Gravitation as the result of the reintegration of migrated electrons and positrons to their atomic nuclei.

Osvaldo Domann

odomann@yahoo.com

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(This paper is an extract of [6] listed in section Bibliography.)

Abstract

This paper presents the mechanism of gravitation based on an approach where the energies of electrons and positrons are stored in fundamental particles (FPs) that move radially and continuously through a focal point in space, point where classically the energies of subatomic particles are thought to be concentrated. FPs store the energy in longitudinal and transversal rotations which define corresponding angular momenta. Forces between subatomic particles are the product of the interactions of their FPs. The laws of interactions between fundamental particles are postulated in that way, that the linear momenta for all the basic laws of physics can subsequently be derived from them, linear momenta that are generated out of opposed pairs of angular momenta of fundamental particles.

The flattening of Galaxies' Rotation Curve is derived without the need of the definition of Dark Matter, and the repulsion between galaxies is shown without the need of Dark Energy.

The mechanism of the dragging between neutral moving masses is explained (Thirring-Lense-effect) and how gravitation affects the precision of atomic clocks is presented (Hafele-Keating experiment).

Finally, the quantification of the gravitation force is derived.

1 Introduction.

Our "Standard Model" describes a particle as a point-like entity with the energy concentrated on one point in space. The mechanism how forces between charged particles are generated is not explained. This limitation of our Standard Model results from the introduction of a series of artificial particles and constructions like Gluons, Gravitons, particle's wave, dark matter, dark energy, etc., to explain the mechanism of interaction between particles.

The proposed approach postulates that a particle is formed by rays of Fundamental Particles (FPs) that move through a focal point in space. The relativistic energy of the particle is stored by the FPs as longitudinal and transversal rotations. Interactions between two particles are now the result of the interactions between FPs of the two particles.

The steps followed to describe mathematically the new model are:

1. Definition of a distribution function $d\kappa$ that assigns to each volume dV in space a differential energy dE of the total relativistic energy of the particle.

2. Definition of a field magnitude $d\bar{H}$ associated with the angular momenta of FPs.

3. Definition of interaction laws between $d\bar{H}$ fields of FPs in that way, that all forces between particles can be mathematically derived.

In what follows electrons and positrons are called "Basic Subatomic Particles" (BSPs).

The total relativistic energy of a BSP is

$$E_e = \sqrt{E_o^2 + E_p^2} = E_s + E_n \quad with \quad E_s = \frac{E_o^2}{\sqrt{E_o^2 \,+\, E_p^2}} \qquad E_n = \frac{E_p^2}{\sqrt{E_o^2 \,+\, E_p^2}} \tag{1}$$

The differential energies for each differential volume are:

$$dE_e = E_e \, d\kappa = \nu \; J_e \qquad dE_s = E_s \, d\kappa = \nu \; J_s \qquad dE_n = E_n \, d\kappa = \nu \; J_n \tag{2}$$

with $d\kappa$ the distribution function, ν the angular frequency and J the angular momenta.

$$d\kappa = \frac{1}{2} \, \frac{r_o}{r_r^2} \, dr \; \sin\varphi \; d\varphi \, \frac{d\gamma}{2\pi} \qquad\qquad dV = dr \; r \; d\varphi \; r \; \sin\varphi \; d\gamma \tag{3}$$

$d\kappa$ is inverse proportional to the square distance to the focal point and gives the fraction of the relativistic energy for the volume dV of the FP.

FPs leaving the focal point (emitted FPs) have only longitudinal angular momenta J_e and associated to it a longitudinal emitted field $d\bar{H}_e$ defined as

$$d\bar{H}_e = H_e \; d\kappa \; \bar{s}_e = \sqrt{\nu \; J_e \; d\kappa} \; \bar{s}_e \qquad with \qquad H_e^2 = E_e \tag{4}$$

FPs moving to the focal point (regenerating FPs) have longitudinal J_s and transversal J_n angular momenta and associated to them respectively a longitudinal emitted field

$d\bar{H}_s$ defined as

$$d\bar{H}_s = H_s \, d\kappa \; \bar{s} = \sqrt{\nu \; J_s \; d\kappa} \; \bar{s} \qquad with \qquad H_s^2 = E_s \tag{5}$$

and a transversal emitted field $d\bar{H}_n$ defined as

$$d\bar{H}_n = H_n \, d\kappa \; \bar{n} = \sqrt{\nu \; J_n \; d\kappa} \; \bar{n} \qquad with \qquad H_n^2 = E_n \tag{6}$$

For the total field magnitude H_e it is $H_e^2 = H_s^2 \; + \; H_n^2$.

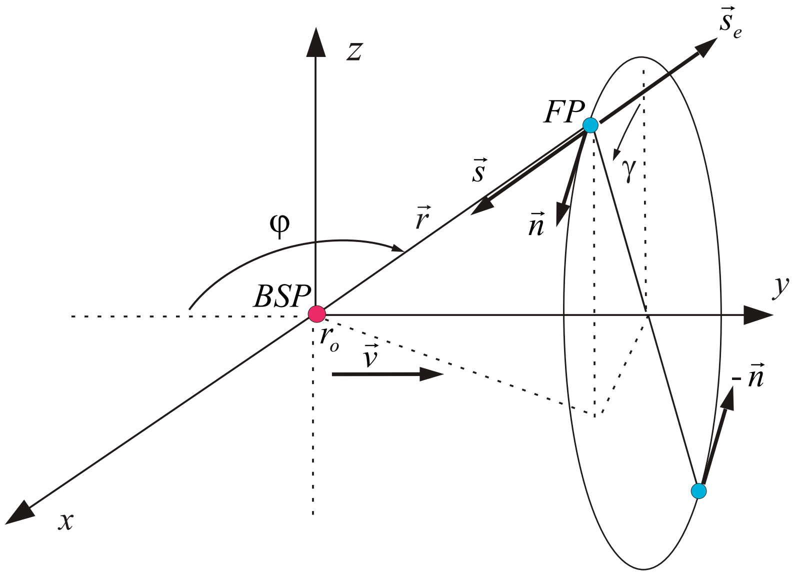

Figure 1: Unit vector $\bar{s}_e$ for an emitted FP and unit vectors $\bar{s}$ and $\bar{n}$ for a regenerating FP of a BSP moving with $v \neq c$

Fig. 1 shows at the origin of the Cartesian coordinates the focus of a BSP moving with speed $\bar{v}$. The vector $\bar{s}_e$ is an unit vector in the moving direction of the emitted fundamental particle (FP). The vector $\bar{s}$ is an unit vector in the moving direction of the regenerating FP. The vector $\bar{n}$ is an unit vector transversal to the moving direction of the regenerating FP and oriented according the right screw rule relative to the velocity $\bar{v}$ of the BSP.

The differential linear momentum dp of a moving BSP is generated out of pairs of opposed transversal fields $d\bar{H}_n$ at the regenerating FPs of the BSP. Opposed pairs of transversal fields $d\bar{H}_n$ are generated because of the axial symmetry relative to the velocity $\bar{v}$ of the BSP as shown in Fig. 1.

Conclusion: Basic subatomic particles (BSPs) are structured particles with longitudinal and transversal angular momenta. The sign of the angular momenta of emitted FPs define the sign of the BSP (electron or positron). The transversal field $d\bar{H}_n$ gives the kinetic linear moment.

Interaction laws between FPs of two BSPs are defined as products between their $d\bar{H}$ fields.

- **Coulomb law**: The close path integration of the cross product between longitudinal $d\bar{H}_s$ fields gives the Coulomb equation.
- **Ampere law**: The close path integration of the cross product between transversal $d\bar{H}_n$ fields gives the Lorentz, Ampere and Bragg equations.
- **Induction law**: The close path integration of the product between the transversal field $d\bar{H}_n$ and the absolute value of the longitudinal $d\bar{H}_s$ field of a static BSP gives the Maxwell equations and the gravitation equations.

The fundamental equation to calculate the differential force between two BSPs is

$$dF = \frac{dp}{\Delta t} = \frac{1}{c\Delta t}\, dE_p = \frac{1}{c\Delta t}\, |d\bar{H}_1 \times d\bar{H}_2| \tag{7}$$

2 Mechanism of Gravitation.

To explain the mechanism of gravitation, the concept of reintegration of BSPs that have migrated out of their nuclei is required.

