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A coherent dual vector field theory for gravitation

Gyro-gravitation F.A.Q.

Analytical method – Applications on cosmic phenomena

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Abstract

This publication concerns the fundamentals of the dynamics of masses interacting by gravitation.
We start with the Maxwell analogy for gravitation or the Heaviside field, and we develop a model. This dynamics model, which we know is relativistic, allow us to quantify by vector way the transfer of angular movement point by point, and to bring a simple, precise and detailed explanation to a large number of cosmic phenomena. And to all appearances, the theory completes gravitation into a wave theory.
With this model the flatness of our solar system and our Milky way can be explained as being caused by an angular collapse of the orbits, creating so a density increase of the disc. Also the halo is explained. The "missing mass" (dark matter) problem is solved, and without harming the Keplerian motion law.
The theory also explains the deviation of mass like in the d*iablo* shape of rotary supernova having mass losses, and it defines the angle of mass losses at 0° and at 35°6'.
Some quantitative calculations describe in detail the relativistic attraction forces maintaining entire the fast rotating stars, the tendency of distortion toward a toroid-like shape, and the description of the attraction fields outside of a rotary black hole. Qualitative considerations on the binary pulsars show the process of cannibalization, with the repulsion of the mass at the poles and to the equator, and this could also explain the origin of the *spin-up* and the *spin-down* process. The bursts of collapsing rotary stars are explained as well. The conditions for the repulsion of masses are also explained, caused by important velocity differences between masses. Finally, the demonstration is made that gyrotation is compatible with the Lorentz invariance.

Keywords. gravitation – star: rotary – disc galaxy – repulsion – relativity – gyrotation – methods : analytical
Photographs : ESA / NASA

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1. Introduction.

Which laws govern gravitation ?

Gravitation is governed by two fields : the radial gravitation field of steady masses and the so-called gyrotation field, induced by relative mass velocities. The Maxwell analogue equations express them entirely.

Several studies have been made earlier to find an analogy between the Maxwell formulas and the gravitation theory. Heaviside O., 1893, predicted the field. This implies the existence of a field, as a result of the transversal time delay of gravitation waves. Further development was also made by several authors. L. Nielsen, 1972, deducted it independently using the Lorentz invariance. E. Negut, 1990 extended the Maxwell equations more generally and discovered the consequence of the flatness of the planetary orbits, Jefimenko O., 2000, rediscovered it, deducted the field from the time delay of light, and developed thoughts about it, and M. Tajmar & C.de Matos, 2003, worked on the same subject.
This deduction follows from the gravitation law of Newton, taking into account the time delay caused by the limited speed of gravitation waves and therefore the transversal forces resulting from the relative velocity of masses. The laws can be expressed in the equations (1) to (5) hereunder.

Lecture A : a word on the Maxwell analogy

The formulas (1.1) to (1.5) form a coherent set of equations, similar to the Maxwell equations. 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 $\mathbf{g}$, the so-called "gyrotation field" as $\mathbf{\Omega}$, and the universal gravitation constant as $G^{-1} = 4\pi\,\zeta$, where G is the "universal" gravitation constant. We use sign $\Leftarrow$ instead of $=$ because the right hand of the equation induces the left hand. This sign $\Leftarrow$ will be used when we want to insist on the induction property in the equation. $\mathbf{F}$ is the induced force, $\mathbf{v}$ the velocity of mass m with density ρ.

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

$$\nabla \cdot \mathbf{g} \Leftarrow \rho / \zeta \qquad (1.2)$$

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

where $\mathbf{j}$ is the flow of mass through a surface. The term $\partial\mathbf{g}/\partial t$ is added for the same reasons as Maxwell did: the compliance of the formula (1.3) with the equation

$$\mathrm{div}\,\mathbf{j} \Leftarrow -\,\partial\rho / \partial t$$

It is also expected

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

and

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

All applications of the electromagnetism can from then on be applied on the *gyrogravitation* with caution. Also it is possible to speak of gyrogravitation waves, where

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

where $\tau = 4\pi G/c^2$.

2. Law of gravitational motion transfer.

What is gyrotation ?

Gyrotation is the field which is caused by the (angular) motion of gravitation, and is defined by the mass' velocity through a steady gravitation field. Gyrotation acts transversally in relation to the gravitation. Rotating bodies generate gyrotation too.

In this theory the hypothesis is developed that the angular motion is transmitted by gravitation. In fact no object in space moves straight, and each motion can be seen as an angular motion.
Considering a rotary central mass m_1 spinning at a rotation velocity $\boldsymbol{\omega}$ and a mass m_2 in orbit, the *rotation transmitted by gravitation* (dimension [rad/s]) is named *gyrotation* $\mathbf{\Omega}$.

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Equation (1.3) can also be written in the integral form as in (2.1), and interpreted as a flux theory. It expresses that the normal component of the rotation of **Ω**, integrated on a surface A, is directly proportional with the flow of mass through this surface. For a spinning sphere, the vector **Ω** is solely present in one direction, and **∇** × **Ω** expresses the distribution of **Ω** on the surface A.
Hence, one can write:

$$\iint_{A} (\nabla \times \mathbf{\Omega})_n \, d\mathbf{A} \Leftarrow 4\pi \, G \, \dot{m} / c^2 \qquad (2.1)$$

Lecture B : a word on the flux theory approach

In order to interpret this equation in a convenient way, the theorem of Stokes is used and applied to the gyrotation **Ω**. This theorem says that the loop integral of a vector equals the normal component of the differential operator of this vector.

Lecture C : a word on the application of the Stokes theorem and on loop integrals

$$\oint \mathbf{\Omega} \cdot d\mathbf{l} = \iint_{A} (\nabla \times \mathbf{\Omega})_n \, d\mathbf{A} \qquad (2.2)$$

Hence, the transfer law of gravitation rotation (*gyrotation*) results in:

$$\oint \mathbf{\Omega} \cdot d\mathbf{l} \Leftarrow 4\pi \, G \, \dot{m} / c^2 \qquad (2.3)$$

This means that the movement of an object through another gravitation field causes a second field, called gyrotation. In other words, the (large) symmetric gravitation field can be disturbed by a (small) moving symmetric gravitation field, resulting in the polarisation of the symmetric transversal gravitation field into an asymmetric field, called gyrotation (analogy to magnetism). The gyrotation works perpendicularly onto other moving masses. By this, the polarised (= gyrotation) field expresses that the gravitation field is partly made of a force field, which is perpendicular to the gravitation force field, but which annihilate itself if no polarisation has been induced.

3. Gyrotation of a moving mass in an external gravitational field.

How to visualize gyrotation ?

