"Emission & Regeneration" Unified Field Theory.

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Abstract

The methodology of today's theoretical physics consists in introducing first all known forces by separate definitions independent of their origin, arriving then to quantum mechanics after postulating the particle's wave, and is then followed by attempts to infer interactions of particles and fields postulating the invariance of the wave equation under gauge transformations, allowing the addition of minimal substitutions.

The origin of the limitations of our standard theoretical model is the assumption that the energy of a particle is concentrated at a small volume in space. The limitations are bridged by introducing artificial objects and constructions like particles wave, gluons, strong force, weak force, bosons, gravitons, dark matter, dark energy, big bang, etc.

The present approach models subatomic particles such as electrons and positrons as focal points in space where continuously fundamental particles are emitted and absorbed, fundamental particles where the energy of the electron or positron is stored as rotations defining longitudinal and transversal angular momenta (fields). Interaction laws between angular momenta of fundamental particles are postulated in that way, that the basic laws of physics (Coulomb, Ampere, Lorentz, Maxwell, Gravitation, bending of particles and interference of photons, Bragg, etc.) can be derived from the postulates. This methodology makes sure, that the approach is in accordance with the basic laws of physics, in other words, with well proven experimental data.

Due to the dynamical description of the particles the present approach has not the limitations of the standard model and is not forced to introduce artificial objects or constructions.

Contents

1   Introduction.

An axiomatic approach was used for the deduction of the "Emission & Regeneration" Field Theory. To find the laws of interactions between the angular momenta of Fundamental Particles (FPs) a recursive procedure was followed until the well proven laws of physics, which describe the forces between particles, were obtained.

Fig. 1 shows shematically the difference between the present approach and the mainstream theory.

Fundamental particles

Interactions between fundamental particles

Basic laws (Coulomb, Ampere, Lorentz, Maxwell, Gravitation)

Laws with state variables (Thermodynamics)

Particle wave postulate (de Broglie)

Quantum mechanics (Schroedinger)

Experimental efforts to detect fundamental particles (scattering)

Theoretical efforts to Infer interactions between fundamental particles postulating the invariance of wave equations under gauge transformations

Present approach

Mainstream physics

Figure 1: Methodology followed by the present approach

The approach is based on the following main conceptual steps:

The energy of an electron or positron is modeled as being distributed in the space around the particle's radius r_o and stored in fundamental particles (FPs) with longitudinal and transversal angular momenta. FPs are emitted continuously with the speed $v_e \ \bar{s}_e$ and regenerate the electron or positron continuously with the speed $v_r \ \bar{s}$. There are two types of FPs, one type that moves with light speed and the other type that

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moves with nearly infinite speed relative to the focal point of the electron or positron.
The concept is shown in Fig. 2.
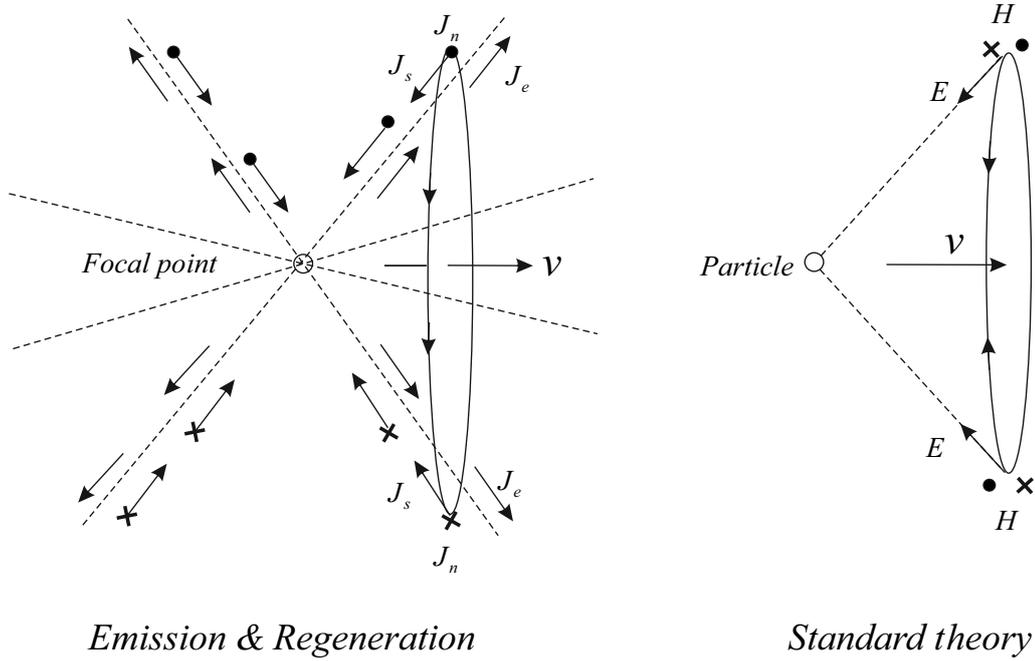
Figure 2: Particle as focal point in space

Electrons and positrons emit and are regenerated always by different types of FPs (see sec. 12) resulting the accelerating and decelerating electrons and positrons which have respectively regenerating FPs with light and infinite speed.

The density of FPs around the particle's radius r_o has a radial distribution and follows the inverse square distance law.

The concept is shown in Fig. 3

Field magnitudes $d\bar{H}$ are defined as square roots of the energy stored in the FPs. Interaction laws between the fields $d\bar{H}$ of electrons and positrons are defined to obtain pairs of opposed angular momenta $\bar{J}_n$ on their regenerating FPs, pairs that generate linear momenta $\bar{p}_{FP}$ responsible for the forces.

Based on the conceptual steps, equations for the vector fields $d\bar{H}$ are obtained that allow the deduction of all experimentally proven basic laws of physics, namely, Coulomb, Ampere, Lorentz, Gravitation, Maxwell, Bragg, Stern Gerlach and the flattening of galaxies' rotation curve.

Note: In this approach
Basic Subatomic Particles (**BSPs**) are:

- for $v < c$ the electron and the positron

- for $v = c$ the neutrino

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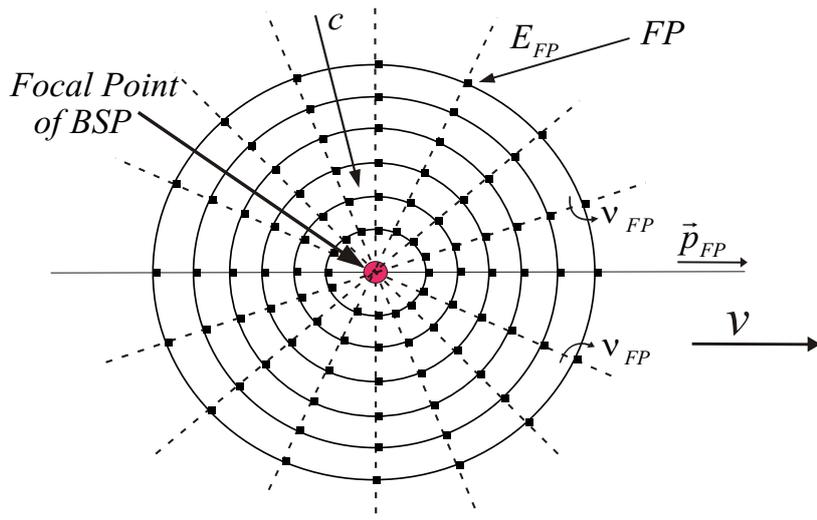
$$dE \; = \; dN_{FP} \, E_{FP} \qquad dN_{FP} = \omega_{FP} dV \; = \; \frac{1}{2\pi} \frac{E}{E_{FP}} d\kappa$$

Figure 3: Regenerating Fundamental Particles of a BSP

Complex Subatomic Particles (**CSPs**) are:

- for $v < c$ the proton, the neutron and nuclei of atoms.

- for $v = c$ the photon.

BSPs and CSPs with speeds $v < c$ emit and are regenerated by FPs that are provided by the emissions of other BSPs and CSPs with speeds $v < c$.

BSPs and CSPs with $v = c$ don't emit and are not regenerated by FPs and move therefore independent from other particles.

2 Space distribution of the energy of basic subatomic particles.

The total energy of a basic subatomic particle (BSP) with constant $v \neq c$ is

$$E = \sqrt{E_o^2 \; + \; E_p^2} \qquad E_o = m \, c^2 \qquad E_p = p \, c \qquad p = \frac{m \, v}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad (1)$$

The total energy $E = E_e$ is split in

$$E_e = E_s + E_n \qquad with \qquad E_s = \frac{E_o^2}{\sqrt{E_o^2 \; + \; E_p^2}} \qquad and \qquad E_n = \frac{E_p^2}{\sqrt{E_o^2 \; + \; E_p^2}} \qquad (2)$$

and differential emitted dE_e and regenerating dE_s and dE_n energies are defined

$$dE_e = E_e \, d\kappa = \nu \, J_e \qquad dE_s = E_s \, d\kappa = \nu \, J_s \qquad dE_n = E_n \, d\kappa = \nu \, J_n \qquad (3)$$

with the distribution equation

$$d\kappa = \frac{1}{2} \frac{r_o}{r^2} \, dr \, \sin \varphi \, d\varphi \, \frac{d\gamma}{2\pi} \qquad (4)$$

The distribution equation $d\kappa$ gives the part of the total energy of a BSP moving with $v \neq c$ contained in the differential volume $dV = dr \, rd\varphi \, r \sin \varphi \, d\gamma$.