Because of $d\bar{H}_s = dH_s \bar{s}$ and $\bar{J}_s = J_s \bar{s}$ the interaction law between FPs of static BSPs (Coulomb) follows the cross product between longitudinal angular momenta $|\bar{J}_{e_1} \times \bar{J}_{s_2}| = J_{e_1}\ J_{s_2} \sin\ \beta = J_n$ of the FPs, cross product which is zero for the distance $d = 0$ between BSPs because of $\beta = \pi/2$.

In Fig. 2 the differential linear momentum dp_2 at BSP 2 is generated by pairs of opposed angular momentum $\bar{J}_{n_2}$ of regenerating FPs.

Fig. 3 gives the linear momentum between two BSPs as a function of the distance d. The variable r_o represents the radii of the focus of the BSPs, which are constant for non relativistic speeds.

Nucleons are composed of electrons and positrons which are concentrated in the range of $0 \leq \gamma \leq 0.1$ of the curve of Fig. 3 where the attractions and repulsions between them are zero.

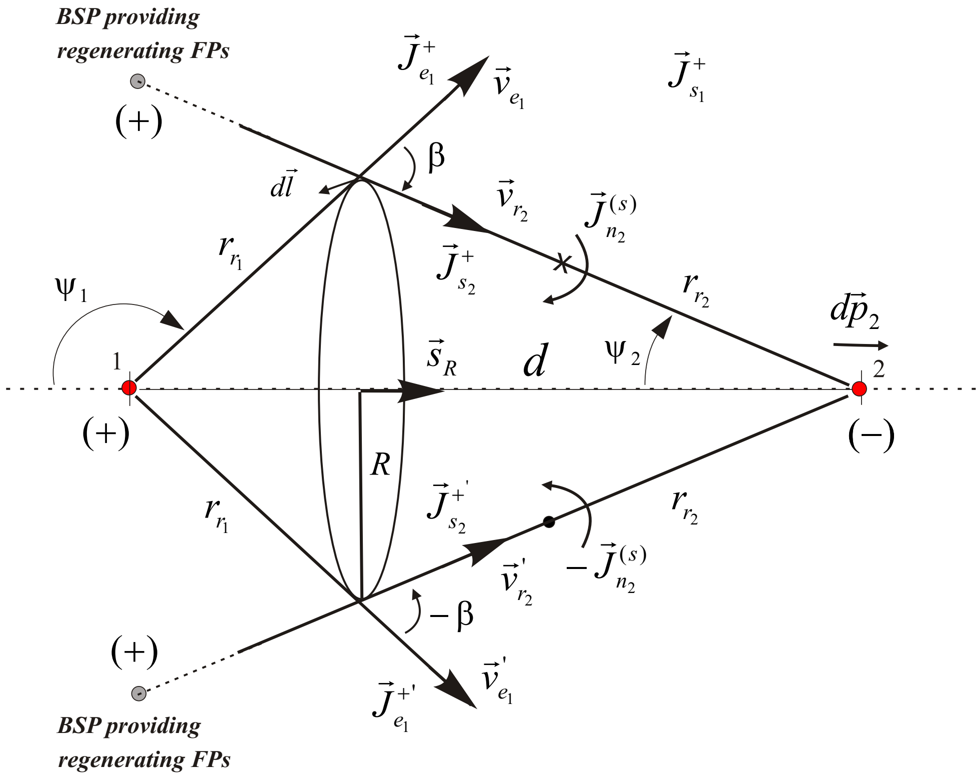

Figure 2: Generation of angular momentum J_n at regenerating fundamental particles of two static basic subatomic particles at the distance d

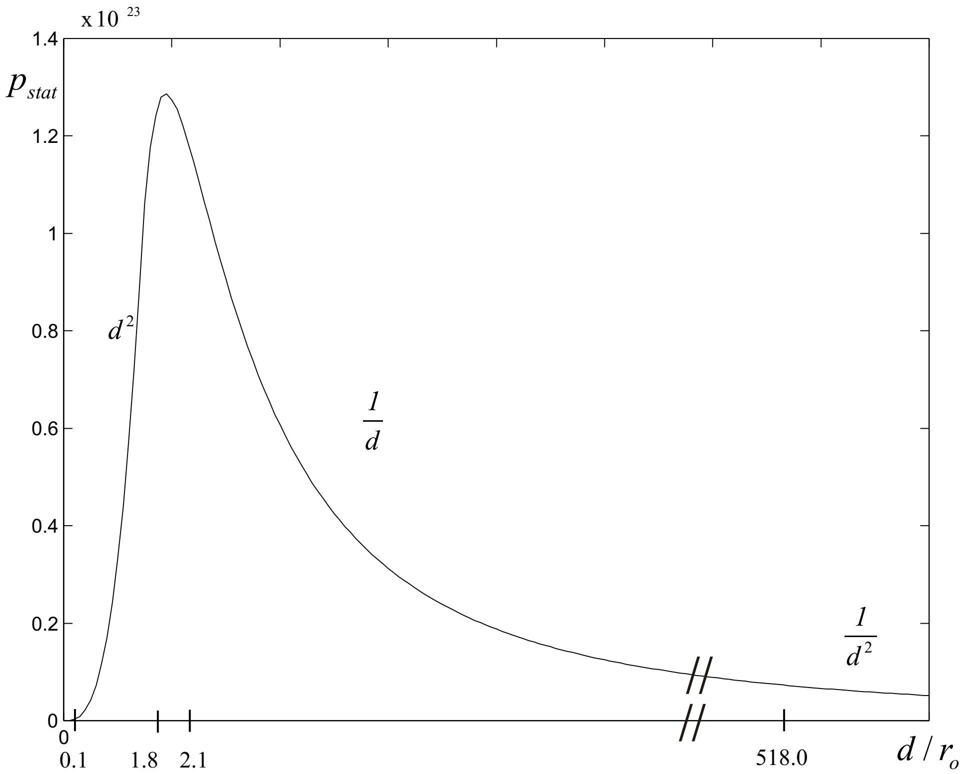

Figure 3: Linear momentum p_{stat} as function of $\gamma = d/r_o$ between two static BSPs with equal radii $r_{o_1} = r_{o_2}$

Electrons and positrons of a nucleon migrate slowly into the range of $0.1 \leq \gamma \leq 1.8$ polarizing the nucleon, and are subsequently reintegrated with high speed when their FPs cross with FPs of the remaining electrons and positrons of the nucleon because of $\beta < \pi/2$ (Neutron 1 at Fig. 4). Opposed linear momenta $d\bar{p}_a$ and $d\bar{p}_b$ are generated at BSPs a and b.

