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GRAVITATION ON PLANET ETHERUS

Content

Rev.6

Introduction

This story is an account of the physical phenomena existing on and around a planet Etherus situated in the vicinity of the star Alpha in a distant galaxy. The main theme is the special and general theory of relativity with the main focus on the latter.

All the calculations are made with the following assumptions:

Time is perceived as absolute.

The universe is filled with a luminiferous ether.

The velocity of light depends on the gravitational potential.

1 The energy of a particle in motion

To see how the energy of a particle in motion is affected by its velocity the following scenario is investigated.

A light source with the frequency f_0 illuminates a mass m_0 with reflexive properties. The light consists of a stream of photons with energy $E = h f_0$ and momentum $P = E/c$. For the mass particle we have; $E_m = m c^2$ and $P_m = m v$:

At reflection against the mass, part of the photon energy and momentum is transferred to the mass causing it to start moving with an increasing velocity v. This velocity results in a Doppler shift of the incoming photons to the frequency $f_1 = f_0 (1\text{-}v/c)$.

At reflection the photons are subjected to a further Doppler shift caused by the receding velocity of the mass to the frequency $f_2 = f_1/ (1+v/c) = f_0 (1\text{-}v/c)/ (1+v/c)$

The photon suffers an energy loss $dE = h (f_0 – f_2) = E (1\text{-}f_2/f_0)$.

Energy conservation demands that this energy is transferred to the mass as $dE_m = dm c^2$.

Further, the change of photon momentum $dP = (1+ f_2/f_0) E/c$ must equal $dP_m = dm v + m dv$

Thus; $f_2 = f_0 (1\text{-}v/c) / (1+v/c)$ $E (1\text{-} f_2 / f_0) = dm c^2$ $(1+ f_2 / f_0) E / c = dm v + m dv$

Elimination of E from the equations above gives; $(dm / dv) / m = v / (c^2 - v^2)$

with the solution; $m = m_0 / \sqrt{(1\text{-} v^2 / c^2)} = \gamma m_0$ **Thus;** $\mathbf{E_m = \gamma m_0 c^2}$

The energy can be rewritten in a very seductive form as; $\mathbf{E_m = m_0 c^2 / \gamma + \gamma m_0 v^2}$

A possible interpretation of this relationship is that the first term could be seen as the rest energy of the mass imbedded in a pattern of motion with the velocity v. The second term should then represent the energy content of this pattern of motion.

2 Gravitation and the velocity of light

2.1 Introduction

The photon is regarded as a particle without mass with energy $E = h \nu$. If m is seen as the "relativistic mass" the energy could be written; $E = m c^2$ and the momentum; $P = m c$.

The energy of a photon is considered to be reduced by red shift if it travels in a direction away from a gravitating mass. The reverse, energy increase, by blue shift is said to be at hand if the direction of motion is towards the gravitating source. The scientists on Etherus interpret the phenomena in an other way. The measured red shift is considered to reveal the fact that the energy of an emitting body at rest close to a gravitating source is lower than the corresponding energy for a body at a greater distance.

Energy and magnitude of momentum for a photon are both seen to be preserved at a continuous passage through a gravitational field.

Energy and momentum for a photon in an environment without gravity can be written;

$$E_0 = m_0 c_0^2 \qquad | P_0 | = m_0 c_0$$

If velocity v and mass m are influenced by gravity the following equations must be satisfied.

$$E = m_0\, c_0^2 = m\, c^2 \qquad |\, P\,| = m_0\, c_0 = m\, v$$

These relations result in: $m = m_0\, c_0^2 / c^2$ and $v = c^2 / c_0$

where c is seen as a function the gravitational potential.

The mass increase as c_0^2 / c^2 can be divided in two terms as: $c_0 / c \times c_0 / c$.
The first term is seen to reflect a real mass increase caused by a greater ether density.
The second term is seen as a dynamic effect caused by the photon passing through an inhomogeneous medium. (compare the relativistic increase of mass for a body in free fall). If the free fall of the body (or photon) is halted (localization) the energy will be reduced as;

$$\mathbf{E = m_0\, (c_0 / c \times c_0 / c) \times c^2 \Rightarrow m_0\, (c_0 / c) \times c^2 = m_0\, c_0\, c}$$

2.2 c as a function of the gravitational potential

If the conclusions drawn in part 2.1 concerning energy and mass content for a "localized" photon were extended to hold for bodies with mass the following must be valid;

$E = m\, c^2 = m_0\, c_0\, c = m_E \times c_0^2$ where $m_E = m_0 \times c / c_0$ gives an unambiguous measure of the energy.

