THE ORIGIN OF MATTER AND INFORMATION

(revised Dec., 2011)

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Abstract

The creation of matter during the "Big Bang" is apparently due to the asymmetric decay of electrically neutral leptoquarks and anti-leptoquarks, in which the anti-leptoquarks decay at a slightly faster rate than the leptoquarks. The leptoquarks in these decays (which are electrically neutral due to their fractionally charged quarks) are also colorless (in the limit of "asymptotic freedom"), due to the great compressive force exerted by the "X" IVB. A leptoquark anti-neutrino is produced in this reaction, balancing the baryon "number" charge of the eventual proton product. *This neutrino is a "dark matter" candidate*. The interaction is the initiating example of a general class of reactions between symmetric primary energy fields and secondary or "alternative" information fields or charge carriers, the latter enabling the charge-conserving birth of our asymmetric "matter-only" universe.

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*(Note to readers: the reactions presented in this paper, and the "**X**" IVB and the "leptoquark" particles, are hypothetical.*

For a guide to the particles, both "real" and speculative, see the "Particle Table". For a more comprehensive overview of this subject, see: "The Higgs Boson and the Weak Force IVBs". This paper treats only the asymmetric decay of electrically neutral leptoquark-antileptoquark pairs.)

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Introduction

During the first micro-moments of the birth of our Cosmos (the "Big Bang"), all the matter of our Universe was produced by an asymmetric reaction between matter and antimatter involving the quarks and color charges of the strong force, and the leptons and Intermediate Vector Bosons (IVBs) of the weak force. The reaction requires the asymmetric decay of a matter-antimatter pair (or its equivalent in terms of single particles) of "leptoquarks", which are neutral with respect to both electric and color charge ("leptoquarks" are very massive, internally fractured leptons). This asymmetric decay is "mediated" or catalyzed by the weak force IVB "**X**", and can be represented succinctly by the reaction equation below (in which antiparticles are underlined):

X(Lq) x Lq -----> baryon + *v*lq + (energy)

where Lq indicates a leptoquark and *v*lq a leptoquark antineutrino.

We can also write this reaction in a more specific and complete form as:

X[(Lq x Lq) (*v*lq x *v*lq)] -----> bbt + *v*lq + bb
(or)
X[(Lq x Lq) (*v*lq x *v*lq)] -----> bbt + *v*lq + bb + bb
(or)
X[(Lq x Lq) (*v*lq x *v*lq)] -----> bbt + *v*lq + bt+ +*u*- + *vu*

1) where the left-side reactants are:

-) "Lq" represents an (electrically neutral) antileptoquark whose quarks are compressed so tightly (by the "**X**" IVB) that their color charge has vanished (in the limit of "asymptotic freedom");
-) "(Lq x Lq)" represents an electrically neutral leptoquark-antileptoquark pair (both leptoquarks in the pair are "color" neutral);
-) "(*v*lq x *v*lq)" represents a leptoquark neutrino-antineutrino pair (particle-antiparticle pairs are shown in brackets with an x between them to indicate their linkage - the lower-case "linking x" not to be confused with the upper case bold "**X**" IVB); (neutrinos are the pure, "bare", or explicit form of "identity" or "number" charge - the weak force charge sometimes referred to as "flavor"). (See: "Identity Charge and the Weak Force".)

2) the reaction is mediated by:

-) an Intermediate Vector Boson (IVB) of the weak force, "**X**", which catalyzes the reaction by forming the complex **X**[(Lq x Lq) (*v*lq x *v*lq)], in which the members of the complex are brought into such close spatial proximity by the **X** that they can exchange, neutralize, or otherwise cancel each other's charges. In this case the *v*lq identity charge of the neutrino particle pair annihilates the anti-identity charge of Lq in the leptoquark particle pair. (See similar weak force reaction mechanisms in: "The Particle Table" and "The 'W' IVB and the Weak Force Mechanism.") The "X" IVB can also be thought of as the quantized expression of a unified force "symmetric energy state" (the GUT unified force symmetric energy state), in which quarks and leptons have merged their otherwise separate identities. (See: "The Higgs Boson and the Weak Force IVBs".)