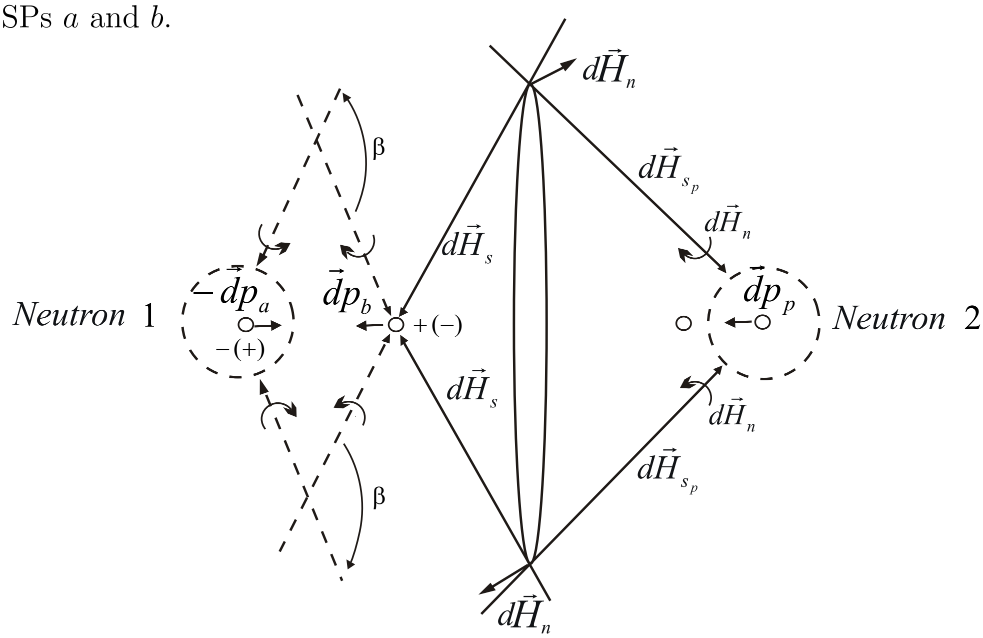

Figure 4: Transmission of momentum dp_b from neutron 1 to neutron 2

The movement of BSP b generates the dH_n field shown in Fig. 4, field that is passed to the static BSP p of neutron 2 according the **induction law** of sec. 1. The final result is that neutron 1 moves with the linear momentum $-d\bar{p}_a$ and neutron 2 with the opposed linear momentum $d\bar{p}_p$. The mechanism is independent of the sign of the interacting BSPs explaining the attracting force of gravitation. It is important to note that as BSPs a and b generate opposed dH_n fields that are passed to BSP p of neutron 2, the field of BSP b is closer to BSP p and has a higher probability to be passed to BSP p.

3 Newton gravitation force.

To calculate the gravitation force induced by the reintegration of migrated BSPs, we need to know the number of migrated BSPs in the time Δt for a neutral body with mass M.

The following equation was derived in [6] for the **induced gravitation** force generated by one reintegrated electron or positron

$$F_i = \frac{dp}{\Delta t} = \frac{k\ c\ \sqrt{m}\ \sqrt{m_p}}{4\ K\ d^2} \int\int_{Induction} \qquad with \qquad \int\int_{Induction} = 2.4662 \qquad (8)$$

with m the mass of the reintegrating BSP, m_p the mass of the resting BSP, $k = 7.4315 \cdot 10^{-2}$. It is also

$$\Delta t = K\ r_o^2 \qquad r_o = 3.8590 \cdot 10^{-13}\ \ m \qquad and \qquad K = 5.4274 \cdot 10^4\ \ s/m^2 \qquad (9)$$

The direction of the force F_i on BSP p of neutron 2 in Fig. 4 is independent of the sign of the BSPs and is always oriented in de direction of the reintegrating BSP b of neutron 1.

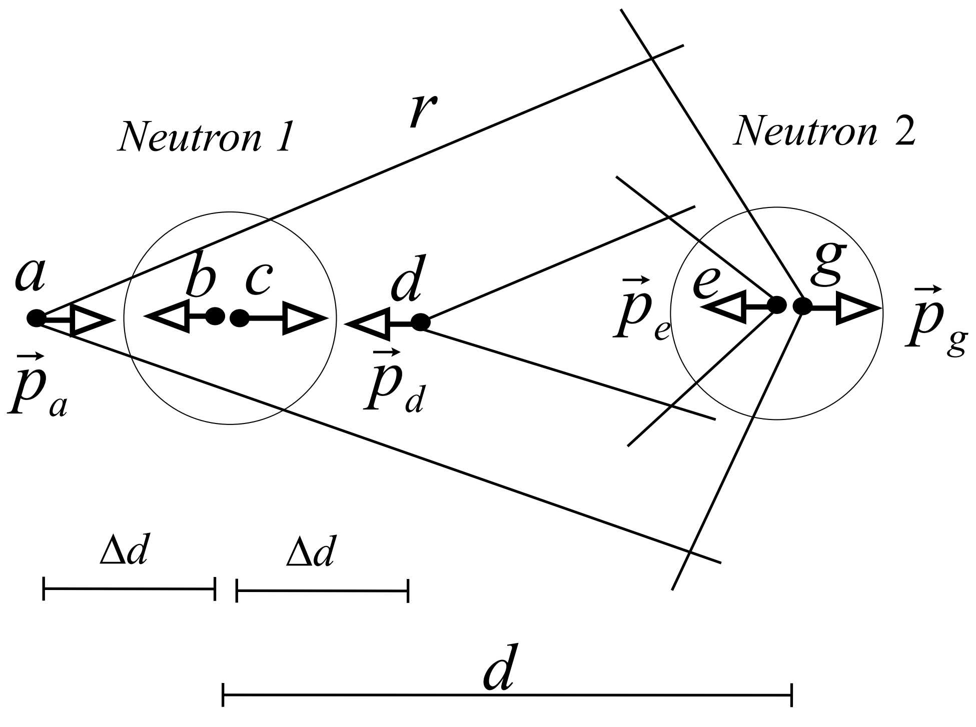

Figure 5: Net momentum transmitted from neutron 1 to neutron 2

Fig. 5 shows reintegrating BSPs a and d at Neutron 1 that transmit respectively opposed momenta p_g and p_e to neutron 2. Because of the grater distance from neutron 2 of BSP a compared with BSP d, the probability for BSP d to transmit his momentum is grater than the probability for BSP a. Momenta are quantized and have all equal absolute value independent if transmitted or not. The result computed over a mass M gives a net number of transmitted momentum to neutron 2 in the direction of neutron 1, what explains the attraction between neutral masses.

For two bodies with masses M_1 and M_2 and where the number of reintegrated BSPs in the time Δt is respectively Δ_{G_1} and Δ_{G_2} it must be

$$F_i\ \Delta_{G_1}\ \Delta_{G_2} = G\ \frac{M_1\ M_2}{d^{\,2}} \qquad with \qquad G = 6.6726 \cdot 10^{-11}\ \ \frac{m^3}{kg\ s^2} \tag{10}$$

As the direction of the force F_i is the same for reintegrating electrons Δ_G^- and positrons Δ_G^+ it is

$$\Delta_G = |\Delta_G^-| + |\Delta_G^+| \tag{11}$$

We get that

$$\Delta_{G_1}\ \Delta_{G_2} = G\ \frac{4\ K\ M_1\ M_2}{m\ k\ c\ \int\int_{Induction}} \tag{12}$$

or

$$\Delta_{G_1}\ \Delta_{G_2} = 2.8922 \cdot 10^{17}\ M_1\ M_2 = \gamma_G^2\ M_1\ M_2 \tag{13}$$

The number of migrated BSPs in the time Δt for a neutral body with mass M is thus

$$\Delta_G = \gamma_G\ M \qquad with \qquad \gamma_G = 5.3779 \cdot 10^{8}\ \ kg^{-1} \tag{14}$$

Calculation example: The number of migrated BSPs that are reintegrated at the sun and the earth in the time Δt are respectively, with $M_\odot = 1.9891 \cdot 10^{30}\ kg$ and $M_\dagger = 5.9736 \cdot 10^{24}\ kg$

$$\Delta_{G_\odot} = 1.0697 \cdot 10^{39} \qquad and \qquad \Delta_\dagger = 3.2125 \cdot 10^{33} \tag{15}$$

The power exchanged between two masses due to gravitation is

$$P_G = F_i\ c = \frac{E_p}{\Delta t} = \frac{k\ m\ c^2}{4\ K\ d^{\,2}}\ \Delta_{G_1}\ \Delta_{G_2}\ \int\int_{Induktion} \tag{16}$$

The power exchanged between the sun and the earth is, with $d_{\odot\dagger} = 1.49476 \cdot 10^{11}\ m$

$$P_G = F_G\ c = \ G\ \frac{M_\odot\ M_\dagger}{d_{\odot\dagger}^2}\ c = 1.0646 \cdot 10^{31}\ \ J/s \tag{17}$$

4 Ampere gravitation force.

In the previous sections we have seen that the induced gravitation force is due to the reintegration of migrated BSPs in the direction d of the two gravitating bodies (longitudinal reintegration). When a BSP is reintegrated to a neutron, the two BSPs of different signs that interact, produce an equivalent current in the direction of the positive BSP as shown in Fig. 6.

