The Emergent Universe

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Abstract

This is the third of three articles that present the concept that all mechanisms of the universe have emerged from the interactions of two fundamental massless particles under specific conditions. The first article[3] identified properties of the massless particles and additional properties of the electron and proton that, when combined with a geometric model, result in equations that accurately compute the fundamental constants and electron and proton properties. The second article[4] developed a neutron inner orbit model that accurately calculates the neutron excess mass equivalent energy. The success of these models in reproducing the experimental data implies that the universe has emerged from the interactions of two massless particles that successively create new conditions and interactions resulting in increasing complex systems. This article investigates some the implied emergent mechanisms that underlie these systems. The mechanisms investigated are those responsible for dynamic electrons and protons, the characteristics of light, space as a flexible and responsive grid system, gravity, magnetism, particle-wave duality, relativistic mass, mass equivalent energy and momentum, time dilation, length contraction, and characteristics of the universe (cosmology). The conclusion is that the implied mechanisms that stem from the successful models developed in the first two articles result in a coherent and comprehensive depiction of the emergent universe.

Introduction

The rationale for the views expressed in this article is that there are unwarranted extensions of both quantum mechanics and the theories of relativity that are based in part on the failure to recognize or remember that mathematics is the servant of both reality and fantasy. Early in the 20th century the scientific pendulum in atomic physics swung heavily toward theoretical mathematical models. The failure to accept the limited applicability of these models appears to have influenced the departure from causality that was an aspect of what became known as the Copenhagen interpretation. This resulted in the acceptance of calculated infinite values of some physical properties such as density as reality although this defies all observations. In fact, these mathematical singularities represent points of zero knowledge and cannot be renormalized into reality as is the prevailing delusion. I still regard causality as the appropriate foundation for all of science. My engineering observations are that almost all mathematical models of reality are valid only in well-defined domains. Aerodynamics is a good example where subsonic models do not apply in transonic or supersonic regimes and vice-versa. General applicability appears to be confined to general principles such as the conservation principles. The result is that there are often multiple interpretations of experimental data in cases where the actual physical mechanisms are unknown or poorly understood. That is why subpopulations of our species believed in astrology, flat earth, geocentric model with explanatory epicycles, etc. Fortunately, the scientific method based on causality has eventually led to the correct interpretation although the process has often taken a long time.

I regard the historical treatment of quantum mechanics and the theories of relativity as incomplete at best. In my view, the common denominator for the incompleteness in most cases is the absence of actual physical models. In fact, the most popular scientific opinion seems to be that there are no physical models at the ultimate fundamental level. This view appears to mandate that the physics principles that have served us so well do not apply at this level. A recent exposition of the extent to which this philosophy has developed is presented in Ref. 1 entitled "What is Real" (*Scientific American*, August 2013, pp. 40-47). Quoting from page 45, "Now the following question arises: What is the reason that we can know only the relations among things and not the things themselves? The straightforward answer is that relations are all there is. This leap makes structural realism a more radical proposition, called ontic structural realism." The author goes on to explain the state of affairs that has led to this position. Quoting from page 47, "How can there be so much fundamental controversy about a theory that is as empirically successful as quantum field theory? The answer is straightforward. Although the theory tells us what we can measure, it speaks in riddles when it comes to the nature of whatever entities give rise to our observations. The theory accounts for our observations in terms of quarks, muons, photons and sundry quantum fields, but it does not tell us what a photon or a quantum field really is. … For many physicists, that is enough. They adopt a so-called instrumentalist attitude: they deny that scientific theories are meant to represent the world in the first place."

Another description of the legacy of quantum mechanics' unwarranted extensions into the bizarre is presented in Ref. 2 entitled "Quantum Weirdness: It's All in Your Mind" (*Scientific American*, June 2013, pp. 46-51). Quoting from page 47, "Physicists have grappled with the quantum world's apparent paradoxes for nine decades, with little to show for their struggles." In a refreshing analysis of the famous paradox of Schrödinger's cat being both alive and dead at the same time, the author states on page 51, "Asserting that Schrödinger's cat is truly both alive and dead is an absurdity, a megalomaniac's delusion that one's personal state of mind makes the world come into being." However, the bold author reviews a new version of quantum theory called Quantum Bayesianism (or QBism) combining "quantum theory with probability theory in an effort to eliminate the paradoxes or put them in a less troubling form." In the summary paragraphs entitled, "A New Reality" he states, "And proponents of QBism embrace the notion that until an experiment is performed, its outcome simply does not exist. Before the speed or position of an electron is measured, for example, the electron does not have a speed or a position. The measurement brings the property in question into being." I respectfully suggest that another refreshing and consistent analysis of this position might paraphrase the previous quote, "Asserting that an electron's speed or position does not exist before it is measured is an absurdity, a megalomaniac's delusion that one's personal actions makes the world come into being."

My alternative response to this state of affairs is that 1) reality does in fact consist of physical entities, 2) there are alternative interpretations of scientific measurements and observations and 3) the correct and complete interpretation of these measurements and observations will emerge when the physical entities are identified and the physical mechanisms are understood. The current article is the third in a three-part series and attempts to further describe the implications

of a physical model that accurately calculates the fundamental constants and the well-founded properties of electrons[3], protons[3] and neutrons[4]. Specifically, in the previously reported work, I discovered that the interactions between two postulated fundamental massless particles provided possible mechanisms for a physical electron with causal properties[3] as contrasted to the currently popular notion of intrinsic electron properties. Likewise, there were also compatible mechanisms for the proton[3]. The second of these three articles presents the neutron inner orbit model that is consistent with the electron and proton models and accurately calculates the experimentally determined neutron excess mass equivalent energy[4]. Therefore, the outcome is that these compatible physical models, which are straight-forward mathematical equations, do accurately calculate the accepted experimental data as expressed in the fundamental constants and properties of electrons, protons and neutrons.

The success of these models in matching the experimental data also results in important implications regarding the underlying physical mechanisms. The current article addresses some of those implications relating to the emergence of the multifaceted mechanisms of the universe such as gravity, magnetism, special and general relativity, and flexible universal space. In order to lay the foundation for further consideration of these implied underlying physical mechanisms, the basic ideas of the previous work reported in Refs. 3 and 4 are summarized. The development begins with the presentation of three primary postulates as follows:

1. All processes in the universe emerge from the interactions of two massless particles.
2. The concepts of mass, force, and all resultant static and dynamic properties of matter result from the action of the two massless particles in the formation and function of the two stable structured particles, the electron and proton.
3. All measured values of the traditional fundamental constants including the electron and proton properties are the result of actual physical mechanisms.

