Light and Matter - a Synopsis

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Abstract

The conceptual basis of the Unified Field Theory, as presented in these pages, can be briefly sketched as follows:

"Noether's Theorem" states that in a multi-component field such as the electromagnetic field (or the metric field of spacetime), where one finds a symmetry one finds an associated conservation law, and vice versa. In matter, light's symmetries are conserved by charge and spin; in spacetime, by inertial and gravitational forces. Light's raw energy is conserved as mass and momentum; light's intrinsic motion or entropy drive is conserved as time and gravitation. All forms of energy, including the conservation/entropy domain of spacetime, originate as light. During the "Big Bang", the asymmetric interaction (as mediated by the weak force) of primordial, high energy light with the metric structure of spacetime produced matter; matter carries charges which are the symmetry (and entropy) debts of the light which created it. Charge invariance is therefore an important corollary of charge and symmetry conservation, maintained in our temporal (gravitational) metric of relative motion by "local gauge symmetry currents" (compensating components of the field vectors, such as magnetism and time). The invariance of "velocity c", the "Interval", and causality (metric analogs of charge) are likewise important corollaries of energy conservation (the "Lorentz Invariance" of Special and General Relativity). Charges produce forces which act to return the material system toward its original symmetric state (light), paying (partially or completely) matter's symmetry/entropy debts. Repayment of matter's symmetry debt (partial and complete) is exampled by: 1) chemical reaction and matter-antimatter annihilation (electromagnetic force); 2) radioactivity and proton decay (nuclear forces); 3) the nucleosynthetic pathway of stars and Hawking's "quantum radiance" of black holes (gravity). 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 of those forces. *The charges of matter are the symmetry debts of light*.

Introduction

Our universe is an electromagnetic universe, a cosmos composed of electromagnetic energy in two forms, free and bound, light and matter. The evidence for this assertion is the complete conversion of

matter to light in matter-antimatter annihilation reactions. All other forces and energy forms (gravitation, nuclear forces) are ancillary to, and derived from, the electromagnetic bound forms and are likewise converted to light in electromagnetic annihilation reactions. Einstein's most famous equation (E = mcc), relating energy, mass, and the velocity of light, is a quantitative expression of this simple but fundamental relationship.

It is the ability of electromagnetic energy to exist in two alternative yet wholly conserved forms that allows (rather than causes) the breaking of the initial symmetric energy state of light (during the "Big Bang"), and the transformation of free energy into the bound state of matter. The actual cause of "Big Bang" symmetry-breaking is evidently a small asymmetry in the interaction of the weak force with matter vs antimatter - probably an inequality in the rate of the weak force decay of leptoquarks vs antileptoquarks, such that more leptoquarks survived to become baryons. (See: "The Origin of Matter and Information"; see also: "The Particle Table".)

As matter is an asymmetric, bound and quantized form of light (one-half of a particle-antiparticle pair), charge is an alternative, bound and quantized form of symmetry, mass is an asymmetric, bound and local form of energy, and history is an asymmetric form of space and entropy (See: "Spatial vs Temporal Entropy"). Leptoquarks are alternative forms of leptons, producing quarks and baryons; leptons, neutrinos, and mesons are alternative charge carriers for the mass-carrying quarks (replacing antiquarks). The Higgs scalar boson and the heavy weak force IVBs (Intermediate Vector Bosons) regulate and gauge the transformation of free energy into massive elementary particles (IVBs are an alternative (bound, quantized) form of the "electroweak" unified force symmetric energy state). (See: "The Higgs Boson and the Weak Force IVBs: Part I".) The gravitational constant (G) regulates the transformation of space into time. Gravitational forces represent an alternative metric, regulating spacetime and matter rather than simply space and light. (See: "The Conversion of Space to Time".)

The connections between the free and bound forms of electromagnetic energy are wholly "internal" and natural: time is simply an alternative form of space ("spacetime") - time is directly extracted from space by gravity (gravity annihilates space, leaving behind a metrically equivalent temporal residue). In turn, *gravity is the spatial consequence of time's intrinsic motion:* gravity and time induce each other endlessly. Matter is an alternative form of light, derived from particle-antiparticle pairs by weak force symmetry-breaking during the "Big Bang". Particle-antiparticle pairs are the product of light's energy and the structural metric of spacetime; the metric is also produced by light's intrinsic motion for light's own conservation. The intrinsic motion of light is the entropy drive of light, also conserving light's energy and "non-local" symmetry. Quarks are fractured leptons (leptoquarks); the strong force is derived from the electromagnetic force - color charge and the gluons are derived from electric charge and photons. Once matter is created, all forces act to conserve, protect, and safeguard matter's bound energy and symmetry content, eventually returning matter to its original free symmetric form, light. (See: "Symmetry Principles of the Unified Field Theory".)