To visualize gyrotation, draw in thought any circle (or any closed line) around a moving mass (fig 3.1). The sum of the gyrotation in all points of that circle is depends from the total mass flow within that circle (closed line). Two parallel flowing masses in a gravitation field attract also by gyrotation.

It is known from the analogy with magnetism that a moving mass in a gravitation reference frame will cause a circular gyrotation field (fig. 3.1). Another mass which moves in this gyrotation field will be deviated by a force, and this force works also the other way around, as shown in fig. 3.2.

The gyrotation field, caused by the motion of m is given by (3.1) using (2.3). The equipotentials are circles:

$$2\pi \, R.\Omega_p \Leftarrow 4\pi \, G \, \dot{m} / c^2 \qquad (3.1)$$

Perhaps the direction of the gravitation filed is important. With electromagnetism in a wire, the direction of the (large) electric field is automatically the drawn one in fig 3.1., perpendicularly to the velocity of the electrons.

fig. 3.1

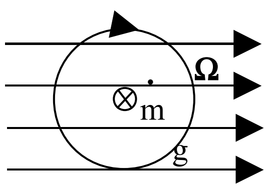
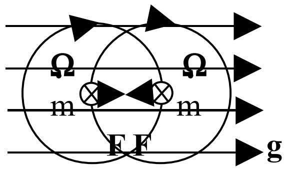


fig. 3.2



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In this example, it is very clear how (absolute local) velocity has to be defined. It is compared with the steady gravitation field.
This application can also be extrapolated in the example below: the gyrotation of a rotating sphere.

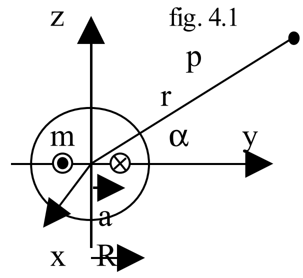
4. Gyrotation of rotating bodies in a gravitational field.

What is the gyrotation for rotating bodies ?

With rotating bodies, the steady gravitation reference field is given by the body itself. The gyrotation field for rotating bodies is given by fig 4.2 (with negative sign) and by equations (4.1) and (4.2) for the inner and the outer field. For rigid homogeny masses, equation (4.3) can be used.

Consider a rotating body like a sphere. We will calculate the gyrotation at a certain distance from it, and inside. We consider the sphere being enveloped by a quite gravitation field, generated by the sphere itself, and at this condition, we can apply the analogy with the electric current in closed loop.

fig. 4.1



The approach for this calculation is similar to the one of the magnetic field generated by a magnetic dipole.

Each magnetic dipole, created by a closed loop of an infinitesimal rotating mass flow is integrated to the whole sphere. *(Reference: Richard Feynmann: Lecture on Physics)*

The results are given by equations inside the sphere and outside the sphere:

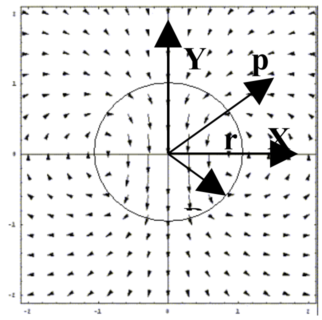


Fig. 4.2

$$\mathbf{\Omega}_{int} \Leftarrow \frac{4\pi G\rho}{c^2} \cdot \left(\boldsymbol{\omega} \left(\frac{2}{5} \cdot r^2 - \frac{1}{3} \cdot R^2 \right) - \frac{\mathbf{r} \cdot (\mathbf{r} \bullet \boldsymbol{\omega})}{5} \right) \qquad (4.1)$$

$$\mathbf{\Omega}_{ext} \Leftarrow \frac{4\pi G\rho R^5}{5 r^3 c^2} \cdot \left(\frac{\boldsymbol{\omega}}{3} - \frac{\mathbf{r} \cdot (\boldsymbol{\omega} \bullet \mathbf{r})}{r^2} \right) \qquad (4.2)$$

(Reference: Eugen Negut, www.freephysics.org) The drawing shows equipotentials of $-\Omega$.

For homogeny rigid masses we can write :

$$\mathbf{\Omega}_{ext} \Leftarrow \frac{G m R^2}{5 r^3 c^2} \cdot \left(\boldsymbol{\omega} - \frac{3\,\mathbf{r} \cdot (\boldsymbol{\omega} \bullet \mathbf{r})}{r^2} \right) \qquad (4.3)$$

When we use this way of thinking, we should keep in mind that the sphere is supposed to be immersed in a steady reference gravitation field.

5. Orbits: angular collapse ; precession.

Why are the planetary orbits flat ?

Concerning the orbits of masses, when the central mass (the sun) rotates, there are found two major effects.

The angular collapse of orbits.

Every possible planetary orbit undergoes a gyrotation force from the rotating sun, that pushes the orbits in a prograde plane at the equator level of the sun. We call it an "angular collapse". Even retrograde orbits are collapsing into prograde orbits.

In analogy with magnetism, it seems acceptable that the field lines of the gyrotation $\mathbf{\Omega}$, for the space outside of the mass itself, have equipotential lines as shown in fig. 5.1. For every point of the space, a local gyrotation can be found.

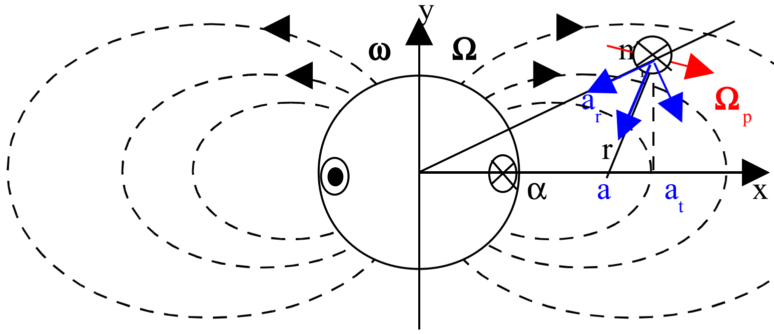


Fig. 5.1

So $v_p = r\,\omega_p$ is the orbit velocity of the mass m_p , it gets an acceleration: $\mathbf{a_p} \Leftarrow \mathbf{v_p} \times \mathbf{\Omega_p}$ where a_p is pointed in a direction, perpendicular on the equipotentials line. One finds the tangential component a_{pt} and the radial component a_{pr} out of (4.2).

The acceleration a_{pt} always sends the orbit of m_p toward the equator plane of m. And so m_p has a retrograde orbit (negative ω_p), a_{pt} will change sign in order to make turn the orbit, away from the equator. Finally, this orbit will turn such that the sign of ω_p and therefore a_{pt} becomes again positive ($\alpha > \pi/2$), (prograde orbit), and the orbit will perform a precession with decreased oscillation around the equator.

