Lectures on "A coherent dual vector field theory for gravitation".

The purpose of these lectures is to get more familiarized with gyrotation concepts and with its applications.

Lecture A: a word on the Maxwell analogy

Concerning our starting point, the Maxwell theory, it is known that the (induced) magnetic field of the electromagnetism is created by moving charges. We can even say, the *only* reason for the existence of the (induced) magnetic field is the velocity of charges, which are moving in a reference frame which has to be a field.
We shall see later that the definition of item "velocity" is very important, and this will be approached in a different way than in the relativity theory, without harming nor contradicting the relativity theory.
We know also that the magnetic field has an action which is perpendicular on the velocity vector of the charged particle, and that the Maxwell laws are complying with the Lorentz invariance, so it is "relativistic" and takes care of the time delay of light.

The magnetic field has to be seen as a transversal interference (or the transversal distortion) of a moving charge's electric field in a reference electric field. For an electric wire, this has been experienced. When the interference has been generated, this magnetic field will only influence other moving charges.

It is attractive to say that also the gravitation is also influenced by moving masses, giving also a second field, which is analogue to the magnetism.
And then, the Maxwell equations become very simple, because the charge is then replaced by the mass (Coulomb law to Newton law) and the gravito-magnetic field becomes the transmitted movement by gravitation, having the dimension s^{-1}.

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Lecture B: a word on the flux theory approach

The basic induction formula of gyrotation can also be understood the following way: Imagine a rotating sphere with spin ω. We know from several observations (disk galaxies, planetary system) that the angular movement of the rotating centre is transmitted to the surrounding objects. So, what else but rotating gravitation field would transmit it?

If we analyze m_1 in the system of fig. B1, and if one can say that a certain effect is produced by gravitation in motion, a certain function $h(\omega)$, generated by the rotation of this mass m_1, must be directly proportional to the flow dm_1/dt.
But we don't want to define the kinetic rotation of the rotary mass indeed, but the gyrotation to a certain distance of this rotary mass, generated by its gravitation field. Let's show how this works.

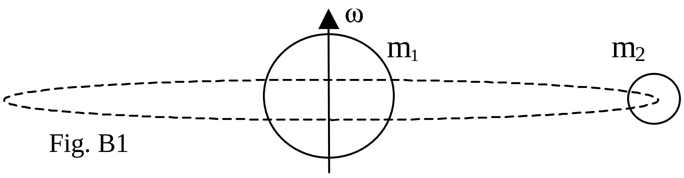

Fig. B1

Let's take a spherical mass (in fact, the shape doesn't have any importance) that of course creates a field of gravitation, and that spins with rotation velocity ω (see fig. B2).
The study of an entity according to a flow can be made like a flux (of energy). To apply this theory, one can therefore define a surface A of the spinning mass in a stationary reference frame that will form half section of the sphere. We isolate the half circle A through which the whole mass of the sphere go in one cycle ("day"). A mass flow dm_1/dt will move through this section.

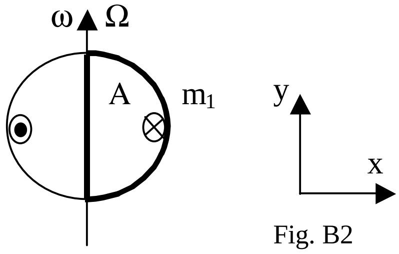

Fig. B2

The distribution of the velocities in the sphere generates a global transmitted angular movement by the gravitation, called *gyrotation* Ω (direction of rotation axis).

And for this *gyrotation* Ω, the law $F = m\,(v \times \omega)$ on a moving body is then transformed into $F = m\,(v \times \Omega)$ for all bodies which are to a certain distance from m_1. So, Ω acts locally on m_2, after being "transported" from m_1. So we can replace the certain function $h(\omega)$ by another one, $f(\Omega)$.

Here as well $f(\Omega)$ of this sphere is directly proportional to the flow of mass through the surface A.
The rotation ω and the gyrotation Ω have the same dimension, but are for the rest different entities: ω has a report with a mass in rotation, and Ω with a rotating gravitation field.

We can see that the total distribution of Ω in that section A is related to dm/dt.

We can easily see that : $\Omega_x = 0$.

