About speed of light and time dilation

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Abstract

Here are discussed two hypotheses how gravitation may effect speed of light.
Both of them well explain known behavior of quantum in gravitation,
therefore they can be useful to generate new ideas for new experiments
to test current theories and to find new phenomenas.
Here is also proposed a new view to well known time dilation phenomena.

Introduction

Although special and general theories of relativity are widely accepted but because of their
pure geometric character there are many attempts to find deeper roots of known facts.
For example Erik Verlinde [1] made a nice attempt to explain gravitation by entropy laws.
Daniel Y. Gezari [2] shows the lack of experimental data to postulate c like invariant constant.
Therefore likely the best way to find new ideas for new experiments is to invoke new hypotheses.
Following this way I propose here two hypothesis how gravitation may effect speed of light.
Initially they were generated to find alternative ways to explain the reason why black holes exist.

Hypothesis 1

Speed of light depends on gravitation by equation,

$$c_{gr}^4 + v_{esc}^2 * c^2 = c^4 \tag{1}$$

where

c_{gr} - speed of light in gravitation,

v_{esc} - gravitation escape velocity,

c - speed of light far from gravitation.

Hypothesis 2

Speed of light depends on gravitation by equation.

$$\vec{c}_{gr} = \vec{c} + \frac{\vec{a}}{|\vec{a}|} * \sqrt{2 * \left| \sum_i \left(\vec{a}_i * r_i \right) \right|} \tag{2}$$

where

$\vec{c}_{gr}$ - speed of light in gravitation,

$\vec{c}$ - speed of light far from gravitation,

$\vec{a}$ - free fall acceleration created by all masses,

$\vec{a}_i$ - free fall acceleration created by point mass,

r_i - distance to point mass.

Let's see what does equation (1) provide

This equation multiplied by m^2 gives equation for total energy of mass in gravitation

$$(m * c_{gr}^2)^2 + (m * v_{esc})^2 * c^2 = (m * c^2)^2$$

$$E_{inner\_in\_gravitation}^2 + E_{additional\_inner\_angular\_momentum}^2 = E_{total}^2$$

(3)

and multiplied by $\left(\dfrac{h * f}{c^2} \right)^2$ it gives equation for total energy of quantum in gravitation

$$\left(h * f * \frac{c_{gr}^2}{c^2} \right)^2 + \left(h * f * \frac{v_{esc}^2}{c^2} \right)^2 = \left(h * f \right)^2$$

$$E_{quantum\_in\_gravitation}^2 + E_{additional\_angular\_momentum}^2 = E_{quantum\_total}^2$$

(4)

Now we may find the energy an atom emits

$$E_{atom\_emission} = \Delta E_{inner\_in\_gravitation} = \sqrt{\Delta E_{atom\_total}^2 - \Delta E_{additional\_inner\_angular\_momentum}^2} =$$

$$= \sqrt{\Delta \left(m * c^2 \right)^2 - \Delta \left(m * v_{esc} * c \right)^2} = \Delta \left(m * c^2 \right) * \sqrt{1 - \frac{v_{esc}^2}{c^2}} = \Delta E_{atom\_total} * \sqrt{1 - \frac{v_{esc}^2}{c^2}}$$

(5)

And according to it the emission frequency is equal to

$$f = \frac{E_{atom\_emision}}{h} = \frac{\Delta E_{atom\_total}}{h} * \sqrt{1 - \frac{v_{esc}^2}{c^2}}$$

(6)

Like we see the frequency of quantum depends on the gravitation where it was emitted.
After emission the quantum travels in space with constant frequency.
But speed of quantum is changing during this travel. It depends on gravitation.

The reason why the speed of light is changing and the reason why an atom emits less energy quantum in gravitation hides in dependence between gravitational potential and electromagnetic constants.
In gravitation we will have

$$\frac{1}{\varepsilon_{0\_gr}} * \frac{1}{\mu_{0\_gr}} = c_{gr}^2 = c^2 * \sqrt{1 - \frac{v_{esc}^2}{c^2}}$$

(7)

where ε_{0_gr} - vacuum permittivity in gravitation

and μ_{0_gr} - vacuum permeability in gravitation.

Therefore electromagnetic interaction becomes weaker in gravitation
and some part of inner electromagnetic energy converts to energy of inner angular momentum.