3) the right-side products of this reaction are:

-) "bbt", the unreacted leptoquark carried over from the left side (originally "Lq"), whose quarks have expanded under their mutually repulsive (electrical and quantum mechanical) forces to reveal their color charges. By the simple expansion of its internal, latent, or nascent quarks (perhaps in concert with and/or in response to) the rapidly expanding early Universe), this particle has transformed itself from a "colorless" leptoquark to a "colored", normal, electrically neutral, heavy baryon (hyperon) containing the bottom (b) and top (t) heavy quark species ("flavors"); it will eventually decay to the ground state proton (via the much lighter "W" IVB).
-) "*v*lq", an antileptoquark neutrino, liberated from the **X** complex when its partner (*v*lq) annihilated with the anti-identity charge of the antileptoquark Lq. The presence of "*v*lq" balances the baryon number charge of the newly formed matter baryon (bbt);
-) energy, in the form of some electrically neutral meson (bb) or meson pair (bb x bb), or some other electrically neutral combination of decay products such as the positively charged meson (bt+), the negatively charged muon (*u*-), and the muon antineutrino (*vu*). This is all that remains of the antileptoquark Lq, which being electrically neutral, and with its color charge vanished due to the compression of its quarks by the **X**, will simply convert its neutralized mass-energy to lighter particles in some energy, momentum, charge, and spin conserving combination, and self-annihilate, once its conserved number charge has been canceled by the leptoquark neutrino "*v*lq".

Discussion

The reaction begins with a symmetric matter-antimatter pair of electrically neutral leptoquarks and a symmetric matter-antimatter pair of leptoquark neutrinos. (While I show a particle-antiparticle pair, the reaction is representative of the general asymmetric weak force decay of leptoquarks whether singly or in pairs.) The source of both is the (real or virtual) particle "sea", the unlimited reservoir of symmetric, particle-antiparticle pairs of all kinds created by the interaction of light with the Heisenberg-Dirac "vacuum" or metric of spacetime (these particle pairs are real or virtual depending upon the energy density and temperature of their spacetime environment). From this symmetric mixture we nevertheless produce, via the mediation of the **X**, an asymmetric product - an unpaired matter hyperon (which will decay to a proton, electron, and electron antineutrino), and an unpaired antileptoquark neutrino, which remains unchanged to balance the "identity" or baryon number charge of the hyperon and its eventual decay product, the proton. The asymmetric character of the weak force is expressed in the decay of just one member of the leptoquark-antileptoquark pair, rather than both. What we actually expect is that this decay occurs slightly more often than its antimatter counterpart (for reasons unknown), thus producing a surplus of matter baryons.

The electrical neutrality of the leptoquark pair is crucial to the success of the reaction, as an electrically charged pair (Lq- x Lq+) would immediately annihilate each other. This electrical neutrality is the reason why this reaction requires a composite particle whose constituent quarks can sum their fractional charges to zero electric charge (as in the neutron). The quark-lepton-IVB system also requires a Higgs scalar boson to select the appropriate force unification domain and associated IVBs (since there is more than one - TOE (Y), GUT (X), or electroweak (W). While the quantized weak force transformation mechanism may seem dauntingly complex, no doubt this is nevertheless the simplest system which is capable of breaking the primordial symmetry of light and its particle-antiparticle pairs in a repeatable and invariant fashion, producing absolutely uniform elementary particles and the atomic matter of our material

Universe.

Color Charge

Just as crucial to the success of this reaction as its electrical neutrality is the internal symmetry of the conserved color charge. Because the gluons which carry the color charge are composed of color-anticolor charge pairs in all possible combinations, the gluon field as a whole sums to zero color. The color field will sum to zero physically if the quarks are sufficiently compressed, yet return to full (explicit) color charge when the compressive forces are relaxed and the quarks expand under the influence of their mutually repulsive forces (both electric and quantum mechanical). This symmetry property allows the antileptoquark to effectively vanish, via the weak force "**X**" IVB and leptoquark neutrino (essentially, the process of "proton decay"), when its quarks are compressed and the color charge is only implicit. However, the same mechanism prevents such total decays when the quarks separate and the color charge becomes explicit (because neutrinos do not carry and hence cannot cancel the conserved color charge). It is the role of the **X** IVB to effect the compression of the quarks, vanishing the color charge (the effect is the limiting case of the principle of "asymptotic freedom": Politzer, Gross, and Wilczek 1973 - 2004 Nobel prize).

