

JOHN A. GOWAN

email:

jag8@cornell.edu

johngowan@earthlink.net

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SYNOPSIS OF THE "TETRAHEDRON MODEL" OF THE UNIFIED FIELD THEORY

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Abstract

The "[Tetrahedron Model](#)" is a model of the devolution (asymmetric transformation) of light (free electromagnetic energy) into matter (bound electromagnetic energy), that is, of the relationship between the two forms of electromagnetic energy which constitute our Universe. The "Tetrahedron Model" revolves around the conversion of light into matter and vice versa, as regulated by four conservation laws or principles: the Conservation of Energy and Symmetry, Causality-Information, and Entropy. These four conservation laws/principles underlie the formulation of any [Unified Field Theory](#).

All great discoveries in experimental physics have been made due to the intuition of men who made free use of models which for them were not products of the imagination but representations of real things. - Max Born

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Preface

In the "Tetrahedron Model", the four "points" or apices of the diagram are associated with fundamental conservation principles: 1) the Conservation of Energy ("C"); 2) Causality-Information ("C-I"); 3) the Conservation of Symmetry ("S"); 4) Entropy ("E"). These cardinal points are furthermore associated with various physical entities/phenomena (respectively): 1) light, or free electromagnetic energy; 2) matter, or bound electromagnetic energy; 3) Charge (including virtual particles), inertial forces and the spacetime metric); 4) Intrinsic Dimensional Motions (of light, gravity, and time - including gravitational/historic spacetime and biological evolution). Six lines connect the points of the diagram; they are divided into two sets, "external" light lines, and "internal" matter lines. The "light lines" are associated with "velocity c ", virtual particles, and the "inertial" (symmetric) spacetime metric. The "matter lines" are associated with atoms/mass, charge/information, time/gravity /causality. The faces of the "Tetrahedron Model" have also been interpreted to represent the four realms of the manifest Cosmos: Microphysical, Biophysical, Astrophysical, Metaphysical. It is

presumed that a complete theory of the Cosmos can be built upon the conservation base provided by this model. This paper addresses the relationships between the four major conservation principles as suggested by their six conjoining lines. (See also: "[Symmetry Principles of the Unified Field Theory](#)".)

Introduction: "Causality" vs "Information" (see also: "[Causality](#)" and "[Section 14](#)")

While "Information" is a good, necessary, and very general characterization of the fundamental significance of matter, both for the Tetrahedron Model and the Universe, it is not quite "active" enough in its meaning to successfully complement and connect to the other three conservation principles of the [Tetrahedron Model](#). "Information" is an asymmetric energy state, whereas Energy Conservation, Entropy, and Symmetry are conservation principles. Causality is also a conservation principle, and it seamlessly connects with the other three in a profound and illuminating way, as we shall hopefully see below. Meanwhile, although "Information" is to be demoted to a secondary position in terms of activity or action among the "Tetragrammaton" of conservation laws, it obviously remains of first importance as regards the description of the significance of the system in both its particulars and its entirety. Information, in the form of charge, is strictly conserved without entropic weakening; in its historical form, information is subject to entropic enervation (age, decay, dispersion, dilution) but is never entirely lost. It is in fact the potent combination of Causality and Information that makes up matter's "causal matrix" within the conservation domain of historic spacetime, the "Karma" and "Akashic Record" of metaphysical systems of thought. It turns out that neither Causality nor Information has any meaning without the other (suggesting garbled chaos), but the linkage to the other conservation laws is clearer and stronger in the case of Casualty - due to its temporal parameter.

As stated in the abstract, the ["Tetrahedron Model"](#) is a model of the devolution (asymmetric transformation) of light (free EM energy) into matter (bound EM energy), that is, of the

relationship between the two forms of electromagnetic (EM) energy which constitute our Universe. As diagrammed, the "top" of the tetrahedron is the free energy apex (light), identified with the principle of Energy Conservation; the "interior" point of the diagram is the bound energy apex (matter/atoms), identified with the two linked principles, Causality-Information. The left-right position of the remaining two conservation principles (which facilitate the transformation of light into matter and vice versa) is arbitrary, but I habitually put Entropy on the (reader's) left and Symmetry on the right. The transformation of light and space (as gauged by the electromagnetic constant "c"), into matter and history (as gauged by the gravitational constant "G"), is also represented as the transformation of absolute "global" gauge symmetries into relative "local" gauge symmetries. (See: "[Global and Local Gauge Symmetries in the Tetrahedron Model](#)".) (See Also: "[The 'Tetrahedron Model' vs the 'Standard Model' of Physics: A Comparison](#)".)

(While this configuration applies only to my particular 2-dimensional drawing of the tetrahedron, I have found it heuristically invaluable, and habitually think of and refer to the "interior" and "exterior" lines of the diagram, which of course cannot be so distinguished in the 3-dimensional figure; but in any case the only value of a model is its heuristic potency.) This intuitive placement is validated by the realization that the three "outer" lines represent "global" or absolute symmetries (whose spatial metric is timeless, established or "gauged" by the electromagnetic constant "c"), while the three "interior" lines represent corresponding or derived "local" or relative gauge symmetries (whose metric includes time, created from space by gravity, in a process established and gauged by the gravitational constant "G"). Because this is a physical as well as a geometric model, the asymmetry of time allows us to distinguish one among the four points of the otherwise symmetric geometric figure as special or "central".

This model revolves around the conversion of light to matter and vice versa, as regulated by four conservation laws - the Conservation of Energy (1st law of thermodynamics), Entropy (2nd law of thermodynamics), Symmetry Conservation (Noether's Theorem), and Causality (Law of Cause and Effect). It is this simplicity which makes the model elegantly beautiful, scientifically rigorous, and explainable. Because of its implications for our extended [General Systems](#) work, it is of utmost significance for our model that: 1) the tetrahedron is the simplest regular polygon in which all apices are directly and equivalently connected; 2) the molecular bonding pattern of both carbon and water is tetrahedral (see below). (See also the tables: "[The Tetrahedron Model in a 4x4 Matrix Format](#)"; and: [The Interaction of 4 Conservation Laws with 4 Forces](#).)