The basic premise for the physical model as seen in the postulates is that the entire universe of mass and energy is solely the result of collisions between the only existent foundational entities in the universe, designated as characteristic one (C1) and characteristic two (C2) particles. Both the C1 and C2 particles are regarded as smooth, rigid, massless spheres. Their collisions are accurately represented by a billiard ball model with purely kinematic responses due to the massless property. An immediate implication of this approach is a physical origin for the observed constant speed of light.

Origin of the Speed of Light

The massless C1 and C2 particles have the same equilibrium isotropic speed distribution and, therefore, the same average speed, $V_{C1avg} = V_{C2avg}$. Since the interaction of the C1 and C2 particles is the cause of all forces and actions, no object with mass can exceed this average speed, consistent with special relativity[5]. This result suggests an important extension to the theory of special relativity which is that the average speed of the massless C1 and C2 particles is the speed of light in a vacuum, c. That is, $V_{C1avg} = V_{C2avg} = c = 299,792,458$ m/s. This condition is analogous to the speed of sound in a gas which is the appropriate average speed of the individual molecules. In this context, the speed of light becomes both a fundamental constant and

a measured property of the massless particles. This average speed is also the propagation speed of any disturbance to the C2 grid system, which includes all electromagnetic radiation. While the average speed of the fundamental particles is the speed of light in a vacuum, the speed distribution includes instantaneous speeds from zero to hyperluminal.

Constancy of the Speed of Light Relative to Any Moving Body

The physical model for the electron is a pulsating shell of C2 particles, one C2 particle thick. Specifically, a precise number of captive C2 particles maintain a dynamically stable, fully contracted rotating electron shell for an exact and brief period of time. The number of C2 particles in the electron shell is determined as one of the emergent properties from the model and fundamental constants[3]. When there is a higher C1 collision rate on one side of a pulsating electron, all the captive C2 particles acquire an additional velocity increment in the direction opposite to the higher collision rate during the electron expansion and contraction phases. Upon full contraction, the electron center will have moved in that same direction. Also this velocity increment will be acquired by all of the C1 particles that interact with the C2's during the accumulation phase. During the next expansion, the expanded C1's and C2's retain this velocity increment so that the electron center retains the increased velocity.

An important consequence of the acquisition of the velocity increments by the interacting C1 and C2 particles is that the time average velocity of the C1's in the vicinity of the electron is always equal to the speed of light relative to the electron. This means that the C1's moving forward from the electron have added the electron's velocity increments while the C1's moving rearward from the electron have subtracted the increments. The result is that any electromagnetic disturbance produced by the electron will be transmitted at the speed of light relative to the electron. This same effect happens with the proton whose outer shell pulsates in the same manner as the electron but 180 degrees out of phase. Since all stable matter in the universe is composed of electrons and protons or their anti-particles, the speed of light is always constant relative to any moving body.

Motion of Structured Bodies through the C2 Particle Grid System

It is also this effect of the addition of velocity increments that allows any structured body to maintain its acquired velocity in this C1 and C2 particle laden environment in the absence of external forces (Newton's first law of motion). It means that the centers of the fully compressed electrons and protons which appear and disappear in phase with the vibrational frequency move through the C2 grid system because they retain any acquired velocity increments. It is also the absence of this effect that keeps the free C2's localized. The result is that the free C2's form a flexible three-dimensional localized grid system as discussed below.

During the expansion phases of the electrons and protons, the captive C2 particles respond kinematically to the C1 particle collisions as contrasted to the dynamic responses of the pulsating composite structures. Therefore, the electron and proton may be viewed as conditions in which kinematic properties of the C1 particles are repetitively transferred to and from two unique collections of captive C2 particles to repeatedly assemble and disassemble these dynamic universal structures.

Space as a Flexible and Responsive C2 Grid System

The C1 particle is small with a large number density, and it is the activator for all forces (gravity, electromagnetic, strong and weak nuclear) and actions in the universe. The C2 particles are much larger and less numerous than the C1 particles. As a result, under equilibrium conditions, the net movement of any C2 particle is small compared to its diameter. This is due to the high collision rate with the C1 particles, which have an exceptionally large number density.[3] The result is that the C2's form a flexible and responsive grid system which suggests the concept of space as the three-dimensional region between adjacent C2 particles in the grid. This flexible grid system is shaped by the contour of objects such as stars and planets because of the attraction of the C2's to the objects. In addition, the number density of the C2 particles in the grid system increases as the distance from the objects decreases, analogous to the mass density of gases in planetary atmospheres. Therefore, as expected, space is curved, consistent with general relativity. It is the interaction of the moving electron or proton with this flexible grid system that results in the relativistic effects as the speed approaches the speed of light as discussed below.

Gravity

The motion of a C2 particle in free space changes the random incoming directional distribution of the interacting C1's to an outgoing directional distribution that has a deficit in the number of C1 particles traveling normal to the C2 directional movement. One simplified model that helps to visualize this effect is a cube representing the C2 particle placed such that the six faces are perpendicular to idealized streams of equally spaced C1 particles. The C1 particles are sufficiently small that they do not impact each other upon reflection from the cube surfaces. If the cube is always stationary, the C1 particles reflecting normally from one surface appear like they are the continuation of the C1 particle stream from the opposite surface. The reflecting streams are continuous so there is no observable gap due to the presence of the cube. However, if the cube is in motion in a direction parallel to one of the rectangular coordinates, streams perpendicular to the motion will have gaps equal to the cube width as the rearward face passes their locations. These gaps would be detectable to any C2 particle at a distant location.

If instead of a single rearward surface, the surface contains two steps, there will be two smaller gaps in the non-reflecting streams corresponding to the passage of each step. Likewise, for any number of steps, there will a corresponding equal number of smaller gaps in the non-reflecting streams. In all cases, the sum of the gap widths will equal the cube width. The realistic case of the sphere corresponds to a number of gaps approaching infinity with a total gap width equal to the sphere diameter. Since the C2 particle is continuously changing direction in response to the C1 impacts, a free C2 particle continuously transmits C1 particle streams that contain less particles normal to its average location than those streams that are being transmitted randomly. The total number of outgoing particles remains unchanged from the number of incoming particles but the directional distribution of the particles has changed.