Hence the antileptoquark can vanish in the high temperature, energy-dense environment of the Big Bang, but the quarks of the leptoquark (the particle-pair partner which does not decay), simply expand (as the Universe expands and cools) under their mutually repulsive forces to reveal their conserved color charge. By simply expanding its quarks, the remaining "singlet" leptoquark is transformed into a heavy, neutral baryon which can only decay partially (to the ground state proton), but cannot vanish completely, as its color charge can neither be neutralized by, nor transferred to, any alternative charge carrier (no leptons carry color charge, and mesons carry only complementary color-anticolor charges). To become a baryon, the leptoquark must only resist decay long enough that the ambient compressive forces of the Big Bang become insufficient to prevent the expansion of its quarks, a very short time indeed in the rapidly expanding and cooling early Universe. For a short time during the early Universe, the **X** IVB will be indistinguishable from the very dense primordial metric. After the Universe expands and cools, however, the energy density of the **X** will be greater than that of the ambient metric, and energy to produce it will have to be borrowed (in accordance with the usual quantum mechanical rules governing the lifetime of Heisenberg virtual particles).

The asymmetry in the weak force reaction creating matter is very small (on the order of one part per ten billion). In most reactions, the leptoquarks will be electrically charged and simply annihilate each other; of those in which the leptoquark partners are neutral, most will annihilate each other anyway, or decay simultaneously despite their electrical neutrality. A few neutral leptoquarks will decay asymmetrically (without their partners also decaying) via the **X** and leptoquark neutrino, but a few more antileptoquarks will decay asymmetrically by an analogous antimatter route. It is this slight imbalance (for which there is no explanation) that produces all the matter of the present Universe. Matter and antimatter are evidently not perfectly symmetric opposites, at least not in their interactions with the weak force IVBs. Even though matter and antimatter are produced in symmetric pairs, they do not decay symmetrically: there is some unknown, subtle difference between them which affects their rate of weak force decay and creates the material Cosmos (Cronin 1981).

The hypothetical "Higgs" scalar boson is presumed to endow the IVBs with mass, and through them, the elementary particles also. The actual conversion of free energy to quantized mass forms such as the IVBs, quarks, and leptons is thought to be "scaled" or "gauged" by the "Higgs". This particle is actively being sought at the largest accelerators; its mass is thought to lie between 100 and 1000 proton masses. (See: *Science* vol. 315, 23 March, 2007 page 1657.) As mentioned above, the quantized Higgs boson is necessary to scale or "gauge" the interaction *in a repeatable and invariant fashion* to the appropriate force unification energy level (the TOE, GUT, or the electroweak, with a separate Higgs for each), a symmetric energy state in which the separate identities of the quarks and/or leptons are merged and hence can be transformed, swapped, or exchanged simply in the normal course of events by the resident IVBs. (See: "The Higgs Boson and the Weak Force IVBs".)

Neutrinos

The crucial role of the neutrino in the creation of particles must also be emphasized. The neutrino is the alternative charge carrier for the "identity" charge, a symmetry debt of light which accrues from the "anonymity" of light. All photons (quanta of light) are alike - they have no individual identity, one cannot be distinguished from another - hence their "symmetry of anonymity". The elementary particle spectrum, however - the leptonic series of electron, muon, tau, and (perhaps) leptoquark - are distinguishable one from another: they are not alike, they occupy different "rungs" on the quantum "ladder" or "spectrum" of massive leptonic elementary particles, and their antiparticles are also distinguishable by their opposite charge and/or spin. Hence the symmetry/information debt of "identity" is in contrast to the photon "sea" of anonymity and is carried by elementary particles as a charge, where it is usually referred to as the conserved "number" charge of the leptons and baryons (all baryons carry one and the same number or identity charge, that of their leptonic ancestor, the leptoquark (*v*lq). Leptoquark neutrinos have never been observed because proton decay has never been observed). The leptoquark (or baryon) antineutrino is an excellent candidate for the "dark matter" of the universe.