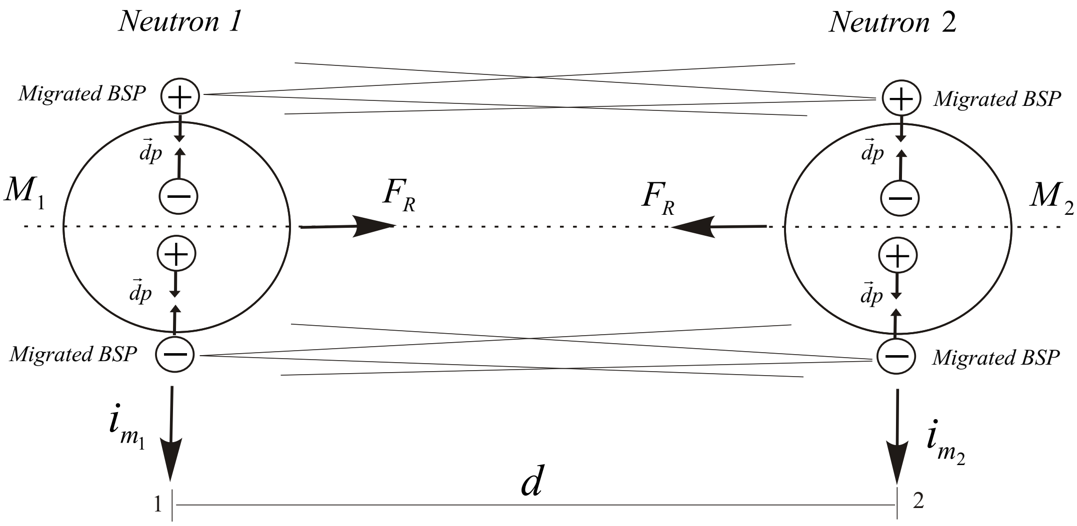

Figure 6: Resulting current due to reintegration of migrated BSPs

As the numbers of positive and negative BSPs that migrate in one direction at one neutron are equal, no average current should exists in that direction in the time Δt. It is

$$\Delta_R = \Delta_R^+ + \Delta_R^- = 0 \tag{18}$$

We now assume that because of the power exchange (16) between the two neutrons, a synchronization between the reintegration of BSPs of equal sign in the direction orthogonal to the axis defined by the two neutrons is generated, resulting in parallel currents of equal sign that generate an attracting force between the neutrons. The synchronization is generated by the relative movements between the gravitating bodies and is zero between static bodies. Thus the total attracting force between the two neutrons is produced first by the induced (Newton) force and second by the currents of reintegrating BSPs (Ampere).

$$F_T = F_G + F_R \qquad with \qquad F_G = G\,\frac{M_1\;M_2}{d^2} \qquad and \qquad F_R = R\,\frac{M_1\;M_2}{d} \tag{19}$$

To derive an equation we start with the following equation from [6] derived for the total force density due to Ampere interaction.

$$\frac{F}{\Delta l} = \frac{b}{c\,\Delta_o t}\,\frac{r_o^2}{64\,m}\,\frac{I_{m_1}\,I_{m_2}}{d}\int_{\gamma_{2min}}^{\gamma_{2max}}\int_{\gamma_{1min}}^{\gamma_{1max}}\frac{\sin^2(\gamma_1-\gamma_2)}{\sqrt{\sin\gamma_1\,\sin\gamma_2}}\,d\gamma_1\,d\gamma_2 \qquad (20)$$

with $\int\int_{Ampere} = 5.8731$.

It is also for $v \ll c$

$$\rho_x = \frac{N_x}{\Delta x} = \frac{1}{2\,r_o} \qquad I_m = \rho\,m\,v \qquad \Delta_o t = K\,r_o^2 \qquad I_m = \frac{m}{q}\,I_q \qquad (21)$$

We have defined a density ρ_x of BSPs for the current so that one BSP follows immediately the next without space between them. As we want the force between one pair of BSPs of the two parallel currents we take $\Delta l = 2\,r_o$.

For one reintegrating BSP it is $\rho = 1$. The current generated by one reintegrating BSP is

$$I_{m_1} = i_m = \rho\,m\,v_m = \rho\,m\,k\,c \qquad with \qquad v_m = k\,c \qquad k = 7.4315\cdot10^{-2} \qquad (22)$$

We get for the force between one transversal reintegrating BSP at the body with mass M_1 and one longitudinal reintegrating BSP at M_2 moving parallel with the speed v_2

$$dF_R = 5.8731\,\frac{b}{\Delta_o t}\,\frac{2\,r_o^3}{64}\,\rho^2\,m\,k\,\frac{v_2}{d} = 2.2086\cdot10^{-50}\,\frac{v_2}{d}\;N \qquad (23)$$

with $I_{m_2} = i_2 = \rho\,m\,v_2$.

The concept is shown in Fig. 7.

Note: The sign that takes the current i_m of the reintegrating BSP at the body with mass M_1 which interacts with the current i_2, is a function of the direction of the magnetic poles of M_1. The Ampere gravitation force F_R is therefore an attraction or a repulsion force depending on the relative directions of the magnetic poles of M_1 and the speed v_2.

In sec. 3 we have derived the mass density γ_G of reintegrating BSPs. At Fig. 5 we have seen that half of the longotudinal reintegrating BSPs of a neutron 1 induce momenta on neutron 2 in one direction while the other half of longitudinal reintegrating BSPs induce momenta in the opposed direction on neutron 2. In Fig. 7 we see, that all longitudinal reintegrating BSPs at M_2 generate a current component i_2 in the direction of the speed v_2. This means that we have to take for the density γ_A of reintegrating BSPs for the Ampere gravitation force approximately twice the value of the density γ_G

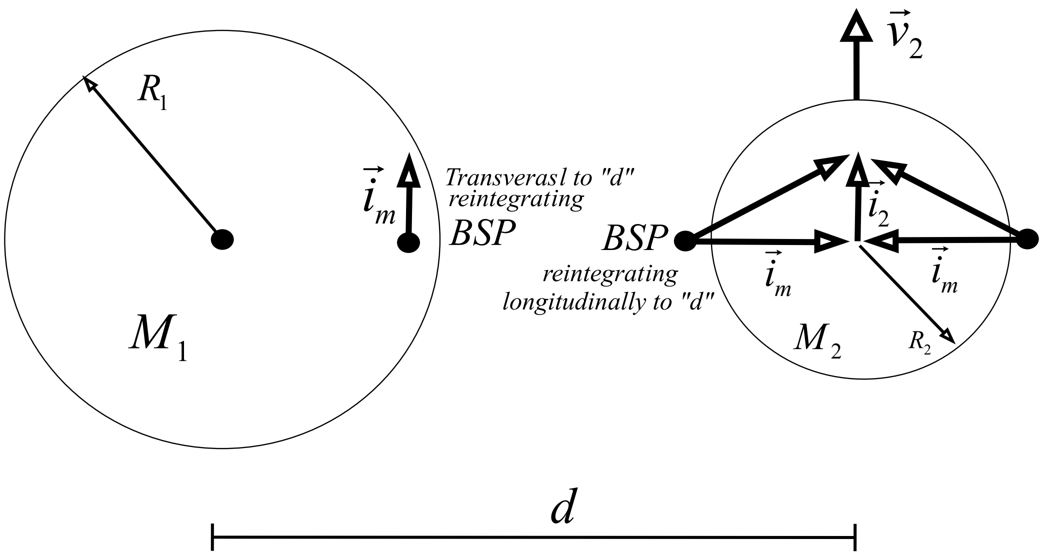

Figure 7: Ampere gravitation

of the Newton gravitation force

$$\gamma_A \approx 2\ \gamma_G = 2 \cdot 5.3779 \cdot 10^8 = 1.07558 \cdot 10^9\ \ kg^{-1} \tag{24}$$

resulting for the total Ampere gravitation force between M_1 and M_2

$$F_R = \ 5.8731\ \frac{b}{\Delta_o t}\ \frac{2\ r_o^3}{64}\ \rho^2\ m\ k\ v_2\ \gamma_A^2\ \frac{M_1\ M_2}{d} = 2.5551 \cdot 10^{-32}\ v_2\ \frac{M_1\ M_2}{d}\ \ N \tag{25}$$

where

$$F_R = R\ \frac{M_1\ M_2}{d} \qquad with \qquad R = 2.5551 \cdot 10^{-32}\ v_2 = R(v_2) \tag{26}$$

The total gravitation force gives

$$F_T = F_G + F_R = \left[\frac{G}{d^2} + \frac{R}{d}\right]\ M_1\ M_2 \tag{27}$$

The concept is shown in Fig. 8.

