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

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(This paper is an extract of [7] 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 presented model for gravitation is compatible with quantum mechanics, what is not the case with general relativity.

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

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 $H_e^2 = H_s^2 \; + \; H_n^2$.

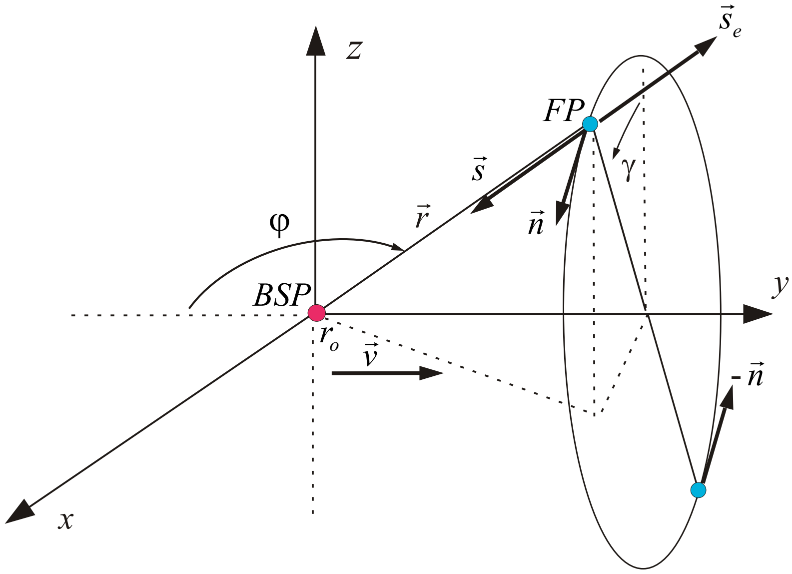

Figure 1: Unit vector $\bar{s}_e$ for an emitted FP and unit vectors $\bar{s}$ and $\bar{n}$ for a regenerating FP of a BSP moving with $v \neq c$

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.

The core of a nucleon is composed of electrons and positrons and is concentrated in the range of $0 \leq \gamma \leq 0.1$ of the curve of Fig. 3 where the attractions and repulsions between electrons and positrons are zero.

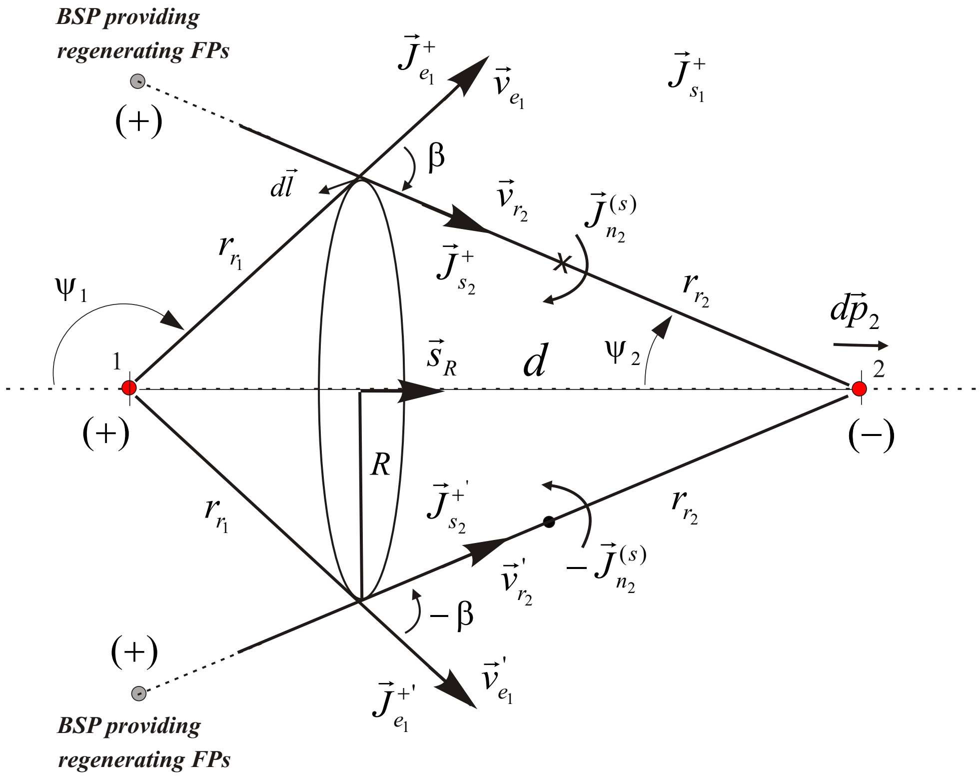

Figure 2: Generation of angular momentum J_n at regenerating fundamental particles of two static basic subatomic particles at the distance d

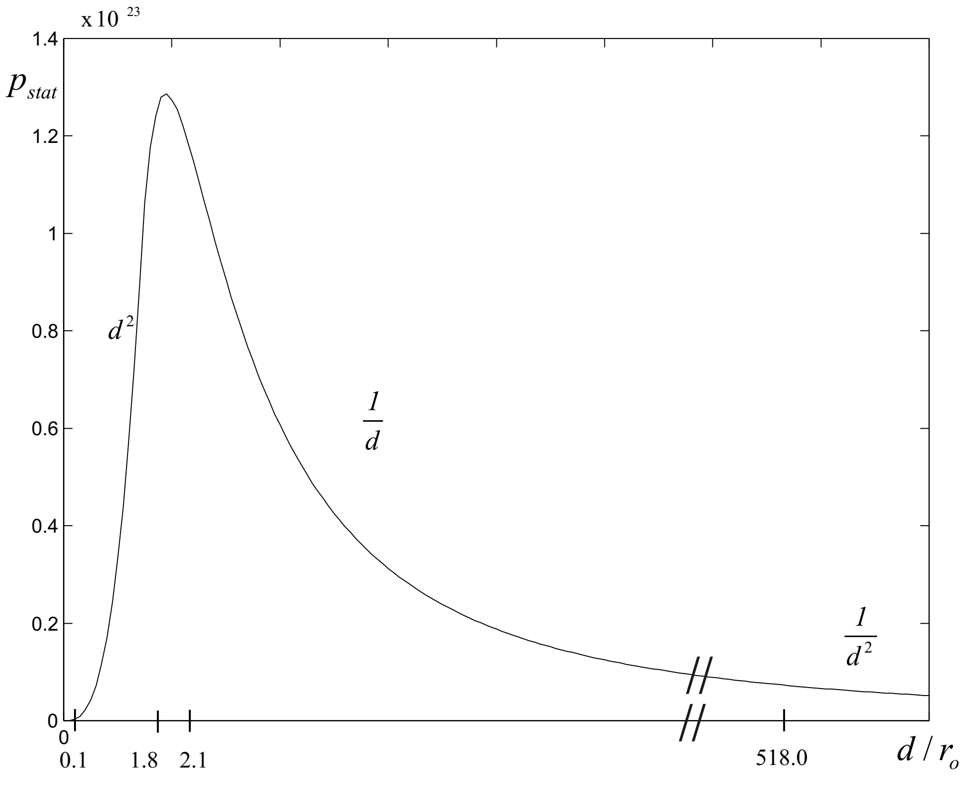

Figure 3: Linear momentum p_{stat} as function of $\gamma = d/r_o$ between two static BSPs with equal radii $r_{o_1} = r_{o_2}$

Electrons and positrons of the core of a nucleon migrate slowly into the range of $0.1 \leq \gamma \leq 1.8$ polarizing the core of the nucleon, and are subsequently reintegrated with high speed when their FPs cross with FPs of the remaining electrons and positrons in the core 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.

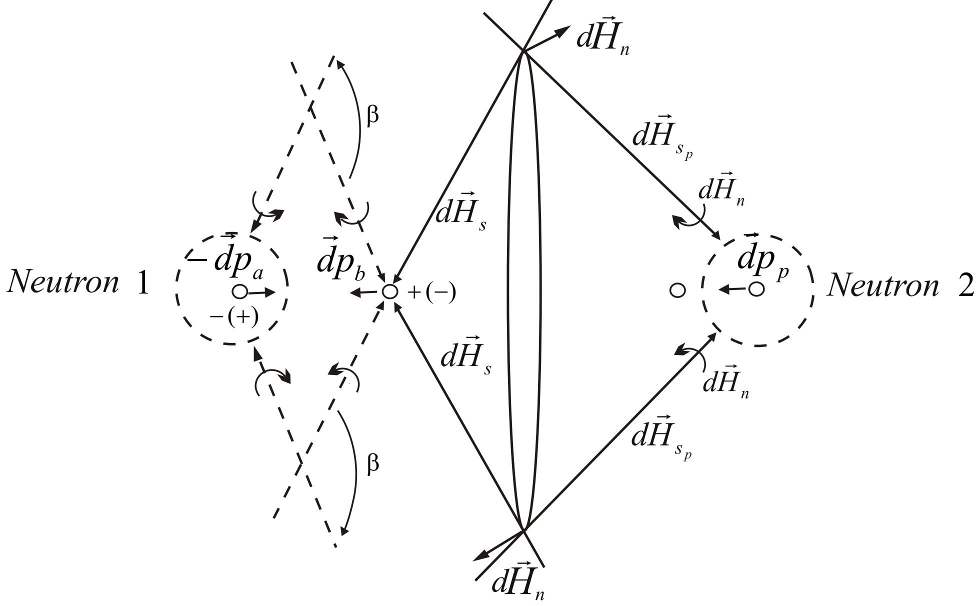

Figure 4: Transmission of momentum dp_b from neutron 1 to neutron 2

The movement of BSP b generates the dH_n field shown in Fig. 4, field that is passed to the static probe 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 a can be neglected compared with the field of BSP b as shown in sec. 3. .

3 The $\bar{d}H_n$ field induced at a point P during reintegration of a migrated BSP to its nucleus.

En electron that has migrated slowly outside the core of a neutron formed by $n^+ = 919$ positrons and $n^- = 919$ electrons will interact with one of the positrons of the core of the neutron and be reintegrated to the neutron. Because of moment conservation they will have the same moment. The moment of the positron who moves in the core of the neutron will pass its moment to the $n^+ = 919$ positrons and now $n^- = 918$ electrons so that the core will move as a unit.

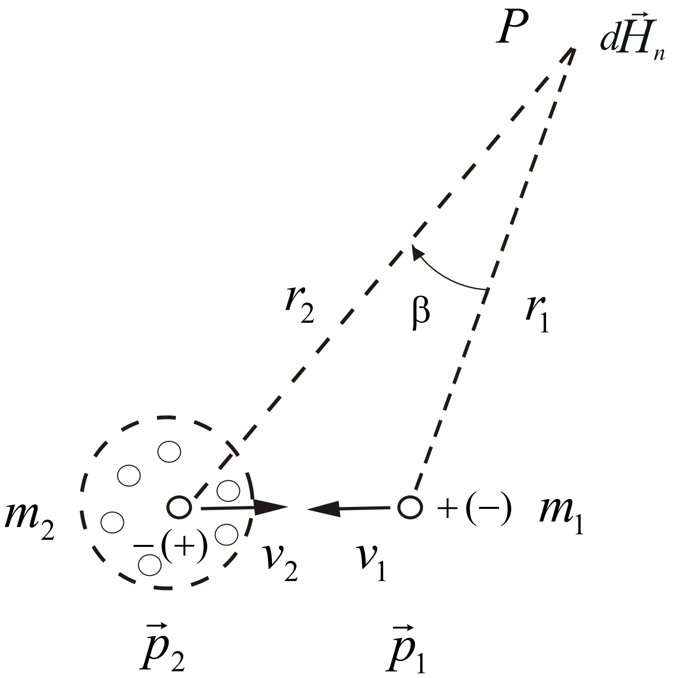

Figure 5: Field dH due to reintegration of an electron to its neutron

The $\bar{d}H_n$ fields induced at a point P in space due to the moving electron and neutron core are:

$$dH_{n_1} = v_1 \sqrt{m_1}\, d\kappa_1 \qquad\qquad dH_{n_2} = v_2 \sqrt{m_2}\, d\kappa_2 \tag{8}$$

where the sub-index **1** stands for the electron and **2** for the neutron which now has a positive charge. The distances r_1 and r_2 to the point in space are nearly equal so that $r_1 = r_2$ and $d\kappa_1 = d\kappa_2$. We also have

$$p_1 = m_1\, v_1 \qquad p_2 = m_2\, v_2 \qquad \textit{with} \qquad p_1 = p_2 \qquad v_2 = \frac{m_1}{m_2}\, v_1 \tag{9}$$

and we get

$$dH_{n_2} = \sqrt{\frac{m_1}{m_2}}\, dH_{n_1} \qquad \textit{resulting} \qquad dH_{n_2} = 2.3321 \cdot 10^{-2}\, dH_{n_1} \tag{10}$$

For the analysis of the induced gravitation force and the induced current in an superconductor only the dH_{n_1} field generated by the reintegrating electron or positron is relevant. The induced opposed dH_{n_2} field generated by the movement of the neutron core can be neglected.

