# 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 [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.

# 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, Bosons, Gravitons, Quarks, Higgs, particle's wave, etc., to explain the mechanism of interaction between particles.

The present 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, $\nu$ 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 $H_e^2 = H_s^2 \, + \, H_n^2$.

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

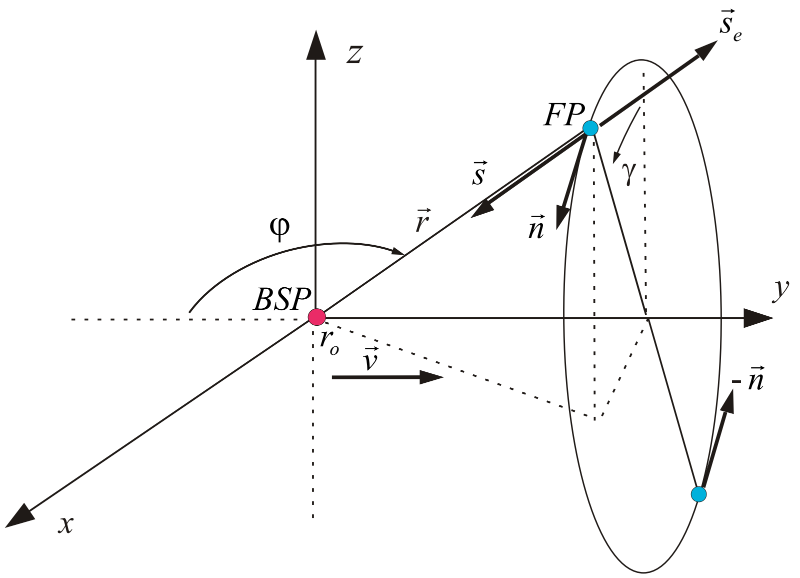


Figure 1: Unit vector $\bar{s}_e$ for an emitted FP and unit vectors $\bar{s}$ and $\bar{n}$ for a regenerating FP of a BSP moving with $v \neq c$

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 mechanical linear moment and the magnetic 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.

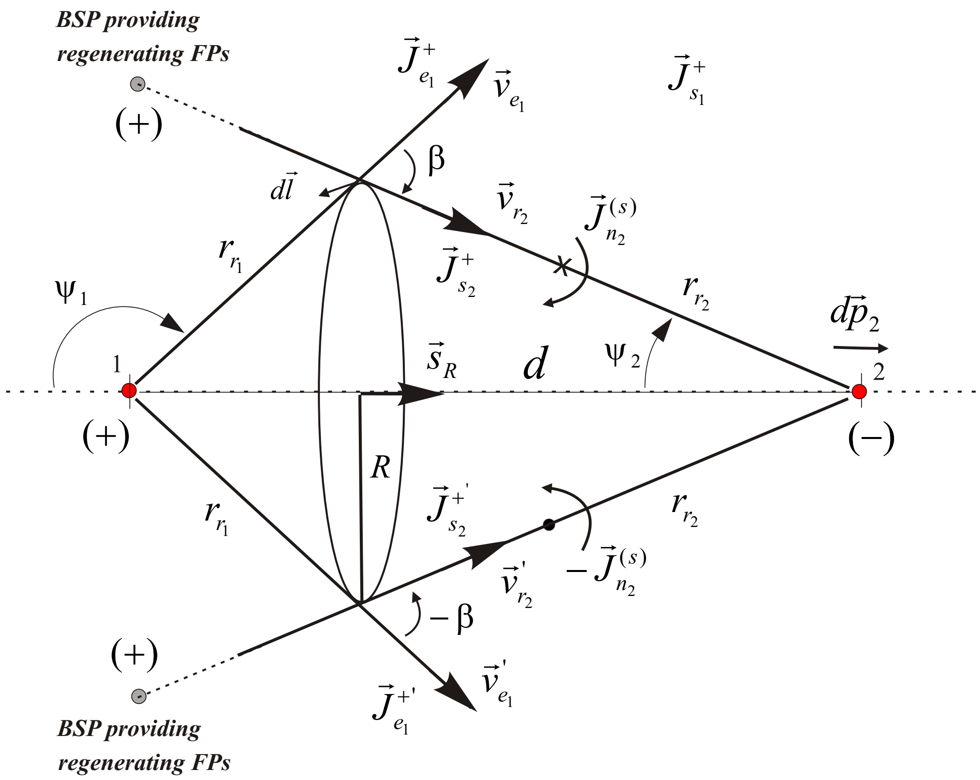


Figure 2: Generation of angular momentum $J_n$ at regenerating fundamental particles of two static basic subatomic particles at the distance $d$

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.

