

## "Dark Energy" and the "Accelerating Universe": Does Light Produce a Gravitational Field?

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### Abstract

Light traveling freely in space does not produce a gravitational field - contrary to most "establishment" thinking. Because the "Interval" of light = zero, light has no specific location in spacetime (light is "non-local"), and hence cannot provide a center for such a field. Since an uncentered gravitational field violates energy (and symmetry) conservation (including the "Equivalence Principle"), light moving freely in vacuum cannot and does not produce a gravitational field. This result is important for theories attempting to unify gravity with the other forces.

### Introduction

The "Interval" of light = zero. This is Einstein's most important formulation of light's "non-local" symmetric energy state. The "Interval" is a quantity of spacetime, a measure of 4-dimensional distance, invariant for all observers, regardless of their relative or accelerated motion. The function of the Interval is to protect causality in the plastic dimensionality of Einstein's relativity theories. Light has no Interval because light has no  $x$  (length in the direction of motion) or  $t$  (time) dimension. Having no Interval, light's position in 4-dimensional spacetime cannot be specified. Having no distance or time parameters, and yet having intrinsic motion, light has, in effect, forever to go nowhere - within its own reference frame (spacetime). From this results the notion of light's "infinite" velocity and the symmetric distribution of light's energy throughout spacetime - everywhere, simultaneously.

### Light is "Non-local"

Massless light is non-local, a-temporal, and a-causal. Light has no associated gravitational field because it has no "Interval" and hence no "location". Being non-local, light cannot provide a center for a gravitational field, and an uncentered gravitational field constitutes a violation of energy conservation (because it would produce "net" energy, a net motion and acceleration in spacetime of the gravitational source). Consequently, freely moving light cannot and does not produce a

gravitational field. Light's "zero Interval" is precisely the symmetry condition necessary to prevent the formation of an explicit time dimension and its associated gravitational field. "Velocity c" could hardly function as the entropic, metric, and symmetry gauge of spacetime if light itself were plagued by a metric-warping "location" charge and gravitational field (which moreover would have to vary with the energy content of individual photons). Light has no time dimension nor the gravitational field which could produce one. (See: "[A Description of Gravitation](#)".)

This is the basic conservation reason why the intrinsic motion of light - whatever its actual numerical value - must be the "velocity of non-locality", gauging the symmetric energy state and entropy drive of free electromagnetic energy, the gauge of metric symmetry and the equivalence between space and time, effectively an infinite velocity within its own spatial reference frame and conservation domain. Otherwise light would have a gravitational "location" charge, a time dimension, and a gravitational field, and spacetime would immediately collapse into a black hole. If light produced a gravitational field, the Universe would have been "still born" as a black hole; instead of a "Big Bang", there would have been a "Big Crunch". The only reason the Universe unfolds from its initial singularity is that almost all of its energy is in the form of light (because of matter-antimatter annihilations) which produces no gravity, but instead blasts apart the small residue of matter forming our material Cosmos. One of gravity's major conservation roles is to produce the time dimension of bound energy. (See: "[The Conversion of Space to Time](#)".) Since light has no time dimension and no bound energy, light has no need of a gravitational field. (See: "[The Double Conservation Role of Gravity](#)".)

The fact that the scientific "establishment" believes that freely moving light in vacuum (spacetime) produces a gravitational field, continues to be a major conceptual roadblock in the ongoing effort to unify gravitation with the other forces. This is also a crucial point of difference between my theory of gravity's origin and "establishment" physics. Of course, when captured by the electron shell of an atom (for example), light loses its intrinsic motion and symmetric non-local energy state, and in this bound condition its energy contributes to the atom's overall gravitational field. But it is no longer light or free energy, it is bound energy with a specifiable location - the atom's center of mass. (See: "[Symmetry Principles of the Unified Field Theory](#)".)

