PARTICLE TABLE

(revised Sept., 2010)
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Abstract

A table of elementary particles, including the weak force Intermediate Vector Bosons and Higgs particles is presented and discussed. The field vectors (force carriers) are discussed and examples of several types of particle decay are given. A list of technical terms is appended.

Table I
(See also: "Table of the Higgs Cascade".)

The Particle Spectrum, Including the Weak Force "Intermediate Vector Bosons" ("IVBs")

Quarks	Designations:		**Higgs, IVBs, Leptons**	Designations:
.	.		H1, H2, H3 ("Higgs")	"Higgs" Bosons (3?)
.	.		W, X, Y, (IVBs)	IVBs (3 families?)
Lq (?)	Leptoquark		Lq, *v*lq (?)	Leptoquark, lq Neutrino
t, b	Top, Bottom	.	*t*-, *vt*	Tau, Tau Neutrino
c, s	Charm, Strange		*u*-, *vu*	Muon, Muon Neutrino
u, d	Up, Down		e-, *ve*	Electron, Electron Neutrino
Composite Particles	Baryons, Mesons		Elementary Particles	Electrons, Neutrinos
Primary Mass Carrier	Nucleons, Nuclei		Alternative Charge Carriers	Leptons, Mesons

Intermediate Vector Bosons and "Higgs" bosons

The W+, W-, and W (neutral) (or Z neutral) are the "Intermediate Vector Bosons" (IVBs) of the weak force (at the "electroweak" (EW) force unification energy level). The "W" IVBs mediate the creation and destruction of unpaired or "singlet" (lacking antimatter partners) leptons, neutrinos, and quarks, and transformations of identity between and among these elementary particles. The "W" neutral (Z) typically mediates neutral weak force scattering ("bouncing" via a weak interaction) of neutrinos, or interactions in which neutrinos simply swap identities with other leptons. The "W" IVBs are heavy particles; the "W" is equivalent to approximately 80.4 proton masses, the Z is equivalent to approximately 91.2 proton masses (Fermilab data). The hypothetical "X" IVB (at the strong and electroweak force ("Grand Unified Theory" or GUT) unification energy level) is an even heavier particle which compresses the quarks of baryons until their color charge self-annihilates ("asymptotic freedom"), producing leptoquark neutrinos and baryons during the Big Bang, and causing "proton decay". A third family of even heavier "Y" IVBs may exist (at the highest energy level ("Theory of Everything" or TOE), at which gravity joins the other forces, creating quarks by splitting primordial leptons (producing leptoquarks) during the first instant of the "Big Bang". The hypothetical "Higgs" boson, the presumed scalar of particle mass, probably belongs here with the other massive "metric" particles, although the Higgs is not strictly an IVB (the Higgs is a scalar boson with spin = 0 whereas the IVBs are vector bosons with spin = 1). If three families of weak force IVBs exist, then we also expect to find three energy levels of Higgs bosons, one each for the "W", "X", and "Y" IVB families. (See: "The "Higgs" Boson and the Weak Force IVBs"; see also: "The 'W' IVB and the Weak force Mechanism".)

Leptons and Quarks

The elementary leptonic series consists of the electron (e), muon (*u*), tau (*t*), and the hypothetical leptoquark (Lq), with their corresponding neutrinos (*v*). The electron, muon and tau are identical except for their masses (tau is the heaviest) and their identity charges (carried in "hidden" or implicit form by the massive leptons, and carried in explicit or "bare" form by their neutrinos). The (hypothetical) leptoquark is the even heavier ancestor of the quarks and leptons; it is indicated at the head of both the lepton and quark series, for although a (fractured) lepton when compressed, when expanded it reveals three sub-units, the quarks. (See: "Identity Charge and the Weak Force".)

The quarks are named up, down (u, d), charm, strange (c, s), and top, bottom (t, b). The u, c, t series carries a fractional electric charge of +2/3; the d, s, b series carries a fractional electric charge of -1/3. Quarks also carry the strong force "color" charge, a three-part charge designated (for convenience of reference only) red, green, yellow, and vectored by a field of 8 "gluons". Gluons are massless, travel at velocity c, and consist of a color-anticolor charge in any combination (except the doubly neutral "green-antigreen"). Baryons consist of three quarks, mesons consist of a quark-antiquark pair. Hadrons are the class of particles containing quarks - that is, the baryons and mesons. Baryons as a class all carry one and the same identity (number) charge, whose (hypothetical) explicit form is the leptoquark neutrino.

