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On the Origin of the Lifetime Dilatation of High Velocity Mesons

Described by using Gravitomagnetism.

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Abstract

We analyze here the influence of gravitomagnetism upon fast moving particles and we find a physical mechanism for the lifetime dilation of mesons at very high velocities. One of the later arguments in favor of the Special Relativity Theory (SRT) was the discovery of a lifetime dilation of high velocity mesons. However, it has also been found that the observed lifetime dilation didn't correspond to SRT predictions. Moreover, SRT neither General Relativity Theory (GRT) ever explained any physical mechanism. When using gravitomagnetism, it becomes clear that not a time delay, but an self-inductive gravitomagnetic compression component is responsible for a delayed decay of the meson. We also find that relativistic mass doesn't exist, but that only the gravitational field gets accumulated to high values when the object's speed is close to the speed of light.

Key words : *gravitation, gravitomagnetism, gyrotation, meson lifetime, Heaviside, Maxwell analogy.*
Method : *analytical.*

1. Pro memore : The Heaviside (Maxwell) Analogy for gravitation (or gravitomagnetism).

Heaviside O., 1893, transposed the Electromagnetism equations of Maxwell into the Gravitation of Newton, creating so a dual field : gravitation and what we propose to call *gyrotation* (which is the gravitational equivalence of magnetism), where the last field is nothing more than an additional field caused by the velocity of the considered object against the existing gravitation fields.

The formulas (1.1) to (1.5) form a coherent set of equations, similar to the Maxwell equations[1]. Electrical charge is then substituted by mass, magnetic field by gyrotation, and the respective constants as well are substituted (the gravitation acceleration is written as $\boldsymbol{g}$, the "*gyrotation* field" as $\boldsymbol{\Omega}$, and the universal gravitation constant G as $G^{-1} = 4\pi\,\zeta$). We use sign $\Leftarrow$ instead of = because the right hand of the equation induces the left hand. This sign will be used when we want to insist on the induction property in the equation.

$$\boldsymbol{F} \Leftarrow m\,(\boldsymbol{g} + \boldsymbol{v} \times \boldsymbol{\Omega}) \qquad (1.1)$$

$$\nabla . \boldsymbol{g} \Leftarrow \rho / \zeta \qquad (1.2)$$

$$c^2\, \nabla \times \boldsymbol{\Omega} \Leftarrow \boldsymbol{j} / \zeta + \partial \boldsymbol{g} / \partial t \qquad (1.3)$$

where $\boldsymbol{j}$ is the flow of mass through a surface.

It is also expected :

$$div\, \boldsymbol{\Omega} \equiv \nabla . \boldsymbol{\Omega} = 0 \qquad (1.4)$$

$$\nabla \times \boldsymbol{g} \Leftarrow - \partial \boldsymbol{\Omega} / \partial t \qquad (1.5)$$

and $$c^2 = 1 / (\zeta\,\tau) \qquad (1.6)$$

wherein $\tau = 4\pi\, G/c^2$

All applications of the electromagnetism can from then on be applied on the gravitatiomagnetism with caution.

2. Gravitomagnetic induction.

2.1. Gyrotational induction and Lorentz-like force for gravitation.

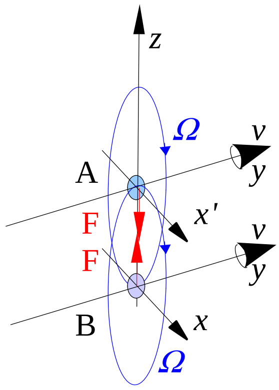

Fig. 2.1 : *two particles attract due to their velocity.*

A particle “A” travels at high velocity nearby the Earth. It lays in the Earth's gravitational field and creates a gravitomagnetic field (the *gyrotation* field) that is circular about its body.

Another mass “B” at high speed and with a path that is here parallel to “A” can become influenced by that gravitomagnetic field (the gyrotation).

It then undergoes a Lorentz-like force[1] that make the masses undergo an additional attraction force given by

This Lorentz-like force works as follows: both masses feel the other magnetic field, that generates a force F upon the particle.

The gyrotational force is given by : $\boldsymbol{F} \Leftarrow m_B\, (\boldsymbol{v} \times \boldsymbol{\Omega})$ (2.1)

and the *gyrotation* field $\boldsymbol{\Omega}$ is found by[1]:

$$\oint \boldsymbol{\Omega}\, .\, \mathrm{d}\boldsymbol{l} \Leftarrow 4\pi\ \mathrm{G}\ \dot{m}_A / \mathrm{c}^2 \qquad (2.2)$$

which is a transcription of (1.3) into integrals, valid for constant values of the gravitation field g.

The equation (2.1) can in this case simply be written as $\boldsymbol{\Omega} \Leftarrow 2\ \mathrm{G}\ v\ \mathrm{d}m_A/(\mathrm{d}y\ r\ \mathrm{c}^2)$ because $\boldsymbol{\Omega}$ is constant over each circular path $2\pi\ r$. Herein r is the distance between the masses m_A and m_B , $r = |\mathrm{A} - \mathrm{B}|$. The distance $\mathrm{d}y$ is the infinitesimal length of particle A along the y–axis for this process.