Matter is an Asymmetric, Bound, Massive, Conserved Form of Light

The fundamental relationship between light and matter is this: matter is an asymmetric, massive, local, conserved form of light, one-half of a symmetric particle-antiparticle pair. Light itself is wholly spatial and "non-local", having no time dimension, whereas matter is light in a form which can exist and be conserved in time - matter is electromagnetic energy which can reside in the historical domain and nevertheless be eventually restored - primarily through the principle of charge conservation - to its original spatial, symmetric form. The charges of a "virtual" particle-antiparticle pair exist only to cause the pair's annihilation, restoring (and hence conserving) the symmetric "non-local" energy state of the light which created the pair. When one member of a virtual pair becomes isolated and "real" in time, its charges are conserved and retain their original functionality and purpose. Everything we know about matter can be related to this fundamental relationship: *the charges of matter are the*

symmetry debts of light (Noether's Theorem). Because symmetry conservation in the time dimension takes the form of charge (and spin) conservation, the issue of charge invariance in a world of relative rather than absolute motion becomes of paramount importance, explaining many of the anomalous phenomena of Quantum Mechanics, Special and General Relativity, and the nuclear forces. For material systems, charge conservation (and hence symmetry conservation) would be meaningless in the absence of charge invariance - or in the absence of time.

From a conservation perspective, some necessary characteristics, capabilities, and parameters of electromagnetic energy are:

Constants of Physics

1) The fundamental constants of physics are the "given" constants of electromagnetic energy, or derived from them. (c, G, e, h, Higgs mass, etc.). These constants are necessary delimiting structural parameters for the conservation of the energy and symmetry of electromagnetic energy and originate with it, perhaps at the "multiverse" level. ("c" is the universal electromagnetic energy gauge constant, and among other functions acts as the gauge (regulator) for light's entropy drive and "non-local" symmetric energy state. "G" is the universal gravitational gauge constant regulating the conversion of light's spatial entropy drive (the intrinsic motion of light) to matter's historical entropy drive (the intrinsic motion of time). "e" is the quantized constant of electric charge; "h" is Planck's quantized energy constant; the quantized Higgs boson regulates the mass scale of elementary particles, etc.). (See: "The Higgs Boson and the Weak Force IVBs: Parts II, III, IV".)

Symmetry Breaking

2) The bound form of electromagnetic energy (matter) must be able to break the initial symmetric energy state of the free form of electromagnetic energy (light), specifically light's particle-antiparticle form. This is the role of the strong and weak nuclear forces, creating, transforming, and destroying single elementary particles, both originally during the "Big Bang", and subsequently, continuing to the present day (fusion, fission, elementary particle transformation and decay). Characteristics which contribute to matter's symmetry-breaking capabilities include: composite nuclear particles (quarks) which can sum to electrical neutrality (because quarks carry fractional charges); "asymptotic freedom" (self-annihilation of the baryon's gluon field and color charge - possible because gluons are composed of color-anticolor charges); leptoquarks (joining leptons and hadrons) and leptoquark neutrinos (carrying leptoquark "number" or "identity" charge). Alternative charge carriers (leptons, neutrinos, and mesons) serve the mass-carrying quarks in place of antiquarks, which would only cause annihilation reactions; a weak force asymmetry with respect to matter vs antimatter reaction products and/or rates produces an excess of matter; the Higgs scalar boson regulates elementary particle mass, and massive weak force Intermediate Vector Bosons accomplish the creation, transformation, and destruction of single elementary particles, etc. (See: "The Origin of Matter and Information"; see also: "Lepton 'Number' or 'Identity' Charge".)

Conservation

3) Matter must be able to conserve (through time) the total energy of light, including raw energy (mass, momentum), symmetry (charge, spin), and entropy (gravity, time). Because matter has relative rather than absolute motion, the conservation of light's total energy and symmetry in matter (and in interactions between light and matter) becomes a crucial and complicated affair, requiring compensating forces and dimensions such as: gravity and time; magnetism; quark confinement; Lorentz Invariance, quantization, the weak force mechanism, etc.) Single elementary particles created today must be the same in all respects as those created during the "Big Bang" - hence the elaborate structure of the weak force (Higgs scalar boson, massive IVBs). (The aforementioned forces and effects are all local gauge symmetry currents or conservation mechanisms protecting the invariance of

charge, causality, the "Interval", and velocity "c", as well as conserving raw energy in a temporal metric involving relative motion). (See: "Global and Local Gauge Symmetries in the 'Tetrahedron Model'.)

