

Spiritual and Scientific Principles of the "Tetrahedron Model"

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(I recommend the reader also consult the "preface" or "guide" to this paper, which may be found at ["About the Papers: An Introduction"](#)) and the ["Preface: The Sun Archetype"](#).

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Abstract

The realm of matter is a conserved, asymmetric, local form of the "ideal" global realm of light and perfect symmetry. It is due to its asymmetric character, expressed as charge and information, and its entropic drives, both positive and negative, that this alternative form of reality has the potential not just for conservation, but for change, growth, and evolution, even bringing forth life from inanimate atoms. Life evolves to self-knowledge, explores the Cosmos and new modes of creativity, producing new forms of beauty. In the mathematical terms of Evariste Galois' "Group Theory", the ["Tetrahedron Model"](#) is a description of the *symmetry group of light*, including its destruction by [asymmetric weak force decays](#) (producing our matter-only Cosmos), and its on-going restoration in obedience to [Noether's Theorem of symmetry conservation](#) (as in the conversion of bound to free energy in stars).

The four principles of the ["Tetrahedron Model"](#) (conservation of energy, entropy, symmetry, causality) are as much "spiritual" principles of "divine law" as they are "scientific" principles of "natural law". This is another example of the convergence of physical scientific thought and metaphysical, spiritual, or religious thought, of the merging of rational and intuitive world views. The ["Tetrahedron Model"](#) represents a fundamental example and iteration of a 4x3 algorithmic hierarchy of fractal models, developed in the context and format of ["General Systems"](#). "General Systems" is a synthetic conceptual science which excels at bridging apparently disparate disciplines and world views. I will consider each of the 4 principles in turn.

The Conservation of Energy

The principle of conservation is the cornerstone of both science and religion. Since conservation upholds reality itself, it is meaningless to speak of anything in its absence. The world of "Alice in Wonderland" is a literary example of a world without conservation laws. In such a place, anything can happen, nothing is predictable, it is a world of chaos "wild and rude". In its Christian religious connotation, conservation equates with the "Father" of the Trinity, the salvation of souls, the idea of a conserved personal identity which transcends the cycle of biological life and death, and of a "Heaven" which is the "eternal home" (conservation domain) of spirit, beyond the finite, transient, and relative dimensional parameters of space and time. All religions refer to a spiritual reality which is a dimensionless source, counterpart, and permanent refuge from our temporal and ephemeral material experience of life.

In science likewise, conservation is the great natural principle, "first among equals", whether it be conservation in terms of *Raw Energy* (mass, momentum); *Symmetry* (charge conservation, inertia and gravitational forces - "Noether's Theorem"); *Entropy* (dimensionality, intrinsic motion, gravitation (again)); or *Causality* (cause and effect, information, historic spacetime, "karma"). All science and mathematics depends upon the principle of conservation for its predictive quality. Mathematics is useful in science precisely because we have fashioned it to be a symbolic or abstract system of quantitative conservation laws which we use to model and understand the energetically conserved natural system. Mathematics would be useless if it were not a conserved quantitative system; for example, without the conservation of number, $2+2$ could equal anything - the "equals" sign would have no meaning. In monetary terms, the fact that the one hundred pennies (pennies are the "quanta" of our monetary system) in a dollar are not lost in the transformation of "making change" is a common and well understood example of the operation of a monetary and arithmetic conservation law. Inflation is an example of the weakening or relativity of the monetary conservation law (not the arithmetic law), in which the quanta of the system do not retain their absolute value through time. Quantum mechanics, the transformation mechanism of the weak force IVBs, and the tangential connection between space and time, prevent any analogous inflation of charge units or symmetry debts in nature. (See: "[The Higgs Boson and the Weak Force IVBs](#)".)

In the [Tetrahedron Model](#), conservation in the case of free energy (light) is realized in three principle modes: 1) the raw energy conservation mode, in which the primordial energy carried by light (electromagnetic radiation: $E = h\nu$) is converted/conserved to the mass and momentum of particles ($h\nu = mcc$) (1st law of thermodynamics). 2) The entropy conservation mode, via the intrinsic motion of light and the creation of light's expanding and cooling dimensional conservation domain (space), as gauged by "velocity c ". In material systems, the intrinsic motion of light (the spatial entropy drive of free electromagnetic energy), is gravitationally converted/conserved to the intrinsic motion of time (the historical entropy drive of bound electromagnetic energy) - 2nd law of thermodynamics). 3) The symmetry conservation mode, through charge conservation (in particles) and the inertial forces of spacetime, including gravitation (Noether's Theorem). The breaking of the symmetric energy state of light, space, and virtual particle-antiparticle pairs by the weak force during the "Big Bang" gives rise to our familiar compound world of free energy (light and space), plus bound energy (mass-matter, charge, time, gravity). Spacetime is a compound dimensional conservation domain created by the "intrinsic" (entropic) motions of light, time, and gravity, in which both free and bound forms of electromagnetic energy can find all their conservation requirements satisfied. (See: "[A General](#)

[Systems Approach to the Unified Field Theory](#) .)

Entropy

Note to Readers Concerning "Entropy":

Unless the context indicates otherwise, when I refer to "entropy" in these papers (especially in such phrases as "space and spatial entropy" or "time and historical entropy"), I am referring to entropy in its most primordial or pure form, as the intrinsic motion of light "gauged" or regulated by "velocity c " (in the case of "spatial entropy"), or as the intrinsic motion of time "gauged" or regulated by "velocity T " (in the case of historical or "temporal entropy"). Of course, time is also ultimately "gauged" or regulated by "velocity c ", since time is defined as the duration (measured by a clock) required for light to travel a given distance (measured by a meter stick). (See: "[Spatial vs Temporal Entropy](#)"; and "[The Tetrahedron Model](#)".)