The leptons and the leptoquark are the only known (or surmised) massive elementary particles. The neutrinos are the (nearly?) massless, "bare", or explicit form of the identity charges of their corresponding massive leptons. Quarks are sub-elementary, carrying fractional electric, color, and number charges. The quarks occur (permanently) only in "white" color combinations as triplets (composed of all colors) confined to baryons, or (temporarily) as quark-antiquark pairs (composed of a color and its specific anticolor) in mesons. Primordially, quarks are produced in isolated particles of matter by the expansion of internally fractured leptoquarks (yielding baryons); or more commonly today, as particle-antiparticle pairs (either mesons or baryons) in high-energy astrophysical (or accelerator) interactions and collisions.

Ordinary matter (including stars) consists of the electron and u, d quark energy level only. The quark complement of a proton is (uud)+; that of a neutron is (udd). An exactly corresponding set of antiparticles also exists, in which all charges are reversed, but is not shown. (In the case of neutrinos, it is the handedness of their intrinsic spin which is reversed: all neutrinos have left-handed spin; all antineutrinos have right-handed spin.) Neutrinos are associated only with elementary particles, and they uniquely identify the particle of their origin, both as to type and matter vs antimatter. Hence we recognize neutrinos as "bare" identity charges, which exist as a consequence of Noether's symmetry-conservation theorem and the breaking of the photon's "anonymity" symmetry by "singlet" leptons and leptoquarks (photons are indistinguishable one from another and hence "anonymous").

Field Vectors, Force Carriers, or Bosons

1) Strong Force

There are two expressions of the strong force, one at a structural level between quarks *within* baryons, and a second at a structural level *between* baryons within a compound atomic nucleus. The primary or quark expression of the strong force produces quark confinement, the force that permanently confines quarks in baryon triplets. The charge of this force is called "color", and the field vectors are called "gluons". All quarks carry one color charge (red, green, or yellow), which they exchange with each other via a gluon force-field. Gluons are composed of color-anticolor charge quanta, are massless, and travel at velocity c. The "round-robin" exchange of gluons between quarks constitutes the primary expression of the strong force, the permanent binding of quarks within baryons. Baryons are the primary mass carriers or energy storage units of the cosmos. The composite structure of the baryon is necessary to produce an electrically neutral mass-carrying particle which can break the initial symmetric energy state of the cosmos, probably via the asymmetric weak force decay of electrically neutral leptoquarks. (See: "The Origin of Matter and Information".)

The secondary or "nucleon" expression of the strong force produces the binding of protons and neutrons into the compound atomic nuclei of the heavy elements. The charge associated with this force is called "flavor", and the field vector or force carriers are mesons, composed of a quark-antiquark pair. The "ground state" family of quarks (which exclusively comprises protons and neutrons) carry either "up" or "down" flavors, and the exchange of flavors between protons and neutrons via meson force carriers constitutes the binding principle of the secondary aspect of the strong force, as expressed in the stability of compound atomic nuclei. Unlike the absolute confinement of quarks via gluons, however, the confinement of nucleons via mesons, while powerful, is not absolute: under the proper circumstances, protons and neutrons can escape the nucleus, and heavy nuclei can fission into lighter elements. (Meson binding is due to a "least bound energy" principle, whereas gluon binding is due to the stricter charge conservation principle; both are ultimately forms of symmetry conservation.) (See: "The Strong Force: Two Expressions".)

2) Weak Force

The weak force IVBs are unusual in that they are very massive bosons, whereas all other field vectors are massless. The mass of the IVBs is why they are called "intermediate" vector bosons. The great mass of the IVB is used to recreate the primordial conditions of the "Big Bang" in which the reactions they now mediate first took place. Such extreme measures are necessary because single elementary particles created today must be the same in all respects as those created eons ago in the "Big Bang". See below and the "Higgs Boson" papers. See also: "The 'W' IVB and the Weak Force Mechanism".)

3) Electromagnetic Force

The photon, a quantum unit of light, is the field vector of electric charge and the electromagnetic force. The exchange of photons between the electric charges of an electron and proton (for example), binds these particles together and maintains the atomic structure of atoms and molecules. Our Universe is an electromagnetic universe, composed of free and bound forms of electromagnetic energy (light and matter).