$$\mathbf{E = mcc (Einstein); E = h\nu (Planck); h\nu = mcc (DeBroglie)}$$

The problem seems to begin with Einstein's  $E = mcc$ ; from this justly famous equation it seems everyone assumed, including Einstein, that light has mass and so produces a gravitational field. But light obviously does not have mass, it has momentum and energy ( $E = h\nu$ ), which is *equivalent* to mass ( $h\nu = mcc$ ), but is not mass itself. ("Mass" is the source of inertial resistance or gravitational "weight" (or gravitational field energy) of any energy form.) Light is manifestly different from bowling balls: light has intrinsic motion c, light is two-dimensional, light has a zero Interval; bowling balls have a time dimension and are four-dimensional with a positive Interval. And the fact that light is "bent" by a gravitational field does not mean it produces a gravitational field. Light follows the geodesic paths of spacetime, and is a co-mover with spacetime, like every other form of energy which moves in spacetime. But light itself does not "warp" spacetime nor produce a gravitational field; light is the primordial symmetric state of electromagnetic energy, a symmetric energy vibration of the metric structure of spacetime. Gravitational fields and the time dimension they produce are only associated with secondary, massive, asymmetric forms of energy derived from light ("ponderable" atomic matter).

"Velocity  $c$ " is the "gauge" (regulator) of metric symmetry, of Einstein's "Interval", of causality, of light's non-local symmetric energy state, and of light's entropy drive, in addition to gauging the magnitude of electric charge, and the energetic equivalence between mass and free energy. "Velocity  $c$ " is an effectively infinite velocity because of these metric/entropic gauge functions, which protect energy conservation and causality. If you still think light and bowling balls are the same because  $E = mc^2$ , then try bouncing actual bowling balls back and forth between two mirrors at "velocity  $c$ ", as light does so easily with their images. To miss this point is to miss the opportunity to unify gravity with the other forces through the symmetry principles of Noether's Theorem. "Velocity  $c$ " is the gauge of a non-local symmetry condition characterizing the equitable distribution of light's energy throughout spacetime: *the charges of matter are the symmetry debts of light* - including the "location" charge of gravity, whose active principle is time. (See: "[Entropy, Gravitation, and Thermodynamics](#)".)

Einstein distinguished between the gravitational energy of free space, which he seems to treat as a metric stress tensor producing a gravitational field whether located inside or outside a planet ("gravity gravitates"), and a free electromagnetic field, which he apparently classifies as another form of matter or bound energy. This latter I believe is a mistake (even Einstein made them occasionally): free electromagnetic energy must be gravitationally distinguished from bound electromagnetic energy. Unlike gravitation, the free electromagnetic field does not cause a metric stress in spacetime (does not "warp" or "curve" spacetime), and so should not be treated under the same rules and assumptions as the spatial energy ("self energy") of the free gravitational field: even if "gravity gravitates" (which I also doubt), light does not. (See Einstein's discussion on page 143, section 14, in the Dover paperback "The Principle of Relativity", 1952.)

In the gravitational case, how could one experimentally distinguish "gravity gravitates" from "gravity does not gravitate"? The hypothesis "gravity gravitates" is not falsifiable, as it contains a circular argument.

In the "[Tetrahedron Model](#)" (as advocated on this website), a *gravitational field is the spatial consequence of the intrinsic motion of time*. Furthermore, time is the active principle of gravity's "location" charge. A "graviton" is a quantum unit of time or temporal entropy. But none of these considerations apply to light, which, according to Einstein, has no time dimension. In the "Tetrahedron Model", light is the archetypical example of a perfectly symmetric energy form; light does not and cannot produce a gravitational field.

That free electromagnetic energy (light) moving in vacuum at velocity  $c$  does not produce a gravitational field is absolutely crucial to understanding the theory presented on this website (the "Tetrahedron Model") concerning the role of gravity and its unification with the other forces. While I defer to Einstein's authority in almost every other matter, here I (reluctantly) part from the scientific hero of my youth - or at least with the "establishment's" interpretation of his thinking on this point. (See: "[The 'Tetrahedron Model' vs the 'Standard Model': A Comparison](#)".)

### **The Accelerating Universe**

Clearly, testing this difference between the theories will be difficult because of the extreme weakness of gravity and the fact that the test must be conducted on light in free flight. Nevertheless, observational evidence in favor of this idea already exists in the recently discovered "acceleration" of

the Cosmos. See the paragraphs below, copied (with minor changes) from "[A Spacetime Map of the Universe](#)":

Because the Universe is constantly converting its original mass into light (via nuclear fusion/fission, supernovas, quasars), but no known process adds to the original mass (no new baryons are ever created), we expect the total gravitational field of the Universe to decrease with time (since light (free electromagnetic energy) produces no gravitational field). Hence a small "acceleration" of the Cosmic expansion (actually a small reduction in the rate of gravitational deceleration) is to be expected from this mass/gravity loss. However, if the early Universe converted mass to light at a much higher rate than today (vigorous star formation, galaxy mergers, quasar and black hole formation), a significant reduction to the total gravitational field during that era could result. Black holes, for example, can convert a significant percentage of a particle's rest mass into free energy as it falls toward the "event horizon".