The evolution of Information, especially biological information and its conservation in molecular form as a heritable genome, as well as in the historic domain of spacetime (as seen in the "[Spacetime Map](#)"), identifies the 4th (Causal) material apex as the locus of most of the complexity in the Universe (illustrated by the "[Fractal Organization of Nature](#)" table, and the [papers which accompany](#) that table). The *abiotic* purpose of Information is to provide a "map" for matter back to its original symmetric energy state (light), despite the absence of antimatter (for example, through the gravitational conversion of bound to free energy in stars, supernovas, quasars, Hawking's "quantum radiance" of black holes, particle and proton decay, fusion and fission). This pathway is illustrated in the 4x4 matrix of the "[Metaphysical Table, Rational Component](#)" and discussed in the papers on "[Symmetry Principles of the Unified Field Theory](#)", etc.

The *biotic* purpose of information is related but distinct (see the "[Information Ladder](#)" table and its [accompanying papers](#)). I have explained the expanding information

networks of biology as the attempt by matter to resurrect the original unity and connectivity of the light Universe. Like "beauty" in nature and human aesthetics, this biotic drive towards "holism" represents the probable operation of an emergent corollary to the principle of Symmetry Conservation. Life is the rationale for our cosmos, providing a means for the universe to know itself, to continue to grow and evolve (indefinitely) in its Information Domain. Remarkably, humans have even converged with the abiotic drive to restore matter to its symmetric state of free energy, most notably in our mimicry of solar fusion in the hydrogen bomb. (A strictly local interpretation of biotic purpose (in the case of humanity) is the dissemination of Gaia's (Mother Earth's) life forms throughout our galaxy via our space program; also humans can (uniquely) defend Gaia against killer meteor/comet strikes via the same.) The entire system, abiotic and biotic, is ultimately driven by matter's eternal search for antimatter (seeking symmetry conservation via annihilation), for which gravity, given the absence of antimatter, is the fail-safe force of last resort (culminating in the "Hawking Radiation" of black holes).

In biology we also find the evolution of consciousness, self-awareness, and personal identity, as the self-referent and fractal Universe awakens, explores, and expands its information and creative potential through living matter, becoming aware of and experiencing itself. The evolution of consciousness in biology can even be seen as the attempt to reconstitute the wave form of light (as thought) in macroscopic material forms. (See: "[DeBroglie's Matter Waves and the Rise of Consciousness in Biology](#)".)

The Tetrahedron Model is an attempt to reduce conservation law to an essential minimum set. Analysis of the Tetrahedron Model's rational component suggests an abundance of metaphysical analogies. For example, in the conservation of Unity, we find an analog of the metaphysical principle of

universal "Love"; in the connectivity of the Cosmos we find the analog of "spirit"; in the 4 conservation laws and the 4 forces of physics we find analogs of Divine Law and Omnipotence; in Causality we find the classical principle of "Karma"; while in Information itself we find the principle of universal self-knowledge ("Omniscience"), essentially [Chardin's "Omega Point"](#). This latter idea is also advanced by Prof. J. C. Gowan (Sr.) in his book ["Trance Art, Creativity"](#): - the "All" evolving toward a state of universal self-knowledge, in which the All shall know and be known by the All.

Synopsis of the Principle Connections and Interactions of [The Tetrahedron Model](#)

(Explaining the meaning associated with the lines connecting the 4 vertices or conservation laws of the model. Interactions between the 4 conservation principles are symbolized by the six lines connecting the vertices of the tetrahedron.) (See also: ["The 'Tetrahedron Model' vs the 'Standard Model' of Physics: A Comparison"](#).)

(Upper-case abbreviations below refer to the 4 principles: C = Energy Conservation; CI = Causality-Information (or simply Causality); E = Entropy; S = Symmetry. The index "C-CI" therefore refers to the interaction between Energy Conservation and Causality, the line (in the model diagram) connecting the Conservation - Causality vertices, etc.)

Part I: The "Trinity of Light": (The "External" Lines: Velocity c ; Virtual Particles; "Inertial" Spatial Metric)

Entropy, Symmetry, Conservation of Energy (Intrinsic Motion c , Virtual Particles and Virtual Time, the "Inertial" (symmetric) Spatial Metric.)

- 1) Line C-S: Virtual particle-antiparticle pairs and "non-local" energetic symmetry; 2) Line S-E: the symmetric, a-temporal, "inertial" spatial metric; 3) Line C-E: the intrinsic, entropic, and

"absolute" motion of light (creating, expanding, and cooling space).

(See also: "[Tetrahedron Model: External Lines](#)"; and "[The Ethereal/Material Tetrahedron](#)".)

C-E) The connection between Energy Conservation and Entropy as found in free electromagnetic energy (light) and "intrinsic motion c ". The creation, expansion, and cooling of space by the intrinsic motion of light, as gauged by the electromagnetic constant c ("velocity c ").

Space is the dimensional conservation/entropy domain of free energy, created by the entropy drive of light (light's "intrinsic" (entropic) motion) for light's own conservation. Space does not preexist the "Big Bang"; spatial dimensionality is created by the intrinsic motion (entropic drive) of free electromagnetic energy. Light is the only energy form which can create its own conservation domain (space) from nothing - or rather, from its own nature (entropy drive, "intrinsic motion"). *Interpreted from the perspective of symmetry conservation*, the "intrinsic" (self-motivated) motion of light is caused by the "wavelength" or symmetric spatial component of an electromagnetic wave fleeing the "frequency" or asymmetric temporal component, which latter is embedded in light's own nature (the classic "bur under the saddle") ("frequency multiplied by wavelength = c "). Intrinsic motion at "velocity c " suppresses the temporal component of spacetime to an implicit state, maintaining the symmetric energetic state of a-temporal metric space and "non-local" free energy, while also causing the entropic expansion and cooling of the Cosmos. The entropy drive and symmetric energy state of free energy (light) and the spacetime metric are all gauged and linked by the electromagnetic constant " c ". Time, whether implicit in light or explicit in matter, is the entropy drive and the motivating agent for change in the Cosmos. (See: "[The Conversion of Space to Time](#)".)