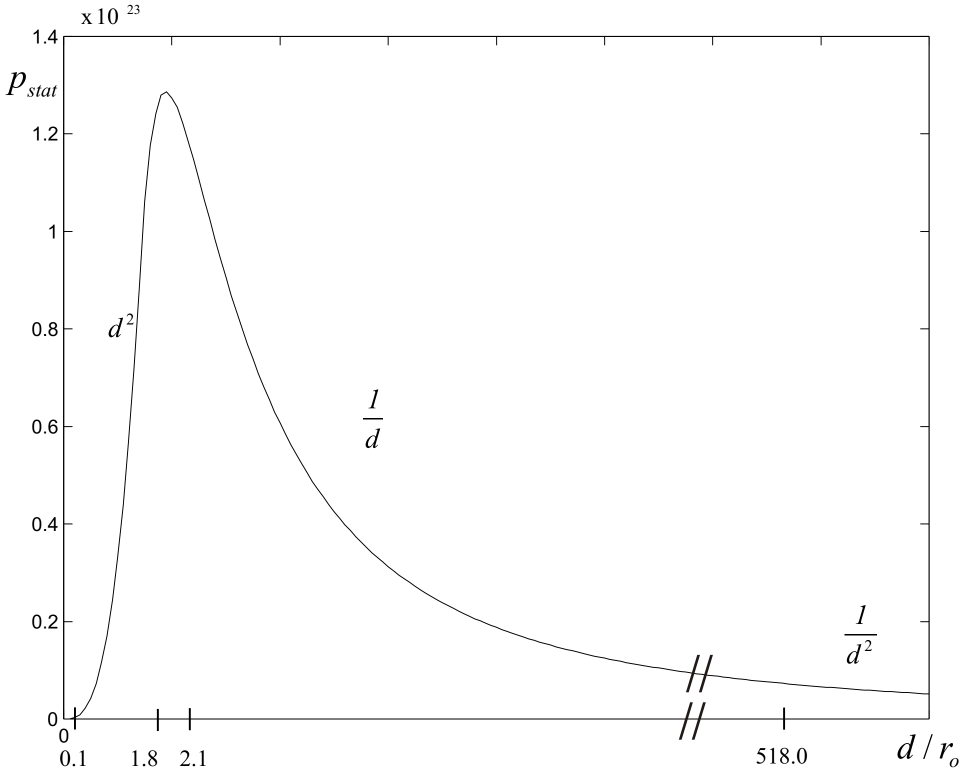


Figure 3: Linear momentum $p_{stat}$ as function of $\gamma = d/r_o$ between two static BSPs with equal radii $r_{o_1} = r_{o_2}$

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 $b$.

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 $p$.

