A Description of Gravitation

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home page

A Gravitational Field is the Spatial Consequence of the Intrinsic Motion of Time

(I recommend the reader consult the "preface" or "guide" to this paper, which may be found at "About the Papers: An Introduction" (section II); also: " Section 7: An Introduction to Entropy").

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Note to Readers Concerning "Entropy":
See: "Spatial vs Temporal Entropy"

ABSTRACT

Gravity's conservation role in nature is (at least) twofold:

1) Entropy conservation role: creating matter's time dimension via the annihilation of space, extracting a metrically equivalent temporal residue. The intrinsic motion of time is the entropy drive of bound energy. The intrinsic motion of time creates history, the conservation domain of matter's causal information field, web, or "matrix" (historic spacetime).

The gravitational conversion of space to time:

a) conserves/converts the spatial entropy drive of free energy (the intrinsic motion of light), to the metrically equivalent historical entropy drive of bound energy (the intrinsic motion of time);
b) creates the temporal, causal linkages of matter;
c) creates, through time's intrinsic motion, historic spacetime, the joint dimensional conservation domain of free and bound electromagnetic energy -

the historic conservation domain of information (matter's "causal matrix").
d) converts the expansion of space to the expansion of history.

2) Symmetry conservation role: conserving the "non-local" metric and distributional symmetry of free energy (light) via the gravitational conversion of bound to free energy in stars, quasars, and Hawking's "quantum radiance" of black holes - in effect, reversing the role and reaction in 1).

Both roles hinge upon the gravitational conservation of light's "non-local" distributional symmetry, but work in essentially opposite directions. The non-local energy state of light is a consequence of light's intrinsic motion, "velocity c", which gauges both the symmetric energy state and the spatial entropy drive of free energy. In these conservation roles gravity, like inertia and charge, enforces the conservation of free energy's symmetry, as required by "Noether's Theorem". (See: "The Double Conservation Role of Gravitation".)

The Origin of Gravitation

Gravity is a conservation force which arises in response (as required by Noether's Theorem - see below) to losses or deficits in two intertwined "gauge" (regulatory) functions of light's dimensional and symmetric energy state: 1) the entropy drive of space and free energy; 2) the "non-local" symmetric energy state of light. Both functions are the product of light's "intrinsic motion", as gauged by "velocity c". The universal gravitational constant G is the entropy conversion gauge, determining how much space must be annihilated and converted to time (per unit mass) to provide matter with its requisite temporal entropy drive, as gauged by "velocity T". The intrinsic motion of time is the entropy drive of bound energy and creates the historic conservation domain of information and matter's "causal matrix". (Time is also ultimately gauged by c, since "velocity T" is defined as the duration (measured by a clock) required for light to travel a given distance (measured by a meter stick). G is therefore related to c through their entropic roles and their common factor, time.)

The magnitude of G measures the small energetic difference between the symmetric spatial entropy drive (S) of free energy (the intrinsic motion of light as gauged by "velocity c"), and the asymmetric historical entropy drive (T) of bound energy (the intrinsic motion of time as gauged by "velocity T"):

$$S - T = -G.$$

Equivalently, -G measures the energetic difference between implicit and explicit time. (See: "Gravity Diagram No. 2" and "The Conversion of Space to Time").

It takes energy to create one-way temporal entropy from "all-way" spatial entropy, because an asymmetric, one-way temporal order must be imposed upon the symmetric, random spatial expansion. This entropy-energy cost of time and history is the origin of the "negative energy" characteristic of gravity and the negative sign of "-G".

The intrinsic motion of light produces space and the expansion and cooling of space; hence the intrinsic motion of light is the entropy drive of free energy. Space is the conservation domain of light (free electromagnetic energy) created by light's entropy drive. It is the function of entropy (in its primordial form and role as intrinsic dimensional motion), to create dimensional conservation domains (space and history) for free and bound forms of electromagnetic energy. In these domains, entropy's energy source (light or matter) can exist and be transformed, used, but nevertheless conserved. Change is allowed, but within a larger conserved framework which includes entropy and dimensionality: this is the relationship between the 1st and 2nd laws of thermodynamics. Because the

entropy drive and symmetric energy state of light are both gauged by "c" (both are consequences of light's intrinsic motion), Noether's theorem will automatically require the conservation of light's entropy drive in any transformation in which light's non-local symmetry must be conserved - as in the conversion of free to bound energy, and/or the creation of matter. Conserving either the entropy drive or the non-local distributional symmetry of light conserves the other by default. (See: "The Double Conservation Role of Gravitation".)

One of gravity's several roles is to conserve the spatial entropy drive of light (the intrinsic motion of light) by transforming it into the historical entropy drive of matter (the intrinsic motion of time). (See: "Spatial vs Temporal Entropy".) Time is created by gravity via the annihilation of space and the extraction of a metrically equivalent temporal residue, resulting in the deceleration of the spatial expansion of the Cosmos. Because the spatial expansion is driven by the intrinsic motion of light, we see it is the spatial entropy drive (S), which ultimately funds the historical entropy drive (T):

$$-Gm(S) = (T)m$$

This conservation circuit between the entropy drives of the long-range force pair (gravitation and the electromagnetic force) may be expressed by a symbolic "concept equation":

$$-Gm(S) - (T)m = 0.$$

The conversion of mass to light by our Sun represents the closure of this same conservation circuit: (see: "Currents of Entropy and Symmetry").

