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Summary
(revised Jan., 2012)

Symmetry Conservation and Charge Invariance in the Unified Field Theory ("Tetrahedron Model")

Abstract

The Cosmos begins with a free form of electromagnetic energy, light, the purest, simplest, and most symmetric form of energy known. through weak-force symmetry-breaking, the primordial light energy is converted into bound forms of electromagnetic energy: atomic matter. Atomic matter is a temporally conserved form of light's spatial energy expression. In matter, light's raw energy is conserved as mass and momentum; light's symmetry is conserved as charge and spin; light's entropy is conserved as gravity; light's continuity is conserved as temporal causality. Energy Conservation, Symmetry Conservation, Entropy, and Causality are the four principle conservation parameters of the "Tetrahedron Model", and constitute the foundation of natural or physical law which underlies and supports the Unified Field Theory of the four physical forces. (See: "The 'Tetrahedron Model' of the Unified Field Theory"). In this paper we explore the connections between of the four physical forces, with special emphasis upon their symmetry relations under the unifying mantle of Noether's symmetry conservation Theorem: "The charges of matter are the symmetry debts of light". The particles of matter bear light's symmetry debts as charges; these charges produce forces which act to return the asymmetric massive system of matter to its symmetric massless origin in light.

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1) Noether's Theorem requires the conservation of light's symmetry no less than light's energy.

2) The charges (and spin) of matter are the symmetry debts of light.

3) Charge/spin conservation is a temporal, material form of symmetry conservation. Charges are a material translation (representation) of specific symmetry parameters which can be conserved through time as active, invariant debts awaiting repayment (as by annihilation with antimatter).

4) Maintaining the invariance of, and paying (discharging) light's symmetry debts as held by the charges of matter, is the role of the field vectors of the four forces of physics.

5) Charge invariance (in the service of symmetry conservation) is the key to understanding the local action of the forces ("local gauge symmetry currents").

Symmetry debts of the four forces, as conserved by their charges, are identified as:

a) Electromagnetic force: electric charge. Dimensional asymmetry; 2-D or 3-D symmetric space vs 4-D asymmetric spacetime (time asymmetry). Opposite electrical charges attract, motivating antimatter annihilation reactions.

b) Gravity: "location" charge. "Non-local" distributional symmetry of light's energy ("free electromagnetic energy") vs local, immobile, undistributed concentrations of mass energy ("bound electromagnetic energy") (the "Interval" of light is zero, the "Interval" of mass is positive). The active principle of "location" charge is time, so the gravitational location charge (Gm) carries both an entropic drive for bound energy (the intrinsic dimensional motion of time), as well as a symmetry debt (the 4-

D spacetime coordinate position of mass, including the quantity and density of any form of bound energy).

c1) Strong force: baryon level, color charge, gluon field. Whole quantum charge units vs the fractional charges of the quarks (symmetry conservation via charge conservation, resulting in permanent confinement of the sub-elementary quarks). Fractional charges threaten the quantum mechanical mechanism of charge conservation (resulting in "asymptotic freedom" and the vanishing of color charge in the leptoquark).

c2) Strong force: nuclear level, flavor charge, meson field. Least bound energy solutions to compound nuclear arrangements of protons and neutrons ("nucleons", "isospin symmetry", Yukawa nuclear binding field - exchange of virtual mesons between neutrons and protons). Symmetry conservation through principle of "least bound energy" = "nuclear chemistry".

d) Weak force: "identity" ("number") charge (sometimes known as "flavor"). Distinguishable (as to type) elementary leptonic particles vs "anonymous" photons. Leptonic elementary particles break the "anonymity" symmetry of the photons (all photons are alike and indistinguishable from one another, a symmetry of "anonymity"). Neutrinos carry "bare" identity charges, which identify elementary leptonic particles and their appropriate antimatter annihilation partners, by "flavor" distinctions and spin. Alternative charge carriers (leptons, neutrinos, mesons) are necessary (but not sufficient) to allow the mass field of the quarks to break the primordial symmetry of matter-antimatter particle-pairs during the "Big Bang".

6) The field vectors of the forces act as local gauge symmetry "currents" which transform globally conserved symmetry parameters of light, space, charge, and absolute motion to locally conserved symmetry parameters of matter, time, charge, and relative motion (and vice versa). The photon in its role as the field vector of electric charge, magnetic forces, and antimatter annihilator is prototypical of this function.