For the inertial (heavy) mass we have; $m_i = m_0\, c_0 / c$

The force of gravity on a mass at rest is dE/dr where r is the distance to the source of gravity. $F = dE / dr = m_0\, c_0\, dc / dr$, to be compared with the normal expression $m\, M\, G / r^2$ where m stands for the inertial mass **m_i.**

$$F = m_0\, c_0\, dc / dr = \mathbf{m_i} \times M\, G / r^2, \quad \text{gives,} \quad c\, dc / dr = M\, G / r^2$$

Integration gives the result:

$$c = c_0 \sqrt{1 - \frac{2MG}{c_0^2 r}}$$

3 *A link between Newton and Einstein*

3.1 Gravitational field from a moving mass

How does the gravitational field from a moving mass look like? A simple reasoning can be made referring to the figures below. Fig.3.1 shows two masses in (momentary) parallel motion with a velocity v. Fig.3.2 shows a rotating binary system where the velocities are in opposite direction.

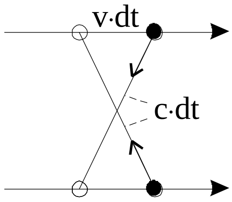

Fig.3.1

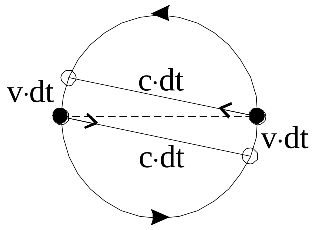

Fig.3.2

The unfilled circles show the positions at time t. The filled circles show corresponding positions at time t + dt. The time dt represents the propagation time for the field. Due to the limited propagation speed, the forces (shown as arrows) have a component along the direction of movement. In Fig. 3.1 it looks like the masses generate a braking effect on each other.
In Fig. 3.2 where the velocities are in opposite directions it looks like the masses generate an accelerating force on each other. None of the figures can of course show the true direction of the forces. If energy is to be conserved nor acceleration or retardation in the direction of movement can be tolerated. In the following a possible explanation is given.

3.2 Mass - Energy- Frequency

Mass is associated with the energy content; $E = M c^2$. When it comes to electromagnetic radiation the energy is written; $E = h\nu$. If the energy specification for radiation is applied to mass the following relation can be obtained.

$$M c^2 = h\,\boldsymbol{\nu_M} \quad \text{or} \quad M = h\,\boldsymbol{\nu_M}/c^2 = \text{const.}\times\boldsymbol{\nu_M}$$

The frequency $\boldsymbol{\nu_M}$ can be interpreted as the rate at which mass M radiates gravitational quanta. The gravitational potential at distance S from a mass M is;

$$\Phi = \Phi_0 - MG/S = \Phi_0 - \Delta\Phi \quad \text{with; M as above we get;} \quad \Delta\Phi = \text{const.}\times\boldsymbol{\nu_M}/S$$

The force of gravity on a test mass m at rest becomes; $F = m\times d\Phi/dS = m\times \text{konst.}\times\boldsymbol{\nu_M}/S^2$

3.3 Gravitational potential and doppler effect

Fig.3.3 shows a momentarily view of the field from a mass moving with a velocity v = c/2, continuously emitting gravity fronts. When calculating the force of gravity in this dynamical situation the frequency $\boldsymbol{\nu_M}$ from above must be replaced with the frequency $\boldsymbol{\nu_F}$ perceived at the field point. This frequency differs from $\boldsymbol{\nu_M}$ at the source due to doppler effect, which is clearly visible in the figure. A short derivation of the doppler effect is done below with reference to Fig. 3.4. The figure shows a source mass moving with a constant velocity v. The position at t = 0 is shown with an unfilled circle. The position at time t is shown with a filled circle. The field point is a fixed point on the circle where to the field has reached at time t with a propagating speed of c.

