

The Case Against Modern Physics

by
Ronald W. Satz, Ph.D*
Transpower Corporation

Abstract

With the development of the Reciprocal System of physical theory by D. B. Larson, there exists a viable alternative to "modern physics." However, many scientists refuse to consider this alternative paradigm because they think nothing is essentially wrong with the current paradigm. Before they will even take a look at the Reciprocal System, they have to be persuaded that much of "modern physics" is, indeed, invalid. This paper summarizes the critique of "modern physics" made by proponents of the Reciprocal System beginning in 1959 and continuing to the present. The paper contrasts the conventional physical concepts with those from the Reciprocal System to show just how *illogical* and *irrational* the accepted concepts are. It does not question the *mathematics* of the current paradigm; it questions the *physical concepts underlying the mathematics*. Correct *physical concepts* must come *before* the mathematics if we wish to obtain the correct *physical* answers. If the physical concepts are *wrong*, then *no matter how precise or elegant the mathematics*, the theory is *wrong*.

Criticism in science is just as important as criticism in philosophy. The rank and file scientists and professors are too trusting of the proclamations and pronouncements of the leading conventional theoreticians and the authors of textbooks. It's time for the rank and file to look more *critically* at existing theories and discard those that are in violation of reason. It is also time for the government to stop funding and propping up "Big Science," except of course for military research; *government control of science makes it very difficult for competing theories to be considered*. With the decks cleared of the nonsense, the way is made open for study and eventual acceptance of the Reciprocal System, a fully rational, unified, and general theory of the universe. In a course on the Reciprocal System based on the author's papers, this paper should be studied first.

keywords: modern physics, conventional physics, theoretical physics, the Reciprocal System, philosophy of science, science criticism

*The author is president of Transpower Corporation, a commercial and custom software manufacturing company and engineering/physics consultancy. Mailing address: P. O. Box 7132, Penndel, PA 19047. He is a full member of ASME, SAE, INFORMS, ISUS, and SIAM. Contact him at transpower@aol.com.

Introduction and Literature Review

Before beginning the development of a new physical theory, it is incumbent upon the theoretician to have a thorough knowledge of current and previous theories so as not to repeat past mistakes. And, even more importantly, the theoretician must have a thorough grasp of the relevant physical facts from observations and experiments. In 1930 Dewey B. Larson began his project to calculate the physical properties of matter *solely from chemical composition and molecular structure*. His first major step was to make a detailed study of the *properties* of thousands of different substances. His second major step was to formulate more accurate and more universally applicable *physical concepts* and *mathematical expressions* to represent these properties. His third major step was to deduce the values of the properties from these expressions and compare the results with other data. Note the sequence here: *inductive reasoning*, then *deductive reasoning*. This work ultimately culminated in Ref. [1], Larson's first book, published in 1959.

Larson's key discovery is that space and time have a *reciprocal relationship* in motion, not just mathematically, but *conceptually* as well. No previous *scientific* theory had contained this concept. The only predecessor to Larson's work is Prof. Samuel Alexander's masterpiece, *Space, Time, and Deity*, Ref. [24]. But this is a work of *philosophy*, not *science*. What Larson did, in effect, is transform Alexander's space-time theory from a philosophy to a science and hence make it *testable*. Larson continued work on the Reciprocal System for many years thereafter, producing Ref. [2]-Ref.[9]. The present author summarized Larson's criticism of existing theory and summarized the Reciprocal System of theory in Ref. [10]. With the conceptual foundation secure, work then began on making the theory *computational and easy to use by engineers*. This has been the focus of the present author in the decades since the publishing of Ref. [10] and has culminated in his group of *Mathcad* papers listed in Ref. [11]-Ref. [22]. Please note the sequence here: philosophy --> science --> engineering. The data come first, then the philosophical concepts, then the scientific concepts, then the mathematics, and then finally the applications--including the Reciprocal System Database, currently a work-in-progress. The Reciprocal System Database carries out the computations of the properties of matter automatically.

Ref. [1] to Ref. [22] contain detailed critiques of conventional theory intermixed with the presentation of the Reciprocal System of theory. For the convenience of newcomers to the Reciprocal System, and especially for those taking a course on the theory, the present author has consolidated and organized this criticism in the sections of the paper which follow. After studying this paper, the reader should be able to peruse Ref. [1]-Ref. [22] with considerably greater understanding.

Note: Unlike nearly all of our competitors in theoretical physics, none of us involved in work on the Reciprocal System have taken any taxpayer money. All work has been supported by private, not public, means.

1. Logic

The scientific method involves inductive reasoning from previous experiments and observations to form a hypothesis and then deductive reasoning from the hypothesis to come to conclusions which can be tested with new or other data. But this procedure, sometimes called Newtonian in honor of Isaac Newton, has been overthrown with the rise of "modern physics." Now the procedure is to "invent" hypotheses and see if there is any "correlation with experience." And, instead of theories, we have "models." But wait, it gets worse. Deductive reasoning has even been thrown out in some situations, particularly in those involving Quantum Mechanics. Echoing the criticism of Quantum Mechanics made by proponents of the Reciprocal System over many decades, philosopher Leonard Peikoff says this (Ref. [25], p. 122):

"Since subatomic entities are vague, predictions in this realm can never be certain; they can have only a degree of probability. Nor for the same reason, can science accept Aristotle's Law of Identity or its corollary Law of Causality, since these are ways of affirming that entities are the opposite of vague--that they have specific, determinate natures. Thus the other name of the uncertainty principle, which identifies these rejections of Aristotelian metaphysics and of the process of induction based on it: the principle of indeterminacy. In regard to the subatomic world, this principle declares, the idea of causal law must be discarded in favor of rule by chance."

In contrast with all of this, the Reciprocal System utilizes the traditional scientific method and Aristotelian logic, including the Law of Identity and the Law of Causality. There is no Heisenberg Uncertainty principle in the Reciprocal System. Nothing is vague. However, the Reciprocal System is *not strictly deterministic*: if A is the cause of B, not *all* of the properties of B are necessarily determined by A--some properties may be determined by chance or by other entities. For example, the energy source for a spherical light bulb causes rays of light to be emitted at a specific *frequency* or a specific set of frequencies, but the *direction* of the *individual* rays is determined by probability: no *one* direction is favored, so there is a *probability distribution* of the rays over *all* directions. (Technically, the direction of an *individual* ray is determined by the direction of the *progressing space-time unit* in which the photon is created. Individual space-time units are moving *outward* in all directions.) Similarly, in calculating the properties of matter, there is a *probability distribution* of the velocities, and hence the temperatures, of the atoms involved. But there is no violation of causality or identity here.

