

Principles of a Unified Field Theory: a Tetrahedral Model

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Six Relationships: An Analysis of the Lines Connecting the 4 Vertices of the [Cosmic Tetrahedron](#)

Table of Contents

Acknowledgments

Abstract

[1\) C-E Conservation and Entropy](#)

[2\) E-I Entropy and Information](#)

[3\) E-S Entropy and Symmetry](#)

[4\) S-I Symmetry and Information](#)

[5\) S-C Symmetry and Conservation](#)

[6\) C-I Conservation and Information](#)

[Postscript: Causality vs Information](#)

[Links](#)

[Tetrahedron Diagram](#)

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ABSTRACT

[The tetrahedron diagram](#) is a model of the conversion of free electromagnetic energy (light) into bound electromagnetic energy (matter), and their consequent relationship. So far as we know, the creation of matter has occurred naturally only once, during the very early moments of the "Big Bang", the birth of our Universe. Other examples of the conversion of free to bound energy, not involving the creation of new matter, include the conversion of free energy to "work" and the momentum and kinetic energy of massive particles and organized macroscopic systems, and the simple absorption of photons by the electron shells of atoms (including photosynthesis).

The tetrahedron diagram is a model of the interrelationship of 4 conservation laws, principles, and corollaries which underlie or regulate the operation of the 4 forces of physics. This is the ground of natural law which is antecedent to the unified field theory, the realm of principle from which the forces are derived and by which they are regulated. These 4 principles are: 1) Energy Conservation (1st law of thermodynamics); 2) Entropy (2nd law of thermodynamics); 3) Symmetry Conservation (Noether's Theorem); 4) Causality (law of cause and effect - "karma").

In the primordial transformation of free to bound energy (creating new matter), we find that several attributes of light must be conserved. First there is the raw energy and momentum of light, transformed and conserved (by the weak and electromagnetic forces) as the mass and momentum of matter (1st Law of Thermodynamics, Energy Conservation). Next there is the entropy drive or intrinsic motion of light, gauged by "velocity c ", creating, expanding, and cooling the dimensional conservation domain of light (space).

Light's entropy drive is transformed and conserved (by gravity) as the entropy drive of matter, the intrinsic motion of time ("velocity T", also gauged by velocity c), creating the dimensional conservation domain of information (historic spacetime - matter's "causal matrix") (2nd Law of Thermodynamics, Entropy, protecting causality and energy conservation). The conversion of space and spatial entropy to time and historical entropy is accomplished by both the quantum mechanical and gravitational annihilation of space, exposing a temporal residue.

Finally, there is the symmetry content of light and its metric, which is transformed and/or conserved in obedience to Noether's Theorem as: 1) the charges (and spin) of matter (the particle-antiparticle form of light - an energetic aspect of light's symmetry); 2) the forces of inertia and (again) gravitation (the spatial, metric, or wave form of light - an entropic aspect of light's symmetry). *The charges of matter are the symmetry debts of light.* Symmetry-breaking is necessary to reveal the information content of particle-antiparticle pairs and their charges, which manifests as fermions (electrons, neutrinos, and quarks), the atomic constituents of matter. Charge conservation is the necessary guarantee to energy conservation that allows symmetry-breaking and the conversion of free energy (light) to massive particles and information: charge conservation therefore plays a role analogous to that of entropy, the necessary guarantee to energy conservation which allows the conversion of free energy to "work". Similarly, inertial forces of the metric structure of spacetime allow the conversion of the absolute motion of massless free energy to the relative motion of massive particles (Newton's Laws of Motion). Gravitational conversion of the entropy drive of free energy (light's intrinsic motion) to the entropy drive of bound energy (time's intrinsic motion) creates a local, temporal, gravitational metric which allows energy, charge, and entropy conservation in a causal domain of historical spacetime. Through the creation of time directly from space, gravity produces a combined spacetime metric in which both free and bound forms of electromagnetic energy can find all their conservation requirements satisfied.

The simple story of the Cosmos is the devolution of light to matter followed by the evolution of matter to light. But the information content of energy considerably complicates this simple ontogeny - the Universe apparently seeks self-awareness, self-knowledge, and self-experience (perhaps as the goal of, or as a payment or justification for, all the effort involved in manifestation). The negative entropy of gravity and Natural Selection drives the evolutionary mechanism of biological matter, with DNA providing replication and the genetic system providing information conservation through heritable genes. Because of its genetic system, life has become a biological conservation domain of molecular information, with humanity advancing this principle evolutionary axis of the Cosmos (Chardin's view) through abstract thought, symbolic writing, science and technology. Our planet is in her reproductive phase, with humanity as her dispersal agents, seeking new territory in the Galaxy. The natural tendency to evolve complex information systems of planetary size (and beyond) can be seen as the simple outgrowth of matter's search for antimatter (locally employing human intelligence in the quest), and a reprise of the original unity, symmetry, and connectivity of the primordial light Universe.