It can be shown that this C1 particle normal deficit is propagated across space, persisting through all kinematic collisions with C2 particles including those with captive C2 particles in electrons and protons. This means that the gravitational attraction between bodies is not blocked by

intervening bodies. This also means that there is an attraction between all C2 particles in the universe so that the gravitational force experienced by any mass is the appropriate sum of the contributions from all existent C2 particles. When this attraction is between electrons and/or protons, their captive C2 particles experience this average C1 deficit and retain the ensuing velocity increments for each pulsation cycle resulting in an acceleration[3]. The difference in the C1 collision rate across the electron and/or proton which causes the acceleration is the attractive force known as universal gravitation. The concept of mass emerges from this process through the defining relationship $F = ma$. In this context, mass is seen as the ratio of the cause (difference in C1-C2 collision rates) and effect (acceleration) under specific conditions (pulsating stable groups of C2 particles). The massless particles are always massless, and the concept of mass arises solely from their participation in the structures of the electron and proton.

Magnetism

The flexible C2 grid system also gives rise to an important effect associated with the motion of the grid's C2 particles in response to properly aligned rotating electrons. This effect known as magnetism is illustrated in a well-known physics demonstration that allows visualization of the magnetic field lines between the ends of a permanent magnet by observing the orientation of iron filings placed on a rigid paper above the magnet. The shape of the magnetic field lines appear like a graphic of the flow lines between a source and a sink in a hydrodynamic flow. This visual analog suggests that the flow of particles in the magnetic case corresponds to the flow of the fluid molecules in the hydrodynamic case. The magnetic particles are in fact the C2 particles in the ubiquitous C2 grid system responding to the characteristic rotation of the properly aligned electrons in the permanent magnet. There are no monopole magnets because the C2 particle grid system is continuous and the flowing C2 particles are immediately replaced by their adjacent C2 neighbors. This continuity requirement results in a continuous circulating flow of C2 particles that completes a circuit around the outside and through the interior of the magnet. There is no friction associated with the motion of these free massless C2 particles.

The magnetic field that accompanies the electric field of moving electrons also results from the alignment of the spin axes of the electrons because of their motion. The alignment of the spin axes produces magnetic field lines that lie in planes perpendicular to the direction of motion. The electric field results from the electrostatic effects of the pulsating electrons. When the electrons are stationary, the magnetic field is not present because the spin axes of the electrons are randomly oriented canceling their cumulative effect on the C2 grid system. However, there is still an electric field associated with the unaligned stationary electrons because the pulsations of the electrons are all in phase independent of their alignment.

Elementary Particles

The only entities in the universe that are not composites of other entities are C1 and C2 particles. In this sense, these two massless entities are the only truly elementary or fundamental particles. Likewise, they alone correspond to the original definition of the atom as "any of the indivisible particles postulated by philosophers as the basic component of all matter". For example, electrons and protons are not single particles but rather they are specific collections of C2

particles responding to collisions with C1 particles as discussed above. However, under certain conditions, electrons and protons can exhibit properties like those of a single particle, giving rise to the first half of the particle-wave phenomenon.

I have observed from my calculations of the properties of the two elementary particles[3] that emerge from the fundamental constants and the appropriate physical model, that structured matter cannot exist with only a single basic component. It is the kinematic interactions of the two particles under particular conditions that give rise to the diversity of mechanisms that characterize the universe.

These mechanisms obey the same conservation principles of physics at all levels from the subatomic to the cosmological. This includes quantum mechanics and special and general relativity. The foundational basis for quantization begins with the two massless particles that exist in two quantized sizes. The kinematic interactions of these two particles can produce specific temporary groupings of C2 particles that constitute specific levels of mass and corresponding levels of mass equivalent energy as in $E = mc^2$. For orbiting electrons these levels of mass and energy result in specific levels of angular momentum as utilized in the mathematical development of the Bohr atom. Likewise, the magnitude of the disturbance of the C2 particle grid system that accompanies the arrival of an electromagnetic wave at the boundary of a pulsating electron or proton affects a specific number of boundary C2 particles resulting in the quantum concept of energy transfer as a function of electromagnetic wave frequency.

Other temporary groupings of the C2 particles result from the collision of protons, electrons, or their combinations at high energy levels in colliders such as the Large Hadron Collider. As the accelerating particles approach relativistic speeds, the C2 particle grid system in the forefront of the particles becomes more and more compressed as discussed below. When the counter-flowing particles collide, the interaction of the ubiquitous C1 particles with the concentrated C2 particles in the grid system results in the production of an array of temporary particles which are the most numerous in the so-called particle zoo. These temporary particles are pulsating at a high frequency and exhibit exceptionally short lifetimes as they do not possess stable structures and therefore give up their C2 particles as a function of their frequency. The only stable particles that result from these collisions are electrons, protons, neutrinos and their anti-particles.

Elementary Waves

As in the case for quantization, the foundation for the observed wave nature of matter comes from the type of mechanism associated with interactions of the C1 and C2 particles under specific conditions. In this case, the foundational mechanism for the formation and maintenance of a stable electron and proton is a pulsation frequency that repeatedly assembles and disassembles these stable structures as discussed above. These pulsations propagate at the speed of light through the ubiquitous C2 particle grid system which, under certain conditions, can cause wave-like interactions with their surroundings giving rise to the second half of the particle-wave phenomenon.

All chemical and physical reactions involving electrons and protons are due to the transfer of C2 particles during the pulsation cycles. This transfer can only occur for atomic and molecular

processes at harmonic frequencies of the electron and proton frequency. That is, the motion of the merging groups of C2 particles must be compatible at specific intervals. Some reactions such as oxidation can occur over a large range of harmonic frequencies which corresponds to a large range of temperatures. Other reactions such as the formation of carbon atoms from helium atoms only occur over a small range of harmonic frequencies.