The concept is shown in Fig. 4.
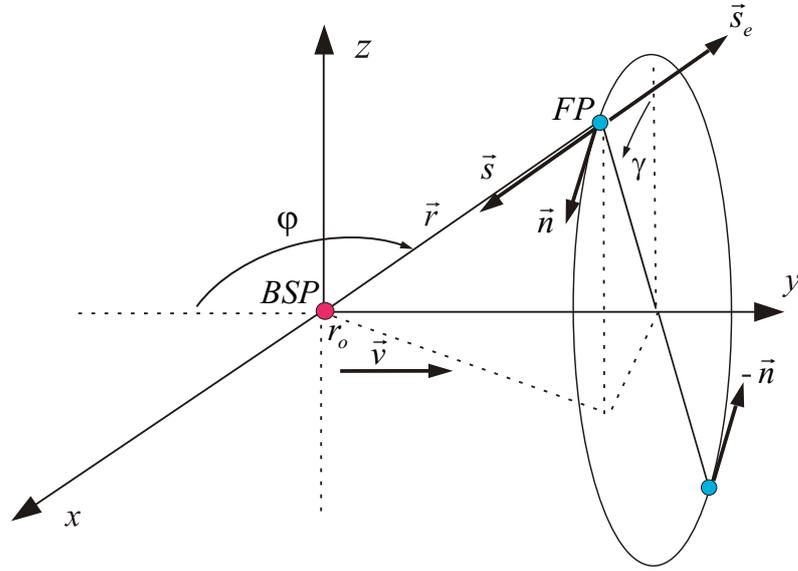
Figure 4: Unit vector $\bar{s}_e$ for an emitted FP and unit vectors $\bar{s}$ and $\bar{n}$
for a regenerating FP of a BSP moving with $v \neq c$

The differential energies are stored as rotations in the FPs which define the longitudinal angular momenta $\bar{J}_e = J_e \, \bar{s}_e$ of emitted FPs and the longitudinal $\bar{J}_s = J_s \, \bar{s}$ and transversal $\bar{J}_n = J_n \, \bar{n}$ angular momenta of regenerating FPs (see also Fig. 2).

The rotation sense in moving direction of emitted longitudinal angular momenta $\bar{J}_e$ defines the sign of the charge of a BSP. Rotation senses of $\bar{J}_e$ and $\bar{J}_s$ are always opposed. The direction of the transversal angular momentum $\bar{J}_n$ is the direction of a right screw that advances in the direction of the velocity v and is independent of the sign of the charge of the BSP.

Conclusion: The elementary charge is replaced by the energy (or mass) of a resting electron ($E_e = 0.511 \, MeV$). The charge of a complex SP (e.g. proton) is given by the difference between the **constituent** numbers of BSPs with positive $\bar{J}_e^{(+)}$ and negative $\bar{J}_e^{(-)}$ that integrate the complex SP, multiplied by the energy of a resting electron. As

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examples we have for the proton with $n^+ = 919$ and $n^- = 918$ and a binding energy of $E_{B_{prot}} = -0.43371 \; MeV$ a charge of $(n^+ - n^-) * 0.511 = 0.511 \; MeV$, and for the neutron with $n^+ = 919$ and $n^- = 919$ and a binding energy of $E_{B_{neutr}} = 0.34936 \; MeV$ a charge of $(n^+ - n^-) * 0.511 = 0.0 \; MeV$.

The unit of the charge thus is the Joule (or kg). The conversion from the electric current I_c (Ampere) to the mass current I_m is given by

$$I_m = \frac{m}{q} \, I_c = 5,685631378 \cdot 10^{-12} \, I_c \; \left[\frac{kg}{s} \right] \tag{5}$$

with m the electron mass in kilogram and q the elementary charge in Coulomb.

Note: The Lorentz invariance of the charge from today's theory has its equivalent in the invariance of the difference between the **constituent** numbers of BSPs with positive $\bar{J}_e^{(+)}$ and negative $\bar{J}_e^{(-)}$ that integrate the complex SP, multiplied by the energy of a resting electron. In the present paper the denomination **charge** will be used according the previous definition.

3   Definition of the field magnitudes dH_s and dH_n.

The field dH at a point in space is defined as that part of the square root of the energy of a BSP that is given by the distribution equation $d\kappa$. The differential values dE and dH refere to the differential volume $dV = dr \, r \, d\varphi \, r \, \sin \varphi \, d\gamma$ (see also eq. (2)). For the emitted field we have

$$d\bar{H}_e = H_e \, d\kappa \, \bar{s}_e \qquad with \qquad H_e^2 = E_e \tag{6}$$

The longitudinal component of the regenerating field at a point in space is defined as

$$d\bar{H}_s = H_s \, d\kappa \, \bar{s} \qquad with \qquad H_s^2 = E_s = \frac{E_o^2}{\sqrt{E_o^2 \; + \; E_p^2}} \tag{7}$$

The transversal component of the regenerating field at a point in space is defined as

$$d\bar{H}_n = H_n \, d\kappa \, \bar{n} \qquad with \qquad H_n^2 = E_n = \frac{E_p^2}{\sqrt{E_o^2 \; + \; E_p^2}} \tag{8}$$

For the total field magnitude H_e it is

$$H_e^2 = H_s^2 \; + \; H_n^2 \qquad\qquad with \qquad\qquad H_e^2 = E_e \tag{9}$$

The vector $\bar{s}_e$ is an unit vector in the moving direction of the emitted FP (Fig. 4). 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.

Conclusion: BSPs are structured particles with emitted and regenerating FPs with longitudinal and transversal angular momenta. The rotation sense of the angular momenta of the emitted FPs defines the sign of the charge of the BSP and the transversal angular momenta of the regenerating FPs define the mechanical and magnetic moments.

4   Interaction laws for field components and generation of linear momentum.

The interaction laws for the field components $d\bar{H}_s$ and $d\bar{H}_n$ are derived from the following interaction postulates for the longitudinal $\bar{J}_s$ and transversal $\bar{J}_n$ angular momenta.

1) If two fundamental particles from two static BSPs cross, their longitudinal rotational momenta J_s generate the following transversal rotational momentum

$$\bar{J}_{n_1}^{(s)} = -\,\text{sign}(\bar{J}_{s_1})\,\text{sign}(\bar{J}_{s_2})\,(\sqrt{J_{s_1}}\,\bar{s}_1 \,\times\, \sqrt{J_{s_2}}\,\bar{s}_2) \tag{10}$$

If both sides of eq. (10) are multiplied with $\sqrt{\nu_{s_1}\,d\kappa_1}$ and $\sqrt{\nu_{s_2}\,d\kappa_2}$, with ν_s the rotational frequency, results the differential energy

$$dE_{n_1}^{(s)} = \left|\,\sqrt{\nu_{s_1}\,J_{s_1}\,d\kappa_1}\,\bar{s}_1 \times \sqrt{\nu_{s_2}\,J_{s_2}\,d\kappa_2}\,\bar{s}_2\,\right| \tag{11}$$

or

$$dE_{n_1}^{(s)} = |\,dH_{s_1}\,\bar{s}_1 \times dH_{s_2}\,\bar{s}_2\,| \qquad with \qquad dH_{s_i}\,\bar{s}_i = \sqrt{\nu_{s_i}\,J_{s_i}\,d\kappa_i}\,\bar{s}_i \tag{12}$$

If at the same time two other fundamental particles from the same two static BSPs generate a transversal rotational momentum $-\bar{J}_{n_1}^{(s)}$, so that the components of the pair are equal and opposed, the generated linear momentum on the two BSPs is

$$dp = \frac{1}{c}\,dE_p^{(s)} \qquad with \qquad dE_p^{(s)} = \left|\,\int_{r_{r_1}}^{\infty} dH_{s_1}\,\bar{s}_1 \times \int_{r_{r_2}}^{\infty} dH_{s_2}\,\bar{s}_2\,\right| \tag{13}$$

2) If two fundamental particles from two moving BSPs cross, their transversal

rotational momenta J_n generate the following rotational momentum.

$$\bar{J}_1^{(n)} = -\operatorname{sign}(\bar{J}_{s_1})\operatorname{sign}(\bar{J}_{s_2})\,(\sqrt{J_{n_1}}\,\bar{n}_1\,\times\,\sqrt{J_{n_2}}\,\bar{n}_2) \tag{14}$$

If both sides of the equation are multiplied with $\sqrt{\nu_{n_1}\,d\kappa_1}$ and $\sqrt{\nu_{n_2}\,d\kappa_2}$, with ν_n the rotational frequency, and the absolute value is taken, it is

$$dE_1^{(n)} = |\,dH_{n_1}\,\bar{n}_1 \times dH_{n_2}\,\bar{n}_2\,| \qquad with \qquad dH_{n_i}\,\bar{n}_i = \sqrt{\nu_{n_i}\,J_{n_i}\,d\kappa_i}\,\bar{n}_i \tag{15}$$

If at the same time two other fundamental particles from the same two moving BSPs cross, and their transversal rotational momenta generate a rotational momentum $-\bar{J}_1^{\prime(n)}$, so that the components of the pair are equal and opposed, the generated linear momentum on the two BSPs is

$$dp = \frac{1}{c}\,dE_p^{(n)} \qquad with \qquad dE_p^{(n)} = \left|\,\int_{r_{r_1}}^{\infty} dH_{n_1}\,\bar{n}_1 \times \int_{r_{r_2}}^{\infty} dH_{n_2}\,\bar{n}_2\,\right| \tag{16}$$