The component a_{pr} is responsible for a slight orbit diameter decrease or increase, depending on the sign of ω_p.

The precession of two spinning objects.

If the planet rotates too, it will undergo a precession for almost all the possible spin orientations except the spin orientation which is opposite to that of the sun. Only the latter case is stable.

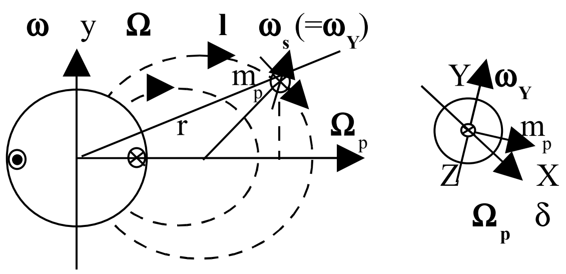


Fig. 5.2

Detail

If the mass m_p is also spinning, with a speed ω_s, one gets: the momentum M_Z of m_p created by $\mathbf{\Omega_p}$ results from the forces acting on the rotating particles:

$\mathbf{a_\Omega} \Leftarrow \mathbf{v_Z} \times \mathbf{\Omega_p}$ where we write $\mathbf{v_Z}$ as $\mathbf{v_Z} = \boldsymbol{\omega_Y} \times \mathbf{X}$ for any particle of m_p.

with $\mathbf{X}$ the equivalent momentum radius for the sphere.

Therefore also for any particle of m_p: $M_Z \Leftarrow 2\,\omega_Y\,X^2\,\Omega_p \cos\delta$.

This means: excepted in the case of an opposite rotation direction of ω_Y and ω, the gyrotation of m_1 will always influence the rotation ω_Y, while generating a precession on m_p.

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6. Disc Galaxies.

Why are some galaxies flat ? Do stellar clusters converge to the galaxy's centre ? What is the relationship between the bulge size and mass, and the star's velocity ?

For contracting spherical galaxies with a spinning centre, two different evolutions can be found. One for objects with an initial tangential velocity (in orbit), and another for objects without orbit (zero initial velocity).

Objects with an orbit

Also the orbits of stars in a galaxy around its spinning centre will collapse in prograde orbits in the equator plane of the spinning centre. The orbits get an absorbed oscillation around the centre's equatorial plane. Far from the centre, the oscillation is wider.

Objects with an orbit will undergo an angular collapse into prograde orbits due to the first effect of section 5. Ejection out of the galaxy is also possible during this collapse motion for retrograde orbits, because a_{pr} is pointing away from the mass m (opposite forces as in fig.5.1 in that case).
The angular collapse starts from the fist spherical zone near the central zone, where the gyrotation is strong and the collapse quick. Every star orbit will undergo an absorbed oscillation around the equator of the mass m , due to the acceleration a_{pt} . This oscillation brings stars closer together. It becomes quickly a group of stars, or even a part of the future disc, and the stars turn out to be more and more in phase. It can become a distorted disc with a sinuous aspect, and finally a disc.

The final tangential velocity $v_{\theta,disc}$ depends from the start position α_o , r_o and the initial tangential velocity $v_{\theta o}$.
At the same final radius, several stars with diverse velocities may join.

Distant stars outside the disc will oscillate "indefinitely", or will be partly captured by the disc's gravitation.

Objects without an orbit

Stars without an orbit will oscillate around the galaxy's centre with a strong flattened retrograde converging or non-converging motion, depending from the initial parameters of that star, such as happened with the oldest stars known, the stellar clusters.

But when a numerical simulation is made of the evolution for objects without an orbital motion, the result is a wide oscillation about the rotation axis of the galaxy's centre, which is perpendicular to the disc.
It is expected that some stars closer to the disc -while oscillating- can be partially captured by its gravitation forces.

In the following few lines, one discovers the complexity of the motion. It appears that the analytical description of the evolution is not successful any more. Only a numerical approach gives clarity.

In fig. 5.1 the law for gravitational contraction is

$$g_r \Leftarrow -G\, m / r^2 \qquad (6.1)$$

This radial displacement creates a gyrotation acceleration, deviating the object in a retrograde way

$$a_\theta \Leftarrow v_r \times \mathbf{\Omega} \qquad (6.2)$$

in the z-direction, where $\mathbf{\Omega}$ is given by (4.2).

When the object does not fall on the rotating centre but misses it, it comes in a region where now a prograde deviation is created. The object will oscillate as follows around the star: when falling towards the star, a retrograde deviation is created, when quitting the star, a prograde deviation is created.

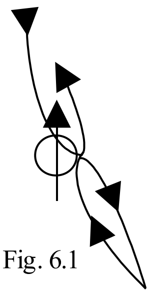

Fig. 6.1

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Stellar clusters

See : Objects without an orbit.

We could wonder if stellar clusters are obeying this law instead of their presumed converging orbits towards the centre of the galaxy. Since those stars are considered as the oldest ones of the galaxy, it is unlikely that converging would occur. Instead, they will oscillate as objects without an orbit, as explained higher, but, apparently, in such a way that the sum of the forces avoids convergence to the galaxy's centre.

Lecture E : a word on the formation of disc galaxies

Calculation of the constant velocity of the stars around the bulge of plane galaxies

The (simplified) velocity of the stars in a disc galaxy is given by $v^2=GM_0/R_0$ where M_0 and R_0 are the mass and the radius of the bulge.

Let's take the spherical galaxy again with a rotary centre (fig. 6.2). The distribution of the mass is such, that a star only feels the gravitation of the centre. We consider equal masses M_o (mass of the centre, named "the bulge") in various concentric hollow spheres according to some function of R (it must not be linear). Possibly, the orbit can be disturbed by the passage of other stars, but in general one can say that only the centre M_o has an influence according to:

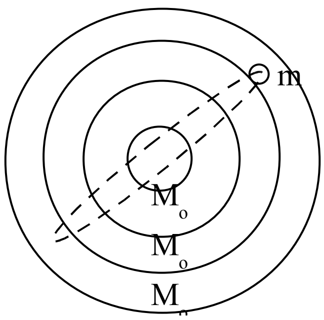

fig. 6.2

$$F_R = G\frac{M_o\, m}{R^2} \quad \text{and} \quad F_C = \frac{m\, v_R^2}{R} \qquad (6.3)\ (6.4)$$

$$\text{So} \quad F_R = F_C \quad \Rightarrow \quad v_R^2 = \frac{G\, M_o}{R} \qquad (6.5)$$

When the angular collapse of the stars is done, creating a disc by this, the following effect occurs: the mass which before took the volume $(4/3)\,\pi\, R^3$, will now be compressed in a volume $\pi\, R^2 h$ where h is the height of the disc, that is a fraction of the diameter of the initial sphere (fig. 6.3).