Light Is Non-Local, Atemporal, and Acausal

"Velocity c" is the gauge of both the spatial entropy drive and the "non-local" distributional symmetry of light (free electromagnetic energy). "Non-locality" is due to the fact, discovered by Einstein, that light has no time dimension and no spatial dimension in the direction of its motion. In Einstein's mathematical formulation of this symmetry, the "Interval" of light = zero. (The "Interval" is an invariant measure of distance (between two "events") in 4-D spacetime, necessary to conserve causality. Two people shaking hands is an example of one "event".)

Due to their relative motion and the finite speed of light, some observers of a given pair of events will see them separated by more space, while others will see them separated by more time, and moving observers will generally not be able to agree on precisely when or even in which order the events occurred. However, regardless of the observer's motions (including accelerated motions), if their observations are entered into Einstein's mathematical formula, they will all find the same "Interval". It is the crucial function of Einstein's "Interval" to rescue causality from the shifting perspectives of Einstein's relativistic spacetime - which is why the concept and invariance of the "Interval" is so important. [3]. (See: "The Paradox of the Traveling Twins".)

Light is a 2-dimensional transverse wave whose intrinsic motion sweeps out a third spatial dimension. Lacking both a time dimension and one spatial dimension (in its direction of propagation), light's position in 3-dimensional space or 4-dimensional spacetime cannot be specified. Since both time and distance are meaningless to light, and yet light has intrinsic motion, light has in effect an infinite amount of time to go nowhere. Hence in its own reference frame (moving freely in spacetime (vacuum) at velocity c), light must be considered to be everywhere simultaneously. From this results the "non-local" character of light, light's zero "Interval", and the distributional symmetry of light's energy.

The charges of matter are the symmetry debts of light, and light's "non-local" metric and distributional

symmetry is conserved through the "location" charge of gravitation, of which time is the active principle. The time charge and the gravitational field it induces identify energetically the specifiable (and hence asymmetric) coordinate position of immobile, undistributed mass-energy in 4-D spacetime, including the quantity and density of matter's distributional symmetry violation. Einstein's "Interval" of mass is always greater than zero, due to the presence of time and a third spatial dimension. The time charge breaks the metric symmetry condition of light's "zero Interval", while time's one-way intrinsic motion establishes the gravitational symmetry/entropy debt of bound energy.

Noether's Theorem

"Noether's Theorem" (Emmy Noether, 1918) states that in a multicomponent field (such as the electromagnetic field, or the metric field of spacetime), where one finds a symmetry, one will find an associated conservation law, and vice versa. Noether's Theorem is saying that in the conversion of light to matter, not only must the raw energy of light be conserved (as in the mass and momentum of particles), but the symmetry of light must also be conserved - not only the quantity but the quality of energy must be conserved. The theorem does not say exactly how this must be done, but in nature the matter-antimatter symmetry of light's particle form is conserved through the charges (and spin) of matter - charge conservation = symmetry conservation. The non-local distributional symmetry of light's spatial, wave, or metric form is conserved through inertial and gravitational forces. (Quantum mechanical "spin" seems to be an (wholly conserved) intermediate or mixed state of charge and inertial force.) The dual character of light's particle vs wave form seems ultimately derived from light's dual energetic parameters: frequency and wavelength. (Frequency multiplied by wavelength = c.)

I think of Noether's theorem as the "Truth and Beauty" theorem, in reference to Keat's great poetic intuition:

> "... Beauty is truth, truth beauty, - that is all
> Ye know on earth, and all ye need to know"
> ("Ode on a Grecian Urn": John Keats,1819)

in which Beauty corresponds to Symmetry and Truth corresponds to Conservation.

The two common examples of Noether's Theorem enforced in Nature - charge (and spin) conservation among the particles, and inertial and gravitational forces in the spacetime metric - are the more enlightening because the former is an example of symmetry conservation and debt repayment deferred indefinitely through time, while the latter is an example of raw energy conservation in which the debt must be paid immediately. Furthermore, in the case of inertial forces, we see the implication that gravitation will also fall under the conservation mantle of Noether's Theorem, via Einstein's "Equivalence Principle". This indication is borne out and verified by the discovery that gravitation is indeed a symmetry debt of light, responding to and conserving the symmetry of light's "non-local" spatial distribution, a symmetry broken by the immobile concentrations of mass energy represented by matter ($E = mcc$).

Noether's theorem tells us why all the forces of nature are busy converting matter to light: matter was created from light in the "Big Bang", but since light has greater symmetry than matter, it is to conserve light's symmetry that all the charges and forces of matter work to accomplish the return of bound energy to its original symmetric state. *The charges of matter are the symmetry debts of light*. These charges produce forces which act to return the system of matter to light (free energy). Our Sun is an archetypical example of symmetry conservation in nature.

Two Entropy Drives?

How can matter have 2 entropy drives - one positive (time) and one negative (gravity)? This is possible because matter's negative entropy is expressed spatially (the intrinsic motion of gravitation), while its positive entropy is expressed historically (the intrinsic motion of time). These two entropy drives exist simultaneously in matter due to the gravitational conversion of space and the drive of spatial entropy (the intrinsic motion of light) into history and the drive of historical entropy (the intrinsic motion of time).

Entropy-energy, the energy of intrinsic (dimensional) motion, creates the dimensional conservation domains of free and bound electromagnetic energy (space, history). The intrinsic motion of light, as gauged by "velocity c", creates space; the intrinsic motion of time, as gauged by "velocity T", creates the historic conservation domain of information and matter's "causal matrix"; the intrinsic motion of gravity, as gauged by "velocity G", creates historic spacetime, the joint dimensional conservation domain of free and bound electromagnetic energy. (See: "Spatial vs Temporal Entropy".) (See also: "The Tetrahedron Model".)