This requirement for a harmonic frequency match sometimes reveals surprising results. An example is the discovery of a molecule called methoxy, or CH_3O in an interstellar gas cloud[6]. It forms when hydroxyl (OH) and methanol (CH_3OH) react. Yet that reaction requires more energy than is available in space, where temperatures hover just above absolute zero. However, in a laboratory setting, researchers found that this same reaction took place 50 times faster at -210º Celsius than at room temperature, even though the chilled molecules have far less energy to work with. The explanation given was "a quirky property of quantum physics" called quantum tunneling[6]. As usual there is no physical basis given for the existence of such a property. An alternative explanation from the emergent universe is that the reaction temperature corresponds to an appropriate harmonic frequency for that reaction.

In another example, it was discovered that the shock wave conditions associated with ballistic impact into a target made of ice mixtures having a similar composition to a comet can generate molecules and transform these molecules into amino acids[7]. The research team made their discovery by recreating the impact of a comet by firing projectiles through a large high speed gun. The resulting impact created amino acids such as glycine and D-and L-alanine. In the recent past, these impact conditions were considered to be too severe to create fragile complex molecules. However, in the context of required harmonic frequencies for chemical reactions, the pressure and temperature profiles associated with the shock wave generation and decay may have produced the correct frequencies for a period of time. The time for the shock wave passage is long, being of the order of microseconds, compared to the electron and proton frequencies of the order of 10^{29} Hz[3]. This means that the electrons and protons will have approximately 10^{23} cycles to sample the conditions associated with the shock wave passage.

This concept of the occurrence of all reactions as functions of electron and proton harmonic frequencies implies the possibility of practical transmutation of elements, designer isotopes, and fusion. However, the technology is daunting as the electron and proton frequency is of the order of 10^{29} Hz corresponding to a period of the order of 10^{-30}s. Reactions requiring a single or a small range of harmonic frequencies will be difficult to achieve but the emergent capabilities for nearly unlimited energy and generous quantities of rare elements may produce an unparalleled upsurge in available resources for humanity.

Relativistic Mass

As discussed above, the moving electron has higher speed C1 particles in the forward direction compared to a stationary electron. These C1 particles move the free C2's in the grid system around the moving electron while inducing compression in the grid system in the path of the electron. The compressed C2 grid system is manifest as additional mass since the compressed grid has a higher C2 number density than the local free-space grid. This additional mass is not an

increase in the electron mass which is a universal constant. This is because the number of captive C2's in an electron is fixed by a precise dynamic force balance requirement. Instead, the additional mass is due to the additional C2 particles in the compressed C2 particle grid system in the forefront of the electron. This additional mass is called relativistic mass herein, and it accompanies the electron without being a component of it. This approach presents a physical basis for an understanding of the concept of an unchanging electron mass and a variable relativistic mass that accompanies an electron in motion.

This same process is at work in the proton. However, the C2 particles in the expanding and contracting proton core causes a proportional additional compression of the C2 grid system compared to the electron. Therefore, the ratio of the electron and proton relativistic masses is equal to the ratio of their constant particle masses.

The notion that the relativistic mass accompanies the electron or proton without being a structural component of it implies that all effects of motion are not relative. For example, a body that is stationary relative to the local C2 grid system does not have an associated relativistic mass because the grid system is not compressed. A second body that is moving relative to the local C2 grid system does have an associated relativistic mass because the grid system is compressed. The relativistic mass is sufficiently small for normal velocities of bodies above the atomic level and this effect can be safely ignored. However, for velocities approaching the speed of light, there is a measureable physically-based relativistic condition that identifies the moving body, and this relativistic condition is not a characteristic of the stationary body when the reference frame is exchanged.

Einstein recognized that the concept of the mass of a body actually changing with speed presented a dilemma in the absence of an understanding of the physical basis for relativistic mass. His position on this dilemma was presented in a letter he wrote to Lincoln Barnett on 19 June 1948 as follows:

"It is not good to introduce the concept of the mass $m = M/(1 - (v/c)^2)^{1/2}$ of a moving body for which no clear definition can be given. It is better to introduce no other mass concept than the 'rest mass' m. Instead of introducing M it is better to mention the expression for the momentum and energy of a body in motion."[8]

Also, some older physics textbooks failed to recognize this point and therefore did not differentiate between particle mass and relativistic mass. For example, in Ref. 9 a plot of electron mass as a function of speed is presented. Also, in this reference the statement introducing "Einstein's statement for the variation of mass with velocity" is given as "The mass of a particle is not a constant but increases with increasing speed in such a way as to approach infinity as the speed of the particle approaches that of light, according to the relation"

$$m = \frac{m_o}{\sqrt{1 - \left(\frac{v}{c}\right)^2}}$$

More modern textbooks[5] in keeping with Einstein's 1948 concern about mass and relativity, limit the presentation to the recommended "expression for the momentum and energy of a body in motion".

In reality, Einstein's famous equation $E = mc^2$ suggests that there should exist a clear relationship between mass and energy, even in the relativistic case, if the correct physical relationship is delineated.

In the context of the physical relationship explained above, the relativistic mass m_{eR} accompanying the constant mass electron is given by an extension of the special relativity equations as

$$m_{eR} = \frac{m_e}{\sqrt{1 - \left(\frac{V_e}{c}\right)^2}} - m_e - \frac{1}{2} m_e \left(\frac{V_e}{c}\right)^2 \tag{1}$$

The constant electron mass is m_e, the electron speed is V_e, and c is the speed of light. The last term in the equation is the mass equivalent for the electron kinetic energy. The relativistic mass approaches zero as the electron speed approaches zero. This is illustrated by using the binomial expansion for the square root term

$$\frac{1}{\sqrt{1 - \left(\frac{V_e}{c}\right)^2}} = 1 + \frac{1}{2} \left(\frac{V_e^2}{c^2}\right) + \frac{3}{8} \left(\frac{V_e^2}{c^2}\right)^2 + \cdots \tag{2}$$

As the electron speed approaches zero, the third and additional terms in the expansion can be neglected in comparison with the first and second terms. Substituting the first two terms into Equation (1) gives

$$m_{eR} = m_e \left[1 + \frac{1}{2} \left(\frac{V_e^2}{c^2}\right) - 1\right] - \frac{1}{2} m_e \left(\frac{V_e}{c}\right)^2 = 0 \tag{3}$$