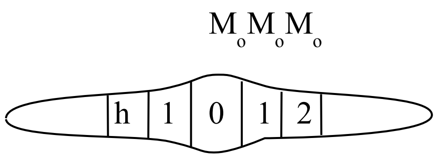

fig. 6.3

And at the distance R, a star feels more gravitation than the one generated by the mass M_o.

To a distance $k.R_o$ the star will be submitted to the influence of about $n.M_o$, where k and n are supposed to be constants.

Strong simplified, this gives for the total mass according to the distance R:

$$v_{r2}^2 = \frac{G.n.M_o}{k.R_o} \qquad (6.6)$$

Therefore, one can conclude that : $\boxed{v_{r2} = \text{constant}}$

Concerning the centre, zone zero, one cannot say much. Let's not forget that a part of the angular momentum has been transmitted to the disc, and that the centre is not a point but a zone.

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For zone one, we can say that the function of the gyrogravitation forces must be somewhere between the one of the initial sphere and the zone 2.

These findings are completely compatible with the measured values.
The diagram shows a typical example, which shows the velocities of stars for our Milky Way.

Using equation (6.6) for our Milky Way, with the reasonable estimate of a bulge diameter of 10000 light years, and a mass of 20 billion of solar masses (10% of the total galaxy), and admitting that $k = n$ we get a quite correct orbital velocity of 240 km/s (fig. 6.4).

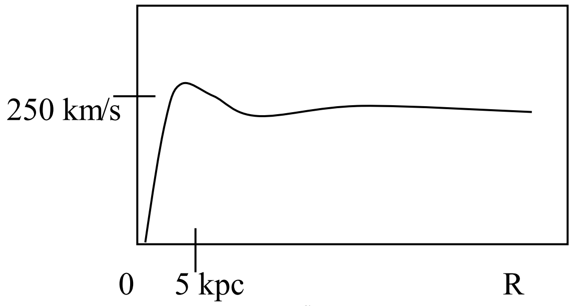


fig. 6.4

Dark matter – Missing mass

There is no need for "dark matter" to explain the formation of disk galaxies.

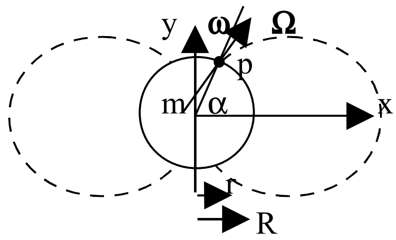
The problem of the 'missing mass' or 'dark matter' that had to bring an explanation for the velocity constancy is also solved with our explanation: the velocity constancy is entirely due to the formation of the plane galaxy without a need of invisible masses.

7. Maximum spin velocity.

Why do some fast rotary stars never explode ?

The gyrotation forces at the surface of a fast spinning star point towards the centre and to the equator of the star, and holds the star together, independently from its rotation speed. At the equator however, the gyrotation becomes zero, as well as at angles over 35°6' measured from the equator. The equations (7.4) and (7.5) express the condition of the radius and the angle for this property.

Fig. 7.1



When a supernova explodes partially, the remaining mass has a shape which does not release more mass, unless the shape of it changes by internal pressure, by collapsing. The purpose here is to find out, roughly, what happens then.
Let us consider the fast rotary star, on which the forces on p are calculated (fig. 7.1). We don't want to polemic on the correct shape for the supernova, and suppose that it is still a homogeny sphere. If the mass distribution is different, we will approximate it by a sphere.
For each point p, the gyrotation can be found by putting $r = R$ in (4.2).
And taken in account the velocity of p in this field, the point p will undergo a gyrotation force which is pointing towards the centre of the sphere.
Putting the mass $m = \pi R^3 \rho\, 4/3$ we get:

$$\mathbf{\Omega}_R \Leftarrow \frac{G\,m}{5\,R\,c^2}\left(\boldsymbol{\omega} - \frac{3\,\mathbf{R}\cdot(\boldsymbol{\omega}\bullet\mathbf{R})}{R^2}\right) \qquad (7.1)$$

The gyrotation accelerations are given by the following equations:

$$a_x \Leftarrow x\,\omega\,\mathbf{\Omega}_y = \omega\,R\cos\alpha\;\mathbf{\Omega}_y \qquad \text{and} \qquad a_y \Leftarrow x\,\omega\,\mathbf{\Omega}_x = \omega\,R\cos\alpha\,\mathbf{\Omega}_x$$

To calculate the gravitation at point p, the sphere can be seen as a point mass. Taking in account the gravitation, the centrifugal force and the gyrotation, one can find the total acceleration force:

$$a_{x\,tot} \Leftarrow R\,\omega^2.\cos\alpha\,\left(1 - \frac{G\,m(1-3\sin^2\alpha)}{5\;R\,c^2}\right) - \frac{Gm\cos\alpha}{R^2} \qquad (7.2)$$

$$- a_{y\,tot} \Leftarrow \frac{3\,Gm\omega^2 \cos^2\alpha\,\sin\alpha}{c^2} + \frac{Gm\sin\alpha}{R^2} \qquad (7.3)$$

The gyrotation term is therefore a supplementary compression force that will stop the neutron star from exploding. For elevated values of ω^2, the last term is negligible, and will maintain below a critical value of R a global compression, regardless of ω. This limit is given by the Critical Compression Radius:

$$r = R_{C\alpha} < R_C\,(1 - 3\sin^2\alpha\,) \qquad (7.4)$$

where R_C is the Equatorial Critical Compression Radius:

$$R_C = G\,m\,/\,c^2 \qquad (7.5)$$

The fig. 7.2 shows the gyrotation and the centrifugal forces at the surface.
The same deduction can be made for the lines of gyrotation inside the star. Fig. 7.3 shows the gyrotation lines and forces at the inner side of the star. We see immediately that (7.4) has to be corrected : at the equator, the gyrotation forces of the inner and the outer material are opposite. So, (7.4) is valid for $\alpha \neq 0$.

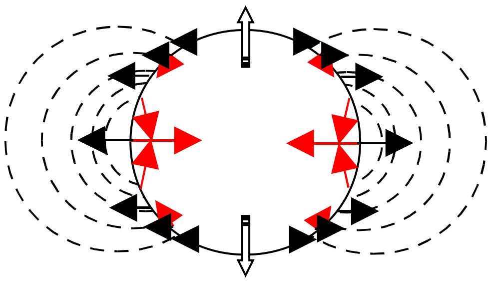


Fig. 7.2

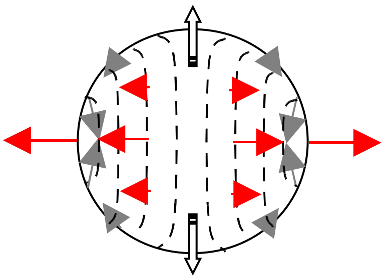


Fig. 7.3

From (7.4) also results that the shape of fast rotating stars stretches toward an *Dyson* ellipse and even a toroid: if $\alpha \geq 35°6'$, the Critical Compression Radius becomes indeed zero. The numeric calculations seems to give similar results (see overview Ansorg et al., 2003, A&A, Astro-Ph.).