Quantum Mechanics and Relativity do not work well together--therefore either one or both are wrong: *contradictions* cannot exist in a logical universe. The conventional theoreticians commonly say that "the laws of physics break down" under certain circumstances--like "inside a black hole." But: in a rational universe, there *cannot* be such a breakdown. The conventional theoreticians also say that "singularities" or "infinities" exist. But, again, in a rational universe, there *cannot* be singularities or infinities. Any theory which leads to these is *wrong*.

2. Fundamental Component of the Universe

The most important task in theoretical physics is ascertaining the *fundamental component of the universe*. The materialists first said that it was atoms, and then they said it was subatoms (after these were discovered). But in the 20th century the detection of hundreds of particles with masses less than the proton threw this idea into confusion. So then the conventional theorists came up with "quarks" or "strings" as the fundamental component. Now mind you there is no hard evidence of such entities. The "quarks" are alleged to have "fractional charges"--but no one has ever observed such. So called "gluons" are supposed to keep the "quarks" together and thus unobservable. "Strings" are even stranger; they are supposed to vibrate in "hidden space dimensions," maybe 9 or maybe 11 total. Really? Where is the evidence? These are "inventive"--not inductive--theories.

To the conventional "elementary particle" or "quark" or "string" theorists, space-time is just the *setting* or background for matter, however defined. It isn't absolute; it's purely relational. However, by *simple inspection*, we can see that space-time must come *before* matter. After all, doesn't matter exist in (coordinate) space and in (clock) time? How could matter possibly come first?

But wait, there's more. Matter can be changed to non-matter, so how can matter be fundamental? For instance, a charged electron and a charged positron, two material particles, can combine to form two gamma rays, which move outward in opposite directions. Radiation is not matter. Similarly, two gamma ray photons can combine to form an electron-positron pair. Thus something must underlie *both* radiation and matter, and this is space-time, or *motion in the most general sense*, the true fundamental component of the universe. This concept was first recognized, in a philosophical manner, by Prof. Alexander in Ref. [24], and then in a scientific manner by Larson in Ref. [1]. The Postulates of the Reciprocal System are given in the Appendix.

Note: Some theoreticians start with energy as the fundamental component of the universe. But the problem here is that energy is a purely *scalar* quantity, whereas space-time or motion can be a scalar quantity *or* a vectorial quantity. Simple observation shows that we need to have a fundamental entity which can be scalar or vectorial, as necessary.

3. Space-Time

If space-time is the fundamental component of the universe, then the dimensions of all physical quantities must be expressed in terms of space, s , and time, t , *only* (along with *auxiliary* units such as radians, steradians, cycles, and revolutions, of course). See Ref. [11]. Also, if space-time is the fundamental component, then it must be *absolute*, and not *purely relative or relational*. But conventional theorists assume the *primacy of matter* (whether as "elementary particles" or "quarks" or "strings") and so space-time is relative or relational, and not absolute, in these theories. Mass and electric charge are unanalyzable in these systems, which certainly does not help with physical understanding.

In Special Relativity, only the speed of light is taken as an absolute. This implies that the space and time of which *this* speed is composed must be *absolute as well*, in contradiction to the premises of the theory. Of course, any given motion can be taken as "relative" to a "fixed" coordinate system, which itself is moving relative to *another* reference system. But, ultimately, there must be some total value of the motion which represents an *absolute* quantity; there cannot be infinite regress. See Ref. [19] for a discussion of Special Relativity and the Reciprocal System.

Mathematically, space and time are known to be reciprocal in motion: *more* space equals *less* time. Larson generalized this conclusion: space and time are reciprocally-related both mathematically *and* conceptually. Reciprocal quantities must have the *same* properties, except that one is the numerator of the ratio of the two and one is the denominator. So if space can have a maximum of three dimensions, then time can have a maximum of three dimensions. If time can progress, then space can progress. This contrasts with the conventional theory which posits that space has three dimensions but time has only one dimension, and that time progresses, but space does not. Of course, in some theories, space progresses, as in the "Big Bang." And in other theories, space has more than three dimensions. But, by Occam 's Razor, we should not theorize more dimensions than are needed to actually explain the physical reality.

Relativity theory posits that space-time is a four-dimensional continuum. But if we start with space-time as fundamental, then space and time must have *discrete units*--otherwise how could we deduce the *dimensional values* of various physical quantities? Therefore the Reciprocal System posits *three-dimensions* of space-time in *discrete, absolute units*. And: space cannot exist without time, and time cannot exist without space; the reality is space-time only.

String theory posits that there are 9 or 11 or whatever number of space dimensions but offers no proof: the dimensions are alleged to be "hidden." String theory is just another one of those "inventive" theories which have little, if anything, to do with actual physical reality. We observe only three dimensions of space. We observe only one dimension of time, but we can *extrapolate* that time really has three dimensions, which may be observed under *some* circumstances. Similarly, we observe that time progresses, so we extrapolate that space progresses. And, in fact, we observe that distant galaxies move away from one another. The so-called "dark energy" is simply the space-time progression.

4. Photons and Radiation

In a space-time universe, photons must be some form of motion. The Reciprocal System says that a photon is a linear vibration existing within a perpendicularly-progressing space-time unit. The result of this *compound motion* is a sine curve. (See Figure 4 of Ref. [10].) This contrasts with the confusion of the conventional theorists: is radiation comprised of waves or particles? Sometimes radiation acts as a wave, and sometimes it acts as a stream of particles. The Reciprocal System explains this perfectly, whereas the conventional theories do not—they tell us that we must live with this "wave-particle duality." No, we don't. The photon travels as a wave because of the space-time progression. The photon acts as a particle, because it is, indeed, a discrete unit, a linear vibration.

But what about the double slit experiment where it seems that a photon can be in two different places at once? The compound motion of the photon easily explains this conundrum of conventional physics. By logic, a photon can, of course, go through only *one or the other* of the two slits. However, the slit disturbs the photon so that it hops onto another progressing space-time unit, thus changing direction. This completely accounts for the observed dispersion of the photons on the target screen.