The electromagnetic constant "c" is the primary gauge constant of energy in the Cosmos, determining, regulating, or "gauging" the inertial metric of spacetime, the entropic expansion of space, the "non-local" symmetric energy state of light, the causal relations of matter, the invariance of charge, and the proportional equivalence between free and bound electromagnetic energy - among other things. (See: "Symmetry Principles of the Unified Field Theory: Part I" and "Part II".)

4) Gravitational Force

"Gravitons" are the presumed field vectors of the gravitational force. The graviton, as conceived in these pages, consists of a quantum unit of temporal entropy, or negative spatial entropy, or a quantum unit of time. Time is the active principle of the gravitational "location" charge. Time is connected to space, and the intrinsic, entropic motion of time into history pulls space after it, producing the spatial flow of a gravitational field. *A gravitational field is the spatial consequence of the intrinsic motion of time*. It is the actual flow of space toward the center of a massive particle's time charge that causes the "binding" effect of gravitation. Whereas the electromagnetic constant "c" gauges the metric relation between space, time, and free energy, the gravitational constant "G" gauges the entropic relation between space, time, and bound energy. The gravitational constant G gauges a temporal metric and historical domain (historical spacetime) in which the conservation requirements of both matter and light in terms of raw energy, symmetry, causality, and entropy can all be satisfied. (See: "The Conversion of Space to Time"; see also: "A Description of Gravitation".)

Examples of Weak Force Decays

While the reaction pathways below are speculative, the rationale for them is straightforward. The dense metric (or large mass) of an IVBs functions to bring the participants of a weak force interaction into such close proximity that they can exchange charges without risking any violation of the conservation laws, which they cannot do when separated by ordinary distances. Typically this will involve a particle-antiparticle pair drawn from the virtual particle "sea", as well as the reacting "real" or "parent" particle itself. For example, in the case of the decay of a muon to an electron, the "W" brings together within its dense metric an electron-positron virtual particle pair, plus the muon. When these particles are sufficiently close together, the positron and muon cancel each other's electric charges, and release their "identity" ("number") charges as neutrinos. The reaction is possible only because the muon is so close to the particle pair that it can transfer its mass-energy to the electron, materializing the virtual particle, thereby conserving the overall electrical and number charge of the reaction while simultaneously conserving total energy. The role of the "Higgs boson" in these transformations is to set, determine, or "gauge" the invariant energy scale of the reaction, and thus select the IVB family (in this case the "W" or electroweak IVB family) appropriate to the task. (See: "The Higgs Boson and the Weak Force IVBs".)

This type of reaction, involving particle-antiparticle pairs drawn from the virtual "sea", explains how the W can participate in so many different reactions and produce so many different products without changing its own identity. The W acts as a sort of "metric catalyst" and bridge between the "virtual particle sea" and "real" particles, simply bringing all reactants into very close contact with each other. It takes a lot of energy to bring particles so close together that they can undergo weak force transformations of elementary identity, hence the need for the large mass-energy of the IVBs. An equivalent way to understand this issue is to realize that the IVB mass is recreating the original, "Big Bang" energy-dense metric of spacetime (the electroweak force-unification symmetric energy state) in which these elementary particle transformations first occurred. Another advantage of this hypothesis is that if the W is a metric particle, then it may also contain an element of time, which could be the source of its asymmetric character. A further advantage is the contact with "string" theory. (See: "The "W" Particle and the Weak Force Mechanism".)

This mechanism also raises another possibility: if the W has a "big brother" (the "X" IVB), it might be powerful enough to squeeze the quarks of a baryon sufficiently to cause the color charge to vanish ("asymptotic freedom"), and initiate proton decay. The energy barrier to proton decay is very high (at least the equivalent of leptoquark mass), so the "X" IVB would have to be very massive indeed. Presumably there is another "Higgs" boson regulating the mass of the "X" IVB family. (See: "Proton Decay and the 'Heat Death' of the Cosmos".)

