

Postscript and Commentary on the [Tetrahedron Model](#)
(See: "[Principles of a Unified Field Theory: A Tetrahedral Model](#)")

John A. Gowan
(revised June, 2011)
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Metric Particles - Bosons

Our first consideration is the bottom line of the [Tetrahedron Model diagram](#) (the line representing the spacetime metric and gravity), connecting the Symmetry and Entropy poles. The spacetime metric has two major expressions: 1) metric particles or "bosons" (derived from the Symmetry pole); and 2) the structural and regulatory dimensional metric field of spacetime (derived from the Entropy pole). The metric field is a conservation mechanism of spacetime, created by: 1) its embedded intrinsic motions, light, time, and gravitation; 2) its regulators, the universal gauge constants "c" and "G"; 3) the energy and symmetry conserving forces of inertia. The particle aspect of this line I refer to as "metric particles", the bosons or field vectors (force carriers) of the forces, such as the photon, the graviton, the IVBs (Intermediate Vector Bosons) of the weak force, and the gluons of the strong force "color" charges. Bosons (except for the massive weak force IVBs) are massless and travel at velocity c; they appear to be produced or transmitted by the metric as vibrations or similar disturbances of its structure (hence the several massless varieties all have the same velocity "c"). Bosons are evidently not composed of quarks or leptons like the fermions of ordinary matter, and most basically, they do not appear to be the product of the symmetry-breaking process that produced ordinary fermions in the "Big Bang" - they do not appear to be the asymmetric halves of particle-antiparticle pairs, but rather whole particle units, complete in themselves and unchanged since the very beginning of the Cosmos - like the dimensions themselves. The "Intermediate Vector Bosons" (IVBs) of the weak force are unusual in that they are very massive bosons, whereas all other bosons are massless. For a discussion of these unusual weak force bosons (and the related "Higgs" boson), see: "[The Higgs Boson and the Weak Force IVBs](#)".

Inertial Forces

The symmetry of the metric is gauged by "velocity c" and regulated by inertial "reaction" forces. These include not only the "g" forces of turns and straight-line accelerations, but the metric regulatory/conservation forces which determine and maintain "velocity c". "Velocity c" (the universal electromagnetic constant) "gauges" or regulates the inertial symmetry of the spacetime metric, determining the intrinsic motion of light and all massless energy forms; "c" gauges the "non-local" distributional symmetry of light's energy, and the spatial entropy drive of light (light's intrinsic motion). Matter, time, and gravitation break the metric symmetry of the light Universe: asymmetric matter/mass, charge, time, and gravity are all transformations of light and the symmetric spatial/inertial forces. Energy conservation requires either spatial metric symmetry, or failing that, a spherical gravitational field (whose acceleration vectors all sum to zero at the common center of mass), symmetrically converting space and the drive of spatial entropy to time and the drive of historical entropy. (See: "[The Conversion of Space to Time](#)".) In the gravitational case, there will also be "[local gauge symmetry](#)" forces producing the covariance of time and space ("Lorentz Invariance"), protecting the invariance of velocity c, the "Interval", and causality.

Among other regulatory functions, "velocity c" gauges both the spatial entropy drive of light and the symmetry of the spacetime metric. This is a crucial realization in that it provides the basis of unifying - or at least connecting - the concepts of entropy and symmetry. "Velocity c" regulates ("gauges") the symmetry of the metric, vanishing time, distance, and location, and ensuring that the metric parameters of the dimensions are energetically equivalent (no energetically preferred dimensions or directions). Lacking a time and distance parameter, the photon has forever to go nowhere - hence, the "infinite" velocity of light, and the "non-local" distributional symmetry of light's energy. Light is everywhere within its conservation domain

(space) simultaneously. Energy conservation requires metric symmetry to prevent the spontaneous, random, and sourceless occurrence of "rogue" gravitational fields. For similar reasons, including the protection of causality, the regulating presence of the metric is necessary to insure that every photon moves with velocity c rather than its own unique velocity.