PREFACE

[Trinity Triangle](#)

Speaking in terms of physical models, the ["Trinity" triangle](#) is the precursor of the ["Energy Tetrahedron"](#), which it creates in its own "image and likeness". In the 2-dimensional drawing of the tetrahedron model, a "doubling" of the three triangle lines occurs - almost reminiscent of chromosome doubling in biological cell division. This second set of lines becomes the 3 "interior" lines of the (2-D) tetrahedron model, all connecting to the 4th pole of causality, matter, and information. In each case, the interior line is formed from an interaction between the two external "Trinity" or triangle lines which enclose them. Thus from a mixture of the C-E free energy and space line with the C-S virtual particle line, we derive the internal raw energy conservation line C-CI, in which the raw energy component of free energy is converted to the mass

and momentum of particles. From a mixture of the C-S virtual particle line with the S-E spacetime metric line, we derive the internal S-CI line of the fermions, atoms extracted by symmetry breaking via the Intermediate Vector Bosons (IVBs) of the weak force from the Heisenberg-Dirac vacuum "sea" of virtual particle-antiparticle pairs. Finally, from a mixture of the E-S line of the spacetime metric and the C-E line of light's intrinsic motion and space, we derive the internal line of time's intrinsic motion and history (including evolution) (E-CI). Note that the three outer triangle or "Trinity" lines are all forms of light, variously expressed as waves, virtual particles, or the metric of spacetime (including "metric particles", the bosons or field vectors of the forces).

This internal "matter set" of 3 lines is a transformed and conserved duplicate of the outer "Trinity set": 1) conserving the raw energy of light as the mass and momentum of matter (via the quantum mechanical collapse of light's wave function); 2) conserving the symmetry of light as the charges (and spin) of matter (via weak force symmetry-breaking and the IVBs), and via the inertial and gravitational forces of the spacetime metric; 3) conserving the spatial entropy drive of light as the temporal entropy drive of matter (via the gravitational conversion of space to time). The information produced in matter by atomic structure, and in life forms by the negentropic march of gravity, natural selection, evolution, and heritable genes, is conserved in the causal domain of historic spacetime.

Matter is created as an asymmetric, conserved form of light whose internal charges, forces, and information content will sooner or later act to return matter to its original symmetric state of free energy. The extensive information and causal webs created by matter (especially through its biological forms), suggests that bound energy is attempting to recreate in material form the original unity and connectivity of the light Universe, as driven by the electromagnetic force and matter's eternal search for antimatter. In this effort, we discern the operation of another conservation law, perhaps a corollary of Symmetry Conservation, the Conservation of Unity and/or Connectivity, which may be the source of humanity's spiritual awareness. The emergence of "beauty" in biological organisms may likewise be seen as a transformed expression of symmetry conservation in material systems and the source of our aesthetic awareness.

We turn next to an examination of each of the 6 lines connecting the 4 vertices of the [Tetrahedron Model](#). The lines are identified in the usual geometric fashion; for example, C-E refers to the line connecting the Conservation (C) and Entropy (E) poles or vertices of the 2-D diagram.

1) C-E The Relationship of Energy Conservation to Entropy

Light, Space, Velocity c , Entropy:

This is the relationship between the 1st and 2nd laws of thermodynamics, which consists of the creation of dimensional conservation domains by the primordial entropy drives of free and bound energy - that is, by the three intrinsic dimensional motions: light ("velocity c "), creating space; time ("velocity T "), creating history); and gravity ("velocity G ") creating spacetime. (See also: ["Spatial vs Temporal Entropy"](#).)

a) The primordial forms of entropy are intrinsic dimensional motions - as gauged by c , G , T .

b) The dimensions of spacetime are entropy domains. The intrinsic motion of light ("velocity c "), and its metric equivalent the intrinsic motion of time ("velocity T "), are effectively infinite velocities which protect causality, the function of entropy, and energy conservation, against tampering by fast spaceship or "time machine", sealing the borders of their respective conservation domains (space and history). Any possible inertial or gravitational loopholes ("wormholes") are closed by the "event horizon" and central "singularity" of black holes. There is no (physical) escape from, or entrance into, the electromagnetic conservation domain of spacetime, other than the "Big Bang" (or perhaps the "Big Crunch").

c) The intrinsic motion of light creates space, including the metric of space (the symmetric, inertial, scaled and regulated relationship between the dimensions). "Velocity c" is both the entropy drive and symmetry "gauge" or regulator of free energy and its spatial metric, not only creating space, but also expanding and cooling space. Space does not preexist the Big Bang; space is a dimensional conservation/entropy domain created by light for its own conservation. Light is the only energy form which can create its own conservation domain from nothing - or rather, from its own nature (intrinsic motion). This is one reason why the Universe must begin with light, not matter. (But see : ["The Higgs Boson and the Weak Force IVBs"](#).)

d) The role of entropy, whether positive or negative, is to create a dimensional conservation domain for its energy type (free or bound energy), in which energy can be both used and conserved. The negative spatial entropy of gravitation creates matter's time dimension and the joint dimensional conservation domain of free and bound energy, spacetime. The intrinsic motion of time (the positive entropy drive of bound energy) creates history, the temporal analog of space, and the conservation domain of Information and matter's "causal matrix".