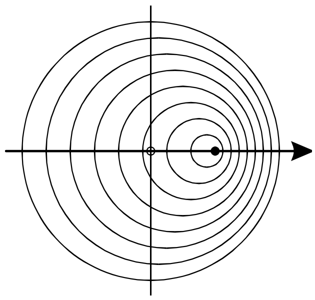

Fig.3.3

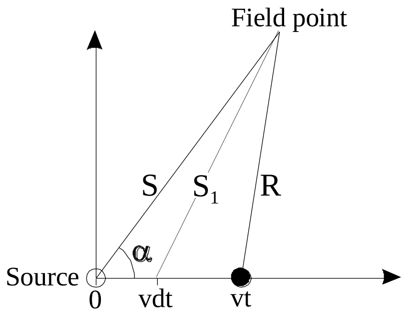

Fig.3.4

The doppler effect is a consequence of time differences between signals (here called 1 and 2,) not being the same at the source and field points.

	Signal 1	Signal 2	Time diff. sign. 2-1
Transmitting time	0	dt	dt
Receiving time	0 + S/c	dt + S_1/c	dt + (S_1 -S)/c

The cosine theorem gives; $S_1^2 = S^2 + v^2dt^2 - 2Svdt\,\text{Cos}\alpha$

If dt goes toward zero; $S_1^2 \Rightarrow S^2 - 2Svdt\,\text{Cos}\alpha$

Series expansion gives; $S_1 = S - vdt\,\text{Cos}\alpha$

With ; $v/c = \beta$, the time difference at the field point can be written; $dt_F = dt\,(1-\beta\,\text{Cos}\alpha)$

Time differences corresponds to frequencies as 1/Timediff..

Thus : $\nu_M = 1/dt$ och $\nu_F = 1/dt_F = \nu_M/(1-\beta\,\text{Cos}\alpha)$

The gravitational potential at the field point can now be written;

$$\Phi = \Phi_0 - \text{const.}\times\boldsymbol{\nu_M}/S(1-\beta\cos\alpha) = \Phi_0 - \Delta\Phi$$

Normalization with; const.$\times\boldsymbol{\nu_M} = 1$ gives; $\Delta\Phi = \frac{1}{S(1-\beta\,Cos\alpha)}$

3.4 Force of gravity from a moving mass

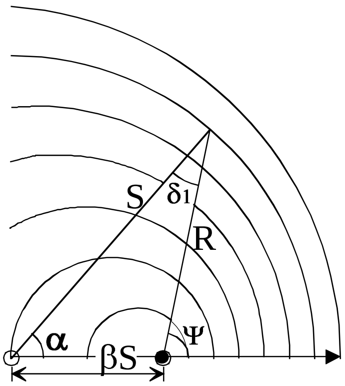

Fig.3.5

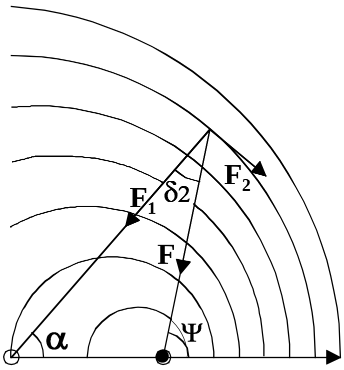

Fig.3.6

According to the previous we have the normalized gravitational potential at the field point;

$$\Phi = \Phi_0 - \frac{1}{S(1-\beta\ Cos\alpha)}$$

The force of gravity (per kg test mass) is the gradient of the potential, which has two orthogonal components;

$$F_1 = -\frac{d\Phi}{dS} = \frac{1}{S^2(1-\beta\ Cos\alpha)} \quad \text{and} \quad F_2 = -\frac{d\Phi}{S\ d\alpha} = \frac{\beta\ Sin\alpha}{S^2(1-\beta\ Cos\alpha)^2}$$

F_2 can be written: $F_2 = F_1 \times \frac{\beta\ Sin\alpha}{1-\beta\ Cos\alpha}$

The vector sum becomes: $F = F_1\sqrt{1+(\frac{\beta\ Sin\alpha}{1-\beta\ Cos\alpha})^2} = F_1\frac{\sqrt{1+\beta^2-2\beta\ Cos\alpha}}{1-\beta\ Cos\alpha}$