The connection between the three primordial types of entropy and their "gauges", "drives" or "intrinsic motions" c , G , T (the "intrinsic motions" of light, gravity, and time) is as follows:

c) Positive spatial entropy of free electromagnetic energy or radiation (the drive of cosmic spatial expansion, the intrinsic motion of non-local, timeless, a-causal symmetric light, as "gauged" or regulated by "velocity c ");

G) Negative spatial entropy of bound electromagnetic energy or mass (the drive of spatial contraction, the intrinsic motion of matter's gravitational field, as "gauged" or regulated by "velocity G "); (gravity converts light's spatial entropy drive into matter's historical entropy drive, via the annihilation of space and the extraction of a metrically equivalent temporal residue) (see: "[The Conversion of Space to Time](#)");

T) Positive historical entropy drive of bound energy forms (the drive of historical expansion, the intrinsic motion of matter's time dimension, as "gauged" or regulated by "velocity T " - the spatial metric as modified by gravity). (Time is an alternative form of light's spatial entropy drive, conserved in matter via the gravitational conversion of space to time.) History is an alternative entropic form of space, in which local, asymmetric bits of information are causally connected in a temporal sequence; the sequence ages and becomes diluted by the march of time, the expansion of history, and the continuous multiplication, divarication, and concatenation of causally connected events.

" G " is, or "gauges", the connecting link or conversion force between c and T ; gravity converts space and the drive of spatial entropy (the intrinsic motion of light) to time and the drive of historical entropy (the intrinsic motion of time - and vice versa). Whereas the electromagnetic constant c is the gauge of the *metric* relation between light, space, and time, the gravitational constant G is the gauge of the *entropic* relation between mass, space, and time. A portion of the entropy-energy driving the spatial expansion of the Universe is gravitationally converted to the entropy-energy driving the historical expansion of the Universe, decelerating the spatial expansion in consequence. When this reaction is reversed, as when mass is converted to light in stars, the cosmic gravitational field is weakened and the spatial universe expands (as recently observed). (See: "[A Spacetime Map of the Universe](#)"; and see: "[Dark Energy: Does Light Create a Gravitational Field?](#)".)

The gravitational conversion of space to time is physically demonstrated by black holes, and mathematically formulated in the Bekenstein-Hawking theory relating the surface area of a black hole to its entropy content. (Einstein's equations of the gravitational "warping" or "curvature" of space by mass were the first to quantify the conversion of space to time - as the changing rate of "acceleration" in four dimensions (x, y, z, t).) (See: "[The Conversion of Space to Time](#)"; and "[The Half-Life of Proton Decay and the 'Heat Death' of the Cosmos](#)".)

Entropy (especially in its temporal and gravitational modes) corresponds to the physical/spiritual principle of progressive change, growth, and evolution, and to the 3rd Person of the Christian Trinity, the "Holy Spirit". (See: "[The Energy Tetrahedron - a Religious Interpretation](#)".)

In the physical system, entropy takes several forms, including the familiar principle which allows the transformation of energy to "work" by protecting energy conservation in all such transformations. Entropy will not allow the abuse or non-conservation of energy in transformations to work, for example, forbidding the "perpetual motion machine", or any device which creates net energy; hence it is entropy which permits energy to be used at all. Entropy is conserved in the sense that it must never decrease in any isolated system, and when energy is transformed or transferred (as from a spatial form (light) to a temporal form (matter) or vice versa), so too is the primordial entropy drive.

Entropy, in its primordial forms, is transformed and conserved (in metrically equivalent units) by gravity from its primary form, the spatial entropy drive of free energy (expressed as the intrinsic motion of light and the expansion and cooling of the spatial Universe), to its secondary or alternative form, the temporal entropy drive of bound energy (expressed as the intrinsic motion of time and the aging and decay of matter and the expansion of history), in any process which transforms free into bound energy. Mixed spatio-temporal or tertiary forms of entropy include "heat", thermal or "work" entropy (Clausius), statistical entropy (Boltzmann), and information or communication entropy (Shannon). The role of the primary and secondary forms of entropy is to produce dimensional conservation domains (space and history), in which energy can be simultaneously conserved, transformed, and used. This is the connection between the 1st and 2nd laws of thermodynamics. It is the principle of entropy which makes energy available for our use by preventing us from breaking the conservation laws while we are using energy. Nature does not allow us to "cook the books" in energy transformations; this is the practical or utilitarian function of entropy. (See: "[Spatial vs Temporal Entropy](#)".)

Thus the three entropy gauges c, T, G, regulate entropy drives ("intrinsic" dimensional motions): "velocity c" regulates the intrinsic motion of light, producing, expanding, and cooling space, the entropy/conservation domain of free electromagnetic energy; "velocity T" regulates the intrinsic motion of time, producing, aging, and expanding and diluting history, the entropy/conservation domain of information and the "causal matrix" of matter or bound electromagnetic energy; and "velocity G" regulates gravity, converting space and the drive of spatial entropy to time and the drive of historical entropy (and vice versa), creating spacetime, the joint entropy/conservation domain of free and bound electromagnetic energy. It is essentially the "infinite" velocities of c and T which endow light and time with the entropic ability to protect energy transformations (and their energy domains) against abuse from causality violations via "time machine" or "rocket ship", or energy conservation violations via "perpetual motion" machines. Similarly, gravity protects spacetime against causality or energy conservation violations via "wormholes" through the closure of the spacetime

metric at the "event horizon" and central "singularity" of black holes. The three entropy drives not only create dimensional conservation arenas of action where energy may be safely transformed and used, they proactively defend their conservation domains against violations or trespass.