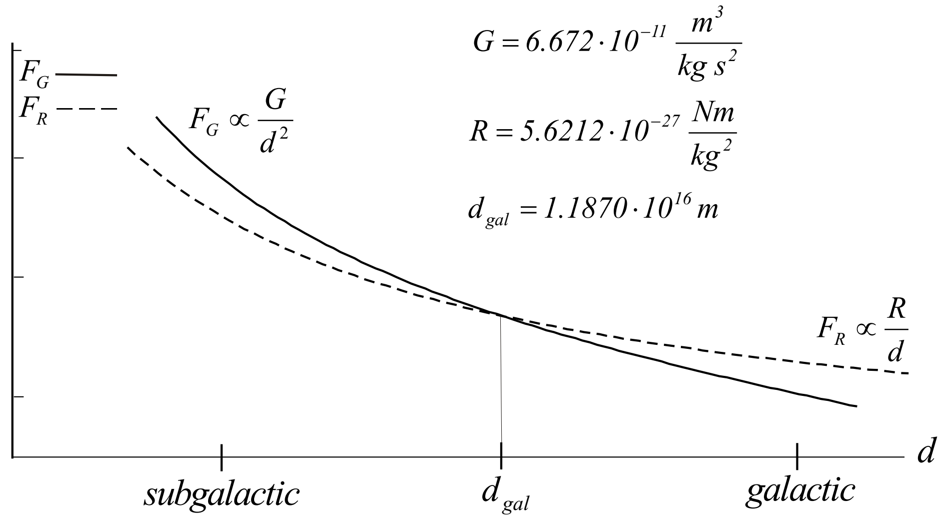

Figure 8: Gravitation forces at sub-galactic and galactic distances.

4.1 Flattening of galaxies' rotation curve.

For galactic distances the Ampere gravitation force F_R predominates over the induced gravitation force F_G and we can write eq. (27) as

$$F_T \approx F_R = \frac{R}{d}\, M_1\, M_2 \tag{28}$$

The equation for the centrifugal force of a body with mass M_2 is

$$F_c = M_2\, \frac{v_{orb}^2}{d} \qquad\qquad with\ v_{orb}\ the\ tangential\ speed \tag{29}$$

For steady state mode the centrifugal force F_c must equal the gravitation force F_T. For our case it is

$$F_c = M_2\, \frac{v_{orb}^2}{d} = F_T \approx F_R = \frac{R}{d}\, M_1\, M_2 \tag{30}$$

We get for the tangential speed

$$v_{orb} \approx \sqrt{R\, M_1} \qquad constant \tag{31}$$

The tangential speed v_{orb} is independent of the distance d what explains the flattening of galaxies' rotation curves.

Calculation example

In the following calculation example we assume that the transition distance d_{gal} is much smaller than the distance between the gravitating bodies and that the Newton force can be neglected compared with the Ampere force.

For the Sun with $v_2 = v_{orb} = 220\ km/s$ and $M_2 = M_\odot = 2 \cdot 10^{30}\ kg$ and a distance to the core of the Milky Way of $d = 25 \cdot 10^{19}\ m$ we get a centrifugal force of

$$F_c = M_2\ \frac{v_{orb}^2}{d} = 3.872 \cdot 10^{20}\ \ N \tag{32}$$

With

$$R(v_2) = 2.5551 \cdot 10^{-32}\ v_2 = 5.6212 \cdot 10^{-27}\ \ Nm/kg^2 \tag{33}$$

and

$$F_c \approx R\ \frac{M_1\ M_2}{d} \tag{34}$$

we get a Mass for the Milky Way of

$$M_1 = F_c\ d\ \frac{1}{R\ M\odot} = 4.3 \cdot 10^6\ M\odot \tag{35}$$

and with

$$F_G = F_R \qquad we\ get \qquad d_{gal} = \frac{G}{R} = 1.1870 \cdot 10^{16}\ \ m \tag{36}$$

justifying our assumption for $F_T \approx F_R$ because the distance between the Sun and the core of the Milky Way is $d \gg d_{gal}$.

Note: The mass of the Milky Way calculated with the Newton gravitation law gives $M_1 \approx 1.5 \cdot 10^{12}\ M\odot$ which is huge more than the bright matter and therefore called dark matter. The mass calculated with the present approach corresponds to the bright matter and there is no need to introduce virtual masses in space.

For sub-galactic distances the induced force F_G is predominant, while for galactic distances the Ampere force F_R predominates, as shown in Fig. 8.

$$d_{gal} = \frac{G}{R} \tag{37}$$

Note: The flattening of galaxies' rotation curve was derived based on the assumption that the gravitation force is composed of an induced component and a component due to parallel currents generated by reintegrating BSPs and, that for galactic distances the induced component can be neglected.

5 Precession of the perihelion.

The total gravitation force is

$$F_T = F_G + F_R = \left[\frac{G}{d^2} + \frac{R}{d} \right] \; M_1 \; M_2 \qquad with \qquad G = G = 6.6726 \cdot 10^{-11} \; \frac{m^3}{kg \; s^2} \tag{38}$$

and

$$R(v_2) = 2.5551 \cdot 10^{-32} \; v_2 \;\; Nm/kg^2 \tag{39}$$

The first term F_G gives the elliptic shape of the planet orbit while the second term F_R gives the precession of the orbit.

6 Quantification of gravitation forces.

In sec. 8.1 from [6] "Induction between an accelerated and a probe BSP expressed as closed path integration over the whole space" the elementary linear momentum p_{elem} is derived which with

$$\Delta t(v = 0) = \Delta_o t = 8.082110^{-21} \;\; s \qquad and \qquad k = 7.4315 \cdot 10^{-2} < 1 \tag{40}$$

gives

$$p_{elem} = m \; c \; k = \frac{h}{c \; \Delta_o t} \; k = 2.0309 \cdot 10^{-23} \;\; kg \; m \; s^{-1} \tag{41}$$

The elementary linear momentum p_{elem} is now used to quantize the two components of the gravitation force.

6.1 Quantification of the induced gravitation force.

From sec. 2 eq. (8) we have that the gravitation force for **one** aligned reintegrating BSPs is

$$F_i = \frac{k \; m \; c}{4 \; K \; d^{\,2}} \int\!\!\int_{Induction} \qquad with \qquad \int\!\!\int_{Induction} = 2.4662 \tag{42}$$

which we can write with $\Delta_o t = K \; r_o^2$ and $p_{elem} = k \; m \; c$ as

$$F_i = N_i \; \nu_o \; p_{elem} \qquad with \qquad N_i = \frac{r_o^2}{4 \; d^{\,2}} \int\!\!\int_{Induction} \tag{43}$$

Considering that $\Delta G_1\, \Delta G_2 = \gamma_G^2\, M_1\, M_2$ we can write for the total force between two masses M_1 and M_2

$$F_G = F_i\, \Delta G_1\, \Delta G_2 = N_G\, \nu_o\, p_{elem} \qquad with \qquad N_G = N_i\, \Delta G_1\, \Delta G_2 \tag{44}$$

where N_G represents the probability of elementary forces $f_{elem} = \nu_o\, p_{elem}$ in the time $\Delta_o t = K\, r_o^2$.

Finally we get

$$F_G = N_G(M_1, M_2, d)\, \nu_o\, p_{elem} \qquad with \qquad N_G = 2.6555 \cdot 10^{-8}\, \frac{M_1\, M_2}{d^2} \tag{45}$$

The frequency with which elementary momenta are generated is

$$\nu_G = N_G(M_1, M_2, d)\, \nu_o = 3.2856 \cdot 10^{12}\, \frac{M_1\, M_2}{d^2} \tag{46}$$

For the earth with a mass of $M_\oplus = 5.974 \cdot 10^{24}\ kg$ and the sun with a mass of $M_\odot = 1.9889 \cdot 10^{30}\ kg$ and a distance of $d = 147.1 \cdot 10^9\ m$ we get a frequency of $\nu_G = 1.8041 \cdot 10^{45}\ s^{-1}$ for aligned reintegrating BSPs.