The angle δ_1 in Fig.3.5 can be calculated by means of the cosine theorem

$\beta^2 S^2 = S^2 + R^2 - 2RS\ Cos\delta_1$ and $R^2 = S^2 + (\beta\ S)^2 - 2\beta\ S^2\ Cos\alpha$

From these equations we get: $Cos\delta_1 = \frac{1-\beta\ Cos\alpha}{\sqrt{1+\beta^2-2\beta\ Cos\alpha}}$

For the angle δ_2 in fig. 3.6 we have; $Cos\delta_2 = \frac{F_1}{F} = \frac{1-\beta\ Cos\alpha}{\sqrt{1+\beta^2-2\beta\ Cos\alpha}}$

The angles are identical. The vector sum of the forces F_1 and F_2 is according to this analysis always pointing to the "now-position" of the gravitating mass.
The potential as function of α and S can be written as a function of Ψ and R with the help of the following conversion relations;

$$Cos\alpha = \beta\ Sin\psi^2 + Cos\psi\sqrt{1-\beta^2\ Sin\psi^2} \qquad S = R\frac{\beta\ Cos\psi + \sqrt{1-\beta^2 Sin\psi^2}}{1-\beta^2}$$

$$\Phi_{[\Psi,R]} = \Phi_0 - \frac{1}{R\sqrt{1-\beta^2\ Sin\Psi^2}}$$

The force component in the R direction is; $d(\Phi_{[\psi,R]})/dR$

$$F_R = \frac{1}{R^2\sqrt{1-\beta^2 Sin\Psi^2}}$$

The result is plotted in the figure below.

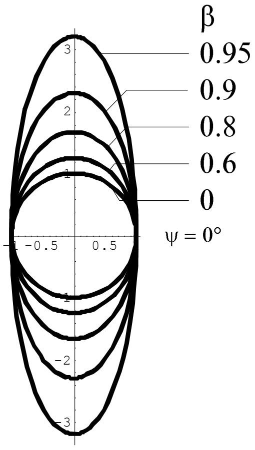

Fig. 3.7

For particles with velocities approaching the speed of light consideration has to be taken to the dependence of the potential on ψ.
This dependence results in a potential gradient and thus a force perpendicular to R.

$$F_\Psi = \frac{d\Phi}{R\,d\Psi} = -\frac{\beta^2 Sin\Psi\ Cos\Psi}{R^2(1-\beta^2\ Sin\Psi^2)^{3/2}}$$

The total force is finally obtained by quadratic addition of F_R and F_ψ.

$$F = \frac{1}{R^2}\sqrt{\frac{1-\beta^2(2-\beta^2)Sin\Psi^2}{(1-\beta^2 Sin\Psi^2)^3}}$$

4. Gravitational radiation

A search for the physics behind gravitational radiation gives a rather meager result.
Apart from descriptions limited to analogies with electromagnetic radiation there are some extraordinarily difficult to understand "recipes".
EM-radiation appears in a number of modes in connection with the accelerated motion of electrical charges. These modes are named electric resp. magnetic (dipole, quadrupole, oktopole) radiation with gradually diminishing strength. My hypothesis is that gravitational radiation can be written;

$$P_{Grav} = \frac{G}{c^3}\left(k_2 + k_4\left(\frac{v}{c}\right)^2 + \cdots.\right) \times F_{acc}^2$$

F_{Acc} is the force at right angle to the velocity vector v. **With the motivation that momentum and angular momentum are preserved entities the dipole constant is considered to be zero.**
The notion gravitational radiation normally means the quadrupole term with in my case the constant k_4.
In the following the relations between electricity and gravitation are illustrated with the assumption that mass can be set equal to electric charge. Relevant notions are shown in the table below

.

Notion	Electricity	Gravitation
Source, test object	- q, q	m, m
Field potential	$-\frac{q}{4\pi\varepsilon_0 r}$	$-\frac{mG}{r}$
Field strength = acc.	$\frac{q}{4\pi\varepsilon_0 r^2}$	$\frac{mG}{r^2}$
Facc.	$q\frac{q}{4\pi\varepsilon_0 r^2}$	$m\frac{mG}{r^2}$
p (dipole moment)	q×distance	m×distance
p´´	q×acc. = $\frac{q^2}{4\pi\varepsilon_0 r^2}$	m×acc. = $\frac{m^2 G}{r^2}$ = Facc.