The reason why electromagnetic constants are changing can be explained by vacuum structure. From quantum mechanics we know that space is filled with many types of virtual particles. So we may guess that some type of these virtual particles may be responsible for realization of electromagnetic interaction. In gravitation these particles may be separated. Near masses a number of mentioned virtual particles which response for electromagnetic interaction may decrease. Therefore vacuum permittivity and vacuum permeability are changing. The reason why virtual particles separate in gravitation can be explained by some modification of Arnold's Stein proposal [3].

Similar predictions about speed of light were independently done by A. Unzicker [4], H. E. Puthoff [5] and other authors. But here I propose different equation with different motivation for such phenomenon.

Now let's see what does equation (2) provide

Equation (2) defines asymmetric speed of light. Speed of light increases to the direction of big masses. At the simplest case when we have quantum outside single mass equation (2) simplifies to

$$\vec{c}_{gr} = \vec{c} + \frac{\vec{a}}{|\vec{a}|} * v_{esc} \tag{8}$$

It looks like ether falls down with escape velocity. In other words at the surface of the Earth we move in space of ether with escape velocity. Now let's say that relativistic equation for time dilation

$$\Delta t_{motion} = \frac{\Delta t_{rest}}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{9}$$

is right only in ether frame. By putting escape velocity to this equation

$$\Delta t_{gravitation} = \frac{\Delta t_{far\_from\_gravitation}}{\sqrt{1 - \frac{v_{esc}^2}{c^2}}} = \frac{\Delta t_{far\_from\_gravitation}}{\sqrt{1 - \frac{2*G*M}{R*c^2}}} \tag{10}$$

we get the same equation for time dilation like general relativity provides for gravitation.

Time dilation in motion which is relative to ether may happen because of Doppler effect. Some part of inner electromagnetic energy which responses for quantum emission decreases by Lorentz factor. This energy transforms to energy of inner momentum or to inner energy of other types.

Similar predictions about speed of light were independently done by Reginald T. Cahill [6], Henry H. Lindner and other authors.

But deeper origins of those both hypotheses I see in Nicolas' Fatio de Duillier proposal about the origins of gravitation made in 1690. In its modern version could be used virtual quanta of dark energy and virtual particles of dark matter. In empty space far from gravitation dominate quanta of dark energy. By interacting with masses dark energy quanta convert to virtual particles of dark matter.

Let's say speed of light depends on average speed and on density of dark energy. If quanta of dark energy have very short lifetime, than for speed of light in gravitation we have equation (1) and if lifetime is big, than for speed of light in gravitation we have equation (2). In case lifetime of quanta of dark energy have some intermedia value there could be used more complex equation composed from both of these two.

Comparisons, conclusions and proposals for new experiments

Both hypotheses provide the same reason for time dilation. Time slows down in gravitation because some part of inner electromagnetic energy converts to other types of energy. It is most likely that this energy converts to energy of inner momentum.

Extending this idea we may say that all experimental data with atomic clock dilation is based on inner energy conversion from electromagnetic to energy of other types.

Both hypotheses well explain all classic experimental data for quantum behavior in gravitation, including light bending, Pound-Rebka experiment, gravitational red shift and similar. Even such modern experiments made in Cassini mission well correspond to both hypotheses. Lunar laser ranging test made by Daniel Y. Gezari [7] detected decrease of speed of light about 8m/s. This also supports both hypotheses, but because of possible different inaccuracies does not separate them.

So what additional experiments can separate these hypotheses? The biggest difference between these hypotheses is that they provide different behavior of atomic clock inside our planet. First hypothesis (equation 1) provides increasing of time dilation by going down. Exactly the same result general relativity provides. Second hypothesis provides the opposite result. At the centrum of the planet it provides zero time

dilation. At depth about 3000m free fall acceleration starts to decrease, therefore by putting atom clock to some deep place it would be possible to find which hypothesis is wrong.

If the results of such experiment would consist with predictions provided by general relativity and with the first hypothesis, we may consider new experiments to test how gravitation effects vacuum permittivity and permeability. This hypothesis about the space separation leads to very interesting foresight which may happen in very strong gravitation. Likely exists such matter state when electromagnetic interaction cannot spread at all. It would mean that there is no interaction between electrically charged particles. In this way matter can be compressed very much. Here we would have very different form of matter.

If the results of proposed experiment would consist with predictions provided by second hypothesis we would have quite new phenomena.

After all it may help to understand better the properties of light and the reason of time dilation phenomena.

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