Purchase of more goods and services provides income for others to buy more goods and services. Until the limits are approached, everyone seems to be better off. It is difficult to gain support for moderation. When the shortage of a commodity drives its price up too much, another will be substituted—if possible. On a finite earth, such continued pressure for more and more material goods must lead eventually to instability and chaos. If each individual or social unit does not voluntarily impose limits, government must eventually impose them one by one until the concept of freedom as experienced in the past becomes impossible. Through intensive advertising, the market economy has taught us to not suppress our desires. As soon as we reach one level of satiation in material goods and services, we begin to seek a new level and move up as long as our creditors will carry us. How far must we go before we begin in earnest to learn and to teach that life will be better and freer for all if we each accept a modest level of material affluence? Or will avarice compel us to lose all freedom?

Megalomania

Great works are fashioned by great persons—persons looked up to with respect, pride and envy. People therefore become “great” by doing things great either in quality or quantity or sheer size. Only a few
have the genius to become great because of the quality of their output—Beethoven, Rembrandt, Einstein. Other talented leaders who have accumulated the wealth, power and influence needed to do "great" things, and who want to be remembered, seek to maximize the quantity of their output, or to build great monuments.

Properly channeled, the desire for greatness has sometimes been to the benefit of society, and is long revered. For others, such as Napoleon or Hitler, megalomania ends in destruction.

Generally speaking, for the bright and ambitious person, a great frenzy of excitement wells up when involved in a large project.

It is much more fun for an architect or planner to be involved in designing a huge project than a single-family home. For the engineer, there was much more excitement in the Apollo moon project than in designing a sounding rocket for meteorological research. For an industrialist, there is much greater satisfaction and reward in managing a large and growing enterprise than a small one. For an admiral, there is much more glory in commanding an aircraft carrier task force with its huge armada of support ships than in commanding a fleet of torpedo boats. An engineering manager feels more important and will be paid more as head of a development project for a solar power-tower system aimed at producing 1000 megawatts or a solar satellite system that will beam thousands of megawatts of microwave power to the earth, than as manager of a development project for a home-sized solar water heater, even though designed for mass production. Without question, there is more power, glory, wealth and prestige—all of the things a person of ambition strives for—in managing a large project rather than a small one. The various stages of megalomania produce unrelenting pressure to build to a scale and size beyond that which is economically or socially desirable in the long run. Megalomania, in its varying degrees, causes people to overlook or ignore many secondary factors that should enter into determining the optimum economic size.

Consulting engineering firms, whose fees are proportioned to project size, provide no constraint.

Massive projects eventually require massive bureaucracies to regulate them. Bureaucracies decrease in efficiency as they increase in size. Consider our life support systems, those that provide our electric power, our heat, our clean water, our food, our waste disposal. Why are they as large as they are? Economy of scale is the standard answer. All are in increasing trouble. All are of such a scale today that the average person feels like a helpless pawn when things go wrong, when quality decreases and prices increase. How much more secure and protected from inflation, pollution and resource limitations would a family or community be if it were self-sufficient in its life support systems? If small is really beautiful, as E. F. Schumacher has insisted with such eloquence and forcefulness, can we move in that direction? Can we overcome megalomania?

Fear

Fear has been the catalyst for the arms race. Only as a result of fear was it possible for Congress to vote more and more money for weapons, until the weapons arsenals of the United States far surpassed those in previous wars. It seems inherent in human nature that we will more readily build up our military defenses against a potential enemy than we will attempt to understand his history, his motives, and his problems. Fear led to lack of communication and to arsenals of defense. Seeing the buildup of arms, the other side reacted by building up its own arms. Each weapon produced a counter-weapon or a counter-strategy. A slight feeling of security at one point was wiped out by the next new weapon. The consequences of a clash become worse year by year. True national security through arms became a receding goal, not only because of increasing consequences of warfare, but because of the enormous resources of material, energy, capital, and highly trained manpower required by the arms race and thus unavailable to solve other pressing problems. The nation became more and more a fortress while its domestic problems worsen out of neglect.

The Soviet Union, unable to continue the arms race, collapsed.

Yet, today, fear has not left us. On the domestic scene, it has led to a flurry of construction of jails, yet programs for disadvantaged children that could keep many of them out of jail five to fifteen years later are considered too "liberal" to be supported politically—they produce results beyond the political horizon. Yet, a fundamental trait of a civilized nation is the way it provides for its children, who are the future of the nation.

The world is finite. The age of expansionism to find new markets for an ever increasing output of material goods cannot continue indefinitely. Nations must not continue on a collision course in search of the same diminishing supplies of materials and
energy. If they do, all will be losers. There can be no winners. Only through enlightened self interest and increased efforts towards self-sufficiency can humankind look forward to a promising future.

Fatalism

The doctrine that all events are predestined, that an individual human being is powerless to change them, has a long history.

Predestination is a tenet of orthodox Islam, and was construed by Augustine from the epistles of Paul. In the 16th century it was amplified by John Calvin. It was still heatedly debated in Protestant religious circles in the 18th century, but gradually the idea that man can act by free choice and hence is responsible for his actions became the dominant view. Yet, how often one hears people say that there is really nothing they can do to change the course of events, that they may as well live their daily routines and not think about projections of apocalyptic events. Preachers cry out that the prophecies of Revelations are about to come to pass, implying that they are predestined.

Belief that one is powerless to alter events has the obvious effect of absolving oneself of responsibility for events.

Today’s life support systems are so vast that it is easy to feel helpless. What after all can one person do? But, the dilemmas of modern times have been produced as a result of millions of individual or group actions. If that is so, why can’t the reverse be true? If each enlightened individual takes whatever action he or she can, either individually or in a small group, and urges others to do likewise, the result could steer society into a sustainable direction. Fortunately, America is a nation of doers. Many people believe they can change things, or why would they join movements or contribute to causes? More who believe the course of events can be changed are needed. A pervasive mood of fatalism will fulfill its own prophecy!

Bibliography


"The problem of human equality is raised by the general agreement of men that in a just society the standing of every member is determined by his true worth.

"As political thinkers, even Thomas Jefferson and Adolf Hitler agree that social justice depends upon the correct appraisal of men. But here their agreement ends. In planning a new world order the author of the Declaration of Independence chose the equality of men, the author of Mein Kampf their supposed inequality, as the fundamental political axiom. Their choice of opposed axioms was fateful; developing on one side into American democracy and on the other into the Nazi will to rule the world, inevitably it brought the United States and Germany into uncompromising conflict."

Myers, Henry Alonzo


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The Scientific and Medical Network

6 January 1997

Dear Frank,

Thank you for your letter of December 12th the amount of subscription which you quote as 36 (18x2) is correct. The next issue of the Review will be coming out next week and contains your review of Dewey Larson's book. I did indeed receive the ISUS material for which many thanks.

With every best wish,

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The International Society of Unified Science, Inc., is a group of scientists, engineers, and others who are trying to call attention to Dewey B. Larson’s theory of a universe of motion. The objective of the Society is the advancement of the Reciprocal System which makes use of two fundamental postulates, together with everything that can be derived from these postulates by logical or mathematical processes. The editors of Reciprocity, Journal of the International Society of Unified Science, welcomes papers, ideas, and experiments, especially from new contributors.

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