The concept of "rest mass" for an electron is superfluous, as the mass of an electron is the result of a specific number of C2 particles in a shell configuration expanding and contracting in response to their dynamic interaction with the exceptionally small and exceptionally numerous C1 particles. The appropriate concept is total mass m_{eT} which is the sum of the electron mass and the relativistic mass

$$m_{eT} = m_e + m_{eR} = \frac{m_e}{\sqrt{1 - \left(\frac{V_e}{c}\right)^2}} - \frac{1}{2} m_e \left(\frac{V_e}{c}\right)^2 \tag{4}$$

The same comments apply to a proton since, like the electron, its mass is independent of speed. Since all matter is composed of electrons and protons or their anti-particles, the mass of any body m is independent of speed V so the general equation for relativistic mass is

$$m_R = \frac{m}{\sqrt{1 - \left(\frac{V}{c}\right)^2}} - m - \frac{1}{2} m \left(\frac{V}{c}\right)^2 \tag{5}$$

The appropriate definition of the relativistic mass associated with an electron or proton is "the equivalent mass of a higher C2 number density region that forms in the forefront of a moving electron or proton". It is analogous to the higher molecule number density region, called the forward stagnation region, which forms in the forefront of a body moving in the atmosphere.

Relativistic Mass Equivalent Energy (mee)

The relationship for the relativistic mass equivalent energy (mee) associated with a moving electron is

$$E_{eR} = m_{eR}c^2 = \frac{m_e c^2}{\sqrt{1-\left(\frac{V_e}{c}\right)^2}} - m_e c^2 - \frac{1}{2}m_e V_e^2 \tag{6}$$

It is noted that this equation is equal to Equation (1) for the relativistic mass multiplied by c^2 which is consistent with the general concept of $E = mc^2$. Unlike electron mass for which the concept of "rest mass' is superfluous, the electron does have a "rest energy" which again in accordance with Einstein's equation is

$$E_{eo} = m_e c^2 \tag{7}$$

The total energy of an electron is the sum of its rest energy and kinetic energy at all speeds,

$$E_e = m_e c^2 + \frac{1}{2}m_e V_e^2 \tag{8}$$

The total energy of the electron and its accompanying relativistic energy is the sum of Equations (6) and (8),

$$E_{eT} = E_e + E_{eR} = \frac{m_e c^2}{\sqrt{1-\left(\frac{V_e}{c}\right)^2}} - m_e c^2 - \frac{1}{2}m_e V_e^2 + m_e c^2 + \frac{1}{2}m_e V_e^2$$

Canceling like terms,

$$E_{eT} = E_e + E_{eR} = \frac{m_e c^2}{\sqrt{1-\left(\frac{V_e}{c}\right)^2}} \tag{9}$$

The electron relativistic mee given by Equation (6) approaches zero as the electron speed approaches zero. This is illustrated by using the binomial expansion for the square root term, Equation (2), and substituting the first two terms into Equation (6) to obtain

$$E_{eR} = m_{eR}c^2 = m_e c^2\left[1 + \frac{1}{2}\left(\frac{V_e^2}{c^2}\right) - 1\right] - \frac{1}{2}m_e V_e^2 = 0 \tag{10}$$

This shows that the electron relativistic mee has zero rest energy as expected. It also has zero kinetic energy because the compressed C2 particle grid that accompanies the moving electron flows around the electron. Therefore, the equivalent mass increase associated with the increased C2 number density of the compressed grid is not a fixed mass that travels with the electron.

Relativistic Momentum

The relationship for the relativistic linear momentum associated with a moving electron is

$$p_{eR} = \frac{m_e V_e}{\sqrt{1 - \left(\frac{V_e}{c}\right)^2}} - m_e V_e \tag{11}$$

The linear momentum of an electron at all speeds is

$$p_e = m_e V_e \tag{12}$$

The total of the linear momentum of the electron and its accompanying relativistic linear momentum is the sum of Equations (11) and (12),

$$p_{eT} = p_{eR} + p_e = \frac{m_e V_e}{\sqrt{1 - \left(\frac{V_e}{c}\right)^2}} - m_e V_e + m_e V_e = \frac{m_e V_e}{\sqrt{1 - \left(\frac{V_e}{c}\right)^2}} \tag{13}$$

Canceling like terms,

$$p_{eT} = p_{eR} + p_e = \frac{m_e V_e}{\sqrt{1 - \left(\frac{V_e}{c}\right)^2}} \tag{14}$$

The relativistic momentum associated with the electron is therefore the difference between the total momentum and the electron momentum as expressed by Equation (11).

Time and Relativity

The passage of time is relative as demonstrated in the required Global Positioning System (GPS) corrections. My view is that the correct physical model of the universe presents an alternative explanation of the cause of this relativity. In order to provide the context for this explanation, it is first proposed that all entities in the universe experience each moment in time simultaneously. The use of the word simultaneous is qualified here to mean practically simultaneous as absolute simultaneity does not exist. With that qualification, consider the possibility that there is a translatable signal (not light) that emanates from a sudden event such as a supernova that has a practically infinite transmission speed, perhaps the "spooky action at a distance" as referred to by Einstein[10]. Under this condition, the signal reaches all receivers simultaneously regardless of their location or speed relative to the source. Likewise, the signal from a second such event also reaches all receivers simultaneously regardless of their location or speed relative to the source. Each of these events occur at a different moment in time, but all receivers receive each signal simultaneously. Given some sequence of such events, all receivers experience the same sequential array of these moments in time.

Regarding the possibility of such a hyperluminal signal, the hyperluminal subpopulation of the C1 particles in Ref. 3 provides a possible explanation for an apparently instantaneous transfer rate associated with quantum entanglement[11]. The calculated average hyperluminal speed of the segregated C1 particles in the electron interior in Ref. 3 (Equation 91) is sufficiently high to approximate instantaneous transfer. The growing number of demonstrations of quantum

entanglement does suggest the possibility of transfer of information at hyperluminal speeds, in spite of protestations to the contrary.