4 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 [7] for the **induced gravitation** force generated by one reintegrated electron or positron

$$F_i = \frac{dp}{\Delta t} = \frac{k\ c\ \sqrt{m}\ \sqrt{m_p}}{4\ K\ d^{\,2}} \int\int_{Induction} \qquad with \qquad \int\int_{Induction} = 2.4662 \tag{11}$$

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

$$\Delta t = K\ r_o^2 \qquad r_o = 3.8590 \cdot 10^{-13}\ \ m \qquad and \qquad K = 5.4274 \cdot 10^4\ \ s/m^2 \tag{12}$$

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.

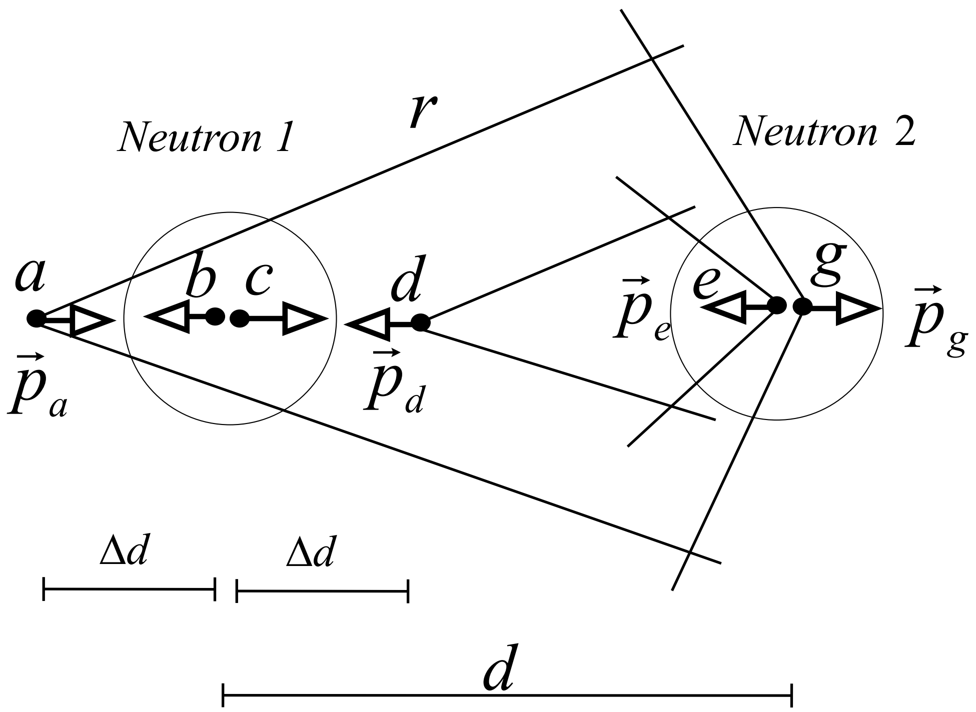

Figure 6: Net momentum transmitted from neutron 1 to neutron 2

Fig. 6 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

$$F_i \, \Delta_{G_1} \, \Delta_{G_2} = G \, \frac{M_1 \, M_2}{d^{\,2}} \qquad with \qquad G = 6.6726 \cdot 10^{-11} \, \frac{m^3}{kg \; s^2} \tag{13}$$

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

$$\Delta_G = |\Delta_G^-| + |\Delta_G^+| \tag{14}$$

We get that

$$\Delta_{G_1} \, \Delta_{G_2} = G \, \frac{4 \, K \, M_1 \, M_2}{m \; k \; c \, \int \int_{Induction}} \tag{15}$$

or

$$\Delta_{G_1} \, \Delta_{G_2} = 2.8922 \cdot 10^{17} \, M_1 \, M_2 = \gamma_G^2 \, M_1 \, M_2 \tag{16}$$

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

$$\Delta_G = \gamma_G \, M \qquad with \qquad \gamma_G = 5.3779 \cdot 10^8 \;\, kg^{-1} \tag{17}$$

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 $M_\dagger = 5.9736 \cdot 10^{24} \; kg$

$$\Delta_{G_\odot} = 1.0697 \cdot 10^{39} \qquad and \qquad \Delta_\dagger = 3.2125 \cdot 10^{33} \tag{18}$$

The power exchanged between two masses due to gravitation is

$$P_G = F_i \; c = \frac{E_p}{\Delta t} = \frac{k \; m \; c^2}{4 \; K \; d^{\,2}} \, \Delta_{G_1} \, \Delta_{G_2} \int \int_{Induktion} \tag{19}$$

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

$$P_G = F_G \; c = \; G \, \frac{M_\odot \; M_\dagger}{d_{\odot\dagger}^2} \, c = 1.0646 \cdot 10^{31} \;\; J/s \tag{20}$$

5 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 i_m in the direction of the positive BSP as shown in Fig. 7.

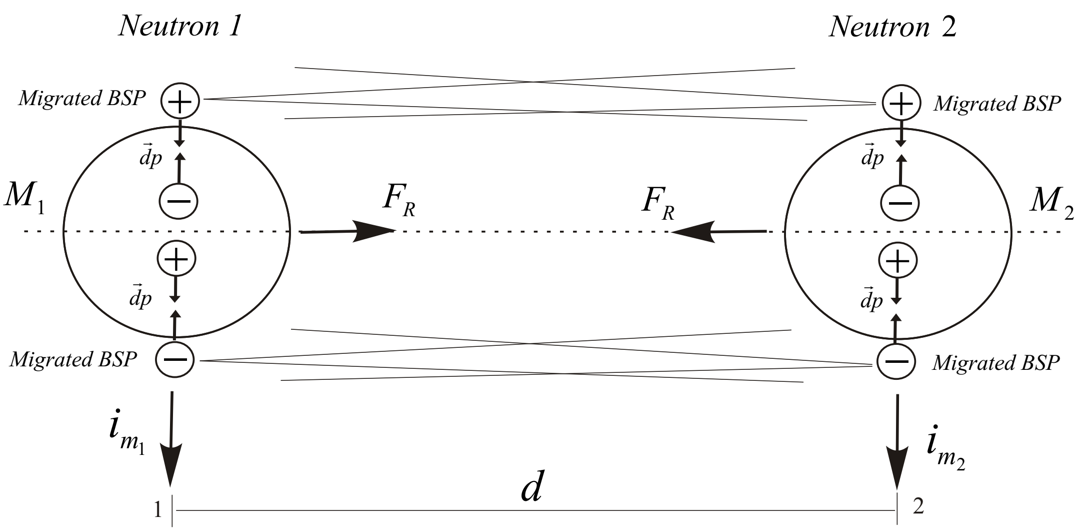

Figure 7: Resulting current i_m due to reintegration of migrated BSPs

As the numbers of positive and negative BSPs that migrate during the time Δt in one direction at one neutron are equal, it is

$$\Delta_R = \Delta_R^+ + \Delta_R^- = 0 \tag{21}$$

where Δ_R represents the number of migrated BSPs in the time Δt.

No average current I_m should exist in that direction in the time Δt to generate a force between parallel currents of the two neutrons according to the Ampere law

$$\frac{F}{\Delta l} \propto \frac{I_{m_1}\, I_{m_2}}{d} \tag{22}$$

Fig. 8 shows a mass M_2 moving with v_2 in an orbit relative to mass M_1. Longitudinal reintegrating electrons and positrons at M_2 generate currents i_m relative to M_2. Because of the speed v_2 the longitudinal currents i_m of M_2 have transversal components i_2 relative to M_1 which interact with the transvetrsal reintegrating electrons and positrons at M_1 in that way that $\Delta R \neq 0$ at M_1 and M_2.

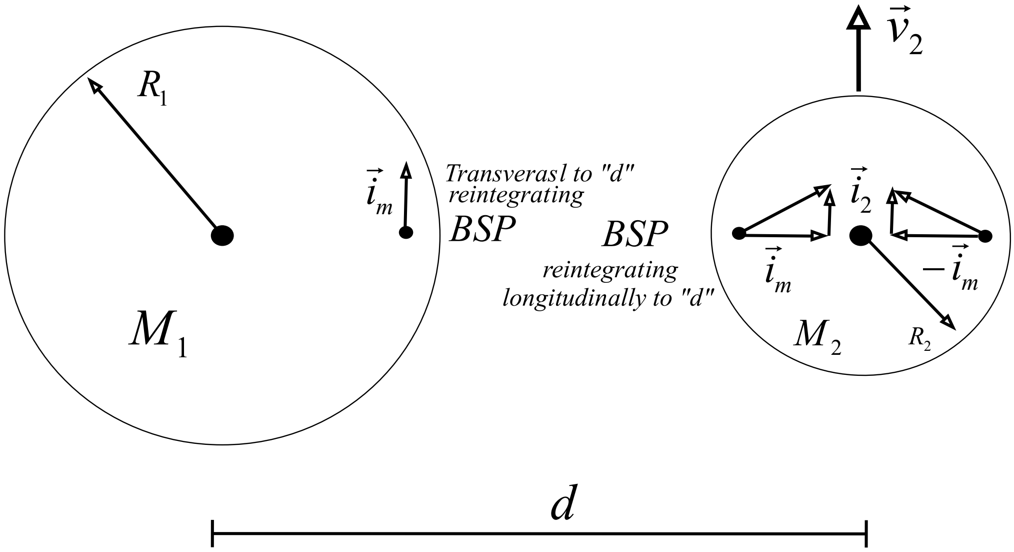

Figure 8: Ampere gravitation due to orbital speed.

We conclude that because of the power exchange (19) between the two neutral bodies M_1 and M_2 a synchronization between the reintegration of BSPs of equal sign in the direction orthogonal to the axis defined by the two bodies is generated, resulting in parallel currents of equal sign that generate an attracting force between the bodies. The synchronization is generated by the relative movement between the gravitating bodies and is zero between static bodies. Thus the total attracting force between the two neutral bodies is produced first by the induced (Newton) force and second by the force due to parallel currents of reintegrating BSPs (Ampere), which like the Newton force is proportional to the masses of the bodies.

$$F_T = F_G + F_R \qquad with \qquad F_G = G\,\frac{M_1\ M_2}{d^2} \qquad and \qquad F_R = R\,\frac{M_1\ M_2}{d} \tag{23}$$

To derive an equation we start with the following equation from [7] derived for the total force density due to Ampere interaction.

$$\frac{F}{\Delta l} = \frac{b}{c\ \Delta_o t}\ \frac{r_o^2}{64\ m}\ \frac{I_{m_1}\ I_{m_2}}{d} \int_{\gamma_{2_{min}}}^{\gamma_{2max}} \int_{\gamma_{1_{min}}}^{\gamma_{1max}} \frac{\sin^2(\gamma_1-\gamma_2)}{\sqrt{\sin\gamma_1\ \sin\gamma_2}}\, d\gamma_1\, d\gamma_2 \tag{24}$$

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

$$\rho_x = \frac{N_x}{\Delta x} = \frac{1}{2\ r_o} \qquad I_m = \rho\ m\ v \qquad \Delta_o t = K\ r_o^2 \qquad I_m = \frac{m}{q}\ I_q \tag{25}$$

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

$$I_{m_1} = i_m = \rho\, m\, v_m = \rho\, m\, k\, c \qquad with \qquad v_m = k\, c \qquad k = 7.4315 \cdot 10^{-2} \tag{26}$$

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

$$dF_R = \ 5.8731\, \frac{b}{\Delta_o t}\, \frac{2\, r_o^3}{64}\, \rho^2\, m\, k\, \frac{v_2}{d} = 2.2086 \cdot 10^{-50}\, \frac{v_2}{d} \ \ N \tag{27}$$

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

The concept is shown in Fig. 8.

Note: The currents i_m and i_2 of the bodies respectively M_1 and M_2 may synchronize with equal or opposed signs resulting in an attraction or repulsion force F_R.