The role of the weak force is to produce (elementary) matter "singlets" from particle-antiparticle pairs. The electron produced today must be exactly the same in all respects as the electron produced long ago during the "Big Bang", otherwise charge and symmetry conservation will fail. The only way to ensure the invariance of elementary particle singlets whenever and wherever they are produced, is to recreate the original conditions in which they were formed. Hence the great mass of the IVBs, which seems out of all proportion to the tiny electron, is explained as necessary to reconstitute the primordial electroweak force unification symmetric energy state of the "Big Bang", in which quark-quark and lepton-lepton transformations occur as the normal course of events. The IVBs provide the transformation mechanism while the Higgs boson scales the quantized and invariant symmetric energy state, selecting between three possible force unification energy levels with their associated IVB families. (See: "Table of the Higgs Cascade".)

Lepton Decays:
(antiparticles underlined)
(Particle-antiparticle pairs are shown enclosed in parenthesis and with an "x" between the pair members - not to be confused with the bold uppercase "**X**" IVB.)

t-($\underline{u+}$ x *u*-)W- -----> *vt* + $\underline{vu}$ + *u*-

A tau decays (via an antimuon-muon particle pair complex formed by the W-) to a tau neutrino, a muon antineutrino, and a muon. Within the complex, the tau and antimuon cancel each other's electric charges, releasing their neutrinos and providing the energy to materialize the muon.

u-($\underline{e+}$ x e-)W- -----> *vu* + $\underline{ve}$ + e-

A muon decays (via a positron-electron particle pair complex formed by the W-) to a muon neutrino, a positron neutrino, and an electron. Within the complex, the muon and positron cancel each other's electric charges, releasing their neutrinos and providing the energy to materialize the electron.

(e- x $\underline{e+}$)(e- + *v*e)Z -----> e- + *v*e

An electron and electron neutrino interact via an electron-positron complex formed with the neutral "Z" IVB, and swap identities. The original electron and virtual positron annihilate, releasing the original neutrino and a replacement electron (this reaction could also be written using a neutrino-antineutrino virtual pair, giving the same result). Here the "Z" (like all IVBs) provides a secure environment in which particles (including virtual particles) are in such close proximity that charges and energy can be exchanged with no danger of violating any conservation laws. The rationale for the heavy IVBs and the weak force mechanism is precisely to safeguard the conservation laws during exchanges and transformations of energy and identity among elementary and virtual particles. Although the neutral interaction above only results in a simple "bounce" (scattering), the electrically neutral neutrino has no possibility for interaction with matter other than through a heavy weak force IVB - which is why neutrinos interact so rarely.

Examples of Weak Force Decays: Mesons and Baryons

Meson Decay

(ud)-(u+ x u-)W- -----> *v*u + u-

A negative pion (ud)- decays (via an antimuon-muon particle pair complex formed by the W-), producing a muon antineutrino, and a muon. Because quark partial flavor charges are not strictly conserved, once the pion's electric charge is canceled by the antimuon, the meson, being composed of a matter-antimatter quark pair, will simply self-annihilate, supplying the energy necessary to materialize the decay products.

Baryon Decay

udd(ud+ x ud-)W- -----> udu+ + ud-(e+ x e-)W- -----> udu+ + *v*e + e-

"Beta decay": a neutron (udd) decays in a two-step process, via an antipion-pion pair, followed by a positron-electron particle pair complex (both formed by the W-), producing a proton (udu)+, a positron neutrino, and an electron. Baryon decay and transformation is a major function of the mesons, complementing their baryon-binding role in compound atomic nuclei, in which they accomplish virtual (rather than actual) transformations between protons and neutrons, creating "nucleons". Virtual mesons are the donors (alternative charge carriers) of quark flavors in weak force transformations of baryons. Within the first complex, the d quark of the positive meson annihilates a d quark in the baryon, and replaces it with an up quark, transforming the neutron to a proton. This annihilation also helps supply the energy to materialize the negative pion which immediately forms another W- complex with a positron-electron virtual particle pair. In the second complex, the pion and positron cancel each other's electric charges, releasing the positron's neutrino and supplying the energy to materialize the electron. The neutralized remains of the pion, which is a quark-antiquark combination, simply self-annihilates, as the partial flavors of quarks are not strictly conserved. Although the reaction is shown in two steps for clarity, in nature it may occur in only one. The complexity of the decay pathway, combined with the tiny energy differential between the neutron and proton, is the reason for the extreme slowness of this reaction (half-life of ~15 minutes).

duu+(ud- x ud+)W+ -----> dud + ud+(e- x e+)W+ -----> dud + *v*e + e+

A proton (duu)+ restructures in a two-step process, via a pion-antipion pair, followed by an electron-positron particle pair complex (both formed by the W+), producing a neutron (dud), an electron neutrino, and a positron. This reaction requires an energy input. The reaction mechanism is similar to that detailed for beta decay (above); and as in beta decay, while shown in two steps for clarity, in nature may proceed in one step.