Hence we can say (flux theory):

$$\iint_{\mathbf{A}} (\partial\Omega_y/\partial x)\, d\mathbf{A} \div \frac{d\,m}{d\,t} \qquad \text{(B.1)}$$

This solution is the simplified axi-symmetric solution for rotating spheres. So, we see that the flux which describes the transmission of the gravitation movement is given by $\partial\Omega_y / \partial x$.

The general form for $\partial\Omega_y / \partial x$ is given by $\tilde{N} \times W$. with $\tilde{N} = \left(\frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z}\right)$

In general, one can say when applying the flux theory: the normal component of the differential operator of W, integrated on a surface A, is directly proportional with the debit of mass through this surface. For fig. B2 one can write:

$$\iint_{\mathbf{A}} (\tilde{N} \times W)_n\, d\mathbf{A} \div \frac{d\,m}{d\,t} \qquad \text{(B.2)}$$

This equation is similar to (2.2), where the factor $4\pi\, G / c^2$ is needed to obtain a full agreement.

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

Equation (2.2) can be interpreted as follows. (We use the theorem of Stokes for the gyrotation Ω.)

The Stokes theorem transforms a two-dimensional curl distribution into a one-dimensional line vector. This is extremely effective if we want to study the law $F = m\,(v \times \Omega)$. Most of the effects which are explained in this paper make use of this law.

Gauss and Stokes have proved the general validity of the idea of a vector, surrounding a flux, valid for a vector in general, and this theorem has been applied with success on fluxes of energy.
There is no argument for not applying it (or at least to check the validity) on all sorts of vector fluxes.

One can say therefore:

The closed loop integral that W forms around the boundary of the surface A is directly proportional to the flow of mass through this surface.

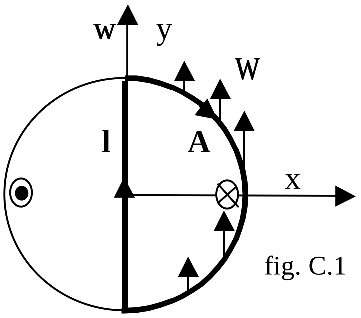

fig. C.1

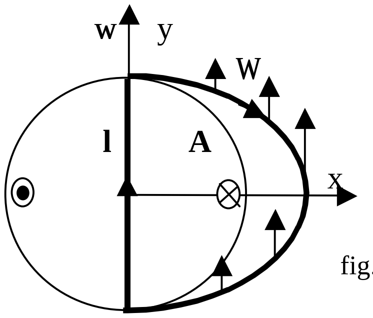

fig. C.2

Equation (8) is valid for fig. C.1 as well as fig C.2, and also for any closed loop.

It can appear strange to consider Ω that locally. Let's not forget that we wanted to study Ω very locally, just as gravitation, dawned by point in the space, on all particles that would be present in the universe.

We will choose the representation by fluxes in the world of gravitation, and find:

Law of Gyrotation :

$$\oint W \,.\, d\mathbf{l} = \tau \;\; dm/dt \qquad \text{(C.1)}$$

In this equation, τ is a constant, equal to $4\pi\, G / c^2$, as the Maxwell analogy demands it.

The previous equation can also be written as:

$$\oint W \,.\, d\mathbf{l} = \tau \iint_{\mathbf{A}} \rho\, \mathbf{v}_n \, d\mathbf{A} \qquad \text{(C.2)}$$

With ρ the density of the mass, and v_n the normal component of the velocity trough the considered surface.

Very important to notice is that the gravitation field remains the same, with or without movement of the masses. Only the (induced) magnetic field has to do with velocity of masses.

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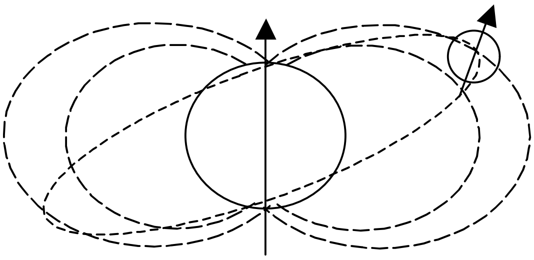
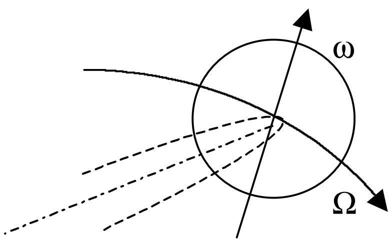
Lecture D: a word on the planetary systems

Small spinning mass near a large spinning mass : a closer look to the orbits.