In sec. 4 we have derived the mass density γ_G of reintegrating BSPs. At Fig. 6 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. 8 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 of the Newton gravitation force

$$\gamma_A \approx 2\, \gamma_G = 2 \cdot 5.3779 \cdot 10^8 = 1.07558 \cdot 10^9 \ \ kg^{-1} \tag{28}$$

resulting for the total Ampere gravitation force between M_1 and M_2

$$F_R = \ 5.8731\, \frac{b}{\Delta_o t}\, \frac{2\, r_o^3}{64}\, \rho^2\, m\, k\, v_2\, \gamma_A^2\, \frac{M_1\, M_2}{d} = 2.5551 \cdot 10^{-32}\, v_2\, \frac{M_1\, M_2}{d} \ \ N \tag{29}$$

where

$$F_R = R\, \frac{M_1\, M_2}{d} \qquad with \qquad R = 2.5551 \cdot 10^{-32}\, v_2 = R(v_2) \tag{30}$$

The total gravitation force gives

$$F_T = F_G + F_R = \left[\frac{G}{d^2} + \frac{R}{d}\right] \; M_1 \; M_2 \tag{31}$$

The concept is shown in Fig. 9.

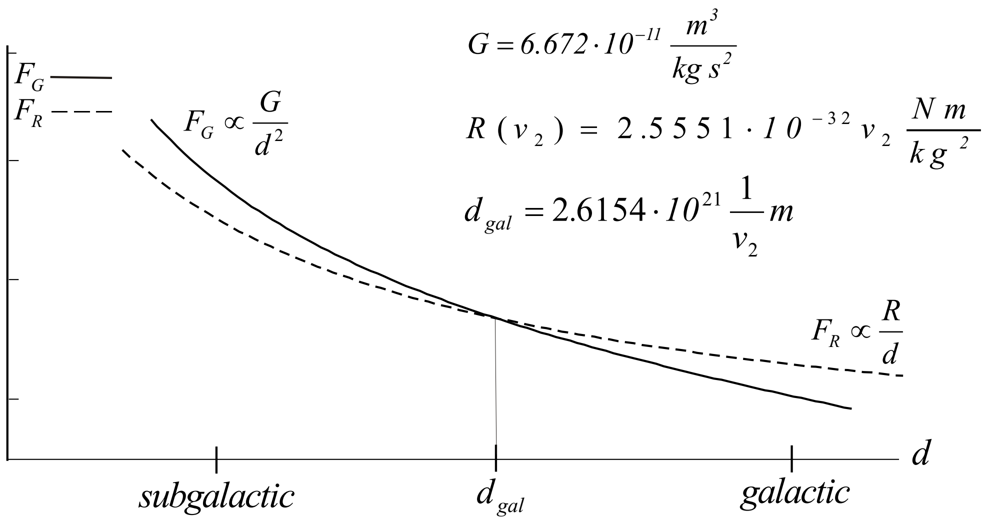

Figure 9: Gravitation forces at sub-galactic and galactic distances.

5.1 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. (31) as

$$F_T \approx F_R = \frac{R}{d} \; M_1 \; M_2 \tag{32}$$

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

$$F_c = M_2 \; \frac{v_{orb}^2}{d} \qquad\qquad \textit{with } v_{orb} \textit{ the tangential speed} \tag{33}$$

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

$$F_c = M_2 \; \frac{v_{orb}^2}{d} = F_T \approx F_R = \frac{R}{d} \; M_1 \; M_2 \tag{34}$$

We get for the tangential speed

$$v_{orb} \approx \sqrt{R \; M_1} \qquad \textit{constant} \tag{35}$$

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

$$F_c = M_2\, \frac{v_{orb}^2}{d} = 3.872 \cdot 10^{20}\ \ N \tag{36}$$

With

$$R(v_2) = 2.5551 \cdot 10^{-32}\ v_2 = 5.6212 \cdot 10^{-27}\ \ Nm/kg^2 \tag{37}$$

and

$$F_c \approx R\, \frac{M_1\, M_2}{d} \tag{38}$$

we get a Mass for the Milky Way of

$$M_1 = F_c\, d\, \frac{1}{R\, M\odot} = 4.3 \cdot 10^6\ M\odot \tag{39}$$

and with

$$F_G = F_R \qquad we\ get \qquad d_{gal} = \frac{G}{R} = 1.1870 \cdot 10^{16}\ \ m \tag{40}$$

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. 9.

$$d_{gal} = \frac{G}{R} \tag{41}$$

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.

6 Compatibility of gravitation with Quantum mechanics.

The potential in which an orbital electron in an Hidrogen atom with $Z = 1$ moves is

$$U(r)_{Coul} = -\left(\frac{Z\ e^2}{4\pi\epsilon_o}\right)\frac{1}{r} = 2.3072 \cdot 10^{-28}\ \frac{1}{r}\ J \qquad with \quad Z = 1 \tag{42}$$

We know from [5] page 178 that the discrete energy levels for the orbital electron of the H-atom is

$$E_{n_{Coul}} = -\ \frac{m}{2\hbar^2}\left(\frac{Z\ e^2}{4\pi\epsilon_o}\right)^2\frac{1}{n^2} = 2.1819 \cdot 10^{-18}\ \frac{1}{n^2}\ J \tag{43}$$

The difference between the energy levels is

$$\Delta E_{n_{Coul}} = 2.1819 \cdot 10^{-18}\ \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]\ J \tag{44}$$

6.1 Quantized gravitation.

According to sec. 4 the force on one electron/positron of a mass M_1 due to the reintegration of an electron/positron to an atomic nucleus of a mass M_2 is given by eq. (11)

$$F_i = \frac{dp}{\Delta t} = \frac{k\ c\ \sqrt{m}\ \sqrt{m_p}}{4\ K\ d^{\,2}}\int\int_{Induction} \qquad with \qquad \int\int_{Induction} = 2.4662 \tag{45}$$

and the corresponding potential is

$$U(r)_{Grav} = \left(2.4662\ \frac{k\ c\ \sqrt{m}\ \sqrt{m_p}}{4\ K}\right)\frac{1}{r} = 2.3071 \cdot 10^{-28}\ \frac{1}{r}\ J \tag{46}$$

If we write the Schroedinger equation with the gravitation potential instead of the Coulomb potential for the H-atom, we get discrete energy levels simply in replacing the expression in brackets of eq.(43) with the expression in brackets of eq. (46)

$$E_{n_{Grav}} = -\ \frac{m}{2\hbar^2}\left(2.4662\ \frac{k\ c\ \sqrt{m}\ \sqrt{m_p}}{4\ K}\right)\frac{1}{n^2} = 2.1816 \cdot 10^{-18}\ \frac{1}{n^2}\ J \tag{47}$$

In the same model of gravitation the number of reintegrating electrons/positrons for a mass M is derived as $\Delta G = \gamma_G\ M$ with $\gamma_G = 5.3779 \cdot 10^8\ kg^{-1}$. The resulting energy level due to all reintegrating electrons/positrons of M_1 and M_2 is

$$E_{n_{Grav\ tot}} = 2.1816 \cdot 10^{-18}\ \Delta G_1\ \Delta G_2\ \frac{1}{n^2}\ J \tag{48}$$

For the H-Atom M_2 is formed by one proton composed of 918 electrons and 919 positrons and M_1 is the mass of the electron. The mass of a proton is $M_2 = m_{prot} = 1.6726 \cdot 10^{-27}\ kg$ and the mass of the electron $M_1 = m_{elec} = 9.1094 \cdot 10^{-31}\ kg$. We get $\Delta G_2 = 8.9951 \cdot 10^{-19}$ and $\Delta G_1 = 4.8989 \cdot 10^{-22}$. We get for the energy difference for orbital electrons at the H-Atom due to gravitation potential

$$\Delta E_{n_{Proton}} = 9.6134 \cdot 10^{-58}\ \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]\ J \tag{49}$$

If we compare the factors of the brackets for the energy difference due to the Coulomb potential of eq. (44) and the gravitational potential of eq. (49), we see that even between very different energy levels n_1 and n_2 of the gravitational levels the energy differences of the gravitation are neglectible compared with the Coulomb.

For the energy difference between two levels n_1 and n_2 of an atom we can write:

$$\Delta E_{n_{Coul}} \pm \Delta E_{n_{Grav}} = h(\nu \pm \Delta\nu) = 2.1819 \cdot 10^{-18}\ [1 \pm \Delta G_1\ \Delta G_2]\ \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]\ J \tag{50}$$

with $\Delta G = \gamma_G\ M$ where $\gamma_G = 5.3779 \cdot 10^8\ kg^{-1}$.

Now we make the same calculations for the difference between the energy levels due to the gravitation potential of the sun with $M_2 = M_\odot = 1.9891 \cdot 10^{30}\ kg$ and the earth with $M_1 = M_\dagger = 5.9736 \cdot 10^{24}\ kg$. We we get $\Delta_{G_\odot} = 1.0697 \cdot 10^{39}$ and $\Delta_{G_\dagger} = 3.2125 \cdot 10^{33}$ resulting

$$\Delta E_{n_{\odot,\dagger}} = 7.4968 \cdot 10^{54}\ \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]\ J \tag{51}$$

As the earth shows no quantization in its orbit around the sun, two adjacent levels n_1 and n_2 must be very large outer levels so that $\Delta E_{n_{\odot,\dagger}} \approx 0$, similar to the large outer levels of the conducting electrons of conducting materials. Mathematically we can write with $n_2 = n_1 + 1$

$$\lim_{n_1 \Rightarrow \infty} \Delta E_{n_{\odot,\dagger}} = 7.4968 \cdot 10^{54}\ \left[\frac{1}{n_1^2} - \frac{1}{(n_1+1)^2}\right]\ = 0\ \ J \tag{52}$$

6.2 Relation between energy levels and space.

The compatibility of gravitation as the reintegration of migrated electrons/positrons to their nuclei is also shown by the following calculations. From eq. (48) we get the energy difference between two gravitation levels

$$\Delta E_{n_{Grav}} = 2.1816 \cdot 10^{-18}\, \Delta G_1\, \Delta G_2\, \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]\; J \tag{53}$$

and with the difference between two gravitation potentials at different distances

$$\Delta U_{Grav} = G\, M_1\, M_2\, \left[\frac{1}{r_1} - \frac{1}{r_2}\right]\; J \tag{54}$$

we can write that $\Delta E_{n_{Grav}} = \Delta U_{Grav}$ what gives with $r_1\, r_2 \approx r^2$

$$\frac{\Delta r}{r^2} = \frac{2.1816 \cdot 10^{-18}\, \gamma_G^2}{G}\, \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] \tag{55}$$

For the H-atom with $r \approx 10^{-13}\ m$ we get for the difference between the two first energy levels $n_1 = 1$ and $n_2 = 2$

$$\Delta r = \frac{2.1816 \cdot 10^{-18}\, \gamma_G^2}{G}\, r^2\, \left[\frac{3}{4}\right] = 7.0926 \cdot 10^{-17}\ m \tag{56}$$

what is a reasonable result because $\Delta r << r$.

Now we make the same calculations for the earth and the sun with $r_{\odot,\dagger} \approx 150.00 \cdot 10^9\ m$. We get

$$\Delta r_{\odot,\dagger} = 2.1164 \cdot 10^{32}\, \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] \tag{57}$$

As the earth shows no quantization in its orbit around the sun, two adjacent levels n_1 and n_2 must be very large outer levels so that $\Delta r_{\odot,\dagger} \approx 0$, similar to the large outer levels of the conducting electrons of conducting materials.

6.3 Superposition of gravitation and Coulomb forces.

The "Emission & Regeneration" UFT shows that the Coulomb and the Ampere forces tend to zero for the distance between electrons/positrons tending to zero. The behaviour is explained with the cross product of the angular momenta of the regenerating rays of FPs that tends to zero.

The induction force is not a function of the cross product but simply the product between angular momenta of the regenerating rays of FPs. The result is that the induction force does not tend to zero with the distance between inducing particles tending to zero. As the gravitation was defined as the reintegration of migrated electrons/positrons to their nuclei and as a induction force, the gravitation force prevails over the Coulomb or Ampere forces for the distance tending to zero.

Fig. 10 shows qualitatively the resulting momentum due to Coulomb/Ampere and Gravitation momenta between an atomic nucleus of a target and a He nucleus.

Note: The gravitation model of "Emission & Regeneration" UFT is based on a physical approach of reintegration of migrated electrons/positrons to their nuclei and compatible with quantum mechanics, while General Relativity, the gravitation model of the SM, based on a mathematical-geometric approach is not compatible with quantum mechanics.

