ABOUT GRAVITY

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John A. Gowan
home page

Note to Readers Concerning "Entropy":

See: Spatial vs Temporal Entropy
See also: The "Tetrahedron Model" vs the "Standard Model" of Physics: A Comparison

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Abstract

The primordial conservation role of gravity is to provide negative energy sufficient to exactly balance the positive energy of the "Creation Event", so the universe can be born from a state of zero net energy as well as zero net charge (the latter due to the equal admixture of matter with antimatter). All subsequent conservation roles of gravity are secondary to and derived from this original creation-role.

Following on from its primary role of providing negative energy during the "Big Bang", gravity plays two further major conservation roles in the evolving universe: 1) conserving the spatial entropy drive of light; 2) conserving the non-local distributional symmetry of light. In its entropy conservation role, gravity converts the intrinsic motion of light to the intrinsic motion of time - via the annihilation of space and the extraction of a metrically equivalent temporal residue. In its symmetry conservation role, gravity converts bound to free energy in stars and via Hawking's "quantum radiance" of black holes. These two conservation roles derive from the double gauge role of "velocity c", which regulates both light's intrinsic motion (the entropy drive of free electromagnetic energy), and light's

non-local distributional symmetry (vanishing time and distance). Conserving light's non-local energy state via "location" charge, gravity simultaneously conserves light's entropy drive, since time itself is the active principle of "location" charge. Hence gravity's entropy conservation role is by default brought under the mantle of Noether's symmetry conservation theorem, revealing a pathway to the unification of gravitation with the other forces of physics: *all charges of matter are symmetry debts of light*.

Introduction
(added June 2013)

In the temporal/historical domain, the graviton plays a role similar to the photon's role in the spatial domain. We might therefore say the graviton is the "photon of time". As the photon is the entropy drive of space, creating, expanding, and cooling the spatial dimensions via its intrinsic motion, so the graviton is the entropy drive of time, creating, expanding, and aging the historical dimension.

Indeed, the graviton is hidden or implicit in the photon as an asymmetric temporal component (necessarily implied by light's "frequency"). This hidden temporal component is revealed in its explicit form when the free energy of the symmetric (non-local) moving photon is converted to the bound energy of asymmetric (local) immobile mass/matter. The intrinsic (pos-entropic) motion of light is thus instantly converted into the intrinsic (neg-entropic) motion of time, establishing and entraining matter's self-feeding and self-perpetuating gravitational field - which creates (reveals) time via the annihilation of (metrically equivalent) space. The non-local symmetric photon is converted to the local asymmetric graviton, whose intrinsic, negentropic, one-way, spatially contractile motion into the historic domain identifies the spatio-temporal location of the asymmetric (because undistributed) concentration of immobile mass-energy (matter). The 4th dimension of time is necessary to exactly specify the 3-D location of matter within a constantly expanding spatial domain. Time is therefore the active element of matter's gravitational symmetry debt or "location" charge. Bound energy's (matter's) gravitational symmetry debt of "location" arises whenever light's non-local, symmetrically distributed energy (moving freely with intrinsic motion "c") is converted into local concentrations of immobile mass-matter. (See: "The Conversion of Space to Time".)

Both space and history are entropy domains which function to guarantee (via their "infinite" velocity or their one-way character) the conservation of energy within their respective domains: space for free electromagnetic energy (light), history for bound electromagnetic energy (matter). As matter is an alternative form of light, so time is an alternative entropy drive of light - creating history as an alternative form of space. Charge is an alternative form of symmetry; gravity is an alternative form of inertia. The negative energy and entropy of gravity are necessary to balance the positive energy and entropy of light, allowing the Universe to be born from zero net energy and zero net charge (when we include the primordial/original antimatter). (See: "Spatial vs Temporal Entropy".)

The gravitational metric is the temporal metric of matter, directed oppositely to the spatial metric of light, contractile and inwardly directed rather than expansive and outwardly

directed in its spatial expression (but expansive in its historical expression). The historical/temporal dimension is at right angles to all three spatial dimensions simultaneously. Time is one-way due to the linkage between causality and energy conservation. A gravitational field is the spatial consequence of the intrinsic motion of time.

We live in a universe composed of both free and bound forms of electromagnetic energy (light and matter), space and time (their respective conservation/entropic domains), and a combined spatio-temporal metric gauged by the universal electromagnetic constant "c" and the universal gravitational constant "G". The gravitational metric modifies the spatial metric by the creation of time from space - annihilating space and replacing it with a metrically equivalent temporal residue. The temporal/gravitational component of the combined metric becomes increasingly dominant as matter concentrations grow increasingly greater and denser. Ultimately, the gravitational/temporal metric of matter completely displaces the spatial metric of light at the "event horizon " of a black hole.

