

Presentation APS 1/29/2017
DT Froedge

The discussion of the conjecture that Gravitation is a gradient in c

By projecting the General Relative metric of a photon trajectory onto flat space, a photon moves through free space as if the index of refraction around a gravitating body described by:

$$\eta_{\theta} = \left(1 - 2 \frac{\mu}{r} \right)^{-1}$$

7. Roger Blandford, Kip S. Thorne, Applications of Classical Physics, (in preparation, 2004), Chapter 26
<http://pmaweb.caltech.edu/Courses/ph136/yr2012/1227.1.K.pdf>

This index of refraction using Fermat's principle properly calculates trajectories and gives the proper deflection of light for a solar grazing photon.

Anisotropic Version

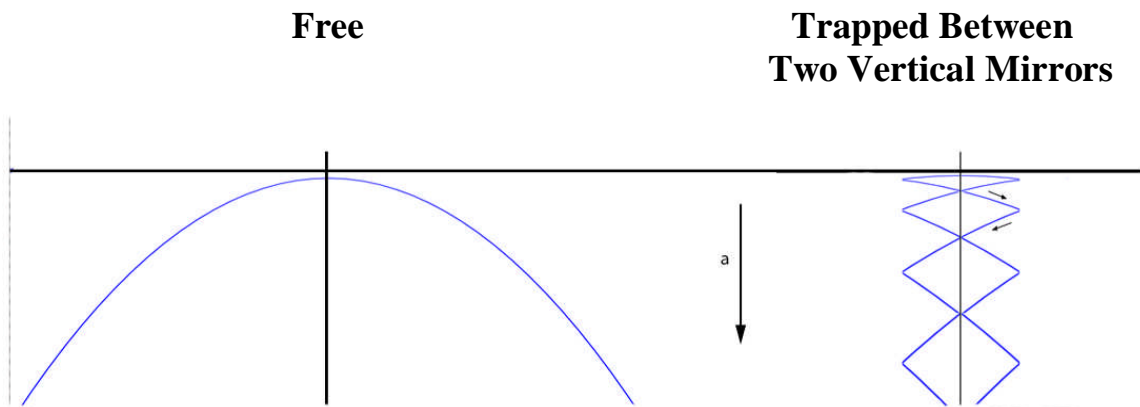
Karimi et.al. did a more rigorous development using the Schwarzschild metric that showed that the actual index of refraction is anisotropic respect to the radius vector and is:

$$\eta = \left(1 - \left(1 + \cos^2 \psi \right) \frac{\mu}{r} \right)^{-1}$$

8. F. Karimi, S. Khorasani, Ray-tracing and Interferometry in Schwarzschild Geometry, arXiv:1001.2177 [gr-qc] arXiv:1206.1947v1 [gr-qc] 9 Jun 2012

Photon Trajectories

Using this index of refraction and well known Fermat relations, it can be shown that if a photon is trapped between two vertical parallel plates the vertical acceleration of the photon is exactly the same as a massive particle:



Trapped Photon

The argument can be made that a trapped photon oscillating between two mirrors constitutes a rest mass and the reasoning is:

One: The photon has energy $E = \hbar\omega$

Two: The photon is confined to a local space.