e) Thermal, thermodynamic, or "work" entropy allows the transformation of energy to work - thermal entropy permits energy to be simultaneously used and conserved by forbidding energy's abuse. Because of entropy, the same energy cannot be used twice to produce the same net work (prohibiting perpetual motion machines, or any device which creates net energy). Thermal and information entropy are related through the concept of ordered vs randomized energy ("useful" energy vs "heat"). (See: ["Spatial vs Temporal Entropy"](#).)

f) Entropy is conserved in the sense that total entropy never decreases, although it may be transformed from one form to another. The intrinsic, entropic, spatial motion c of free energy (light) is gravitationally conserved as (converted to) the intrinsic, entropic, temporal motion T of bound energy's (matter's) time dimension. Without entropy, the first law would prevent any use of energy at all, and there would be no dimensional conservation domains, nor intrinsic motions to create them. As we should expect, the primordial forms of entropy (intrinsic dimensional motion) are embedded properties of energy: entropy and energy are an inseparable conservation pair.

g) Gravitational entropy conservation is demonstrated in a cosmic gravitational collapse or "Big Crunch", where the total heat loss and entropy of the Universe is reversed; in such a case, the total entropy of the Universe sums to zero. Gravity replaces the drive of positive spatial entropy (S) with the drive of a metrically equivalent positive temporal entropy (T); spatial expansion is consequently reduced as gravitation funds the temporal component of the total entropy equation. We can represent the gravitational conversion of the drive of spatial entropy (S) to the drive of temporal entropy (T) as:

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

See: ["Entropy, Gravitation, and Thermodynamics"](#) and ["A Description of Gravitation"](#).

2) E-CI The Relationship Between Entropy and Causality (or Causality-Information)

Time, Evolution

This line represents the time dimension, history, and in living systems includes evolution and the negative entropy of Natural Selection.

a) The origin of time is space and light; the intrinsic motion of time is derived from the intrinsic motion of light. Both time and space are implicit in the formula describing the intrinsic motion of light: "frequency" (time) multiplied by "wavelength" (space) = c. Time is extracted from space by the action of gravitation (gravity annihilates space, extracting a metrically equivalent temporal residue), or the quantum mechanical

collapse of an electromagnetic wave. In turn, the intrinsic motion of time causes the intrinsic motion of gravitation: gravity and time induce each other in an endless entropic loop. In the end, the entropy of time and gravitation are both derived from the entropy of light and space; this linkage is why the Universe decelerates when free energy is converted to bound energy - an amount $-Gm(S)$ of the spatial entropy drive (S) of light has been gravitationally transferred to the temporal entropy drive (T) of matter:
 $-Gm(S) = (T)m$.

b) The intrinsic motion of time is the metric equivalent of the intrinsic motion of light ("time flies").

c) The aging of the temporal dimension (the expansion of history) and the decay of matter and information is the analog of the expansion and cooling of the spatial dimension; history is the temporal analog of space.

d) History is the conservation domain of information and matter's "causal matrix"; bound energy forms are connected by the causal time line and matrix of history. Time and history are the connective tissue of massive energy forms, as space is the connective medium of massless energy forms. Gravity connects everything: light, space, time, history, and matter.

e) Time is an asymmetric, one-way, moving, linear dimension (actually 1/2 of a linear dimension) - massive objects age, but they do not participate in the expansion of history in the way light participates in the expansion of space; hence they retain their energy content practically indefinitely (depending on their gravitational environment and the half-life of particle and proton decay). (See: "[The Time Train](#)" and "[The Half-Life of Proton Decay and the Heat Death of the Cosmos](#)".)

The intrinsic motion of time is the entropy drive of bound energy. Matter requires a one-way linear moving time dimension to maintain causality and to keep its energy accounts, because unlike light, which moves with an absolute, constant, and non-relative velocity, the energy content of matter is relative and varies with matter's variable and relative velocity. Without the time dimension, matter could not move because its kinetic and momentum energy accounts could not be continuously monitored, updated, and conserved, nor could the causal relations associated with these motions and its spacetime position be established, maintained, and regulated.

There is a radical difference between temporal and spatial entropy. Because space is 3-dimensional and symmetric (each spatial dimension is two-way), spatial entropy (the intrinsic motion of light) causes the rapid expansion and cooling of the conservation domain of light. Light fully participates in the entropic expansion of its conservation domain - in fact, the intrinsic motion of light is the entropy drive which creates space and causes its expansion. This is not true for matter and matter's entropy drive, time. History is not an expansive domain available for our exploration as is space, again because time is one-way only, and it is the [time dimension which moves](#), not us. We are in physical contact only tangentially with time's moving front; the increasing time line and matrix of history, which is certainly real enough, nevertheless recedes from us at the equivalent of light speed (and at "right angles" to all three spatial dimensions), and therefore cannot be accessed by we who have created it. See: "[A Spacetime Map of the Universe](#)".

Whereas light completely occupies its expanding (and cooling) spatial conservation domain, matter does not similarly occupy its historic domain - only information follows time into history. Matter exists always in the "Eternal Now", forever on the tangential cusp of an ever receding and expanding historical dimension. These dimensional differences profoundly change the effects of entropy on bound vs free energy forms. Biological organisms like ourselves "age" because of our complexity, genetic programming, and fragility; but our constituent atoms hardly age at all. (See: "[Proton Decay and the 'Heat Death' of the Universe](#)".)