At the "event horizon", space vanishes and time "stands still" - one second of time becoming of infinite duration where g = c. This ultimate, local, temporal/gravitational metric of matter is in contradistinction to a pure, non-local, spatial/electromagnetic metric of light - in which space stands still and time vanishes.

Gravity is united with the other forces through Noether's Theorem of symmetry conservation - all four forces are caused by charges which arise as symmetry debts of light - when freely moving, non-local forms of electromagnetic energy are converted to bound, immobile, local forms of electromagnetic energy. See: "A Rationale for Gravity"; and "Symmetry Principles of the Unified Field Theory".

The gravitational symmetry debt is repaid via the conversion of bound to free energy (mass to light) in various gravitationally driven astrophysical processes, such as stars, supernovas, quasars, etc. The final and total gravitational conversion of mass to light is accomplished via Hawking's "quantum radiance" of black holes, completely fulfilling the symmetry conservation mandate of Noether's Theorem, and completely repaying the symmetry debt of gravity's "location" charge. (See: "Noether's Theorem and Einstein's Interval".)

In the course of thinking and writing about gravity for more than 40 years, the following are some of the conclusions I have drawn regarding this remarkable and enigmatic force. (See: "Introduction to Gravitation".)

1) Gravity plays a double conservation role in nature, conserving:
A) the spatial entropy drive of free electromagnetic energy, converting light's intrinsic motion to the historical entropy drive of bound electromagnetic energy - time's intrinsic motion. This gravity accomplishes by the annihilation of space, which reveals a temporal residue, the metric equivalent of the collapsed space. Because entropy is an embedded corollary of energy conservation, this is gravity's major energy conservation role, seen from elementary particles to galaxies and cosmological

spacetime.
B) the non-local distributional symmetry of light's energy - as required by "Noether's Theorem". This gravity accomplishes by the conversion of bound electromagnetic energy (mass) to free electromagnetic energy (light), in stars, supernovas, quasars, etc., and ultimately and completely, by Hawking's "quantum radiance" of black holes.

The two conservation roles of gravity are a consequence of the double regulating role of "velocity c", the electromagnetic constant, which gauges both the entropy drive of free energy (light's intrinsic motion), and the "non-local" distributional symmetry of light's energy. The "intrinsic" (entropic) motion of light creates, expands, and cools the spatial cosmos; "velocity c" also vanishes the time dimension and a single spatial dimension (in the direction of propagation): clocks stop and meter sticks shrink to nothing at the speed of light (metric and distributional symmetry function). Light therefore acquires an "infinite" velocity in its own reference frame, having forever to go nowhere. Light is a 2-dimensional transverse wave whose intrinsic (entropic) motion "sweeps out" a third spatial dimension. When gravity conserves either gauge function of "velocity" c (in accordance with Noether's Theorem and the requirements of energy and/or symmetry conservation), it conserves the other by default. Space is the conservation domain of free electromagnetic energy, created by light's own embedded entropy drive (intrinsic motion).

2) Like the other four forces of physics, gravity is the consequence of a charge which arises as a symmetry debt of light. "Noether's Theorem" requires that the symmetry of light, no less than the energy of light, be conserved. *The charges of matter are the symmetry debts of light*. Identifying the (broken) symmetries of light from which the charges and their associated forces arise provides a simple conceptual basis for a Unified Field Theory: all forces trace back to a common origin as symmetry debts of light - just as all matter finds the origin of its energy in light. Matter is an asymmetric, bound form of light whose symmetries are conserved as charge and spin, whose energy is conserved as mass and momentum, and whose entropy drive or intrinsic motion is conserved as time/gravity. All matter's inherent charges and forces work spontaneously and incessantly to return matter to its primordial symmetric form - as our Sun bears daily witness.

In the case of gravity, the charge (carried by all forms of bound energy in amount Gm) is the "location" charge, whose active principle is time. "Location" charge identifies the 4-dimensional spacetime location of immobile, undistributed bound energy, which as we have seen above, breaks the non-local distributional symmetry of light's free energy as gauged by "velocity c" (because mass has no intrinsic spatial motion), and results in the eventual return of bound to free energy, as we should expect (in stars, for example). (See: "The Double Conservation Role of Gravity".)

