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:

Our Universe is asymmetric in that it consists only of matter, without an antimatter complement. This cosmic-scale asymmetry was created during the "Big Bang" by the action of the weak force, creating matter from perfectly symmetric light, thus bringing our manifest world into existence (our Cosmos is an asymmetric "breakout" from an all-symmetric "Multiverse"). "Noether's Theorem" states that in a continuous 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. *The symmetries of light must be conserved no less than its energy*. Consequent upon the creation of asymmetric matter from symmetric light during the "Big Bang", light's lost symmetries are conserved in matter by charge and spin; in spacetime, by inertial and gravitational forces. Light's raw energy is conserved as mass and momentum; light's "non-local" intrinsic motion or entropy drive (as

"gauged" by "velocity c") is conserved in "local" matter as time and gravitation.

All forms of energy, including the entropic conservation domain of spacetime, originate as light. During the "Big Bang", an unknown, asymmetric self-interaction within primordial, high-energy light produced single particles of matter (lacking antimatter partners); 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, time, the strong force "gluons", and the massive "Intermediate Vector Bosons" ("IVBs") of the weak force). The invariance of "velocity c", the "Interval", and causality are likewise important metric corollaries of energy conservation (the "Lorentz Invariance" of Special and General Relativity). Charges produce forces which act to return the material system to its original symmetric energy state (light), paying (partially or completely) matter's symmetry/entropy debt. Repayment of matter's symmetry debt is exampled by: 1) spontaneous, exothermic chemical reactions (partial) and matter-antimatter annihilations (complete); 2) radioactivity (partial) and "proton decay" (complete); 3) the nucleosynthetic pathway of stars (partial) and Hawking's "quantum radiance" of black holes (complete). Identifying the broken symmetries of light associated with the charges and forces of physics (including gravity) is the first step toward their conceptual unification. *The charges of matter are symmetry debts of light.* *(Abstract revised Oct. 2016.)*

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Introduction

Our Universe is 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. Our Universe is an electromagnetic subset of the Multiverse, a Cosmos conserved within an entropic dimensional arena of its own creation, historic spacetime. 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 electromagnetic 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 alternative, 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 alternative, asymmetric, bound and local form of energy; history is an alternative, asymmetric form of space and entropy; gravity is an asymmetric, alternative metric, creating and accommodating time, spacetime, and history. (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) gauge and regulate 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) gauges the transformation of space into time. Gravitational forces represent an alternative metric, regulating spacetime, light, and matter rather than simply space and light, as in the case of the electromagnetic constant "c". (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, immobile, local, conserved form of light, comprising one-half of a symmetric particle-antiparticle pair. Massless light is atemporal, acausal, and non-local, carrying no charges and (in free flight) producing no gravitational field; massive matter is temporal, causal, and local, carrying various charges

(symmetry debts) and producing a gravitational field which creates matter's time dimension, entropy drive, and historic conservation domain.

The fundamental problem posed to the universe following the creation of matter in the "Big Bang", is how to return matter to its original symmetric form (light) in the absence of antimatter - (as required by Noether's symmetry-conservation theorem)? Can it be done at all? Matter contains only one-half of the information of the original particle-antiparticle pairs, which easily accomplished the feat by mutual and instantaneous annihilation reactions. The return of matter to light in the absence of antimatter is actually possible, but only if an extra dimension (time) is added to accommodate the variable energy accounts of matter in relative (rather than absolute) motion, and to provide an entropy drive for immobile matter, which has no intrinsic motion of its own (hence the dimension itself must move), and finally to provide a conservation domain for matter's causal information field (historic spacetime). Finally, an extra force must be added to create this time dimension - gravity. This is accomplished by the gravitational annihilation of space and the extraction of a metrically equivalent temporal residue. Naturally enough, the necessary gravitational field is produced by the particle itself, in exact proportion to its bound energy content, or mass: Gm.

Light itself is wholly spatial and "non-local", having no time dimension, whereas matter is light in a local 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 - and moot in the absence of time (witness the instantaneous annihilation reactions of virtual particle-antiparticle pairs).

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

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, metric, and energetic 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 (intrinsic

motion) and "non-local" distributional and metric symmetry (vanishing time and distance). "G" is the universal gravitational gauge constant regulating the conversion (in either direction) 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 the weak force IVBs and the elementary particles they produce, 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 in all combinations); 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 gauges or regulates the massive weak force Intermediate Vector Bosons, and through them regulates elementary particle mass, accomplishing 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 (as mass, momentum), symmetry (as charge, spin), and entropy (as 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 ("local gauge symmetry currents") and dimensions such as: gravity and time; magnetism; quark confinement by gluons; "Lorentz Invariance", quantization, the massive weak force IVB 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 elementary particle rest mass, charge, causality, the "Interval", and velocity "c", as well as conserving total energy involving relative motion in a variable temporal metric). (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" distributional and metric symmetry of light, as well as for gauging and 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 critical significance and role of this most important gauge constant of nature.

The gravitational constant "G" establishes the entropic temporal and historic metric of bound energy directly from the entropic spatial metric of free energy (creating historic spacetime), via the annihilation of space and the extraction of a metrically equivalent temporal residue. Gravity is weak for two reasons: 1) the small energy difference between implicit and explicit time (the spatial entropy drive of light vs the historical entropy drive of matter); and 2) because matter is connected to its entropic conservation domain (historic spacetime) only by the tangential point of the "present moment" or "eternal now". Gravity creates only enough temporal entropy drive to establish and maintain matter's tangential point of connection to its historical conservation domain - historic spacetime, which contains the "causal matrix" of matter's historical information field, web, or network ("karma"). (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 information (in its primordial form of charge), and of the four forces of physics: (electrical matter-antimatter annihilation reactions; gravitational fusion reactions (stars), gravitational potential energy conversions (quasars), 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 evolution 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" sub-domain and neg-entropic force of the electromagnetic force (the "life force" encompassing both negative entropy (growth, development and evolution) and positive entropy (aging, death, and decay)), acting through gravity, information, chemistry, identity, genetics, evolution, and the universal 4x3 algorithm in the causal arena 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 (aside from its primal role of providing balancing negative energy to enable the creation of the Cosmos), is a

function derived from its primal role: the creation of time (via the annihilation of space), including historical spacetime, a conservation domain for matter's causal information field or "matrix". The intrinsic motion of light (light's primordial entropy drive) creates space, the original symmetric, atemporal, "global", acausal, dimensional and entropic electromagnetic metric which is modified by gravity to accommodate bound energy's relative motion and causal relations (energy conservation), provide matter's primordial historical entropy drive (entropy conservation), and (eventually, as in stars) convert mass to free energy, conserving light's non-local distributional and metric symmetry. (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 "velocity c", the metric, 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 primordial entropy drive of light), creates space, the entropic conservation domain of free energy. The intrinsic motion of matter ("velocity G", gravity/time, the primordial entropy drive of matter), creates spacetime, the entropic 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, while simultaneously (in stars) conserving the non-local distributional and metric symmetry of light via the conversion of bound to free energy. (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 proceeds into the historic domain, at right angles to all three spatial dimensions, causing the further collapse of space, and 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 via the nucleosynthetic pathway in stars, and via the conversion of gravitational potential energy to light in quasars. The conversion goes to completion via Hawking's "quantum radiance" of black holes, the final repayment of all matter's symmetry and entropy debts. (See: "Entropy, Gravitation, and Thermodynamics".)

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-Information (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

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