It has been objected that the conversion of bound to free energy in stars is not sufficient to account for the recently observed "acceleration" of the Cosmos. However, if the conversion of bound to free energy also occurs in the "dark matter" presumed to be five times more abundant than the visible matter of the stars, then such mass conversions, driven by the conservation of the symmetry of free energy, whether that energy is "dark" or "light" (as demanded by "Noether's theorem"), might well be sufficient to account for the observed reduction in the gravitational deceleration. Finally, the existence and decay (including "oscillation") of a fourth, heavy "leptoquark" neutrino might even account for the reduced deceleration within the boundaries of "ordinary" matter.

The "acceleration" (or reduced deceleration) of the expansion of the Cosmos is caused by the expansive entropic property (intrinsic dimensional motion) of light, combined with a reduction of the total gravitational energy of the Cosmos. This expansive combination is the "dark energy" or "cosmological constant" producing the observed acceleration (which should have been anticipated if we had realized that light does not produce a gravitational field). In any case, it seems obvious that this "cosmic acceleration" constitutes the observational evidence that light, traveling freely in spacetime at velocity  $c$ , does not and cannot produce a gravitational field.

### **Time (added Feb., 2014)**

It should be noted that I treat the gravitational "location" charge like other charges, in the sense that antimatter carries the same charge but with an opposite sign. Hence particle-antiparticle pairs will cancel each other's "location" charges, just as they do all other charges. My expectation is that the antimatter gravitational "location" charge nevertheless is universally attractive with respect to bound energy of any type, in the same manner as our familiar matter gravitational charge (since space is perfectly symmetric with respect to "anti-space"), but differs in the one-way (asymmetric) "direction" of antimatter time. We are familiar with our own one-way time asymmetry - in the anti-universe, I expect this same one-way causal temporal flow to occur, but in a "direction" opposite to our own. By this I do not mean causality is violated in the anti-world (which would also violate energy conservation), I simply mean the one-way direction of time is opposite our own, much like "east vs west", but expressed within the temporal rather than spatial parameter. We have a related example of

such an effect in the "handedness" or "parity" of our neutrinos - all matter neutrinos are left-handed, all antimatter neutrinos are right handed, distinguishing the information content of matter vs antimatter.

Wheeler and Feynman raised similar speculations regarding the time travel of antimatter, but later abandoned them, evidently due to causality concerns. However, I think the causality violations can be avoided if a purely "directional" reversal of time flow is postulated, that is, a reversal (like parity) that does not have causal consequences violating energy conservation.

Nevertheless, two oppositely directed time flows cannot coexist within the same reference frame, hence accounting for the immediate and violent annihilation of matter vs antimatter (the head-on collision of two universes time-traveling in opposite directions). This may be the actual mechanism producing the attraction between opposite electric charges - whereas the principle involved is the conservation of light's non-local symmetric energy state (returning bound energy to light via particle-antiparticle annihilation reactions).

Accordingly, in the "[Spacetime Map of the Universe](#)", we would diagram the anti-universe with the spatial axis increasing upwards, as before, but with time increasing toward the right, rather than the left, as in the [original diagram](#). That is, the universe and anti-universe would occupy opposite (left-right) quadrants in the upper half of the figure.

### **Links:**

#### **Gravitation**

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[Global-Local Gauge Symmetries in Gravitation](#)

[The Double Conservation Role of Gravitation: Entropy vs Symmetry](#)

[Extending Einstein's "Equivalence Principle"](#)

[The Conversion of Space to Time](#)

#### **Entropy**

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[Spatial vs Temporal Entropy](#)

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#### **Cosmology**

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[A Spacetime Map of the Universe \(text - updated copy\)](#)

#### **Gravity Diagrams**

[A New Gravity Diagram](#)

[The Gravity Diagram](#)

[The Three Entropies: Intrinsic Motions of Gravity, Time, and Light](#)

[Nodes of the Gravitational Metric](#)