The form of the electrical relations become identical to the gravitational relations if

$$q \rightarrow m \qquad G \rightarrow \frac{1}{4\pi\varepsilon_0}$$

According to Erik Hallén:s Elektricitetslära (ekv. 31,66) the momentary value of the radiated power from an electrical dipole is;

$$P_{Rad\ El\ Dipol} = \frac{\mu_0}{6\pi c} p''^2 = \frac{2}{3}\frac{1}{4\pi\varepsilon_0 c^3} p''^2$$

Corresponding expression for gravitational radiation becomes;

$$P_{Rad\ Grav\ Dipol} = \frac{2}{3}\frac{G}{c^3} Facc^2$$

If the radiated power is separated equally for the two masses m, m, half this value can be attributed to m.

This means that if gravitational dipole radiation exists it should be written;

$$P_{Rad\ Grav\ Dipol} = \frac{G}{3\ c^3} Facc^2$$

5 A test of the theory with an unexpected result

5.1 Introduction

The results from part 3 have been applied to a somewhat simplified version of the famous double pulsar PSR 1913 +16. The expectations were that the calculations should reveal a braking force on the two masses on a par with data for the gravitational radiation. The disappointment was great when the predictions of the theory pointed at a force of acceleration amounting to a value of approximately 16000 times the expected braking force.

An analyses of the result showed that the positive effect interpreted as the product of velocity times the force component along the velocity vector with astonishing accuracy could be written;

$$P = \frac{G}{3\ c^3} Facc^2$$

This result is identical to the hypothesis for dipole radiation according to part 4.
On Etherus the conclusion is drawn that gravitational dipole radiation exists and that it (close to 100%) outbalances the positive effect from above.

5.2 Calculations

According to part 3.4 the force of gravity on a mass M_2 from a mass M_1 in linear motion (with v << c) points at the position of M_1 at the time when the field arrives at M_2.
With this as a basis a symmetrical binary system is analyzed.
The terminology is defined with the help of the figures below.