Entropy creates dimensional conservation domains (space, history, historic spacetime) in which energy can be used and transformed, but nevertheless conserved: this is the connection between the 1st and 2nd laws of thermodynamics. This is one reason why "velocity c " must be an effectively infinite ("absolute") velocity; the conservation

of Causality is another. The intrinsic motion of light is caused by the entropy drive of free energy in the service of energy and symmetry conservation. (See: "[Gravity, Entropy, and Thermodynamics](#)".) (Concerning the Primordial Forms, Drives, and Gauges of Entropy (c, G, T) - the intrinsic dimensional motions of light, gravity, and time - see: "[Spatial vs Temporal Entropy](#)").

C-S) The connection between Energy Conservation and Symmetry Conservation as found in free electromagnetic energy (light): (the suppression of time, distance, and massive particles at "velocity c"; virtual particles and virtual time; metric and matter-antimatter symmetry; [Noether's Theorem](#)).

Matter-antimatter pairs of elementary particles are created in the virtual Heisenberg/Dirac vacuum "sea" of spacetime, apparently as an alternative expression of light's electromagnetic energy. Under the special high-energy conditions pertaining during the "Big Bang", it was just this dual character of light, combined with the asymmetric action of the weak force, which led to the creation of our "matter-only" universe. The mixture of wavelike light with the metric structure of spacetime (itself created by light's intrinsic motion) exhibits a secondary particle-like expression of energy in terms of a variety of elementary particle-antiparticle pairs - according to the rules of quantum mechanics, including Heisenberg's "Uncertainty Relation" and Dirac's virtual particle-antiparticle "sea". Virtual particles are potentially bound forms of energy but they remain as unmanifest (symmetric) particle pairs so long as they are created (and instantly annihilated) in equal numbers.

Virtual particle-antiparticle pairs are created with opposite sets of various charges (color, flavor, electric, spin) which function to cause their immediate annihilation - thereby maintaining the non-local, massless, a-temporal, energetic and metric symmetry of light. The symmetry keeping/conserving role of electric charge is to prevent light's symmetric energy state from devolving into asymmetric, immobile, massive particles and their asymmetric companions: time, gravity, and charge. [Noether's theorem](#) requires the conservation of

light's symmetry, no less than light's energy, realized (in part) through electrically motivated annihilation reactions, suppressing the creation of "real" (massive, temporal) particles, and the metric-warping gravitational fields which must accompany them. According to Noether, not only the quantity (total energy) but the quality (symmetry) of light must be conserved. Symmetry conservation in light (as gauged by "velocity c ") suppresses the creation of "real" particles from the virtual "sea": as the force carrier or field vector of electric charge, the photon protects its own symmetry by means of particle-antiparticle annihilation reactions. *The charges of matter are the symmetry debts of light.*

Matter is an asymmetric form of light - one half of a particle-antiparticle pair. The function of charge is symmetry conservation, as we see demonstrated by the annihilation of particle-antiparticle pairs - returning the potentially massive particles to their original massless, symmetric form, light. When the symmetry of particle-antiparticle pairs (and hence of light) is broken by the weak force creation of matter during the "Big Bang", the charges of the matter half of the particle-antiparticle pairs remain, and their symmetry conservation function continues in the new time/historical dimension as the principle of charge conservation (time and gravity are created simultaneously with massive particles during weak force symmetry-breaking). Charge and charge conservation are necessary to symmetry-breaking and the creation of matter because they allow symmetry conservation to continue in a massive, temporal form during and after the conversion of symmetric light to asymmetric matter. Charge conservation allows the conversion of light to matter and the energy of light to information - information previously expressed (before the creation of particles) as the structural content of the spacetime metric and virtual particle-antiparticle pairs. The information content of the "spacetime metric" is therefore reflected in the "particle metric" - as seen in the [4x3 fractal](#) (resonant) structure of both. The conversion of light's energy to mass, light's entropy to time, and light's symmetry to charge, are the energy conversions and conservation measures necessary for the creation of matter from light (during symmetry-breaking via the asymmetric action of the weak

force). We will visit all these conversions and conservation considerations in the second half of this paper, where we discuss the "interior" lines of connection in the "[Tetrahedron Model](#)".

E-S) The connection between Entropy and Symmetry Conservation as found in the inertial forces of spacetime and the intrinsic motion of light (the creation of the "non-local" spacetime metric by the intrinsic motion of light). Space vs time, and "non-local" metric symmetry gauged by "c" (as contrasted with "local" metric asymmetry gauged by "G").

"Velocity c" gauges, regulates, and maintains the symmetry of the spacetime metric, suppressing time and distance (the x, t, dimensions of spacetime). Noether's Theorem states that symmetry is a conserved property of light and light's conservation domain, spacetime. The symmetric spacetime metric is created by the intrinsic motion of light, and is the site of "inertial" forces which maintain the metric's energy-conserving symmetry. The "metric" of spacetime is the measured relationship within and between the dimensions - "gauged", regulated, created, and maintained by the electromagnetic constant "c" and the intrinsic motion of light. "Velocity c" is the gauge of light's "non-local", a-temporal, and massless symmetric energy state, as well as the gauge of light's entropy drive (light's intrinsic motion). The symmetry (uniformity) of the metric is required by energy conservation. The metric relationship between space and time is "gauged" (established, fixed, regulated) such that one second of temporal duration (measured by a clock) is metrically equivalent to 300,000 kilometers of linear space (measured by a meter stick). It is the function of "velocity c" to maintain the metric symmetry of space by suppressing time to an implicit state, and to maintain light's "non-local" symmetric energy state by suppressing distance in the direction of propagation. "Velocity c" also suppresses the conversion of virtual particles into real particles, preventing the devolution of free energy into asymmetric matter, mass, time, gravity, and charge. The a-temporal metric symmetry state and entropy drive of light (or free electromagnetic energy), as expressed in the entropic (expanding and cooling) conservation domain of spacetime, are both gauged and

linked by "velocity c ".