Entropy and free energy conservation are related through dimensionality and the creation of space (the conservation/entropy domain of free energy), by the intrinsic motion of light; entropy and causality are related through time, evolution, and the creation of history by the intrinsic motion of time; entropy and symmetry are related through the electromagnetic constant c , the inertial forces of the metric, and the creation of spacetime by the gravitational conversion of space into time and vice versa. The latter relationship is due to gravity's "location" charge, which records the symmetry/entropy debt of light's lost "non-local" distribution (symmetry debt) and lost intrinsic motion (entropy debt), whenever free energy is transformed into bound energy. The active principle of the gravitational "location" charge is time. Finally, in material systems, entropy and symmetry are related through statistical thermodynamics, since at any given temperature, the most symmetric (random) distributions have the greatest entropy. (See: "[Entropy, Gravitation, and Thermodynamics](#)".)

Massless light is non-local, a-temporal, and a-causal. Massive matter is local, temporal, and causal. (See: "[The Time Train](#)".) In addition to providing sufficient negative energy to balance the positive energy of the "Big Bang", the rationale for gravitation is twofold: 1) the (immediate) establishment of the temporal metric of bound energy (spacetime), including matter's temporal entropy drive (the intrinsic motion of time) and "causal matrix" (historic spacetime), which maintains Causality and upholds the reality of the "Universal Present Moment"; 2) the (eventual) conservation/restoration of light's non-local symmetric energy state as required by Noether's theorem, via the gravitational conversion of bound to free energy, as in stars, supernovas, quasars, and finally and completely in Hawking's "quantum radiance" of black holes. (See: "[The Double Conservation Role of Gravitation](#)".)

Symmetry and Charge

Symmetry

The principle of symmetry corresponds to the spiritual principle of beauty, and to the "Son", or 2nd person of the Christian Trinity. The "Golden Rule" is an exact prescription for symmetric behavior in our social relations (also: "judge not that ye be not judged"), and the notion of every person's equality before God is likewise a statement of symmetry regarding the spiritual status of the human soul.

"Noether's Theorem" (1918) equates symmetry with conservation, stating that in a continuous multicomponent field, such as the metric field of spacetime or the electromagnetic field of light, where one finds a symmetry one will find an associated conservation law, and vice versa. From this we deduce the connection between beauty and truth, surmised by Keats (1819) in his famous "Ode on a Grecian Urn", where beauty corresponds to symmetry and conservation corresponds to truth. Similarly, the connection between the beautiful and the good, and between beauty and Heaven, God, or the Spirit, has been made since classical times. Humanity's natural esthetic sense of beauty is our inborn guide to the good, to truth, and to spiritual conservation or "salvation" in every sense. The connection between beauty and truth in the sciences has been expressly stated by Einstein, Dirac, Schroedinger, and many other of the greatest scientists, who judge the validity and quality of their work by (among other things) the beauty of their equations.

In the physical system ([and in the Tetrahedron Model](#)), Noether's theorem is expressed/enforced in three major areas: 1) as charge (and spin) conservation (the connection between the Symmetry and the Causality pole of the model); 2) as the inertial and gravitational forces of the spacetime metric (the connection between the Symmetry and the Entropy pole); 3) as the continuous annihilation of the virtual particle-antiparticle pairs of the "vacuum" (suppressing time, mass, charge, gravity) - the connection between the Symmetry and the Conservation pole.

Charge

Perhaps the most important understanding gained from Noether's Theorem in terms of facilitating a conceptual solution toward the unity of forces or Unified Field Theory is this: *the charges of matter are the symmetry debts of light*. Charges are a temporally conserved form of symmetry, just as mass is a temporally conserved form of energy. Time is an alternative (historical) form of spatial entropy which makes possible the conversion of free energy to bound energy (light to matter), by (among other essential services) the creation of the historic conservation domain of information (matter's "causal matrix" or "karmic field"). Charge (and spin) conservation makes possible symmetry-breaking in the "Big Bang", ensuring that the symmetry debts held as charges will be repaid in the new dimension expressly created for this purpose: time, history, and historical spacetime. If the Universe were not allowed to pay its symmetry debts through time, the Cosmos of matter could not exist - matter-antimatter annihilations would result instead. Time is created so symmetry debts can be created, held through history, and finally paid off. In the "meantime", through that special, one-way, 4th dimension created expressly to accommodate massive, causal, local, temporal matter, the Universe can live, evolve, explore, and experience itself. Charge conservation is the "credit card" of the material Cosmos.