The combination of the equations (2.1) and (2.2) gives then for a local place y :

$$\mathrm{d}\boldsymbol{F}/\mathrm{d}y \Leftarrow 2\ \mathrm{G}\ \mathrm{d}m_A/\mathrm{d}y\ .\ \mathrm{d}m_B/\mathrm{d}y\ .\ v^2/(r\ \mathrm{c}^2) \qquad (2.3)$$

This kind of gravitomagnetic induction happens between the Sun and the planets and is responsible for the flatness of our solar system. It also explains the flatness of disc galaxies and the constancy of the star's velocity in disc galaxies without any need for “dark mass”. See also section *2.3* for further explanations.

2.2. Gyrotational self-induction of rectilinear fast particles and its global cylindrical pressure.

A mass that travel in a gravitation field creates a magnetic-like field, called *gyrotation* field, as shown in fig. 2.1. This field is circular and it is also present inside and at the surface of the object. The global *gyrotation* field is produced by the sum of all the particles of the object, but that field also acts on each single particle of that object. This really means that each of the particles undergo a Lorentz-like force that is perpendicular on both the path that the object follows and the *gyrotation* field (see fig. 2.2).

In other words, there is a Lorentz-like force that compresses the object cylindrically over the whole object and that helps the object not to disintegrate at high velocities.

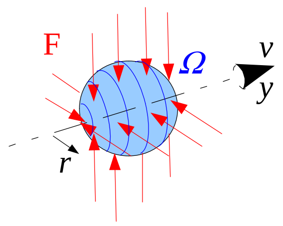

Fig. 2.2 : *a particle is compressed due to its velocity.*

The gyrotational acceleration is given by :

$$a = \mathrm{d}\boldsymbol{F}/\mathrm{d}m \Leftarrow (\boldsymbol{v} \times \boldsymbol{\Omega}) \qquad (2.4)$$

and the *gyrotation* field $\boldsymbol{\Omega}$ is found by:

$$\oint \boldsymbol{\Omega} \,.\, \mathrm{d}\boldsymbol{l} \Leftarrow 4\pi\, \mathrm{G}\, \dot{m} \,/\, \mathrm{c}^2 \qquad (2.5)$$

which is a transcription of (1.3) into integrals, valid for constant values of the gravitation field g.

The equation (2.5) can in this case simply be written as $\boldsymbol{\Omega} \Leftarrow 2\,\mathrm{G}\, v\, \mathrm{d}m/(\mathrm{d}y\; r\; \mathrm{c}^2)$ because $\boldsymbol{\Omega}$ is constant over each circular path $2\pi\, r$. Herein r is the variable diameter of the cross section of mass m on the place y . The distance $\mathrm{d}y$ is the infinitesimal length of the mass along the y–axis for this process.

The combination of the equations (2.4) and (2.5) gives then at a place r of the mass the acceleration (compression) $a(r)$:

$$a(r) = \mathrm{d}\boldsymbol{F}/\mathrm{d}m \Leftarrow 2\,\mathrm{G}\, \mathrm{d}m/\mathrm{d}y \,.\, v^2/(r\, \mathrm{c}^2) \qquad (2.6)$$

The local pressure $p(r)$ at the variable place r is then given by :

$$p(r) = \mathrm{d}\boldsymbol{F}/\mathrm{d}A \Leftarrow \mathrm{G}\, (\mathrm{d}m/\mathrm{d}y)^2 \,.\, v^2/(\pi\, r^2\, \mathrm{c}^2) \qquad (2.7)$$

For a sphere with density ρ :

$$p(r) \Leftarrow \pi\, \mathrm{G}\, r^2 \rho\, v^2/\mathrm{c}^2 = 3\, \mathrm{G}\, m\, v^2/(4\, r\, \mathrm{c}^2) \qquad (2.8)$$

The equation (2.8) is valid for not too fast particles because it didn't take in account the time delay of the gravitation field between the object's mass and its surface. Let us see below what this means.

2.3. How does a high speed gravitation field look like?

Oleg Jefimenko proved that the velocity increase of a particle results in the flattening of the gravitational spectrum. This flattens the gravitational field, perpendicularly to the path of motion. The gravitational zones in the direction of the motion of the particle, are decreasing with the velocity.

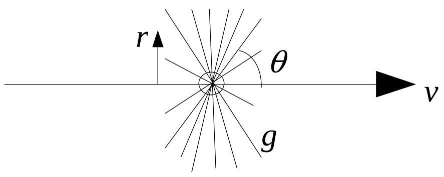

Fig. 2.3 : *a particle's gravitation field is heterogeneous due to its velocity.*

The original equation of Oliver Heaviside that he wrote down at the end of the 19th century showed already the dependency of the angle θ (see fig. 2.3) with the retarded value of the gravitation field for a fast moving mass.

$$\boldsymbol{g}(\boldsymbol{r},\theta) = \boldsymbol{G}\, \frac{\boldsymbol{m}\left(\mathbf{1} - \boldsymbol{v}^2/\boldsymbol{c}^2\right)}{\boldsymbol{r}^2\left(\mathbf{1} - \left(\boldsymbol{v}^2/\boldsymbol{c}^2\right)\mathbf{sin}^2\,\theta\right)^{3/2}} \qquad (2.9)$$