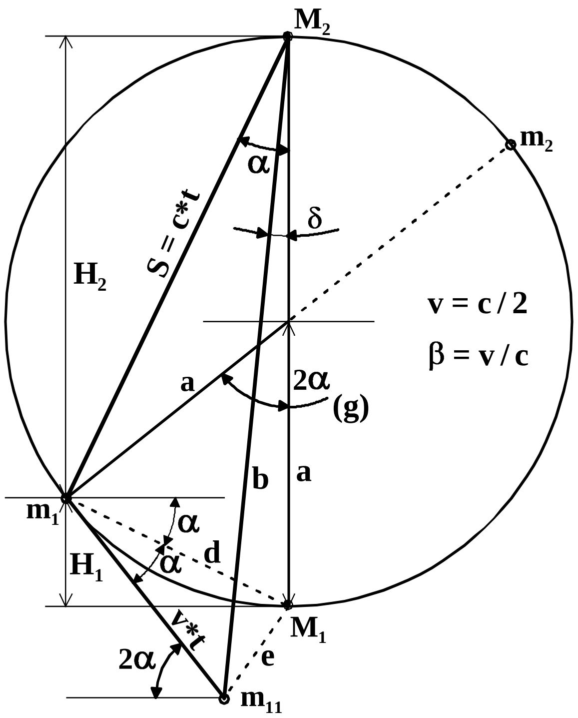

Fig. 7.1

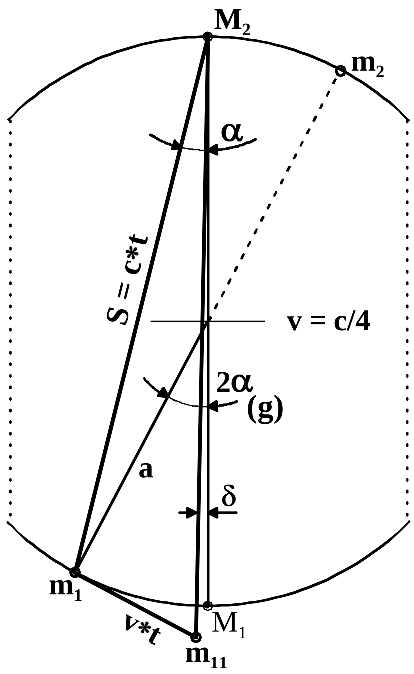

Fig. 7.2

Fig. 7.1 with the extreme velocity c/2 only serves as a demonstration example to clarify the definitions. m_{11} shows the position m_1 would have at time t if it continued with linear velocity in the direction of the tangent.
The distances S and d can directly be calculated as; $S = 2\,a\,\mathrm{Cos}[\alpha]$ $d = 2\,a\,\mathrm{Sin}[\alpha]$
The arc $m_1 - M_1$ is; $v\,t = \beta\,S = a\,2\,\alpha$ which gives; $\beta = a\,2\,\alpha\,/\,S$
A series expansion gives; $\beta = \alpha + \alpha^3/2$ From this relation α can be solved as a function of β.
A series expansion of the result gives; $\alpha = \beta - 0{,}5\,\beta^3$
With the cosine theorem applied on the three triangles;

$m_1\ m_{11}\ M_2$ $m_1\ m_{11}\ M_1$ $m_{11}\ M_1\ M_2$

the angle δ can be solved; $Sin[\delta] = \frac{4\,\beta^3}{3} - \frac{469\,\beta^5}{120} ...)$

Force balance demands that;

$$\mathrm{Facc} = \frac{Mv^2}{a} = \mathrm{Fgrav} \cong \frac{MMG}{4a^2} \qquad \text{This gives;} \qquad M = \frac{4av^2}{G}$$

The force in the direction of v becomes; $F_V = \mathrm{Sin}[\delta]\times \mathrm{Facc}$

With the matching power; $P_V = v\times F_V = \frac{v\,Sin[\delta]}{Facc}\times \mathrm{Facc}^2 = \mathbf{Term}\times \mathrm{Facc}^2$

With Term = $\frac{v\,Sin[\delta]}{Mv^2/a} = \frac{G\,Sin[\delta]}{c^3\beta^3 4}$ the final result becomes;

$$\mathrm{Term} = = \frac{G}{c^3}\left(\frac{1}{3} - \frac{469}{480}\ \frac{v^2}{c^2} + \cdots\right)$$

A more accurate (and more complicated) calculation where consideration is taken to the accelerated movement of m_1 gives the result:

$$\textbf{Term} = \frac{G}{c^3}\left(\frac{1}{3} - \frac{17}{15}\ \frac{v^2}{c^2} + \ \dots\right)$$

The calculations show that to M_1 (and M_2) is added a power; P = $\frac{G}{3\,c^3}\ Facc^2$.
The continuing existence of the system demands that corresponding power is radiated away in the form of dipole radiation. This balanced exchange of energy between mass and ether must clearly be the explanation for the gravitational force.
Angular momentum is preserved thanks to the existence of a dipole radiation.
The second term in"Term" is treated in the complete file; "Etherus".

6 Gravitons, dark matter and dark energy

According to scientific journals there is a transformation going on between different forms of the neutrinos emanating from the Sun. The generated dipole radiation (according to the previous) could show to have similar properties. A suitable notation for this radiation would be graviton radiation.
For the universe not to be completely filled with these gravitons one have to conceive a disintegration process where the energy of these gravitons is returned back to the ether
If energy is added to the ether this will show up as an increase of the speed of light.

Expansion of the Universe is expressed by means of the Hubble constant ~ 72 km/s/Mpc (velocity/distance). The distance to the remote object can be replaced by the elapsed time as Mpc/c. The Doppler frequency could be explained if the velocity of light is seen to be increasing with time.
As shown earlier in this document, the velocity of light is influenced by the presence of matter. If amounts of diluted matter is trapped into heavy stars and galaxies the overall influence on c could result in an increase of the velocity of light over time.
The remote information generated with an old value of c, is on Earth analyzed with c of today and falsely interpreted as revealing a Doppler shift caused by dark energy.

An explanation of the dark matter phenomenon can be made if consideration is taken to a frame drag effect. If a body is floating around a gravitational center M with the same velocity as a rotating ether V_{frame} that body can not experience any acceleration force. Force balance demands that the velocity of the body amounts to; $V_{frame} + V_{Newton}$ (Sqrt[MG/r])