The role of c is to prevent the devolution of space into time, just as the role of electric charge is to prevent the devolution of light into matter (through particle-antiparticle annihilation). Because the field vector of electric charge is the photon, we see that the symmetry-keeping role of velocity c extends to the suppression of the spontaneous manifestation of virtual particles, as well as suppressing time and distance. So long as light keeps moving at c , then free energy and its metric cannot devolve into the asymmetry of mass, time, charge, and gravitation. The entropy drive and "non-local" symmetric energy state of light have to be governed by the same gauge such that the entropic spatial expansion does not affect metric symmetry. Only a "non-local" or "global" gauge with "infinite velocity c " can do this job, which requires the regulating metric gauge to be everywhere in spacetime simultaneously.

The Fractal Universe

Biological systems have genes and genetics to transfer and conserve information from one generation to the next, but the abiotic physical world evidently uses a 4x3 fractal algorithm for a similar purpose: to transfer, conserve, and replicate structural and functional patterns from one level of material organization to another. Because light has perfect symmetry, one might suppose that it transfers no special imprint or information to matter, yet this is not quite true. While most charges can be seen as simple, elementary, positive or negative force units with no further information content, yet they exist within the larger context of a 4x3 pattern whose origin is apparently the structure of the spacetime metric. (For example, the elementary particles exist in 3 distinct energy families each composed of 4 members, two leptons and two quarks.)

Particles are evidently "knotted" entanglements of electromagnetic energy and metric dimensional structure; the 4x3 fractal pattern in which they exist is apparently the contribution of the three- and four-dimensional structure of space and spacetime. For example, the leptons (electrons and neutrinos) have the simple elemental structure of one-dimensional time; the baryons (proton, neutrons) have the complex three-part internal structure of space, and this filled with photon-like gluons, massless and moving at velocity c , as if inside a miniature Cosmos. All particles have intrinsic motions such as spin; the barons have internal motions of quarks and gluons, atoms have orbiting electrons; all these intrinsic motions are reminiscent of, and probably derived from, the intrinsic entropic motions c , T , G (light, time, gravity) associated with the spacetime dimensions.

The fractal structure of the Universe is thoroughgoing, and it is the resonant mechanism by which the structural imprint of electromagnetic energy and spacetime is transmitted to every level of organized information, including life (through the 4x3 structure of the baryon, alpha particle, carbon, DNA, and the genetic code). It is also the basis for the fractal assertion: "as above, so below"; "man created in the image and likeness of God"; Teilhard de Chardin's vision of the "Omega Point", etc. Holographic, resonant, and General Systems models of universal structure all reduce to fractal models. The "[Tetrahedron Model](#)" used here is of course 4x3, the simplest Platonic solid of 4 equilateral triangles, but more significantly for biology, the tetrahedron is also the molecular bonding pattern of both carbon and water. (See: "[Nature's Fractal Pathway](#)".)

For more on the topic of the fractal pattern of the Universe see: "[The Fractal Organization of Nature](#)", and the "[Table of Natural Organization](#)". See also: "[The Information Ladder](#)", and "[The Information Pathway](#)"; see also: "[The Higgs Boson and the Weak Force IVBs](#)"; "[Table of the Higgs Cascade](#)".

Chardin and "Spirit"

The relationship between the Sun and the Earth is illustrative of the relationship between light and matter, a relationship so complex that we struggle, with [Teilhard de Chardin](#), to grasp its full and subtle import. Light and the spacetime metric (including gravity) create matter (via asymmetric weak force decays of matter vs antimatter during the Big Bang), and subsequently (as in the Sun-Earth interaction) light and matter produce life, consciousness, and the abstract information systems of human thought: philosophy, art, metaphysics, science, technology, etc. At its root, every human achievement, action, emotion, or idea is nothing else but the metamorphosis of light and the metric of spacetime - as wrought by the four forces of physics and regulated by the four conservation principles of the "Tetrahedron Model". (See: "[The Sun Archetype](#)").

The universal human concept of a spiritual realm is probably an emergent system memory of the original unity of the light Universe. Every elementary particle is produced with a specific "identity" charge, carried (in explicit form) by a neutrino. The notion of a human soul (a conserved personal identity) may likewise be a structural memory of this elemental "birth trauma" ("Not a sparrow falls but your Father knows; and every hair of your head is numbered").

