QFT Origin of Gravitation?

D.T. Froedge

Formerly Auburn University
Phys-dtfroedge@glasgow-ky.com

ABSTRACT

It has been demonstrated by this author that the effect of gravitation can be mimicked on the dynamics of photons and particles by a gradient in c [1], [2]. It is certainly true for the dynamics of photons and confined photons. Given this; a demonstration that a photon reciprocating in a cavity generates a gradient in c, of the proper value, in the surrounding space by methods of QFT, would transform gravitation form a distinct force, to electromagnetic phenomena.

Since there are well-known processes defined in QFT and path integral formulations of QM, that alter the velocity of light in the proximity of moving particles,[3] it is speculated that these processes could be the progenitor of the gravitational phenomena. It is a bit of speculation, but not farfetched with respect to known QFT phenomena.

It has long been known that a photon entering a gravitational potential follows a path identical to that of a photon in a variable speed of light defined by the Shapiro velocity for Minkowski flat space [4]. A spatially variable speed of light is implicitly present in General Relativity, and in fact has a long history starting in the pre GR efforts of Einstein and others. The difference in the approach taken in this author's papers, [1], is not that gravitation changes the speed of light, but that gravitation **is a change in the speed of light.** Newton's apple falls not because of an increase in energy, but because the speed of light at the branch is higher than the speed of light at the ground.

Simplifying the Discussion

First; it is observed that a photon confined in a reflective cavity constitutes rest mass. If to an empty cavity having a given mass is added a number of photons, the energy is increased, for an outside observer the increase though small, constitutes

an inertial or rest mass increase. For a black body cavity containing black body radiation the effect may be small, but in the case of an atomic nucleon the addition of a gamma ray is quite measurable. It must be concluded that the radiation confined in a black body cavity must contribute to the rest mass of the cavity and must be included in its inertial mass.

Second; if confined photons must be included in the rest mass, then the presence of the photons must also generate gravitational attraction. It must be concluded that a single photon bouncing back and forth between two reflectors is somehow generating the effect of gravitation, and in the view of this author a gradient in c.

Consider an apparatus having a cavity with opposing mirrors and having photons trapped between the mirrors. From conservation of energy the apparatus has more mass and generates more gravitational attraction than the cavity without the photons. There is not speculated an interaction between the photons, so the photons that are bouncing back and forth must be generating gravitation.
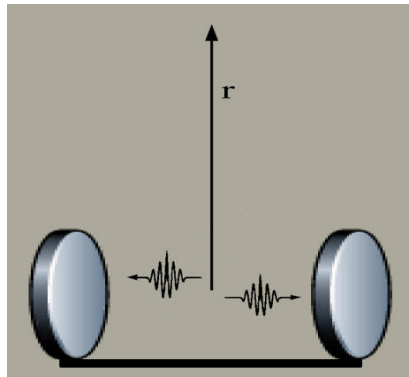

Fig1 *Photons trapped between mirrors of an apparatus increase the mass and thus the gravitational attraction of the apparatus.*

The increase in energy of the system is $h v$ so the mass of the apparatus increase as a result of a trapped photon is:

$$m = \frac{\hbar \omega}{c^2} \qquad (2.1)$$

The gravitational potential due to a confined photon is then:

$$\frac{\mu}{r} = \frac{G\hbar\omega}{c^4 r}$$ (2.2)

Putting this into the radial value of the index of refraction [5] of light in flat space yields: *

$$c = c_0 \left(1 - \frac{G\hbar\omega}{c^4 r} \right)$$ (2.3)

or:

$$\Delta c = \frac{G\hbar}{c^3 r} \omega$$ (2.4)

Noting that the square of the Planck radius is $G\hbar / c^3$ this can be stated as:

$$\Delta c = \frac{r_P^2}{r} \omega ,$$ (2.5)

which if the motion of the photons generates gravitation, has to be the change in c at a distance r induced by a photon The fact that the Planck radius is the constant in the equation is quite curious.

If the premise is correct then Eq.(2.5), would be the result.

By the methods of path integrals noted by Feynman the probability for the particle moving from point a to point b, exist throughout spaces, it has already been shown by the methods of Quantum Electrodynamics that a photon beam induces a change in the velocity of light in the vicinity of the beam.
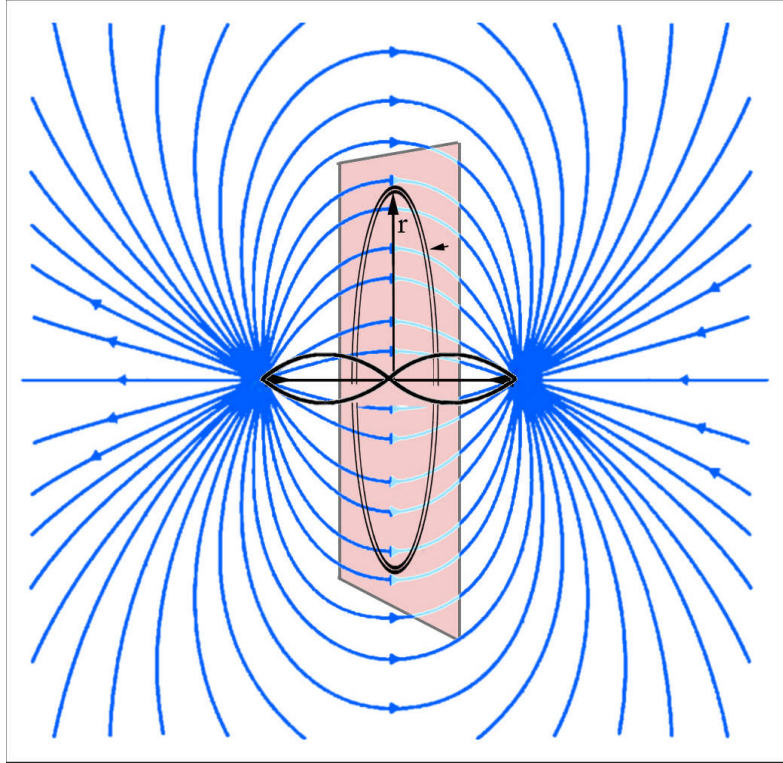
Fig.2.This illustration shows the path actions induced by a pair of oscillating photons.

From the work of D. Kharzeeva, et.al, [6] it is shown that for an intense laser beam the QFT effects related to electron–positron loops induce vacuum "self-focusing" which is a vacuum alteration of the index of refraction in the speed of light in the vicinity of the beam

A particle model being reciprocating bosons in a massless box, as asserted here, constitutes an intense, highly energetic back and forth reciprocal motion, orders of magnitude greater than a laser.

It is suggested here that the multiple path integration of the photon action over all space would alter the velocity of light near the path as a function of r, and if Eq.(2.5), is realized the connection between gravitation and QFT would be established.

* More accurately the asymmetric gravitational induced velocity of light should be

$$c = c_0 \left(1 - \left(1 + \cos^2 \theta\right) \mu / r\right)$$, with θ being the angle between the velocity and the radius vector[5]

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3. D. Kharzeeva, K. Tuchinb, Vacuum Self–Focusing of Very Intense Laser Beams, arXiv:hep-ph/0611133v2

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