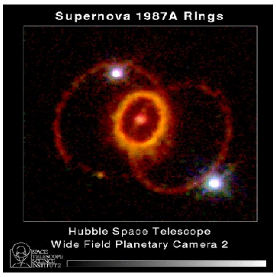
8. Mass loss, stellar wind.

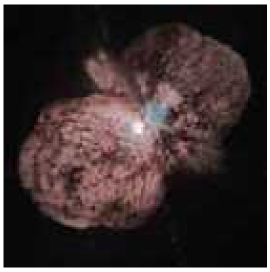
Why do some supernova remnants get curved shapes ?

Fast spinning supernova will explode locally, due to centrifugal forces and gyrotation, as explained in former section : it will explode at the equator and at the zone over 35°6' measured from the equator. But the fast speed of the remnant mass will feel a gyrotation force which bends the mass according the vector law $F = m\,v \times \Omega$.

When a rotary supernova ejects mass, the forces can be described as in section 6, but with an high initial velocity. At the equator the ejected mass is deviated in a prograde ring, which expansion slows down by gravitation but even more by the gyrotation working on the prograde motion.

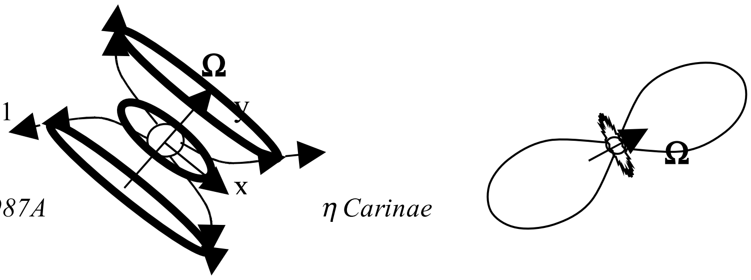
When the mass leaves under angle, a prograde ring is obtained, parallel to the equator, but outside of the equator's plane. This ring expands in a spiral, away from the star, because of its initial velocity. The expansion slows down, and will eventually collapse when contraction starts again.





The probable origin of the angle has been given in section 7: the zones of the sphere near the poles (35° to 145° and -35° to -145°) are the "weakest". Indeed, these zones have a gyrotation pointing perpendicularly on the surface of the sphere, so that the gyrotation acceleration points tangentially at this surface, so that no compensation with the centripetal force is possible. The zone near the equator (0°) has no gyrotation force which could hold the mass together in compensation of the centripetal force.

Fig. 8.1



SN 1987A: a local mass loss took place on the equator and probably close to the 35° 6' angle.
η Carinae : mass loss by complete shells, probably above the 35° 6' angle, forming two lobes with a central ring (see overview Van Boekel, R. et al., 2003).

The observation complies perfectly with this theoretical deduction. The supernovae explode into symmetric lobes, with a central disc. These lobes start nearly at 35° from equator and can reach the whole zone between.

9. Dynamo motion of the sun.

What causes the dynamo motion of the sun ?

Gyrotation forces, almost tangential on the sun's surface push the plasma to the equator. This results not in a static pressure increase, but in a double tore motion, because of the plasma proprieties (fig. 9.1).

It is observed that the spots on the sun have a displacement from nearby the poles to the equator. This takes about 11 years. This effect can be explained by the gyrotation forces.

Equation (7.1) gives the gyrotation field at the level of the sun. Equations (7.2) and (7.3) can be expressed as a new set of components to the surface of the sun: a tangential component and a radial one.

$$a_{t\,tot} \Leftarrow \omega^2.\sin 2\alpha \,.\, \left(\frac{R}{2} + \frac{G\,m}{5\,c^2} \right) \qquad (9.1)$$

$$a_{r\,tot} \Leftarrow \omega^2.\cos^2\alpha \,.\, \left(R - \frac{G\,m}{5\,c^2} \right) - \frac{G\,m}{R^2} \qquad (9.2)$$

When looking at the tangential component, mainly the centrifugal but also the gyrotation forces push the surface mass to the equator, but considering the radial component, the closer to the equator the more the gyrotation forces push the mass inwards the centre of the sun (excepted at the equator where the forces are zero).

The sun's plasma will begin to rotate internally by creating two toroid motions, one in the northern hemisphere, one in the southern.

The differential spin of the sun is not explained by this. For some reason, the spin velocity at the equator is faster than near the poles.

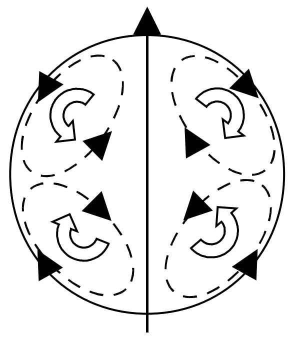


Fig. 9.1.

10. Binary stars with accretion disc.

What are the dynamics of binary pulsar systems ?
What is the origin of polar bursts, spin-up and spin-down, and bursts of collapsing stars ?

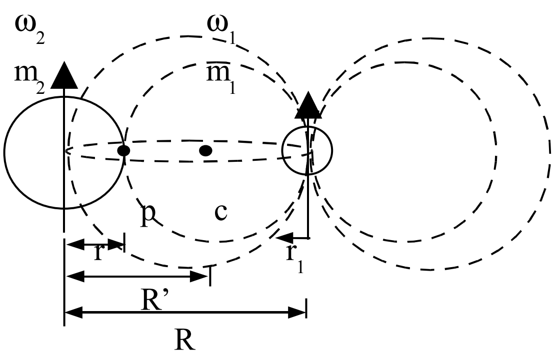
Absorption conditions of the companion.

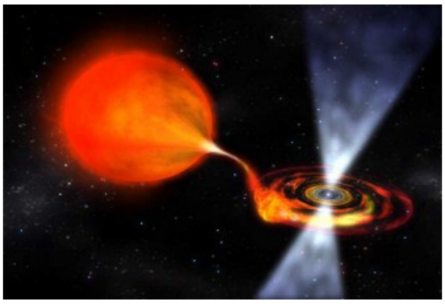
A binary pulsar system with one fast rotating star and one gas star will result in the absorption of the gas star by the rotary star due to the extra forces from gyrotation. This can happen at the front and at the rear side of the gas star.