The notion of "enlightenment" suggests there may be emerging an independent "Information Pathway" in consciousness back to this original symmetric state. Similarly, Chardin's notion of a realized "Heaven on Earth", his "Omega Point" of universal consciousness, suggests that the physical Universe, in its ultimate state, may recreate in matter what it once experienced in light - total unity, connectivity, and intercommunication. It may be that the unity, wholeness, and connectivity of light, like "beauty", is also a conserved property, perhaps an emergent corollary of symmetry conservation.

Beyond molecules and genes in biological systems, with the advent of brains and humans came new ways to create and conserve information: memory, language, writing, books, libraries, schools, social systems, information technology of all sorts, computers, the internet, and what Chardin would have recognized as the beginning of the "noosphere", a global network of knowledge and consciousness, consisting now of orbiting satellites, the internet with powerful centralized servers/processors, connected to individual personal computers. The information potential of the primordial nucleus-orbiting electron has evolved and been realized, in true fractal form, as the present-day global information system of the Earth-orbiting communication satellite.

The true significance of the information content of matter is that it provides the roadmap back to symmetry, the "straight and narrow" path, the charge conserved "lawful" route for matter to return to light. The natural buildup of information systems, otherwise so mysterious in their purpose, can therefore be seen as the simple consequence of matter's continuing search for antimatter and the pathway to light and symmetry - a search in which human intelligence has now been employed (as in theoretical physics, particle accelerators, etc.). That this search should produce a human spiritual and intellectual consciousness which desires and strives for the same metaphorical end ("enlightenment"), was to Teilhard de Chardin obviously the consequence of a universal evolutionary thrust toward information, consciousness and knowledge which begins in the atom, and ends in an "Omega Point" of universal awareness, connection, and understanding. See: "[Chardin: Prophet of the Information Age](#)", and his great book "*The Phenomenon of Man*" (Harper Torchbooks 1965). Similar views are advanced in my late father's book on transpersonal psychology and the nature of reality: "[Trance, Art, Creativity](#)", in which he suggests the Universe evolves toward a state of greater and more complete self-awareness and self-knowledge.

Biology

Biological systems have become a material (molecular) conservation domain of information because of at least 4 factors: 1) the ability of RNA and DNA to replicate themselves with rapidity and accuracy; 2) the infinite variety of the combinations and permutations of DNA and carbon chemistry; 3) the conservation and transmission of information in heritable genes by life's genetic system; 4) the negative entropy

mechanism of Natural Selection operating upon and reversing the natural positive entropy of mutation, sex, and other forms of genetic variation. All negentropic entropy systems originate with gravitation. (See: "[Newton, Darwin, and the Origin and Abundance of Life in the Cosmos](#)".)

Thus (in the "[Tetrahedron Model](#)") the Causality-Information-Matter pole pays the Conservation pole a great dividend in terms of conserved information through biological systems. Biological systems can convert light's energy to information and conserve the information as genes; abiotic systems can conserve light's energy but not information, as they have neither genetic systems nor heritable genes to do so (they do conserve and transmit fractal information - as do biological systems). While the abiotic system of matter is a Universe of energy conserved, the biological system of matter is a Universe of information conserved, a Universe awakened, aware, conscious, and experiencing itself. This is the difference between the physical Grand Canyon (a large erosional/geologic feature) and the observed Grand Canyon, the Grand Canyon as observed by aesthetically aware and appreciative humans (a spectacular expression of natural landscape beauty with profound emotional impact involving intuited geologic time as well). Only when you are an (adult) observer of this natural wonder can you begin to appreciate the significance of this difference. If humans do not develop, pursue, and indulge their natural capacity and tendency to appreciate beauty, mystery, and awful wonder, the Universe loses a uniquely human opportunity to experience itself with depth, sensitivity, and sophistication, and humanity loses its natural guide to truth, enlightenment, and salvation (in every sense).