Another shibboleth of conventional theory is that radiation is "electromagnetic." The vibrations supposedly represent an electric field and a perpendicular magnetic field. Actually, there is no evidence for this: no one has ever observed electric or magnetic effects from photons *by themselves*. Of course, if a material surface is bombarded by photons of sufficient frequency, we observe the photoelectric effect. Here, the photons (linear vibrations) are transformed to electric charges (rotational vibrations) of originally uncharged electrons and these newly-charged electrons may then escape from the material.

Physical and geometric optics have been derived from experience, and the Reciprocal System has no disagreement with these subjects.

5. Subatoms

In the Reciprocal System, the space-time progression is a linear or translational motion. Photons are linear vibrations moving as waves due to the perpendicular space-time progression. The next type of motion is rotation. *Rotational motion* or *spin* applied to a photon creates a subatom. Ref. [1], [6], [10], [13], [19] discuss the details. All subatoms are *rotating photons*.

The "quark" and "string" theorists posit that subatoms are a certain number and arrangement of "quarks" or "strings." But we have observed neither. Besides, what is a quark? What is a string? They are "unanalyzable" in these theories. We do observe photons, however, so why wouldn't it be possible that they could be set spinning?

And what about electric charges? Conventional theory says that they are "unanalyzable." But, in the Reciprocal System, all physical phenomena are *motions* or *relations of motions*, so electric charges must be some form of motion. Indeed, they are one-dimensional *rotational vibrations*, the details of which are given in the references. Chargeless particles come before charged particles; charges represent an *additional motion* to the bare particles. Would you rather have a theory which explains what charges are, or would you rather have a theory which says they are "unanalyzable"?

Conventional theory fails to explain why there are hundreds of "elementary particles." According to the Reciprocal System, most of these are really cosmic--or inverse--atoms. The cosmic sector of the universe is exactly like our material sector, except that space and time are *interchanged*. The masses of cosmic atoms are therefore the inverse of the masses of the corresponding material atoms. There is a Periodic Table of the cosmic elements, just like there is one for our material elements. This explains why there are so many "elementary particles" with a mass less than that of the proton but more than that of a charged electron or positron, the "mesons."

6. Atoms

Conventional theorists still preach the nuclear theory of the atom, despite Larson's total refutation of it many years ago (Ref. [4]). Here are the main points of the Reciprocal System critique:

- a. The charged electrons supposedly in orbit around the "nucleus" should, of course, spiral into the nucleus and neutralize the charges of the protons. Bohr merely *hypothesized* this problem away!
- b. The protons in the "nucleus" should, of course, repel one another. The nuclear theorists posit a "strong nuclear force" which supposedly keeps the protons together. This force is alleged to be mediated by mesons, but no one has found the "meson current." The nuclear force has no other purpose--therefore it is purely *ad hoc* just like the demon forces held by our ancient ancestors.
- c. The neutrons somehow become stable inside the "nucleus," whereas they are unstable outside, with a half-life of approx. 12 or 13 minutes or so. Just how would a neutron become stable inside the "nucleus"?
- d. The velocities and positions of the electrons are said to be "indeterminate"; the electrons may jump from orbit to orbit without going through the intervening distance. Such statements are obviously illogical and contrary to reason. The Reciprocal System has a much better explanation for the spectral lines; see Ref. [14].
- e. Applying pressure to a solid decreases the interatomic distance; if the atoms are in contact, as conventionally supposed, this would mean that the electronic orbitals would have to be *continuously* moved *inward*, contrary to the *quantization* supposed by the theory.
- f. In the scattering experiments, Rutherford used only alpha particles, not *neutralized* alpha particles. Had he used neutralized alpha particles he would have discovered that the scattering of these would be very similar to that of the normal alpha particles--which means that *electrical force* could *not* be the cause of the scattering. See Ref. [12]. The *basic* forces of matter are *not* electrical!
- g. A particular uranium isotope is alleged to have 92 electrons, 92 protons, and 146 neutrons. Really? Just how could all these particles actually work together?

In the Reciprocal System, the atom is *not* comprised of subatoms. Rather it is a *single integral unit*. Whereas a subatom has one rotating photon, an atom has two. The orthogonal photons have *quantized spins* around the three perpendicular axes. Under appropriate circumstances, the atom can *take in* additional motions or *give up* some of its existing motions. For the details, see Ref. [1]-Ref. [22]. Also, see the Periodic Table at <http://transpower.wordpress.com>.

7. Atomic Bonding

In conventional theory, the electrons (somehow) cause atoms to bond. In ionic bonding, one atom supposedly gives up an electron or electrons, and the other atom takes in the electron or electrons. In covalent bonding, the electrons are "shared" between or among the atoms. Really? These same electrons are supposed to give the atoms their structure and their spectral lines, and now they also have to bind the atoms together electrically. But it's obvious from studies of interatomic distance that two forces are necessary: one attractive, and one repulsive. The electrical theory of matter bonding provides only an *attractive* force. Besides, the gyrations required of the *hypothetical* electrons are impossible for any *actual* particles.

In metals, these same electrons are alleged to be "free" to move translationally, so as to explain electric and thermal currents. They sure are busy doing that *and* keeping the metallic atoms together. How on earth could such particles do so much?

In the Reciprocal System, in the region outside unit space, the space-time progression is, in effect, an outward force, moving atoms away from each other; gravitation is the opposite--it is an inward force. In the region inside unit space, the domain of solids, the two forces invert: the space-time progression becomes a force of cohesion, whereas the gravitational force becomes a force of repulsion. The natural result is an *equilibrium interatomic distance inside unit space*. If an outside pressure is applied to the solid, this adds to the space-time progression, inward in this region, and the atoms move closer together. If heat is applied to the solid, this adds to the gravitational force, outward in this region, and the solid expands.

In the Reciprocal System, matter is neutral, not because there is an equal number of positive and negative charges; rather, matter is neutral, because the atoms are *not normally charged*. Yes, there are electrons in ordinary matter, but these are usually *chargeless and massless*. (On average, there is one massless, chargeless electron per atom.)