In biology, the negentropic mechanism of Natural Selection uses the positive entropy of genetic variation to produce organisms with greater "fitness", reversing the entropic erosion of genetic information. The

negative entropy mechanism of Natural Selection is necessary to produce the incredible complexity of biological organisms. It is because of the negative entropy associated with evolution, and the conservation of information via heritable genes, that the biological systems of life have truly become a molecular conservation domain of information. History is the analogous conservation domain of matter's information web, network, or "causal matrix". (See: "[Newton, Darwin, and the Origin and Abundance of Life in the Cosmos](#)".)

Like chemistry, *evolution is simply a physical fact and process*, the natural negentropic pathway for the conscious awakening of matter, energy, and the Cosmos. Evolution and the facts of Biology are no more an affront to human dignity than the facts of Chemistry, Physics, or Celestial Mechanics. Humans have furthered the natural evolution of information systems through abstract thought and symbolic writing, science, technology, and social systems. Human information systems actually represent a new iteration of the universal 4x3 fractal algorithm (the "[Metaphysical Realm](#)"), as demonstrated in our understanding and control of the evolutionary process, chemistry, and even nuclear reactions (see: "[The Information Pathway](#)"). According to Teilhard de Chardin, information building is the central evolutionary axis of the Universe. See: "[Chardin: Prophet of the Information Age](#)".

3) E-S The Relationship Between Entropy and Symmetry Conservation

Spacetime, the Metric, Gravity, General Relativity, Inertia, Metric Particles, Bosons, Fractals

Gravity

Gravity is matter's memory it once was light

a) One of gravity's several conservation roles is the creation of matter's time dimension; another role - the conservation of light's "non-local" symmetry - seemingly reverses the first by converting bound to free energy. Gravity creates time by the annihilation of space, extracting a temporal residue. Because time is created from space, this same gravitational action creates spacetime, the joint dimensional conservation domain of free and bound electromagnetic energy. Time and space are entropically equilibrated by G and metrically equilibrated by c, allowing the interaction of light and matter in spacetime. (See: "[Gravity, Entropy, and Thermodynamics](#)".)

b) Gravity is the convergent, accelerated motion of spacetime, which by Einstein's "Equivalence Principle" is exactly equivalent to the notion of a static but "curved" or "warped" metric. The actual motion of spacetime is why everything, including light, falls at the same rate - everything must be a co-mover with the motion of spacetime. (See: "[A Description of Gravitation](#)".)

c) Gravity and time induce each other in an endless cycle. The intrinsic motion of time drags space with it; the gravitational acceleration of spacetime is caused by the constant application of a force - the constant intrinsic motion of time. The attractive principle of gravitation essentially subsists in the motion of spacetime as caused by the unbreakable connection between space and time. If time moves, space must move with it. The converse action (symmetric space "fleeing" asymmetric time) causes the intrinsic motion of light. Space is primary and symmetric; time is secondary, asymmetric, and derived from space. The time dimension cannot exist without space to support and create it. Hence the Cosmos begins with light and space, not matter and time. (See: "[The Higgs Boson and the Weak Force IVBs](#)".)

The spherically symmetric field of gravitation is caused by the symmetric connection of time to all spatial dimensions. The convergence of the gravitational field is due to 3-D space being squeezed into the zero-D point which constitutes the beginning of the linear time dimension at the gravitational center of mass. Space is pulled into the time line like bath water being sucked down a drain. Because the timeline is at right angles

to space, space is annihilated at this central point, leaving behind a temporal residue (time is the active "entropic charge" of gravitation) whose intrinsic motion drags more space to the beginning of the timeline, repeating the cycle endlessly. (See: "[The Conversion of Space to Time](#)".)

The spatial entropy drive of light is converted gravitationally via the annihilation of space into the temporal entropy drive of matter. This conversion decelerates the expansion of the Cosmos: the Cosmos must decelerate because some of its spatial entropy drive (S) has been converted into a historical entropy drive (T):

$$-Gm(S) = (T)m.$$

d) Time is the active, entropic principle of gravity's "location" charge, identifying the 4-dimensional position, quantity, and density of massive, immobile energy sources. "Location" is the symmetry debt of light's "non-local" energy state, a symmetric energy state with respect to the distribution of light's energy, which is broken when light is converted to massive stationary forms (bound energy).

e) Light produces no gravitational field in free flight; only energy sources with a time dimension, whose spacetime "Interval" is greater than zero, whose spacetime position can be localized and specified, produce gravitational fields. Light is 2-dimensional and "non-local", having no "x" dimension in the direction of motion, and no time dimension, nor the gravitational field which could produce one. However, the energy of light will produce a gravitational field once it is absorbed, immobilized, and has acquired a specifiable location in spacetime (for example, when a photon is absorbed by the electron shell of an atom). "Non-local" light in free flight cannot produce a spatially centered gravitational field; an uncentered gravitational field would violate energy conservation, hence light cannot produce one. ("See: "[Does Light Produce a Gravitational Field](#)"?)

f) Gravity is both an entropy and a symmetry debt of light (which is why in the "Tetrahedron Model" we associate gravity with the E-S line); velocity c is both the symmetry gauge and the entropy drive of the spacetime metric (see: "[The Double Conservation Role of Gravitation](#)"). Time is the active principle of both gravitational debts. The quantum mechanical collapse of an electromagnetic wave initiates a gravitational field: the wave switches from a "wavelength" or explicit spatial character to a "frequency" or explicit temporal character (see: "[Gravity Diagram No. 2](#)"). The implicit temporal component of light or the traveling wave becomes the explicit temporal component of the particle or stationary wave, "setting" or initiating the time charge, determining the magnitude of G , and identifying the four-dimensional position, quantity, and density of immobilized energy. (See: "[The Conversion of Space to Time](#)".)

