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Table of Contents

The Physical Nature of Space  Dewey B. Larson  3
Glimpses Into a New Paradigm  K.V.K. Nehru  7
Six Representational Modes and the Structure of Photons  Lawrence E. Denslow  13
Sub-Atomic Particle Array--A Revised Hypothesis  Thomas Kirk  17
The Space-Time Universe: Part II  K.V.K. Nehru  22
Sub-Atomic Mass Recalculated: Update  Bruce M. Peret  25
Research Programme for ISUS  Ronald W. Satz  28
Outline of the Deductive Development of the Theory of the Universe of Motion, Section IV  Dewey B. Larson  30

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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 Møller 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 these 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 inter-galactic 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 STRARRY 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.

The Cartwheel Galaxy presumably was a normal spiral galaxy like our Milky Way before the collision. This spiral structure is beginning to re-emerge, as seen in the faint arms or spokes between the outer ring and bulls-eye shaped nucleus. The ring contains at least several billion new stars that would not normally have been created in such a short time span and is so large (150,000 light-years across) our entire Milky Way Galaxy would fit inside.

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 knot-like 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 Larson.

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, ts). 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 towards 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 
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 multi-
dimensional 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


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 multidimensional. 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 $1D2d_1$ 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 1D1dL. 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

Equivalent Euclidean mode; (in symbols #of Dimensions #of directions type)

<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>1D1dL</td>
<td>One Dimension</td>
<td>one direction</td>
<td>linear</td>
</tr>
<tr>
<td>Linear oscillation;</td>
<td>1D2dL</td>
<td>One Dimension</td>
<td>two directions</td>
<td>linear</td>
</tr>
<tr>
<td>Unidirectional rotation;</td>
<td>1D1dR</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>2D1dR</td>
<td>Two Dimensions</td>
<td>one direction</td>
<td>rotational</td>
</tr>
<tr>
<td>Rotational Oscillation</td>
<td>1D2dR</td>
<td>One Dimension</td>
<td>two directions</td>
<td>rotational</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2D2dR</td>
<td>Two Dimensions</td>
<td>two directions</td>
<td>rotational</td>
</tr>
</tbody>
</table>
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 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>$2D^2d_R$ to specific particles magnetostatic effects</td>
</tr>
<tr>
<td>4</td>
<td>Complex Linear and Oscillational Phenomena</td>
<td>$1D^2d_R$ to most kinds of particles electrostatic effects</td>
</tr>
<tr>
<td>3</td>
<td>Atoms and Atomic Interactional Phenomena</td>
<td>$2D^1d_R$ &amp; $1D^1d_R$; atoms $\gg$ 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>$1D^2d_L$; 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. Gravitational 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 n 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 its 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 s:t 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 an 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 H^1 atom, and in turn, two H^1 atoms have a high probability of uniting as an H^2 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>1-0</td>
</tr>
<tr>
<td>Neutrino</td>
<td>1-(1)</td>
</tr>
<tr>
<td>Muon</td>
<td>(1)-0</td>
</tr>
<tr>
<td>Neutrino</td>
<td>(1)-1</td>
</tr>
<tr>
<td>Proton</td>
<td>1-1</td>
</tr>
<tr>
<td>Neutron</td>
<td>1-1</td>
</tr>
<tr>
<td>H^1</td>
<td>1-1</td>
</tr>
</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
The Space-Time Universe: Part II

K.V.K. Nehru

(Continued from Reciprocity XXV, Number 1, Spring, 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, p341)

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 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 everpresent 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 + 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 ½-½-0 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 adapts the ½-½ 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 ½-½-0 notation.

Since $I^2 = 1$, 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):

\[
e / 2 \times (\text{nu}→\text{u}) = 0.00057870 / 2 \times 0.999706441403 = 0.00028926691 \text{u}
\]

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, ½-½-(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 "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:

\[
(C+c)^2 \times (\text{nu->u}) = (0.00004494+0.00002996)^2 \times 0.999706 = 0.000000000560 \text{ u}
\]

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.)

<table>
<thead>
<tr>
<th>Composition</th>
<th>Particle</th>
<th>Calculated</th>
<th>Observed</th>
<th>Difference</th>
</tr>
</thead>
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<tr>
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</tr>
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<td>massless</td>
</tr>
<tr>
<td>e</td>
<td>positron</td>
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<td>0.00018815657</td>
</tr>
<tr>
<td>p+m+3e+E</td>
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<td>0.00033130812</td>
</tr>
</tbody>
</table>

<table>
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<th>Composition</th>
<th>Particle</th>
<th>Calculated</th>
<th>Observed</th>
<th>Difference</th>
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</thead>
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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.

References

2. ibid., page 141.
5. ibid., page 163.

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

<table>
<thead>
<tr>
<th>The Material Sector</th>
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<th>The Cosmic Sector</th>
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D 25.2-27
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 | Name: *2 | Alt. Name: *3 |
| Atomic No.: *4 | Division: *8 | Group: *9 |
| Crystal: *56 | G: *57 | Thermal Groups: *53 |

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<td>Tot. Resistance Factor</td>
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And if the holy man refused
To 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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<td>Dissociation Energy</td>
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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—within 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 their 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.