Gravity's negative spatial entropy drive is associated with a symmetry debt - light's lost "non-local" metric and distributional symmetry - as reflected by the "location" charge of gravitation, which records the spacetime position, quantity, and density of immobile matter. Matter's positive historical entropy drive is associated with an entropy debt (light's lost intrinsic motion c, the entropy drive of free energy), which gravity's "location" charge replaces with time, the entropy drive of matter. Time is the active principle of gravity's "location" charge.

In our Sun (for example), both reactions go on simultaneously: gravity creates the Sun's time dimension by annihilating space, and yet creates new space by converting mass to light, a conversion which actually reverses the metric effect of the first reaction, and reduces the Sun's gravitational field as it reduces the Sun's mass. These reactions do interfere with each other to some extent, resulting in a standoff between the gravitational force of compression and the radiative force of expansion - a seesaw battle between the symmetry and entropy conservation roles of gravitation whose final resolution (in favor of symmetry) is expressed through Hawking's "quantum radiance" of black holes.

We need the concept of matter's entropy debt to explain gravity's insatiable, dimensional, universal, one-way character, and the concept of matter's symmetry debt to explain gravity's "location" charge, the fact that gravity identifies the spacetime position, magnitude, and density of massive objects, and converts mass to light (as in the stars). We also need the concept of gravity's symmetry debt to help unify gravity with the other forces of physics under the conservation umbrella of Noether's Theorem: *the charges of matter are the symmetry debts of light*. Finally, we note that gravity (partially) repays the "location" symmetry debt of matter by converting bound to free energy in stellar processes, and completely repays it through Hawking's "quantum radiance" of black holes. These conversions, of course, simultaneously repay the entropy debt, restoring the entropy drive (intrinsic motion) of light.

Let us consider in general terms the gravitational transformation of space to time (see Fig. 1 "The Gravity Diagram".) The gravitational annihilation of space is our common experience of gravitational force - space accelerating through us on its way to Earth's center. This we designate as the negative spatial entropy drive of gravity, because space is collapsing and warming, rather than expanding and cooling, as when driven by light. -Gm is the negentropic energy and -G is the universal gauge of the strength of the gravitational force. "G" determines (per unit mass) how much space and spatial entropy drive is required to produce matter's time dimension and historic entropy drive. Within this collapsing space resides a metrically equivalent, but implicit, component of time. This temporal entropy component is not lost when gravity annihilates space, but is revealed as matter's explicit time

dimension. Space is consumed by gravity, leaving behind a metrically equivalent temporal residue, producing matter's temporal entropy drive and the historic conservation domain of information and matter's "causal matrix" (historic spacetime), the joint dimensional conservation domain of free and bound energy.

The continuing reality of "yesterday" and matter's historic "causal matrix" is absolutely necessary to uphold the reality of today and the "Universal Present Moment" of bound energy and human experience. This is (one of several) rationales for gravitation and the long-range character of its force. (See: "A Spacetime Map of the Universe".) We are all immortal in history.

-Gm is the negative entropy-energy required to produce m's time dimension from space. -Gm tells us how much gravitational entropy-energy is required to produce m's time dimension - in the metrically equivalent terms of the space which must be annihilated to create time. Hence the gravitational field energy of planet Earth is the entropy-energy required to produce Earth's time dimension - entropy-energy which is gravitationally subtracted from the spatial expansion of the Cosmos (by the actual conversion of space into time).

The intrinsic motion of free energy is the expansive principle of the spatial Universe, but it is time itself, implicitly present in the "frequency" component of the electromagnetic wave, which causes the spatial or "wavelength" component of the wave to move: wavelength "flees" the asymmetric temporal potential embedded in its own nature. This flight by "wavelength" from "frequency" at velocity c suppresses the explicit appearance of time, hence maintaining metric symmetry. Thus we come back to a combination of entropy and metric symmetry conservation, both in the service of energy conservation, as the ultimate principles causing the intrinsic motion of light. Time, whether implicit in light or explicit in matter, is the entropic driver of the Cosmos. (See: "The Conversion of Space to Time".)

The Universal Gravitational Constant G

gravity is a metric form of entropy

(See also: "Global vs Local Gauge Symmetries in Gravitation")

The *metric* equivalency between space, time, and light is "gauged" (regulated, determined, established) by the universal electromagnetic constant c. The *entropic* equivalency between space, time, and mass is gauged by the universal gravitational constant G. (Alternatively stated: the energetic equivalency between the primordial entropy drives of space and history - the intrinsic motion of light vs the intrinsic motion of time - is gauged by G.) Time, the historical entropy drive of matter, is provided by the gravitational annihilation of space, extracting a metrically equivalent temporal residue from the collapsed space. G is related to c through time and entropy. -G is the measure of the small energy difference between the symmetric spatial entropy drive (S) of free energy (the intrinsic motion of light), and the asymmetric historical entropy drive (T) of bound energy (the intrinsic motion of time):

$$S - T = -G.$$

Equivalently, -G measures the small energy difference between implicit (S) and explicit (T) time. Gravity is a metric form of entropy. (See: "Gravity Diagram No. 2".)