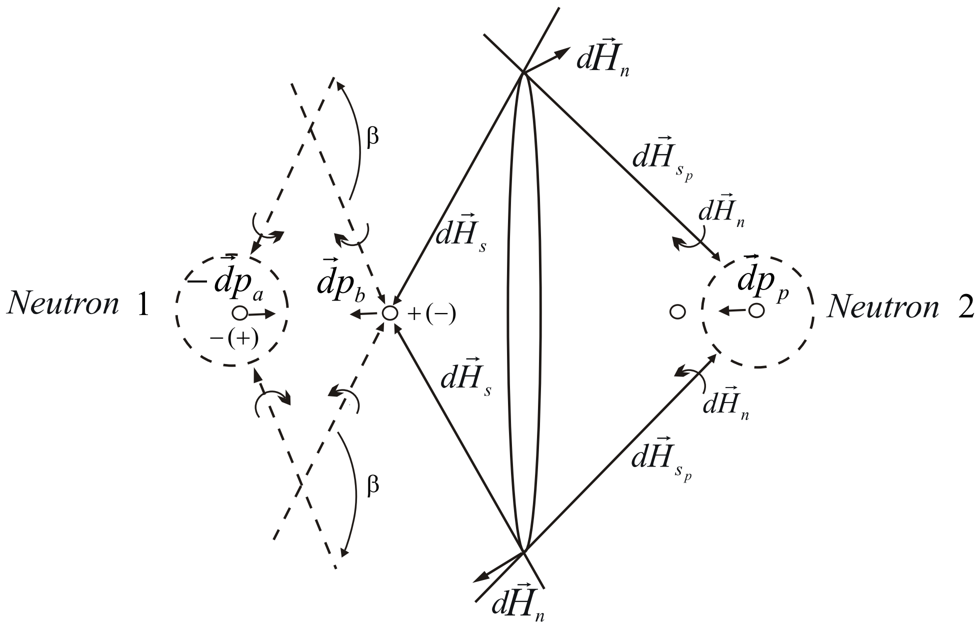


Figure 4: Transmission of momentum $dp_b$ from neutron 1 to neutron 2

# 3 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 $\Delta t$ 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

$$F_i = \frac{dp}{\Delta t} = \frac{\sqrt{h\,\nu_o}\,\sqrt{m_p}}{4\,K\,d^2}\int\!\!\int_{Grav} \qquad with \qquad \int\!\!\int_{Grav} = 2.4662 \tag{8}$$

with $m_p$ the mass of the resting electron, $h$ the Planck constant and $h\,\nu_o = E_o$ where $E_o$ is the energy of the resting electron. Also it is

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

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 to the reintegrating BSP $b$ of neutron 1.

For two bodies with masses $M_1$ and $M_2$ and where the number of reintegrated BSPs in the time $\Delta t$ is respectively $\Delta_{G_1}$ and $\Delta_{G_2}$ it must be

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

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

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

We get that

$$\Delta_{G_1}\ \Delta_{G_2} = G\ \frac{4\ K\ M_1\ M_2}{\sqrt{h\ \nu_o}\ \sqrt{m_p}\ \int\int_{Grav}} \tag{12}$$

or

$$\Delta_{G_1}\ \Delta_{G_2} = 2.1493 \cdot 10^{16}\ M_1\ M_2 = \gamma_G^2\ M_1\ M_2 \tag{13}$$

The number of migrated BSPs in the time $\Delta t$ for a neutral body with mass $M$ is thus

$$\Delta_G = \gamma_G\ M \qquad with \qquad \gamma_G = 1.4661 \cdot 10^8\ \ kg^{-1} \tag{14}$$

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

$$\Delta_{G_\odot} = 2.9162 \cdot 10^{38} \qquad and \qquad \Delta_\dagger = 8.7579 \cdot 10^{32} \tag{15}$$

The power exchanged between two masses due to gravitation is

$$P_G = F_i\ c = \frac{E_p}{\Delta t} = \frac{c\ \sqrt{h\ \nu_o}\ \sqrt{m_p}}{4\ K\ d^{\,2}}\ \Delta_{G_1}\ \Delta_{G_2}\ \int\int_{Grav} \tag{16}$$

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

$$P_G = F_G\ c = \ G\ \frac{M_\odot\ M_\dagger}{d_{\odot\dagger}^2}\ c = 7.8156 \cdot 10^{19}\ \ J/s \tag{17}$$

# 4 Dark matter and dark energy.

In the previous sections we have seen that the induced gravitation force is due to the reintegration of migrated BSPs in the direction of the two gravitating bodies. 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. 5.