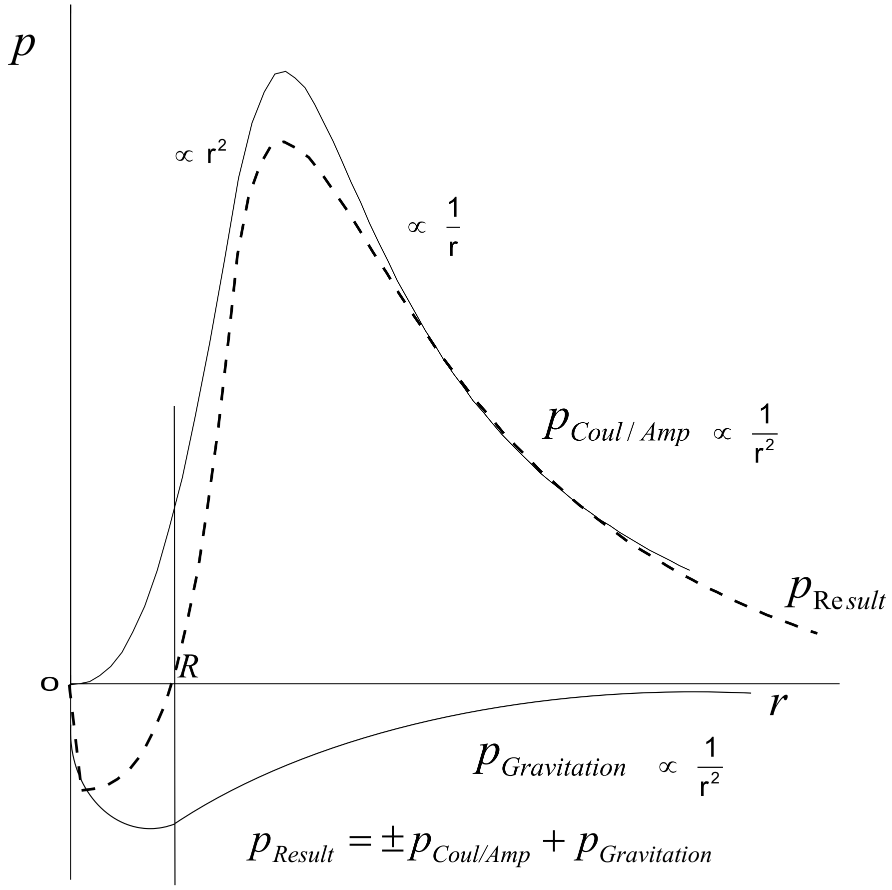

Figure 10: Resulting linear momentum p due to Coulomb/Ampere and Gravitation momenta.

7 Electromagnetic and Gravitation emissions.

Fig. 11 shows the generation of the electromagnetic emission and the gravitation emission.

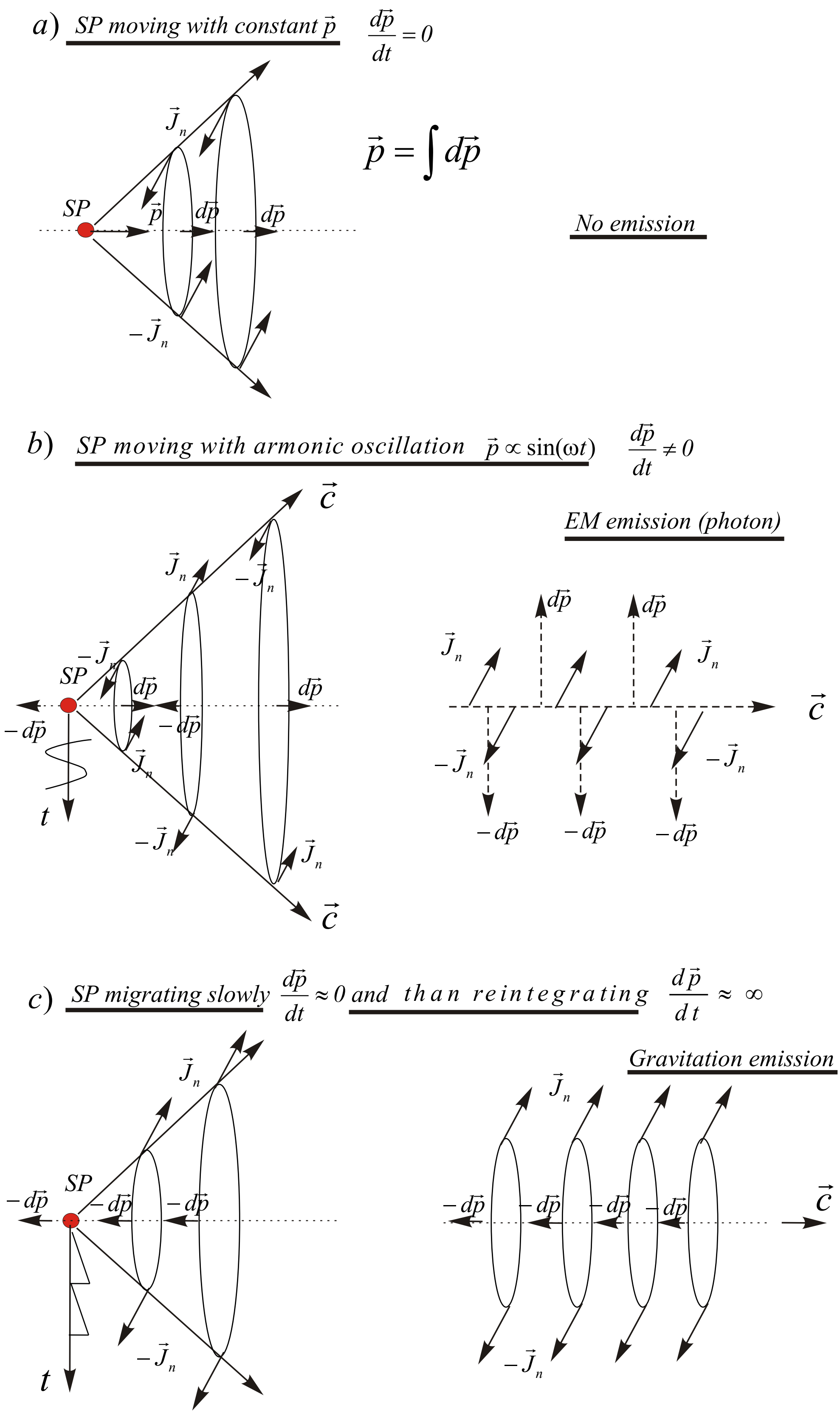

Figure 11: Electromagnetic and Gravitation emissions

At **a)** a Subatomic Particle (SP), electron or positron, shows transversal angular momenta J_n of its Fundamental particles (FPs) when moving with constant moment p relative to a second SP (not shown). The transversal angular momenta of its FPs follow the right screw law in moving direction independent of the charge. FPs with opposed angular momenta are entangled and are fixed to the SP. No FPs are emitted when moving with constant speed.

When the moving SP approaches a second SP (not in the drawing), the opposed transversal angular momenta are passed to the second SP via their regenerating FPs so that the first SP looses linear momentum while the second SPs gains linear momentum.

At **b**) a oscillating SP is shown with the pairs of emitted FPs with opposed angular momenta at the closed circles changing ciclically their directions. At far distances from the SP trains of FPs with opposed angular momenta become independent from the SP and move with light speed (photons) relative to its source. According to which combination of opposed entangled FPs become independent we have a train with potentially transversal momenta p (shown) or potentially longitudinal momenta p (not shown).

At **c**) a SP is shown that migrates slowly to the right outside the core of the atomic nucleus and is then reintegrated to the left with high speed to its nucleus . The migration is so slow that no transversal angular momenta are generated at their FPs. When reintegrated, FPs with opposed transversal angular momenta become independent and move until absorbed by regenerating FPs of a second SP (not shown). As the transversal angular momenta of a moving SP follow the right screw law in moving direction independent of the charge of the SP, the reintegration will generate always potential longitudinal momenta p in the direction of the nucleus. The emitted pairs of opposed angular momenta with potential longitudinal momenta p have all the same direction, and when passed to a second SP generate the gravitation force.

8 Permanent magnetism.

Based on the present theory, two possible mechanism of how permanent magnetism is generated can be imagined:

- An energy flow along a closed chain of static BSPs.
- A current flow along a closed chain of reintegrating BSPs.

An energy flow along a closed chain of static BSPs.

Between two static isolated BSPs that are separated by the distance d, energy is exchanged because of the flow of fundamental particles. The transversal rotational momenta $\bar{J}_n^{(s)}$ generated on the regenerating fundamental particles compensate each other. The concept is shown in Fig. 12.

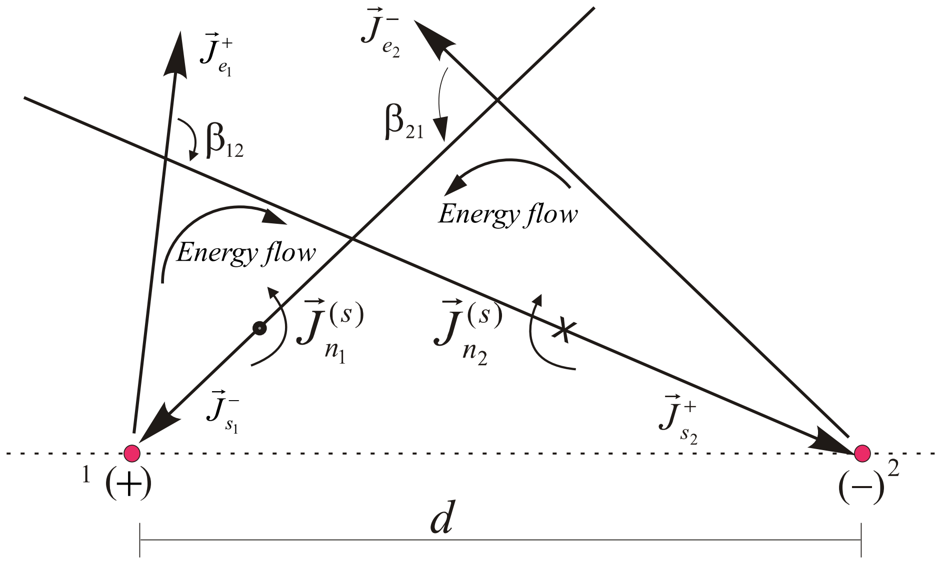

Figure 12: Energy flow between two static basic subatomic particles

If the energy flow is between static BSPs that belong to a close chain of atoms or molecules as shown in Fig. 13, the transversal rotational momenta $\vec{J}_n^{(s)}$ generated between two adjacent BSPs of the chain don't compensate, resulting in a field that is equal to the magnetic field generated by a current of BSPs in a closed circuit but without the moving of the BSPs.

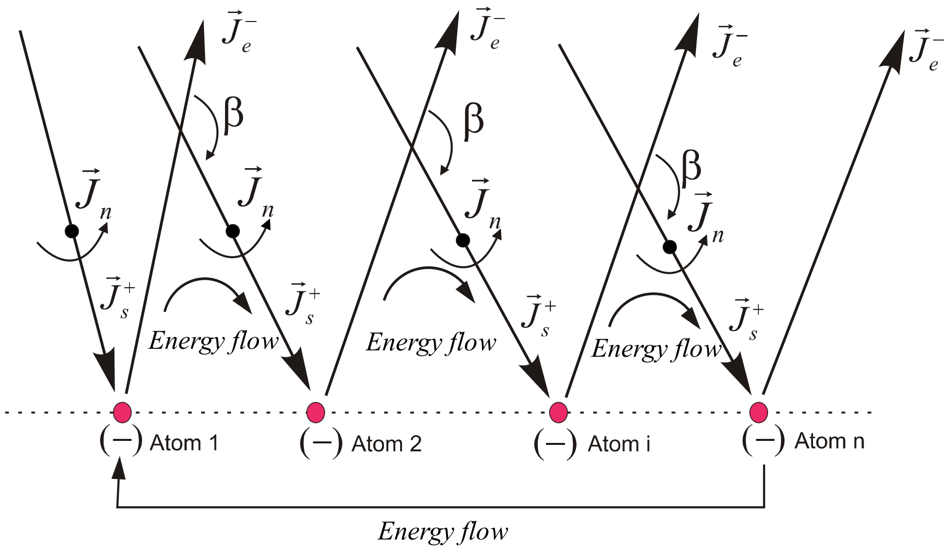

Figure 13: Energy flow along a closed chain of static basic subatomic particles

The concept is shown in Fig. 13.