"Big G" is the universal gravitational constant, familiar to us through Newton's famous formula for the gravitational force acting between two bodies: F = GMm/rr, where Mm is the mass of the respective bodies, and r is the distance between their centers. G is a never-varying constant of force. I think of it as the gauge or determinant of the entropic relationship between mass, time, and space -

gauging the magnitude, in terms of an equivalent amount of spatial entropy-energy, of m's time dimension. It takes entropy-energy to create the time dimension of m, and G is the gauge constant that determines how much space and spatial entropy will be required (must be annihilated/transformed) to produce m's time dimension - per given mass.

Because gravity creates matter's temporal entropy drive by the annihilation and transformation of space, a "falling force" is created around a massive body by the accelerated motion of space rushing toward the center of mass; this force diminishes with the square of the object's distance for simple reasons of spherical geometry and total energy conservation. For example, if the total gravitational energy is to remain the same at any distance from the mass center, then its local intensity per standard unit of surface area (square meter) on any concentric spherical surface must diminish as the square of distance from that center - simply because the surface area over which the total force must be distributed increases as the square of that distance. The same force law holds for electric charge (Coulomb's law) and the dimming of stellar luminosities, for the same simple reasons. Newton's difficulty proving this inverse square law was due to general ignorance (or lack of acceptance) of the energy conservation principle in his time. Einstein's modification of Newton's law was due to his realization that the appropriate geometry was 4-dimensional (including time) rather than 3-dimensional. Einstein represented the gravitational force with Riemann's tensor geometry as a metric "warping" or "curving" force ("four 3rd-order equations" - the changing rate of acceleration in x, y, z, t).

"Little g" ("surface gravity" or the local force of gravity) can take any value up to g = c. If the Earth were to shrink to the size at which it becomes a black hole (about the size of a ping-pong ball!), it is little g, Earth's surface gravity, the local intensity of Earth's field, which changes in the process. Big G would be unaffected; the Moon's orbit, for example, would not change, since none of the three parameters of Newton's equation, G, m, or r, are changed by shrinking Earth (at least not from the Moon's perspective). The density of m changes, and that affects little g because r shrinks, but only from the perspective of Earth's (unfortunate) surface dwellers.

Einstein's "Equivalence Principle"

Little g is the local intensity of the gravitational field; it measures the force or "weight" we feel standing on Earth's surface. Little g is much less on the moon, but big G is the same everywhere. Little g is also equivalent to the "g" forces of acceleration experienced in sudden starts, stops, and sharp turns (Einstein's "Principle of Equivalence" of gravitational and accelerated reference frames). The equivalence holds because as we stand on the surface of the Earth, space accelerates through us toward Earth's center, while in the reciprocal situation (through the appropriate application of energy, as in a rocket ship), we accelerate through space. "g" forces vanish in "free fall" (or orbit) because we become co-movers with the field. Similarly, acceleration forces vanish when we "turn off the engines" of a rocket ship and coast freely in space with the metric's inertial field. An earlier version of the equivalence principle, attributed to Newton, noted only the unexplained equality between inertial mass and gravitational weight, which was invoked to explain the curious fact earlier discovered by Galileo that all things fall with the same acceleration (because their inertial resistance to acceleration is exactly balanced by the attractive force of their gravitational "weight"). It is readily seen that Einstein's equivalence principle includes and explains its predecessor. (For more on this topic see: "Extending Einstein's Equivalence Principle".)

The Attractive Principle of Gravitation

In Newton's gravitational equation ($F = GMm/rr$) each mass is presumed to attract the other (along a straight line connecting their centers) with a force proportional to its mass (Gm). What the attractive

principle was Newton did not say. Einstein thought the attractive principle was a distortion of the spacetime metric, proportional to the total energy of a body, including its associated fields. However, why such a distortion should (must) exist was not explained. In the theory presented here, I assume Einstein's geometric formulation of the spacetime "warpage" is correct, but with the understanding that it represents not a static field, but the actual accelerated motion of spacetime. This assumption is allowed within the framework of Einstein's equations due to his own "Principle of Equivalence" of the forces of gravity and acceleration, and it reproduces all the usual gravitational phenomena. (However, there is a major difference between my theory and Einstein's regarding the gravitational field produced (or not) by light freely moving in vacuum. See: "Does Light Produce a Gravitational Field"?)

The advantage of a moving (rather than a static) field interpretation is that the dynamic view allows us to discover (at least) two conservation reasons for the existence of the gravitational force: 1) the creation of the historical entropy drive of matter (the intrinsic motion of time), via the annihilation of space and the extraction of a metrically equivalent temporal residue, including the creation of the joint dimensional conservation domain of free and bound electromagnetic energy (historic spacetime); 2) the conservation of light's dimensionally and distributionally symmetric "non-local" energy state, via the gravitational conversion of bound to free energy (as in stars). Furthermore, the dynamic view allows us to postulate a simple attractive principle, namely the infall of spacetime to a center of mass, the infall due to the unbreakable connection between space and time. It is the intrinsic motion of time at the center of mass, at "right angles" to all three spatial dimensions, which pulls space after it, creating the accelerated, convergent infall of space that we recognize as the gravitational field. *A gravitational field is the spatial consequence of the intrinsic motion of time*.

Space and time are a dimensional entropic pair which cannot be completely separated, much like the electric and magnetic field of light. Indeed, these dualities are related phenomenal expressions of free and bound forms of electromagnetic energy.

In the dynamic view, the attractive principle is really the intrinsic motion of time itself, which pulls space after it because energy conservation will not allow these dimensional forms to be separated; they are the "faces" of a single electromagnetic entropy "coin".