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 $\Delta t$. It is

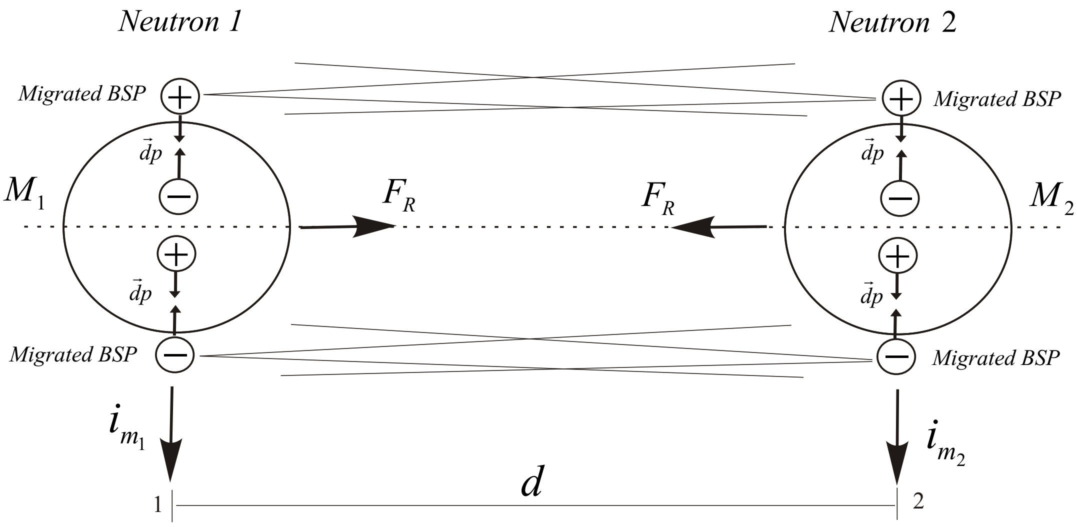


Figure 5: Resulting current due to reintegration of migrated BSPs

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

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

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

To obtain an equation for the force $F_R$ we start with an equation that was deduced in [6] for the linear momentum when bending electrons through a crystal, equation that is based on the **Ampere law** of sec. 1 for the interaction of parallel currents.

$$p_b = \frac{1}{4}\,\frac{5.8731}{64\,c}\,\frac{h\,\nu_o}{d}\,\Delta l\;n \tag{20}$$

with

$$\nu_o = 1.2373\cdot 10^{\,20}\;\; s^{-1} \qquad \Delta l = 5.2843\cdot 10^{-11}\;\; m \qquad \Delta_o\,t = 8.0821\cdot 10^{-21}\;\; s \tag{21}$$

The force for one pair of parallel BSPs ($n = 1$) is given by

$$dF_R = \frac{p_b}{\Delta_o t} = \frac{K_{Dark}}{d} \qquad with \qquad K_{Dark} = \frac{1}{2}\,\frac{h}{\Delta_o t} = 4.09924 \cdot 10^{-14}\;\; Nm \tag{22}$$

The total force is

$$F_R = \Delta_{R_1}\,\Delta_{R_2}\,dF_R = \Delta_{R_1}\,\Delta_{R_2}\,\frac{K_{Dark}}{d} = R\,\frac{M_1\,M_2}{d} \tag{23}$$

We get

$$\Delta_{R_1}\,\Delta_{R_2} = \frac{R}{K_{Dark}}\,M_1\,M_2 \tag{24}$$

or

$$\Delta_{R_1}\,\Delta_{R_2} = \gamma_R^2\,M_1\,M_2 \qquad with \qquad \gamma_R^2 = \frac{R}{K_{Dark}} \tag{25}$$

The number of currents in the time $\Delta t$ for a neutral body with mass $M$ thus is

$$\Delta_R = \gamma_R\,M \tag{26}$$

The total attraction force gives

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

For sub-galactic distances the induced force $F_G$ is predominant, while for galactic distances the force of parallel reintegrating BSPs $F_R$ predominates, as shown in Fig. 6.