The same is valid for a closed chain of positive complex particles (atomic nucleus or ions).

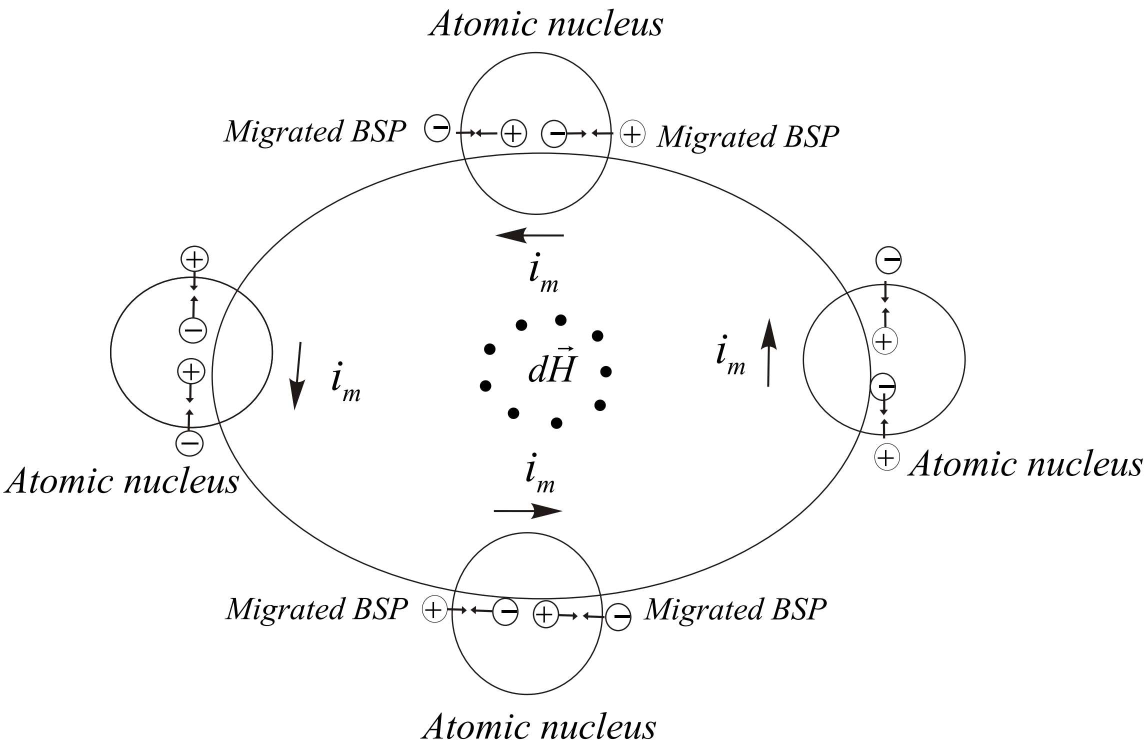

Figure 14: Current flow along a closed chain of reintegrating BSPs

A current flow along a closed chain of reintegrating BSPs. The concept is shown in Fig. 14.

In sec.5 we have described how the reintegration of BSPs to their nuclei generates a current. If we have a synchronized reintegration of BSPs along a closed chain of nuclei, a closed current I_m is generated that produces a permanent magnetic field. It is important to remember that BSPs migrate slowly outside their nuclei and are then reintegrated with high speed.

9 The Meissner-Ochsenfeld Effect.

The Meissner Effect consists of the repulsion between a permanent magnet and a material that was cooled below its transition temperature to become a superconductor. The repulsion is due to close loop currents induced on the surface of the material that generate an opposed magnetic field. This field cancels the permanent magnetic field leaving the innards of the superconductor completely field free. To induce the currents requires that the permanent magnetic field varies continuously in time, what would be if the distance between them varies continuously, but what is not the case.

The induction can only be explained if the permanent magnetic field is generated by the reintegration of BSPs along a closed chain of nuclei, where each reintegration generates a quantized current i_m with the associated magnetic field during a short time

$\Delta_o t$, as explained in sec.8.

$$i_m = \frac{q}{\Delta_o t} = \frac{e}{\Delta_o t} = 1.9823 \cdot 10 \ \ A \tag{58}$$

For the induced dH_n field due to the reintegration of an electron or positron see sec. 3 .

It can now be asked why the Meissner Effect does not exist at temperatures above the transition temperature. The electro motive force is induced in the material at all temperatures, only that above the transition temperature the electrons are hindered in their movement and don't cancel the external magnetic field and no repulsion exist.

10 Current induced on a rotating body.

In sec. 5 we have analysed the interactions between reintegrating BSPs of two bodies that move relative with the speed v_2. Now we analyse the case of two bodies where one of them rotates relative to the other.

The concept is shown in Fig. 15

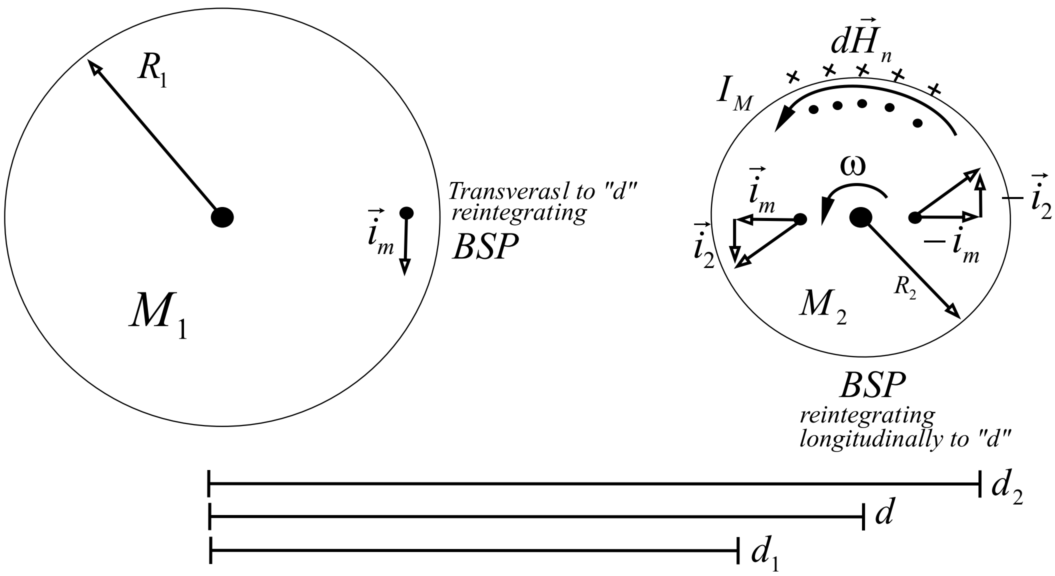

Figure 15: Induced current I_M and field dH_n on a rotating neutral body.

Comparing with Fig.8 all BSPs at the distance d_1 move with $-v_2$ and all BSPs at the distance d_2 move with v_2. Reintegrating BSPs at M_2 that are at the distance d_1 from M_1 define the direction of the currents i_m at M_1 because they are closer than reintegrating BSPs of M_2 at the distance d_2. The net result is a closed loop of currents i_2 at M_2 giving the current I_M which generates the transversal field dH_n. Please see also section **Permanent magnetism** at sec. 8.

11 Faraday paradox.

The Faraday paradox or Faraday's paradox is an experiment in which Michael Faraday's law of electromagnetic induction appears to predict an incorrect result. The paradoxes fall into two classes:

- Faraday's law appears to predict that there will be zero EMF but there is a non-zero EMF.
- Faraday's law appears to predict that there will be a non-zero EMF but there is a zero EMF.

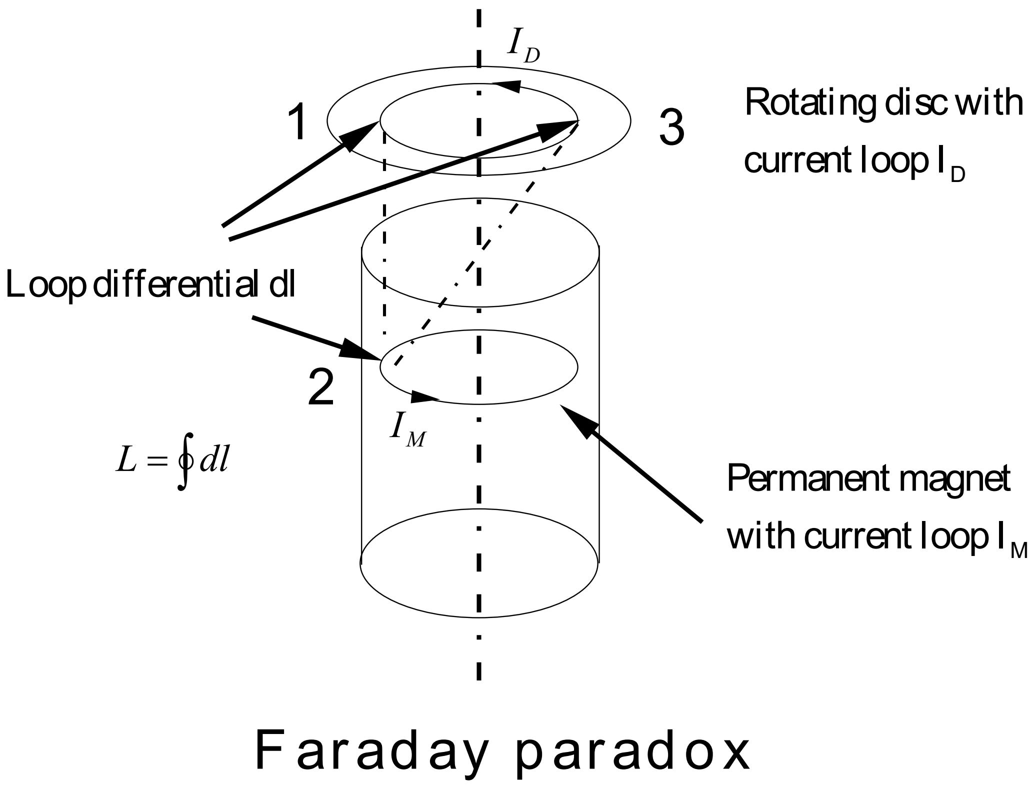

Figure 16: Setup to explain Faraday's paradox.

The setup consists of a disc and a magnet that are fitted a short distance apart on the axle, on which they are free to rotate about their own axes of symmetry. An electrical circuit is formed by connecting sliding contacts: one to the axle of the disc, the other to its rim. A galvanometer can be inserted in the circuit to measure the current.

The concept is shown in Fig. 16

According to the present approach permanent magnets are generated by current loops i_m that are produced by the reintegration of electrons and positrons to their nuclei. In a metal that is not magnetized, the reintegration occurs randomly in all directions at each nucleus and no current loop exists. When magnetized, the reintegration is oriented along a closed loop of nuclei what gives a current I_M where each reintegrating electron and positron remains associated to its nucleus. When the magnet rotates, according the direction of rotation the current in the magnet increases or decreases relative to the measuring equipment.

When the disc rotates, the free electrons at the disc generate a current loop I_D relative to the measuring equipment. So we have two parallel current loops, one at the magnet and one at the rotating disc. The parallel currents will attract or repel each other according the Ampere law. Between differential dl of the loops at points **1** and **2** the force is perpendicular to the surface of the disc and no EMF is induced at the disc by these currents. Between points **2** and **3** the force has a component in the direction of the surface of the disc and an EMF is generated.

The following situations are possible:

a) Only the disc rotates. We have two parallel current loops that induce a EMF at the disc.

b) Only the magnet rotates. We have no current in the disc and no EMF is induced in the disc.

c) Disc and magnet rotate. We have again case a) and an EMF is induced in the disc.

If one intends to explain the above situations with the help of the Lorentz law which describes the forces based on the magnetic field, the question arises if the field rotates or not with the magnet. With the Ampere law no use of a magnetic field is made and all situations are explained satisfactorily.

12 Precession of the perihelion.

The total gravitation force is

$$F_T = F_G + F_R = \left[\frac{G}{d^2} + \frac{R}{d}\right] M_1\, M_2 \qquad with \qquad G = G = 6.6726 \cdot 10^{-11}\ \frac{m^3}{kg\ s^2} \quad (59)$$

and

$$R(v_2) = 2.5551 \cdot 10^{-32}\ v_2\ \ Nm/kg^2 \tag{60}$$

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.