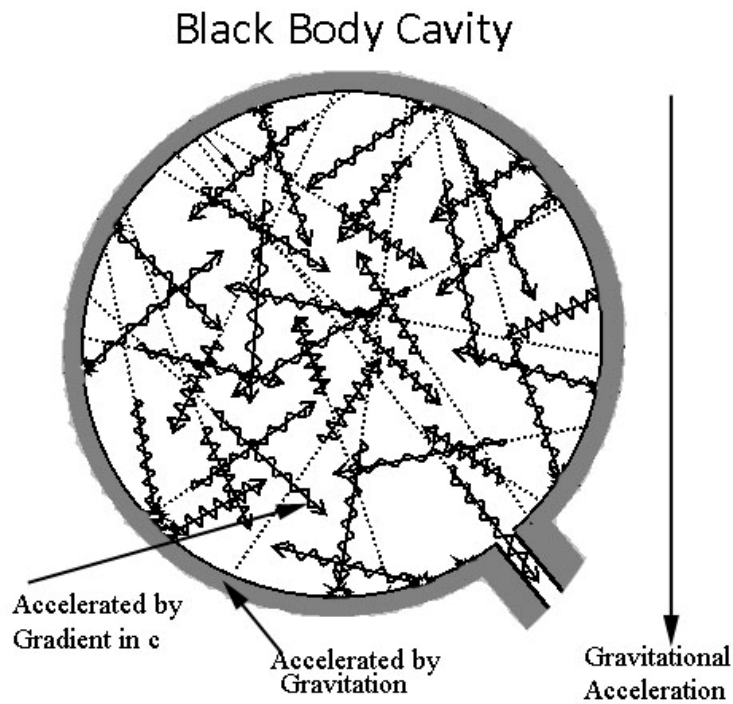
Three : In the same way a nucleon increases its mass as the result of absorbing a gamma, the mass of the apparatus containing the photon has more mass.

$$\Delta m = \hbar\omega / c^2$$

Internal Black Body Radiation

Note that the mass and gravitation from a black body cavity must include the contained energy in the black body cavity.

Every photon in the cavity is part of the rest mass

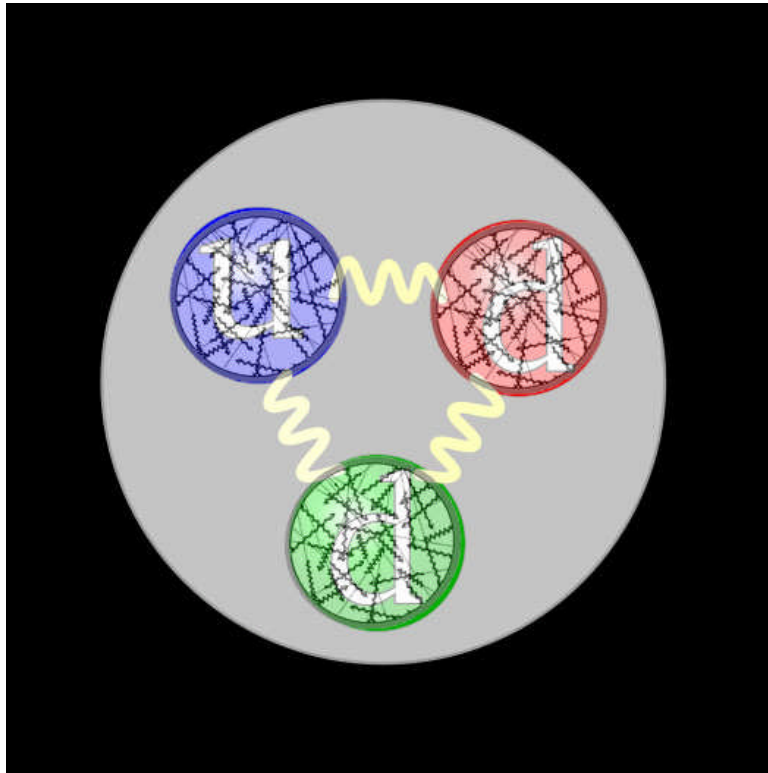


And the photons *acceleration under a gradient in c* is exactly the same as the *acceleration by gravity of the massive particles* containing those photons.

Constituents of massive particles

It is not a stretch of the imagination to suggest that the substructures of massive particles whatever they are, are null vector particles traveling at c and having a vanishing Lorentz magnitude meaning their trajectories are subject to changes in c just as is a photon.