6.2 Quantification of Ampere force between parallel reintegrating BSPs.

From sec. 4 eq. (23) we have for a pair of parallel reintegrating BSPs that

$$dF_R = 5.8731\, \frac{b}{\Delta_o t}\, \frac{2\, r_o^3}{64}\, \rho^2\, m\, k\, \frac{\upsilon_2}{d} = 2.2086 \cdot 10^{-50}\, \frac{\upsilon_2}{d}\ N \tag{47}$$

which we can write as

$$dF_R = N\, \nu_o\, p_{elem} \qquad with \qquad N = 8.7893 \cdot 10^{-48}\, \frac{\upsilon_2}{d} \tag{48}$$

where

$$p_{elem} = k\, m\, c \qquad and \qquad k = 7.4315 \cdot 10^{-2} \tag{49}$$

The total Ampere force between masses M_1 and m_2 is given with eq. (25)

$$F_R = 2.5551 \cdot 10^{-32}\, \upsilon_2\, \frac{M_1\, M_2}{d}\ N \tag{50}$$

We now write the equation in the form

$$F_R = N_R(M_1, M_2, d)\, \nu_o\, p_{elem} \qquad with \qquad N_R = 1.01682 \cdot 10^{-29}\, \upsilon_2\, \frac{M_1\, M_2}{d} \tag{51}$$

The frequency with which pairs of FPs cross in space is

$$\nu_R = N_R(M_1, M_2, d)\ \nu_o = 1.25811 \cdot 10^{-9}\ \upsilon_2\ \frac{M_1\ M_2}{d}\ \ s^{-1} \tag{52}$$

For the earth with a mass of $M_\oplus = 5.974 \cdot 10^{24}\ kg$ and the sun with a mass of $M_\odot = 1.9889 \cdot 10^{30}\ kg$ and a distance of $d = 1.5 \cdot 10^8\ m$ and a tangential speed of the earth around the sun of $\upsilon_2 = 30\ m/s$ we get a frequency of $\nu_R = 2.9896 \cdot 10^{39}\ s^{-1}$ for parallel reintegrating BSPs. The frequency ν_G for aligned BSPs is nearly 10^6 times grater than the frequency for parallel reintegrating BSPs and so the corresponding forces.

6.3 Quantification of the total gravitation force.

The total gravitation force is given by the sum of the induced force between aligned reintegrating BSPs and the force between parallel reintegrating BSPs.

$$F_T = F_G + F_R = [N_G(M_1, M_2, d)\ +\ N_R(M_1, M_2, d)]\ p_{elem}\ \nu_o \tag{53}$$

or

$$F_T = F_G + F_R =\ p_{elem}\ \nu_o\ \left[\frac{2.6555 \cdot 10^{-8}}{d^2} + \frac{1.01682 \cdot 10^{-29}}{d}\ \upsilon_2\right]\ M_1\ M_2 \tag{54}$$

We define the distance d_{gal} as the distance for which $F_G = F_R$ and get

$$d_{gal} = \frac{2.6555 \cdot 10^{-8}}{1.01682 \cdot 10^{-29}\ \upsilon_2} = 2.6116 \cdot 10^{21}\ \frac{1}{\upsilon_2}\ \ m \tag{55}$$

7 Precession of a gyroscope due to the Ampere gravitation force.

To derive the precession of a gyroscope in the presence of a massive body we start with the following equation from [6] derived for the total force density due to Ampere interaction.

$$\frac{F}{\Delta l} = \frac{b}{c\ \Delta_o t}\ \frac{r_o^2}{64\ m}\ \frac{I_{m_1}\ I_{m_2}}{d}\ \int_{\gamma_{2_{min}}}^{\gamma_{2max}} \int_{\gamma_{1_{min}}}^{\gamma_{1max}} \frac{\sin^2(\gamma_1 - \gamma_2)}{\sqrt{\sin\gamma_1\ \sin\gamma_2}}\ d\gamma_1\ d\gamma_2 \tag{56}$$

with $\int\int_{Ampere} = 5.8731$.
It is also for $v \ll c$

$$\rho_x = \frac{N_x}{\Delta x} = \frac{1}{2\ r_o} \qquad I_m = \rho\ m\ v \qquad \Delta_o t = K\ r_o^2 \qquad I_m = \frac{m}{q}\ I_q \tag{57}$$

We have defined a density ρ_x of BSPs for the current so that one BSP follows immediately the next without space between them. As we want the force between one pair of BSPs of the two parallel currents we take $\Delta l = 2\ r_o$.

The concept is shown in Fig. 9

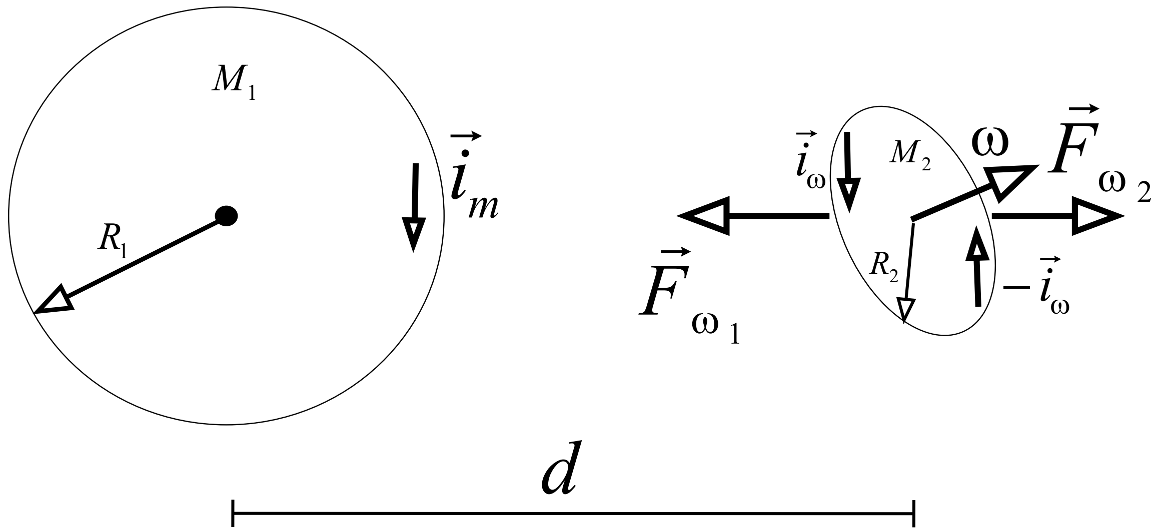

Figure 9: Gyroscopic precession.

For one reintegrating BSP it is $\rho = 1$. The current generated by one reintegrating BSP is

$$i_m = \rho\ m\ v_m = \rho\ m\ k\ c \qquad with \qquad v_m = k\ c \qquad k = 7.4315 \cdot 10^{-2} \tag{58}$$

The currents at the rotating gyroscope that are parallel to the current i_m of M_1 are

$$i_\omega = \pm\ \rho\ m\ v_\omega \qquad with \qquad v_\omega = \omega\ R_2 \tag{59}$$

For the two opposed forces that give the momentum at the gyroscope and which generate the precession we get

$$F_{\omega_1} \propto + \frac{v_m\ v_\omega}{d - R_\omega} \qquad\qquad F_{\omega_2} \propto - \frac{v_m\ v_\omega}{d + R_\omega} \tag{60}$$

From eq. (56) with $v_1 = v_m = k\ c$ we get for a pair of moving BSPs

$$dF_R = \ 5.8731\ \frac{b}{c\ \Delta_o t}\ \frac{2\ r_o^3}{64}\ \rho^2\ m\ \ \frac{v_1\ v_2}{d}\ \ N \tag{61}$$

and $d >> R_2$ we get the total force

$$F_R = \ 5.8731\ \frac{b}{c\ \Delta_o t}\ \frac{2\ r_o^3}{64}\ \rho^2\ m\ v_m\ v_\omega\ \gamma_A^2\ \frac{M_1\ M_2}{d}\ \ \ N \tag{62}$$

$$F_R = 2.551 \cdot 10^{-32}\ \ v_\omega\ \ \frac{M_1\ M_2}{d}\ \ \ N \tag{63}$$

with M_1 and M_2 the masses of the bodies.