One can calculate the conditions for cannibalisation of the companion at its front side and its back side, taking into account the gravitation, the centrifuge force and the gyrotation.

This problem can be solved by using equilibrium equations for the accelerations which are responsible for the orbits.
Another problem to solve is to find the "centre of mass" of the system. One should consider the sum of the gravitation and the gyrotation forces working reciprocally on the masses. This gives apparent masses, from which we can calculate the "centre of mass".

Fig. 10.1





The spin of the neutron star is ω_1, the spin of its companion is ω_2, and its orbital motion is ω_3.
The point p is the closest point to m_2 by report of m_1.

First part

In the first part the equilibrium of al the accelerations is studied.

1. Acceleration of point p.

In the p point one has the following accelerations:

a. the gyrotation on p, by the rotation of m_1, and by the orbit of m_2.
The gyrotation of m_2 on p has been neglected.

$a_{p\Omega} \Leftarrow v_p \times \Omega_p$ where $5(R\text{-}r)^3 .\ \Omega_p \Leftarrow G\, m_1\, \omega_1\, r_1^2 / c^2$ and $v_p = (R'\text{-}r)\, \omega_3 - r\, \omega_2$

This gives $a_{p\Omega} \Leftarrow G\,((R'\text{-}r)\, \omega_3 - r\, \omega_2)\, m_1\, \omega_1\, r_1^2 / (5(R\text{-}r)^3\, c^2)$

b. the gravitation of the mass m_1.

$$g_{p1} = G\,\frac{m_1}{(R\text{-}r)^2}$$

c. the gravitation of the mass m_2.

$$g_{p2} = G\,\frac{m_2}{r^2}$$

d. the centrifugal acceleration by ω_2.

$$a_{p2} = r\,\omega_2^2$$

e. the centripetal acceleration by ω_3.

$$a_{p3} = -\,(R'\text{-}r)\,\omega_3^2$$

The total acceleration in p is: $a_{p\,tot} = a_{p\Omega} + g_{p1} + g_{p2} + a_{p2} + a_{p3}$ (10.1)

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2. Equilibrium of the centre of m_2

On the other hand, the orbit of the centre of m_2 is in equilibrium with the gyrotation and the gravitation of this centre.

a. the gyrotation by the spin of m_1, and by the orbit of m_2

$a_{c2\Omega} \Leftarrow v_{c2} \times \Omega_{c2}$ where $5 R^3 . \Omega_{c2} \Leftarrow G\, m_1\, \omega_1\, r_1^2 / c^2$ and $v_{c2} = R'\, \omega_3$

which gives $a_{c2\Omega} \Leftarrow G\, R'\, m_1\, \omega_1\, \omega_3\, r_1^2 / (5 R^3 c^2)$

b. the gravitation of the mass m_1.

$$g_{c2} = G \frac{m_1}{R^2}$$

c. the centripetal acceleration by ω_3.

$$a_{c3} = - R'\, \omega_3^2$$

the total acceleration is: $a_{c2\ tot} = 0 = a_{c2\Omega} + g_{c2} + a_{c2}$ (10.2)

3. Equilibrium of the centre of m_1

And also, the orbit of the centre of m_1 is in equilibrium with the gyrotation and the gravitation of this centre.

a. the gyrotation by the rotation of m_1, and by the orbit of m_2

$a_{c1\Omega} \Leftarrow v_{c1} \times \Omega_{c1}$ where $5 R^3 . \Omega_{c1} \Leftarrow G\, m_2\, \omega_2\, r_2^2 / c^2$ and $v_{c1} = (R-R')\, \omega_3$

This influence can be neglected.

b. the gravitation of the mass m_2.

$$g_{c1} = G \frac{m_2}{R^2}$$

c. the centripetal acceleration by ω_3.

$$a_{c1} = - (R-R')\, \omega_3^2$$

the total acceleration is: $a_{c1\ tot} = 0 = a_{c1\Omega} + g_{c1} + a_{c3}$ (10.3)

Second part

For the second part, the gravitation centre of the system is investigated, but taking into account the gyrotation forces, which create apparent masses.

We find the apparent mass m_{1a} out of $G\, m_{1a} / R^2 = a_{c2\Omega} + g_{c2}$

or $m_{1a} = m_1\, (R'\, \omega_1\, \omega_3\, r_1^2 / (5 R c^2) + 1)$

and the apparent mass m_{2a} out of $G\, m_{2a} / R^2 = a_{c1\Omega} + g_{c1}$

or $m_{2a} = m_2\, (\, (R-R')\, \omega_2\, \omega_3\, r_2^2 / (5 R c^2) + 1)$

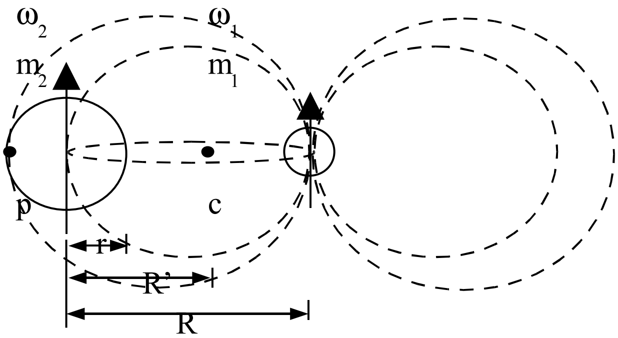
The "centre of gravity" is given by $m_{1a}\, (R-R') = m_{2a}\, R'$

Mostly, $m_{2a} \approx m_2$ which gives $m_2 = m_1\, (R-R')\, (R'\, \omega_1\, \omega_3\, r_1^2 / (5 R c^2) + 1) / R'$ (10.4)

With the equations (10.2), (10.3) and (10.4) we can eliminate three parameters, and solve (10.1).

The conditions of the absorption of the companion are being found, and by analogy the ejection conditions of material at the back side of the companion can be found as well.

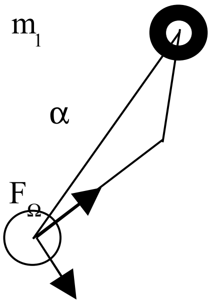
Fig. 10.2



Asymmetric orbits of binary pulsars.

The gravity centre of the system is not always its centre of rotation, in the case that the rotary star becomes a black hole because the high spin (no light escapes). But even if gravitation and gyrotation of the equator region cannot escape, gyrotation can reach the gas star via the poles region, where the rotary star is not "black" because its low velocity.

Fig. 10.3



Observation shows that the calculated centre of mass of some binary pulsars do not coincide with the centre of revolution. The velocity of the companion m_2 is not tangential to its axis with m_1.