7) Gravity transforms the global spatial metric of absolute motion and light, as gauged by the electromagnetic constant c, into a local spacetime metric for relative motion and matter, as gauged by the gravitational constant G.

8) Gravity pays the entropy "interest" on matter's symmetry debt, creating time by the annihilation of space and the extraction of a metrically equivalent temporal residue, decelerating the cosmic spatial expansion in consequence. Conversely, the gravitational conversion of bound to free energy (as in the stars and Hawking's "quantum radiance" of black holes), pays the "principle" on matter's symmetry debt, discharging all symmetry and entropy debts, and accelerating the cosmic expansion (as recently observed). The expansion of matter's historic domain (historic spacetime - the conservation domain of matter's causal information "matrix"), is funded by and replaces the purely spatial expansion of the Cosmos. Black holes are the extreme example of the gravitational conversion and replacement of space and the electromagnetic metric by time and the gravitational metric.

9) Gravity and time induce each other endlessly. A gravitational field is the spatial consequence of the intrinsic motion of time.

10) The radiance of our sun and the stars announce a completed "circuit" of symmetry

conservation. The solar gravitational field is reduced as the sun's mass is converted to light. when a black hole's mass is completely converted to light via Hawking's "quantum radiance", the hole's gravitational field likewise vanishes, its symmetry-conservation role having been finally fulfilled.

11) Gravitation arises in response to light's (broken) "non-local" distributional symmetry in space, a symmetry broken by the immobile and hence undistributed energy content of mass, matter, or bound energy generally. The active principle of gravity's "location" charge is time. Time and gravity identify the 4-D location, quantity, and density of matter's immobile energy content. The gravitational "location" charge is unique in that it is an entropic charge, a charge with intrinsic, dimensional motion. Gravitation creates the time dimension through its ceaseless annihilation of space. In turn, time creates gravity as time's intrinsic motion drags space into the historic domain. Space self-annihilates at the point-like entrance to the one-dimensional and one-way time line, creating another temporal residue, the metric equivalent of the annihilated space. The new temporal residue marches off into history, dragging along more space, which creates more gravity, etc. Time and gravity induce each other endlessly, creating historic spacetime, the conservation domain of matter's causal information matrix: *a gravitational field is the spatial consequence of the intrinsic motion of time*.

12) Gravity creates a local, spacetime metric (gauged by "G"), imposed upon the global, spatial metric (gauged by "c"), in which the conservation requirements of both free and bound electromagnetic energy can be satisfied simultaneously. Spacetime becomes the dimensional entropy/conservation stage upon which a cosmic drama now unfolds, a negentropic arena provided by the energy of gravitation (energy borrowed, in turn, from the entropic expansion of space). Gravity pays the entropy-interest on the symmetry debt of matter by the creation of time, funded through the deceleration of cosmic spatial expansion. The question posed to the Cosmos is this: can the particles, using their conserved symmetry charges, either individually or collectively, revert to their symmetric wave form (light) in the absence of their antimatter partners? Is one-half of the information contained in the original particle-antiparticle pair enough to accomplish this magical transformation? The answer is yes, but only in the additional dimension of explicit time, and in two modes: a collective process (the gravitational conversion of bound to free energy in stars and black holes), and an individual process (proton decay). Both will arrive at the same result, the complete transformation of the particle and bound energy to light. Meanwhile, as a sort of subplot or "play within a play", an electromagnetic information pathway develops (life, biology), which attempts to express or reconstitute in material systems its charge-memory of the symmetry and connective unity of its primordial state. The development of personal "identity" and the abstract information systems of humans reprise and recollect our primordial, abiotic, physical origins, in religious, artistic, psychological, intuitive and rational terms, including even the fractal algorithm of the information pathway. (See: "The Information Ladder").

Postscript

As for the issue of "intelligent design", the recent concept of the global "Multiverse" in service of the "Anthropic Principle" offers a completely satisfactory resolution of the problem of the "special balancing" or "exquisite adjustment" of our Universe's physical constants. According to this view, we naturally find ourselves inhabiting that special local Universe, of perhaps infinitely many realized possibilities, in which the physical constants of Nature are so adjusted, by chance alone, as to favor the evolutionary development of our life form. While this is a completely rational explanation for the peculiar characteristics of our Universe, it actually says nothing at all regarding the existence of a "First Cause" or "Creator" - neither for nor against;

that issue is simply pushed back to the level of the all-symmetric "Multiverse". Concerning the issue of evolution, it is simply a biological form of negative entropy driven by Natural Selection, as factual, mechanical, and impersonal as gravity or chemistry. (See: "Newton and Darwin: the Evolution and Abundance of Life in the Universe".)