Light is non-local, due to its lack of an "X" and "T" dimension. The consequent "infinite" velocity of light results in the symmetric distribution of its energy, everywhere, simultaneously, throughout its spatial conservation domain (the Cosmos). This distributional symmetry of light's energy is broken when light loses its intrinsic motion and is converted to bound energy. This broken symmetry is conserved in accordance with Noether's Theorem by gravity's "location" charge, of which time is the active principle. The magnitude of G is determined by the small energy difference between the drive of symmetric spatial entropy (S), and the drive of asymmetric temporal entropy (T), or equivalently, between implicit vs explicit time: $S - T = -G$.

g) Gravity pays its symmetry and entropy debts simultaneously by converting bound to free energy, as in stellar processes, and in Hawking's "quantum radiance" of black holes. The latter process demonstrates that even the symmetry of entropy is conserved - the "all-way" spatial entropy of light having greater symmetry than the one-way temporal entropy of bound energy. Black holes provide the physical demonstration of the notion that gravity converts space and the drive of spatial entropy (intrinsic motion c) to time and the drive of historical entropy (intrinsic motion T). The surface of a black hole (the "event horizon") is a time surface, and its area is proportional to the black hole's entropy (theorem of Beckenstein-Hawking).

h) From the point of view of energy conservation, it is the "causal" nature of matter that requires the one-way time dimension, and hence the quantum mechanical mechanism to produce it; from the point of view of Noether's Theorem (symmetry conservation), it is the "local" nature of matter that requires the gravitational conversion of bound to free energy. From the point of view of entropy, it is the fact that matter cannot move at velocity c that requires the intrinsic motion of matter's time dimension. These entropy and symmetry debts originate with "velocity c ", which is both the entropy drive and symmetry gauge of "non-local" and hence "acausal" free energy. To conserve either aspect of velocity c is to conserve the other by default. Light is "non-local", atemporal, and acausal; matter is local, temporal, and causal. (See: "[The Double Conservation Role of Gravity](#)" and "[A Rationale for Gravitation](#)".)

4) S-CI The Relationship Between Symmetry Conservation and Causality-Information

Symmetry-Breaking, Fermions, Atoms, Elements, IVBs, the Weak Force

a) *The charges of matter are the symmetry debts of light.*

b) Information requires asymmetry. Light carries zero information because it is perfectly symmetrical. Information is conserved in the historic spacetime domain (matter's "causal matrix").

c) The production of particles and information from energy during the "Big Bang" requires both charge conservation and symmetry-breaking; symmetry-breaking is permitted only because of charge conservation (among other factors).

d) Charges and elementary particles are the primordial physical forms of information.

e) Charges create forces whose purpose is to return matter to its symmetric origins, light (symmetry conservation - Noether's theorem). The search for antimatter and a pathway back to symmetry is eternal, due to charge conservation.

f) The conservation role of information (in the form of charge) is to provide a return pathway from the asymmetric state of bound energy (matter) to the symmetric state of free energy (light). (The human analog is "knowledge" providing the pathway to "enlightenment".)

g) Matter is created from light; light is primary, matter secondary; matter is an asymmetric form of light, consisting of one-half of a particle-antiparticle pair. (In a similar fashion, time seems to be one-half of a symmetric spatial dimension.) Hence matter is one-half of light's symmetric particle form. The charges carried by particles were intended to cause and facilitate annihilation reactions with antimatter partners, restoring such pairs to light's original symmetry. Hence these particle charges, "hung" in time because of the absence of an annihilation partner, are indeed the "symmetry debts of light".

h) A charge can be considered a "bit" of elementary information, and charge conservation is the mechanism which allows one component of the symmetry of free energy to be transformed into particles and information. In this regard, charge conservation plays a similar enabling role for particles as entropy plays for "work". Charge conservation is the guarantee that the symmetry debts held by charges will be repaid. Entropy is the guarantee that energy will be conserved when transformed to work. Charges generate forces that act to return the material system to symmetry. Without charge conservation, the symmetry of the particle-antiparticle pairs could not be broken, as there would be no guaranteed pathway back to symmetry, and hence no symmetry conservation. The information held by the charges of matter is the information necessary for matter's return to symmetry; this is the reason why information is a significant physical parameter.