Note: For distances d between gravitating masses smaller than d_{gal} the precession due to the Ampere force is neglect able compared with the precession due to the Newton gravitation force.

8 Thirring-Lense-Effect.

The Thirring-Lense-Effect is an effect that is based on the induction law and on the Doppler effect.

In [6] about induction bending the following equation was deduced for the force induced on a probe BSP by a BSP moving with speed v.

The concept is shown in Fig. 10

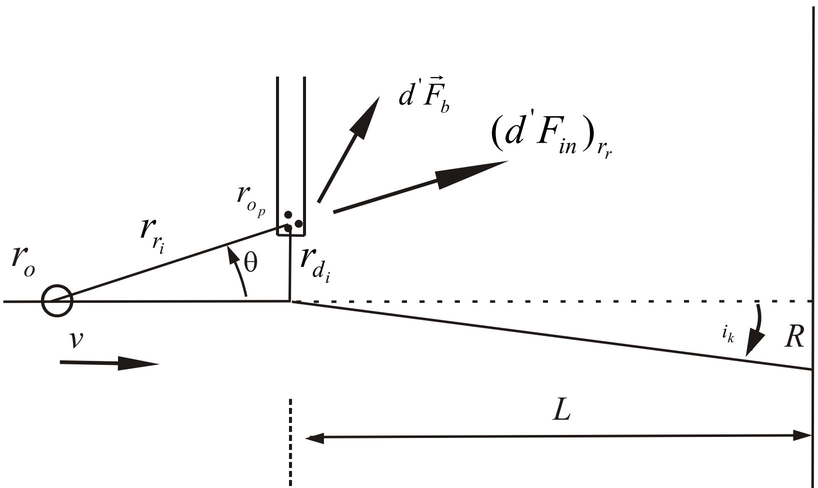

Figure 10: Force induced on a BSP at a bending edge by a BSP moving with speed v.

$$d^{\,\prime}\,\bar{F}_{i_n} = \ \frac{1}{8\ \pi}\ \sqrt{m_p}\ r_{o_p}\ rot\ \bar{C}_n^{\,\prime} \tag{64}$$

with

$$rot\ \bar{C}_n^{\,\prime} = \frac{1}{2\pi}\ \sqrt{m}\ v^2\ \frac{r_o}{r_r^{\,3}} \left[2\ \cos^2\theta - \sin^2\theta\right]\ \bar{e}_r\ +\ 0 \cdot \bar{e}_\gamma \tag{65}$$

$$\frac{1}{2\pi}\ \sqrt{m}\ v^2\ \frac{r_o}{r_r^3}\ \sin\theta\cos\theta\ \bar{e}_\theta$$

For the analysis of the dragging produced by a rotating mass on a probe mass placed in the equatorial plane, the components of the induced force in the direction $\bar{e}_r$ and the direction $\bar{e}_\theta$ are required.

$$d^{\,\prime}F_{i_n}\bar{e}_r = \frac{1}{16\ \pi^2}\ m\ v^2\ \frac{r_o^2}{r_r^{\,3}} \left[2\ \cos^2\theta - \sin^2\theta\right]\ \bar{e}_r \tag{66}$$

$$d^{\,\prime\prime}F_{i_n}\bar{e}_\theta = \frac{1}{16\ \pi^2}\ m\ v^2\ \frac{r_o^2}{r_r^{\,3}}\ \sin\theta\cos\theta\ \bar{e}_\theta \tag{67}$$

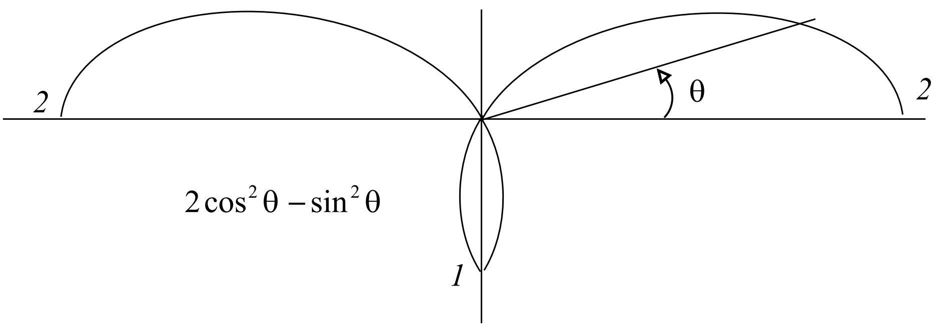

Figure 11: Plotting of the trigonometric relation for the analysis of Dragging.

For equal speed v and distance r_r the components of the forces in the direction of the speed v are equal but opposed for the angles θ and $2\pi - \theta$. This means that two BSPs located at θ and $2\pi - \theta$ induce on the probe BSP forces in the direction of v that compensate each other.

Fig. 12 shows two BSPs from the surface of the earth that moves with the speed v relative to a probe BSP_p located at the distance d. Each moving BSP emittes rays of FPs with light speed c relative to the BSP, with a constant interval λ between them. The speed of the FPs relative to a probe BSP_p located at the ray is

$$c + v\ \cos\theta = \lambda\ \nu \tag{68}$$

FPs located at the proximity of the probe BSP_p have a higher probability to contribute to the generation of the force on the probe BSP_P. The angle $\theta = \arcsin(d/r)$ of the probe BSP_p is therefore used to calculate the force.

For the two BSPs located at the angles $\theta_1 = \theta$ and $\theta_2 = 2\pi - \theta$ we get the frequencies

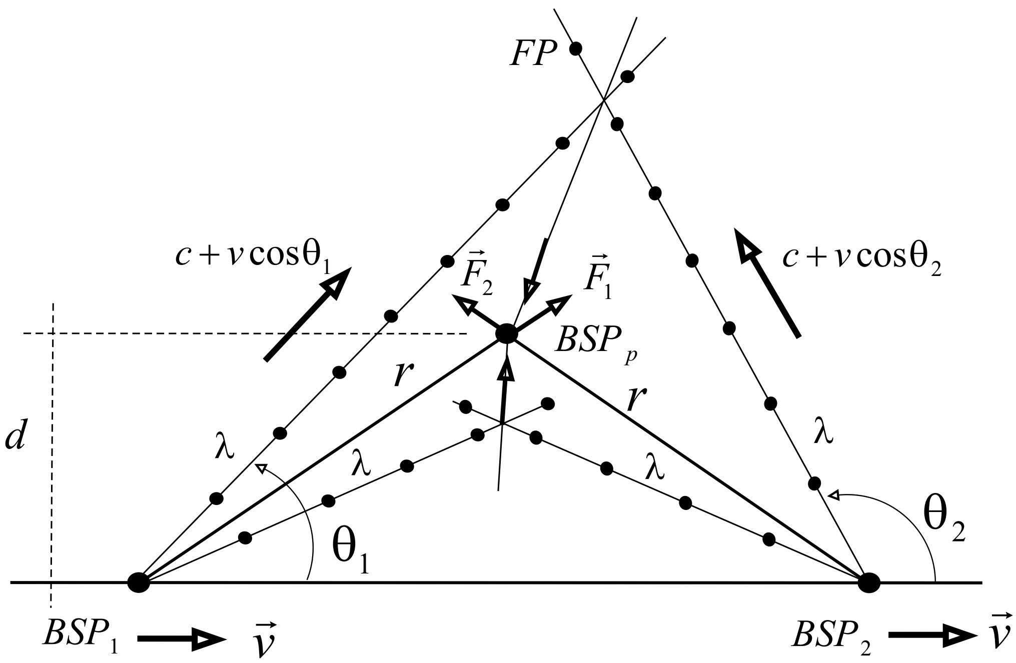

Figure 12: Dragging due to Doppler effect.

of FPs at the probe BSP_P

$$\nu_1 = \frac{c + v\ \cos\theta_1}{\lambda} \qquad \nu_2 = \frac{c + v\ \cos\theta_2}{\lambda} \qquad \nu_o = \frac{c}{\lambda} \tag{69}$$