The role of "velocity c" as the invariant gauge constant of electromagnetic energy is of primary importance for the maintenance of charge invariance, the invariance of Einstein's "Interval" and causality, for metric symmetry, and for the "non-local" symmetric energy state of light, as well as sustaining light's entropy drive. "Velocity c" furthermore gauges Einstein's mass-energy relation (E=mcc), as noted above. For all these reasons, and more, the entire conservation structure of the Cosmos, including its dimensional metric and its energy content, depends upon the invariant magnitude of "velocity c". To think of "c" only as a large or even absolute "velocity" is to fail to appreciate the full significance and role of this most important gauge constant of nature.

The gravitational constant "G" establishes the temporal and entropic metric of bound energy directly from the spatial and entropic metric of free energy, via the annihilation of space and the extraction of a metrically equivalent temporal residue. Gravity is weak because matter is connected to its entropic conservation domain (historic spacetime) only by the tangential point of the "present moment". Gravity creates only enough temporal entropy drive to establish and maintain matter's tangential point of connection to its historical conservation domain. (See: "Proton Decay and the 'Heat Death' of the Cosmos"; see also: "A Spacetime Map of the Universe".)

Symmetry Restoration

4) Matter must be able to eventually return to light. This is the ultimate role of the four forces of physics. (Electrical matter-antimatter annihilation reactions; gravitational fusion reactions (stars) and Hawking's "Quantum Radiance" (black holes); strong force fusion and proton decay; weak force fission, particle and proton decay. (See: "Symmetry Principles of the Unified Field Theory".)

Role of Life

5) The role of biology and living forms is the self-knowledge, self-experience, self-exploration, and creative self-fulfillment of the Cosmos, which is the rationale for the conversion of light into matter, information, identity, and "work". Life is how the universe becomes aware of and experiences itself. Biology is a special "information" protocol of the electromagnetic force, acting through chemistry in the causal domain of historic spacetime. (See: "The Human Connection"; "The Information Pathway"; "Newton, Darwin, and the Origin of Life"; see also: "Chardin: Prophet of the Information Age".)

Role and Linkage of the Forces

The special role of gravity is the creation of time (via the annihilation of space), including the asymmetric, temporal, "local", causal, and historical spacetime metric of matter. The intrinsic motion of light (light's primordial entropy drive) creates space, the original symmetric, atemporal, "global", acausal, dimensional metric which is modified by gravity to accommodate bound energy's relative motion and causal relations (energy conservation), provide matter's primordial entropy drive (entropy conservation), and (eventually, as in stars) convert mass to free energy, conserving light's symmetric energy state. (See: "Global vs Local Gauge Symmetry in Gravitation"; see also: "The Double Conservation Role of Gravity".) The special role of the nuclear forces is the creation, transformation, and destruction of *single* elementary particles (not particle-antiparticle pairs), including the initial symmetry-breaking which created matter from light during the "Big Bang". Acting together, the strong and weak forces not only create matter during the "Big Bang", but subsequently (in stars) create all 92 elements of the Periodic Table. (See: "Global vs Local Gauge Symmetry and the Weak Force"; see also: "The 'W' IVB and the Weak Force Mechanism".)

The electrical and weak forces are linked through the "electroweak" unification and the leptons (electron, neutrino, photon, IVBs). The strong and weak forces are linked through the leptoquark and leptoquark neutrino ("identity" charge); the strong and electrical forces are linked through the photon and gluon ("sticky light"), and thus through color and electric charge. The electromagnetic force and gravity are linked through time and the gravitational creation of time via the annihilation of space - a "graviton" is a quantum unit of time or negative entropy. The intrinsic motion of light ("velocity c", the entropy drive of light), creates space, the conservation domain of free energy. The intrinsic motion of matter ("velocity G", gravity/time, the entropy drive of matter), creates spacetime, the conservation domain of bound energy. Time marches on to create history (historic spacetime), the conservation domain of matter's causal information network. Because gravity creates time via the annihilation of space, gravity essentially converts light's spatial entropy drive into matter's historical entropy drive. (See: "The Conversion of Space to Time".) This reaction is reversed during the gravitational conversion of bound to free energy in stars (for example), a process which goes to completion in Hawking's "quantum radiance" of black holes. Hence we see that (among other conservation roles), gravity is actually conserving (via the creation of time and time's intrinsic motion) the entropy drive (the intrinsic motion) of light. (See: "A Description of Gravitation"; see also: "Proton Decay and the 'Heat Death' of the Cosmos".)