Human Purpose

The development, through evolutionary time, of massive, complex, information structures can be understood not only in terms of matter's quest for its lost antimatter partners and a return to its original state of light-symmetry, but also as matter's quest for the original connectivity and unity of the light Universe, which knew no division or separation, and which communicated freely throughout its whole structure instantaneously. The reestablishment and recreation of this original unity of the light-Cosmos, but in the material world constructed of atomic elements - as in the interconnection of the planets, stars, and galaxies - is Chardin's vision of the physical "Omega Point" of Cosmic evolution. Toward the fulfillment of that vision we are currently taking the first tiny steps into our own Solar System, human seeds of "Gaia" (Lovelock's term for Mother Earth), as our planet begins her reproductive phase of life. *In purely biological terms*, this is the whole meaning and purpose of human life, our great mission to the stars, the reproduction and dispersal of Earth life, for which we, social anthropoids with clever hands and minds that make rocket ships, have been specifically evolved. "Noah's Ark" is more a vision of the future than a legend of the past. If we do not destroy ourselves first, we will take Earth-life with us into the galaxy.

Others will insist that human life finds its greatest significance in the spiritual, intellectual, or aesthetic terms of an "enlightened" individual consciousness in communication with the Cosmos - and this may be perfectly true at the individual level. But at the species level, Gaia herself is primarily interested in humanity's social ability to disperse Earth-life into the Universe, and perhaps also to protect her precious evolutionary creations from large asteroid and comet strikes.

We should also be aware that this same scenario is doubtless being enacted on many other planets, all of whom would also like to disperse their life forms as far and wide into our Galaxy as possible. On the astronomical scale of fractal organization, planets are like individuals, people are like cells. We are the seed cells of Gaia. Therefore, as always, time is of the essence. We need to stop mistreating our planet, stop mistreating each other, and get on with our species' mission to the Milky Way. The Universe will not be thwarted in its awakening by the misbehavior of a single irrational species on a single planet; even if God does play dice, at least He doesn't bet all of Heaven on a single throw. But if the Cosmic awakening now in progress everywhere is to include *Homo sapiens*, we must set our house and priorities in order.

See also: J. E. Lovelock: "Gaia" Oxford University Press 1979. ["Chardin, Prophet of the Information age";](#) ["The Information Pathway" \(text\)](#) and ["The Information Ladder" \(table\)](#).

Information vs Causality

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 compare and compete with, or complement and connect to, the other three conservation principles of the "Tetrahedron Model". "Information" is an energy state, whereas Conservation, Entropy, and Symmetry are conservation principles. Causality is also a conservation principle and it connects with the other three in a very 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. It is in fact the potent combination of Causality with 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, but the linkage of both to the remaining conservation laws is clearer and stronger when presented through the principle of Casualty. In the intuitive terms of "karma", causality guarantees there will be consequences to our actions - the mechanical linkage of cause with effect. The information associated with our actions determines the character of those consequences - good, bad, or indifferent. In Quantum Mechanics, Information is a conserved parameter; in the "Tetrahedron Model", the conservation of Information is primarily seen as an historical phenomenon.

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

Interactions of the 4 Conservation Principles of the [Tetrahedron Model](#) (Causality Interpretation)

1) [Energy Conservation](#) subsists in:

- a) Entropy: the creation of the dimensions of spacetime through the intrinsic, entropic motions "gauged" (regulated, scaled) by c , T , G . The dimensions are domains of entropy and conservation in which energy can be simultaneously used and conserved (as regulated by the laws of Thermodynamics, and the conservation principles of the "Tetrahedron Model");
- b) Causality: raw energy conservation (also gauged by " c ": $E = mc^2$), including the conversion of free to bound energy in the violent conversion of light into matter during the "Big Bang", as well as the gentler biological phenomenon of photosynthesis, and the temporal sequence of cause and effect (as regulated by Special Relativity through "velocity c ", the invariant "Interval", and "Lorentz invariance");
- c) Symmetry Conservation: Noether's Theorem; charge conservation, including spin. The virtual particle-antiparticle pairs of the Heisenberg-Dirac "vacuum" of spacetime. Particle-antiparticle pairs are created and annihilated by the electromagnetic force, for which the photon is the field vector. In these annihilations we see light aggressively protecting its own symmetric energy state. Charge is a temporally conserved expression of light's symmetry in material form. *The charges of matter are the symmetry debts of light.*

2) [Entropy](#) (in its primordial form as the intrinsic motions (entropic drives) c , T , G) creates dimensionality: Entropy serves Energy Conservation by the creation of dimensional arenas in which energy can be simultaneously used and conserved. The dimensions of spacetime are conservation/entropy domains:

- a) Space for free energy (via the intrinsic motion of light as gauged by "velocity c ", creating, expanding, and cooling space);
- b) History (historic spacetime) for bound energy's causal information web, network, or "matrix" (via the intrinsic motion of time, as gauged by "velocity T ", the metric equivalent of c , expanding, aging, and diluting history, the entropic equivalent of space); ("velocity T " is also gauged by " c " as the duration required by light to travel a given distance).

c) Spacetime for the mixture of light and matter (via the intrinsic motion of gravitation, as gauged by "velocity G", decelerating the spatial expansion of the cosmos as it contributes to the temporal component of spacetime). Gravity is the force which converts space and the drive of spatial entropy (light's intrinsic motion) to time and the drive of historical entropy (time's intrinsic motion), and vice versa (the latter in the conversion of bound to free energy in stars, etc.). A local gravitational metric (characterized by the active presence of time) is imposed upon the global spatial metric (via the gravitational conversion of space to time), so that the conservation requirements of both free and bound forms of electromagnetic energy can be satisfied. When bound energy is reconverted to free energy (as in stars, etc.), the total mass and gravitational energy of the Cosmos is reduced, and the spatial expansion rebounds accordingly - as recently observed.

3) Symmetry Conservation serves Energy Conservation in obedience to Noether's Theorem, primarily through:

a) Inertial forces of the spacetime metric, including the intrinsic motion of light, as gauged by "velocity c": maintaining metric symmetry requires the suppression of time and distance by velocity c, while simultaneously allowing the operation of spatial entropy (the expansion and cooling of space); velocity c gauges both the entropy drive and the non-local symmetric energy state of free energy; gravitation (ultimately) conserves (restores) light's and the metric's symmetry by converting bound to free energy (as in stars and via Hawking's "quantum radiance" of black holes).

b) Suppression of the virtual particle "sea": Symmetry Conservation suppresses the devolution of light to matter by the continual annihilation of matter-antimatter virtual particle pairs, via the mutual attraction of their opposite electric charges.

c) Charge Conservation: Symmetry Conservation allows "symmetry-breaking" by the weak force during the "Big Bang", only because through charge conservation the eventual return of bound to free energy in the historical domain is guaranteed (as via particle and proton decay, and via the gravitational "location" charge, converting matter to light in stars, quasars, and (finally and completely) in black holes through Hawking's "quantum radiance"). *The charges of matter are the symmetry debts of light.* The role of charge conservation and information is to provide a conserved (guaranteed) pathway for asymmetric matter back to the symmetric energy state of light. Gravity pays the entropy-"interest" on matter's symmetry debt by creating the time dimension from space, decelerating the cosmic spatial expansion in consequence (it is only in the time dimension that charge conservation has meaning for the material realm). Raw energy debts such as entropy, inertia, and mass, must be paid immediately; symmetry debts such as charge are time-deferred, and can be paid on any schedule, provided gravity continues to pay the entropy-interest by creating matter's time dimension.

4) Causality is the temporal, sequential ordering of energy, information, and the spacetime metric, such that causes are always associated with and precede effects. Causality requires:

a) "Lorentz invariance", Einstein's invariant "Interval", and the invariance of "velocity c" to regulate the interactions of the relative motions of matter with the absolute motion of light. "Lorentz invariance" of Special and General Relativity requires the covariance of space and time to protect causality in massive systems in relative motion; light is the causal messenger.

b) The one-way intrinsic, entropic motion of time as an ordering principle for causality, including a gravitational field to create and sustain matter's time dimension (time is the active principle of gravity's "location" charge, and [gravity is the spatial consequence of time's intrinsic motion](#)); causality is one of [several rationales for gravitation](#). Historic spacetime is the conservation domain of matter's causal information field, regulating "karmic" interactions and relations, and sustaining the reality of the "universal present moment" via causal linkages with the historic past (the "Akashic Record" of occult philosophy).

c) Charge conservation to create and preserve information in the historic domain of spacetime (Noether's Theorem). Causality (in the sense of the Causality-Information "pole" of the "Tetrahedron Model") serves Energy Conservation by insuring that there is always a source for energy (causes must precede effects), an entropy drive for bound energy (time); a spacetime center for the gravitational field (4-D "location": the "Interval" of mass is always greater than zero); and that the raw energy component of free energy may be

conserved in the mass and momentum of matter ($E = mc^2$). Finally, Causality orders information just as it orders the metric and energy, providing a separate, biological, evolutionary and developmental route (in addition to the gravitational pathway) for the return of matter to light. Causality implies and requires Information to direct and inform its actions, consequences, and effects. Massless light is non-local, atemporal, and acausal; massive matter is local, temporal, and causal.