Einstein's "Interval", which measures the invariant spacetime separation between any two events (regardless of the relative motion of observers), is zero, indicating the absence of time. Light is everywhere in its conservation domain (space) simultaneously, a crucial distributional feature of light's symmetric energy state. The breaking of this distributional symmetry of light's energy by the conversion of light to massive, immobile particles with no intrinsic spatial motion (during the "Big Bang"), is the root cause of the gravitational symmetry debt and charge ("location" - "Gm"), and the consequent creation of the temporal dimension as an alternative entropy drive for bound EM energy forms. Time is created by the gravitational annihilation of space, which leaves a metrically equivalent temporal residue (because "space" is really "spacetime"). Thus gravity acts to seamlessly replace light's spatial entropy drive ("intrinsic motion c ") with matter's alternative entropy drive ("intrinsic motion T "), utilizing and revealing the dual character of the spacetime metric which must exist to service the conservation requirements of the free and bound forms of EM energy. The entire dimensional structure of historic spacetime, including gravitation, is an entropic conservation containment for electromagnetic energy. (See also the gravitational line "E-CI" below).

The spacetime metric has both a wavelike aspect (light, the dimensions, intrinsic motion, etc.), and a particle-like aspect (the bosons or field vectors, photons and gravitons, virtual particle-antiparticle pairs, etc.). Unlike the fermions (quarks, leptons) of the atomic elements, bosons (photons, gluons, gravitons) which are their own antiparticles, are not created by symmetry-breaking during the "Big Bang", but appear to be vibrations, compressions, or particle-forming convolutions of the metric itself, perhaps relicts (in the case of the IVBs) of the early, dense metric of the "Big Bang".

Part II: The "Trinity of Matter" (The "Internal" Lines: Mass, Time, Charge)

(Matter, Causality, Information) ($h\nu = mcc$, the conversion of free to bound energy; atoms, galaxies, history, information; "Karma": the historical conservation domain of matter's causal information "matrix" - historic spacetime).

(See also: "[Tetrahedron Model: Interior Lines](#)"; and "[The Etheric/Material Tetrahedron](#)".)

C-CI) The connection between Energy Conservation and Causality-Information (or free and bound electromagnetic energy) - as seen in massless light vs massive particles.

Mass: Raw energy conservation expressed through the conversion of free energy to the mass and momentum of particles, as in the creation of matter during the "Big Bang" (or more simply and commonly, the capture of photons by the electron shells of atoms).

The heat/light produced by our Sun and captured by abiotic and biotic chemical and physical processes on Earth is a secondary example of the transformation of free to bound energy, not involving the creation of elementary particles. $E = h\nu$, $E = mcc$, $h\nu = mcc$, are all famous equations (by Planck, Einstein, and DeBroglie, respectively) which represent the energetic equivalence between free and bound electromagnetic energy forms. It is the transformation of free to bound energy (and vice versa) which is the central process of the Cosmos (and the "[Tetrahedron Model](#)"). The proclivity of light to interact with electrically charged particles and to conserve its energy in the bound form of particle mass, momentum, and electronic shells and configurations, is the basis for the existence of the material realm of particulate matter, and its highest and most complex expression, life (including photosynthesis). (Neutrinos, by contrast, hardly interact with matter at all; "dark matter" (if it exists) apparently interacts only gravitationally.)

The basic unit of energetic information recorded in the transformation of light to matter is the quantity of energy involved, reflected in the mass, momentum, kinetic energy, and "excitation" of particles, and the "[location charge of gravitation \(Gm\)](#)". Responding (in accordance

with "Noether's Theorem") to the breaking of light's "non-local" symmetric energy state (by the conversion of free to bound energy), gravity records the spacetime location of mass by the "warpage", "curvature", or "acceleration" of the spacetime metric. Gravity (immediately) creates matter's time dimension by the conversion of space to time (gravity's entropy conservation role), and (eventually) conserves light's "non-local" distributional and metric symmetry by the conversion of mass to light in stars, supernovas, quasars, and Hawking's "quantum radiance" of black holes (gravity's symmetry conservation role). (See: "[The Double Conservation Role of Gravitation](#)".) The great difference between energy/entropy conservation and symmetry conservation is that the latter can be deferred through time - via the transformation of symmetry to charge followed by charge conservation - until eventual charge-anticharge annihilation restores the original symmetry of light. It is charge conservation (through time) and the services of [alternative charge carriers](#) that allows the breaking of light's symmetry in the "Big Bang".

The primordial example of the conversion of massless light to massive atomic matter occurred via weak force symmetry-breaking during the "Big Bang" - the creation of our "matter only" cosmos - presumably by the asymmetric weak force decay of electrically neutral leptoquarks. (See: "[The Origin of Matter and Information](#)"; see:

["The Higgs Boson and the Weak Force IVBs"](#).) While the raw energy of light was stored in the mass and momentum of (matter-only) particles, the symmetry of light was stored in the alternative and conserved form of charges (see S - CI below), and the entropy of light was stored in the alternative form of time and gravitation (see E - CI below).

S-CI The connection between Symmetry Conservation (manifesting as charge conservation) and Information.

Charge conservation is an alternative means of conserving symmetry

and extending the conservation function into the time or historic dimension (in contrast to the inertial forces of the spacetime metric, which also conserve symmetry, but which have no mechanism allowing deferment in time) - just the difference between a credit card and a cash payment . *The charges of matter are the symmetry debts of light.*

Information is conserved as charge, and in historic spacetime (as matter's "causal matrix") - upholding the "Universal Present Moment" of bound energy (with a universal network of causal relations). Because of gravity, the location of all bound energy forms is recorded by the warpage of spacetime; because of the charge of the neutrino, the identity and number of every elementary particle is known; and because of the causal linkages of time, every "event" is immortalized in historic spacetime - the conservation domain of information and matter's "causal matrix". The Universe is indeed a dimensional, entropic conservation domain for information and electromagnetic energy in all its forms. (See: "[A Spacetime Map of the Universe](#)".)