If time is defined as the dimensional entity that occurs between moments in time, it is the measurement of this entity, the passage of time, which is relative. There are two relativity effects that depend on two properties of the clock's environment. One of these environmental properties is the number density of the static C2 grid system which is directly related to the strength of the gravitational field. The second property is the number density of the compressed C2 grid system due to the speed with which the clock is moving relative to the static C2 grid system. Therefore, the total time correction for the GPS system relative to a clock on earth is the sum of these two corrections, one due to a static effect and the second due to a kinematic effect. A simple analogy is the total pressure for steady, incompressible, frictionless flow of a gas which is the sum of the static pressure and the dynamic pressure as expressed in the simple form of the Bernoulli equation

$$p + \frac{1}{2}\rho V^2 = p_t \tag{15}$$

The first term is the static pressure, the second term is the dynamic pressure and the right hand side is the total or stagnation pressure. The analogous form for the total time correction is

$$\Delta t_s + \Delta t_k = \Delta t_t \tag{16}$$

The first term is the static or gravitational time correction, the second term is the kinematic or relativistic time correction, both relative to a clock on earth, and the right hand side is the total correction. The purpose in highlighting this analogy is to emphasize that the relativity of the passage of time has a physical basis which is the number density and relative speed of the massless C2 particles. This is analogous to the effect of number density and relative speed of gaseous molecules on the gas total pressure.

This postulated physical mechanism means that an atomic clock aboard a GPS satellite actually vibrates at a higher frequency due to the lower C2 particle number density in the static grid system at the satellite altitude compared to the higher number density and lower vibrational frequency on the earth's surface. The lower C2 particle number density results in less blockage of the penetrating C1 particles and therefore less time in reaching the critical C1 particle interference number density in the C2 particle shell peripheral space, resulting in a higher electron and proton pulsation frequency. The atomic clock vibrational frequency is a harmonic of this pulsation frequency. Therefore, the unadjusted clock in orbit actually runs faster than the same clock would run on earth due to the higher static C2 particle number density on earth. These physical effects correlate with the difference in the gravitational fields as given by a common expression for the gravitational time dilation

$$\Delta t_\infty = \frac{\Delta t_G}{\sqrt{1 - \frac{2GM}{Rc^2}}} \tag{17}$$

The Δt_∞ is the time interval recorded by a stationary clock located sufficiently far from earth $(R \to \infty)$, the Δt_G is the time interval due to the finite R recorded by an unadjusted clock, G is

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the universal gravitational constant, M is the mass of the earth, R is approximately the radial coordinate (actually a Schwarzschild coordinate), and c is the speed of light. The gravitational time correction is the difference in the Δt_G calculated for the ground radial coordinate and for the orbital radial coordinate.

In addition, the postulated physical mechanism also means that an atomic clock aboard a GPS satellite actually vibrates at a lower frequency due to the higher C2 particle number density around the moving (orbiting) satellite compared to the lower number density and higher vibrational frequency of the stationary ground clock. The higher C2 particle number density results in more blockage of the penetrating C1 particles and therefore more time in reaching the critical C1 particle interference number density in the C2 particle shell peripheral space, resulting in a lower electron and proton pulsation frequency. As in the gravitational effect case, the atomic clock vibrational frequency is a harmonic of this pulsation frequency. Therefore, the unadjusted clock in orbit runs slower than the same clock would run on earth due to the compression of the C2 particle grid system in orbit, resulting in a locally higher kinematic C2 particle number density in orbit. These physical effects correlate with the difference in the speeds at which the orbiting and ground clocks are traveling relative to the C2 particle grid system as given by the standard expression for the relativistic time dilation[5]

$$\Delta t_e = \frac{\Delta t_R}{\sqrt{1 - \frac{V^2}{c^2}}}$$

(18)

The time interval recorded by a stationary ground clock is Δt_e, the time interval recorded by an unadjusted satellite clock is Δt_R, the satellite orbital speed is V, and c is the speed of light. The relativistic time correction is the difference between Δt_e and Δt_R evaluated at the average orbital speed. The total time correction is the sum of the two corrections as indicated above.

In reality, the GPS clocks are adjusted before launch as discussed in Ref. 12. The direct quote is "For GPS satellites, General Relativity (GR) predicts that the atomic clocks at GPS orbital altitudes will tick faster by about 45,900 ns/day because they are in a weaker gravitational field than atomic clocks on Earth's surface. Special Relativity (SR) predicts that atomic clocks moving at GPS orbital speeds will tick slower by about 7,200 ns/day than stationary ground clocks. Rather than have clocks with such large rate differences, the satellite clocks are reset in rate before launch to compensate for these predicted effects."[9]

The alternative view expressed in this article is that all processes in the universe are actually physical in nature. This means that all time measurement systems actually run faster or slower in response to the electron and proton pulsation frequency change caused by changes in the local number density of C2 particles. Since all atomic and molecular processes occur at distinct harmonic frequencies of the electron and proton pulsation frequency as discussed above, these processes thereby occur at faster or slower rates depending on the local number density of C2 particles. Therefore, all systems, living and non-living, are affected. The aging processes actually slow down in environments with higher C2 particle number densities such as stronger gravitational fields and higher speeds relative to the C2 particle grid system. Likewise, the non-

living systems such as those that are mechanical, electronic, or chemical also slow down under these same conditions. Therefore, it is the passage of time that is relative.

Relativistic Length Contraction

The concept of relativistic length contraction also follows from the perspective that the C2 particle grid system is compressed in the forefront of a body as a function of the speed of the body relative to the grid system. This flexible and responsive grid system suggests the concept of space as the three-dimensional region between adjacent C2 particles in the grid as discussed above. In this context, the compressed grid system means that space is compressed in the forward direction. The standard expression for the relation between the length L measured by an observer traveling at speed V and the length L_o measured by a stationary observer is[5]

$$L = L_o \sqrt{1 - \frac{V^2}{c^2}} \tag{19}$$

It is important to note that this length contraction occurs only along the direction of the motion. Those dimensions that are perpendicular to the motion are not shortened. Consistent with the approach taken here, space is only compressed in the direction of motion.

Cosmology

The concept that all processes in the universe, inclusive of the subatomic to the cosmological, are the result of the kinematic interactions of two massless particles under specific conditions invites an expanded interpretation of the history and destiny of the universe. An immediate implication is that the three-dimensional flexible C2 particle grid system created by the collisions of the highly numerous C1 particles with the C2 particles may be of infinite extent. As discussed above, this concept gives rise to the physical definition of space as the three-dimensional region between adjacent C2 particles in the grid system that allows for expansion, contraction, and curvature in response to initial and boundary conditions. Our universe may occupy only a finite portion of this infinite expanse.