The "entropic charge" of time (by "entropic charge" I mean a symmetry debt with intrinsic dimensional motion), which is *implicit* in free energy or light (for example, as the "frequency" component of the wave), becomes *explicit* when free energy collapses to a bound (stationary) form (such as a particle). In such a collapse, light loses its symmetric and intrinsic state of motion, as gauged by "velocity c". The entropic time charge "picks up" the lost intrinsic motion or spatial entropic drive of light, and conserves it as the intrinsic motion of matter's historic entropy drive, time. (See: "Gravity Diagram No. 2".)

The intrinsic motion of time is directed one-way at "right angles" to space, and its motion drags space after it, as the connection between space and time cannot be broken. 3-D space is forced to collapse to a point at the center of mass, squeezing into the zero-dimensional (point-like) beginning of the 1-D time line. The symmetric spatial dimensions self-annihilate at the point-like center, leaving a metrically equivalent but asymmetric temporal residue. The explicit-implicit states of the entropic gauges of space and time are reversed by the spatial annihilation (see the "Gravity Diagrams"). This renews the always-moving time charge at the center of mass, which again moves down the time line (the one-way dimensional motion of a point charge creates a line), pulling space after it, and so on forever. Time continuously renews itself via the extraction of new temporal residues from the space annihilated by time's own intrinsic motion - a self-feeding cycle.

The spherical symmetry of the gravitational field is due to the fact that all the spatial dimensions are equally connected to the time dimension; this allows the spherically opposing spatial dimensions (+x, -x, etc.) to match up exactly at the center of mass where they self-annihilate "cleanly", leaving a metrically equivalent temporal residue. The self-annihilation of space reveals its implicit temporal component, which cannot self-annihilate because time being asymmetric, there is + t but no -t. Gravity's accelerated motion is due to the constant application of a force, the constant intrinsic motion of time. Time's one-way motion is necessary for the protection of causality and the continuous updating of matter's raw energy accounts, especially those due to matter's relative motion.

The point-like center of mass, which is just the beginning of the time line seen "end on" (because time is at right angles to all the spatial dimensions), is the germ of what, in extreme circumstances of density and gravity, will grow into the surface area or "event horizon" of a black hole.

Hence the spatial motion due to gravity is the consequence of the intrinsic motion of time; the convergent, accelerated flow of space is the principle of gravitational attraction; this spatial collapse continuously feeds the time line which forever pulls more space after it. The conservation of energy, entropy, symmetry, and causality requires the time dimension for matter; gravity creates time (and spacetime) by producing time from space. The annihilation of space decelerates the spatial expansion of the Cosmos; therefore, matter's time dimension or historical entropy drive is ultimately funded by light's intrinsic motion or spatial entropy drive. The entropy drive expressed as free energy's spatial expansion (S) is gravitationally converted to the entropy drive expressed as bound energy's historical expansion (T), a transformation which (as we have seen above), may be symbolically represented in a "concept equation" as:

$$-Gm(S) = (T)m$$
$$-Gm(S) - (T)m = 0$$

(See: "Currents of Symmetry and Entropy".)

The Mechanism of Gravitation

Gravitation is both a symmetry debt and an entropy debt of light, unique among the charges and their forces. This double conservation role is reflected in two different mechanisms, both of which convert space to time, one at the microscopic quantum level of charge - the entropy debt, involving time, causality, and energy conservation, and one at the macroscopic level of gravitational force - the symmetry debt, involving mass, "location" charge, and symmetry conservation. (See: "The Double Conservation Role of Gravitation".)

The collapse of an electromagnetic wave confers a quantized time charge on a massive particle. This time charge is derived from the collapsed spatial component or spatial equivalent of the wave, similarly to the process of the gravitational extraction of time from space. This is the "primary" or quantum mechanical process of producing the entropy debt or time charge. We can visualize this as a switching or flipping of the "wavelength" or spatial aspect of light or the moving electromagnetic wave, to the "frequency" or temporal aspect of the particle or stationary wave (see: "Gravity Figure No. 2"). This is just the change from implicit to explicit time, as time is always present as the implicit or hidden driver of light's intrinsic motion (see: "The Conversion of Space to Time".) Once this time charge is gauged and placed, the "secondary" or symmetry aspect of gravitation comes into play: this is the cyclic, continuous flow of space as it is pulled toward the center of mass by the intrinsic motion of time, producing the macroscopic gravitational field (see fig. "Gravity"). The continuous secondary process simply copies or reproduces the time charge set and gauged by the one-time primary process. We can visualize this secondary process as the actual symmetric flow and annihilation of the spatial

dimensions, leaving in their place a metrically equivalent uncanceled time residue whose intrinsic motion - at right angles to all three spatial dimensions - pulls space after it, producing the continuous spatial collapse that is a gravitational field (see fig. "gravity 1").

Finally, we can visualize the ephemeral nature of the time charge as a manifestation of its actual motion from the spatial dimensions, where it is initiated, to the historic causal domain, where only information can follow. It is the intrinsic motion of the time charge which "pulls" space after it and produces the gravitational flow. Hence *a gravitational field is the spatial consequence of the intrinsic motion of time*. The collapse of space leaves a metrically equivalent temporal residue whose intrinsic motion pulls more space after it, in an endlessly repeating cycle. The intrinsic motions of gravitation and time continuously induce each other, much as the oscillations of an electric and magnetic field induce each other. In both cases, the motion of a current, either moving space or moving electrically charged particles, produces a field at right angles to the current flow (time or a magnetic field). Conversely, a moving time or magnetic field produces a spatial (gravitational) or electric current. This is the analogy between electromagnetism and gravitation which so intrigued Einstein.