The charges of matter are the symmetry debts of light (Noether's Theorem). Gravity is one of those charges ("location" charge), conserving light's metric, entropic, and distributional symmetric energy state (all consequences of the "non-local" character of light's energy, and all gauged by "velocity c"). Gravity creates time by the annihilation of space and the extraction of a metrically equivalent temporal residue; the intrinsic motion of the temporal residue causes the further collapse of space, producing a self-feeding, continuous cycle. *A gravitational field is the spatial consequence of the intrinsic motion of time*. Gravity pays the entropy-"interest" on the symmetry debt of matter by converting the spatial entropy drive of light to the historical entropy drive of matter, decelerating the spatial expansion of the Cosmos in consequence. Hence it is ultimately the expansive entropy-energy of light which funds the expansive entropy-energy of history. Gravity pays the energy-"principle" of matter's symmetry debt, and demonstrates its symmetry conservation role, by returning bound energy to its original symmetric form through the conversion of mass to light in stars; the conversion goes to completion via Hawking's "quantum radiance" of black holes. (See: "Entropy, Gravitation, and Thermodynamics".)

Links:

Unified Field Theory

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Section XIV: Causality
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Entropy

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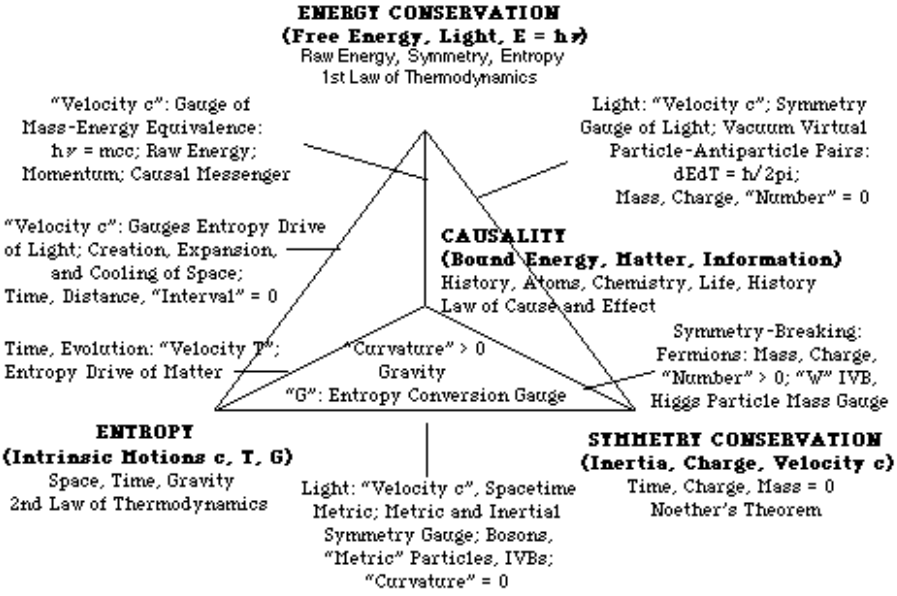
Currents of Symmetry and Entropy
The Time Train
The Halflife of Proton Decay and the 'Heat Death' of the Cosmos

The Tetrahedron Model

The "Tetrahedron Model" offers a succinct, visual representation of the relationship between light and matter in terms of four fundamental conservation laws which characterize, regulate, and define their interaction: Energy Conservation; Symmetry Conservation; Entropy; Causality (see: "The 'Tetrahedron Model'"; see also: "The 'Tetrahedron Model' vs the 'Standard Model' of Physics"). Finally, these four conservation laws comprise the foundation of a fractal hierarchy of nested physical structures in the natural (and even in the man-made) world, all built upon the global-local relationship between light and matter, free and bound electromagnetic energy (see: "Nature's Fractal Pathway" (and Table); see also: "The Information Pathway" (and Table)).

Fig. 1: The Tetrahedron Model



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. Gowan and August T. Jaccaci Jan., 2009
http://www.johngowan.org/index.html
Global vs Local Gauge Symmetries = "External" vs "Internal Lines"

1) Energy conservation: 1st law of thermodynamics. Free energy, light. E = h ν (Planck's energy quantum); h ν= mcc (Einstein-deBroglie mass-energy equivalence); dEdT = h/2pi (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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