With eqs. (66) and (67) we get for the components of the forces in the direction of the speed v taking into consideration the Doppler effect

$$d^{\,\prime}\bar{F}_v = \frac{\nu}{\nu_o}\, d^{\,\prime}F_{i_n}\ \cos\theta\ \bar{e}_r \qquad \theta = \arcsin(d/r) \tag{70}$$

$$d^{\,\prime\prime}\bar{F}_v = \frac{\nu}{\nu_o}\, d^{\,\prime\prime}F_{i_n}\ \sin\theta\ \bar{e}_\theta \qquad \theta = \arcsin(d/r) \tag{71}$$

The dragging forces in the direction of the speed v on the probe BSP_p are

$$d^{\,\prime}\bar{F}_{drag} = (d^{\,\prime}\bar{F}_{v_1} - d^{\,\prime}\bar{F}_{v_2}) = \frac{\nu_1 - \nu_2}{\nu_o}\, d^{\,\prime}\bar{F}_{i_n}\ \cos\theta\ e_r \tag{72}$$

$$d^{\,\prime\prime}\bar{F}_{drag} = (d^{\,\prime\prime}\bar{F}_{v_1} - d^{\,\prime\prime}\bar{F}_{v_2}) = \frac{\nu_1 - \nu_2}{\nu_o}\, d^{\,\prime\prime}\bar{F}_{i_n}\ \sin\theta\ e_\theta \tag{73}$$

The total dragging force is

$$\bar{F}_{drag} = \frac{2}{\pi}\int_{\theta=0}^{\pi/2} (d^{\,\prime}\bar{F}_{drag} + d^{\,\prime\prime}\bar{F}_{drag})\ d\theta \tag{74}$$

9 Atomic clocks and gravitation.

Oscillations of mechanical instruments like a pendulum have been used in the past to define time unit of second. Big efforts were made to minimise the influence of factors like temperature, vibrations, humidity, gravitation, etc. on the precision. Modern clocks make use of the quantized change of states of atoms which takes place at a much higher frequency leading to better precisions. When comparing the precision of clocks it is very important to compare them under the same conditions of temperature, vibrations, humidity, gravitation, etc. If this is not possible, corrections for each deviation must be made. The origin of the variation of the precision of atomic clocks due to gravitation is unknown and can be attributed to changes in the energy levels of the atoms itself or to changes in the frequencies of photons after emission.

The intention of the present section is to show a possible mechanism based on the approach that gravitation is generated by the reintegration of BSP to their nuclei. According to the approach, the energies of level electrons are given by stable dynamic configurations of BSPs in nuclei, which change for each atom and its ions. The number of regenerating FPs with opposed angular momenta that arrive to a nucleus is a function of the distance to the other gravitating nucleus. They influence the stable dynamic configuration of BSPs in the nucleus changing the energy of level electrons.

The gravitation components are due to:

- Reintegration of BSPs in the direction of the distance between the gravitating bodies (induction, Newton).

$$F_G = G \frac{M_1 M_2}{r^2} \tag{75}$$

- Reintegration of BSPs perpendicular to the distance between the gravitating bodies (Ampere).

$$F_R = \pm R(v) \frac{M_1 M_2}{r} \qquad \textit{with} \qquad R(v) = 2.551 \cdot 10^{-32}\, v \tag{76}$$

Hafele-Keating Experiment. If we have a look at the Hafele-Keating Experiment we see that the influence of gravitation on atomic clocks depends on the intensity of the gravitation potential and on the direction of movement of the clocks relative to the earth.

The concept is shown on Fig. 13.

a) Flying eastwards a total loss of 59 ns was measured.

b) Flying westwards a total gain of 273 ns was measured.

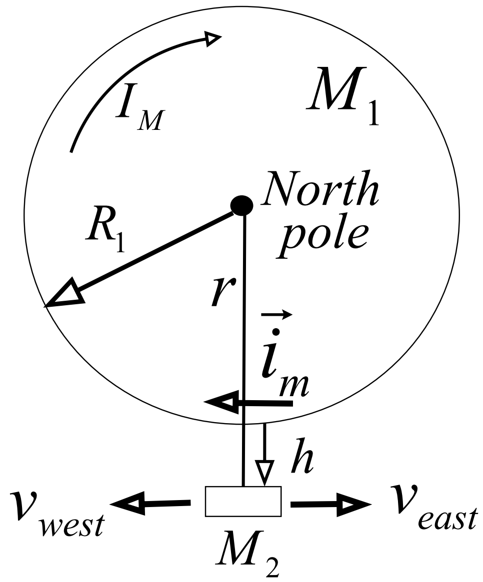

Figure 13: Influence of gravitation on time.

The aeroplain's altitude h was constant and the flight times and speeds eastwards and westwards were equal. The gain or loss is measured relative to an equivalent atomic clock based on the earth.

At Fig. 13 we have the earth with mass M_1 and an aeroplane with mass M_2 moving with the speed v east or westwards relative to the surface of the earth at an altitude h. The current i_m due to the reintegration of a BSP has the same direction as the equivalent current I_M that produce the magnetic field of the earth.

The interpretation with the present approach of the results of the Hafele-Keating Experiment following the previously listed results is:

Eastwards	$X - Y = Z_{east} = -59\ ns$	$X = 107\ ns$
Westwards	$X + Y = Z_{west} = 273$	$Y = 166\ ns$

where X is the time gain due to the Newton gravitation and Y the time gain and $-Y$ the time loss due to Ampere gravitation.

a) The total loss of 59 ns flying eastwards is composed of a gain of 107 ns due to the Newton gravitation potential of force F_G and a loss of 166 ns due to the Ampere gravitation potential of force F_R.

Flying eastwards the current $i = \rho\ m\ v$ due the speed v of the aeroplane and the current i_m due to the reintegration have opposed directions and produce an repulsion force contrary to the Newton force resulting in a time loss.

b) The total gain of 273 ns flying westwards is composed of a gain of 107 ns due to the Newton gravitation potential of force F_G and a gain of 166 ns due to the Ampere gravitation potential of force F_R.

Flying westwards the current $i = \rho\ m\ v$ due the speed v of the aeroplane and the current i_m due to the reintegration have the same directions and produce an attraction force like the Newton force resulting in a time gain.

10 Resume.

The work is based on particles represented as structured dynamic entities with the relativistic energy distributed over the whole space on FPs, contrary to the representation used in standard theory where particles are point-like entities with the energy concentrated on one point in space.

Fundamental parts of the mechanism of gravitation are the reintegration of migrated electrons and positrons to their nuclei, and the Induction and Ampere laws between FPs of BSPs.

The gravitation force has two components, one component due to the reintegration in the direction of the two gravitating bodies and one component due to the reintegration in the direction perpendicular to it.

For sub-galactic distances the first component, which is inverse proportional to the square distance, predominates, while for galactic distances the second component, which is inverse proportional to the distance is predominant.

The second component explains the flattening of galaxies' rotation curves without the need of additional virtual matter (dark matter).

The second component also explains the repulsive forces between galaxies without the need of additional virtual energies (dark energy).

The two components of the gravitation force are quantized with the help of the elementary linear momentum deduced for the reintegration of migrated electrons and positrons to their nuclei.

The present approach is based on a more physical description of nature when postulating that light is emitted with light speed relative to the emission source (Emission Theory). There are no incompatibilities with "Special Relativity without time delay and length contraction" deduced in [6].

The dragging between two parallel moving neutral masses (Thirring-Lense-Effect) is the result of the induction law and the Doppler effect of FPs.

The time gain or loss of atomic clock due to the interaction with gravitation (Hafele-Keating-Experiment) is explained with the two components (Newton and Ampere) of the gravitation force.

11 Bibliograpy.

1. Albrecht Lindner. **Grundkurs Theoretische Physik.** Teubner Verlag, Stuttgart 1994.

2. Benenson · Harris · Stocker · Lutz. **Handbook of Physics.** Springer Verlag 2001.

3. Stephen G. Lipson. **Optik.** Springer Verlag 1997.

4. B.R. Martin & G. Shaw. **Particle Physics.** John Wiley & Sons 2003.

5. Max Schubert / Gerhard Weber. **Quantentheorie, Grundlagen und Anwendungen.** Spektrum, Akad. Verlag 1993.

6. Osvaldo Domann. **"Emission & Regeneration" Field Theory.** June 2003. www.odomann.com.