Gravity pays the entropy-"interest" on the symmetry debt of matter through the creation of matter's time dimension - the only dimension in which charge conservation has durable, historic, or causal ("karmic") significance. Because gravity slows the spatial expansion of the Cosmos (via the annihilation of space), we see that matter's time dimension or historical entropy drive (T) is actually funded by the intrinsic motion or spatial entropy drive of light (S), with gravity acting as the conversion force - as represented below by a quasi-mathematical "concept equation":

$$\begin{aligned} -Gm(S) &= (T)m \\ -Gm(S) - (T)m &= 0 \end{aligned}$$

Light has perfect symmetry, bearing no charges of any kind. When the symmetry of light (and light's particle-antiparticle pairs) is broken in the "Big Bang" (by asymmetric weak force decays), and the symmetric light cosmos is transformed to an asymmetric "matter-only" cosmos, the raw energy of light is conserved as the mass and momentum of particles; the entropy drive or intrinsic motion of light (as gauged by "velocity c") is conserved (via gravitational transformation) as the entropy drive or intrinsic motion of matter's time dimension (as gauged by "velocity T" - the spatial metric as modified by gravity); but the various symmetries of light are conserved as the charges (and spin) of matter. These charges produce forces which act to return the asymmetric system of bound energy to its original symmetric state of free energy - fulfilling Noether's Theorem. The particles and their charges constitute the "fermions" - the leptons and hadrons which make up the atomic matter of the periodic table of the elements. A conceptual pathway to the Unified Field Theory is thus suggested by

Noether's Theorem: identify the broken symmetries of light represented by the charges associated with each of the four forces of physics. (See: "[Symmetry Principles of the Unified Field Theory](#)"; and "[The Unified Field Theory: A General Systems Perspective](#)".)

"Identity" - the Primordial Charge of Manifestation and Matter

If we are simply considering the most general case of converting free to bound energy, such as the absorption of a photon by the electron shell of an atom, we need only take into account the conservation of raw energy and its entropy - which is to say mass and momentum, gravitation and time. These are the two internal lines of the [Tetrahedron Model](#) running from the peripheral Conservation and Entropy poles to the central Causality pole. However, if we wish to consider the conversion of free energy into an isolated particle (a "singlet", not a particle-antiparticle pair), born new into the Universe, then we must add "charge" to our accounting, the third internal line of the Tetrahedron Model, running from the Symmetry to the Causality pole. The charges, in the case of the creation of the elementary leptons (for example), are the (strictly conserved) electric and weak force charges, the latter known as "number", or as I prefer, "identity" charge. In the case of the creation of the composite hadrons (particles containing quarks), the internal quark charges "color" (strictly conserved) and "flavor" (only partially conserved) must also be added. Below I will discuss only the leptons and the "identity" charge, including the "Intermediate Vector Bosons" ("IVBs"), the field vectors or force carriers of the leptonic "identity" charge. The other charges, including gravity, are discussed in "[Symmetry Principles of the Unified Field Theory](#)". See also: "[Identity Charge and the Weak Force](#)". For the gravitational charge and force: See: "[The Double Conservation Role of Gravity](#)"; "[Gravity, Entropy, and Thermodynamics](#)"; "[A Description of Gravitation](#)" and "[The Half-Life of Proton Decay and the 'Heat Death' of the Cosmos](#)".

"Identity" charge is also known as "number" charge. It exists in two expressions, explicit and implicit, and like all other charges (except the gravitational "location" charge), in self-annihilating matter/antimatter states. Like electric charge, identity charge is strictly conserved and must always sum to zero; that is, a "positive" identity charge must always be balanced by a "negative" anti-identity charge, but unlike electric charge, in the case of "identity" the balancing can be accomplished by either the implicit or the explicit form of the charge. The elementary massive leptons, the electron, muon, and tau, carry identity charge implicitly, in "hidden", latent, or potential form, whereas their respective neutrinos carry identity charge in explicit or "bare" form. A neutrino is nothing else but the pure, explicit, or "bare" form of an identity charge. The electron, for example, in addition to spin carries two charges, an electric charge, and an implicit ("hidden") identity charge. The electron neutrino is the explicit form of the electron's hidden identity charge. (See: "[The Particle Table](#)".)

When an isolated elementary particle (a "singlet" - not a particle-antiparticle pair) is created or destroyed, an identity charge must record the event explicitly - an antineutrino or neutrino must be emitted - notifying spacetime of a change (or asymmetry) in its population of elementary particles. The protocol of identity charge is very similar to our religious notion of a human soul implicit in the body from birth, which becomes explicit at death, conserving the essential element of personal identity. While we can think of the neutrinos and anti-neutrinos in terms of positive and negative arithmetic signs which sum to zero, nature distinguishes matter from antimatter by spin: all neutrinos have left-handed spin, all anti-neutrinos have right-handed spin.

Only the massive leptons - the electron, muon, and tau, are known to have associated neutrinos, and each neutrino is specific to its massive lepton partner and namesake. Neutrinos are the hallmark of an elementary particle, and therefore only the three massive leptons are elementary particles. Quarks, for example, have no associated neutrinos, but quarks are sub-elementary particles, as we know because they carry fractional elementary (leptonic) electric charges. (The partial identity charges of the quarks (if they have any) may be collectively summed up, carried, and conserved by the (hypothetical) "leptoquark" neutrino. See: "[The Weak Force Identity Charge](#)".) The neutrinos themselves are also usually accounted as elementary particles. However, there remains a lot we do not know about neutrinos, and if they have mass, they may also be composite particles. Current observations suggest neutrinos have a tiny mass and oscillate more or less freely between the three types, somewhat as the three massive leptons can transform into one another (albeit less freely, requiring in the latter case the services of the "W" IVB to mediate their identity transformations). (See: *Science* 26 Nov. 2004 page 1458.)