In contrast with Quantum Mechanics, the Reciprocal System has a complete set of interatomic distance calculations; see Ref. [2] for the details. The Reciprocal System also has a complete set of calculations for the fluid properties of matter; see Ref. [20]. There is *nothing* corresponding to this in Quantum Mechanics. Engineers have to make do with empirical regression equations, such as those in Ref. [23].

8. Gravitation

General Relativity and similar theories posit that gravitation is caused by a deformation or "warping" of space. They say that space is "non-Euclidean." But: all of the sky surveys of recent years have shown that space is Euclidean, just as the Reciprocal System says.

Quoting from Ref. [10], p. 10:

"No truly authentic evidence exists of

- (1) a finite propagation of the gravitational effect,
- (2) a deformation of space,
- (3) a medium of any kind through which the gravitational effect could be propagated,
- (4) medium-like properties of space,
- (5) infinite effectiveness throughout space of the gravitational effect,
- (6) gravitational waves,
- (7) gravitons."

The situation has not changed since Ref. [10] was published--but a tremendous amount of manpower and money have been wasted trying to find the nonexistent gravitational waves and gravitons.

In the Reciprocal System, the same rotational motion which gives the atom its shape and mass also causes it to move inward in opposition to the space-time progression (in the region outside of unit space). The basic motions are all scalar, so a scalar rotational motion is equivalent to a scalar translational motion. The gravitational force is therefore *not propagated at all*, and space is *not curved*. For the details, see Ref. [1], Ref. [3], Ref. [5], Ref. [6], Ref. [8], Ref. [10], Ref. [15], and Ref. [21].

Note: Inertial mass exactly equals gravitational mass. So to this extent, and this extent only, we can agree with General Relativity's "Principle of Equivalence."

9. Electric Current and Thermal Current

Conventional theory says that electric current is a flow of *charged* electrons. But if this were the case, the electrons would repel themselves to the surface of the conductor, and possibly *leave* the conductor. Resistivity is known to be proportional to the *cross-sectional area* of the conductor, and this proves that the flow must be distributed *through* the conductor, not along the *surface*. The conventional theory also says that a conductor raised to a high potential at one end is the same as that of an object with a substantial static charge at that end. But there is no evidence of this: conductors are *neutral*. As for solid heat flow, conventional theory says that "phonons," supposed to be quanta of vibration of the crystal lattice, transport the energy (as well as charged electrons, in metals). Really? Has anyone ever "seen" a phonon?

The Reciprocal System says that electric current and thermal current are flows of *uncharged* electrons; electric current is unidirectional, whereas thermal current loops back within the same conductor (therefore negating any electrical effects). These uncharged electrons move *through* the atoms of the conductor, which naturally resist the motion (above the superconducting temperature). See Ref. [17] and Ref. [18] for a thorough treatment of electric and thermal resistivity in the Reciprocal System.

10. The Two-Capacitor Problem

Conventional theory says that capacitors, which are known to be neutral overall, have positive electric charges on one plate and an equal number of negative charges on the other plate. Consider an electrical circuit with two capacitors in parallel, connected by an initially-open switch. The first capacitor is "charged" by a voltage source. The second capacitor is discharged by short-circuiting its plates. The voltage source is then disconnected, and the switch is closed. What happens? Conventional theory says that there must be "charge conservation" and so some of the charge leaves the first capacitor and moves to the second capacitor, the total charge remaining the same as that initially in the first capacitor, and the voltage of the two capacitors equilibrating. Unfortunately for the theory, this violates energy conservation, for the final voltage of the two capacitors is *considerably lower* than what it would be were energy conservation to hold. Of course, the conventional theorists say that the missing energy is simply "radiated away." Really? Where's the proof?

The Reciprocal System upholds energy conservation here. There are no charges involved and hence no charge conservation! There is an *increase* in the number of electrons (massless and chargeless) taking part, because some of the electrons (again, massless and chargeless) in the *connecting circuit between the capacitors* flow into the second capacitor, as well as some of the original electrons in the first capacitor. Therefore, at the end of the process, the voltage of the two capacitors is *higher* than that calculated using the conventional equations, and thus there *is*, indeed, energy conservation. The author has confirmed these deductions by *experiment*. See Ref. [16] for all the details, including the mathematics.

11. Magnetism

Conventional theory says that the Coulombic *electric* charges of the moving electrons in matter are the cause of *all magnetic* phenomena, even including those of *magnetostatics*. But conventional theory has no explanation for many of the features of diamagnetism, paramagnetism, and ferromagnetism. For example, consider a Gouy Balance, which has a *horizontal* electromagnet. When the electromagnet is turned on, a diamagnetic specimen (initially between the poles) moves *away* from the magnet *vertically*, whereas a paramagnetic specimen (initially above or below the poles) moves *toward* the space between the poles *vertically*. Conventional theory has no explanation for this *perpendicular* effect! But the Reciprocal System does: *actual* magnetic charges exist and are *two-dimensional rotational vibrations*; a magnetic charge is the two-dimensional analog of the one-dimensional rotational vibration of the electric charge. The *horizontal* forces of the north and south poles of the electromagnet cancel, so they cause no horizontal motion of the specimen. The *second* dimension of magnetism then becomes *effective in our reference system*, and so the specimen moves *vertically*. (Our ordinary Cartesian reference system can *directly* represent just *one* dimension of a multi-dimensional motion.)

Conventional physics has various theories to explain ferromagnetism, including the Heisenberg "Electron Exchange" theory and the Heitler-London theory. Neither can be used to compute the values of the magnetic properties of matter. The Reciprocal System, by contrast, provides a complete set of calculations; see Ref. [15]. And see Ref. [11] for a compendium of the space-time dimensions and natural unit values of physical quantities, including all electric and magnetic quantities. Magnetic quantities which are analogous to electric quantities have the dimensions of the corresponding electric quantities multiplied by t/s ($t = \text{time}$, $s = \text{space}$).