13 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 [7] derived for the total force density due to Ampere interaction.

$$\frac{F}{\Delta l} = \frac{b}{c\,\Delta_o t}\,\frac{r_o^2}{64\,m}\,\frac{I_{m_1}\,I_{m_2}}{d}\int_{\gamma_{2min}}^{\gamma_{2max}}\int_{\gamma_{1min}}^{\gamma_{1max}}\frac{\sin^2(\gamma_1-\gamma_2)}{\sqrt{\sin\gamma_1\ \sin\gamma_2}}\,d\gamma_1\,d\gamma_2 \tag{61}$$

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

It is also for $v \ll c$

$$\rho_x = \frac{N_x}{\Delta x} = \frac{1}{2\,r_o} \qquad I_m = \rho\,m\,v \qquad \Delta_o t = K\,r_o^2 \qquad I_m = \frac{m}{q}\,I_q \tag{62}$$

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. 17

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

$$i_m = \rho\,m\,v_m = \rho\,m\,k\,c \qquad with \qquad v_m = k\,c \qquad k = 7.4315 \cdot 10^{-2} \tag{63}$$

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

$$i_\omega = \pm\,\rho\,m\,v_\omega \qquad with \qquad v_\omega = \omega\,R_2 \tag{64}$$

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

$$F_{\omega_1} \propto +\frac{v_m\,v_\omega}{d-R_\omega} \qquad\qquad F_{\omega_2} \propto -\frac{v_m\,v_\omega}{d+R_\omega} \tag{65}$$

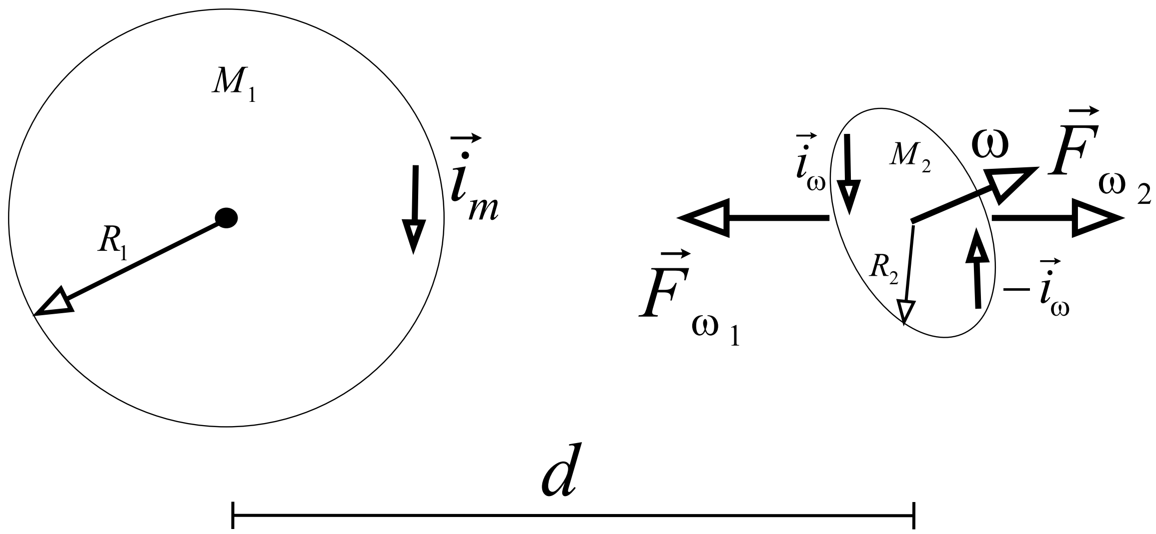

Figure 17: Gyroscopic precession.

From eq. (61) with $v_1 = v_m = k\ c$ we get for a pair of moving BSPs

$$dF_R = \ 5.8731\ \frac{b}{c\ \Delta_o t}\ \frac{2\ r_o^3}{64}\ \rho^2\ m\ \ \frac{v_1\ v_2}{d}\ \ N \tag{66}$$

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

$$F_R = \ 5.8731\ \frac{b}{c\ \Delta_o t}\ \frac{2\ r_o^3}{64}\ \rho^2\ m\ v_m\ v_\omega\ \gamma_A^2\ \frac{M_1\ M_2}{d}\ \ \ N \tag{67}$$

$$F_R = 2.551 \cdot 10^{-32}\ \ v_\omega\ \ \frac{M_1\ M_2}{d}\ \ \ N \tag{68}$$

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.

14 Thirring-Lense-Effect.

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

In [7] 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. 18

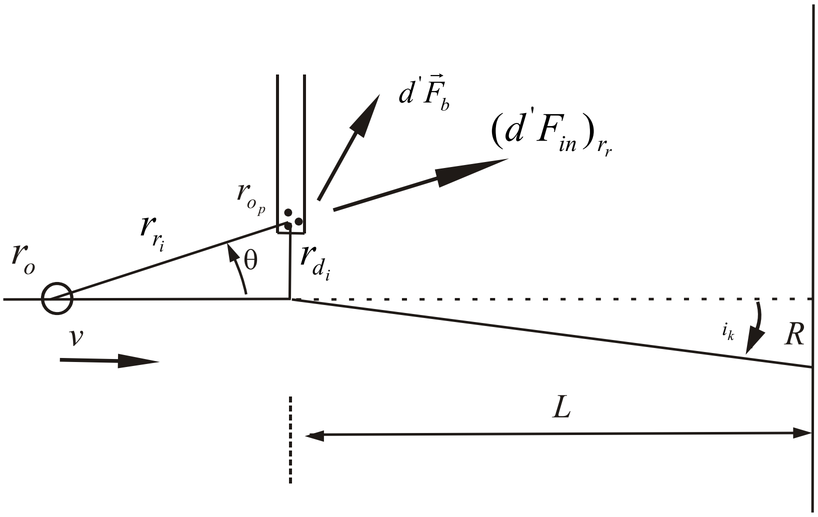

Figure 18: Force induced on a BSP at a bending edge by a BSP moving with speed v.

$$d'\bar{F}_{i_n} = \frac{1}{8\,\pi}\,\sqrt{m_p}\,r_{o_p}\,rot\,\bar{C}_n^{'} \tag{69}$$

with

$$rot\,\bar{C}_n^{'} = \frac{1}{2\pi}\,\sqrt{m}\,v^2\,\frac{r_o}{r_r^3}\left[2\,\cos^2\theta - \sin^2\theta\right]\,\bar{e}_r\;+\;0\cdot\bar{e}_\gamma \tag{70}$$

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

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. See Fig. 19

$$d'F_{i_n}\bar{e}_r = \frac{1}{16\,\pi^2}\,m\,v^2\,\frac{r_o^2}{r_r^3}\left[2\,\cos^2\theta - \sin^2\theta\right]\,\bar{e}_r \tag{71}$$

$$d''F_{i_n}\bar{e}_\theta = \frac{1}{16\,\pi^2}\,m\,v^2\,\frac{r_o^2}{r_r^3}\,\sin\theta\cos\theta\,\bar{e}_\theta \tag{72}$$

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. 20 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.

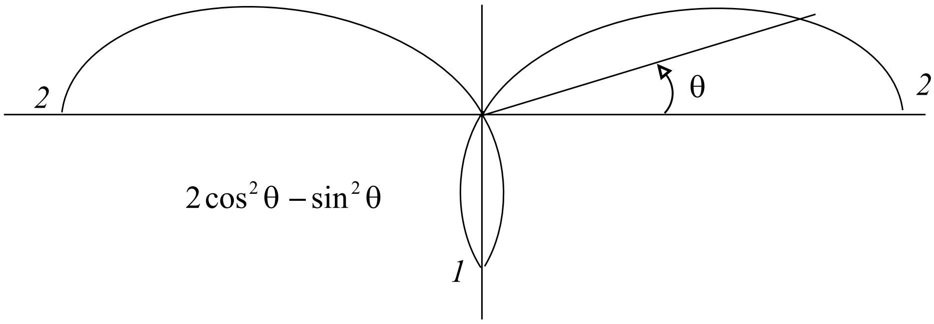

Figure 19: Plotting of the trigonometric relation for the analysis of Dragging.

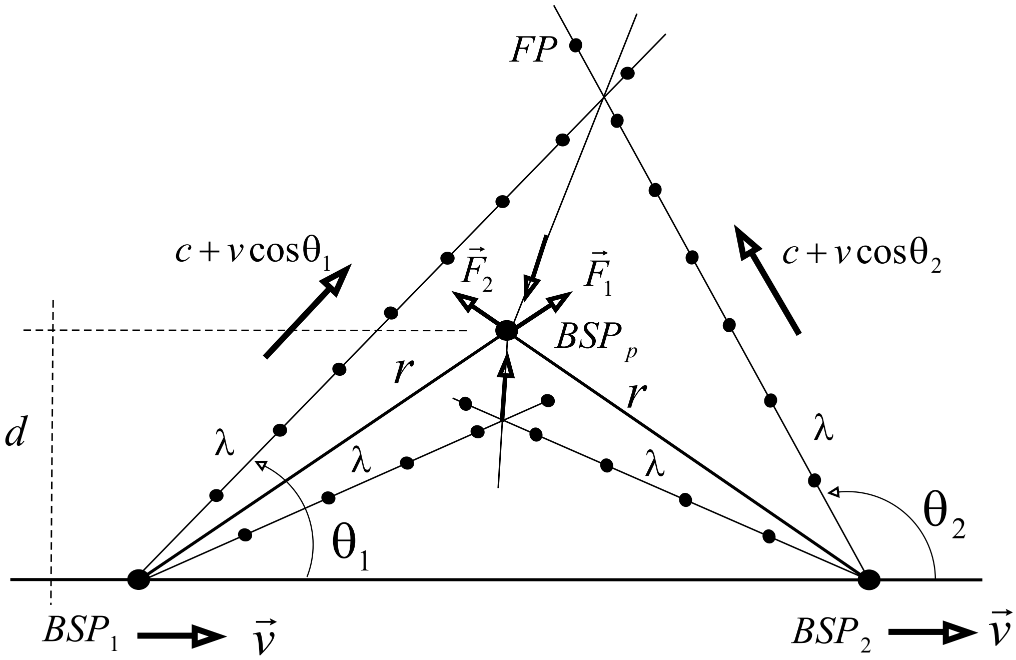

Figure 20: Dragging due to Doppler effect.

The speed of the FPs relative to a probe BSP_p located at the ray is

$$c + v \ \cos\theta = \lambda \ \nu \tag{73}$$

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 of FPs at the probe BSP_P

$$\nu_1 = \frac{c + v \ \cos\theta_1}{\lambda} \qquad \nu_2 = \frac{c + v \ \cos\theta_2}{\lambda} \qquad \nu_o = \frac{c}{\lambda} \tag{74}$$

With eqs. (71) and (72) we get for the components of the forces in the direction of the speed v taking into consideration the Doppler effect

$$d^{'}\bar{F}_v = \frac{\nu}{\nu_o}\, d^{'}F_{i_n}\ \cos\theta\ \bar{e}_r \qquad \theta = \arcsin(d/r) \tag{75}$$

$$d^{''}\bar{F}_v = \frac{\nu}{\nu_o}\, d^{''}F_{i_n}\ \sin\theta\ \bar{e}_\theta \qquad \theta = \arcsin(d/r) \tag{76}$$

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

$$d^{'}\bar{F}_{drag} = (d^{'}\bar{F}_{v_1} - d^{'}\bar{F}_{v_2}) = \frac{\nu_1 - \nu_2}{\nu_o}\, d^{'}\bar{F}_{i_n}\ \cos\theta\ e_r \tag{77}$$

$$d^{''}\bar{F}_{drag} = (d^{''}\bar{F}_{v_1} - d^{''}\bar{F}_{v_2}) = \frac{\nu_1 - \nu_2}{\nu_o}\, d^{''}\bar{F}_{i_n}\ \sin\theta\ e_\theta \tag{78}$$

The total dragging force is

$$\bar{F}_{drag} = \frac{2}{\pi}\int_{\theta=0}^{\pi/2} (d^{'}\bar{F}_{drag} + d^{''}\bar{F}_{drag})\ d\theta \tag{79}$$

15 The Pound-Rebka Experiment.

The Pound-Rebka Experiment shows the red/blue shift of Photons that cross a potential of a gravitation field. The theoretical explanation of the SM is based on the bending of the space-time of General Relativity.