3) If a FP 1 with an angular momentum $\bar{J}_1$ crosses with a FP 2 with a longitudinal angular momentum $\bar{J}_{s_2}$, the orthogonal component of $\bar{J}_1$ to $\bar{J}_{s_2}$ is transferred to the FP 2, if at the same instant between two other FPs 3 and 4 an orthogonal component is transferred which is opposed to the first one. (see Fig. 11)

5 Fundamental equations for the calculation of linear momenta between subatomic particles.

The Fundamental equations for the calculation of linear momenta according to the interaction postulates are:

a) The equation for the calculation of linear momentum between two static BSPs according postulate **1)** is

$$dp_{stat}\,\bar{s}_R = \frac{1}{c}\oint_R \left\{ \frac{\bar{dl}\cdot(\bar{s}_{e_1}\times\bar{s}_{s_2})}{2\pi R}\int_{r_1}^{\infty} H_{e_1}\,d\kappa_{r_1}\int_{r_2}^{\infty} H_{s_2}\,d\kappa_{r_2} \right\}\bar{s}_R \tag{17}$$

where $H_{e_1}\,d\kappa_{r_1}\bar{s}_{e_1}$ is the longitudinal field of the emitted FPs of particle 1 and $H_{s_2}\,d\kappa_{r_2}\bar{s}_{s_2}$ is the longitudinal field of the regenerating FPs of particle 2. The unit vector $\bar{s}_R$ is orthogonal to the plane that contains the closed path with radius R.

The linear momentum generated between two static BSPs is the origin of all movements of particles. The law of Coulomb is deduced from eq. (17) and because of its importance is analyzed in sec. 7.

b) The equation for the calculation of linear momentum between two moving BSPs according to postulate **2**) is

$$dp_{dyn} \; \bar{s}_R = \frac{1}{c} \oint_R \left\{ \frac{\bar{dl} \cdot (\bar{n}_1 \times \bar{n}_2)}{2\pi R} \int_{r_1}^{\infty} H_{n_1} \, d\kappa_{r_1} \int_{r_2}^{\infty} H_{n_2} \, d\kappa_{r_2} \right\} \bar{s}_R \qquad (18)$$

where $H_{n_1} \, d\kappa_{r_1} \bar{n}_1$ is the transversal field of the regenerating FPs of particle 1 and $H_{n_2} \, d\kappa_{r_2} \bar{n}_2$ is the transversal field of the regenerating FPs of particle 2.

The laws of Lorentz, Ampere and Bragg are deduced from equation (18).

c) The equations for the calculation of the induced linear momentum between a moving and a static probe BSP_p according to postulate **3**) are

$$dp_{ind}^{(s)} \; \bar{s}_R = \frac{1}{c} \oint_R \left\{ \frac{\bar{dl} \cdot \bar{s}}{2\pi R} \int_{r_r}^{\infty} H_s \, d\kappa_{r_r} \int_{r_p}^{\infty} H_{s_p} \, d\kappa_{r_p} \right\} \bar{s}_R \qquad (19)$$

$$dp_{ind}^{(n)} \; \bar{s}_R = \frac{1}{c} \oint_R \left\{ \frac{\bar{dl} \cdot \bar{n}}{2\pi R} \int_{r_r}^{\infty} H_n \, d\kappa_{r_r} \int_{r_p}^{\infty} H_{s_p} \, d\kappa_{r_p} \right\} \bar{s}_R \qquad (20)$$

The upper indexes (s) or (n) denote that the linear momentum $d'p_{ind}$ on the static probe BSP_p (subindex s_p) is induced by the longitudinal (s) or transversal (n) field component of the moving BSP.

The Maxwell and the gravitation laws are deduced from equations (19) and (20).

The total linear momentum for all equations is given by

$$\bar{p} = \int_{\sigma} dp \; \bar{s}_R \qquad (21)$$

where $\int_{\sigma}$ symbolizes the integration over the whole space.

Conclusion: All forces can be expressed as rotors from the vector field $d\bar{H}$ generated by the longitudinal and transversal angular momenta of the two types of fundamental particles defined in chapter 1.

$$d\bar{F} = \frac{dp}{dt} = \frac{1}{8\,\pi} \, \sqrt{m} \; r_o \; rot \; \frac{d}{dt} \int_{r_r}^{\infty} d\bar{H} \qquad (22)$$

6   Force quantification and the radius of a BSPs.

The relation between the force and the linear momentum for all the fundamental equations of chapter 5 is given by

$$\bar{F} = \frac{\Delta p}{\Delta t} \; \bar{s}_R \qquad with \qquad \Delta p = p - 0 = p \qquad (23)$$

The force is quantized in force quanta

$$F = \Delta p \, \nu \qquad with \qquad \nu = \frac{1}{\Delta t} \tag{24}$$

and Δp the quantum of action.

The time Δt between the two BSPs is defined as

$$\Delta t = K \, r_{o_1} \, r_{o_2} \qquad where \qquad K = 5.4271 \cdot 10^4 \left[\frac{s}{m^2} \right] \tag{25}$$

is a constant and r_{o_1} and r_{o_2} are the radii of the BSPs.

The constant K results when eqs. (17) and (18) are equalized respectively with the Coulomb and the Ampere equations

$$F_{stat} = \frac{1}{4\pi\epsilon_o} \frac{Q_1 \, Q_2}{d^2} \qquad\qquad F_{dyn} = \frac{\mu_o}{2\pi} \frac{I_1 \, I_2}{d} \tag{26}$$

The radius r_o of a particle is given by

$$r_o = \frac{\hbar \, c}{E} \qquad with \qquad E = \sqrt{E_o^2 + E_p^2} \qquad for \ \ BSPs \ \ with \ \ v \neq c \tag{27}$$

and

$$E = \hbar\omega \qquad for \ \ BSPs \ \ with \ \ v = c \tag{28}$$

and is derived from the quantified far field of the irradiated energy of an oscillating BSP [10].

7 Analysis of linear momentum between two static BSPs.

In this section the static eq.(17) is analyzed in order to explain

- why BSPs of equal sign don't repel in atomic nuclei

- how gravitation forces are generated

- why atomic nuclei radiate

Although the analysis is based only on the static eq.(17) for two BSPs, neglecting the influence of the important dynamic eq.(18) that explains for instance the magnetic moment of nuclei, it shows already the origin of the above listed phenomena.

With the integration limits shown in Fig. 5 and considering that for static BSPs it is $r_{o_1} = r_{o_2} = r_o$ and $m_1 = m_2 = m$, the integration limits are
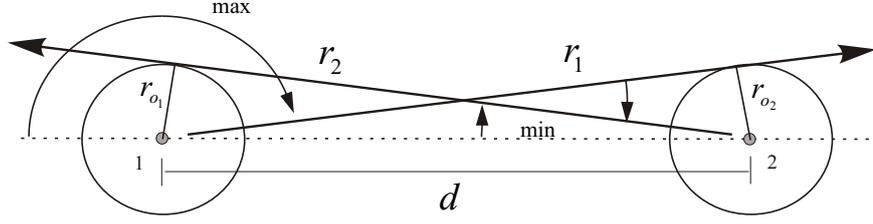
Figure 5: Integration limits for the calculation of the linear momentum between two static basic subatomic particles at the distance d

$$\varphi_{min} = \arcsin \frac{r_o}{d} \qquad \varphi_{max} = \pi - \varphi_{min} \quad for \quad d \geq \sqrt{r_o^2 + r_o^2} \qquad (29)$$

$$\varphi_{min} = \arccos \frac{d}{2\,r_o} \qquad \varphi_{max} = \pi - \varphi_{min} \quad for \quad d < \sqrt{r_o^2 + r_o^2} \qquad (30)$$

and eq.(17) transforms to

$$p_{stat} = \frac{m\,c\,r_o^2}{4\,d^2} \int_{\varphi_{1min}}^{\varphi_{1max}} \int_{\varphi_{2min}}^{\varphi_{2max}} |\sin^3(\varphi_1 - \varphi_2)| \, d\varphi_2 \, d\varphi_1 \qquad (31)$$

The double integral becomes zero for $d \to 0$ because the integration limits approximate each other taking the values $\varphi_{min} = \frac{\pi}{2}$ and $\varphi_{max} = \frac{\pi}{2}$. For $d \gg r_o$ the double integral becomes a constant because the integration limits tend to $\varphi_{min} = 0$ and $\varphi_{max} = \pi$.

Fig.6 shows the curve of eq.(17) where five regions can be identified with the help of $d/r_o = \gamma$ from the integration limits:

1. From $0 \ll \gamma \ll 0.1$ where $p_{stat} = 0$

2. From $0.1 \ll \gamma \ll 1.8$ where $p_{stat} \propto d^2$

3. From $1.8 \ll \gamma \ll 2.1$ where $p_{stat} \approx constant$

4. From $2.1 \ll \gamma \ll 518$ where $p_{stat} \propto \frac{1}{d}$

5. From $518 \ll \gamma \ll \infty$ where $p_{stat} \propto \frac{1}{d^2}$ (Coulomb)

The **first and second regions** are where the BSPs that form the atomic nucleus are confined and in a dynamic equilibrium. BSPs of different sign of charge don't mix in the nucleus because of the different signs their longitudinal angular momentum of the emitted FPs have.