The miracle of Life, the raising of atoms to conscious biological information systems of incredible complexity and sophistication, appears to be the means by which the Universe becomes self-aware and experiences itself, including exploring new modes of creativity and new forms of beauty. The meaning of the biological information pathway that develops through time in the negentropic domain of gravitation, the significance of our human experience and our Universe, are separate topics which I address in other papers (see: "The Information Pathway"; and: "Chardin: Prophet of the Information Age"); "The Human Condition"; "Is There Life After Death?"). See also my late father's book: "Trance, Art, Creativity" in regard to the significance and meaning of the human experience.

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Tetrahedron Model Diagram

Table of Forces and Energy States (Simple Table #1)

4 Forces of Physics --->		Electromagnetism	Gravitation	Strong	Weak
Below: Comments on the Energy State Rows:		**FORCES**			
Free Energy, Light: electromagnetic radiation; space; symmetric forms; virtual particles; symmetry-breaking; (reprising the "Big Bang"); (incurring the debt); Spatial Energy Forms; (row 1)	**ENERGY STATES**	Light: E = hν (Planck); Intrinsic Motion c; All Charges = 0; Symmetric Energy ("velocity c" is free energy's entropy drive and symmetry gauge)	Space; Conservation/Entropy Domain of Light; Light's "Interval" = 0; The Spatial Metric; Metric Symmetry, Inertial Symmetry; Metric Curvature = 0 ("non-local" energy)	Sub-Elementary Particles (fractured leptons); Quarks; Particle-Antiparticle pairs; Leptoquarks; Particle Symmetry	Elementary Particles; Leptons; Neutrinos; Particle-Antiparticle Pairs; Higgs (Mass Gauge); Intermediate Vector Bosons (IVBs); Symmetry-Breaking
Bound Energy: matter; history; asymmetric forms; real particles (consequences of row 1 symmetry breaking); raw energy conservation; (down payment), "pay now"; Temporal Energy Forms; (row 2)		Mass: E = mcc; hν = mcc; (Einstein-deBroglie); Matter, Momentum; Asymmetric Bound Energy; Charges > 0;	Causality; Time, History; Conservation/Entropy Domain of Information; Mass Interval > 0; Metric Asymmetry; Time, Gravity; ("local" energy) ("intrinsic motion T" is bound energy's entropy drive)	Mass Carriers; Baryons, Mesons, Nucleons; Atomic Nucleus; (elements)	Alternative Charge Carriers; Leptons, Neutrinos: Electron Shell; (atoms)
Charges: quantized symmetry debts (carried by particles of row 2); symmetry (charge) conservation; (mortgage, credit), "pay later"; Temporal Symmetry Forms; (row 3)		Electric Charge: (4 - dimensional asymmetry - time)	Gravitational Charge: "Location" Charge; "Location" Asymmetry, Temporal Entropy; Spacetime Metric; Conservation/Entropy Domain of Free and Bound Energy; ("G" is the entropy conversion gauge)	Partial Charges: Color Charge (quantum - mechanical partial charge asymmetry); Flavor Charge (least bound energy, "isospin")	"Number" or "Identity" Charge: Neutrinos; ("anonymity" asymmetry - distinguishable elementary particles)
Force Carriers, Field Vectors, Bosons: (produced by charges of row 3) (symmetry restoration via the conversion of bound to free energy); (retiring the debt); Temporal Conservation Cycles; (row 4)		Photons; Exothermic Chemical Reactions; Matter-Antimatter Annihilation Reactions	Gravitons: Stars, Quasars, Black Holes; "Quantum Radiance" Gravitational Conversion of Mass to Light	Mesons, Gluons: Fusion, Nucleosynthesis; Proton Decay	Intermediate Vector Bosons (IVBs: W, Z, X); Leptonic Decays, Fission, Radioactivity; Particle and Proton Decay
John A. Gowan and August T. Jaccaci Oct., 2008					

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