Neutrinos comprise an accounting system by which spacetime keeps track of all elementary particles existing within its conservation domain - much as the government records the number and identity of its citizens. Neutrinos are weak force "identity" charges, and so they must record, carry, and be the consequence of a broken symmetry of light. In the case of identity charge, the broken symmetry is light's "anonymity". All photons are exactly alike, and the photon is also its own antiparticle. Elementary particles, however, are not all alike (and they are not their own antiparticles), and can be separated into three types (plus antiparticles): the electron, muon, and tau (and perhaps additionally, the hypothetical leptoquark). These particles are distinguished by large and exact rest mass differences; anti-neutrinos are distinguished by right-handed spins, whereas neutrinos have left-handed spins ("parity"). The photon's "anonymity" constitutes a symmetry of identity, which Noether's Theorem says must be conserved, requiring the identity charge, whose explicit form is the neutrino. In practical terms, the identity charge serves to facilitate annihilation reactions (and hence helps to conserve light's symmetry) by identifying in a timely fashion - within the time limit for Heisenberg's virtual reality - the appropriate leptonic annihilation partner (and one which also has the appropriate spin). Nature is telling us through the charges of matter exactly what symmetries of light she considers worth conserving. It's up to us to figure out what symmetries the charges represent and why they should require conservation.

The Intermediate Vector Bosons (IVBs)

The "Intermediate Vector Bosons" or "IVBs" are the (highly specialized) field vectors or force carriers of the weak force. As noted above, the massive leptons (the electron, muon, and tau) and perhaps the hypothetical leptoquark, carry identity charge in hidden or implicit form, while the massless (or nearly massless) neutrinos are the "bare" or explicit form of identity charge. Each massive lepton is paired with a corresponding massless neutrino or explicit identity charge. (See: "[The Weak Force Identity Charge](#)"). As the field vector of identity charge, it is the role of the IVBs to mediate transformations of identity charge among the elementary leptonic particles, including, when necessary, transformations of "flavor" among the quarks.

Unlike the bosons or field vectors of the other charges (photons, gluons, gravitons), which are massless particles with intrinsic motion c , the weak force IVBs are extremely massive particles: the "W" and "Z" are approximately 80 and 90 times heavier than the proton, respectively. The IVBs are

apparently "metric" particles, whose great mass is entirely due to the binding energy required to compress (and perhaps fold?) the metric of spacetime into the particular configuration that characterizes the IVBs. The IVBs' mode of action is apparently to form a "complex" with, or "engulf" within its compressed metric, a "real" particle ripe for transformation, combined with an appropriate virtual particle-antiparticle pair drawn from the Heisenberg - Dirac "virtual particle sea", the vacuum repository of all possible virtual particle-antiparticle pairs. The compressed metric of the heavy IVB brings the real particle and the selected virtual particle pair into very close contact with each other, (perhaps even "touching"), such that they can safely exchange charges and energy in a manner they could not when separated by normal distances (because of the danger of violating charge, energy, and causality conservation laws, interference from unwelcome virtual particles, etc.).

The IVBs of the weak force can also be conceived as recreating the original energy-densities of the "Big Bang" force-unity eras (the "W" IVB reproduces the environment of the electroweak era, for example) during which the reactions they now mediate first took place. This is the fail-safe method of the weak force IVBs for ensuring the invariance of all single elementary particles it produces. The global gauge character (invariant everywhere always) of the spacetime particle metric or Dirac-Heisenberg "vacuum" ensures the invariance of particle-antiparticle pairs when they are created by the electromagnetic, strong, or gravitational forces. But when *single* elementary particles must be created, the IVBs of the weak force play this particle gauge role on a local stage - an important example of a "local gauge symmetry current" operating in the weak force (also suggesting an analogy between the weak force Higgs boson, IVBs, and the spacetime metric). A connection between the weak and electromagnetic forces is also hinted - since both seem able to create the same elementary particles. This connection was of course formalized as the Electroweak Unification by Salam, Glashow, and Weinberg, for which they received the 1979 Nobel Prize in physics. For more details of the weak force transformation mechanism, see: "[The "W" Particle and the Weak Force Mechanism](#)" (PDF file) ([also available here in HTML format](#); see also: "[The Higgs Boson and the Weak Force IVBs](#)".

The IVBs therefore are a form of "metric catalyst", mediating reactions between real and virtual particles; the IVBs form a bridge between ordinary 4-dimensional reality and 2-dimensional virtual reality, a bridge which makes available to "real" particles the infinite charge resources of the virtual particle "sea", bringing virtual particles into the "real" world and sinking "real" particles into the virtual world. No identity change occurs in the real world which is not also reflected in changes in the virtual world. This bridge of the IVBs is all that remains of the primordial unity and connection of the electroweak force-unity era which existed during the early micro-moments of the "Big Bang". The bridge, in the form of the primordial condensed metric of the IVBs, remains in the world today as a massive connecting link with the symmetric, virtual, and primordial electroweak era (like an actual "time machine"), providing a secure pathway for elementary particles and identity charges to move between 2-D virtual reality and 4-D "real time". (See: "[The Weak Force IVBs as a Bridge Between Virtual \(2-D\) and Temporal \(4-D\) Reality](#)".) (See also: "[Table of the Higgs Cascade](#)".)

