The Tetrahedron Model in the Context of a Complete Conservation Cycle

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Abstract

"Noether's Theorem" states that in a multicomponent field such as the electromagnetic field (or the metric field of spacetime), symmetries are associated with conservation laws. In matter, light's (broken) symmetries are conserved by charge and spin; in spacetime, light's symmetries are protected by inertial forces, and conserved (when broken) by gravitational forces. All forms of energy originate as light; matter carries charges which are the symmetry/entropy debts of the light which created it (both concepts are required to fully integrate gravity - which has a double conservation role - with the other forces). Charges produce forces which act to return the material system to its original symmetric state, repaying matter's symmetry/entropy debts. Repayment is exampled by any spontaneous interaction producing net free energy, including: chemical reactions and matter-antimatter annihilation reactions; radioactivity, particle and proton decay; the nucleosynthetic pathway of stars, and Hawking's "quantum radiance" of black holes. Identifying the broken symmetries of light associated with each of the 4 charges and forces of physics is the first step toward a conceptual unification. *The charges of matter are the symmetry debts of light.*

Section I: Four Conservation Principles

The Tetrahedron Model (a Unified Field Theory or "Theory of Everything") has as its principle focus the transformation of free electromagnetic energy (light) into bound electromagnetic energy (matter) and vice versa. Four primary and interrelated conservation laws govern these transformations, as diagrammed in the model; briefly, they are:

I) The Conservation of Energy: 1st law of thermodynamics. Energy may be transformed but energy cannot be created or destroyed. Total energy within a closed system is invariant. In the Tetrahedron Model we see 3 major expressions of the transformation and conservation of light's energy (free electromagnetic radiation): 1) raw energy conservation - the transformation of free to bound energy - as in the creation of matter during the Big Bang: E = mcc (or any conversion of light's energy into the bound energy of matter, including chemical, molecular, and kinetic energy, momentum, heat, etc.) 2) Entropy - as expressed through

the intrinsic dimensional motions of light, time, and gravity, which create the dimensional conservation domains of space, history, and spacetime (the dimensions are conservation arenas created by the primordial drives of spatial and temporal entropy, including their gravitational transformations, one to the other). 3) Symmetry conservation - expressed principally through charge conservation in matter and through inertial forces in spacetime (Noether's theorem - charge is a temporally conserved form of light's symmetry).

Raw energy conservation allows the transformation of light to bound energy; entropy allows the transformation of free energy to "work", and light's intrinsic motion to time's intrinsic motion (via gravity); symmetry conservation allows the transformation of light to charge and information: together they create the material world. (See: "Synopsis of the Tetrahedron Model". The Cosmos is a manifest domain of conservation law, whose principle and interrelated expressions are raw energy conservation, symmetry, entropy, and causality (as expressed through matter, charge, spacetime, information, and "karma"). Additional, auxiliary conservation parameters and corollaries are discussed below in section II.

II) Entropy: 2nd law of thermodynamics - allowing the transformation of energy to many forms, including "work". Entropy increases so that energy is not created or destroyed during its many allowed transformations. (In this regard, entropy is like a very generalized or "global" example of a "local gauge symmetry current" operating at the primordial level of conservation law, protecting the conservation of energy.) The expansion and cooling of the universe is driven by entropy, which demands that the capacity for work by any closed system must decrease over time. The intrinsic motion of light is the entropy drive of free energy, creating, expanding, and cooling spacetime; the intrinsic motion of time is the entropy drive of bound energy, creating, expanding, and aging (diluting) history, the temporal analog of space. The dimensions of spacetime are domains of energy conservation created by the entropic drives of the intrinsic motions of light, time, and gravity. Gravity is the entropy conversion force, converting space and the drive of spatial entropy (the intrinsic motion of light) to time and the drive of historical entropy (the intrinsic motion of time), and vice versa. Entropy allows us to use energy because it absolutely forbids us to abuse energy. This is why both light and time have effectively "infinite" velocities which are metric equivalents of each other - they are the entropy drives of free and bound energy, creating dimensional conservation domains in which energy can be simultaneously used, transformed, and yet conserved. See: "Entropy, Gravitation, and Thermodynamics".