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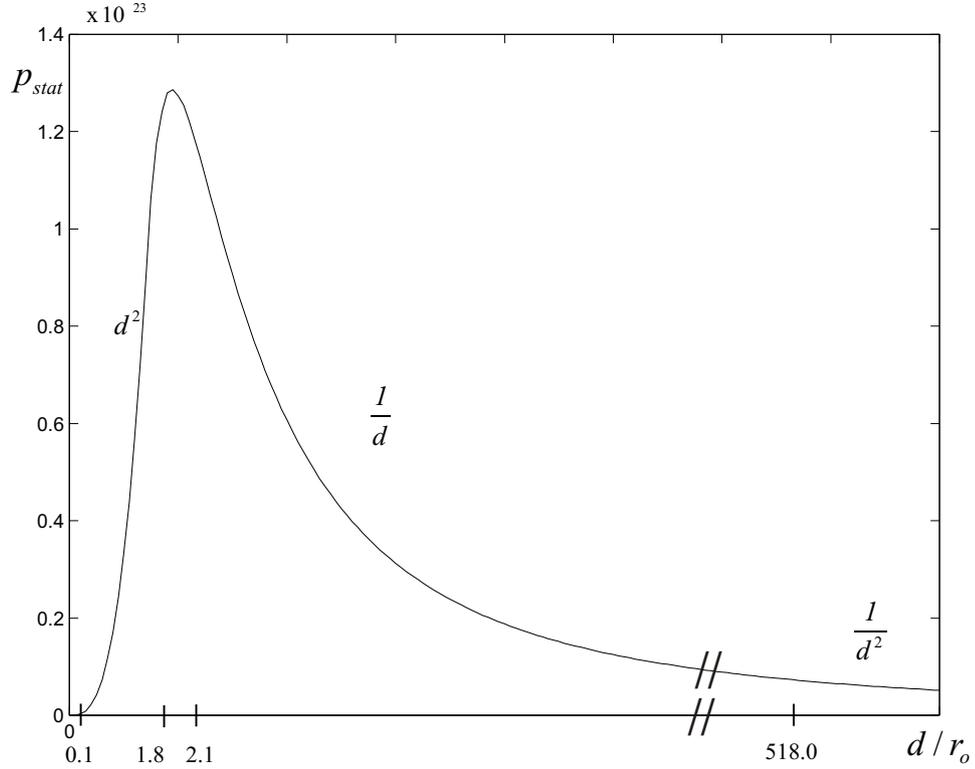
Figure 6: Linear momentum p_{stat} as function of $\gamma = d/r_o$ between two static BSPs with maximum at $\gamma = 2$

For BSPs that are in the first region, the attracting or repelling forces are zero because the angle β between their longitudinal rotational momentum is $\beta = \pi + \varphi_1 - \varphi_2 = \pi$. BSPs that migrate outside the first region are reintegrated or expelled with high speed when their FPs cross with FPs of the remaining BSPs of the atomic nucleus because the angle $\beta < \pi$.

Fig.7 shows two neutrons where at neutron 1 the migrated BSP "b" is reintegrated, inducing at neutron 2 the gravitational linear momentum according postulate 3) of sec 4.

At stable nuclei all BSPs that migrate outside the first region are reintegrated, while at unstable nuclei some are expelled in all possible combinations (electrons, positrons, hadrons) together with neutrinos and photons maintaining the energy balance.

As the force described by eq. (20) induced on other particles during reintegration has always the direction and sense of the reintegrating particle (right screw of $\bar{J}_n$) independent of its charge, BSPs that are reintegrated induce on other atomic nuclei the gravitation force. The inverse square distance law for the gravitation force results from the inverse square distance law of the radial density of FPs that transfer their angular momentum from the moving to the static BSPs according postulate **3)** of sec.

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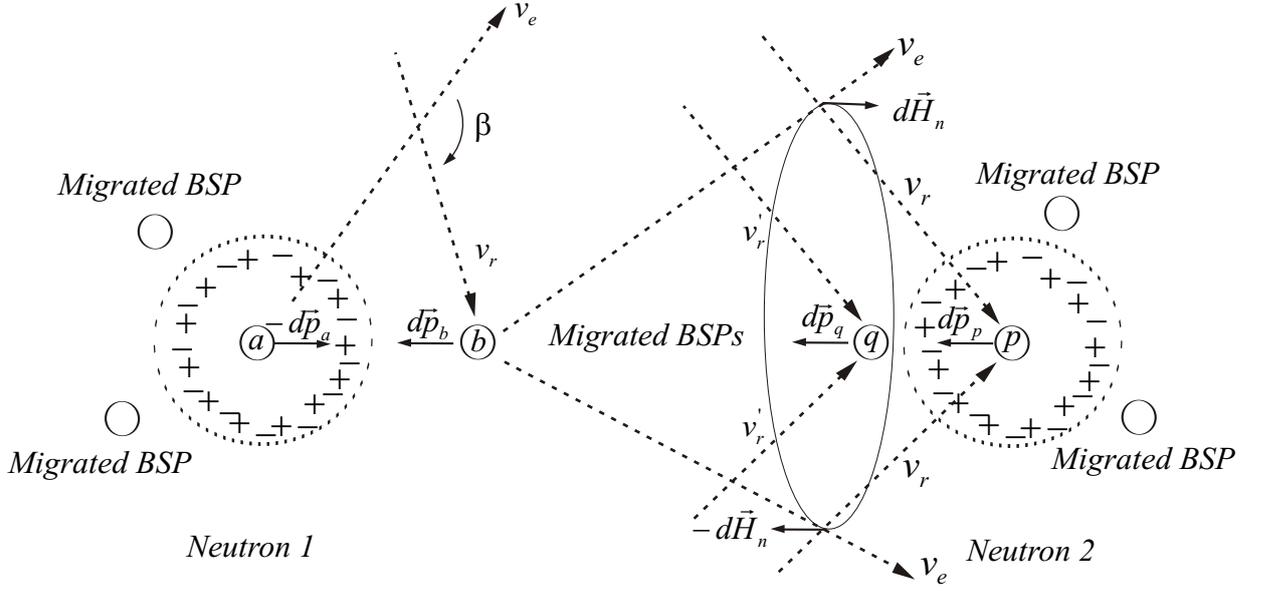
Figure 7: Transmission of momentum dp from neutron 1 to neutron 2

4. Gravitation force is thus a function of the number of BSPs that migrate and are reintegrated in the time Δt (migration current), and the reintegration velocity.

The **third region** gives the width of the tunnel barrier through which the expelled particles of atomic nuclei are emitted. As the reintegration process of BSPs that migrate outside the first region depend on the special dynamic polarization of the remaining BSPs of the atomic nucleus, particles are not always reintegrated but expelled when the special dynamic polarization is not fulfilled. The emission is quantized and follows the exponential radioactive decay law.

The **fourth region** is a transition region to the Coulomb law.

The transition value $\gamma_{trans} = 518$ to the Coulomb law was determined by comparing the tangents of the Coulomb equation and the curve from Fig.6. At $\gamma_{trans} = 518$ the ratio of their tangents begin to deviate from 1.

At the transition distance d_{trans}, where $\gamma_{trans} = 518$, the inverse proportionality to the distance d_{trans} from the neighbor regions must give the same force F_{trans}

$$F_{trans} = \frac{1}{\Delta t} \frac{K^{'}}{d_{trans}} = \frac{1}{\Delta t} \frac{K^{'}_F}{d^2_{trans}} \tag{32}$$

with $K^{'}$ and $K^{'}_F$ the proportionality factors of the fourth and fifth regions.

The transition distance for a Carbon nucleus C^{12} is, with m_p and m_n the mass of the proton and neutron respectively,

$$d_{trans} = \gamma\, r_o = \gamma\, \frac{\hbar\, c}{E_o} = 518\, \frac{\hbar\, c}{6\,(m_p + m_n)\, c^2} = 9.0724\; fm \qquad (33)$$

The **fifth region** is where the Coulomb law is valid.

8 Ampere bending (Bragg law).

With the fundamental eq. (18) from sec. 5 for parallel currents the force density generated between two straight parallel currents of BSPs due to the interactions of their transversal angular momenta is calculated in [10] and gives

$$\frac{F}{\Delta l} = \frac{b}{c\,\Delta_o t}\, \frac{r_o^2}{64\, m}\, \frac{I_{m_1}\, I_{m_2}}{d} \int_{\gamma_{2 min}}^{\gamma_{2 max}} \int_{\gamma_{1 min}}^{\gamma_{1 max}} \frac{\sin^2(\gamma_1 - \gamma_2)}{\sqrt{\sin\gamma_1\,\sin\gamma_2}}\, d\gamma_1\, d\gamma_2 \qquad (34)$$

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

In the case of the bending of a BSP the interaction is now between one BSP moving with speed v_2 and one reintegrating BSP of a nucleon that moves with the speed v_1 parallel to v_2. The reintegration of a migrated BSP is described in sec. 7.