12. Stellar Energy Generation

The conventional theory of stellar energy generation is that four hydrogen atoms combine to form one helium atom, the change in mass between the reactants and product being converted to energy. (Stars at later stages of evolution are also said to have similar fusion reactions, using elements of higher atomic number.) But there are numerous problems with this theory:

a. The output of energy of the O and B classes of stars is so enormous that the hydrogen "fuel" cannot last for long, and so stars of these classes are thought to be *young*. But this is contradicted by the observation that these stars exist *within galaxies* or *within galactic clusters*, which means that they are actually *old*. Young stars may exist only in globular clusters (or as a result of a recent supernova explosion within the galaxy of an *old* star, which creates a new white dwarf star and a new red giant--but these are just fragments of the original). Globular clusters eventually merge into the galactic plane, becoming galactic clusters, as the stars continue to age. Note: The relatively few O and B stars found in globular clusters can be explained as captured stragglers from previous galactic events.

b. The hydrogen-to-helium conversion process cannot possibly account for the amazing energy output of the quasars and the centers of "active" galaxies, like Seyfert galaxies.

c. The output of stars on the main sequence is quite steady and controlled. This is contrary to what we observe in the *known* hydrogen fusion process--the hydrogen bomb.

d. The greater kinetic energy and temperature of atoms in stars should result in more *fragmentation*, not more *consolidation*.

e. The hydrogen atom is just as stable as the helium atom at high temperatures, and therefore just as probable. There is therefore no reason, per se, for hydrogen atoms to combine to form helium.

f. Experiments designed to detect neutrinos created as a side-effect of the hydrogen fusion process have usually found far fewer neutrinos than expected from the theory.

The Reciprocal System explanation of stellar energy generation is that *heavy* elements in the stellar core *fission*. This is the same explanation that conventional physics and the Reciprocal System use to explain the heat generated in the *cores* of *planets*! The only difference, of course, is in the scale. For the details, see Ref. [1]-Ref. [8] and Ref. [10].

13. Stellar Explosions, White Dwarfs, Pulsars, Quasars, Radio Galaxies

The universe is a very violent place. Supernovae create nebulae and white dwarfs or pulsars. Exploding galaxies create quasars and radio galaxies. Conventional theory has a tough time explaining all these events. The Reciprocal System says that Type I supernovae occur when a hot star reaches a certain temperature or mass limit; these occur fairly regularly in any galaxy. By contrast, most Type II supernovae occur only in the older and larger galaxies; these are due to the attainment of an isotopic mass limit (essentially an age limit), not just a temperature or size limit. Conventional theory says that old stars settle down to a white dwarf--but this is based on the pure assumption that red giants are old, rather than new, as claimed by the Reciprocal System--because red giants are often found together with white dwarfs, which means that they *originated jointly*.

White dwarfs, pulsars, and quasars are all very dense. The best that conventional theory can say is that this is due to "degenerate" matter--collapsed atoms, leaving just neutrons (plus some electrons) and therefore "neutron stars," when the star's "fuel" runs out. But spectroscopy will eventually show that these stars are composed of *normal* atoms. The Reciprocal System says that in both white dwarfs and pulsars, there is an inverse density gradient, so helium will appear on the surface, with hydrogen underneath. Whereas in a red giant, there is much "empty space" between the atoms, in a white dwarf or a pulsar there is much "empty time." Hence, the inversion. Eventually, nebulae *condense* to red giants which in turn condense back into stars on the main sequence, and white dwarfs *expand* into stars on the main sequence. Pulsars have a translational velocity which, if sufficient, may cause them to leave the galaxy.

Quasars are essentially just very big pulsars. Conventional theory still has no explanation for the existence of quasars and radio galaxies associated with "active" galaxies. Currently, "black holes" are hypothesized to--somehow--explain the energy output of such entities, but this contradicts the theory that *nothing can escape a black hole*, not even light! The Reciprocal System says that quasars and radio galaxies result from galactic explosions and are powered by ongoing supernovae explosions (mostly Type II). For the details, see Ref. [3], Dewey B. Larson's astrophysical masterpiece.

14. Galactic Structure

The conventional theorists have trouble explaining how galaxies can form, given that their "Big Bang" theory claims that the matter is dispersed in all directions at very high speeds (even above the speed of light in the "inflationary part") away from the alleged "point" of the explosion. How could this eventually condense at various locations? Most conventional theorists say that the "big things" (like galaxies) came first. The usual suggestion is that there were "fluctuations" in the density of the dispersed matter, and so by probability there were some clumps of matter which then grew to form the stars and galaxies we now see. As for the globular clusters, the theorists say that they originated *with* the galaxies; therefore, to them, the globular clusters are "old." But the stars in globular clusters are mostly relatively *new!* And another thing: the theorists used to think that galaxy formation was finished many billions of years ago, but now there is solid observational evidence to the contrary.

The Reciprocal System says "No" to all of the conventional theory. There was no "Big Bang." The matter was not originally "concentrated"; it was initially widely dispersed. There is a *gravitational limit* of matter, within which atoms attract one another to form dust particles, and then eventually stars. Outside the gravitational limit, the matter moves apart due to the space-time progression. The first associations of stars are globular clusters (the individual stars of which are moving apart from one another, but remaining together by the mass of the globular cluster as a whole); these then combine to form small galaxies, and the small galaxies then combine to form the big galaxies. Galaxy formation is a *continuing process*. See Ref. [21] for a calculation of the gravitational limits and the Hubble "Constant" for the Local Group of galaxies.

15. Cosmology and Metaphysics

Conventional physicists think that our physical universe is on a *one-way process*, from the "Big Bang" to the formation of stars and galaxies, and then eventually to the running out of stellar "fuel", which means the end of all stars. The final result is a totally cold, lifeless universe. Most conventional theorists also think that our physical universe is the *total of all existence*; a few think that there are a number of physical universes within a *multiverse*. Regardless, most believe there is no metaphysical reality.

In contrast, the Reciprocal System is a *cyclical* theory. The material galaxies end their lives in a huge explosion or explosions, creating quasars, whose matter eventually leaves our material sector for the cosmic (inverse) sector. The material atoms transform to cosmic atoms, which eventually coalesce to form cosmic stars and cosmic globular clusters. These globular clusters combine to form small galaxies, which then combine to form large galaxies. These eventually end their lives in a huge explosion or explosions, creating cosmic quasars, whose matter eventually enters our material sector, isotropically--these are the cosmic rays. The whole cycle then repeats, etc.