A stable situation can be obtained by the gyrotation of the rotary star. A force F_Ω on m_2 is deviating the orbit, so that a prograde deviating circular or elliptic orbit will be observed.

An interesting explanation follows if the rotary valve is a special black hole.
As we have seen in section 8, the fast rotating star gets a local gyrotation force depending on its latitude. By 'special black hole' is meant a rotary star of which the equator has such a high velocity that when light tries to escape, it is send back. At the poles however, light escapes easily because of a much lower velocity and thus gyrotation force. Let's call it a '*black tire hole*': white at the poles, black at the equator.
If m_1 is such a *black tire hole*, it might be possible that gravitation does not reach m_2 but only gyrotation does. When a rotary star turns out to be transformed in a *black tire hole*, suddenly m_1 does not feel gravitation any more, but only gyrotation. This will break the symmetry, and cause a release of m_2 more away from m_1 and a retardation of orbit timing. The equilibrium between F_Ω and a centripetal force based on velocity v can create an angle α with the gravitational axis.

Fast rotating star analysis.

Fast rotating stars are tore shaped and they repulse matter at the equator and at the poles because of gyrotation forces (fig. 10.4). Matter which arrives inside the tore by accident rotate always inversely and slow down the rotation (spin-down). Too much trapped matter will finally result in re-ejection via the poles, so that spin-up occurs.

Near the rotary star we have the following. The accretion ring is prograde at the beginning of its formation. But the prograde results into an attraction of the ring following $\mathbf{a_r} \Leftarrow \mathbf{v_{pr}} \times \mathbf{\Omega}$.

When the matter of the accretion ring approaches the radial way, it deviates in retrograde direction, according (for particle A): $\mathbf{a_R} \Leftarrow \mathbf{v_A} \times \mathbf{\Omega}$

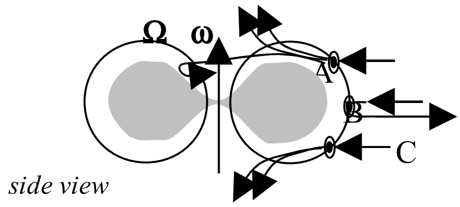
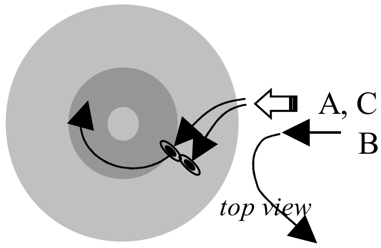


Fig. 10.4



With fast rotating heavy masses this acceleration is enormous. Then, when the particles go by retrograde way, again an acceleration is exerted on the particles in another direction $\mathbf{a_P} \Leftarrow \mathbf{v_R} \times \mathbf{\Omega}$.

As a consequence these particles are projected away from the poles.

At the level of the equator, the mass is sent back towards the accretion disc. We expect an accretion ring whose part the closest to the rotary star is almost standing still, with local prograde vortices.

If a particle, due to collisions, arrives inside the toroid to the level of the equator, it can be trapped by the gyrotation in a retrograde orbit.
This effect can result in a temporary crowding, after which the accumulation should disappear again due to the limited space and because of the local gyrotation forces.
The observed spin-up and spin-down effects are possibly explained by these trapped particles.

When these phenomena are observed, high energy X-rays are related to it. It seems not clear whether these X-rays would be gravitational waves. But there is another possible origin for these X-rays. One should not forget that the velocity of the bursts is extremely high, and probably faster than light for some particles. Both the relativity theory and the ether theories would say that high energies are produced. Considering that matter is "trapped light", and for ether theories, that the particles are forced through a slow ether, the stability of these particles could be harmed seriously. If so, the light can escape from the trap, and scatter as X-rays.

Bursts of collapsing stars.

Collapsing rotating stars will have a high spin increase, and create so a very fast increase of gyrotation. This results in the creation of a circular gravitation, which contracts the accretion disk, and re-ejects it violently as explained in the former section.

When a rotating star collapses, this happens in a very short time, and it will result in a burst. What is its process ?

The conservation of momentum causes a quick increase of its spin when a collapse occurs. And an increase of spin velocity results in an increase of gyrotation forces.

The law (1.5) : $\nabla \times \mathbf{g} \Leftarrow -\partial \mathbf{\Omega} / \partial t$

is responsible for a huge rotational gravitation force in the accretion ring. The attraction occurs in a circular way.

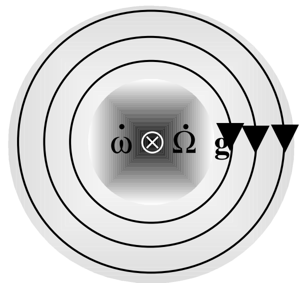


Fig. 10.5

The consequence is a strong contraction of the accretion ring, resulting in shrinking, and so a sudden repulsion of accretion matter, away from the star at the equator and at the poles, as described in the former section.

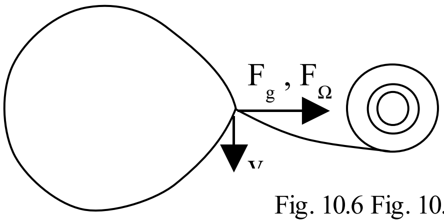
A burst occurs both at the poles and at the level of the accretion ring (see fig. 10.4 and fig. 10.5).

Calculation method for the accretion disc of a binary pulsar.

The accretion disc begin to take form via prograde matter from the gas star, which is partially stopped near the rotary star and compressed to a disc. With time, the accretion disk grows, becoming wider and thicker.

Ejection near the poles becomes possible. Later on, the followed path of matter from the gas star to the rotary star will almost remain the same, but the matter will knock the ring.

Consider fig. 10.5 in order to analyse the absorption process. Matter is absorbed according to the equation (10.1),



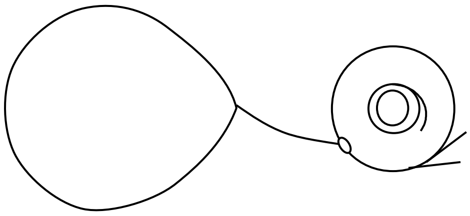


Fig. 10.6 Fig. 10.7

and will be attracted by the gravitation and the gyrotation forces near the rotary star. This matter goes prograde, and some of it will flow over the poles, which is then ejected as beams. Some prograde matter at the equator level is absorbed by the rotary star. But some matter can stay near the rotary star as a cloud, which is subject to the gyrotation pressure forces. A disc around the rotary star is being created according to this gyrotation pressure. The density of the ring will increase, and will approach the rotary star. But because of the limited thickness of the ring, it will also spill toward the outside. The masses that are pulled from the companion will then knock the widened ring (fig. 10.6).