3) *Gravity is the spatial consequence of the intrinsic motion of time*. Time is the active principle of the gravitational "location" charge. Time has "intrinsic" (entropic) motion which causes the expansion and aging of history, the temporal analog of space. The dimensions of space and history are conservation domains created by the entropic drives of light and matter, the "intrinsic" motions of free and bound electromagnetic energy. Gravity connects and conjoins these two entropic conservation domains, actually converting either into the other, creating the compound conservation domain of spacetime, wherein both free and bound forms of electromagnetic energy can find their conservation needs satisfied. The flight of time into history drags space along behind it, causing the symmetric collapse of space, which we perceive as a gravitational field. The collapse of space, in turn, liberates a

metrically equivalent temporal residue, which continues the self-feeding entropic cycle. (See: "The Conversion of Space to Time".)

4) Gravity pays the entropy-interest on the symmetry debt of matter by creating the time dimension for bound energy, through which charge conservation can have an extended significance - as a means whereby a symmetry debt can be contracted and held as a "promissory note" (a "conserved charge"), which may be redeemed at some future time, as guaranteed by the invariant principle of charge conservation (and the existence of a temporal or historical dimension as created by gravity). Our material universe functions in an historical or "karmic" (causal) mode through charge conservation in which symmetry debts, held as temporal charges, allow matter to "buy now and pay later": gravity pays the entropy-"interest" through the creation of time. Gravity funds the expansion of the historical cosmos by subtracting energy from the expansion of the spatial cosmos - via the direct conversion of space to time. As matter's symmetry debt is paid off (by the conversion of bound to free energy in stars, for example), the cosmic gravitational field is reduced and the suppressed expansion of the spatial universe begins to relax, resulting in the recently perceived "acceleration" of the cosmic expansion. (See: "Dark Energy: Does Light Produce a Gravitational Field?".)

Symmetric massless light is "non-local", atemporal, and acausal, with intrinsic (entropic) spatial motion "c", and produces no gravitational field. Asymmetric massive matter is local, temporal, and causal with intrinsic (entropic) historical motion "T", and produces a gravitational field (the source of matter's time dimension).

5) The conversion of space to time is accomplished by the gravitational annihilation of space, which reveals a hidden, latent, or implicit component of time, the metric equivalent of the annihilated space. Einstein has taught us that space is not "just" space but spacetime: destroy space and you have a metrically equivalent temporal component remaining. This temporal component is in fact the hidden entropic principle that also causes the spatial expansion of the cosmos (the "Hubble expansion" of cosmology). Freed of its spatial envelope, in which it was implicit (as "frequency"), time becomes explicit and creates, expands, and ages history by its own "naked" intrinsic and entropic motion.

6) The entropic expansive motion of space and history is necessary for reasons of energy, symmetry, and causality conservation. The dimensions of spacetime are conservation domains created by entropy which must have intrinsic (entropic) drives of light, time, and gravity in order to conserve energy, symmetry and causality via the "infinite" and/or one-way velocity of light, time, and gravitation. Gravity is the force which converts either entropy drive into the other. These reversible and interconvertible entropy drives actually oppose each other in practice. In the Sun for example, they create a dynamic balance of opposing expansive radiative (spatial) vs contractile gravitational (temporal) forces. Similarly, they cause a cosmic-scale battle between the entropic forces of light and cosmological spatial expansion, vs the gravitational entropic forces of matter, historical expansion, and consequent cosmological spatial contraction. (See: "Entropy, Gravity, and Thermodynamics".)

7) The incredible weakness of gravity has been a perennial puzzle. However, from the viewpoint of gravity as a conservation force that converts the spatial entropy drive of free energy (light's intrinsic motion) to the historical entropy drive of bound energy (time's intrinsic motion), we can finally begin to see a plausible explanation for gravity's weakness.

The first thing to note is that the weakness of gravity means that (in the context of the theory espoused here) on a per given mass basis, gravity needs to annihilate only a small amount of space to extract a sufficient amount of time to serve as the entropy drive for matter. Matter doesn't seem to require much time to energize its historical entropy drive (either that, or the extracted spatial entropy drive of light is enormously more potent than the historical entropy drive of time it replaces). Why should this be? Thinking along these lines, a rather obvious explanation comes readily to mind: massive objects such as ourselves (which are the only energy forms or states which require a historical causal dimension and its associated temporal entropy drive) are only tangentially connected to their historical entropy/conservation domain. We live only in the "now", not in the historical and causal past. Contrast this with the energy state of free energy or light, which is coextensive with its entropy domain (space). (Due to its effectively "infinite" velocity, light, in its own reference frame, is everywhere simultaneously within its spatial conservation domain.) The "now" is a tangent point on the surface of historical spacetime. P. A. M. Dirac pointed out that the ratio between the strength of gravity and the strength of the electromagnetic force was very similar to the ratio between the size of an electron and the size of the Cosmos - which quantitatively is essentially the same comparison that I am making between the tangential "now" and "bulk" historic spacetime. Our conclusion is that gravity produces only enough temporal entropy to service matter's point-like connection to its historical entropy domain. (See: "Proton Decay and the 'Heat Death' of the Cosmos".)