The two mechanisms are distinct but both are part of the gravitational conversion of space to time, connecting the quantum-mechanical aspect of gravitational charge (the entropy debt) to the macroscopic aspect of gravitational flow (the symmetry debt). Both are linked by time, their common gauge c, and Noether's Theorem requiring the conservation of light's "non-local" symmetry. The gravitational charge, "location", is unique among charges in that its active principle is time. The gravitational charge is an "entropic" charge, a charge with intrinsic dimensional motion. It is the temporal, entropic nature of the gravitational charge which connects the microscopic quantum mechanical (charge-time-particle-entropy) and the macroscopic dimensional (location-time-mass-symmetry) aspects of gravity. In turn, the double nature of the gravitational charge gives gravity a double conservation role, on the one hand conserving the entropy drive of free energy (the intrinsic motion of light) by converting space to the entropy drive of bound energy (the intrinsic motion of time), and on the other hand conserving the non-local distributional symmetry of light's energy by converting bound to free energy (as in stars, and via Hawking's "quantum radiance" of black holes). This duality extends backward in a conservation chain to the dual role of velocity c, which gauges both the "non-local" distributional symmetry and the spatial entropy drive of light. Gravity must conserve both consequences of light's intrinsic motion if it conserves either one - as "Noether's Theorem" requires. (see: " The Double Conservation Role of Gravitation").

The "graviton" or field vector of the gravitational charge is a quantum unit of temporal entropy, the "flipped" or transformed entropy drive or intrinsic motion of the photon - implicit time transformed to explicit time. (See: "Gravity Diagram No. 2".)

The Conservation Roles of Gravitation

The conservation roles of gravitation include:

1) Entropy: the conservation of free energy's spatial entropy drive - by converting light's intrinsic motion to the historic entropy drive of bound energy, the intrinsic motion of matter's time dimension (collapsing space and extracting a temporal residue);
2) Causality: creating the causal (temporal, historical) linkages of matter and hence protecting energy conservation;
3) Energy: the creation of the local metric of historic spacetime, the joint dimensional conservation domain of light and matter (by creating time from its metric equivalent, space);
4) Symmetry: the payment of light's "non-local" distributional symmetry debt, and light's

spatial entropy debt (by converting bound energy to free energy - as in stars, quasars, and Hawking's "quantum radiance" of black holes).

The energy conservation role of gravity is to impose a local, temporal metric of arbitrary strength (varying with the magnitude and density of mass), which can conserve energy in a mixed system of free and bound energy. This gravity accomplishes by converting the absolute metric of light and space (as gauged by the electromagnetic constant c), into the relative metric of matter and time (as gauged by the universal gravitational constant G). Time provides the entropic drive of matter, the causal linkage of matter, balances the energy budget of matter in relative motion, and accommodates the flexible metric of Special and General Relativity, as well as maintaining the invariance of the positive "Interval" of matter ("Lorentz Invariance"). This satisfies the 1st and 2nd laws of thermodynamics and the causality relation.

The symmetry conservation role of gravity is to conserve the non-local distributional symmetry of light (in satisfaction of Noether's Theorem), by converting bound to free energy in stars via the nucleosynthetic pathway, and in black holes via proton decay and Hawking's "quantum radiance". Gravity has a double conservation role because gravity conserves all metric symmetries associated with velocity c, including the symmetric "non-local" spatial distribution of light's energy, and the spatial entropy drive of free energy (the intrinsic motion of light). (See: " The Double Conservation Role of Gravitation".)

Gravity performs the first conservation role (creating the time dimension of matter) for all bound energy forms, and the second (converting bound to free energy) for all sufficiently large accumulations of matter (stars and black holes).

The full conservation role of gravitation is complex on the one hand, in that gravitation has two primary conservation roles, one involving light's spatial entropy drive (light's intrinsic motion), and another involving an aspect of light's symmetric energy state (light's "non-locality"). "Non-locality" produces a complete distributional symmetry of light's energy within light's spatial conservation domain - the Cosmos. On the other hand, gravitation's conservation role is simplified because both light's spatial entropy drive and non-local symmetric energy state are consequences of the intrinsic motion of light, producing light's atemporal, acausal, and "non-local" character. The gravitational restoration of bound to free energy in stellar processes and the "quantum radiance" of black holes pays both the symmetry and the entropy debt of light, simultaneously. (See: "Currents of Entropy and Symmetry".)

Time and its asymmetric intrinsic motion is the pivotal feature of the entire process, providing both the active principle of gravity's "location" charge, and producing matter's positive entropy drive, including information's historic and causal conservation domain. Finally, time is also the implicit or "hidden" driver of light's intrinsic motion. (See: "The Double Conservation Role of Gravitation".)

Black Holes

Hawking's "quantum radiance" of black holes is the ultimate expression of Noether's Theorem fulfilled (in the case of the gravitational symmetry/entropy debt), confirming that only in the black hole is gravity's conservation quest totally realized. With the complete evaporation of the black hole via quantum radiance, the mass and entropy of asymmetric matter are all converted to its original symmetric form (light), and the gravitational field that was associated with the hole vanishes, its conservation work finally accomplished. (See: "Entropy, Gravitation, and Thermodynamics".)