The conservation of light's various symmetries is required by Noether's Theorem. *The charges of matter are the symmetry debts of light*. "Identity" or "number" charge is the symmetry debt of the weak force, recording and conserving the broken symmetry of light's "anonymity". (See: "Symmetry Principles of the Unified Field Theory".)

In the massive leptons, including the leptoquark, this identity charge is said to be "hidden", or in its "implicit" form. The neutrino is the "explicit" or "bare" form of identity charge. As such, the neutrino functions as an alternative carrier of identity charge, which otherwise could only be carried by the particle itself, or neutralized by its antiparticle. It is because this charge is specifically "identity" that it alone, among all other charges, must have its own unique carrier. In contrast, the universal electric charge can be carried by, or transferred to, any other lepton, baryon, or meson, and color charge can be carried by any quark. But identity, being specific to each "rung" of the elementary particle quantum "ladder" (spectrum), requires a carrier specific to that rung, either the particle itself or its specific neutrino. (Note that the identity charge carried by the electron, muon, tau, and baryon, while different from each other, are exactly the same within each particle type; hence it is quite possible for one electron to swap identities with another electron, as in reactions mediated by the "Z" IVB, but identities cannot be exchanged between different types of elementary particles - an electron cannot swap identities with a muon, for example. When a muon decays to an electron, the identities of both particles are conserved or neutralized by their separate neutrinos, a reaction requiring the mediation of the "W" IVB).

Without the neutrino, there would be no material Universe, as there would be no alternative carrier for identity charge - only particles and antiparticles could carry this charge and the system would be "stuck" with particle-antiparticle pairs which could only annihilate each other. Manifestation requires "information", which in its essential character is asymmetric - otherwise it is not "information". In the particle realm, the fundamental bit of information is "identity". Particles can manifest only because their identity can also be carried by neutrinos, which provide a conserved alternative to the usual antiparticle carriers. These alternative carriers maintain the essential features of the original symmetry by balancing or neutralizing the identity charge of the manifest particle such that overall identity still sums to zero, as it did in the particle-antiparticle pair: identity is simply carried in two different forms, one "hidden" or implicit in the particle, one "bare" or explicit in the neutrino. (Whether or not neutrinos have mass makes no difference to their role as the alternative, "bare", or explicit carrier of identity charge; most charges are in fact carried by massive particles. If the leptoquark neutrino is (very) massive, it may account for the "missing mass" or "dark matter" of the Cosmos.)

Recent observations suggest that neutrinos "oscillate" among their several identities; in this they are somewhat similar to their massive leptonic counterparts which exchange identities among themselves (and with particle-antiparticle pairs in the virtual particle "sea"), but which require the mediation of the "W" IVB and their specific neutrinos to do so. Despite these "oscillations" or excursions into "identity" space, only an electron neutrino can cancel or neutralize an electron's hidden identity charge; hence neutrinos must revert to type in any interaction with a specific lepton - perhaps another example of a quantum mechanical "collapsing wave function". (See: *Science* Vol. 313, 21 July, 2006 page 291.)

The IVBs

Because all particles are derived from the interaction of light with the structural metric of spacetime, the virtual particle "sea" will contain any asymmetry embedded in light, spacetime, or their interaction. The only asymmetry we know of in either light or spacetime is the potential time asymmetry; in light the component of time is implicitly expressed as "frequency". In virtual particle pairs the potential for asymmetry is expressed as "information" in the form of various charges, which in unpaired "real" particles we characterize as the conserved symmetry debts of light. It is likely that the IVB particles are "metric" in origin, "string-like" particles (as in the particles of "string theory"), which are composed of a compressed dimensional matrix requiring a huge binding energy to maintain - the source of the

IVB's enormous mass-energy (the W is about 80 times more massive than the proton). This compressed metric, derived from (or identical to) the dense metric of the early Universe, is the mechanism which enables the IVBs to bring particles into such close spatial proximity that they can exchange charges, swap identities, or create new ones without violating the applicable conservation laws. Being derived from the metric, the asymmetric principle (if any) embedded in the IVBs must apparently be time. The time asymmetry is reflected in the differential rate of decay of leptoquarks vs antileptoquarks.