The value or magnitude of most charges is not affected by relative motion (or entropy) because charges are

symmetry debts, not energy debts, and have no relation to the quantity of energy they are associated with. Gravity is exceptional in this regard because its charge is essentially time, which is both the entropy drive and the non-local symmetry debt of bound energy. The quantity of time, gravity, and temporal entropy varies with the quantity of bound energy (in accordance with the Bekenstein-Hawking theorem relating the surface area of a black hole to its entropy content).

i) Fermions are the basic information carriers produced in the symmetry-breaking reactions of the "Big Bang". Fermions include the familiar atomic constituents, nucleons (protons, neutrons), electrons, and neutrinos. Matter is composed of fermions. Bosons are typically the force carriers of fermion charges - photons, gravitons, gluons, IVBs. The IVBs (Intermediate Vector Bosons) of the weak force are instrumental in the process of symmetry breaking. IVBs (as scaled by the Higgs boson) form a bridge between the real world of fermions and the virtual realm of particle-antiparticle pairs, mediating the birth, death, and transformation of quarks and leptons through interactions between the "real" world and the virtual particle "sea" of the spacetime vacuum. As the name indicates, the IVBs are intermediate forms between typical bosons and fermions, and hence appear in both the S-E and S-CI lines. IVBs have mass like the fermions, but act as force carriers like the bosons. The weak force charge mediated by the IVBs is known as "number", "flavor", or "identity" charge (these charges are actually provided by the virtual particle sea rather than the IVB itself). (See: "[The Weak Force: Identity or Number Charge](#)".)

j) The mechanism of symmetry breaking in the "Big Bang" remains a mystery, but evidently involves a tiny asymmetry in the weak force reaction rate with matter vs antimatter, on the order of about one part per ten billion. Hence the time dimension ("rate"), already asymmetric, is thought to play the major symmetry-breaking role. (See: "[The Origin of Matter and Information](#)").

k) Matter holds information in the nuclei and electron shells of the atomic elements of the periodic table, and especially in their chemical combinations, permutations, and geometric configurations. The "organic" bonding patterns of carbon and the replicating molecules RNA and DNA form the chemical basis for life. Through the complex chemistry of these molecules, genetic heritability, and evolution, life has become a molecular conservation domain of information. There is simply no upper limit to the amount of information that can be produced from energy, and no way of knowing what the extent and complexity of its domain might become. The rise of consciousness, cognition, and information systems is an evolutionary vector recognized by Chardin and carried forward in many abstract and artificial forms by the Human species (memory, language, writing, technology, social systems, schools, science, etc.). (See: "[Newton, Darwin, and the Origin and Abundance of Life in the Cosmos](#)".)

See also: "[Chardin: Prophet of the Information Age](#)", "[The Information Ladder](#)" and "[The Information Pathway](#)" and "[Nature's Fractal Pathway](#)".

5) S-C The Relationship Between Symmetry Conservation and Energy Conservation

Noether's Theorem, Charge Conservation, Virtual Particle-Antiparticle Pairs, Heisenberg-Dirac "Vacuum"

The relationship between Symmetry Conservation and Energy Conservation is characterized by Noether's Theorem which states: in a multicomponent field (such as the electromagnetic field or the metric field of spacetime) wherever one finds a symmetry one will find an associated conservation law, and vice versa. I think of this great theorem (the key to force unification) as the "Truth and Beauty" theorem (referring to Keat's *Ode on a Grecian Urn*: "Beauty is truth, truth beauty, - that is all / ye know on Earth, and all ye need to know.") where the role of truth is played by Energy Conservation and that of beauty by Symmetry Conservation. Charge conservation is a common example of this theorem as it is enforced in nature; the symmetry of the spacetime metric as regulated by inertial forces (and as conserved by gravitation) is another example.

In essence, Noether's theorem states that the symmetries of light are conserved. Because matter is created from light, consisting in effect of one member of a particle-antiparticle pair, we see that *the charges of matter are the symmetry debts of light*. Because light itself is perfectly symmetric and carries no charges of any kind, light can only endow the particle pairs it creates with charges which sum to zero. The function of all charges in particle-antiparticle pairs is to cause and facilitate the annihilation of the pair, returning its energy to the symmetric state of light. If one member of a pair disappears, the other member is left with its charges intact, charges whose annihilation functions are suspended indefinitely in the absence of their intended mates. Hence these charges are nothing if not the symmetry debts of light, for the other half of their original "whole" or symmetric charge is missing.

The "vacuum" is full of virtual particle-antiparticle pairs whose opposite electric charges function to attract the partners to each other through space, effecting their annihilation within the "Heisenberg Interval", the time limit for the existence of virtual particles. Because the photon is the field vector of electric charge, we see that light is directly protecting its own symmetry in particle-antiparticle annihilations. The role of electric charge in nature is precisely to protect the symmetry of light, preventing light from devolving into the asymmetries of mass, time, charge, and gravitation.

Virtual particles illustrate the tendency of light to manifest; particles are a consequence of the entanglement of a 2-dimensional electromagnetic energy wave with the structure of the spacetime metric, producing immobile 4-dimensional "knots": the structural attributes of particles derive from their origin in the dimensional metric. The production of real rather than virtual particles is thought to also involve the "Higgs" boson as well as the IVBs of the weak force. Both the Higgs and the IVBs appear to be "metric" particles, particles composed of a compressed, convoluted, and bound element of the metric structure itself, rather like one of the "string" particles of "string theory". (See: "[The Higgs Boson and the Weak Force IVBs](#)".)