The concept is shown in Fig. 8
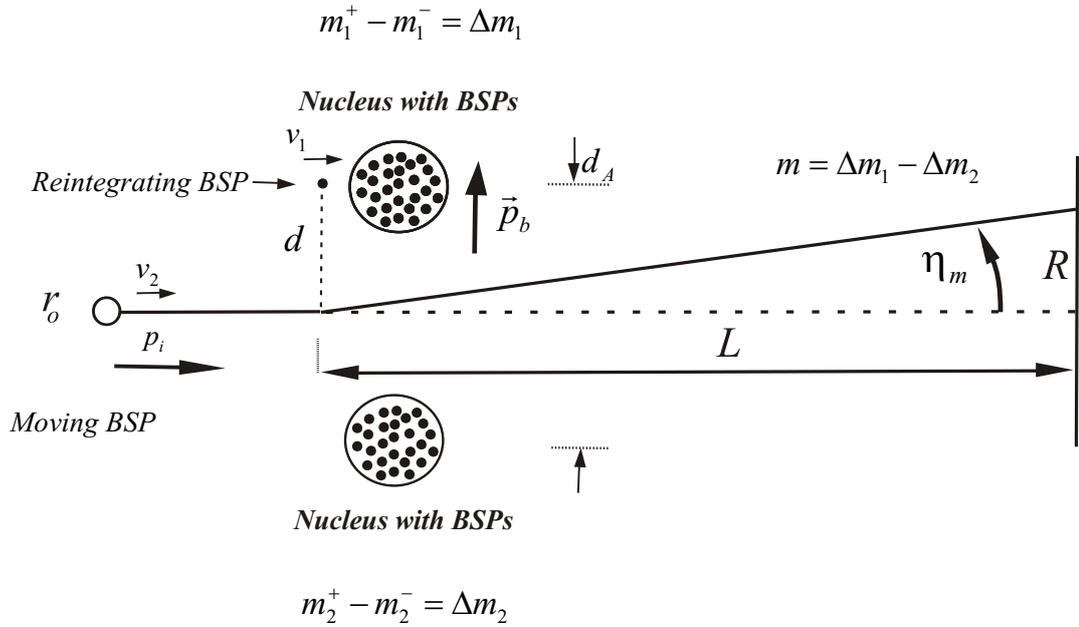
Figure 8: Bending of BSPs

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For $v \ll c$ it is

$$\rho_x = \frac{N_x}{\Delta x} = \frac{1}{2 \, r_o} \qquad I_m = \rho \, m \, v \qquad \Delta_o t = K \, r_o^2 \qquad p = F \, \Delta_o t \qquad (35)$$

We get for the force

$$F = \frac{b}{4 \, \Delta_o t} \, \frac{5.8731}{64 \, c} \, \frac{\sqrt{m} \, v_1 \, \sqrt{m} \, v_2}{d} \, \Delta l \qquad (36)$$

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 interaction between the two parallel BSPs takes place along a distance $\Delta'' l = v_2 \, \Delta'' t$ giving a total bending momentum $p_b = F \, \Delta'' t$. With all that we get

$$p_b = \frac{b}{2 \, K \, r_o} \, \frac{5.8731}{64 \, c} \, \frac{m \, v_1}{d} \, \Delta'' l \qquad (37)$$

which is independent of the speed v_2. In [10] the speed of a reintegrating BSP is deduced giving $v_1 = k \, c$ with $k = 7.4315 \cdot 10^{-2}$. We get

$$p_b = \frac{b}{2 \, K \, r_o} \, \frac{5.8731}{64 \, c} \, \frac{m \, k \, c}{d} \, \Delta'' l \qquad (38)$$

If we now write the bending equation with the help of $\tan \eta = 2 \sin \theta$ for small η and with $2 \, d = d_A$ we get

$$\sin \theta = \frac{p_b}{2 \, p_i} = \left(\frac{5.8731 \, b \, m \, v_1}{64 \, c \, K \, r_o \, h} \, \Delta'' l \right) \, \frac{h}{2 \, p_i \, d_A} \, n \qquad (39)$$

To get the Bragg law the expression between brackets must be constant and equal to the unit what gives for the constant interaction distance $\Delta'' l$

$$\Delta'' l = \frac{64 \, c \, K \, r_o \, h}{5.8731 \, b \, m \, k \, c} = 8.9357 \cdot 10^{-9} \ m \qquad (40)$$

We get for the bending momentum and force

$$p_b = \frac{h}{d_A} \, n \qquad F_b = \frac{1}{2} \, \frac{h}{d \, \Delta_o t} = \frac{1}{2} \, \frac{n \, E_o}{d} \qquad (41)$$

The bending force is quantized in energy quanta equal to the rest energy E_o of a BSP.

Conclusion: We have derived the Bragg equation without the concept of particle-wave introduced by de Broglie. Numerical results obtained using the quantized ir-radiated energy instead of the particle-wave are equivalent, different is the physical interpretation of the underlying phenomenon.

8.1 Dark matter and dark energy.

In section 7 we have seen in Fig. 7 that the origin of the gravitation force is the induced force 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. 9.
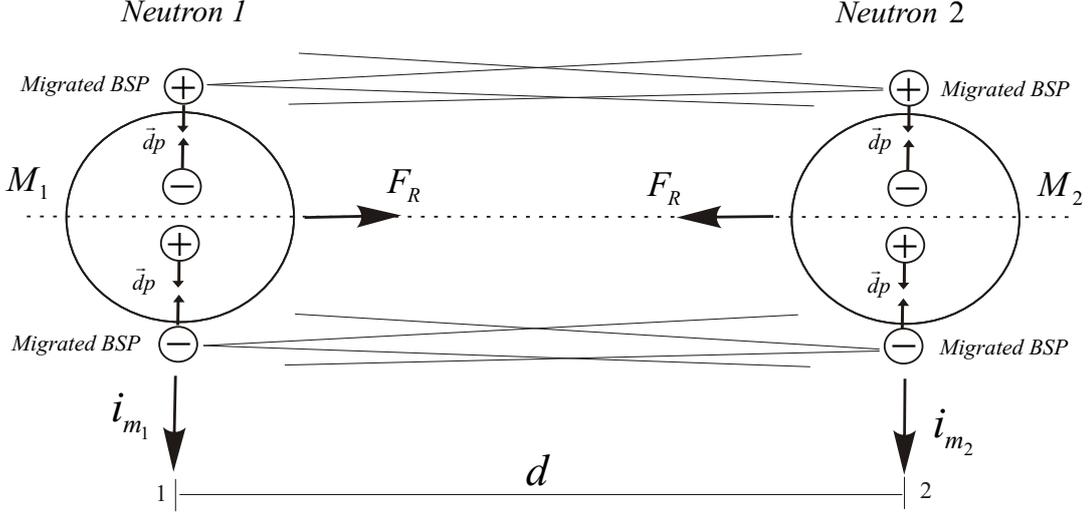

Figure 9: Resulting current due to reintegration of migrated BSPs

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

$$\Delta_R = \Delta_R^+ + \Delta_R^- = 0 \tag{42}$$

We now assume, that because of the energy interchange between the two neutrons a synchronization exists between the reintegration of BSPs of equal sign in the orthogonal direction of the two neutrons, resulting in parallel currents of equal signs that generate an attracting force between the neutrons. Thus the resulting attractive force between the two neutrons is produced by the induced force and the currents of reintegrating BSPs.

$$F_T = F_G + F_R \qquad with \qquad F_G = G\,\frac{M_1\,M_2}{d^2} \qquad and \qquad F_R = R\,\frac{M_1\,M_2}{d} \tag{43}$$

To obtain an equation for the force F_R we start with eq. (38) from sec. 8 which

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was calculated for one pair of BSPs.

$$p_b = \frac{1}{2} \left(\frac{5.8731}{64} \frac{b \, m \, k}{K \, r_o} \Delta'' l \right) \frac{1}{d} \, n = \frac{h}{2 \, d} \, n \tag{44}$$

with $b = 0.25$, $K = 5.4274 \cdot 10^4 \, s/m^2$, $r_o = 3.8590 \cdot 10^{-13} \, m$ and

$$k = 7.4315 \cdot 10^{-2} \qquad \Delta'' l = 8.9357 \cdot 10^{-9} \, m \qquad \Delta_o t = 8.0821 \cdot 10^{-21} \, s \tag{45}$$

The force for one pair of BSPs is given by

$$dF_R = \frac{p_b}{\Delta_o t} = \frac{1}{2} \frac{h \, \nu_o}{d} = \frac{1}{2} \frac{E_o}{d} \qquad n = 1 \tag{46}$$

or

$$dF_R = \frac{p_b}{\Delta_o t} = \frac{K_{Dark}}{d} \qquad with \qquad K_{Dark} = \frac{1}{2} \frac{h}{\Delta_o t} = 4.09924 \cdot 10^{-14} \, Nm \tag{47}$$

The total force is

$$F_R = \frac{K_{Dark}}{d} \Delta_{R_1} \Delta_{R_2} = R \frac{M_1 \, M_2}{d} \tag{48}$$

We get

$$\Delta_{R_1} \Delta_{R_2} = \frac{R}{K_{Dark}} M_1 \, M_2 \tag{49}$$

or

$$\Delta_{R_1} \Delta_{R_2} = \gamma_R^2 \, M_1 \, M_2 \qquad with \qquad \gamma_R^2 = \frac{R}{K_{Dark}} \tag{50}$$

and

$$\Delta_R = \gamma_R \, M \tag{51}$$

The total attraction force gives

$$F_T = F_G + F_R = \left[\frac{G}{d^2} + \frac{R}{d} \right] M_1 \, M_2 \tag{52}$$