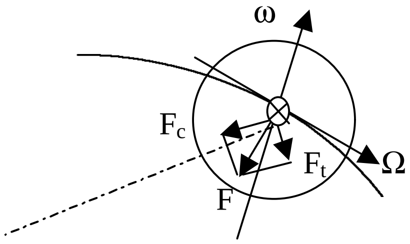
In the drawing below, we show a large spinning object which has in orbit a small object.





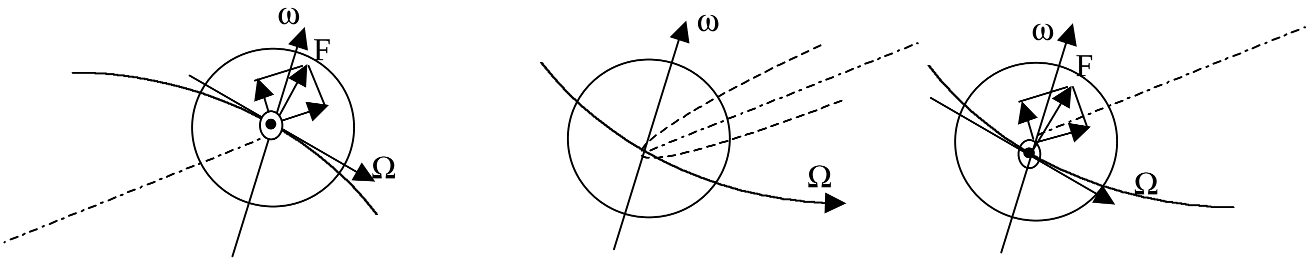
Which behaviour can the system have, depending on the orbit of the small object and the spins of the two objects?

The First Effect



The small mass, name it a planet, is rotating around a star. This is of course due to the gravitation force, in equilibrium with the centrifugal force. But in the gyrotation field of the star, the planet will feel another force, perpendicular to the gyrotation field.
This force can be split in one force F_c pointing to the centre of the star, and one, F_t perpendicular to the first, tending to move the planet downwards.

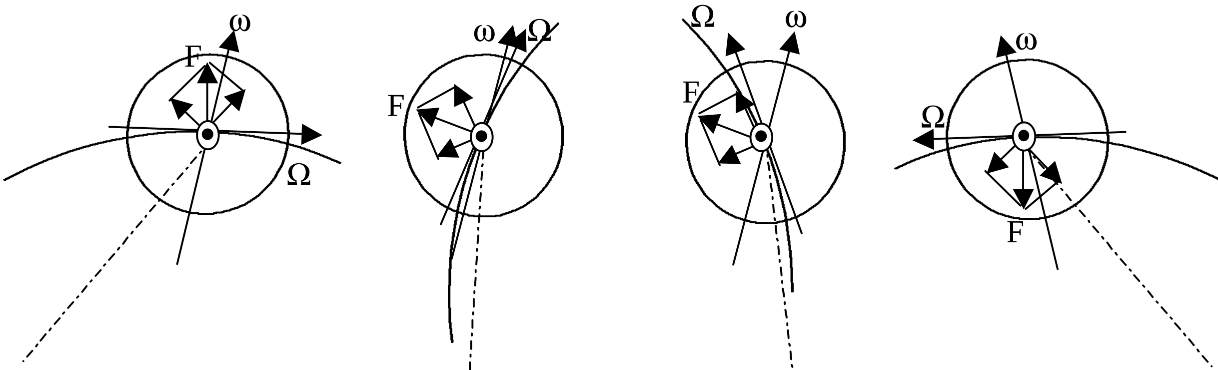
When the planet arrives after a half revolution at the other side, also the forces will be inverted:



F_c is still pointing to the centre of the star, and F_t tends this time to move the planet upwards. This will bring the planet away from the plane through the equator of the star.

But when the orbit direction of the planet is retrograde (the orbit spin of the planet and the spin of star are opposite), the orbit derives away ! The star seems ejecting the planet !