Weak Force Transformations

While of course the product of a weak force transformation is important (say, an electron), the uniformity of that product is just as important - all electrons must be exactly the same in mass and charge, whenever and wherever produced - for obvious reasons of energy, charge, and symmetry conservation. Uniformity is the reason why the whole weak force transformation process is quantized

into particle form, and why it is divided into two interactive parts, the [Higgs boson and the weak force IVBs](#). The Higgs is responsible for the uniformity of the IVBs and by extension, their products (quantized scalar "quality control"), while the IVBs provide the actual transformation/translation mechanism. Particle creation and transformation did not end with the Big Bang creation of matter, but continues with the creation and transformation of leptons, neutrinos, quarks, and mesons (including the creation, transformation, and destruction of the elements and elementary particles in stars and via "radioactive" processes). This ongoing creation/transformation process involving single elementary particles is why we find a functional weak force mechanism still operating today.

As for details, one can only surmise that the critical "phase transition" temperature or energy density, at which one force joins (or decouples from) another, is copied or reprised by the IVBs. The "W" IVB energy level is capable of performing lepton-lepton and quark-quark transformations. This IVB form is simply representative of the energy density of the electroweak force unification level or symmetric energy state. The Higgs scalar determines the mass of the IVB, which makes the IVB an effective "citizen" of the electroweak force unification realm, and therefore capable of participating in and performing the typical transformations which characterize the electroweak force unification regime, or symmetric energy state. The IVB mechanism or form may consist of nothing more than a quantized sample of the typically dense metric of the electroweak symmetric energy state - as selected, determined, or "gauged" by the Higgs boson. During the electroweak force-unity era, all leptons were united at a "generic" rather than "specific" level of energy and identity; hence transformations of specific identity within the conserved confines of this "generic" symmetry era take place as a simple matter of course, since at this extreme energy level all differences are erased.

IVBs function by reprising the "Big Bang" energy density of the force unification regime or symmetric energy state in which the transformations they are mediating first took place. This is a "fail-safe" method for reproducing the original values of charge, mass, and energy of elementary particles when the latter are created as "singlets" rather than as particle-antiparticle pairs. Quantization makes the whole mechanism reliably and indefinitely repeatable at a specific energy, charge, and mass, without inflation or depreciation due to entropy, gravitation, relative motion, the passage of time, or any other factor. The quantized Higgs scalar is necessary to meet the conservation requirement for invariance through time in the creation and transformation of the charge, mass, energy, and other conserved parameters of elementary particles. Conservation of energy, symmetry, and charge demands that "singlet" electrons created today be the same in all respects as "singlet" electrons created eons ago in the "Big Bang". This is the conservation challenge posed to and surmounted by the weak force Higgs and IVB mechanism. It seems likely that there are at least three energy levels of Higgs and IVB bosons - a distinct level for each force-unity state or era. (See: "[The Higgs Boson and the Weak Force IVBs](#)"; See: "[Table of the Higgs Cascade](#)".)

Intuitive Connections

What is so striking about this arrangement from our perspective is its strong resemblance to the role of the human shaman, spiritual medium, or religious priest in providing a bridge between the virtual realm of the spirit and the "real time" world of the body - and especially in terms of personal identity transformations at the moments of birth, marriage, and death. The fundamental "bit" of information is identity. It is a striking fact that between the identity charge of the neutrino and the "location" charge of gravitation, spacetime has a complete record of the identity, energy, and coordinate position of

every massive elementary particle in the Universe. Furthermore, every "event" or action is immortalized in historic spacetime. Not only is every hair on your head numbered, but every elementary particle in that hair is numbered, identified, and its position, energy, and history are known to the conservation domain of spacetime. "Not a sparrow falls but the Father knows"; and "every jot and tittle of the law will be fulfilled".

"Identity" is the essence of information, the primordial charge, bit, or quanta of information which holds the key to the manifestation of an elementary particle. It is remarkable that this notion from the very base of the manifest hierarchy should reappear at the human metaphysical level in the concept of the human "soul", apparently signaling, in some respect, the completion of a fractal resonance, hierarchy, or cycle. The "Big Bang" may be conceived as an explosion of Identity and Information, as well as of raw energy and spacetime, creating the material Cosmos, with its potential for life, biology, evolution, and humanity.

Causality ("Karma")

Of the 4 principles of the "[Cosmic Tetrahedron](#)", perhaps none has more spiritual significance for humanity than Causality ("Karma"). Causality corresponds to the 4th member of the Christian Pantheon, Mary, who represents the human connection to the spiritual realm, as it is Mary who symbolizes the direct physical interaction between massless spirit and ordinary, massive humanity.

Without humanity (or its equivalent) as a "project" or "outside interest", the Christian Trinity would be "bored" by its own perfection, the analog of a Universe of light and particle-antiparticle pairs locked in an eternal cycle of annihilation and creation, without the ability to break out of the cycle of symmetry conservation. The Trinity, like light, although complete in itself, is complete in potential only. It needs matter and humanity to explore and appreciate its own creative capacity and information potential. The way to manifestation involves symmetry-breaking, and this act will produce mass, matter, information, charge, gravity, time, history, and causality. Information is by definition asymmetric. A particle-antiparticle pair contains no explicit information because all its charges sum to zero, as is demonstrated when the pair annihilates itself and reconstitutes the light from which it was formed. A Universe that contained only light would be a Cosmos without information. Clearly, symmetry-breaking and the "fall" of light into matter can readily be associated in religious mythology with the appearance of the "devil" or "fallen" angels, "original sin", the eating of the fruit of the tree of "knowledge", an act which produces asymmetric information and the "hell" of time, karma, causality, charge, gravitation, mass, matter, and human suffering (biological imperatives of evolution and death).