For more weak force decays and transformations, see: The "W" IVB and the Weak Force Mechanism (Adobe Acrobat pdf file). (Also available in an html file.)

Hypothetical Weak Force Proton and Leptoquark Decays

Proton Decay

1) proton decay (hypothetical) mediated by the X+ IVB:

A) [(*u*+ x *u*-)(uud+)]X+ -----> *v*lq + *vu* + *u*+
B) [(ud+ x ud-)(uud+)]X+ -----> *v*lq + ud+ + *y*

A) A proton (uud+) decays via the super-heavy X+ IVB, producing a leptoquark neutrino (*v*lq), a muon neutrino (*vu*), and an antimuon (*u*+).
B) The same, except that mesons rather than muons serve as the alternative charge carriers. A photon (*y*) and positive pion (ud+) are produced in the product, along with the leptoquark neutrino (*v*lq). Note that

different conservation laws (allowing the conversion of quarks to leptons and vice versa) apply at the GUT force unification or "X" IVB energy level. Here the proton is compressed by the heavy "X" IVB to the leptoquark configuration, vanishing the proton's color charge (in the limit of "asymptotic freedom"); the color charge of baryons is otherwise conserved (in reactions mediated by the "W" IVB, for example). (See also: "Proton Decay and the 'Heat Death' of the Cosmos".)

Leptoquark Decay

2) leptoquark decay (hypothetical - during the Big Bang only - asymmetries in this decay are the source of matter and the material Universe)

$$[(\nu lq \text{ x } \underline{\nu lq})(Lq \text{ x } \underline{Lq})]\mathbf{X} \text{ -----> } bbt + \underline{\nu lq} + b\underline{b}$$

One member of an electrically neutral leptoquark-antileptoquark pair decays (via the "**X**"), producing an antileptoquark neutrino ($\underline{\nu lq}$) and a neutral meson composed of bottom quarks; the other leptoquark does not decay, but expands to produce a heavy neutral baryon (hyperon) (bbt). (One of several possible decay pathways.)

In a leptoquark, the quarks are compressed by the "**X**" to "leptonic size", vanishing the color charge ("in the limit" of "asymptotic freedom"). An electrically neutral leptoquark should decay like a very heavy neutral lepton, producing a leptoquark antineutrino plus energy. Once released from the grip of the "**X**", the quarks in the unreacted leptoquark simply expand under the force of their mutual repulsion to form an electrically neutral heavy baryon (hyperon). The electrical neutrality of the leptoquark pair is necessary to allow time for the asymmetric weak force decay to occur; the requirement of electrical neutrality is the reason why baryons must be composed of sub-elementay particles (quarks) bearing partial charges. (See: "The Origin of Matter and Information".)

Leptoquarks are presumed to be very heavy; leptoquark neutrinos may also be very massive (for neutrinos). Leptoquark neutrinos are prime "dark matter" candidates; if they indeed account for the bulk of the dark matter currently supposed to be present in the Cosmos, they would have to weigh approximately 5-6 proton masses (5-6 Gev) - since there should be one antileptoquark neutrino for each proton produced in the "Big Bang". If this seems too heavy for a neutrino, recall that the weak force sports massive bosons (the W and Z) which weigh much more than this, although bosons in the other forces are massless. 5 Gev is also less than the lower bound predicted for the least massive supersymmetric particle, the "neutralino" (10-20 Gev).

List of technical terms:

Particles = fermions, bosons, and IVBs, virtual particles, and virtual particle-antiparticle pairs.

Virtual particles (often in particle-antiparticle pairs) = ephemeral particles which exist within the Heisenberg time limit for virtual reality (dEdT $\geq$ h/2pi). Field vectors of the forces are typically in the form of virtual particles.

Fermions = hadrons and leptons (spin 1/2 particles) (carriers of mass and charge - the constituents of atomic matter).

Hadrons = particles containing quarks (mesons and baryons).