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. 10.
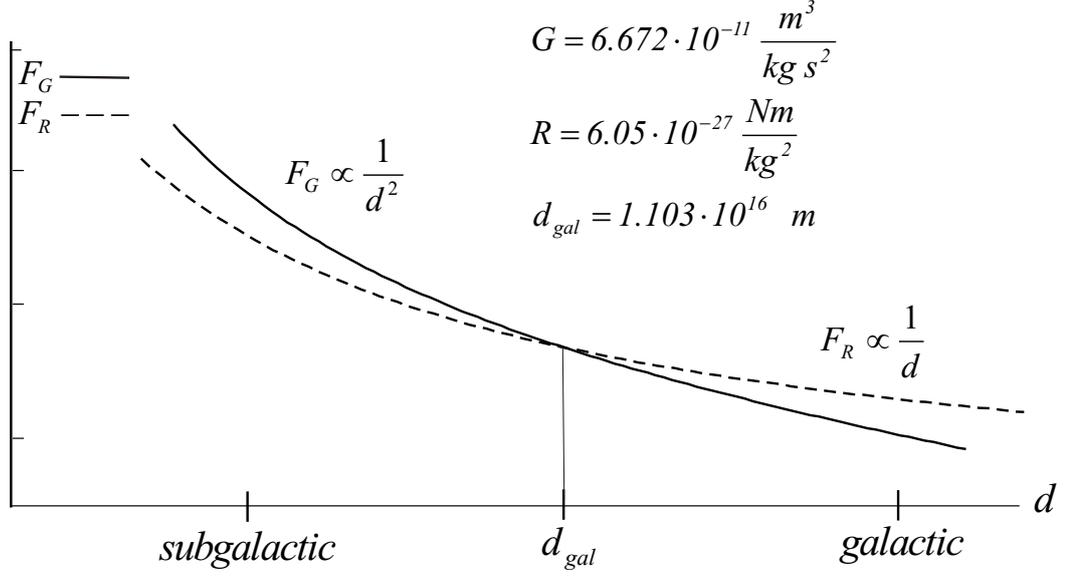
Figure 10: Gravitation forces at sub-galactic and galactic distances.

Calculation example:

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

$$F_c = M_2 \frac{v_{orb}^2}{d} = 3.872 \cdot 10^{20} \ N \tag{53}$$

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

$$F_c = F_T \approx F_R = R \frac{M_1 \ M_2}{d} \qquad we \ get \qquad R = 6.05 \cdot 10^{-27} \ Nm/kg^2 \tag{54}$$

and with

$$F_G = F_R \qquad we \ get \qquad d_{gal} = \frac{G}{R} = 1.103 \cdot 10^{16} \ m \tag{55}$$

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

$$\gamma_R = \sqrt{\frac{R}{K_{Dark}}} = 3.842 \cdot 10^{-7} \ kg^{-1} \tag{56}$$

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.

Dark energy: We also may assume that the synchronization of the reintegrating BSPs in the orthogonal direction of the two neutrons results in parallel currents of opposed signs, generating a repulsive force between the two neutrons what is called dark energy .

9   Induction between a moving and a probe BSP.

In the present approach the energy of a BSP is distributed in space around the radius (focal point) of the BSP. The carriers of the energy are the FPs with their angular momenta, FPs that are continuously emitted and regenerate the BSP. At a free moving BSP each angular momentum of a FP is balanced by an other angular momentum of a FP of the same BSP.

The concept is shown in Fig. 11.

Figure 11: Linear momentum balance between static and moving BSPs

Opposed transversal angular momenta $d\bar{H}_n$ and $-d\bar{H}_n$ from two FPs that regenerate the BSP produce the linear momentum $\bar{p}$ of the BSP. If a second static probe BSP_p appropriates with its regenerating angular momenta ($d\bar{H}_{s_p}$) angular momenta ($d\bar{H}_n$) from FPs of the first BSP according postulate 3) of sec. 4, angular momenta that built a rotor different from zero in the direction of the second BSP_p generating $d\bar{p}_{i_p}$, the first BSP loses energy and its linear momentum changes to $\bar{p} - d\bar{p}_{i_p}$. The angular momenta

appropriated at point P by the probe BSP_p generating the linear momentum $d\bar{p}_{i_p}$ are missing now at the first BSP to compensate the angular momenta at the symmetric point P'. The linear momenta at the two symmetric points are therefore equal and opposed $d'\bar{p}_i = -d\bar{p}_{i_p}$ because of the symmetry of the energy distribution function $d\kappa(\pi - \theta) = d\kappa(\theta)$.

As the closed linear integral $\oint d\bar{H}_n \, d\bar{l}$ generates the linear momentum $\bar{p}$ of a BSP, the orientation of the field $d\bar{H}_n$ (right screw in the direction of the velocity) must be independent of the sign of the BSP, sign that is defined by $\bar{J}_e^{(\pm)}$.

10   Quantification of irradiated energy and movement.

10.1   Quantification of irradiated energy.

To express the energy irradiated by a BSP as quantified in angular momenta over time we start with

$$E = E_e = E_s + E_n = \sqrt{E_o^2 + E_p^2} \qquad \Delta t = K r_o r_{o_p} \qquad r_o = \frac{\hbar \, c}{E_e} \qquad r_{o_p} = \frac{\hbar \, c}{E_o} \quad (57)$$

with r_o the radius of the moving particle and r_{o_p} the radius of the resting probe particle. It is

$$\Delta t = K r_o r_{o_p} \frac{r_{o_p}}{r_{o_p}} = K r_{o_p}^2 \frac{r_o}{r_{o_p}} = \Delta_o t \, \frac{r_o}{r_{o_p}} \qquad (58)$$

with

$$\Delta_o t = \Delta t_{(v=0)} = K \, \frac{\hbar^2 \, c^2}{E_o^2} = 8.082097 \cdot 10^{-21} \ s \quad with \quad K = 5.4274 \cdot 10^4 \ s/m^2 \quad (59)$$

We now define $E_e \, \Delta t$ and get

$$E_e \, \Delta t = K \, \frac{\hbar^2 \, c^2}{E_o} = K \, \frac{h^2}{4 \, \pi^2 \, m} = h \qquad (60)$$

equation that is valid for every speed $0 \le v \le c$ of the BSP giving

$$E_e \, \Delta t = E_o \, \Delta_o t = h \qquad (61)$$

where h is the Planck constant.

Note: In the equation $E_e \, \Delta t = h$ the energy E_e is the total energy of the moving particle and the differential time Δt is the time the differential momentum Δp is active to give the force $F = \Delta p / \Delta t$ between the moving and the probe particle.

In connection with the quantification of the energy $E = J \, \nu$ the following cases are possible:

- A common frequency ν_g exists and the angular momentum J is variable.

- A common angular momentum J_g exists and the frequency ν is variable.

The concept is shown in Fig. 12.
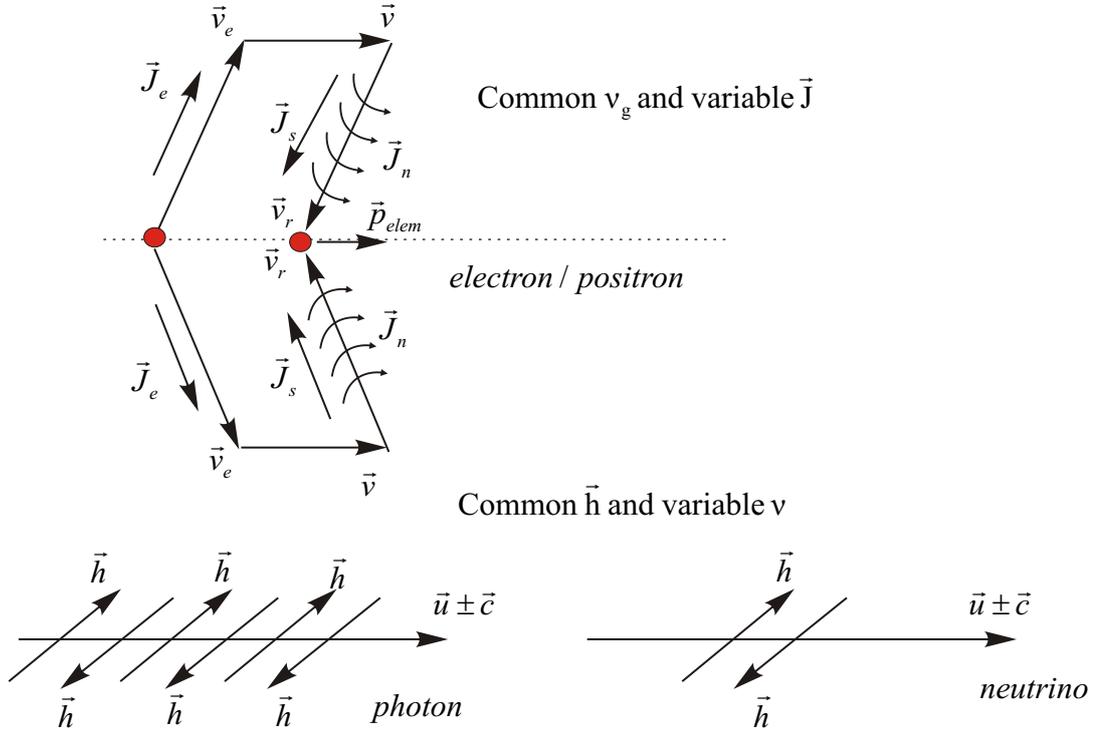
Figure 12: Quantification of linear momentum