What happens with this planet ? We check it out. The planet will move towards different oriented gyrotation fields of the star, but the orbit diameter will stay unchanged, as before.

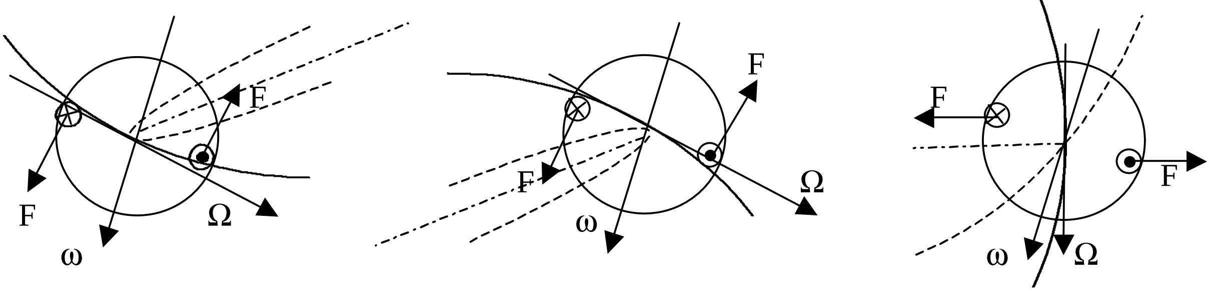


And after a while, it becomes a planet with an orbit in the other direction, in order to get forces which tend to the plane which is perpendicular to the spin of the star !

The first effect: In both cases, F_c will create a new equilibrium with the gravitation force, but F_t tend to move the planet in a plane, perpendicular to **Ω**. All the orbits of the planets tend to go in the same direction of the star's spin, prograde.

The Second Effect

But what about the influence of the planet's rotation? The planet can be seen as a multitude of rotating mass dipoles. Each dipole will feel the force F = m (v x Ω) and will create a momentum.

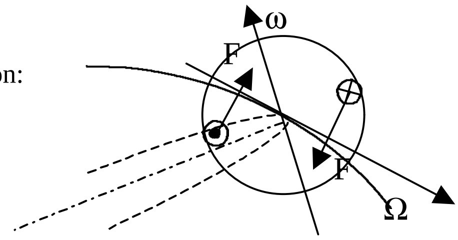


After a while, the planet arrives at the plane through the equator of the star. The direction of the forces change, but the momentum keeps the same direction.

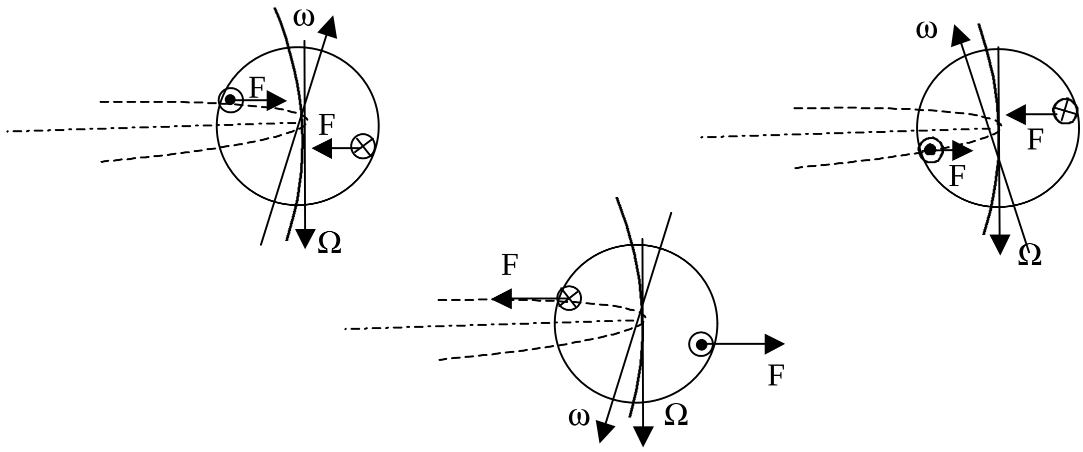
When the planet arrives at the other side of the orbit, the forces will turn differently again, as shown on the second drawing. Again, the same momentum as before is acting on the planet: it wants to put the rotation in the opposite direction than the direction of the spin of the star, as shown in the third drawing.