8) Black Holes are the most extreme expression of gravitational force - the "limiting case" - and they have much to teach us. A black hole is a region of spacetime in which the gravitational field is so powerful that its local field strength "g" is equal to the velocity of light "c". Consequently, no light can escape from a black hole - or at least not much. Stephen Hawking has calculated that a quantum mechanical effect due to the extreme shear forces at or near the "event horizon" or "surface" of a black hole actually converts the gravitational energy of the hole into a form of radiation which will eventually, over immense stretches of time, cause the total conversion of the mass or bound energy of the black hole into radiation, completely fulfilling Noether's Theorem with respect to the gravitationally held entropy and symmetry debt.

Jacob Bekenstein and Stephen Hawking have also produced a theorem which relates the surface area of the event horizon of a black hole to its entropy. In the theory advanced here (see the "Tetrahedron Model"), this surface of the black hole must be a time surface, and so the entropy in question must be temporal (historical) entropy. The logic is that once the limiting case of increasing field strength is reached (g = c), the only way to accommodate the temporal entropy requirements of any further mass inputs to the hole is to increase the effective surface area through which space can be sucked in and converted to time, so the Bekenstein-Hawking theorem makes perfect sense with regard to the notion that gravity converts space to time - just as Hawking radiation is a sensible resolution to the question of the final and complete payment of the gravitational symmetry debt. (See: *Scientific American* August 2003, page 58)

According to Einstein, in a gravitational field, meter sticks shrink and clocks run slow, and at the black hole's event horizon meter sticks shrink to nothing and clocks stop. The local gravitational metric as gauged by "g", which is superimposed upon the global electromagnetic metric as gauged by "c", completely overwhelms the latter. A gravitational metric of time and matter replaces the electromagnetic metric of space and light. Just as gravity overwhelms and replaces the atomic and nuclear binding forces in the white dwarf and the neutron star, so in the black hole gravity also

overwhelms and replaces the regulatory function of the electromagnetic spacetime metric. Time stands still at the event horizon because it is being replaced as fast as it moves away into history; meter sticks vanish because space is completely replaced by time. The event horizon represents the end point of temporal entropy, the triumph of time and gravity over space and light, and yet Hawking radiation tells us that this triumph of darkness and matter is incomplete, ephemeral, and cannot last. We should have known, even without Hawking's brilliant deduction: Noether's Theorem requires the conservation of symmetry, and the all-way spatial entropy drive of light's intrinsic motion has more symmetry than the one-way historical entropy drive of time's intrinsic motion.

At a black hole's event horizon, gravity and temporal entropy return immobile matter to an intrinsic spatial motion equal to velocity c - revealing their hidden agenda of symmetry conservation, which is nevertheless fulfilled only through Hawking's "quantum radiance". While outside the black hole, symmetry conservation is proceeding via Hawking radiation, it is likely that inside the black hole symmetry conservation is proceeding via proton decay. The extreme gravitational pressures at the central singularity squeeze the quarks of baryons back to their primordial leptonic configuration (the "leptoquark"), vanishing the color charge in the limit of "asymptotic freedom", and proton decay proceeds via the weak force "X" IVB with the emission of a leptoquark neutrino. (See: "The Origin of Matter and Information".) The inside of a black hole is therefore full of nothing but light, solving the problem of the infinite compression of matter at the central singularity. A black hole is apparently a gravitationally bound state of light, somewhat similar to a gigantic baryon, the next stage of simplification beyond the neutron star, which is essentially a gigantic gravitationally bound atomic nucleus.