Because certain types of symmetry can be conserved through time in the form of charge, matter can have an historical (and necessarily causal) dimension, unlike light which bears no charges and is both a-temporal and a-causal. Unlike raw energy and entropy debts, which must be paid immediately, symmetry debts (when in the form of conserved charges), constitute the "credit card" of the Cosmos - "buy now, pay later". Gravity pays the "interest" on the symmetry debt of matter through the deceleration of the cosmic expansion via the gravitational conversion of space to time (converting spatial to temporal entropy - the intrinsic motion of light to the intrinsic motion of time). It is therefore the entropy drive of free electromagnetic energy (light) and the expansion of space which (through gravity) funds the entropy drive of bound electromagnetic energy (matter) and the expansion of history. The charges of matter (symmetry debts) are eventually paid by matter-antimatter annihilations, the conversion of bound energy to free energy in stars, supernovas, quasars, and

Hawking's "quantum radiance" of black holes, and by particle and proton decay. Charge conservation, like the historical entropy drive (time's intrinsic motion) and the conversion of free energy to mass ($h\nu = mc^2$), gives the Universe a life in the historical domain, in which energy can be converted to work, information, and material objects with relative rather than absolute motion, and yet all conservation laws are nevertheless observed. (See: ["Global vs Local Gauge Symmetry and the 'Tetrahedron Model'"](#).)

The Information domain is unique in that the universe can explore and expand this domain almost without limit, especially in the realm of biology. In humans, the cosmos seems to be building a co-creator, capable of making artificial universes in his head, his books and movies, his computers. Who knows where this will eventually lead (think Star Trek), but the Information Domain is definitely the creative center of the universe. We may be sure that planet Earth is not the only locus of this universal creative energy, which we may rightfully regard as sacred.

Charge: the creation of fermions (quarks, leptons, neutrinos, and their charges) by symmetry-breaking during the "Big Bang". Fermions are the surviving matter half of light's particle-antiparticle form: charge conservation ensures that their symmetry debts, held through time as invariant charges, will eventually be repaid. Charge conservation = symmetry conservation in the time dimension (hence the cardinal importance of charge invariance, with all the local gauge symmetry currents and forces required for its maintenance). *The charges of matter are the symmetry debts of light* - (Noether's Theorem). Charge conservation is a temporal form of symmetry conservation - made possible by the creation of the historical domain through the gravitational conversion of space to time. Fermions comprise the 92 naturally occurring elements, the information base of matter, created in the "Big Bang" and by the nucleosynthetic pathway in stars (and supernovas). Charges are held in the time or historical dimension where they are balanced or neutralized until they can be annihilated or otherwise canceled by their corresponding antimatter charges. Charge conservation is moot in the absence of a time

dimension, as the mutual annihilations of virtual particle-antiparticle pairs attests.

This line (in the "Tetrahedron Model") is essentially the linkage between Causality and the source of Information, as Information (in the form of charge) is primarily supplied from the Symmetry pole, beginning with fermions, atoms, and charge conservation. In the chain of cause and effect, information must always be associated with the purely reactionary or mechanical aspects of the causal linkage - what, exactly, is the cause, and what, exactly, is the consequent effect? In the classic notion of "Karma", the linkage of cause and effect with information is implicit: both the criminal and the crime are known, and "the punishment must fit the crime". Information is by its very nature asymmetric and begins with charge. The gravitational "location" charge of bound energy, and the "identity" or weak force "number" (or "flavor") charges of elementary particles (carried in their explicit form by neutrinos), are with electric charge among the most fundamental charges of matter. Charges produce forces (carried by "field vectors" or "bosons") which act to pay the symmetry debts of atomic matter. Exactly what symmetries of light these charges represent and conserve is discussed in the paper ["Symmetry Principles of the Unified Field Theory"](#), among others.

Symmetry-breaking is necessary during the "Big Bang" to extract a residue of matter from the otherwise symmetric virtual particle "sea". Virtual particles (when not bound to an atom or other massive particle) do not exist in real time and hence do not produce a gravitational field (see: ["Does Light Produce a Gravitational Field?"](#)). Free virtual particles become manifest ("real", massive, temporal) as *single particles* (not particle-antiparticle pairs) only through the mediation of the [weak force Intermediate Vector Bosons \(IVBs\)](#). Acting in concert, the "Tetrahedron" of conservation principles allows the conversion of free energy to the mass, 4th dimension, and information of particles (bound energy, causal and entropic time, charge). But the weak force must still produce an asymmetry between particle vs antiparticle before the symmetry of the primordial pairs can be broken, isolating matter from antimatter, a "divorce" so

difficult it has only happened once, during the extraordinary energy/heat of the "Big Bang". (See: "[The Origin of Matter and Information](#)".)

Charge conservation and atomic matter form the base of the "information pyramid". Most information originates in the atomic nucleus, but is vastly amplified in the chemical interactions, combinations, and permutations of the electron shells of atoms. (See: "[The Information Ladder](#)" and "[The Information Pathway](#)".)

Molecular biologic information is carried by DNA and genes; symbolic information is carried by language and human writing, including math, music, and machine language, etc.

The gravitational charge is complex in that it represents a double debt, one of entropy (intrinsic motion), and one of symmetry (immobile concentrations of mass-energy), both consequent upon the loss of light's intrinsic motion and non-local distributional symmetry (lost whenever free electromagnetic energy is converted to bound electromagnetic energy). (See: "[The Double Conservation Role of Gravitation](#)".) Due to the mixture of the entropy debt with the symmetry debt, the latter cannot be deferred in time; gravity can never be neutralized, unlike electric charge. Hence we see the gravitational debt being paid or satisfied in two modes, which it is convenient to think of as a payment of: 1) "interest", occurring at all gravitational energies (entropy debt - intrinsic motion, the gravitational conversion of space to time - as on planet Earth), and a payment of: 2) "principle", occurring only at high gravitational energies (symmetry debt - immobile mass, the gravitational conversion of bound to free energy - as in the sun and stars).