III) The Conservation of Symmetry: Noether's Theorem. Not only the total energy of light, but also light's symmetry must be conserved. The quality of energy as well as the quantity of energy must be conserved. The principle expressions of Noether's Theorem and symmetry conservation are through the inertial forces of spacetime and charge conservation in matter. *The charges of matter are the symmetry debts of light*. Symmetry conservation allows the conversion of energy to information through the mechanism of quantized charges which are redeemable through time, whereas raw energy and entropy debts (and inertial symmetry debts) must be paid immediately. Charges are a temporally conserved form of light's symmetry, just as mass is a temporally conserved form of light's raw energy. To use a financial analogy, gravity pays the entropy-"interest" on matter's symmetry debt, creating matter's time dimension, borrowing entropy-energy from the intrinsic motion of light and the spatial expansion of the cosmos, which decelerates accordingly. Hence, through gravity, it is ultimately the spatial entropy drive of light's intrinsic motion which funds the historical entropy drive of time's intrinsic motion. All forces act in concert to return asymmetric matter to its original symmetric energy state, light. Our Sun is the archetypal example of a closed symmetry-conservation circuit. (This gravitational circuit actually goes to completion via Hawking's "quantum radiance" of black holes.) See: "Symmetry Principles of the Unified Field Theory" and "The Sun Archetype".

IV) Causality-Information: The law of cause and effect - "Karma". Light is non-local, atemporal, and acausal. Matter is local, temporal, causal. The historical dimension of spacetime is the conservation domain of matter's information field, matter's "causal matrix". The reality of today is only maintained by the continuing reality of yesterday. As the "Spacetime Map" clearly indicates, our "yesterday" is another

observer's "today", and vice versa. The universe is a thoroughly interconnected causal network which begins with the plasma era of the "Big Bang", a period of thermal equilibrium between matter and light which lasted for about 300,000 years. We are all immortal in spacetime; total energy, symmetry, entropy, and information are all conserved in historic spacetime. "Every jot and tittle of the law will be fulfilled" and "not a sparrow falls but the Father knows."

Section II: Four Stages of Conservation

While the "Tetrahedron Diagram" represents the most important conservation considerations involved in the conversion of free energy to bound energy (raw energy, entropy, symmetry), it cannot also represent all the additional modes and levels of conservation involved in the maintenance and evolution of matter's conserved state through time, including the eventual return of the material system to its original symmetric form. At least four stages are involved in the complete conservation cycle: 1) the initial devolution of our Universe from the Multiverse (in which the types and magnitudes of the various physical constants are established); 2) the "Genesis" conversion of light to matter during the "Big Bang"; 3) the maintenance and evolution of the conserved parameters of matter (such as charge) through time; 4) the final return of matter and its conserved properties to its original symmetric energy state, light. These stages are discussed briefly below, and more extensively in many papers referenced on my web site. (See also: "The Higgs Boson and the Weak Force IVBs" for a more detailed discussion of the complete conservation cycle.)

I) The "Light Lines"

In the Tetrahedron diagram, the three "outer" lines represent "global" conservation parameters pertaining to light and absolute motion as gauged by "velocity c": 1) the creation, expansion, and cooling of space; 2) the creation and annihilation of virtual particle-antiparticle pairs; 3) the inertially symmetric spatial metric in which time and distance (x, t) are vanished. Gravity, mass, charge, time, and distance are all suppressed in the symmetric and entropic spatial domain established by the intrinsic motion of free electromagnetic energy as gauged by "velocity c": particle number = 0; mass = 0; charge = 0; spacetime "Interval" = 0; metric warpage = 0; time and distance = 0; "location" = 0 (light is non-local, atemporal, and acausal).