A consequence of the concept of the gravitational force between C2 particles as being caused by a net deficit in the outgoing C1 particle streams normal to the C2 particle random motion addresses the possible history and future state of a physically finite universe. It means that the C2 particles located at the outer extremities of the expanding universe receive more impacts from the ubiquitous C1 particles coming toward the universe than those coming from the interior. The electrons and protons which are composed of C2 particles cannot have reached an escape velocity when they approach the outer boundary because the attraction is inward and increasing in strength. These large-scale kinematic and dynamic processes suggest that the universe will begin a contraction phase that will eventually compress a large portion of the mass in the universe to the maximum C2 particle number density. This spherical region is herein called the compressed region to distinguish it from the currently popular concept of a black hole.

The maximum C2 particle number density exists because the C2 particles are incompressible and possess a finite size. During the contraction phase the C1 particles would continue their interaction with this enlarging compressed region resulting in periodic pulsations. This process is

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actually the separation and transfer of a hyperluminal subpopulation of the C1 particles into the open spaces of the pulsating compressed region. These partitioned hyperluminal particles are the actuating source for the kinematic properties of the compressed region analogous to the processes that create the pulsating electron and proton[3]. Eventually the growing compressed region reaches an unstable condition in which the partitioned hyperluminal subpopulation initiates a rapid and extensive expansion that presents a physical basis for the concept of hyperluminal inflation as the first phase of the so-called big bang.

A major difference between the compressed region concept and the black hole/big bang concept is that the initial conditions for the compressed region are a finite size and a specific number density of C2 particles. The infinitesimal size and infinite density initial conditions of the black hole/big bang concept defy all observations of objective reality. During and following the initial inflation, the interactions of the C1 and C2 particles during the early expansion phase would encounter the required C2 particle motion and number density conditions to form stable electrons and protons in addition to other C2 groups of unstable particles. Further expansion would bring these electrons and protons together under the right conditions to form hydrogen atoms, neutrons and helium atoms. This entire process illustrates how complexity emerges from the interactions of two massless particles obeying simple kinematic conservation principles under specific conditions.

This process of the emergence of complexity continues through many stages from the formation of large stars due to the universal gravitational attraction described above to the production of the elements of the periodic table during the life cycles of these stars. All of this comes into existence from the interaction of the two massless particles with the systems formed by these same particles in previous stages of emergence. Likewise, smaller stars and their planetary systems utilize the new elements and follow the same patterns and principles of their predecessors like emerging designs in fractal geometry.

The elements also combine to form molecules in response to the electronic force fields produced by their diverse structures of pulsating electrons and protons. These combinations like all processes in the universe are in harmonic synchronization with the electron and proton pulsation frequency. For planets orbiting their stars under the right conditions, these simple molecules can combine into more complex molecules, again due to the attraction and repulsion of the electronic force fields. Given the right conditions including synchronized harmonic frequencies, these molecules can employ the emergence process to develop advanced molecular structures that satisfy the requirements for primitive life systems[7].

These same patterns and principles are employed repeatedly under the newest conditions to bring more complex systems and corresponding new conditions into existence. The diverse complex life forms that constitute our current condition have emerged from these same processes. Complexity in the universe has developed to the point where the emergent intelligence can provide new conditions to continue and even accelerate the emergence process. For example, it may be possible to accomplish the practical transmutation of elements, development of designer isotopes, and controlled fusion in ways that are more manageable than the corresponding processes in stars. It is important to emphasize that if this becomes possible as I believe that it

will, these emergent achievements will be as natural as those in the stars because like the galaxies, stars, and planets, we are the naturally emergent universe.

Another consequence of this concept of the universe is that the cycle of expansion and contraction may have been the case for a time span approaching infinity and will continue indefinitely. This view is in contrast to the view that the generally accepted age of 13.8 billion years for the current cycle of the universe represents the totality of existence. This shortsighted view is consistent with humanity's record of assuming all that we see is all that there is. It is also probable that each universe cycle has proceeded utilizing the same emergence principles that ultimately produces highly complex systems including consciousness and intelligence. These logical concepts open the door for numerous possibilities relating to the current state and future of the emergent universe.

Summary

All of the effects described above resulted from the interactions of the massless C1 and C2 particles under the various prescribed conditions. It is remarkable that the highly complex mechanisms of the universe may emerge from the straightforward kinematic interactions of two massless particles under the conditions that characterize the universe. It appears to be analogous to the intricate shapes that emerge from simple equations in fractal geometry. The equations from which the universal mechanisms arise are not arbitrary but rather they are the simple relations that describe the collisions of these two massless particles. These simple relations are the kinematic analogs of the dynamic equations for the conservation of mass, energy, and momentum.

A foundational mechanism that is described herein is the interactions of the massless particles to maintain the pulsating stable structures of electrons and protons. Two other important observations are that the constant speed of light is the average speed of the massless particles, and the interactions of the massless particles with electrons and protons cause the speed of light to be constant relative to any moving body. These same interactions cause the motion of any body to be constant in the absence of external forces. The concept of space as a flexible and responsive grid system composed of nodes of C2 particles also emerges from the collisions of these particles. The C2 particles in this grid system will flow in response to the rotation of electrons with their spin axes aligned in a permanent magnet or aligned by electron motion. These flowing C2 particles represent the magnetic field lines associated with these two cases and are an integral part of the mechanism for magnetism.

Additionally, the collisions between C1 and C2 particles create an attraction between all of the C2 particles in the universe. When this attraction is between electrons and/or protons the resulting force is universal gravitation. This analysis has also addressed the potential mechanisms for the so-called particle-wave duality. It has shown that electrons and protons are not single particles but rather they are specific collections of C2 particles responding to collisions with C1 particles. Under certain conditions, these dynamic structured collections of C2's exhibit properties like those of a single particle. In addition, these structured collections are pulsating at a high frequency, and these pulsations propagate at the speed of light through the ubiquitous C2

particle grid system which, under certain conditions, can cause wave-like interactions with their surroundings.