Causality is connected to the "Trinity" or 3 "external" poles of the Tetrahedron Model via: 1) the Symmetry pole through symmetry-breaking and charge conservation, creating charged atomic matter and information; 2) the Conservation pole through mass and momentum, the conservation of light's raw energy ($h\nu = mcc$); 3) the Entropy pole as time, Causality ("karma"), evolution, and history (historic spacetime).

The most basic form of information is charge. An asymmetric isolated charge, that is, a charge not coupled to its anti-charge, is a conserved unit of information associated with a force and a force carrier. For example, the electric charge is associated with the electromagnetic force whose force

carrier is the photon. Along with the conservation of entropy (as time) and raw energy (as mass), the conservation of symmetry (as charge) allows (but does not cause) symmetry-breaking to occur in the Big Bang. Charge conservation guarantees that light's symmetries will eventually be restored, and it is only this absolute guarantee which allows symmetry-breaking to occur in the first place, and energy to be transformed into atomic information via the conserved charges of matter.

Hence charge conservation, mass conversion, and entropy conversion all play analogous roles in the conversion of free energy to bound energy: entropy (in its various forms, including the intrinsic motions of light, time, and gravitation) guarantees that energy conservation will not be violated, and so permits the transformation of free energy to "work". Similarly, charge conservation guarantees that the symmetry of energy will be conserved, and so permits the transformation of free energy to "information". Together with raw energy conservation in the form of mass and momentum, entropy and charge conservation permit the transformation of free energy to bound energy in the form of atomic matter, which is the whole argument of the "Tetrahedron Model". (It must be clearly understood that these conservation principles are "necessary but not sufficient" conditions for symmetry-breaking. There is an asymmetry in the weak force interaction between matter and antimatter (of unknown origin) which is the ultimate cause of symmetry-breaking, but which cannot occur without the safeguards of the three conservation principles cited above. See: "[The Origin of Matter and Information](#)".) God needs the "devilish" weak force asymmetry to understand, explore, and develop his own creative potential. Beethoven and his music cannot exist in a perfect universe of pure light.

Information, in the form of conserved charges, constitutes a road map, recipe, or set of instructions for matter to return to its symmetric origin despite the absence of antimatter. This is the fundamental purpose of information. Hence natural law and information is analogous to "Holy Writ" in that both contain the instructions for the "straight and narrow" path (within the confines of natural or spiritual law) back to "enlightenment" and salvation, the return to the original state of symmetry, light, and "grace".

There is in addition an evolutionary biological process which seems to produce a reunification pathway in the information domain which is parallel to that produced by the purely physical forces. This information pathway is powered by free energy supplied by our Sun due to the neg-entropic action of gravitation, energy which is captured by photosynthesis and used for the conservation of information in heritable genes, creating a molecular conservation domain of information (DNA and the "genome") through the action of Natural Selection. Hence Darwin's Natural Selection is the neg-entropic information analog of Newton's gravity; the biological process is completely dependent upon the physical process - there is no biology in the absence of gravitation. Indeed, Natural Selection can be thought of as the neg-entropic "gravity" or "intrinsic motion" of a biological information dimension, whose products are the flora and fauna of the Earth rather than the elemental species of the nucleosynthetic pathway. (See: "[Newton, Darwin, and the Origin and Abundance of Life in the Cosmos](#)".)

The evolution and elaboration of biological information systems appears to have no limit in terms of size and complexity; the biological system of Earth ("Gaia") appears poised to extend itself into the galaxy in the typical reproductive and dispersal phase of a complex biological organism. Even if the Earth system fails through self-destruction, other planetary systems will not fail their reproductive and

dispersal phases.

The curious spread and extension of biological systems into huge interconnected webs of information, while now only global in extent, will someday surely spread into the galaxy (if not from this planet, then from others; if not in this galaxy, then in others). The spread of these biological systems is fundamentally and inexorably motivated by matter's eternal search for antimatter. [Teilhard De Chardin](#) visualized a universal expression of this biological communication web as the apex of the evolutionary process, his "Omega Point", a far-future convergence of divine intention, symmetry conservation, and evolutionary purpose, binding the entire Universe into a single self-knowing entity. (See: "[The Information Pathway](#)" and "[The Information Ladder](#)".)

Charge conservation is the "memory" of atoms, and one of these memories is of the primordial unity and connectivity of the light Universe, before the "fall" into asymmetry, separation, and matter. Biological systems appear to be matter's attempt to recreate in material form this original unity and connection, which was of the "whole" or "Holy" Cosmos. Human information systems continue and extend this trend into symbolic, abstract, "spiritual", intellectual, and metaphysical realms (including the spiritual identity-union of the pair bond, love, and "Holy Matrimony"). Humanity has even learned to directly convert bound to free energy, mimicking the solar fusion process, in the most literal evolutionary convergence between the abiotic and biotic information pathways leading toward symmetry restoration in the Universe.

The "spirit" of the Universe resides in its connectivity and information content: light is connected through space; matter is connected through time; gravitation connects everything, converting space into time/history and matter into light/space. It seems likely that "unity" and "connectivity" conservation are corollaries of symmetry conservation, just as entropy, causality, and symmetry conservation are corollaries of energy conservation.

Our spiritual awareness is our intuitive sense, especially in terms of information, of our intimate and ancient cosmic connection, from the least atom of our body up to the great Milky Way galaxy, that majestic cosmic metropolis which is our physical home in this beautiful and mysterious Cosmos. Truly, we are made in the "image and likeness" of God. (See also: "[The Human Connection](#)".)