We now derive the red/blue shift based on the “Emission & Regeneration” UFT. We start with

$$dE_n = E_n\ d\kappa \qquad with \qquad d\kappa = \frac{1}{4\pi}\ \frac{r_o}{r^2}\ dr\ \sin\varphi\ d\varphi\ d\gamma \tag{80}$$

where $d\kappa$ is the probability of dE_n in the volume $dV = dr\ rd\varphi\ r\sin\varphi\ d\gamma$ at the distance r.

The cumulated probability from ∞ to r is

$$\int dE_n = E_n \int_r^\infty d\kappa \qquad with \qquad \int_r^\infty d\kappa = \frac{1}{4\pi}\ \frac{r_o}{r}\ \sin\varphi\ d\varphi\ d\gamma \tag{81}$$

We have seen in sec 4 that the number of reintegrating electrons/positrons in a gravitating mass M_2 is $\Delta G_2 = \gamma_G\ M_2$. As each reintegrating electron/positron at M_2 generates a dE_n at the distance r from the center of the mass M_2, we get at the distance r the cumulated dE_n

$$\sum \int dE_n = \Delta G_2\ E_n \int_r^\infty d\kappa \tag{82}$$

For the deduction of ΔG_2 we used a second gravitating mass M_1 composed of electrons and positrons with regenerating rays of FPs that collect the FPs with opposed angular momenta of all the regenerating rays of M_2, from $0 <= \varphi <= \pi$.

The concept is shown in Fig. 21

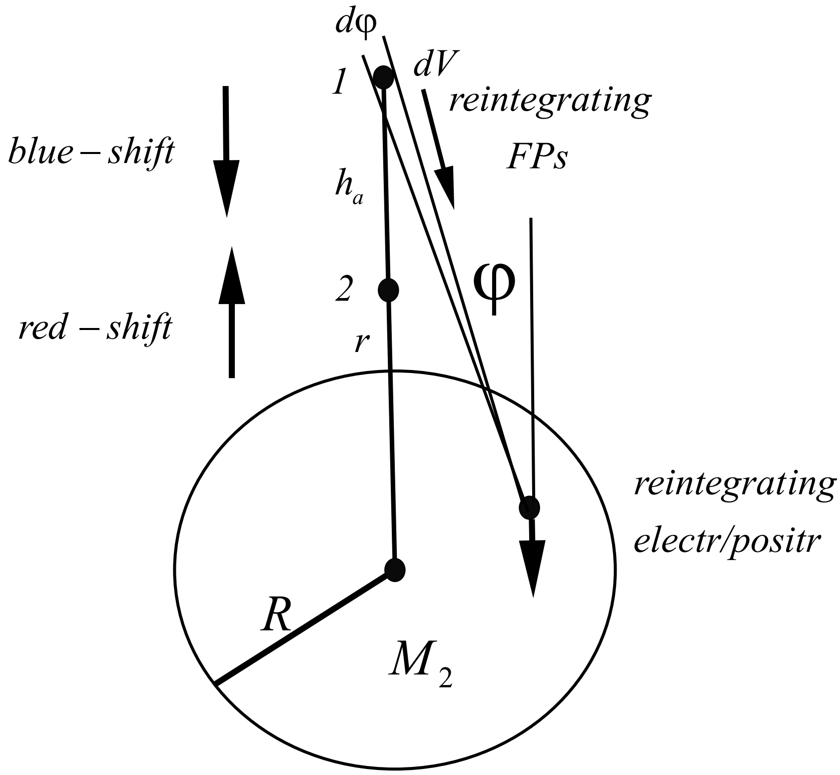

Figure 21: Pound-Rebka Experiment.

Now we assume that instead of the mass M_1 at point **1** we have a photon with $E_{phot} = h\nu$, photon that doesn't has regenerating rays of FPs to collect FPs of M_2 with opposed angular momenta. Only those reintegrating electrons/positrons of M_2 that are not on the straight line joining the center of M_2 and the photon at point **1** will have $\varphi \neq 0$ and $\varphi \neq \pi$. To take also account that the interaction between the photon and dE_n reduces to a small volume dV instead of the whole space as for M_1, we introduce the factor N_φ and get

$$\int_r^\infty d\kappa = \frac{1}{4\pi}\,\frac{r_o}{r}\,\sin\varphi\,d\varphi\,d\gamma = N_\varphi\,\frac{1}{4\pi}\,\frac{r_o}{r} \tag{83}$$

The cumulated probability for all ΔG_2 becomes

$$\sum \int dE_n = N_\varphi\,\Delta G_2\,E_n\,\frac{r_o}{4\pi}\,\frac{1}{r} \tag{84}$$

The energy E_n of the reintegrating electrons/positrons is distributed over space as

$dE_n = h\nu'$ at the transversal angular momenta of their regenerating FPs. We now make $E_n = h\nu$, where ν is an equivalent frequency, and get

$$\sum \int dE_n = N_\varphi \, \Delta G_2 \, h\nu \, \frac{r_o}{4\pi} \, \frac{1}{r} \tag{85}$$

A photon that moves from r_2 to r_1 crosses a potential difference of dE_n of

$$\Delta \left[\sum \int dE_n \right] = N_\varphi \, \Delta G_2 \, h\nu \, \frac{r_o}{4\pi} \, \left[\frac{1}{r_1} - \frac{1}{r_2} \right] = h \Delta\nu \tag{86}$$

which modifies the energy of the photon in $h\Delta\nu$. The relative change of the frequency of the photon is so given by

$$\frac{\Delta\nu}{\nu} = N_\varphi \, \Delta G_2 \, \frac{r_o}{4\pi} \, \left[\frac{1}{r_1} - \frac{1}{r_2} \right] \tag{87}$$

When the photon moves in the direction of the regenerating FPs of the reintegrating electrons/positrons of M_2, energy is passed to the photon and we have blue-shift. If the photon moves in the opposite direction it looses energy and we have red-shift.

The Pound-Rebka experiment arrives for an altitude of $22.5m$ at the surface of the earth to a relative frequency change of about $\frac{\Delta\nu}{\nu} = 10^{-15}$. This gives an experimentally determined factor of $N_\varphi = 10^{-26}$.

From

$$\Delta G_2 = \gamma_G \, M_2 \qquad and \qquad \gamma_G = \sqrt{G \, \frac{4 \, K}{m \, k \, c \, \int \int_{Induccion}}} \tag{88}$$

with $K = 5.4274 \cdot 10^4 \; s/m^2$ and $k = 7.4315 \cdot 10^{-2}$ and $\int \int_{Induccion} = 2.4662$ we see how the mass M_2 of the gravitating body and the gravitation constant G enter the equations.

16 Atomic clocks and gravitation.

Oscillations of mechanical instruments like a pendulum have been used in the past to define the time units. Big efforts were made to minimise the influence of factors like temperature, vibrations, humidity, gravitation, etc. on the precision, stability and reliability of the instruments. 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 what would produce changes in the frequencies of the emitted photons.

The present section shows a possible mechanism for the variation of the precision of atomic clocks based on the approach that gravitation is generated by the reintegration of migrated BSP to their nuclei. According to the approach, the energies of level electrons are given by stable dynamic configurations of BSPs in their nuclei, which is different 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 levels of electrons.

The approach is based on the assumption that the transition between two hyperfine levels of the ground state of atoms used in atomic clocks (Caesium-133, Rubidium-87, Thalium-205, etc.) is influenced by the Newton and Ampere gravitation forces. Because of the different mechanism for the generation of these two forces the strength of the influence is different.

The gravitation components are due to:

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

$$F_G = G \, \frac{M_1 \, M_2}{r^2} \tag{89}$$

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

$$F_R = \pm \, R(v) \, \frac{M_1 \, M_2}{r} \qquad with \qquad R(v) = 2.551 \cdot 10^{-32} \, v \tag{90}$$

16.1 Hafele-Keating Experiment.

We assume that the atomic transition frequencies of the atoms used in atomic clocks change proportional to the gravitation force and so the gains and losses expressed in ns. Each Caesium atom C_s^{133} of an atomic clock changes its frequency with the gravitation force.

The following measured data were obtained during the Hafele-Keating Experiment: The concept is shown on Fig. 22.

a) Flying eastwards a total loss of $\Delta t^E = -59 \; ns$ was measured during a flight of 41.2 hours at a hight of $h^E = 8.900$ m and a speed of $v = 950 \; km/h$ relative to the earth surface.

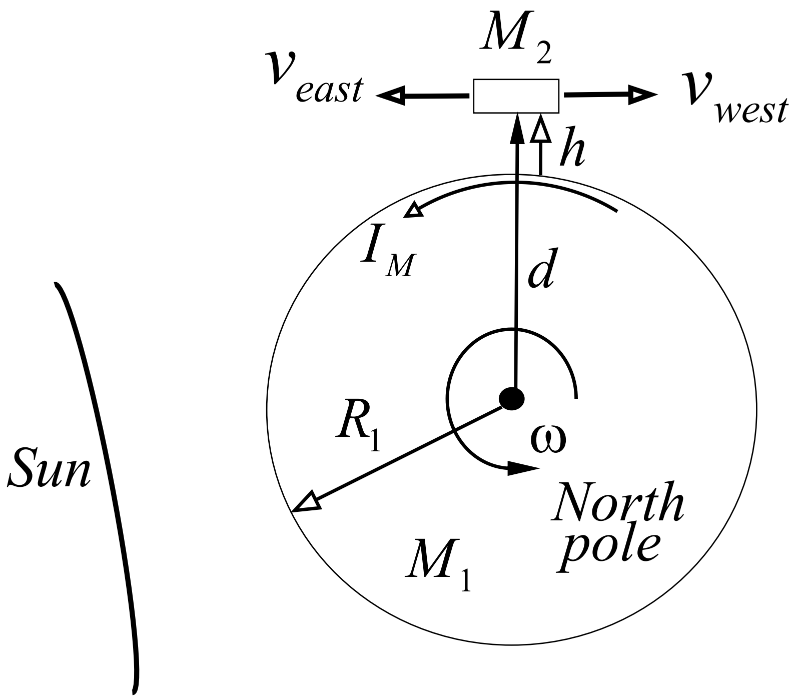

Figure 22: Influence of gravitation on clocks frequency.

b) Flying westwards a total gain of $\Delta t^W = 273\ ns$ was measured during a flight of 48.6 hours at a hight of $h^W = 9.400$ m and a speed of $v = 950\ km/h$ relative to the earth surface.

The gain or loss was measured relative to an equivalent atomic clock based on the earth.

At Fig. 22 we have the earth with mass M_1 and the mass M_2 of an Caesium atom C_s^{133} 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 interaction of reintegrating BSPs of the earth and the sun has the same direction as the rotation ω of the earth on its axis relative to the sun (see sec.10).

The results of the Hafele-Keating Experiment are better expressed in ns loss or gain per day.

Eastwards the plane was flying during $41,2\ h$ which is equivalent to $1,716\ days$ and which gives a total loss eastwards of $\Delta t^E = -59/1.716 = -34,38\ ns/day$.

Westwards the plane was flying during $48,6\ h$ which is equivalent to $2,025\ days$ and which gives a total loss westwards of $\Delta t^W = 273/2,025 = 134,81\ ns/day$.

We get for the losses and gains in ns/day

$$\Delta t^E = -34,38\ \ ns/day \qquad and \qquad \Delta t^W = 134,81\ \ ns/day \tag{91}$$

The total gain or loss eastwards and westwards is

$$\Delta t^E = \Delta t_G^E \ + \ \Delta t_R^E \qquad and \qquad \Delta t^W = \Delta t_G^W \ + \ \Delta t_R^W \tag{92}$$

The proportionality factors are not the same for the Newton and Ampere gravitation forces because of the different generation mechanism of the gravitation forces.

The proportionality factors are defined as

$$K_G = \frac{\Delta t_G}{\Delta F_G} \qquad and \qquad K_R = \frac{\Delta t_R}{\Delta F_R} \tag{93}$$

where Δt_G are the ns/day due to the Newton gravitation and Δt_R are the ns/day due to the Ampere gravitation.

The difference between the Newton gravitation forces between the distances d_1 and d_2 from the centre of the earth is given by

$$\Delta F_G = F_{G_2} - F_{G_1} = G\ M_1\ M_2\ \left[\frac{1}{d_2^2} - \frac{1}{d_1^2}\right] \qquad where \qquad d_2 < d_1 \tag{94}$$

The difference between the Ampere gravitation forces of a body moving with v_{tot} at the hight d_1 and d_2 from the centre of the earth is given by

$$\Delta F_R = R(v_{tot})\ M_1\ M_2\ \left[\frac{1}{d_2} - \frac{1}{d_1}\right] \qquad where \qquad d_2 < d_1 \tag{95}$$

where v_{tot} is a velocity still to be deduced.