If so, then the motion is deflected in a gradient in c just as a trapped photon



Thus the particle containing only null vector particle constituents, accelerates in a gradient in c *just as a particle in a gravitational field.*

The Implication

(So what?) If Gravitation is only a gradient in c

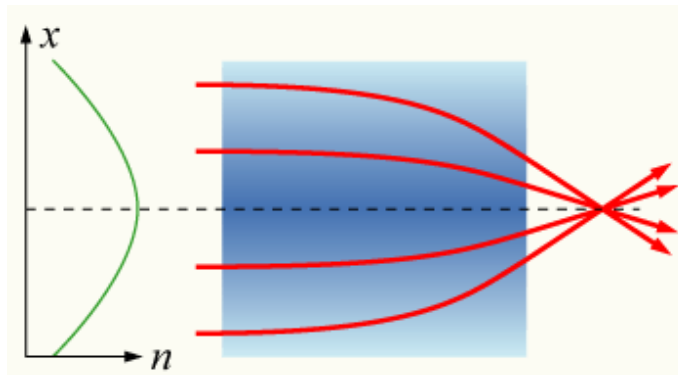
A well known QFT phenomenon vacuum polarization makes this very important. Vacuum polarization not only affects the gradient in c , but has been postulated to be the origin of the velocity of light.

1. M. Urban, et.al. The quantum vacuum as the origin of the speed of light, The European Physical Journal D 67(11):219- November 2013 <http://arxiv.org/abs/1302.6165>

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

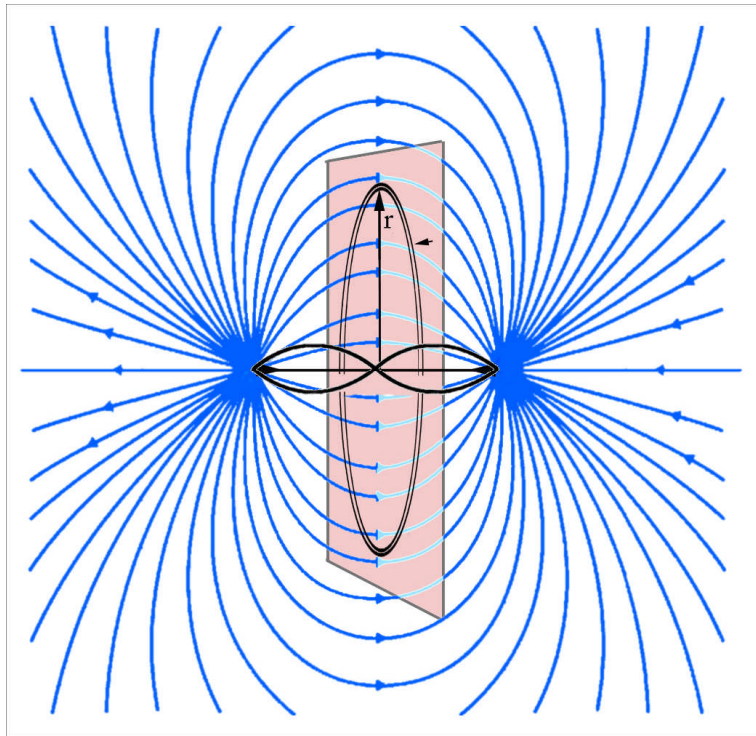
Self-trapping of electromagnetic beams in vacuum supported by QED nonlinear effects
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From QFT , passing photons generate a change in the local value of c and thus a gradient in surrounding the trajectory c , a strong laser beam is theoretically able to self-focus due to the change in c induced by the passage of the photons the other photons.



Path Integral Trajectory of Photon

Possible paths of a photon moving from point a to b:



Illustrating the path integral formulation of QFT shows that a particle oscillating between points has a probability of traveling throughout space and thus inducing a change in the index of refraction in its proximity.

If the change in the index of refraction in the area surrounding an oscillating photon can be shown to be

$$\Delta c = \frac{r_p^2}{r} \omega ,$$

Where r_p is the planck radius then the effect induced is the same as gravitation

The Argument

- 1: A photon trapped between two reflectors whether mirrors or in a black box cavity represents rest mass. From the outside the photon is part of the total energy and cannot be ignored as part of the proper mass.
- 2: A photon reflecting between two parallel vertical mirrors accelerates vertically in a gradient in c exactly as a mass particle in a gravitational field.
- 3: If a trapped photon is mass then a photon oscillating between two mirrors must generate gravitation the same as a mass particle of the same energy.
- 4: An energetic photon can by virtue of QFT generate a gradient in c in its path vicinity.

If this is true then:

Gravitation is an electromagnetic effect not a curvature of spacetime!