In the limiting case of a "black hole", the gravitational conversion of space to time becomes physically expressed in the surface area of the hole's "event horizon", according to the Bekenstein-Hawking theorem, which relates the surface area of a black hole to the entropy of its mass. We understand the necessity of the relationship because increasing the area of the event horizon surface is the only way to increase the time/entropy domain of the black hole for any additional mass inputs - this because further acceleration of the gravitational field is forbidden beyond the already realized limit of velocity c. (Similarly, if the flow of water through a pipe is already at some theoretical maximum pressure and velocity, the volume of flow can be increased only by enlarging the cross-sectional area of the pipe.) The surface of a black hole is a time-entropy surface which displaces space somewhat (not exactly) as a ship displaces water. At this surface the moving time dimension is replaced by the gravitational transformation of space as fast as time moves away, so time effectively "stands still", becoming "visible" by the displacement of space. The event horizon of the black hole is the physical demonstration of the gravitational conversion of space and the drive of spatial entropy to time and the drive of historical entropy - complete with the mathematical formalism of the Bekenstein-Hawking Theorem. Just as a rock is the visible evidence of light's energy in an asymmetric stationary mode - light's energy transformed to matter and brought to rest ($E = mcc$), so the event horizon of a black hole is the visible evidence of light's entropy in an asymmetric stationary mode - light's entropy transformed to time and brought to rest: $-Gm(S) = (T)m$.

If Earth's gravity or temporal entropy field were the full equivalent in strength of light's spatial entropic field, then Earth would be a "black hole". In other words, the "black hole" condition is just that in which $g = c$ and T stands still (because gravity is replacing T as fast as T moves away into history). If the mass of the Earth were compressed to the condition of $g = c$ or a "black hole", the Earth's event horizon would be about the size of a ping-pong ball! The surface area of this ball = the pure time dimension or temporal entropy of the Earth's entire "rest mass", as translated into equivalent spatial entropy terms ($g = c$), allowing us to quantify time by measuring the surface area of the space it displaces. This illustrates dramatically just how small the temporal entropy component of bound energy really is. The gravity we feel on Earth's surface is the spatial pull caused by the intrinsic motion of that same time dimension, in effect, the tiny "black hole" at the gravitational center of the Earth, but the surface of that "ping-pong ball", in terms of its gravitational influence, is diluted over the surface of the entire Earth. (See: "The Half-Life of Proton Decay and the 'Heat Death' of the Cosmos".)

Gravity is weak because matter is connected to its historical conservation domain only tangentially via the "universal present moment". The tiny size of the (theoretical) black hole at the center of the Earth represents this tangential contact point for the entire mass of our planet, in which spatial and temporal entropy are fully equivalent. Gravity creates only enough temporal entropy (for any given mass) to establish this tangential contact point, whose size is to be compared to the whole of historical spacetime, the bulk remainder of matter's entropic conservation domain or "causal matrix". (The fact that this contact point is greater than zero means that the temporal entropy drive of matter will actually have a very small vitiating effect upon atoms, as realized through "proton decay" and Hawking's "quantum radiance" of black holes.) (See: " A Spacetime Map of the Universe".)

Charge Invariance

The invariance of charge in the service of symmetry conservation is another rationale for the tangential relationship between matter and matter's entropic conservation domain, historic spacetime. Matter, and matter's associated charges, exist only in the present moment of time, and do not participate in the entropic expansion of historic spacetime. The charges of matter, as well as the energy content of matter, are therefore protected from entropic enervation or dilution. Atoms simply do not age, and charge magnitudes are invariant through time. Charge quantization also plays a

significant role in the "ageing" of matter; atoms cannot disintegrate by continuous degrees, but only in discreet quantum units: proton decay can go forward only if all the proton's conserved charges are actually annihilated.

The tangential contact between matter and historic spacetime is also the reason for the weakness of gravity: gravity need supply matter with only enough temporal entropy to maintain or service the tiny tangential point of contact. At this point of contact, gravity is actually the same strength as the electromagnetic force - as the black hole demonstrates. This notion accords with the observation of P. A. M. Dirac that the ratio of the strength of the electromagnetic force to the gravitational force is the same as the ratio of the radius of the Cosmos to the radius of an electron - the electron here representing the physical size of the "tangential" point of contact between matter and historic spacetime.

Charge conservation acts as the "credit card" of the Cosmos - "buy now, pay later", with gravity paying the entropy-interest on matter's symmetry debt by creating matter's time dimension via the annihilation of space. The notion of charge conservation would have no meaning in the absence of time. It is interesting to note the convergence of fundamental principles here: symmetry conservation thrust into the time dimension by the mechanism of charge and charge conservation; the resulting necessity for the invariance of matter's charges and mass-energy through time; the gravitational creation of time from space and the consequent deceleration of the cosmic expansion; the tangential "hit" of the "present moment" upon historical "bulk" spacetime preventing the entropic enervation of matter's charges and mass-energy content. The weakness of gravity is therefore related to (required by) charge, symmetry, and energy conservation. Of course, Special Relativity also tells us that matter cannot move with the metric equivalent of "velocity c", and that therefore the time dimension must move instead, while matter remains stationary and rides the "time train". There are multiple reasons for matter's isolation in the "universal present moment", illustrating the seamless interweaving of all natural law, and raising again Einstein's question: is there any latitude in the construction of the Universe? From the perspective of the "Anthropic Principle" (natural law and the physical constants must allow human life), the answer is apparently "no".

The Ratio 1/4 x 10(42) (42 powers of ten)
(Why is Gravity so Weak?)