Gravity pays the "interest" on the symmetry/entropy debt of matter by the conversion of space to time, creating an historical domain and a temporal entropy drive for matter and its charges. This action, however, only addresses the entropy debt (intrinsic motion), and does not diminish the actual symmetry debt of matter (immobile mass - as in the familiar case of planet Earth), hence the analogy with "interest". The spatial expansion of the Cosmos is reduced

nevertheless, supplying energy for the historical expansion. Therefore it is ultimately the intrinsic motion of light, the primordial entropy drive of free energy, which (through gravity) funds the intrinsic motion of time, the primordial entropy drive of bound energy. Gravity finally pays the "principle" on matter's symmetry/entropy debt by converting bound to free energy in stars, and by various other astrophysical processes, which go to completion in Hawking's "quantum radiance" of black holes. The gravitational force vanishes when mass vanishes - demonstrating the final repayment of the symmetry/entropy debt "principle", in complete satisfaction of Noether's Theorem. (See: "[A Description of Gravitation](#)".)

The "intrinsic" information inherently contained in free electromagnetic energy (light), and in the spacetime light creates, is expressed as the dimensional metric with its derivative, entropic regulatory gauges c , T , and G , and as the inertial forces conserving energy and symmetry, and finally as the "particle metric", the structural property of spacetime determining the species and masses of particles (virtual and real), charges, and force carriers that the "vacuum" is prepared to host, produce, and conserve (including the scaling property of the "particle mass gauge" or "Higgs" boson).

The realized possibilities we see in our Universe for quantized, bound energy forms are the 3 families of 4 elementary particles: 6 leptons and 6 quarks, and these determine the material parameters and characteristics of the Universe as we experience it (in our daily life, only 2 leptons and 2 quarks are found). The four dimensions of spacetime, the 3 energetic families each of 4 elementary particles, the four forces of physics, and the four major conservation laws, constitute the primary evidence of a 4×3 fractal algorithm inherent and operating in Nature, beginning with the electromagnetic "vacuum" of energized spacetime. This fractal algorithm is the fundamental and resonant "bit" or "Word" of Cosmic Information diagrammatically and symbolically represented by the "[Tetrahedron Model](#)". (See also: "[Nature's Fractal Pathway](#)"; "[The Information Pathway](#)"; and "[The Fractal Organization of Nature](#)".)

E-CI) The connection between Entropy (expressed as the intrinsic motion of matter's time dimension) and Causality-Information (the cause-and-effect relations of mass-matter). Gravity, negative entropy, the "warping" of spacetime by the gravitational conversion of space to time.

Inertial forces, gravitation, and metric symmetry conservation are also linked through [Einstein's "Equivalence Principle"](#). The spherical symmetry of gravitational force, required by energy conservation, is also an example of this association.

This line represents gravity and the gravitational metric when energy is in the form of mass, entropy is in the form of time, and symmetry is in the form of charge. Inertial forces maintain metric symmetry, for which "velocity c " is the gauge. "Velocity c " gauges both the entropy drive and the distributional symmetry of light and the spacetime metric; gravitation is both an entropy and a symmetry debt of light's "non-local" character. Through this dual association, gravitation is brought under the symmetry conservation umbrella of [Noether's theorem](#). The "4 forces of physics" are thus unified by the concept that their various resident charges *are all symmetry debts of light*. In Hawking's "quantum radiance" of black holes, we see the ultimate gravitational conservation of light's symmetry, even including the conservation of the symmetry of light's entropy drive. (See: "[The Double Conservation Role of Gravitation](#)".)

In Einstein's theory, gravitation is the "warpage", "curvature", or "acceleration" of this line (the spacetime metric). It is the presence of one-way time (matter's entropy drive) which "warps" the symmetry of the spatial metric of light. Whereas " c " is the positive gauge of the symmetric metric/entropic relation between light, space, and (implicit) time, " G " is the negative gauge of the asymmetric metric/entropic relation between mass, space, and (explicit) time. (See: "[Symmetry Principles of the Unified Field Theory](#)"; and "[A Description of Gravitation](#)".) Einstein's "Interval", which measures the invariant spacetime separation between any two events (regardless of the relative motion of observers), will always be

greater than zero because of the presence of time, and because massive objects cannot travel at "velocity c ".

One of gravity's several conservation roles is the creation of matter's historical entropy drive, time, by the gravitational conversion of space to time. Conversely, *gravity is the spatial consequence of time's intrinsic motion*. The intrinsic motion of time and gravity induce each other in an endless entropic loop. Time is the active principle of gravity's "location" charge. Gravity provides a local, temporal metric complete with entropy drive to service and conserve the energy accounts of a local, massive, typically immobile energy form, matter. When matter does move, it must be motivated by an external force and moves with relative rather than absolute motion. (See: "[Entropy, Thermodynamics, and Gravitation](#)".)

Another conservation role of gravity, the conservation of light's "non-local" distributional and metric symmetry, is demonstrated by the gravitational conversion of bound to free energy, as in stars, supernovas, quasars, and Hawking's "quantum radiance" of black holes. Gravity converts space and the spatial entropy drive of free energy (the intrinsic motion of light) to time and the historical entropy drive of bound energy (the intrinsic motion of time), and vice-versa. Establishing and maintaining the causal relations of matter (creating time via the annihilation of space - entropy role), and conserving light's symmetric "non-local" energy state (converting bound to free energy in stars - symmetry role), are among the chief conservation roles and [rationales for gravitation](#). The entropy and causality of bound energy are linked through the intrinsic motion of time just as the entropy and symmetry of free energy are linked through the intrinsic motion of light.