We define for a common angular momentum $J_g = h$ the equivalent angular frequencies ν, ν_o and ν_p with the following equations

$$E = E_e = h \, \nu \qquad \nu = \frac{1}{\Delta t} \qquad and \qquad E_p = p \, c = h \, \nu_p \tag{62}$$

and

$$E_o = m \, c^2 = h \, \nu_o \qquad \nu_o = \frac{1}{\Delta_o t} = 1.2373 \cdot 10^{20} \ \ s^{-1} \tag{63}$$

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We have already defined the angular frequencies ν_e, ν_s and ν_n for the FPs with the following equations

$$E_e = E_s + E_n \qquad and \qquad dE_e = dE_s + dE_n \tag{64}$$

With a common angular momentum $J_g = h$ it is

$$dE_e = E_e \, d\kappa = h \, \nu_e \qquad dE_s = E_s \, d\kappa = h \, \nu_s \qquad dE_n = E_n \, d\kappa = h \, \nu_n \tag{65}$$

The relation between the angular frequencies of FPs and the equivalent angular frequencies is

$$\nu = \sum_i \nu_{e_i} = \sum_i \nu_{s_i} + \sum_i \nu_{n_i} = \sqrt{\nu_o^2 + \nu_p^2} \tag{66}$$

If all FPs have the same angular frequency $\nu_{e_i} = \nu_{s_i} = \nu_{n_i} = \nu_{FP}$ we get

$$\nu = N_e \, \nu_{FP} = N_s \, \nu_{FP} + N_n \, \nu_{FP} = \sqrt{\nu_o^2 + \nu_p^2} \tag{67}$$

with N the corresponding total number of FPs of the BSP. If we multiply the equation with h we get

$$h \, \nu = N_e \, h \, \nu_{FP} = N_s \, h \, \nu_{FP} + N_n \, h \, \nu_{FP} = h \, \sqrt{\nu_o^2 + \nu_p^2} \tag{68}$$

or

$$E = E_e = E_s + E_n = \sqrt{E_o^2 + E_p^2} \tag{69}$$

with $E_{FP} = h \, \nu_{FP}$ the energy of one FP.

10.1.1 Fundamental equations expressed as functions of the powers exchanged by the BSPs.

We define the quantized emission of energy for a BSP with $v \neq c$ defining the power as

$$P_e = \frac{E_e}{\Delta t} = E_e \, \nu \qquad \nu = \frac{1}{\Delta t} \tag{70}$$

$$P_e = \frac{E_e}{\Delta t} = \frac{1}{\Delta t} \sqrt{E_o^2 + E_p^2} = \sqrt{P_o^{\,2} + P_p^{\,2}} = E_s \, \nu + E_n \, \nu = P_s + P_n \tag{71}$$

where

$$P_o = E_o \, \nu \qquad P_p = E_p \, \nu \qquad P_s = E_s \, \nu \qquad P_n = E_n \, \nu \tag{72}$$

For the differential powers we get

$$dP_e = \nu \, E_e \, d\kappa \qquad dP_s = \nu \, E_s \, d\kappa \qquad dP_n = \nu \, E_n \, d\kappa \qquad (73)$$

Now we show that the fundamental equations of sec 5 for the generation of linear momentum can be expressed as functions of the powers of their interacting BSPs.

With

$$dE = E \, d\kappa \qquad dH = \sqrt{E} \, d\kappa = H \, d\kappa \qquad and \qquad \frac{H}{\sqrt{\Delta t}} = \sqrt{E} \, \nu = \sqrt{P} \qquad (74)$$

the equations for the Coulomb, Ampere and induction forces of sec. 5 can be transformed to

$$d'F \, \bar{s}_R = \frac{d'p}{\Delta t} \, \bar{s}_R \; \propto \; \frac{1}{c} \oint_R \left\{ \int_{r_1}^{\infty} \frac{H_1}{\sqrt{\Delta t}} \, d\kappa_{r_1} \int_{r_2}^{\infty} \frac{H_2}{\sqrt{\Delta t}} \, d\kappa_{r_2} \right\} \bar{s}_R \qquad (75)$$

and expressed as a function of the powers of the interacting BSPs

$$d'F \, \bar{s}_R = \frac{d'p}{\Delta t} \, \bar{s}_R \; \propto \; \frac{1}{c} \oint_R \left\{ \int_{r_1}^{\infty} \sqrt{P_1} \, d\kappa_{r_1} \int_{r_2}^{\infty} \sqrt{P_2} \, d\kappa_{r_2} \right\} \bar{s}_R \qquad (76)$$

It is also possible to define differential energy fluxes for BSPs. We start with

$$dP_e = \nu \, E_e \, d\kappa \qquad dP_s = \nu \, E_s \, d\kappa \qquad dP_n = \nu \, E_n \, d\kappa \qquad (77)$$

and with

$$d\kappa = \frac{1}{2} \frac{r_o}{r^2} \, dr \, \sin\varphi \, d\varphi \, \frac{d\gamma}{2\pi} \qquad and \quad dA = r^2 \, \sin\varphi \, d\varphi \, d\gamma \qquad (78)$$

The concept is shown in Fig. 13.

The cumulated differential energy flux is

$$\int_r^{\infty} dP_e = \nu \, E \int_r^{\infty} d\kappa = \nu \, E \, \frac{1}{2} \frac{r_o}{r} \, \sin\varphi \, d\varphi \, \frac{d\gamma}{2\pi} \quad J \, s^{-1} \qquad (79)$$

The cumulated differential energy flux density is

$$\int_r^{\infty} dS_e = \frac{1}{dA} \int_r^{\infty} dP_e = \nu \, E_e \, \frac{1}{4\pi} \frac{r_o}{r^3} \quad \frac{J}{m^2 \, s} \qquad (80)$$

To get the total cumulated energy flux through a sphere with a radius r we make

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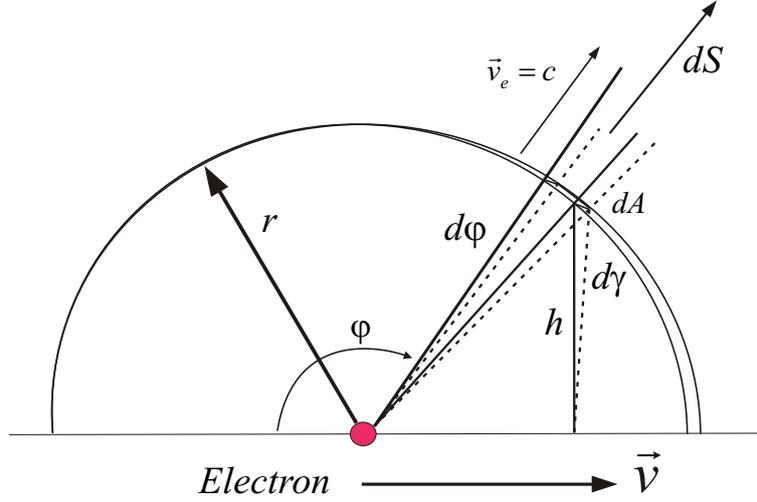
Figure 13: Emitted Energy flux density dS of a moving electron

$r_o = r$ and integrate over the whole surface $A = 4\pi\, r^2$ of the sphere and get

$$4\pi\, r^2 \int_r^\infty dS_e = \nu\, E_e \quad \frac{J}{m^2\, s} \tag{81}$$

Note: The differential energy flux density is independent of φ and γ and therefore independent of the direction of the speed v. This is because of the relativity of the speed v that does not define who is moving relative to whom.

10.1.2 Physical interpretation of an electron and positron as radiating and absorbing FPs:

The emitted differential energy is

$$dE_e = E_e\, d\kappa = \frac{h}{\Delta t}\ \frac{1}{2}\frac{r_o}{r^2}\, dr\ \sin\varphi\, d\varphi\, \frac{d\gamma}{2\pi} \tag{82}$$

With the help of Fig. 13 we see that the area of the sphere is $A = 4\pi r^2$, and we get

$$dE_e = \frac{h}{\Delta t\, A}\ r_o\, dr\ \sin\varphi\, d\varphi\, d\gamma \tag{83}$$

We now define

$$dE_e = \sigma_h\ r_o\, dr\ \sin\varphi\, d\varphi\, d\gamma \quad with \quad \sigma_h = \frac{h}{\Delta t\, A} \tag{84}$$

where σ_h is the *current density of fundamental angular momentum h.*
We can also write

$$dE_e = \sigma_h\ dA \quad with \quad dA = r_o\, dr\ \sin\varphi\, d\varphi\, d\gamma \tag{85}$$

10.2 Energy and density of Fundamental Particles.

10.2.1 Energy of Fundamental Particles.

The emission time of photons from isolated atoms is approximately $\tau = 10^{-8}$ s what gives a length for the train of waves of $L = c\,\tau = 3$ m. The total energy of the emitted photon is $E_t = h\,\nu_t$ and the wavelength is $\lambda_t = c/\nu_t$. We have defined (see Fig. 12), that the photon is composed of a train of FPs with alternated angular momenta where the distance between two consecutive FPs is equal $\lambda_t/2$. The number of FPs that build the photon is therefore $L/(\lambda_t/2)$ and we get for the energy of one FP

$$E_{FP} = \frac{E_t\,\lambda_t}{2\,L} = \frac{h}{2\,\tau} = 3.313 \cdot 10^{-26}\ J = 2.068 \cdot 10^{-7}\ eV \tag{86}$$

and for the angular frequency of the angular momentum h

$$\nu_{FP} = \frac{E_{FP}}{h} = \frac{1}{2\,\tau} = 5 \cdot 10^{7}\ s^{-1} \tag{87}$$

The number N_{FP_o} of FPs of an resting BSP (electron or positron) is

$$N_{FP_o} = \frac{E_o}{E_{FP}} = 2.4746 \cdot 10^{12} \tag{88}$$

Note: The frequency ν_t represents a linear frequency where the relation with the velocity v and the wavelength λ_t is given by $v = \lambda_t\,\nu_t$. The frequency ν_{FP} represents the angular frequency of the angular momentum h.