Charge invariance is the key to understanding the local compensating actions ("local gauge symmetry currents") of the forces and their field vectors (magnetism, time and Lorentz invariance, quark confinement, the massive Higgs boson and IVBs of the weak force transformation mechanism, etc.). Because charges are symmetry debts which must be paid in full, charge conservation depends upon charge invariance, regardless of relative motion, entropy, the passage of time or the expansion of the Universe, the presence of gravitational fields, fractional charges, etc. (See: ["Global vs Local Gauge Symmetry in the Tetrahedron Model"](#).)

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

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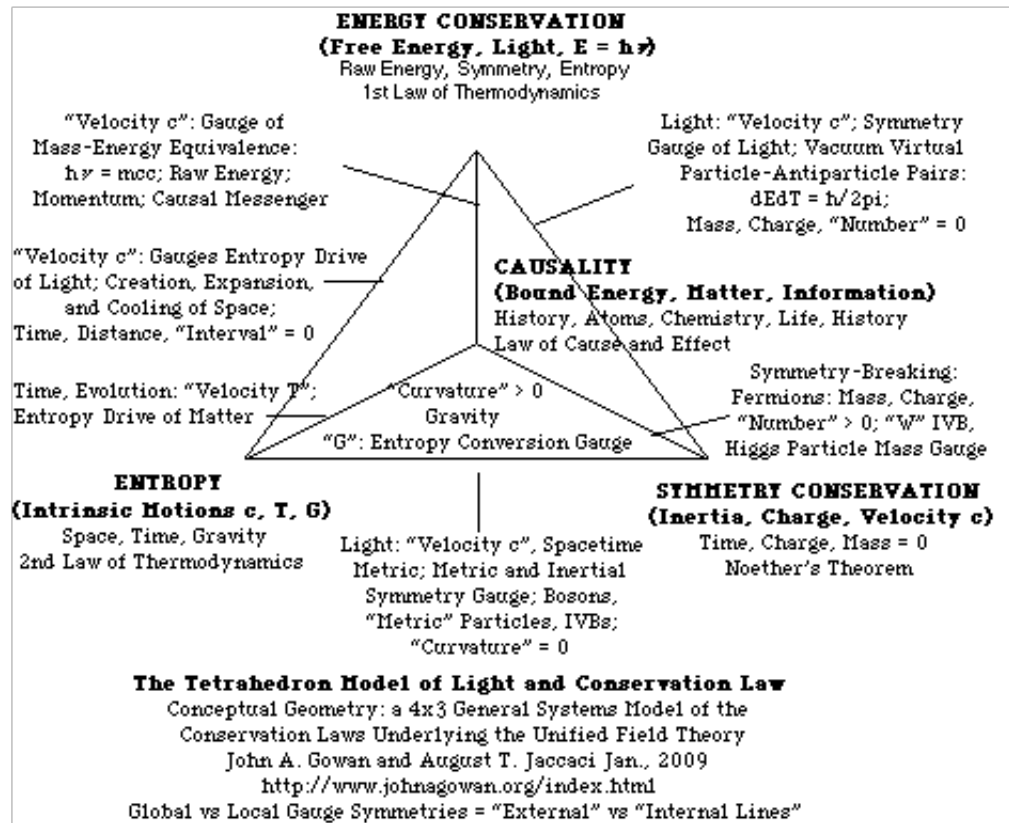
[Entropy, Gravitation, and Thermodynamics](#)

[Spatial vs Temporal Entropy](#)

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Fig. 1: The Tetrahedron Model



1) Energy conservation: 1st law of thermodynamics. Free energy, light, $E = h\nu$ (Planck's energy quantum); $h\nu = m_0c^2$ (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.