II) The "Matter Lines"

When light is converted to matter, breaking the symmetry of space and matter-antimatter particle pairs via the asymmetric weak force decay of electrically neutral leptoquarks during the "Big Bang", conservation takes a new, asymmetric, "local" and "relative" form, directly derived from the preexisting, symmetric, "global" and absolute form. For example, the spatial metric formerly gauged by the universal electromagnetic constant "c", becomes the spacetime metric gauged by the universal gravitational constant "G". "G" gauges the creation of time from space per given mass (Gm): gravity annihilates space, extracting or revealing a metrically equivalent temporal residue. The asymmetric, "one-way" presence of time "warps" the symmetric "all way" entropic domain of space, establishing a new (compound) entropic domain (historic spacetime) for light and matter's causal information network or "matrix". Whereas light is atemporal, non-local, and acausal, matter is temporal, local, and causal. The entropic expansion of space is gravitationally converted to the entropic expansion of historic spacetime: the purely spatial expansion of the Cosmos decelerates accordingly. The raw energy of light is converted into the raw energy of matter-mass: $h\nu = mcc$. The symmetry of light is converted into the temporally conserved charges of matter: charges are a temporally conserved form of light's various (broken) symmetries. *The charges of matter are the symmetry debts of light* (Noether's Theorem). Gravity pays the entropy-interest on matter's symmetry debt by the annihilation of space and the extraction of a metrically equivalent temporal residue, decelerating the spatial expansion of the Cosmos accordingly. Hence it is the spatial expansion or entropy drive of light that ultimately funds the gravitational creation of time from space, and the entropic historical expansion of matter's causal information field.

III) The Maintenance of Charge Invariance

In the relative, temporal, and gravitational spacetime domain of matter, the conservation of symmetry, now in the form of charge conservation, also requires the invariance of those charges through time and despite any relative motion. Hence locally active forces are required to protect the invariance of charges and other conserved attributes of matter's symmetry, energy, and entropy debts. For example, magnetism is necessary to protect the value of electric charge in relative motion; the weak force IVBs (and the scalar Higgs boson) are necessary to protect the invariant masses and associated charges of elementary particles whenever and wherever they may be created. Elementary particles created today must be exactly the same in all respects as those created yesterday, tomorrow, or in the Big Bang 14 billion years ago. To this end, the great mass of the weak force IVBs recapitulates the original environmental conditions (in terms of energy density) in which elementary particles were first created during the "Big Bang". The gluons of the strong force color charge are necessary to hold together the partial charges of the quarks, protecting the quantum mechanical integrity and value of whole quantum unit symmetry debts; "asymptotic freedom" is a direct force consequence of the increasing or decreasing threat to symmetry-keeping through whole quantum unit charges, responsive to the expansion or contraction of the quarks relative to a common center. (Quark partial charges are required in the first place to allow the creation of an electrically neutral particle (the "leptoquark") which can break the symmetry of matter-antimatter particle pairs via weak force decays during the "Big Bang". These partial charges, in turn, require confinement via the gluons of the strong force. Matter is only as complex as necessary to break the original matter-antimatter symmetry of the Cosmos.) "Lorentz Invariance", the covariance of temporal and spatial dimensions in Einstein's Special and General Relativity, is necessary to protect causality, the spacetime "Interval", and the invariant value of "velocity c" in a material world of relative rather than absolute motion. Time and the gravitational metric required to create a 4th dimension are necessary to conserve energy in the realm of relative motion of massive particles rather than the realm of absolute motion of massless light. Time is one-way to satisfy causality, entropy, and energy conservation for massive particles. *Gravity is the spatial consequence of the intrinsic motion of time;* gravity creates time via the annihilation of space and the extraction of a metrically equivalent temporal residue; time and gravity induce each other endlessly. (See: "A Description of Gravitation".)

Hence we see an additional layer of conservation law ("local gauge symmetry forces or currents") associated with the maintenance through time of various conserved properties of the material realm, but in all cases this layer is derived directly from the primary spatial conservation domain of light and its metric. (For example, time is derived from space, charges are derived from light's symmetry, mass is derived from light's raw energy, real particles are derived from virtual particles, color charge is derived from electric charge, gluons are derived from photons, particles are derived from spacetime, etc.) This secondary level of conservation activity is typically produced by embedded partial aspects of the field vectors of the four forces - magnetism, time, IVB mass, gluons. We noted earlier that entropy itself may be seen as performing a similar but generalized maintenance function protecting energy conservation, at the primary or "global" level of conservation law. Entropy at this primordial level of function is also an embedded property of energy ("intrinsic motion" c, G, T). (See: "Local" or relative vs "global" or absolute gauge symmetry currents).