Given that the Reciprocal System is a cyclical theory, we cannot say definitively whether or not there was a creation. If there were, we can *speculate* on the cause. In Reciprocal System metaphysics, there is a region of existence, termed the Metaphysical Realm, which is comprised of *non-space-time units*; see the Appendix for the Postulates governing this realm. The proof that there is such a realm is that human beings are compound structures, part physical and part metaphysical. We are creative and ethical and intuitive, whereas a *purely physical mechanism* (like a machine or a plant or animal) is *not creative or ethical or intuitive*--it just does what it was designed to do or evolved to do, and no more. The physical universe is a physical mechanism; although things are always changing in detail, there is no *overall* change--it is cyclical, and no new class of object is created (after the first cycle). Therefore, there must be a Metaphysical Realm, discretized into units, which is the source of our creativity, our ethics, our intuition, and our status as "observers." This realm is *beyond space and time* and so there is no "infinite regress." Conceivably, a *portion* of the non-space-time units transformed to space-time units and displacements (photons, subatoms, atoms--both material and cosmic) to form our physical universe (and others, if existence is a multiverse). The sum of the original non-space-time units equals, in some manner, the sum of the space-time units and displacements created, so there is no violation of a very generalized conservation law. Both the physical realm and the Metaphysical Realm are *huge*, but *finite*.

The above speculation gets around the problem of the "Big Bang" theory and "M(embrane)-Theory" which has to explain where all the matter/energy came from in the first place, and how it could all be concentrated into *a point smaller than an atom!* Conventional theories have many *infinities and singularities*, the Reciprocal System *does not*. See Ref. [9] and Ref. [22].

Conclusion

This paper provides a detailed refutation of many of the *physical concepts* of "modern physics." Included are those from the conventional theories of space-time, photons, subatoms, atoms, atomic bonding, electric and thermal currents, capacitors, magnetism, stellar energy generation, stellar explosions, galactic structure, and cosmology and metaphysics. The Reciprocal System of theory is shown to be a much more rational, logical paradigm for the physical universe and beyond. The reader should now be better prepared to comprehend Ref. [1] to Ref. [22]. It's time for college and university professors to replace courses on "modern physics" with courses on the Reciprocal System!

Acknowledgments

Funding for this work came from Transpower Corporation, not the government! Of course, great thanks go to Dewey B. Larson, who served as my theoretical physics mentor from 1965 until his death in 1990. He was, by far, the most intelligent and most logical of any individual I've ever known.

References

- [1] D. Larson, *The Structure of the Physical Universe* (Portland, OR: North Pacific Publishers, 1959); *Nothing But Motion* (Portland, OR: North Pacific Publishers, 1979). The latter is Volume I of the revised and enlarged *The Structure of the Physical Universe*.
- [2] D. Larson, *Basic Properties of Matter* (Salt Lake City, UT: International Society of Unified Science, 1988). This is Volume II of the revised and enlarged *The Structure of the Physical Universe*.
- [3] D. Larson, *The Universe of Motion* (Portland, OR: North Pacific Publishers, 1984). This is Volume III of the revised and enlarged *The Structure of the Physical Universe*.
- [4] D. Larson, *The Case Against the Nuclear Atom* (Portland, OR: North Pacific Publishers, 1963).
- [5] D. Larson, *Beyond Newton: An Explanation of Gravitation* (Portland, OR: North Pacific Publishers, 1964).
- [6] D. Larson, *New Light on Space and Time* (Portland, OR: North Pacific Publishers, 1965).
- [7] D. Larson, *Quasars and Pulsars* (Portland, OR: North Pacific Publishers, 1971).
- [8] D. Larson, *The Neglected Facts of Science* (Portland, OR: North Pacific Publishers, 1982).
- [9] D. Larson, *Beyond Space and Time* (Portland, OR: North Pacific Publishers, 1995).
- [10] R. Satz, *The Unmysterious Universe* (Troy, NY: The New Science Advocates, 1971). (The New Science Advocates was the original name of the International Society of Unified Science.)
- [11] R. Satz, "Space-Time Dimensions and Natural Unit Values of Physical Quantities" (original publishing date: 01/17/2013, last updated 01/22/2013, <http://transpower.wordpress.com>).
- [12] R. Satz, "Proposal for a Modified Rutherford Experiment--Includes Seven Papers" (original proposal published in *Reciprocity*, Vol. X11, No. 1, Winter 1981-1982, p.3.; all related papers are now at <http://transpower.wordpress.com>).

- [13] R. Satz, "Theory of Subatomic and Atomic Masses and Half-Lives (original publishing date: 02/01/2012, last updated: 02/10/2012, <http://transpower.wordpress.com>).
- [14] R. Satz, "Theory of Atomic Spectra and Ionization Energies (original publishing date: 05/06/2012, last updated: 05/06/2012, <http://transpower.wordpress.com>).
- [15] R. Satz, "Theory of Dielectrics, Diamagnets, Paramagnets, and Ferromagnets, including Calculation of Electric and Magnetic Susceptibilities" (original publishing date: 03/23/2011, last updated: 06/19/2012, <http://transpower.wordpress.com>.)
- [16] R. Satz, "Theory of the Capacitor" (original publishing date: 07/04/2007, las updated: 01/25/2013, <http://transpower.wordpress.com>).
- [17] R. Satz, "Theory of Electrical Resistivity (original publishing date: 11/24/2009, last updated: 01/10/2010, <http://transpower.wordpress.com>).
- [18] R. Satz, "Theory of Thermoelectricity, Thermomagnetism, and Thermal Resistivity (original publishing date: 02/21/2010, last updated: 02/03/2013, <http://transpower.wordpress.com>).
- [19] R. Satz, "Theory of Faster Than Light Neutrinos (original publishing date: 10/01/2011, last updated: 12/03/2012, <http://transpower.wordpress.com>).
- [20] R. Satz, "Theory of Liquids, Vapors, and Gases (original publishing date: 11/18/2012, last updated: 11/18/2012, <http://transpower.wordpress.com>).
- [21] R. Satz, "Calculation of the Gravitational Limits and the Hubble Constant for the Local Group (original publishing date: 05/28/2008, last updated: 02/01/2012, <http://transpower.wordpress.com>).
- [22] R. Satz, "A Graphical Representation of the Reciprocal System World View" (originally published in the 08/2001 issue of *Integra*, now available at <http://transpower.wordpress.com>).
- [23] C. Yaws, *Chemical Properties Handbook* (New York, NY: McGraw-Hill Book Company, 1999).

