Energies at High Speeds

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One of the major problems involved in arriving at a judgment with respect to a new theory in any field of knowledge stems from the fact that it is difficult to put aside concepts based on other, conflicting, theories, and to view the new theory in its own context. But unless this is done, the judgment that is reached is meaningless. In order to be correct, a new theory must be *self-consistent*, and it must also be consistent with known facts, but it cannot be required to be consistent with all other *theories*, or with the concepts on which these other theories are based. Indeed, it must disagree with some previous ideas; otherwise it would not be a *new* theory.

The general structure of the Reciprocal System of theory, as outlined in my previous publications, is self-consistent, and it is likewise consistent with all of the multitude of experimental and observational facts that I have examined in those publications. Inasmuch as all of the very large number of conclusions reached in many different physical fields in the course of development of the new theory were derived from the same set of basic premises, so that the product is a single integrated structure, the probability that the theory as a whole is incorrect is very remote, particularly since it is the *only* general physical theory ever developed in the three thousand years during which construction of such a theory has been a prime goal of science. The problem still remaining is to fill out this valid general structure of theory by developing the details. In most cases this will involve nothing more than a straightforward extension of the previous results into more detail. It can be expected, however, that at least a few erroneous conclusions have been reached, and that in some other instances the true situation is more complex than the original study indicated.

Such points as that brought out by Fred Jansen in his article on *Increase in Mass Versus Decrease in Force* are helpful in this respect, inasmuch as they indicate areas in which further study and investigation are required. The particular point brought out by Jansen is that experiments show that the energy of a particle increases greatly as its speed approaches the speed of light, in conformity with the relation $KE = ½mv^2$, whereas the concept of a decrease in the effective force at high speeds, as derived from the Reciprocal System, when viewed in the context of the usual relation between force and energy, leads to a relatively low energy limit. This question as to the energy relations at high speeds is one that had never been critically examined in the context of the Reciprocal System (so far as I am aware) prior to the time that Jansen raised the issue at the conference in Salt Lake City in 1978. Now that the question has come up, however, such an examination is obviously required.

Development of the consequences of the postulates of the Reciprocal System shows that motion can be imparted to an object only by transferring to it some motion previously existing elsewhere. “Force” is merely an artificial construct: a way of looking at such a combination of motions that enables it to be more readily handled mathematically. The magnitude of any force is limited by the magnitude (that is, the speed) of the motion from which the force originates, consequently there is no such thing as a constant force. Newton’s second law of motion *must* break down as the speed of any object reaches the limiting speed in space: the speed of light. The relations between force and energy that prevail at low speeds likewise cease to be valid. Actually, these conclusions can be reached by a consideration of the *definitions* of the quantities involved, independently of the additional information contributed by the Reciprocal System. Force is defined by the second law: $F = ma$. Mass can be defined independently of this equation—for example, by relation to atomic number. Acceleration can likewise be defined independently. When the equation breaks down, as it does at speeds approaching that of light, the quantity defined by the equation is the one whose magnitude changes, not the ones that are independent of the equation.

The explanation of the energy situation at high speeds, in terms of the Reciprocal System, involves two of the unique features of that system:

(1) the basic motion is scalar, and
(2) it exists only in discrete units.

The basic scalar motions of our ordinary experience take place in only one scalar dimension; that is, the net change of position, inward or outward, during a given time interval, can be represented by a line connecting the initial and final positions in a three-dimensional spatial system of reference. Scalar motion in two dimensions cannot be represented in such a reference system, but this does not mean that such motion is non-existent. It merely means that the conventional reference systems are not capable of representing this kind of motion.

Since speed exists only in units, and the maximum speed in each scalar dimension is one unit, an object in the material sector of the universe can have one unit of speed (the speed of light), two units, or three units. Fractional units are not possible. Consequently, intermediate speeds do not exist. The *equivalent* of an intermediate speed can, however, be attained by adding reversely directed units of energy to any of the three possible speed levels. Because of the inverse relation between speed and energy, the addition of *n* units of energy to a one-unit speed results in a speed of $1-1/n$.

Most matter exists in the form of complex combinations of motions where the net speeds are the resultants of many individual speeds of this nature, but we can verify the foregoing conclusion by examining the spectral frequencies (radiation speeds) of the simplest atom, the mass one isotope of hydrogen. At the atomic level, the expression $1-1/n$ takes the form $1-1/n^2$, by reason of the inter-regional relationship. Thus, the ^1H atom can move only at the specific speeds generated by applying discrete units of *n* to the expression $1-1/n^2$. When the atom drops from a higher speed, $1-1/(n+a)^2$, to $1-1/n^2$, the difference is released in the form of a photon with a speed (frequency) of $1-1/(n+a)^2 - (1-1/n^2) = 1/n^2 - (1-1/(n+a)^2)$. (When expressed in conventional units, a numerical constant is, of course, required.) Similarly, the atom is able to absorb radiation of these frequencies only. The spectral frequencies of more complex atoms conform to similar, but more complex, relationships; that is, these atoms, when in the gaseous state where they are free to act independently, have characteristic line spectra.

In conventional theory, the spectral frequencies are considered to be due to transitions between internal states of different energy, related to the positions of the electrons in the hypothetical nuclear atomic structure. The need for any pure invention of this kind is eliminated by the finding that the speeds (and consequently the kinetic energies) of all freely moving atoms are limited to certain specific values. These possible speeds are "energy levels" (the expression currently in use), and the changes from one speed to another are "transitions between energy levels." All that is necessary, therefore, to bring the existing knowledge of atomic spectra into the Reciprocal System is to change some of the language and drop the unnecessary assumption of "internal" changes in the atoms.

The foregoing explanation of the nature of the increase in speed produced by adding increments of energy provides the answer to the problem pointed out by Jansen in his paper. Energy is added in units of *n* applied to the effective speed $1-1/n^2$. As the speed approaches the limiting value, unity, the result of further energy increments toward increasing the speed approaches zero. The theory therefore calls for a rapid rise in the energy in this speed range, in agreement with the experimental findings reported by Jansen. Coincidentally, the acceleration is decreasing at an equally rapid rate, approaching zero as the speed approaches unity. As brought out in my earlier publications, the so-called “constant” forces, such as gravitation and electrical forces, are products of motions at unit speed that are applied to the acceleration of material objects. The resulting acceleration is proportional to the difference in speeds, $\sqrt{1^2 - v^2}$. (In conventional units, v^2 appears as v^2/c^2.)

Just how the factor $\sqrt{1-v^2}$ should be applied in the mathematical expressions of the motion depends on the definitions that are employed. Inasmuch as force is defined arbitrarily, this factor can logically be included in the definition of force, and this was the way in which it was handled in my previous publications. Alternatively, force could be defined as constant, in which case the reduction factor becomes a mathematical coefficient in the acceleration equation. This equation then becomes $a = \sqrt{1-v^2} F/m$. The reduction factor *cannot* legitimately be applied to the mass, as in conventional theory, since mass is a specific property of matter that is (or can be) defined independently of the motion equations. The conclusions reached in Jansen’s paper therefore cannot be accepted, but he can be credited with bringing up a pertinent issue that needed clarification.