The transition distance between sub-galactic and galactic distances we get making $F_G = F_R$ resulting

$$d_{gal} = \frac{G}{R} \tag{28}$$

## 4.1 Flattening of galaxies' rotation curve.

For galactic distances the force of parallel reintegrating BSPs $F_R$ predominates over the induced gravitation force $F_G$ and we can write eq. (27) as

$$F_T \approx F_R = \frac{R}{d}\,M_1\,M_2 \tag{29}$$

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

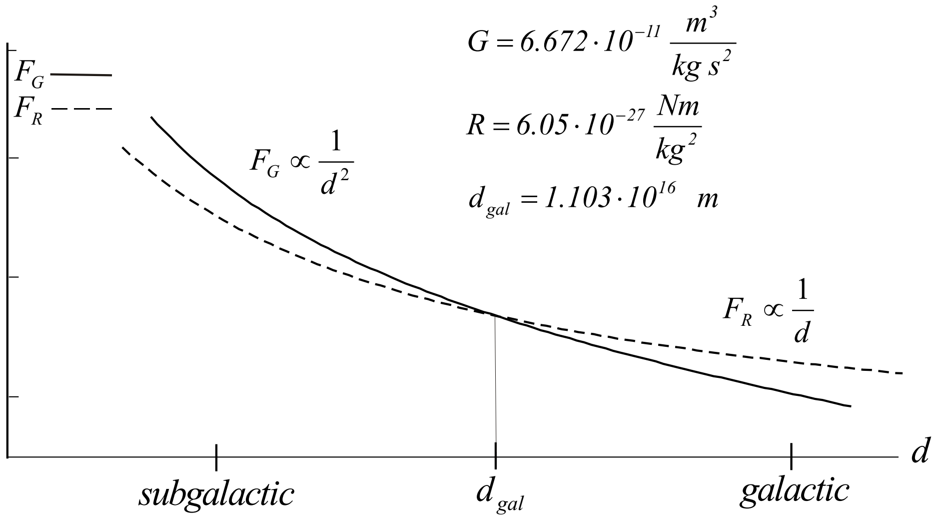


Figure 6: Gravitation forces at sub-galactic and galactic distances.

$$F_c = M_2\, \frac{v_{orb}^2}{d} \qquad \textit{with } v_{orb} \textit{ the tangential speed} \tag{30}$$

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

$$F_c = M_2\, \frac{v_{orb}^2}{d} = F_T \approx F_R = \frac{R}{d}\, M_1\, M_2 \tag{31}$$

We get for the tangential speed

$$v_{orb} \approx \sqrt{R\, M_1} \qquad \textit{constant} \tag{32}$$

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

**Calculation example**

With the following calculation example we will determine the value of the constant $R$ and the transition distance $d_{gal}$.

For the Sun with $v_{orb} = 220\ km/s$ 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

$$F_c = M_2\, \frac{v_{orb}^2}{d} = 3.872 \cdot 10^{20}\ \ N \tag{33}$$

With the mass of the core of the Milky Way of $M_1 = 4 \cdot 10^6\ M_\odot$ and

$$F_c = F_T \approx F_R = R\, \frac{M_1\, M_2}{d} \qquad \textit{we get} \qquad R = 6.05 \cdot 10^{-27}\ \ Nm/kg^2 \tag{34}$$

and with

$$F_G = F_R \qquad we\ get \qquad d_{gal} = \frac{G}{R} = 1.103 \cdot 10^{16}\ \ m \tag{35}$$

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

We also have that

$$\gamma_R = \sqrt{\frac{R}{K_{Dark}}} = 3.842 \cdot 10^{-7}\ \ kg^{-1} \tag{36}$$

If we compare with $\gamma_G = 1.4661 \cdot 10^8\ \ kg^{-1}$ for the induced force we see that $\gamma_R$ is very small.

**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 of reintegrating BSPs and, that for galactic distances the induced component can be neglected.

### 4.2 Dark Energy:

We have assume in sec. 4 about "Dark Matter" that because of the power exchange (16) between the two neutrons, a synchronization exists between the reintegration of BSPs of equal sign in the direction orthogonal to the axis defined by the two neutrons, resulting in parallel currents of equal sign that generate an attracting gravitation force between the neutrons.

We now assume that the synchronization of the reintegrating BSPs in the orthogonal direction of the two neutrons is between parallel currents of opposed sign, generating a repulsive gravitation force between the two neutrons. The repulsive gravitation force between matter is known as dark energy.