> At the "event horizon" of a black hole, both clocks and light come to a halt, as the electromagnetic metric is completely replaced by the gravitational metric. Within the event horizon, all former functions of the electromagnetic metric are either defunct or performed by the gravitational metric, including those of the the binding forces between particles. Also absent are the primordial entropy drives of space and history, the intrinsic motions of light and time. Hence the black hole is just that physical environment in which entropy, in its usual electromagnetic expressions, does not exist, and hence no change is possible as we ordinarily experience it. But gravitation is also a form of (negative) entropy, and indeed we find, just at the boundary between the electromagnetic and gravitational domains, entropy operating to convert the mass of the black hole entirely to light - via the mechanism of "Hawking radiation". This is the ultimate expression of Noether's symmetry conservation theorem, the complete gravitational conversion of bound to free energy, definitively revealing the final conservation rationale for gravitation, and by extension, for time as well.
>
> **9)** Finally, although I have no talent in mathematics (as my family is fond of reminding me), I have nevertheless attempted to formulate a "concept equation" representing the gravitational conversion of space to time. Obviously I accept Einstein's gravitational field equations as essentially correct (without the "cosmological constant"), except for the caveat expressed in: "Dark Energy: Does Light Produce a Gravitational Field?".
>
> In my "concept equation" (S) represents the spatial volume annihilated or

collapsed by gravity "-Gm" in order to produce the historical entropy drive (T) or time dimension of matter for any given mass "m".

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

It is to be understood that the temporal component is the metric equivalent of the annihilated space (as gauged by the electromagnetic constant "c"), and is "hidden" in ordinary space as "spacetime", elucidated by Einstein. Since every massive elementary particle, atom, or other form of bound energy produces its own gravitational field: -Gm(S), every mass produces its own time dimension (T)m, as gauged by the universal gravitational constant "G". The gravitational constant is negative because it requires energy to annihilate space and to convert a symmetric spatial entropy drive (the intrinsic motion of light) to an asymmetric historical entropy drive (the intrinsic motion of time). Furthermore, it is this same temporal component (at work in the electromagnetic wave through "frequency") that is also ultimately responsible for the spatial entropy drive of light's intrinsic motion. The symmetric, spatial component of light's entropy drive ("wavelength") must "flee" the embedded asymmetric temporal component ("frequency") to maintain light's non-local symmetric energy state and suppress the asymmetric time dimension, which, like the proverbial "bur under the saddle", is an intrinsic feature of light's own nature - the embedded entropy corollary of energy.

Energy plus symmetry conservation, spurred by the implicit presence of time, is the cause of light's intrinsic motion. Implicit in "frequency", time is the universal entropy element embedded in every form of energy: frequency multiplied by wavelength = c; E = hv; hv = mcc. Time is the entropic motivator of cosmic expansion, whether implicit in the intrinsic motion of light and the expansion of space, or explicit in the intrinsic motion of gravity and the expansion of history. (See: "A Description of Gravitation".)

10) The gravitational field of bound energy gives the impression that matter actually does have an intrinsic spatial motion. However, due to the perfectly symmetric character of matter's gravitational field (caused by the equivalent coupling of time to all 3 spatial dimensions, conserving both inertial symmetry and energy), matter has no "net" intrinsic spatial motion via its own gravity. Rather, the intrinsic (entropic) motion of matter's time dimension collapses space and provides bound energy with true intrinsic (and one-way) motion in the historical domain, at right angles to all three spatial dimensions. The one-way character of time and gravity are thus linked, and both are due to the causal nature of matter and matter's historical domain of "karmic" or causal information. *A gravitational field is the spatial consequence of time's intrinsic motion.*

11) The conservation role of gravity addresses the four conservation parameters of the "Tetrahedron Model": entropy (converting light's intrinsic motion to time's intrinsic motion), symmetry (the conversion of bound to free energy), causality (the creation of time and historic spacetime, and including "Lorentz Invariance"), and finally energy itself (providing negative energy to balance matter's positive energy). All these roles are intimately connected and related to the regulatory or "gauge" functions of "velocity c". Negative gravitational energy is provided by an imploding rather than exploding spatial metric, which in turn is caused by the intrinsic motion of time, matter's entropy drive (time and gravity induce each other endlessly). Time provides matter's causal linkage and creates matter's historic conservation domain of information, while simultaneously providing matter with a "location" charge representing light's non-local distributional symmetry debt. "Location" charge (whose active principle is time) identifies the 4-dimensional location of immobile, undistributed mass-energy, and eventually converts matter back to its original and symmetric form, light (in stars, black holes, and other astrophysical/gravitational processes). The active "push" or "drive" of this chain of conservation effects is provided by entropy - the implicit or explicit presence of time causing the expansion of space or history.

12) Entropy allows the transformation of free energy to "work"; symmetry conservation allows the conversion of free energy to information (charge); energy conservation allows the conversion of free energy to bound energy (mass); gravity allows the conversion of light's entropy drive to matter's entropy drive (time). Add in the asymmetric action of the weak force to break the primordial symmetry of light and its particle-antiparticle pairs, and you have the makings of a Universe such as our own, composed of free and bound forms of electromagnetic energy and their compound metric conservation domain, historic spacetime.

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