The collisions of the C1 and C2 particles under the conditions accompanying a mass moving through the C2 particle grid system result in equations that account for the compression of the grid system in the forefront of the mass. Specifically for the case of a moving electron, the expressions for mass, energy, and momentum are summarized below in terms of a relativistic component, a separate particle component, and the total of the components as follows:

The relativistic mass is

$$m_{eR} = \frac{m_e}{\sqrt{1-\left(\frac{V_e}{c}\right)^2}} - m_e - \frac{1}{2}m_e\left(\frac{V_e}{c}\right)^2 \tag{1}$$

The constant electron mass is m_e. Therefore, the total mass is

$$m_{eT} = m_e + m_{eR} = \frac{m_e}{\sqrt{1-\left(\frac{V_e}{c}\right)^2}} - \frac{1}{2}m_e\left(\frac{V_e}{c}\right)^2 \tag{4}$$

The relativistic mass equivalent energy (mee) is

$$E_{eR} = m_{eR}c^2 = \frac{m_ec^2}{\sqrt{1-\left(\frac{V_e}{c}\right)^2}} - m_ec^2 - \frac{1}{2}m_eV_e^2 \tag{6}$$

The electron total particle energy is

$$E_e = m_ec^2 + \frac{1}{2}m_eV_e^2 \tag{8}$$

Therefore, the total energy is

$$E_{eT} = E_e + E_{eR} = \frac{m_ec^2}{\sqrt{1-\left(\frac{V_e}{c}\right)^2}} \tag{9}$$

The relativistic linear momentum is

$$p_{eR} = \frac{m_eV_e}{\sqrt{1-\left(\frac{V_e}{c}\right)^2}} - m_eV_e \tag{11}$$

The electron linear momentum is

$$p_e = m_eV_e \tag{12}$$

Therefore, the total momentum is

$$p_{eT} = p_{eR} + p_e = \frac{m_eV_e}{\sqrt{1-\left(\frac{V_e}{c}\right)^2}} \tag{14}$$

Relating to the relativity of time, it is concluded that all moments in time occur simultaneously in the universe. It is the measurement of the passage of time between those moments that is relative.

The relativity effects are produced solely by the effects of the number density of C2 particles in the local static and compressed grid systems. These effects are shown to be qualitatively consistent with the known time corrections for the clocks in the Global Positioning System (GPS). Similarly, the relativity-based length contraction is a function of the compression of the C2 particle grid system in the forefront of a moving mass.

The emergence of increasing complexity resulting from C1-C2 particle interactions under continuously developing new conditions has profound implications for cosmology. At the boundaries of the expanding universe, the net attraction will always be inward. This means that the universe is characterized by expansion and contraction cycles utilizing mechanisms analogous to electrons and protons. These cycles may have been occurring for a period of time approaching infinity and may continue indefinitely. The implication of two finite sized, incompressible fundamental particles is that the initial conditions for the initiation of a new cycle are a finite sized compressed region with a finite number of C2 particles. When the critical condition in the interior of the compressed region is reached, the initial hyperluminal expansion may be extensive, resulting in an exceptionally large universe. It is also implied that all processes in the universe occur at specific harmonics of the pulsating electrons and protons. This is because all interactions have to be synchronized with these pulsations in order to accommodate the transfer of the C2 particles from photon encounters at the boundaries of the electrons and protons. These photon-electron and photon-proton interactions represent mass and mass equivalent energy transfer as in $E = mc^2$ as well as momentum transfer.

The implied mechanisms discussed in this article have emerged from the simple rules for kinematic collisions of two massless particles[3, 4]. The emergent processes of the universe based on these simple rules are consistent with concepts expressed in the colossal work of Stephen Wolfram published in his seminal volume entitled *A New Kind of Science*[13]. On the subject of the potential simplicity of the underlying rules for the universe, he says "But what we have now seen over and over again in this book is that in fact it is perfectly possible to get phenomena of great complexity even with a remarkably simple underlying setup. And I suspect that particles in physics – with all their various properties and interactions – are just yet another example of this very general phenomenon." On the subject of the universality of the underlying rules, he says "So this means that one cannot reasonably expect to use some kind of incremental procedure to find the ultimate rule for the universe. But it also means that if one once discovers a rule that reproduces sufficiently many features of the universe, then it becomes extremely likely that this rule is indeed the final and correct one for the whole universe."

These emergent processes that lead to ever increasing complexity may be the genesis mechanisms for the entire universe. Therefore, it is expected that the emergence of complex molecules and life systems is commonplace in any area of the universe where the necessary elements and conditions are present. As these emergent mechanisms are quantified and understood, it may be possible to identify and produce the required conditions and harmonic frequencies for the practical transmutation of elements, development of designer isotopes, and controlled fusion in ways that are more manageable than the corresponding processes in stars.

The conclusion is that these implied mechanisms have produced a coherent and comprehensive depiction of the emergent universe.

References

1. Kuhlmann, M. What is Real? *Scientific American* **309 No.2**, 40-47 (August 2013).

2. von Baeyer, H.C. Quantum Weirdness? It's All in Your Mind. *Scientific American* **308 No.**6, 46-51 (June 2013).

3. Callens G. The Physical Electron. http://genecallens.net (2013).

4. Callens G. The Emergent Universe. http://genecallens.net (2013).

5. Cutnell, J.D. & Johnson, K.W. *Physics* (John Wiley & Sons, Inc., 1998).

6. Grant, A. How molecules hook up in space. *Science News*, p. 9 (August 10, 2013).

7. Martins, Z. et al. Shock synthesis of amino acids from impacting cometary and icy planet surface analogues. *Nature Geoscience*, DOI: 10.1038/ngeo1930 (2013)

8. Barnett, L. *The Universe and Doctor Einstein* (William Sloane Associates, 1948).

9. Shortley, G. & Williams, D. *Elements of Physics* (Prentice-Hall, Inc., 1955)

10. Born, M. & Einstein, A. Letter from Einstein to Max Born, 3 March 1947. *The Born - Einstein Letters 1916-1955: Friendship, Politics and Physics in Uncertain Times* (Macmillan, 2005).

11. Bub, J. Quantum entanglement and information. *The Stanford Encyclopedia of Philosophy* (ed. Zalta, E,N.) http://plato.stanford.edu/archives/win2010/entries/qt-entangle/ (2010).

12. Flandern, T.V. http://www.metaresearch.org/cosmology/gps-relativity.asp and *Open Questions in Relativistic Physics*, 81-90, ed. Selleri F. (Apeiron, Montreal, 1998).

13. Wolfram, S. *A New Kind of Science*, pp. 469, 528 (Wolfram Media, Inc., 2002).

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