See also: [Postscript to Spiritual and Scientific Principles of the Cosmic Tetrahedron Model - Causality and Information in the Energy Tetrahedron Model](#)

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References:

Noether, E. *Emmy Noether: A Tribute to her Life and Work*. Brewer, J. W. and M. K. Smith, eds.

M. Dekker, New York, **1981**, 180 + x pp. + 10 plates.

Pierre Teilhard de Chardin: *The Phenomenon of Man* French: Editions du Seuil, Paris, 1955;

English: Harper and Row, New York, 1959

J. E. Lovelock. *Gaia. A New Look at Life on Earth*. Oxford University Press 1979.

Books by my late father Prof. John Curtis Gowan

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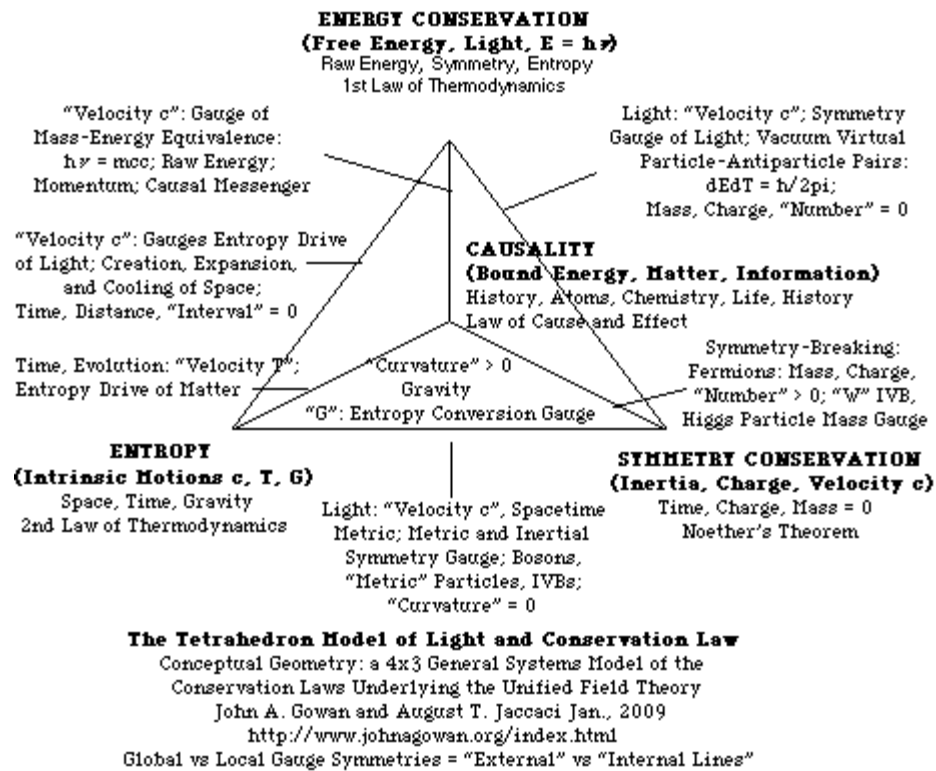
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Davies, P. and N. H. Gregersen: *Information and the Nature of Reality*. 2010. Cambridge Univ. Press.

See Diagrams: "[Tetrahedron Model of the Universe of Light](#)"

["Tetrahedron Model of the Universe of Matter"](#)

Fig. 1: The Tetrahedron Model



1) Energy conservation: 1st law of thermodynamics. Free energy, light, $E = h\nu$ (Planck's energy quantum); $h\nu = mcc$ (Einstein-deBroglie mass-energy equivalence); $dEdT = h/2\pi$ (Heisenberg's uncertainty relation). Three aspects of light's energy are conserved: raw energy, symmetry, and entropy (all gauged by velocity c : Special Relativity). Mass, gravity, "Interval", charge, and particle "Number" of light all = 0. Light is non-local, atemporal, acausal. Among its other gauge and entropic functions, light is the invariant messenger of causality.

2) Symmetry conservation: Noether's Theorem. Spacetime "Interval", charge, and particle "Number" = 0. Inertial forces, metric symmetry, virtual particles. Velocity c gauges the entropy drive and nonlocal distributional symmetry of light. Intermediate Vector Bosons (IVBs): W, Z, X (?). Fermions, virtual particle-antiparticle pairs, and other particles are formed from the interaction of high-energy light with the spacetime metric. *The charges of matter are the symmetry debts of light.*

3) Entropy: 2nd law of thermodynamics. Intrinsic motions c, T, G (light, time, gravity). Dimensionality: space, time, spacetime. Dimensions are entropy/conservation domains created by the entropy drives c, T, G . Gravitational conversion of space and drive of spatial entropy (S) to time and drive of temporal entropy (T): $-Gm(S) = (T)m$; $-Gm(S) - (T)m = 0$. Light's intrinsic motion (light's entropy drive) is conserved as time's intrinsic motion (matter's entropy drive). "Bottom" line: absent mass, spacetime's metric "curvature" = 0; with mass, spacetime's metric "curvature" > 0 (= gravity).

4) Causality: law of cause and effect; raw energy, charge, and historic information conservation; weak force symmetry-breaking. Bound energy, matter, life, evolution. Charge, mass, time. Information is conserved in historic spacetime = matter's "causal matrix". Matter is local, causal, temporal.