IV) The Return of Matter to Light

A final stage of conservation activity, due to the direct action of the field vectors or force carriers, gives rise to the "4 forces of physics", which act to return the material system to its original symmetric state, light. These include: 1) exothermic chemical reactions, matter-antimatter annihilations (electromagnetic force); 2, 3) fusion and fission, radioactivity and nucleosynthesis, particle and proton decay (strong and weak forces); 4) the stellar conversion of mass to light, quasar conversion of gravitational energy to light, and finally Hawking's "quantum radiance" of black holes (gravity). These annihilation reactions all involve the reunion of matter with antimatter in some form, in total effect reversing the "Big Bang" reactions that originally separated them. The fact that the field vectors of the four forces are all their own antiparticles (either

individually or in sum), is necessary to this final reunion. (See: "Symmetry Principles of the Unified Field Theory".)

Synopsis of the Four Conservation Stages or Activity Levels:

1) Devolution of our Universe from the Multiverse - the specification and establishment of the "given" physical constants and their "gauge" magnitudes (c, G, h, e, etc.). ("This is to be a universe of electromagnetic energy, in two interchangeable and interactive forms, free and bound (light and matter), wholly conserved in terms of energy, symmetry, and information, with dimensional and interchangeable entropic parameters (space and time), and including the following types and values of physical constants: "c", the electromagnetic constant, 300,000 meters/sec; "G", the gravitational constant, ... etc. ") - (such details would automatically accompany the specification of the principle energy type ("electromagnetic"), with little or no option for variation (in a universe "friendly" to our life form)).

2) Conversion of Light to Matter ("Big Bang") (Via the asymmetric weak force decay of electrically neutral leptoquarks):
a) Conservation of Raw Energy (the energy of light converted to mass and momentum - allowing "matter");
b) Conservation of Symmetry (the symmetry of light converted to charge and spin - allowing "information");
c) Conservation of Entropy (the spatial entropy drive of light (the intrinsic motion of light) converted to the historical entropy drive of matter (the intrinsic motion of time) - allowing "work" and relative rather than "absolute" motion).

3) Maintenance of the Conserved Parameters of the Material System Through Time in an Invariant State (invariance of charge/spin, elementary particles, causality, the "Interval", and "velocity c" in all circumstances):
a) Electric Charge Invariance (magnetic fields protect the invariance of electric charge in relative motion);
b) "Lorentz Invariance" (covariance of time and space with relative motion) (Special and General Relativity - invariance of "velocity c", the "Interval", and causality);
c) Elementary Particle Invariance (weak force IVBs and Higgs scalar boson);
d) Whole Quantum Charge Unit Invariance (strong force color charge and gluon field).

4) Return of the Material System to Light via Action of the Four Forces of Physics - Conversion of Mass-Matter to Light:
a) Exothermic chemical reactions; matter-antimatter annihilations, including normal suppression of virtual particle-antiparticle pairs (electromagnetic force);
b) Nucleosynthetic pathway - fusion; proton decay (strong force);
c) Radioactivity - fission; particle and proton decay (weak force);
d) Stellar conversion of mass to light; quasar conversion of gravitational energy to light; Hawking's "quantum radiance" of black holes (gravitational force);
e) Evolution of life forms - the Universe becomes aware of and experiences itself through life, converting energy into self-experience and self-understanding, "enlightenment" (unity), and new forms of creativity (art, science, technology). Humans also convert bound into free energy through exothermic chemical reactions and even controlled (and uncontrolled) nuclear fission and fusion.

Acknowledgment:

The author gratefully acknowledges the contribution of August T. Jaccaci to the "General Systems" content of the Tetrahedron Model discussed in this paper. The "scientific" content of the model is the author's own responsibility - JAG. (See: "Introduction to General Systems" and "Introduction to Fractals" for a discussion of the development of the General Systems models exhibited on this website.)

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