The equilibrium equations can be produced again, this time for a ring of gas. However, the velocity of the inner part of the disc near the rotary star determines whether the disc material will be absorbed or ejected. Prograde matter is attracted, but retrograde or in-falling matter is repulsed.

11. Repulsion of masses.

Can masses be repulsive ? Can chaos be explained ?

Two parallel opposite mass streams in a gravitation field are repulsive by their gyrotation forces (fig. 11.1). Two parallel spinning objects are repulsive too (fig. 11.2).

Repulsion of masses is deducted from drawing 10.3 (particle B), but also directly from the theory: when two flows of masses dm/dt move in the same way in the same direction, the respective fields attract each other. For flows of masses having a relative velocity, their respective gyrotation fields will be repulsive.

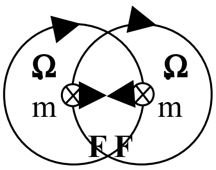
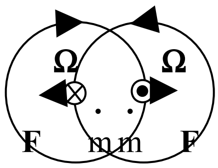


Fig. 11.1



Spinning masses do the same.

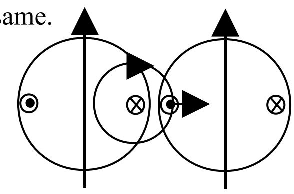
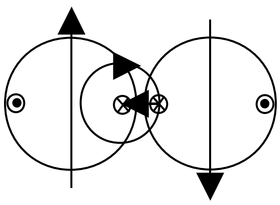


Fig. 11.2



This could explain what happens when two planets cross: gravitation and gyrotation give an apparent effect of a chaotic interference.

An important remark: we have not said much until now how to define velocities. In section 12 we will introduce this point, and in section 13 it will be detailed.

12. Relativity and Gyrotation.

How is Relativity Theory linked with Gyrotation ?

The gravitation of the steady system added with the gyrotation of the moving system gives the total field working on moving masses. The Relativity Theory's equation for a moving system observed by a steady system seems to be the gravitation of the moving system minus the gyrotation of the moving system. But in the latter theory, the existence of only Newtonian gravitation is admitted.

Two flows of masses $\dot{m}$ moving in the same way in the same direction, attract. Whether one follows the movement or not, the effect must remain the same when we apply the relativity principle.

The two points of view are compared hereunder.

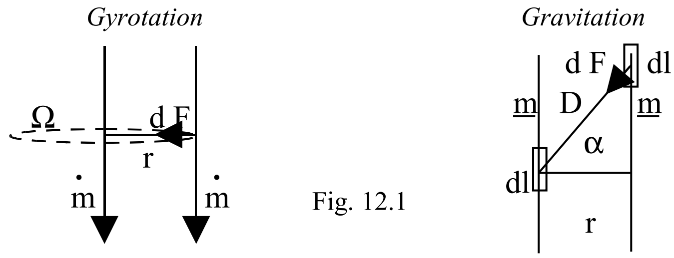


Fig. 12.1

The following notations are used:

$$\dot{m} = dm/dt \qquad \text{and} \qquad \underline{m} = dm/dl$$

For the *gyrotation* part, the work can be found from the basic formulas in sections 1 until 3 :

$$\underline{F} \Leftarrow \Omega\, \dot{m} \quad \text{and} \quad 2\pi r.\Omega \Leftarrow \tau\, \dot{m}$$

where $\underline{F} = dF/dl$ and $\tau = 4\pi G/c^2$.

So, $\underline{F} = 2\, G\, \dot{m}^2 /(rc^2)$. Now $\dot{m} = \underline{m}.v$

Hence, the work is :

$$\underline{F}.dr = 2\, G\, \underline{m}^2 v^2/(rc^2)\, dr \qquad (12.1)$$

For the *gravitation* part, the gravitation of $\underline{m}$ acting on dl is integrated, which gives :

$$\underline{F} = 2\, G\, \underline{m}^2 / r$$

The work is :

$$\underline{F}.dr = 2\, G\, \underline{m}^2/r\, dr \qquad (12.2)$$

Let's assume two observers look at the system in movement: an observer at rest and one in movement with velocity v.
An observer at rest will say: the system in movement will exercise a work equal to the gravitation of the system at rest, increased by the work exerted by the gyrotation of the system in motion.
A moving observer will say: the system will exert a work equal to the gravitation (of the moving system).
Because of the principle of relativity, the two observers are right. One can write therefore:

$$\frac{2G(\underline{m}^2_{st})_{st}}{r} + \frac{2G(\underline{m}^2_{v})_{st}\, v^2}{r\, c^2} = \frac{2G(\underline{m}^2_{st})_{v}}{r} + 0 \qquad (12.3)$$

where it is assumed (due to the relativity principle) that:

$$(\underline{m}_{st})_v = (\underline{m}_v)_{st} . \qquad \text{Hence,} \quad (\underline{m}_{st})_{st} = (\underline{m}_v)_{st}\sqrt{(1-v^2/c^2)}$$

An important consequence of this is: the "relativistic effect" of gravitation, or better, the time delay of light is expressed by gyrotation. This could be expected from the analogy with the electromagnetism.
In other words: when the gravitation and the gyrotation are taken into account, the frame can be chosen freely, while guaranteeing a "relativistic" result.

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The fact that the neutron stars don't explode can find its explanation through the forces of gyrotation, but can also be seen as a "mass increase" due to the relativistic effect. The mass increase of the relativity theory is however an *equivalent pseudo mass* due to the gyrotation forces which act locally on every point.

13. Discussion

Is the Gyrotation Theory contradicting the Relativity Theory ?

The Gyro-gravitation Theory describes what masses really do; the Relativity Theory describes how a steady observer sees light coming from a moving object assuming that only the (Relativistic) Gravitation Theory has to be taken in account. Both theories have got their application domain and their limitations.

The discussion about the paragraph 11 relates to the consequences for the relativity theory. This paragraph is treated separately in *"Relativity theory analysed"*, in order to not harm the objective of this paper which is to show how the gyrotation works and what it offers for the study of the dynamics of objects.

Relativity theory analysed

14. Conclusions

Does the Gyrotation Theory fulfils all criteria for a valid extension of Gravitation ?

Yes, it does. Gravitation Theory is only complete if the Maxwell analogue equations are used instead of the gravitation law of Newton only. Motion in a gravitation field induces gyrotation fields, which generate new forces on moving masses.

Gyrotation, defined as the transmitted angular movement by gravitation in motion, is a plausible solution for a whole set of unexplained problems of the universe. It forms a whole with gravitation, in the shape of a vector field wave theory, that becomes extremely simple by its close similarity to the electromagnetism. And in this gyrotation, the time retardation of light is locked in.
An advantage of the theory is also that it is Euclid, and that predictions are deductible of laws analogous to those of Maxwell.

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