Gravity pays the entropy-"interest" on the symmetry debt of matter by the annihilation of space and the extraction of a metrically equivalent temporal residue. The spatial expansion of the Cosmos decelerates as it is gravitationally converted into the historical expansion of spacetime. Thus it is the intrinsic motion of light and the expansive, entropic energy of space which ultimately funds the

intrinsic motion of time and the expansive, entropic energy of history. Gravity pays the energy "principle" of matter's symmetry debt by converting bound to free energy in stars, supernovas and quasars (partially), and in Hawking's "quantum radiance" of black holes (completely). The gravitational force vanishes when mass vanishes, demonstrating the completion of gravity's symmetry conservation role, in complete satisfaction of Noether's theorem. (See: "[The Double Conservation Role of Gravitation](#)".) Gravity is the conversion force (in either direction) operating between the non-local, a-temporal (a-causal) symmetric ("all-way") entropy drive and conservation domain of light and space (free EM energy), and the local, temporal (causal) asymmetric ("one way") entropy drive and conservation domain of matter and history (bound EM energy).

Causality: the temporal sequence of cause and effect (as regulated by the interdependence of time and space in Special and General Relativity ("Lorentz Invariance") - gauged by the invariant "velocity c " and Einstein's similarly invariant "Interval").

Light is the causal messenger. Time is necessary to regulate matter's raw energy accounts because matter's energy content varies with its relative velocity. Think of the classic example of breaking a rack of billiard balls with the cue ball on a pool table. Time is necessary to regulate the orderly (and energy conserving) transmission of momentum and kinetic energy from one ball to the next. Massive matter is local, temporal, causal; massless light is non-local, a-temporal, a-causal (think of light bouncing/reflecting between two mirrors). Causality (temporal linkage) is a necessary but not sufficient condition allowing the conversion of free to bound energy. Light does not require a time dimension because light's motion is invariant and absolute, not relative; light's energy varies with its frequency, not its motion. Time is also necessary to provide the entropy drive of bound energy. Light is connected by space; matter is connected by time; gravity connects all. (See also: "[The Time Train](#)".)

History is the temporal analog of space; both are the creations of the intrinsic dimensional motions of their entropy drives, time and light. Yesterday must remain real to uphold the reality of today ("karma").

The causal relations of matter and bound energy generally are a [rationale for time and gravity](#). Time is produced by the gravitational annihilation of space and the extraction of a metrically equivalent temporal residue. Time is one-way due to the requirements of causality, entropy, and hence energy conservation. (See: "[Gravity, Entropy, and Thermodynamics](#)".)

The energy required to create matter's 4th dimension and entropy domain (history), is simply subtracted from the entropy domain of light and space by the gravitational conversion of space to time. The expansion of pure space is gravitationally converted to the historical expansion of spacetime, with the consequent deceleration of the spatial expansion of the universe. However, this process is actually opposed by the gravitational conversion of mass to light (paying the symmetry debt - in stars, etc.), with the eventual net consequence (as recently observed) that the universal expansion actually accelerates (because converting mass to light reduces the universal symmetry debt and hence also the universal gravitational field). (See: "[The Conversion of Space to Time](#)"; See: "[Dark Energy: Does Light Produce a Gravitational Field?](#)")

Information is conserved permanently in the historic domain of spacetime (matter's causal web, net, field, or "matrix"), and conserved temporarily in the molecular genetic code of life, and symbolically through human agency (as in libraries). Time is a necessary dimensional parameter both to order information (as in abiotic cause and effect and in biotic development and evolution), to preserve information and matter's "causal matrix" through historic spacetime, and to produce the entropy drive of bound energy. Causality orders information just as it orders the spacetime metric and energy, providing evolutionary and developmental routes, abiotic and biotic, for the return of bound to free energy (symmetry conservation). Finally, time is the necessary dimensional parameter in which charge conservation has durable integrity - in terms of symmetry debt repayment, etc.

Time, History, Historic Spacetime: The one-way (due to causality)

temporal entropy drive of bound energy, information, and matter's "causal matrix"; creating, expanding, and aging historic spacetime (see: "[The Time Train](#)"). "Intrinsic motion T" is the metric and entropic equivalent of "intrinsic motion c". (See: "[Spatial vs Temporal Entropy](#)".) Time is created from space and/or the collapse of an electromagnetic wave by two processes:

1) By the quantum mechanical switch ("collapse of the wave function") from the space-like or "wavelength" character of a freely moving electromagnetic wave, to the time-like or "frequency" aspect of a particle or stationary wave. Time is the *implicit* entropy drive of free energy and the *explicit* entropy drive of bound energy. (see: "[Gravity Diagram No. 2](#)" and: "[The Conversion of Space to Time](#)").

2) By the gravitational annihilation of space with the consequent conversion of the primordial drive of spatial entropy (the intrinsic motion of light) (S), to the primordial drive of historical entropy (the intrinsic motion of time) (T). The entropic expansion of space is gravitationally converted to the entropic expansion of history, as symbolically represented in a quasi-mathematical "concept equation":

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

History is the temporal analog of space, the dimensional entropic conservation domain of matter's causal/karmic information network. Historic spacetime is a 5th dimension, containing Information and matter's "causal matrix", the whole past and evolutionary history of the entire Cosmos. (Time and our own history is a 4th dimension; adding up the historical timelines of the entire universe constitutes a 5th dimension.) (See: "[A Spacetime Map of the Universe](#)"; see also: "[The Spacetime Map as a Model of Juan Maldacena's 5-Dimensional Holographic Cosmos](#)".)

Aging and the expansion (dilution) of history is due to the positive entropy drive of time, affecting all material elements. Proton decay and black holes are the ultimate form of temporal or information entropy. The entropic march of time creates the historic conservation

domain of Information at "right angles" to all three spatial dimensions, conserving matter's "causal matrix". It is only matter's causal matrix that sustains the reality of the "present moment" everywhere in the Cosmos. Today (the "effect") is real only because yesterday (the "cause") remains real in historic spacetime. Our past is some other observer's present, and vice versa. We are all immortal in history. (See also: "[Proton Decay and the 'Heat Death' of the Cosmos](#)".)