The view we adopt here is that the mass of the "W" recreates the dense metric of the electroweak force unification era, when all leptons shared a single generic "flavor" or identity, and similarly, all quarks shared a single generic flavor. The "X" IVB recreates the still higher level, more energetic GUT force unification era, when all leptons and quarks merged their generic identities in the more inclusive "family" identity level of fermions (the joining of the strong and electroweak forces). The Higgs boson is the quantized particle which selects between these eras or force unification symmetric energy states, "gauging" or "scaling" the appropriate energy level or symmetry domain, while the IVBs do the transformation work (there is a distinct Higgs for each era). This complex weak force particle creation and transformation mechanism is necessary to ensure that the elementary particles created today are the same in all respects as those created eons ago during the "Big Bang" - charge invariance and charge and symmetry conservation require no less. (See: "The Higgs Boson and the Weak Force IVBs".)

Like the "**X**", the "W" is a heavy "metric" particle, but much less massive (see: "The Particle Table"). Both **X** and W have the similar role of bringing ordinary particles very close together within their spatially compressed metrics. The very massive **X** compresses quark triplets, the less massive W incorporates baryons, mesons, or leptons requiring alternative charge carriers into complexes with leptonic virtual particle-antiparticle pairs that can provide carrier leptons (or with mesons which can supply quark colors and "flavors"). Similarly, the Z brings particles so close together that (if they are compatible), they can swap identities (or simply scatter or bounce off each other). In all cases, the IVBs essentially provide a bridge between the virtual particle "sea" of the vacuum and real particles, such that real particles can exchange charges and energies with the unlimited information resources of the "sea", and thus effect their "real world" decays and transformations. (See: The Weak Force "W" Particle as the Bridge Between Symmetric (2-D) and Asymmetric (4-D) Reality

Leptoquarks

The fact that both leptons and hadrons have equivalent whole quantum unit electric charges is evidently due to their common origin in the spacetime "vacuum". Leptons and hadrons of all kinds can be produced as either virtual or real particles from the vacuum in high-energy collisions between cosmic rays and atomic particles in our atmosphere, or in similar high-energy collisions in earth-bound laboratory accelerators. The leptonic unit electric charge (of the electron, for example) is evidently what our electromagnetic universe is prepared to bestow upon all her massive elementary particles, of whatever kind, at least in their allowed "ground" states.

While quarks carry electric charge in fractional amounts (-1/3, +2/3), they are only allowed to manifest when combined in whole quantum charge units, either as baryons or mesons. The origin of the quarks and their partial charges and gluon field is most readily understood as the product of a fractured primordial lepton (a "leptoquark"). It is also possible that an ultra-hot primordial "soup" composed of quark-antiquark pairs and lepton-antilepton pairs existed which reassembled (upon cooling) into barons and antibaryons. Following matter-antimatter annihilations, nothing remained but a few heavy neutral baryons which decayed as modeled above to produce hyperons with their charge-balancing leptonic alternative charge carriers - one lepton per charged baryon. (See: "The Higgs Boson and the Weak Force IVBs".)

In the leptoquark scenario, the conceptual difficulty is splitting the primordial elementary leptons; in the "quark soup" scenario, the conceptual difficulty is why the primordial universe should produce both quarks and leptons. This problem is surmounted if the primordial leptons are simply split, producing leptoquarks with an internal gluon field, the latter in response to quantum mechanical and symmetry demands to maintain (at least the outward appearance of) whole quantum units of charge by permanently confining the fractionally charged quarks.

The primordial leptoquark is conceived as the most massive member of the leptonic series or spectrum (e, *u*, *t*, Lq). The leptoquark may in fact be so massive as to be unstable, split asunder into three parts by the self-repulsion or disruptive effects of its own electric charge. By splitting into 3 quarks, which have smaller masses and lesser electric charges, the leptoquark achieves a more stable configuration - an accommodation perhaps necessitated by the reduction of confining pressures in a cooling and expanding "Big Bang". Leptoquarks therefore form a natural end to the leptonic elementary particle spectrum or series. It is the role of the "Y" IVBs of this TOE or Planck era force-unification energy level to create electrically charged leptoquarks, either by assembly from the primordial quark soup, or by splitting a primordial heavy lepton, and to transform charged leptoquarks into their electrically neutral congeners. (See: "Table of the Higgs Cascade".)