A program of force unification would involve the identification of the broken symmetries of light which are represented by each of the four forces and their charges. We have already seen that gravitation is associated with the symmetry and entropy debt of light's "non-local" and "acausal" energy state, light's loss of intrinsic motion c when its energy is converted to rest mass. Hence the gravitational charge (time) confers "locality", temporal causality, and an historical entropy drive upon any form of bound energy. Other examples (of light's broken symmetries) include light's 2-dimensional symmetry (lacking a time dimension), protected by electric charge; light's "anonymity" symmetry (light's indistinguishable individual photons), a symmetry of "identity" protected by the IVBs, neutrinos, and "identity" charges of the weak force; and finally, a quantum-mechanical symmetry involving whole quantum unit ("leptonic") elementary charges, which confines the fractional charges of quarks within baryons, a symmetry protected by the color charges and gluons of the strong force. For more on this topic of charges, forces, and their unification, see: "[Symmetry Principles of the Unified Field Theory](#)".

Charge conservation makes possible the conversion of free energy to particles and elementary forms of information, much as entropy makes possible the conversion of free energy to work, while raw energy conservation makes possible the conversion of free energy to mass and momentum. Similarly, inertial forces make possible the relative motion of massive particles, while gravity makes the conservation parameter of time possible, converting the entropy drive of free energy (light's intrinsic motion) to the entropy drive of bound energy (time's intrinsic motion). It is the time dimension that makes the conservation of energy possible for any massive particle, including the historical redemption of conserved charges, and relative rather than absolute motion. The conservation function of time is why mass requires a gravitational field.

6) C-CI The Relationship between Energy Conservation and Causality-Information

Raw Energy conservation, Mass and Momentum, Special Relativity, The Energetic Equivalence of Light and Mass ($E=mc^2$), Matter, Life, Photosynthesis, Genetics, Humanity

The equivalence relation between mass and free energy - $E = mc^2$ - the ability of Nature to create massive particles from light, makes possible the conversion (because it is a conservation relation) of free energy to particle mass and momentum. Massive particles are created by the entanglement of light's electromagnetic wave in the structural web of the spacetime metric. The Higgs boson is the mass scalar of the weak force IVBs which mediate the asymmetric creation of matter during the "Big Bang". (See: "[The Origin of Matter and Information](#)"; see also: "[The Higgs Boson and the Weak Force IVBs](#)".)

a) When light is converted to matter, as in the "Big Bang", there are three principle conservation modes protecting the energy of light: 1) Raw Energy (as conserved by mass and momentum in matter); 2) Entropy (dimensionality, intrinsic motion), the intrinsic motion of light (the entropy drive of free energy, creating space), conserved as the intrinsic motion of time (the entropy drive of bound energy, creating history); 3) Symmetry (as conserved in symmetry-breaking by the charges and spin of matter, and the inertial and gravitational forces of spacetime). Free and bound energy are only equivalent energetically: free energy (light) is 2-dimensional, massless, non-local, atemporal, acausal, and symmetric, carrying no charges of any kind (neither gravitation nor information); bound energy (matter) is 4-dimensional, massive, local, temporal, causal, and asymmetric, carrying various charges (including gravitation and information). The formal elements of time and causality as they apply to matter, including its interactions with light, are the subject of Einstein's Special Theory of Relativity. The ability of Earth and its life forms to capture and process energy from the Sun (for example, in photosynthesis) depends upon the capacity of light and matter to engage in energy-conserving interactions. (See: "[The Tetrahedron Model](#)".)

b) Information is strictly conserved only at the level of elementary particles and charges, and in the historic (causal) dimension of spacetime. This has the advantage of freeing higher levels of system information (for example, electron shell interactions) from conservation restrictions. If information were strictly conserved, evolution would be either impossible or ineffective; evolutionary advance depends upon a moderately rapid cycle of death, birth, extinction, and the creation of new species - in a word, change. However, the conservation of information in the historic time dimension is another matter altogether. In this case one "observer's" history or past is another observer's present moment. Causality would fail if the historical dimension did not conserve information. Yesterday is inaccessible, but real nonetheless. If it were not, the linkage between the present moment and our birth would disappear, and we would cease to exist. In the occult tradition of the "Akashic record", access to the information stored in the historical dimension of spacetime is possible to the adept. We are all immortal in history. (See: "[A Spacetime Map of the Universe](#)".)