## 5 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

$$\Delta t(v=0) = \Delta_o t = 8.082110^{-21}\ \ s \qquad and \qquad k = 7.4315 \cdot 10^{-2} < 1 \tag{37}$$

gives

$$p_{elem} = m\, c\, k = \frac{h}{c\, \Delta_o t}\, k = 2.0309 \cdot 10^{-23}\ \ kg\ m\ s^{-1} \tag{38}$$

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

## 5.1 Quantification of the induced gravitation force.

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

$$F_i = \frac{\sqrt{h\,\nu_o}\,\sqrt{m_p}}{4\,K\,d^{\,2}} \int\!\!\int_{Induction} \qquad with \qquad \int\!\!\int_{Induction} = 2.4662 \tag{39}$$

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

$$F_i = N_i\,\nu_o\,p_{elem} \qquad with \qquad N_i = \frac{r_o^2}{4\,k\,d^{\,2}} \int\!\!\int_{Induction} \tag{40}$$

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

$$F_G = F_i\,\Delta G_1\,\Delta G_2 = N_G\,\nu_o\,p_{elem} \qquad with \qquad N_G = N_i\,\Delta G_1\,\Delta G_2 \tag{41}$$

Finally we get

$$F_G = N_G(M_1, M_2, d)\,\nu_o\,p_{elem} \qquad with \qquad N_G = 2.65558 \cdot 10^{-8}\,\frac{M_1\,M_2}{d^2} \tag{42}$$

The frequency with which aligned reintegrating BSPs interact in space is

$$\nu_G = N_G(M_1, M_2, d)\,\nu_o = 3.28575 \cdot 10^{12}\,\frac{M_1\,M_2}{d^2} \tag{43}$$

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 $\nu_G = 1.8043 \cdot 10^{46}\ s^{-1}$ for aligned reintegrating BSPs.

## 5.2 Quantification of the Ampere gravitation force.

From sec. 4 and eq. (20) we have for a pair of parallel reintegrating BSPs that

$$dF_R = \frac{p_b}{\Delta_o t} = \frac{1}{4}\,\frac{5.8731}{64\,c}\,\frac{h\,\nu_o}{\Delta_o t}\,\frac{\Delta l}{d} \tag{44}$$

with

$$\nu_o = 1.2373 \cdot 10^{\,20} \;\; s^{-1} \qquad \Delta l = 5.2843 \cdot 10^{-11} \;\; m \qquad \Delta_o\, t = 8.0821 \cdot 10^{-21} \;\; s \quad (45)$$

and which we can write as

$$dF_R = N\ \nu_o\ p_{elem} \qquad with \qquad p_{elem} = m\ c\ k \qquad and \qquad N = \frac{1}{4}\ \frac{5.8731}{64\ k}\ \frac{\Delta l}{d} \quad (46)$$

For $\Delta_{R_1}$ and $\Delta_{R_2}$ parallel reintegrating BSPs we get for the total Ampere gravitation force

$$F_R = dF_R\ \Delta_{R_1}\ \Delta_{R_2} = N_R\ \nu_o\ p_{elem} \qquad with \qquad N_R = N\ \Delta_{R_1}\ \Delta_{R_2} \quad (47)$$

and with $\Delta_{R_1}\ \Delta_{R_2} = \gamma_R^2\ M_1\ M_2$ we get

$$F_R = N_R(M_1, M_2, d, \Delta l)\ \nu_o\ p_{elem} \qquad with \qquad N_R = 4.55686 \cdot 10^{-14}\ \frac{M_1\ M_2}{d} \Delta l \quad (48)$$

The frequency with which parallel reintegrating BSP interact in space is

$$\nu_R = N_R(M_1, M_2, d, \Delta l)\ \nu_o = 5.6382 \cdot 10^6\ \frac{M_1\ M_2}{d} \Delta l \;\; s^{-1} \quad (49)$$

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 $\nu_R = 2.4065 \cdot 10^{40}\ \ s^{-1}$ for parallel reintegrating BSPs. The frequency $\nu_G$ for aligned reintegrating BSPs is nearly $10^6$ times grater than the frequency for parallel reintegrating BSPs and so the corresponding forces.