It should be noted that the bestowing (by the "vacuum") of a uniform and universal quantum unit of electric charge upon all types of massive elementary particles is perfectly commensurate with our hypothesis that the origin of electric charge is due to the asymmetry of time vs the symmetry of space. Massive particles must have a time dimension to accommodate their variable and relative energy accounts, but this descent into dimensional asymmetry is mightily resisted by the spatial metric or electromagnetic vacuum, which creates massive particles only in particle-antiparticle pairs such that they annihilate each other instantaneously via their opposite electric charges, thereby restoring and protecting the spatial symmetry of the vacuum in accordance with Noether's theorem.

The electric charge is dimensional in origin, a symmetry debt of the Heisenberg-Dirac "vacuum" or the spacetime metric, carried by any and all massive particles which enter the 4th temporal dimension, violating in so doing the symmetry of light and space from which they originated, and to which, sooner or later, they must return through the good offices of electric charge and matter-antimatter annihilations. *The charges of matter are the symmetry debts of light*.

General Principles

The general principle at work in this reaction, which is significant for the origin of matter, information, and the systems they produce, is the interaction of two fields, one symmetric (the color charge of the strong force and quarks - the mass-energy carriers) and one asymmetric (the weak force IVBs and the leptonic field of alternative charge carriers - the information or charge carriers). The action of the asymmetric field is necessary to reveal the information content embedded in both fields. We see the same principle at work in the dimensional conservation domains of light and matter, where the intersection of symmetric space with asymmetric time (an intersection which produces gravitation), reveals a specific "location" in the symmetric field of space. "Location" is the fundamental information "bit" in the dimensional realm (as indicated by the character of gravity), just as "identity" is the fundamental information bit in the particle realm (as indicated by the character of the weak force). The information bit "location" (requiring time) is the anchor point of Einstein's "Interval". The asymmetric potential is embedded in the symmetric field from the beginning, as is time in spacetime, "frequency" (time) in light, or the information content of the virtual particle "sea" in the vacuum. Thus the manifest world is a revelation of the information potential and content of the symmetric unmanifest world, as exposed by interaction with its own embedded asymmetric energy component or field. By such means is pure energy converted into conserved charges and information.

It is of interest to note that between the metric warpage of gravity and the "bare" or explicit identity charges of the neutrinos, spacetime contains a complete record of the location, mass, and identity of every elementary particle within its conservation domain - and within historic spacetime resides a causal memory of every event. This is the "Akashic Record" of occult tradition, and the basis for the notion of universal "karma".

Alternative Charge Carriers and Forces

The role of alternative forces and charge carriers is thoroughgoing and absolutely essential to breaking the initial symmetric energy state of the universe, which begins with light, the spacetime metric, and elementary particle-antiparticle pairs. Alternative forces and charges are usually local transformations of global parameters. The crucial role of embedded alternative forces has long been recognized in philosophical systems of thought. In religious terms and symbolism, the "devil" is necessary so that God may manifest; the role of "evil" in the world is to energize the good. The "soul" is an alternative form of personal identity, the physical realm is an alternative form of the spiritual realm, etc. Holographic models of reality are modern extensions of these ancient ideas.

The Particle Table

1) Mass is an alternative (bound, local) form of electromagnetic energy which allows the conservation of energy in the time dimension and the transformation of massless light to massive particles.
2) Charge is an alternative (local) form of symmetry which allows the conservation of symmetry in the time dimension