As the Hafele-Keating experiment doesn't give measured values of Δt_G, we calculate the proportionality factor K_G with measured values of an experiment made by **Briatore and Leschiutto** in 1976. The experiment concentrates exclusively on the influence of the Newton gravitation on the frequency of clocks. The measured data are:

a) Turin $h_2 = 250\ m$ and Plateau Rosa $h_1 = 3.500\ m$

b) $\Delta t_G = 33,8 - 36,5\ \ ns/day$

For the calculation of ΔF_G we use

a) The mass of C_s^{133} with $M_2 = 2,2061 \cdot 10^{-25}\ kg$

b) The mass of the earth $M_1 = 5,972 \cdot 10^{24}\ kg$

c) For Plateau Rosa $d_1 = R_\oplus + h_1 = 6.378,0\ km + 3,5\ km = 6.381,5\ km$

d) For Turin $d_2 = R_\oplus + h_2 = 6.378,0\ km + 0,25\ km = 6.378,25\ km$

We get $\Delta F_G = 2,2201 \cdot 10^{-27}\ N$ and for the proportionality factor

$$K_G = \frac{\Delta t_G}{\Delta F_G} = \frac{33,8}{2,2201 \cdot 10^{-27}} = 1,5362 \cdot 10^{28}\ \frac{ns}{N\ day} \tag{96}$$

Now we can calculate for the Hafele-Keating Experiment the clock variations that correspond to the Newton gravitation for the east flight with $d_2^E = 8,9\ km$ and the west flight with $d_2^W = 9,4\ km$. We get

$$\Delta t_G^E = 92,45\ \frac{ns}{day} \qquad and \qquad \Delta t_G^W = 97,63\ \frac{ns}{day} \tag{97}$$

With

$$\Delta t^E = \Delta t_G^E\ +\ \Delta t_R^E \qquad and \qquad \Delta t^W = \Delta t_G^W\ +\ \Delta t_R^W \tag{98}$$

we get

$$\Delta t_R^E = -126,83 \qquad and \qquad \Delta t_R^W = 37,18 \tag{99}$$

With

$$\Delta t_R = K_R\ R(v_{tot})\ M_1\ M_2\ \left[\frac{1}{d_2} - \frac{1}{d_1}\right] \qquad\qquad R(v_{tot}) = 2.551 \cdot 10^{-32}\ v_{tot} \tag{100}$$

we get with $v_{tot} = v_E$ in the east direction and $v_{tot} = v_W$ in the west direction

$$\frac{\Delta t_R^E}{\Delta t_R^W} = -\ \frac{v_E}{v_W}\ \left[\frac{1}{d_2^E} - \frac{1}{d_1^E}\right]\ /\ \left[\frac{1}{d_2^W} - \frac{1}{d_1^W}\right] \tag{101}$$

and

$$\frac{\Delta t_R^E}{\Delta t_R^W} = -\ 0,9468\ \frac{v_E}{v_W} \qquad or \qquad \frac{v_E}{v_W} = k = 3,6029 \tag{102}$$

We define that

$$v_E = v_S + v \qquad and \qquad v_w = v_S - v \tag{103}$$

where v is the velocity of the plane relative to the surface of the earth and v_S a velocity still to be determined. We get that

$$v_S = \frac{k+1}{k-1}\ v = 1,7683\ v \tag{104}$$

If we assume that the velocity of the commercial plane used was $v = 750\ km/h$ we get for $v_S = 1.326\ km/h$ or $v_S = 368\ m/s$.

The speed of the surface of the earth at the equator in a frame with centre at the sun and the earth placed at an axis of the frame is $v_{center} = 463\ m/s$, which is not far from $v_S = 368\ m/s$. The difference could come from the not very reliable data of the Hafele-Keating experiment.

The conclusion is, that the speed $v_S = 368\ m/s$ calculated on the basis of the variations of the frequencies of atomic clocks due to the influences of the Newton and Ampere gravitation forces based on the mass of the C_s^{133} atom, is not far from the speed $v_{center} = 463\ m/s$ of the surface of the earth at the equator for a frame placed at the centre of the earth. This can be seen as a confirmation of the proposed approach for the gravitation mechanism as the result of the reintegration of migrated electrons and positrons to their nuclei.

Finally we calculate also the proportionality factor K_R for the Ampere gravitation.

$$K_R = \frac{\Delta t_R}{\Delta F_R} \Big|^E = \frac{\Delta t_R}{\Delta F_R} \Big|^W \tag{105}$$

$$\Delta F_R = R(v_{tot})\ M_1\ M_2\ \left[\frac{1}{d_2} - \frac{1}{d_1}\right] \qquad where \qquad d_2 < d_1 \tag{106}$$

with $v_{tot} = v_E$ for the east direction and $v_{tot} = v_W$ for the west direction. We get

$$K_R = \frac{\Delta t_R}{\Delta F_R} \Big|^E = \frac{\Delta t_R}{\Delta F_R} \Big|^W = 2,9965 \cdot 10^{40}\ \frac{ns}{N\ day} \tag{107}$$

For K_G we had

$$K_G = \frac{\Delta t_G}{\Delta F_G} = \frac{33,8}{2,2201 \cdot 10^{-27}} = 1,5362 \cdot 10^{28}\ \frac{ns}{N\ day} \tag{108}$$

Now we calculate the current I_M generated by the speed v_S of BSPs. From sec.5 we have with v_S that $i_S = \rho_x\ m\ v_S$ and for the earth we get $I_M = i_S\ \gamma_A\ M_\oplus$.

We defined a density ρ_x of BSPs for the current I_M so that one BSP follows immediately the next without space between them and get

$$\rho_x = \frac{N_x}{\Delta x} = \frac{1}{2\ r_o} \qquad with \qquad r_o = 3,8590 \cdot 10^{-13}\ m \tag{109}$$

With $\rho_x = 1,2957 \cdot 10^{12}\ m^{-1}$, $m = 9,1094 \cdot 10^{-31}\ kg$, $v_S = 368\ m/s$, $\gamma_A = 1,07558 \cdot 10^9\ kg^{-1}$, and $M_\oplus = 5,972 \cdot 10^{24}\ kg$ we get for the current I_M at the equator that generates the transversal field dH_n of the earth.

$$I_M = \rho_x \, m \, v_S \, \gamma_A \, M_{\oplus} = 2,7900 \cdot 10^{18} \; kg/s \tag{110}$$

17 Interpretation of Data in a theoretical frame.

A theory like our Standard Model was improved over time to match with experimental data introducing fictious entities (particle wave, gluons, gravitons, dark matter, dark energy, time dilation, length contraction, Higgs particle, Quarks, Axions, etc.) and helpmates (duality principle, equivalent principle, uncertainty principle, violation of energy conservation, etc.) taking care that the theory is as consistent and free of paradoxes as possible. The concept is shown in Fig. 23.

These improvements were integrated to the existing model trying to modify it as less as possible what led, with the time, to a model that resembles a monumental patchwork. To return to a mathematical consistent theory without paradoxes (contradictions) a completely new approach is required that starts from the basic picture we have from a particle. "E & R" UFT is such an approach representing particles as focal points in space of rays of FPs. This representation contains from the start the possibility to describe interactions between particles through their FPs, interactions that the SM with its particle representation attempts to explain with fictious entities.

Fig. 23 is an organigram where the main steps of the integration of fictious entities to the SM are shown. All experiments where the previously defined fictious entities are indirectly detected (point 7. of Fig. 23) are not a confirmation of the existence of the fictious entities (point 8. of Fig. 23), they are simply the confirmation that the model was made consistent with the fictious entities (point 3. of Fig. 23).

All experiments where time dilation or length contraction are apparently measured are indirect measurements and where the experimental results are explained with time dilation or length contraction, which stand for the interactions between light and the measuring instruments, interactions that were omited.

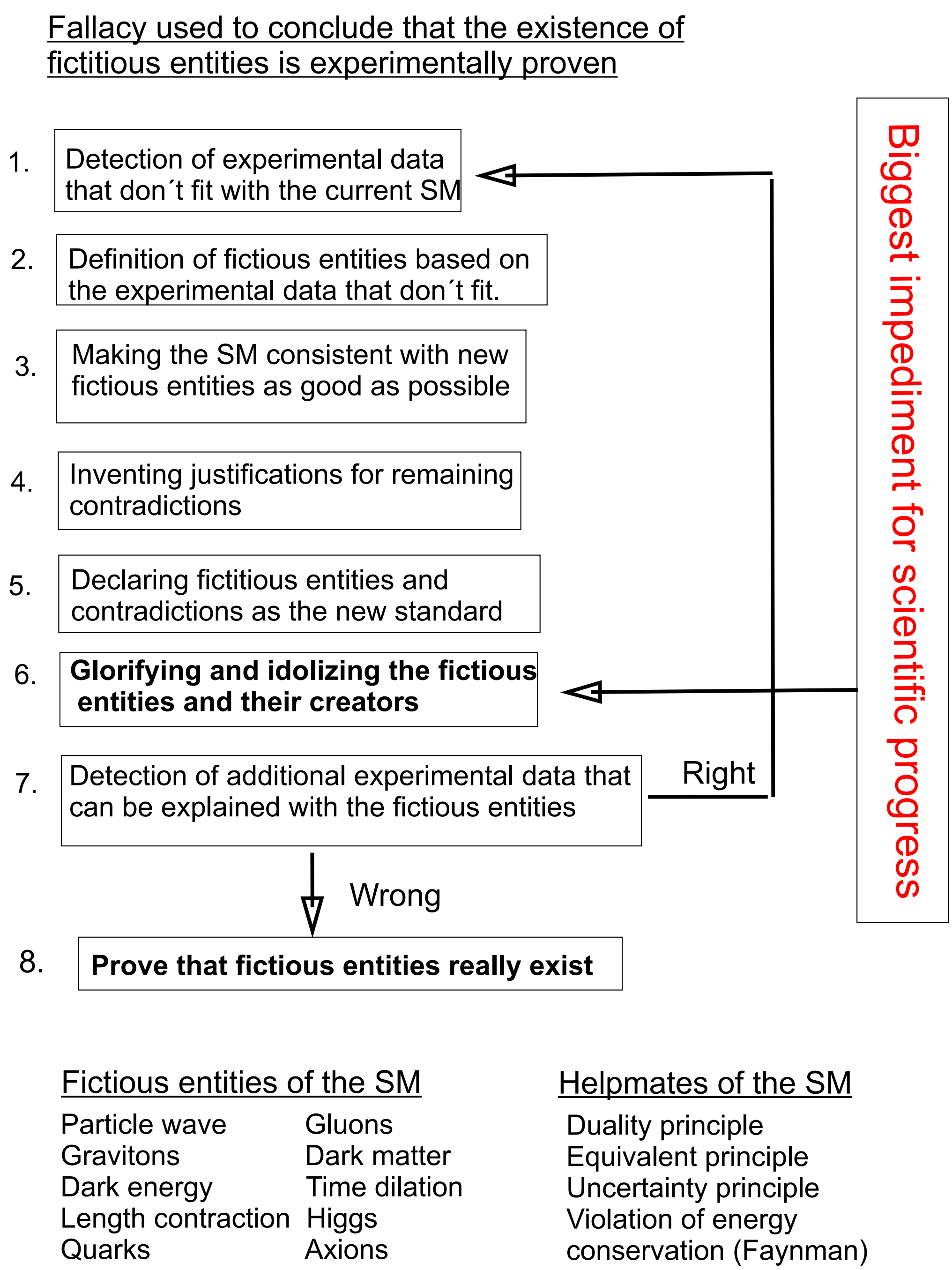

Figure 23: Fallacy used to conclude that fictious entities really exist

In the case of the increase of the life time of moving muons the increase is because of the interactions between the FPs of the muons with the FPs of the matter that constitute the real frame relative to which the muons move. To explain it with time dilation only avoids that scientists search for the real physical origin of the increase of the life time.

18 Resume.

The work is based on particles represented as structured dynamic entities with the relativistic energy distributed over the whole space on FPs (Fundamental Particles), 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 (Electrons and Positrons).

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 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.

Finally, the presented model for gravitation is compatible with quantum mechanics, what is not the case with general relativity.

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