Equation (2.9) gives the value of the local gravitation for a certain mass m at a velocity v. Thus, for very high speeds, we have put equation (2.5) in a more general form, as follows :

$$\oint \boldsymbol{\Omega} \,.\, \mathrm{d}\boldsymbol{l} \Leftarrow 4\pi\, \mathrm{G}\, \dot{g}\, r^2 \,/\, \mathrm{c}^2 \qquad (2.10)$$

In fact, (2.10) is physically speaking more correct than (2.5) because not the mass, but the interaction between moving gravitation fields is responsible for the creation of the gyrotation field.
By using (2.9) we can easily recalculate equation (2.8) in the case of a sphere:

$$\boldsymbol{p}(\boldsymbol{r},\theta) \Leftarrow \frac{\mathbf{3}\,\boldsymbol{g}\,\boldsymbol{v}^2\boldsymbol{r}}{\mathbf{4}\,\boldsymbol{c}^2} = \frac{\mathbf{3}\;\boldsymbol{G}\;\boldsymbol{m}\,\boldsymbol{v}^2\left(\mathbf{1} - \boldsymbol{v}^2/\boldsymbol{c}^2\right)}{\mathbf{4}\,\boldsymbol{r}\,\boldsymbol{c}^2\left(\mathbf{1} - \left(\boldsymbol{v}^2/\boldsymbol{c}^2\right)\mathbf{sin}^2\,\theta\right)^{3/2}} \qquad (2.11)$$

On top of that, we also should include a retardation of the field along the path of the object. The object will be further than its gravitation or gyrotation field would suggest.

2.3. Gyrotational self-induction of rectilinear very fast particles and its delayed global cylindrical pressure.

For very high speeds, such as cosmic mesons, reaching nearly the speed of light, the compression at the place r , assuming the meson as a homogeneous sphere, is given by (2.11) where the divider of the quotient becomes close to zero, especially for angles nearby $\pi/2$. Due to the global exponent of -1/2 , the pressure becomes close to infinite. Away from $\pi/2$, the pressure becomes rapidly very low.

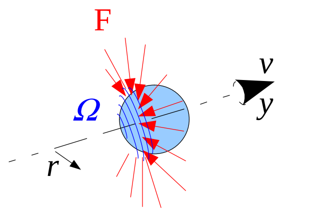

Fig. 2.4 : *a particle's gyrotation field and therefore its compression is heterogeneous due to its velocity.*

This signifies that the gravitational field can end up to become infinite at $\pi/2$ when the velocity of light is reached.
The meson is compressed by a very high cylindrical pressure all around it, that hinders the meson from decaying, unless the velocity has been reduced to lower values.
Besides, due to the position of the delayed fields, behind the meson's progression path, the compression will be somewhat conical instead of cylindrical, making the decay more difficult at the back side of the progression path. Due to the high speed, the decay can not occur ahead of the progression path either, because that would require an even higher velocity of the decay residues.

This proves that the lifetime delay of the meson is physically made possible by a compression rather than a change of the time dimension.

3. Discussion and conclusion: does relativistic mass exist?

When a particle in the CERN accelerator is accelerated, magnetic fields are used. These magnetic fields can only “push” the particles at not more than the speed of light. Moreover, the magnetic fields are put under an angle to the particle's path. Thus, the particles never can reach the speed of light because the magnetic fields, under an angle to the particles' path, are always themselves below the speed of light.
And just as in equation (2.9) for gravitomagnetism, charged particles in CERN never can be accelerated by magnetic fields up to the speed of light because of the quasi fully $\pi/2$–orientation of the electrical field at that speed.

But does that mean that the particle's mass is increasing by velocity? No, it isn't. The consequence of a high velocity is the self-inductive cylindrical compression upon the particles, as explained above. Relativistic mass doesn't exist.
We can show this by the following. Equation (2.9) shows that not the mass but the gravitation field is locally increasing, especially for the angle around $\pi/2$.
But can the global value of g in equation (2.9) reach infinity at speeds that are close to the speed of light?

To know that, the easiest way is to argue as follows: if we consider the highest value for (2.9) by putting $\sin\theta$ = 1, we get :

$$\int_0^{\pi/2} \boldsymbol{g}(\boldsymbol{r},\theta)\,\mathbf{d}\,\theta \le \frac{\pi \boldsymbol{G}\,\boldsymbol{m}}{2\,\boldsymbol{r}^2\sqrt{1-\boldsymbol{v}^2/\boldsymbol{c}^2}} \tag{3.4}$$

and this confirms that at the speed of light, the global gravitation field is theoretically able to reach infinity, due to the accumulation of the gravitation waves at that speed, the same as what happens with the sound waves of a plane, just before it passes the sound barrier.

Remember however that the direction of that infinite gravitational field is oriented at the angle of $\theta = \pi/2$ and that at other angles (thus all other directions), the gravitation field is decreasing quickly !

4. References and interesting literature.

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