and the transformation of symmetric light to asymmetric "information".
3) Entropy is an alternative form of energy which allows the transformation of light to space, space to time, time to history, and energy to "work".
4) Time is an alternative (local) form of space and entropy which allows the transformation of the absolute motion of massless light to the relative motion of massive particles, and the transformation of acausal space to causal history (historic spacetime). The causal integrity of history is an alternative form of the energetic unity of space.
5) Gravity is an alternative (local) form of the spacetime metric which allows the transformation of space and the spatial entropy drive of free energy (the intrinsic motion of light), to time and the historical entropy drive of bound energy (the intrinsic motion of time), and vice versa. Gravity converts a global, spatial metric to a local, historical metric, so that (by means of the time dimension so created) energy may be conserved in the relative realm of matter no less than in the absolute realm of light (the compound conservation domain of spacetime). Gravity creates time by the annihilation of space and the extraction of a metrically equivalent temporal residue. Gravity ultimately restores metric and energetic symmetry via the conversion of mass to light - as in the stars and Hawking's "quantum radiance" of black holes.
6) Magnetism is an alternative form of electricity conserving the invariance of electric charge and allowing its relative motion.
7) Leptoquarks are an alternative form of leptons which allow the transformation of elementary leptonic particles into sub-elementary quarks and composite baryons.
8) Gluons are an alternative form of light which allow the transformation of whole leptonic charge units into fractional quark charge units.
9) IVBs are alternative forms of force unity symmetry states

which allow the transformation of virtual particles into real particles (and vice versa), and the creation and destruction of (single) elementary particles.
10) Leptons, neutrinos, and mesons are alternative charge carriers (for electric charge, identity charge, and quark partial charges) which allow the transformation of virtual hadrons and leptons into "real" (temporal) atomic matter.
11) The material universe is an alternative form of the light universe, which allows the free energy content of light to express itself in terms of (locally) bound energy, gravitational and astrophysical megastructure, conserved information and charge, atomic matter and chemical material systems, including life.
12) Life is an alternative form of matter which has achieved consciousness, self-awareness, and a personal identity and survival agenda. Life is the information pathway by which the universe knows and explores itself, extending its creative potential and information content.

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Cronin, J. W. 1981. CP Symmetry Violation - the Search for its Origin. Science 212: 1221.
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Suggested Additional Reading:
"The Origin of Matter". James M. Cline, *American Scientist,* March-April 2004, Vol. 92, No. 2, Pages 148 - 157.

Postscript (added Dec., 2011)

The large spacetime dimensions (space, time, historic spacetime) are unique features of our "ground state" (electromagnetic) chemical, information, or biological era and are unknown at the higher-energy force unification eras (EW, GUT, TOE). (See: Table of the "Higgs Cascade".) Our large dimensions are entropic/conservation features of our ground state electromagnetic domain, created by the "intrinsic" (entropic) motion of light, time, and gravity, necessary for energy (entropy), symmetry (charge), and causality (time) conservation of both free and bound electromagnetic energy forms in their shared domain of historic spacetime. (See: Symmetry Principles of the Unified Field Theory: Part 1.)

Because particles are originally created (during the "Big Bang") by the compression of the spacetime structural metric (a combined action of all four physical forces), particles and spacetime are intimately related and share many features, as demonstrated even today in the creation of virtual particle-antiparticle pairs by the Heisenberg-Dirac spacetime "vacuum" or structural metric. We need to think in terms of a "particle metric" of allowed and regulated symmetry states at the higher energy force-unification levels, just as we think of a spacetime metric which allows and regulates interactions in our own ground state large-scale dimensions. In this regard, the Higgs boson is the analog of the photon, the Higgs mass is the analog of velocity c, the three quarks and the three family energy levels of particles may be resonances of the three spatial dimensions, the inertial/dimensional "metric symmetries" of our ground state are mirrored in the force/particle "identity symmetries" of the higher energy Higgs domains, etc.

In addition to these and similar analogies between particles and the spacetime metric, there is another series of comparisons we can make between the spatial and temporal conservation modes of free vs bound forms of electromagnetic energy. In these comparisons the conservation modes of free spatial forms of electromagnetic energy (light) have been translated into corresponding conservation modes of bound temporal forms of electromagnetic energy (matter/atoms). For example: Time is an alternative form of entropy ("velocity T" is the entropic analog of "velocity c", history is the analog of space); charge is an alternative form of symmetry, mass is an alternative form of energy, gravity is an alternative form of inertia; causality is an alternative form of entanglement. All such transformations serve conservation purposes, especially regarding energy and symmetry, as free forms of electromagnetic energy are converted into bound forms of electromagnetic energy. *The charges of matter are the symmetry debts of light* (Noether's Theorem). Charge conservation and charge invariance = symmetry conservation in the temporal domain. (See also: Global-Local Gauge Symmetries and the "Tetrahedron Model".)

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