The "infinite" velocities of both time and light (the entropic drives of bound and free energy) constitute entropy's guarantee to energy conservation that violations of the spacetime domain by "time machine" or fast space ship are impossible. Velocities "T" and "c" are metric equivalents, sealing the borders of their respective conservation domains (history and space). The intrinsic motions of time and light establish and also protect their dimensional conservation/entropy domains. Gravity performs the same protective function through the "event horizon" and central "singularity" of black holes, where $g = c$ and light and time stand still. In a black hole, gravity assumes the protective functions of both c and T as it takes over their entropic roles, just as gravity assumes the binding functions of the atomic and nuclear forces. In the black hole, the gravitational metric performs locally all functions that were formerly performed globally by the electromagnetic metric. (See: "[Entropy, Gravitation, and Thermodynamics](#)".)

In contradistinction to light, which is indistinguishable from its entropy drive (the intrinsic motion of light), and inseparable from its conservation domain (space), matter is distinct from its entropy drive (the intrinsic motion of time), and separate from its conservation domain (history). (See: "[The Time Train](#)".) Matter's time dimension moves but matter itself does not; nor does matter participate in the expansion of its entropic conservation domain, history. The tangential relation between matter, time, and history prevents the inflation, or attrition, of the value of charge by matter's entropy drive and hence the devaluation of the symmetry debts those charges represent (charge invariance = charge conservation = symmetry conservation).

There is no cosmological "red shift" for charge.

The preservation of the value of symmetry debts through time and regardless of the expansion of the Cosmos and the action of entropy, provides a conservation rationale both for the quantization of charge and for the otherwise anomalous separation of matter from its entropy drive, time, and its conservation domain, history. Note in this regard that light, which is united with its entropy drive and expands with its entropy domain, carries no charges of any kind.

The tangential relation between matter and its historic domain (experienced as the ephemeral "present moment"), is due to the fact that the time dimension has intrinsic motion but matter does not. Nevertheless, the separation of matter from its temporal entropy drive and the historic conservation domain of information is not sufficient to completely protect the invariance of charge (and hence charge and symmetry conservation), or the invariance of the "Interval" (and hence causality and energy conservation), from local effects in the present moment such as relative motion, the partial charges of the quarks, or the hidden, implicit "identity" charges of the weak force. To protect charge invariance in these local, variable, and relative conditions, extra help is needed in the form of magnetism, time ("Lorentz Invariance"), the gluon field, and the massive weak force IVBs with their associated "Higgs boson". (See: "[Global and Local Gauge Symmetries in the Tetrahedron Model](#)".)

Another, perhaps equally important reason (at least from an "anthropic" perspective) for the separation of matter from its entropy drive and historic domain, is to preserve the energy content of matter in an undiluted form so that it can perform the evolutionary work of the Cosmos - as in the slow release of matter's energy content by our Sun. Whereas the energy of light is rapidly vitiated by its intrinsic motion, "diamonds are forever"; atoms simply do not age, at least by human standards. Given the absence of antimatter, strong gravitational fields and proton decay are the only threats to the proton's lifetime or the permanence of matter.

The physical, "tangential" separation of matter from its entropy drive

and historic conservation domain is the fundamental reason for the weakness of gravity - and for humanity's "angst" regarding our tenuous connection to the Cosmos. (Gravity is weak because only a small amount of space need be converted to time per given mass ($-Gm(S) = (T)m$) to provide the temporal entropy drive for the tiny tangential connection (consisting of the ephemeral "present moment") between matter and its historic entropy domain. This is actually commensurate with P. A. M. Dirac's observation that the ratio of the strength of the gravitational force to the electromagnetic force is the same as the ratio of the radius of an electron to the radius of the universe - if we take the radius of the electron as equivalent to the tangential point of contact between the "present moment" and the cosmic continuum of historic spacetime. (See: "[The Half-Life of Proton Decay and the 'Heat Death' of the Cosmos](#)".)

Postscript: An Antimatter Model

If we add a fifth apex to the "[Tetrahedron Model](#)", directly opposite the causal vertex and projecting backward rather than forward from the plane of the paper and the free energy "base" of the tetrahedron figure, we create a diagram of two tetrahedra which share a common free energy base, a six-sided hexahedron. I have begun to think this is a suitable representation for the combined realm of matter-antimatter. Note that there is no direct connection between the two Causal or Information (matter-antimatter) vertices - they are insulated from each other by the free energy base (essentially neutral light), so they avoid an immediate annihilation reaction, although their opposite charges (the doubled set of "internal" lines) will soon pull them back together and cause an annihilation, leaving nothing but the original "trinity" base of light, an expanding spacetime metric, and virtual particles. The oscillation, or inflation and collapse, of the 3-D hexahedron crystal with its 2-D free energy "trinity" base, exactly expresses the creation and annihilation cycle of particle-antiparticle pairs with the light which creates them.

It is to be noted that it is only possible to add a single (fourth) point to the "trinity base" of the tetrahedron, and still have all model points

directly connected one to another; this to me expresses the essential fact of the cohesion and unitary character of the tetrahedron (diamond) crystal and of the spiritual-material Universe, and why the Anti-universe cannot coexist with it. The physical assumption is that there is some difference in the time lines of the two tetrahedra that prevents their exact reciprocal alignment, and thus allows a matter residue to remain after otherwise mutual annihilation reactions.

See also the two papers: "[Information vs Causality](#)" and "[Section 14: Causality](#)".

Links:

email:

jag8@cornell.edu

johngowan@earthlink.net

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Tetrahedron Model Diagrams: "[The Symmetry Groups of Light](#)"

See: [Diagram of the Universe of Light](#)

See: [Diagram of the Universe of Matter](#)