Quarks = sub-elementary particles, carrying fractional charges, apparently derived primordially from the splitting of elementary leptonic precursors into 3 parts (leptoquarks). Quarks occur only in meson and baryon combinations. Quarks occur in six "flavors" and three "colors". A structurally distinct version of the strong force is associated with color vs flavor charge. Color charges (carried by a gluon field) bind quarks in baryons and mesons; flavor charges (carried by a meson field) bind baryons in compound atomic nuclei.

Mesons contain a quark-antiquark pair (examples: pions (ud)- and kaons (us)-). Mesons have interger spin (0,1), depending upon whether the quarks spin oppositely or parallel to one another.

Baryons contain 3 quarks (examples: the neutron (ddu) and proton (uud+).

Baryons are mass carriers; mesons function as alternative charge carriers for electric charge and especially for quark partial charges, assisting baryon decays and transformations, balancing the charges of hadrons (and sometimes other leptons) in place of antiparticles. In the nuclear expression of the strong force, mesons act as virtual field vectors of quark flavor charges, binding protons and neutrons in compound atomic nuclei. In general, alternative charge carriers (leptons and mesons) function to allow charges to be balanced, canceled, or otherwise neutralized while avoiding the matter-antimatter annihilation reactions which would be inevitable if these functions were performed by the corresponding charges of antiparticles. Hence the leptonic charge field is a necessary adjunct to the explicit expression of the baryon mass field.

Leptons = massive leptons (electron, muon, tau) and (nearly) massless neutrinos (*ν*e, *ν*u, *ν*t). Unlike hadrons, leptons are true elementary particles with no internal constituents. Massive leptons function as alternative carriers of electric charge; neutrinos function as alternative carriers of "identity" ("number") charge. The hypothetical leptoquark is the heaviest member of the leptonic elementary particle spectrum, containing within its fractured interior the primordial quarks, waiting to appear with the expansion of the universe and the symmetry-breaking asymmetric decays of the weak force.

Bosons = photon, graviton, gluon (field vectors, force carriers). Particles with integer spin (photon/gluon spin = 1, graviton spin = 2). The hypothetical Higgs boson is a spin = 0 particle. Gluons consist of a color-anticolor charge pair, in any combination other than green-antigreen, which is doubly neutral. Thus there are eight effective gluon pairs.

Intermediate Vector Bosons (IVBs) = W+, W-, Z, (**X**, Y ?) (all spin = 1). Heavy, transient metric particles of interaction which catalyze and mediate transformations of identity, number, and flavor among the fermions, including single particle creation and destruction. The supermassive "**X**" (and the even heavier "Y") is hypothetical, responsible respectively for leptoquark and proton decay, and the original creation of leptoquarks from light and the spacetime metric. (See: "Table of the Higgs Cascade".)

Leptoquarks = hypothetical primordial particles consisting of a primitive, high mass, lepton fractured into 3 parts (the nascent quarks) by the extreme pressures of the "Big Bang" and the compressive force of the very massive "Y" IVB. The "Y" IVB creates leptoquarks from light and spacetime; the "X" IVB creates baryons from leptoquarks; the "W" IVB creates leptons from baryons. (See: "The Origin of Matter and Information".)

Charges: electric, spin, color, identity (all symmetry debts of light). The weak force "identity" charge is also known as "flavor" or "number" charge. The gravitational charge is known as "location". The active principle of "location" charge is time. *The charges of matter are the symmetry debts of light:* (Noether's Theorem). Gravity is unified with the other forces through Noether's Theorem, because like the other forces, gravity originates as a symmetry debt of light (recording, conserving, and eventually restoring light's "non-local" symmetric energy distribution - a symmetry broken during the conversion of free energy (light) to bound energy (mass, matter)). (See: "Entropy, Gravitation, and Thermodynamics".)

Forces: electromagnetic, gravitational, strong, weak (the forces represent demands for payment of light's symmetry debts). These demands are satisfied by particle-antiparticle annihilations, fission, fusion, particle and proton decay, the nucleosynthetic pathway in stars, and Hawking's "quantum radiance" of black holes. (See: "The Double Conservation Role of Gravity".)

During the Big Bang, high energy light and metric spacetime produce particles which carry charges: *the charges of matter are the symmetry debts of light* (Noether's Theorem). These charges produce forces which act to pay the symmetry (and entropy) debts they represent, returning the asymmetric system of matter to its original symmetric state of light. (See: "Symmetry Principles of the Unified Field Theory".)

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