We check this out with a few other situations:

When the rotation axis is oriented in a different direction:



And when the planet rotates in a plane perpendicular to the rotation axis of the star:



We conclude that in this plane, the spin of the planet tends to put the its rotation parallel to the spin of the star, but in opposite direction. At the other hand, it is clear that in the two first examples, where the spin is almost parallel and in the same direction, the momentum tries to redress the rotation to an inversed spin, although it is a very small momentum compared with the momentum of the planet. The rotation becomes labile.
Only the last drawing shown gives a stable situation.

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Lecture E : a word on the formation of disk galaxies

From a sphere to a disk.

When we see at shapes of disk galaxies, how beautifully flat they are, it is strange that a rotating galaxy centre would be the reason of it. It is acceptable that the rotation of this centre is somehow transmitted to surrounding objects, but the flat shape is quite a surprise. However, the gyrotation forces explains perfectly this behaviour. The surrounding orbits obey to a downwards pressure if it is above the equator, and an upwards pressure if it is under the equator. Retrograde orbits are not allowed. Let's follow the formation of such a galaxy.

In order to fix ideas, we can imagine a small 'big bang' of a gigantic object permitting to give birth in a galaxy. We will follow the stars that remain in the action field of the system's gravitation.

The explosion is non symmetrical, causing the rotation of some parts. When the galaxy retract due to gravitation, the central zone can have a global angular momentum, whose spin velocity increases with its retraction.

The phenomenon that we will describe starts at the centre of the galaxy: following the First Effect (see Lecture D), the orbit of every star orbit cannot be retrograde, but is prograde, and will move toward the equator plan the of the rotary centre of the galaxy (angular collapse). The spherical galaxy turns into an ellipsoid galaxy and finally to a disk.

Greatly exaggerated, it could look like the fig. E.1.

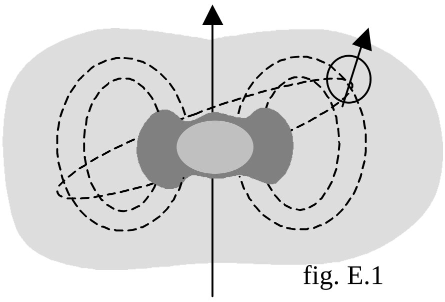

fig. E.1

Taking into account the First Effect, all stars will end up having the orbit in the same sense that the sense of the rotation of the centre, depending on the amplitude of the gyrotation. Every star will have an absorbed oscillation, but it can become a group of stars in phase, or even a part of the disk. It can become a disk with a sinuous aspect.

And in this way, the gyrotation widens its field in agreement with the conservation law of the angular momentum.

The centre is obviously not a point but an amalgam of stars that has own rotations in various directions. Farther on the disk, only a gravitmagnetism force of the centre and of the first part of the disk exists. Closer to the centre the stars have chaotic movements, what the First Effect does not cover.

From a disk to a spiral disk.

The pressure on the stars exerted by the gyrotation flattens the disk and increases its density so much that several stars will get in fusion. Several high density zones will create empty zones elsewhere. Finally, some structured shapes, such as spirals or matrices, will begin to be shaped.

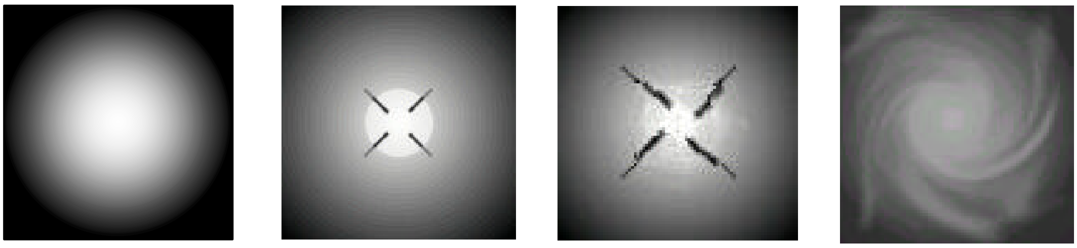

Fig. E.2

Since the creation of the galaxy, a long time has passed. The mystery of the (apparently too) low number of windings of spirals in spiral galaxies is explained by the time needed for the angular collapse and the formation of the spirals.

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