See Also: "[Postscript, Commentary, and Additions to this Paper](#)"

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

Links:

Unified Field Theory

[Section I: Introduction to Unification](#)

[Section X: Introduction to Conservation](#)

[Section IX: Symmetry: Noether's Theorem and Einstein's "Interval"](#)

[Section XIV: Causality](#)

[Symmetry Principles of the Unified Field Theory \(a "Theory of Everything"\) - Part I](#)

[Symmetry Principles of the Unified Field Theory \(a "Theory of Everything"\) - Part 2](#)

[Principles of the Unified Field Theory: A Tetrahedral Model](#)

[\(Postscript and Commentary on paper above\)](#)

[Synopsis of the Unification Theory: The System of Spacetime](#)
[Synopsis of the Unification Theory: The System of Matter](#)
[Light and Matter: A Synopsis](#)
[Global-Local Gauge Symmetries and the "Tetrahedron Model"](#)
[Global-Local Gauge Symmetries: Material Effects of Local Gauge Symmetries](#)
[The "Tetrahedron Model" vs the "Standard Model" of Physics: A Comparison](#)

Gravitation

[Section II: Introduction to Gravitation](#)
[A Description of Gravitation](#)
[Global-Local Gauge Symmetries in Gravitation](#)
[The Double Conservation Role of Gravitation: Entropy vs Symmetry](#)
[12 Summary Points Concerning Gravitation](#)
[Extending Einstein's "Equivalence Principle"](#)
[The Conversion of Space to Time](#)
["Dark Energy": Does Light Produce a Gravitational field?](#)

Entropy

[Section VII: Introduction to Entropy](#)
[Entropy, Gravitation, and Thermodynamics](#)
[Spatial vs Temporal Entropy](#)
[Currents of Symmetry and Entropy](#)
[The Time Train](#)
[The Halflife of Proton Decay and the 'Heat Death' of the Cosmos](#)

General Systems and Metaphysics

[Section VIII: Introduction to General Systems, Complex Systems](#)
[Section XI: Religion and Science](#)
[Section XII: Man's Role in Nature](#)
[Section XIII: The Solar Archetype](#)
[A General Systems Approach to the Unified Field Theory: Part 1](#)
[A General Systems Approach to the Unified Field Theory: Part 2](#)
[Synopsis of the "Tetrahedron Model" of the Unified Field Theory](#)
[The Tetrahedron Model in the Context of a Complete Conservation Cycle \(text\)](#)
[The Tetrahedron Model \(diagram\)](#)
["Trance, Art, Creativity" An Investigation of the Numinous Element and the Metaphysical Realm. A Book by Prof. John C. Gowan, Sr.](#)
[Stewart C. Dodd's 4x4 Mathematical General System Matrix](#)
[Spiritual and Scientific Principles of the Tetrahedron Cosmic Energy Model](#)
[Postscript: Causality, Information, Karma](#)
[The Grail and Hourglass Diagrams](#)
[A General Systems Analysis of the Creative Process in Nature](#)
[Is There Life After Death?](#)
[A Rationale for Love in the Cosmos](#)
[Human Development and Life Stages General Systems Models](#)
[DeBroglie Matter Waves and the Evolution of Consciousness](#)
[An Overview of the Astrological System of the Grail Diagrams](#)
[Text for the Sun Sign Table \(The "Sun Signs" of Astrology: Part One\)](#)

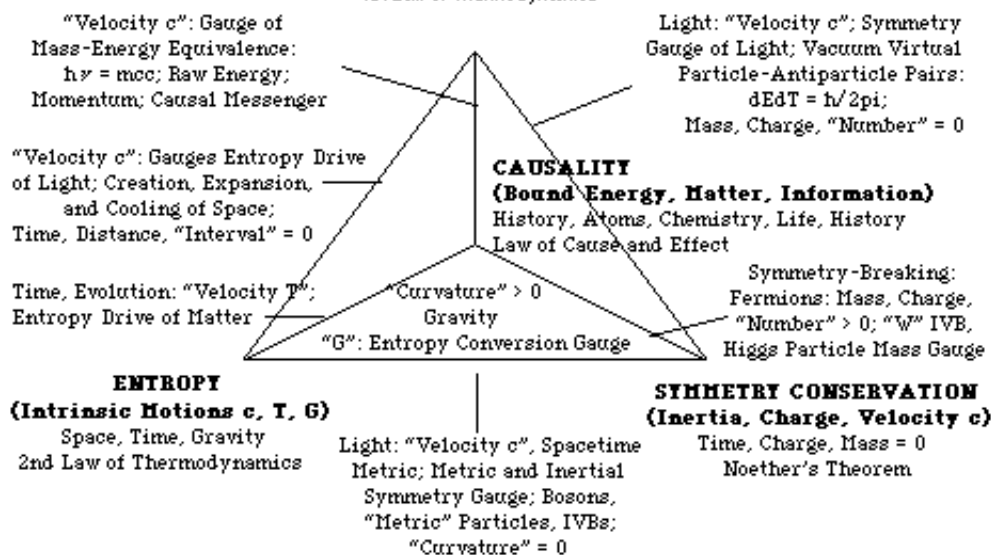
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Fig. 1: The Tetrahedron Model

ENERGY CONSERVATION
(Free Energy, Light, $E = h\nu$)
 Raw Energy, Symmetry, Entropy
 1st Law of Thermodynamics



The Tetrahedron Model of Light and Conservation Law

Conceptual Geometry: a 4x3 General Systems Model of the Conservation Laws Underlying the Unified Field Theory

John A. Gowen and August T. Jaccaci Jan., 2009

<http://www.johnagowen.org/index.html>

Global vs Local Gauge Symmetries = "External" vs "Internal Lines"

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.

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