## 5.3 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 Ampere force between parallel reintegrating BSPs.

$$F_T = F_G + F_R = [N_G(M_1, M_2, d)\ +\ N_R(M_1, M_2, d, \Delta l)]\ p_{elem}\ \nu_o \quad (50)$$

or with $\Delta l = 5.2843 \cdot 10^{-11}\ m$

$$F_T = F_G + F_R =\ p_{elem}\ \nu_o\ \left[ \frac{1.9735 \cdot 10^{-9}}{d^2} + \frac{1.7895 \cdot 10^{-25}}{d} \right]\ M_1\ M_2 \quad (51)$$

We define the distance $d_{gal}$ (Fig. 6 ) as the distance for which $F_G = F_R$ and get

$$d_{gal} = \frac{1.9735 \cdot 10^{-9}}{1.7895 \cdot 10^{-25}} = 1.103 \cdot 10^{16} \;\; m \tag{52}$$

## 5.4 Gravitation and the Cosmic Microwave Background radiation.

We have seen in sec. 2 that gravitation is generated by the reintegration of electrons and positrons to neutrons and protons of their atomic nucleus. Due to the acceleration, transversal angular momenta are generated on the regenerating FPs of the reitegrating electrons and positrons, transversal angular momenta that comply with the requirements to generate linear momenta (opposed $dH$ fields). The opposed pairs of transversal angular momenta are passed to electrons and positrons of neutrons and protons of another atomic nucleus, generating on it linear momenta in the same direction they first generated at the neutron or proton of the atomic nucleus where the reintegration took place.

Atoms are formed of an atomic nucleus with neutrons and protons and the level electrons. When protons and neutrons of a nucleus reintegrate migrated electrons and positrons, the generated opposed $dH$ fields are also passed partly to the level electrons of another nucleus shifting temporarily the electrons to a little higher energy level. When these electrons return to their original energy level they emit photons in the range of micro waves which are detected by the detector.

The main difference between linear momenta generated by gravitation and photons is, that gravitation generates linear momenta that are all oriented in the same direction, while photons generate alternate linear momenta.

What follows is a calculation comparison with the intention to show that the apparent CMB radiation is really radiation that is produced indirectly by gravitation.

CMB radiation is measured at a temperature of 2.7 $K$ uniformly from all directions in space. According Wien's law we get for the maximum of the radiation curve

$$\lambda_{max} = \frac{2898}{T} \;\; \mu m = 1073.33 \;\; \mu m \qquad or \qquad \nu_{max} = 2.795 \cdot 10^{11} \;\; s^{-1} \tag{53}$$

From sec. 5.3 we have that the total gravitation force is

$$F_T = [\nu_G + \nu_R] \, p_{elem} = \left[ \frac{1.9735 \cdot 10^{-9}}{d^2} + \frac{1.7895 \cdot 10^{-25}}{d} \right] \nu_o \; M_1 \; M_2 \; p_{elem} \tag{54}$$

We now calculate the gravitation force on the small microwave detector in the center of the COBE satellite which has a mass of 840 $kg$. The small detector has a mass of approximately 3.0 $g$. The mass of the satellite around the detector we assume is equivalent to a concentrated mass at a distance $d = 2.0\ m$ of the small mass of the detector.

For the small distance of $d = 2.0\ m$ the second term of eq. (54) can be neglected and we have

$$\nu_G = \frac{1.9735 \cdot 10^{-9}}{d^2}\ \nu_o\ M_1\ M_2 \tag{55}$$

We now make calculations for the COBE satellite with the mass $M_C = M_1 + M_2 = 840\ kg$ where $M_1 = 3.0\ g$ and $M_2 = 840\ kg - 3.0\ g$. We get a gravitation frequency $\nu_G = 1.538 \cdot 10^{11}\ s^{-1}$ which is very close to the frequency $\nu_{max} = 2.795 \cdot 10^{11}\ \ s^{-1}$ calculated for the thermal radiation with 2.7 $K$.

If we now assume that the intensity of the thermal radiation at 2.7 $K$ is much smaller than the intensity of the radiation induced by gravitation, we can explain easily the measured isotropy of the apparent CMB radiation.

# 6 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.

Finally the hypothesis is made that the apparent CMB radiation is a radiation induced by the gravitation mechanism explaining the isotropy of the radiation.

# 7 Bibliograpy.


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