(See: "The Half-Life of Proton Decay and the 'Heat Death' of the Cosmos".)

Summary
(See also: "12 Summary Points Concerning Gravity")

The problem to be solved by the material Universe is how to return to the original symmetry of light in the absence of antimatter. The information carried by the charges of matter is 1/2 of the original information intended to solve this problem (the other half belongs to antimatter, now absent). Nevertheless, the half carried by matter is still sufficient to do the job, but only if an additional dimension or degree of freedom - time (and the gravitational field of matter required to produce it) - is added to accommodate the much more complex pathway back to antimatter this reduced information set now requires.

The charges of matter are the symmetry debts of light. Symmetry debts in the form of charges are conserved through time, and may be paid at any future moment. Gravity pays the entropy-interest on matter's symmetry debts by creating matter's time dimension via the annihilation of space, decelerating the spatial expansion of the Universe in consequence. The tangential connection between historical "bulk" spacetime and the "present moment" accounts for the weakness of gravity and is necessary to

protect matter's energy and charges from entropic enervation through time.

While the slow liberation of free energy from the storehouse of bound energy is progressing (in stars, quasars, and Hawking's "quantum radiance" of black holes, and by radioactive, particle, and proton decay), there is plenty of time and energy for the information systems of matter to become self-aware, explore their creative potential, and experience and enjoy the glory and beauty of the Universe. Living, biological information systems seem to be evolving toward a unity, beauty, and wholeness of their own, a fractal expression of the unity, symmetry, and wholeness of the Cosmos of light from which they came - "as above, so below". Life is a molecular conservation domain of information, combining the negative entropy of Natural Selection with heritable genes. Life is a physically realized historical information domain, a sort of molecular iteration of historical spacetime, carrying the condensed, coded, historical information of its species and of life generally within a heritable genome. Humanity has vastly extended the molecular information conservation domain of biology into the abstract realm of memory, language, writing, libraries, museums, school systems, social systems, the arts and sciences, technology, mathematics, computers, electronic language, etc. We have also actively participated in the cosmic drive to liberate free energy from its bondage in matter - by harnessing chemical, electrical, gravitational, and nuclear (fission/fusion) forces. (See: "Newton, Darwin, and the Origin and Abundance of Life in the Cosmos".) (See also: "The Information Pathway" and "The Information Ladder".)

Whether this curious result is due to the simple physics/chemistry of matter's relentless search for antimatter, the elemental "memory" of a fractal, unifying algorithm, a Divine Plan, or some combination of these or other forces, the Cosmos at large has awakened to itself through life. Our self-consciousness is the self-consciousness of the Universe: "I and the Father are one". Earth's biological information systems (and their products) are now beginning to reach out into our Solar System, and (barring self-destruction) will continue evolving until they eventually encompass the entire galaxy, or encounter a competing alien expansion. This is Chardin's "Omega Point", the Cosmos evolving a universal, material Self, a Super Organism, a reflection in matter of its spiritual organization, in which the Universe becomes cohesive, self-aware, and intelligent, with individuals playing the role of biological cells, planets playing the role of individuals, and galaxies playing the role of states. (See also: "Chardin: Prophet of the Information Age"; "The Fractal Organization of Nature"; "de Broglie Matter Waves and the Evolution of Consciousness".)

Links:

Unified Field Theory

- Symmetry Principles of the Unified Field Theory (a "Theory of Everything") - Part I
- Symmetry Principles of the Unified Field Theory (a "Theory of Everything") - Part 2
- Principles of the Unified Field Theory: A Tetrahedral Model
- (Postscript and Commentary on paper above)
- Synopsis of the Unification Theory: The System of Spacetime
- Synopsis of the Unification Theory: The System of Matter
- Light and Matter: A Synopsis
- Global-Local Gauge Symmetries and the "Tetrahedron Model"
- Global-Local Gauge Symmetries: Material Effects of Local Gauge Symmetries
- The "Tetrahedron Model" vs the "Standard Model" of Physics: A Comparison

Gravitation

- A Description of Gravitation
- Global-Local Gauge Symmetries in Gravitation
- The Double Conservation Role of Gravitation: Entropy vs Symmetry
- 12 Summary Points Concerning Gravitation

Extending Einstein's "Equivalence Principle"
The Conversion of Space to Time
"Dark Energy": Does Light Produce a Gravitational field?

Entropy

Entropy, Gravitation, and Thermodynamics
Spatial vs Temporal Entropy
Currents of Symmetry and Entropy
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The Halflife of Proton Decay and the 'Heat Death' of the Cosmos

Cosmology

A Spacetime Map of the Universe (text - updated copy)
A Spacetime Map of the Universe (original gif diagram)

Misc. Papers on Entropy and Gravitation

A Rationale for Gravitation
The Connection Between Gravitation, Time, Entropy, and Symmetry
The Connection Between Entropy and Symmetry
Time and Entropy
Gravity and Symmetry
The Origin of Gravitation: Time and the Conservation of Energy
Parameters of Entropy and Gravity
The Origin of Time and Space
The Intrinsic Motions of Time, Space, and Gravity
The Intrinsic Motions of Matter
Traveling Twin Paradox: Covariance of Space and Time
Feynman Diagrams and "Time's Arrow"
"Heat" as the Currency of Work
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Section VII: Entropy

Gravity Diagrams

A New Gravity Diagram
The Gravity Diagram
The Three Entropies: Intrinsic Motions of Gravity, Time, and Light

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