[24] S. Alexander, *Space, Time, and Deity* (London, UK: Macmillan & Company, Limited, 1920).

[25] L. Peikoff, *The DIM Hypothesis: Why the Lights of the West Are Going Out* (New York, NY: New American Library, 2012).

last updated: 06/27/2017--added Appendix B

original publishing date: 03/14/2013

Appendix A: The Postulates of the Reciprocal System and the Metaphysical Realm

From Ref. [1], [2], [4], [5], [6], [7], [9], and [10]--

FIRST FUNDAMENTAL POSTULATE: The physical universe is composed entirely of one component, *space-time* or *motion in the most general sense*, existing in three dimensions, in discrete units, and with two reciprocal aspects, space and time.

SECOND FUNDAMENTAL POSTULATE: The physical universe conforms to the relations of ordinary commutative mathematics, its magnitudes are absolute, and its geometry is Euclidean.

THIRD FUNDAMENTAL POSTULATE (IMPLIED): The physical universe is logical, orderly, and rational. (Ref. [9], p. 29.)

From Ref. [9], pp. 43-44--

FIRST METAPHYSICAL POSTULATE: There are existences in the metaphysical region of a more general and less restricted type than the units of motion that are the basic constituents of the physical universe.

SECOND METAPHYSICAL POSTULATE: The metaphysical existences are logical, orderly, and rational.

THIRD METAPHYSICAL POSTULATE: Metaphysical existence conforms to a specific set of laws and principles different in some respects from those of the physical universe.

FOURTH METAPHYSICAL POSTULATE: The metaphysical existences of which we have evidence are intelligent.

Aristotelian logic, including the Laws of Identity and Causality, apply to entities of *both* the physical universe and the Metaphysical Realm. There are no contradictions anywhere.

The metaphysical units are *non-space-time units*. They are therefore *beyond* space and time. There is thus no "infinite regress."

Appendix B: Review of Hawking's *A Brief History of Time* (posted to Amazon.com 09/10/2010)

This review will critique the conventional physical theory espoused by Stephen Hawking (hereafter abbreviated to SH) in his best-selling book. From the perspective of the Reciprocal System (hereafter abbreviated to RS), the book is full of errors on practically every page. Still I urge students and faculty to read it--SH does a good job of presenting the "establishment's" viewpoint and it's worth pondering his thinking. The book's dust jacket proclaims SH to be the "most brilliant theoretical physicist since Einstein" yet he begins his conclusion (p. 171) with the words "We find ourselves in a bewildering world." This is a far cry from my Unmysterious Universe, published in 1971. (Hawking's later editions of this work are very similar and so the comments here need not be updated.)

SH is confused as to whether the universe was created or not. He states that in "imaginary time" the universe has no beginning or end, no singularities or boundaries--it simply is. But in "real time" the universe does have a beginning and an end at singularities that form a boundary to space-time and at which the laws of science break down (p. 139). The beginning singularity is, of course, called the "big bang", when the universe was "infinitesimally small and infinitely dense" (p. 8) and "infinitely hot" (p. 117) and space-time had infinite curvature [!]. Time, and by implication, space-time, had no meaning prior to the beginning (p. 8). SH defines an event (p. 23) as "something that happens at a particular point in space and at a particular time. So one can specify it by four numbers or coordinates." This is the conventional four-dimensional space-time, 3 spatial coordinates and 1 temporal coordinate, which is quite different from the 3-dimensional space-time of the RS (where each dimension is a dimension of motion, not of space or time individually). In the RS, space-time has an in-built expansion and hence there is no need for a "big bang" to explain the recession of the distant galaxies. SH states (p. 33) that "Space and time are now dynamic quantities: when a body moves, or a force acts, it affects the curvature of space and time--and in turn the structure of space-time affects the way in which bodies move and forces act." Certainly there is no physical evidence for this; bare space-time is non-physical since it cannot be changed into something else--it is simply a reference system for motion. SH does not specify a mechanism for producing this alleged warping of space-time by the "distribution of mass and energy in it" (p. 29). SH treats space and time as both purely relative, not absolute (p. 21, 33); he says that "each observer must have his own measure of time, as recorded by a clock carried with him, and identical clocks carried by different observers would not necessarily agree." Of course, this subjectivist belief leads to numerous logical contradictions and is wrong; space-time is the fundamental component of the universe and must thus be absolute (there is nothing for it to be "relative to" since it is itself the reference).

An electromagnetic field fills the space-time of SH. There can be (p. 19) "wavelike disturbances in the combined electromagnetic field"; (p. 38) "...visible light consists of fluctuations or waves, in the electromagnetic field". But (p. 54) "Although light is made up of waves, Planck's quantum hypothesis tells us that in some ways it behaves as if it were composed of particles: it can be emitted or absorbed only in packets or quanta." This is the old wave-particle duality. Compare this with the definition of photon in the RS: a linear vibration within a single space-time unit, which itself progresses perpendicularly, the combination thus generating a wave motion. SH states (p. 31) that "Light rays too must follow geodesics in space-time" and (p. 28) "...nothing can travel faster than light". In the RS, spatial motion is limited to speeds lower than that of light, but temporal speeds are higher: the speed of light is the mid-point of the speed range of the universe, not the upper limit.

According to SH (p. 117) "One second after the big bang, [the temperature] would have fallen to about ten thousand million degrees...At this time the universe would have contained mostly photons, electrons, and neutrinos..and their antiparticles, together with some protons and neutrons." SH does not provide a fundamental definition of electrons or neutrinos (the quark hypothesis does not include them; quarks are the undefined elementary particles of matter). He states (p. 65) that "A proton contains two up quarks and one down quark; a neutron contains two down and one up." (p. 73) "One cannot have a single quark on its own...confinement prevents one from observing an isolated quark or gluon" [which carries the "strong nuclear force"]. (p. 75) "...the uncertainty principle means that the energy of the quarks inside the proton cannot be fixed exactly. The proton would then decay." (p. 73) "Another possibility is a pair consisting of a quark and an antiquark...such combinations make up the particles known as mesons, which are unstable because the quark and antiquark can annihilate each other, producing electrons and other particles." Each subatom has a spin, but (p. 66) "quantum mechanics tells us that the particles do not have any well-defined axes". (p. 67) "Particles of spin $1/2$...make up the matter of the universe, and particles of spin 0, 1, and 2 give rise to forces between the matter particles." (p. 69) "The electric repulsive force between two electrons is due to the exchange of virtual photons (spin 1)" and (p. 70) "the force between two matter particles is pictured as being carried by a particle of spin 2 called the graviton." This is all in contrast with the RS, in which each subatom is a set of quantized spins of a photon, with definite axes. The mesons are actually cosmic atoms in the process of converting to the prevailing structures of our sector. The apparent force interactions are not due to exchange of particles (virtual or otherwise), but rather represent an interaction between the particle and the omnipresent space-time progression.

SH continues (p. 117): "About one hundred seconds after the big bang, the temperature would have fallen to one thousand million degrees, the temperature inside the hottest stars. At this temperature protons and neutrons would no longer have sufficient energy to escape the attraction of the strong nuclear force, and would start to combine together to produce the nuclei of atoms of deuterium...The deuterium nuclei then would have combined with more protons and neutrons to make the helium nuclei...and also small amounts of a couple of heavier elements, lithium and beryllium...Within only a few hours of the big bang, the production of helium and other elements would have stopped." SH doesn't question the validity of the nuclear theory of the atom. No mention is made of the instability of the neutron: how can an atom be stable if one of its main components is known to be unstable? Also, why don't the alleged protons in the nucleus repel each other? To explain the "strong nuclear force" as due to the exchange of unobserved "gluons" is mystical. Also, the alleged orbiting electrons are thought not to combine with protons and neutralize their charges, whereas other pairs of oppositely charged particles do. Finally, why should the production of new elements cease? It seems more likely that over the course of thousands, or millions, or billions of years that atoms would continue to combine to form heavier atoms, and these would join to form ever more complex molecules. SH states (p. 60) that "Since the structure of molecules and their reactions with each other underlie all of chemistry and biology, quantum mechanics allows us in principle to predict nearly everything we see around us, within the limits set by the uncertainty principle. (In practice, however, the calculations required for systems containing more than a few electrons are so complicated that we cannot do them.)" Well, what good is a theory if we can only use it in principle?

SH continues (p. 117): "The universe as a whole would have continued expanding and cooling, but in regions that were slightly denser than average, the expansion would have been slowed down by the extra gravitational attraction. This would eventually stop expansion in some regions and cause them to start to recollapse...in this way disklike rotating galaxies were born." SH uses the uncertainty principle to explain the non-uniform density. He says (p. 140) that "...there must have been some uncertainties or fluctuations in the positions or velocities of the particles. Using the no boundary condition, we find that the universe must in fact have started off with just the minimum possible nonuniformity allowed by the uncertainty principle." The RS explanation is much better: the two main forces of the universe are the space-time progression and gravitation; where gravitation is stronger, galaxies and stars are formed; where the progression is stronger, the galaxies move away from each other. Also, the latest evidence is that the formation of galaxies is not a one-time occurrence--observations indicate that galaxy building is going on right now, just as the RS predicts.

An average galaxy has a hundred billion stars. SH states (p. 82) that "A star is formed when a large amount of gas (mostly hydrogen) starts to collapse in on itself due to gravitational attraction. As it contracts the atoms of the gas collide with each other more and more frequently and at greater and greater speeds--the gas heats up. Eventually, the gas will be so hot that when the hydrogen atoms collide they no longer bounce off each other, but instead coalesce to form helium. The heat released in this reaction, which is like a controlled hydrogen bomb explosion, is what makes the star shine. This additional heat also increases the pressure of the gas until it is sufficient to balance the gravitational attraction, and the gas stops contracting....Stars will remain stable like this for a long time....Eventually, however, the star will run out of its hydrogen and other fuels. Paradoxically, the more fuel a star starts off with, the sooner it runs out." This is paradoxical indeed, for the larger stars should be the oldest and the smaller stars the youngest. In fact, the observed evidence indicates that the astronomers have the evolutionary sequence precisely upside down, as the RS contends. SH continues (p. 83, 84, 87): "When a star runs out of fuel, it starts to cool off and so to contract...If a star's mass is less than the Chandrasekhar limit, it can eventually stop contracting and settle down to a possible final state as a 'white dwarf' with a radius of a few thousand miles and a density of hundreds of tons per cubic inch....[If a star's mass is greater than the Chandrasekhar limit, the star will eventually collapse to a black hole] in which neither light nor anything else can escape." In the RS, stars slowly accumulate mass, rather than losing mass, and there is no end in a black hole. Rather at the mass limit, a supernova explosion occurs, and a red giant/white dwarf pair is formed (or a planetary satellite system) and both stars eventually return to the main sequence. It's interesting that SH proposes a radical theoretical change in the black hole construct: he says that actually a black hole would emit particles and radiation and (p. 115) "...the black hole, along with any singularity inside it, would evaporate away and eventually disappear."

SH continues (p. 46): "The present evidence therefore suggests that the universe will probably expand forever, but all we can really be sure of is that even if the universe is going to recollapse, it won't do so for at least another ten thousand million years, since it has already been expanding for at least that long." Compare this with the RS: there are two sectors, the material sector, and the cosmic sector. Outward spatial expansion in the material sector is terminated with a galactic explosion which sends the matter over to the cosmic (inverse) sector, where outward temporal expansion (the inverse of spatial expansion) occurs. This expansion in turn is terminated with a cosmic galactic explosion which sends the matter back to the material sector. Thus the main process in the universe is cyclic, rather than a singular one-time expansion. Also the net total displacement in the universe is zero, because the number of cosmic displacement units balances the number of material displacement units (whereas SH states (p. 129) "...the total energy of the universe is exactly zero...this negative gravitational energy exactly cancels the positive energy represented by the matter.")

efully studied this book, I think the supporters of the RS have nothing to fear. If this is the best popular rendition of conventional theoretical physics, the future looks bright for the spread of the RS, which is a unified, general theoretical system. (Contrast the RS with the current "Grand Unified theories", which (p. 156) "are not very satisfactory because they do not include the force of gravity and because they contain a number of quantities, like the relative masses of different particles, that cannot be predicted from the theory but have to be chosen to fit observations.") Further details of the RS refutation of the ideas expressed by SH can be found in Dewey Larson's books, particularly *The Universe of Motion*.