The momentum generated by a pair of FPs with opposed angular momenta is

$$p_{FP} = \frac{2\,E_{FP}}{c} = 2.20866 \cdot 10^{-34}\ kg\ m\ s^{-1} \tag{89}$$

The angular momentum of a FP is $h = \rho\,p$ and we get

$$\rho = \frac{h}{p_{FP}} = 3.0\ \ m \tag{90}$$

Note: Isolated FPs have only angular momenta, they have no linear momenta and therefore cannot generate a force through the change of linear momenta . Linear momentum is generated only out of pairs of FPs with opposed angular momentum. It makes no sense to define a dynamic mass for FPS because they have no linear inertia, which is a product of the energy stored in FPs with opposed angular momenta. FPs that meet in space interact changing the orientation of their angular momenta but conserving each its energy $E_{FP} = 3.313 \cdot 10^{-26}\ J$.

10.2.2 Density of Fundamental Particles.

We have defined that

$$dE = E \, d\kappa = E \, \frac{1}{2} \frac{r_o}{r^2} \, dr \, \sin\varphi \, d\varphi \, \frac{d\gamma}{2\pi} \qquad and \qquad dV = r^2 \, dr \, \sin\varphi \, d\varphi \, d\gamma \qquad (91)$$

resulting for the energy density

$$\omega = \frac{dE}{dV} = \frac{E}{4\pi} \frac{r_o}{r^4} \qquad J \, m^{-3} \qquad (92)$$

The density of FPs we define as

$$\omega_{FP} = \frac{\omega}{E_{FP}} = \frac{1}{4\pi} \frac{E}{E_{FP}} \frac{r_o}{r^4} \qquad m^{-3} \qquad (93)$$

with $E_{FP} = h \, \nu_{FP} = 3.313 \cdot 10^{-26} \, J$.

The concept is shown in Fig. 3

The energy emitted by a BSP is equal to the sum of the energies of the regenerating FPs with longitudinal (s) and transversal (n) angular momenta. The corresponding densities are

$$\omega_{FP}^{(s)} = \frac{1}{4\pi} \frac{E_s}{E_{FP}} \frac{r_o}{r^4} \qquad \omega_{FP}^{(n)} = \frac{1}{4\pi} \frac{E_n}{E_{FP}} \frac{r_o}{r^4} \qquad m^{-3} \qquad (94)$$

As $E_e = E_s + E_n$ we get

$$\omega_{FP}^{(e)} = \omega_{FP}^{(s)} + \omega_{FP}^{(n)} \qquad m^{-3} \qquad (95)$$

The number dN_{FP} of FPs in a volume dV is given with

$$dN_{FP} = \omega_{FP} \, dV \qquad and \; with \qquad dV = r^2 \, dr \, \sin\varphi \, d\varphi \, d\gamma \qquad (96)$$

we get

$$dN_{FP} = \frac{1}{2\pi} \frac{E}{E_{FP}} \, d\kappa \qquad (97)$$

With the definition of $\mu_{FP} = E_{FP}/c^2$, where μ_{FP} is the dynamic mass of a FP, we get for the density of the mass

$$\omega_\mu = \frac{\mu_{FP} \, dN_{FP}}{dV} = \mu_{FP} \, \omega_{FP} \qquad kg \, m^{-3} \qquad (98)$$

The rest mass m of a BSP expressed as a function of the dynamic mass μ_{FP} of its

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FPs is

$$m = N_{FP_o}\, \mu_{FP} = \frac{\nu_o}{\nu_{FP}}\, \mu_{FP} \tag{99}$$

Note: In the present theory all BSPs are expressed through FPs with the Energy E_{FP}, the angular frequency ν_{FP} and the dynamic mass μ_{FP}.

10.3 Quantification of movement.

An isolated moving BSP has a potential energy

$$E = E_s\; +\; E_n \tag{100}$$

which is a function of the relative speed v to the selected reference coordinate. The potential energy will manifest when the isolated moving BSP interacts with a BSP which is static in the selected coordinate system.

The time variation Δt derived for the variation dp of the momentum for the Coulomb, Ampere and Induction forces between two BSPs, we use also as time variation to describe the movement of a BSP that moves with constant speed $v = \Delta x/\Delta t$ where $dp = 0$.

The energy E_n is responsible for the movement of the BSP and the number of FPs that generate the movement during the time Δt is

$$N_{FP}^{(n)} = \frac{E_n}{E_{FP}} \tag{101}$$

The total momentum of a BSP moving with constant speed v is therefore

$$p = m\, v = N_{FP}^{(n)}\, p_{FP} = m\, \frac{\Delta x}{\Delta t} \tag{102}$$

with p_{FP} defined in eq. (89). For Δx we get

$$\Delta x = N_{FP}^{(n)}\, p_{FP}\, \frac{\Delta t}{m} \tag{103}$$

For $v = 0$ we get

$$v = 0 \qquad E_n = 0 \qquad N_{FP}^{(n)} = 0 \qquad \Delta x = 0 \tag{104}$$

For $v \to c$ we get with $\Delta t = K\, r_o^2$ with r_o the radius of the moving BSP

$$v \to c \qquad E_p \to \infty \qquad E_n \to \infty \qquad N_{FP}^{(n)} \to \infty \qquad \Delta t \to 0 \tag{105}$$

$$\lim_{v \to c} \Delta x = \lim_{v \to c} \frac{2 \, K \, \hbar^2 \, c}{m \, E_p} = 0 \qquad for \qquad v \to c \tag{106}$$

$$\lim_{v \to c} \frac{\Delta x}{\Delta t} = v \tag{107}$$

Note: For the isolated BSP moving with constant speed v we have no static probe BSP with radius r_{o_p} that measures the force between them, force that is zero because $dp = 0$. There is no difference between the two BSPs and the equation $\Delta t = K \, r_o \, r_{o_p}$ becomes $\Delta t = K \, r_o^2$ with r_o the radius of the moving BSP.

11   Quantification of forces between BSPs and CSPs.

In [10] the speed $v = k \, c$ was derived with which migrated BSP are reintegrated generating the Coulomb force and the two components of the gravitation force. In sec. 10.2.1 we have seen that the momentum generated by one pair of FPs with opposed angular momenta is

$$p_{FP} = \frac{2 \, E_{FP}}{c} = 2.20866 \cdot 10^{-34} \ kgms^{-1} \tag{108}$$

We define now an elementary momentum

$$p_{elem} = m \, k \, c = 2.0309 \cdot 10^{-23} \ kgms^{-1} \tag{109}$$

The number of pairs of FPs required to generate the momentum p_{elem} in the time $\Delta_o t$ is

$$\frac{p_{elem}}{p_{FP}} = 9.1951 \cdot 10^{10} \tag{110}$$

In the following subsections we express all known forces quantized in elementary linear momenta p_{elem}.

11.1   Quantification of the Coulomb force.

From the general eq. (20) from sec. 5 for the induced force, the Coulomb force between two BSPs was deduced in [10] giving

$$F_2 = \frac{a \, m \, c \, r_o^2}{4 \, \Delta_o t \, d^2} \int\!\!\int_{Coulomb} \qquad with \qquad \int\!\!\int_{Coulomb} = 2.0887 \tag{111}$$

We now write the equation as follows

$$F_2 = N_C(d) \, \frac{1}{\Delta_o t} \, p_{elem} = N_C(d) \, \nu_o \, p_{elem} \qquad p_{elem} = m \, k \, c \qquad a = 8.774 \cdot 10^{-2} \quad (112)$$

with

$$N_C(d) = \frac{a \, r_o^2}{4 \, k \, d^2} \int \int_{Coulomb} = 9.1808 \cdot 10^{-26} \, \frac{1}{d^2} \qquad (113)$$

$\nu_C(d) = N_C(d) \, \nu_o$ gives the number of elementary linear momenta p_{elem} during the time $\Delta_o t$ resulting in the force F_2.

For an inter-atomic distance of $d = 10^{-10} \, m$ we get $N_C = 9.1808 \cdot 10^{-6}$ resulting a frequency of elementary momenta of

$$\nu_C(d) = N_C(d) \, \nu_o = 1.1359 \cdot 10^{15} \, s^{-1} \qquad for \qquad d = 10^{-10} \, m \qquad (114)$$

11.2 Quantification of the Ampere force between straight infinite parallel conductors.

From the general eq. (18) from sec. 5 the Ampere force between two parallel conductors was derived in [10] arriving to

$$\frac{F}{dl} = \frac{b}{c \, \Delta t} \, \frac{r_o^2}{64 \, m} \, \frac{I_{m_1} \, I_{m_2}}{d} \int \int_{Ampere} \qquad with \qquad \int \int_{Ampere} = 5.8731 \qquad (115)$$

and $b = 0.25$. We now write the equation in the following form assuming that the velocity of the electrons is $v << c$ so that $\Delta t \approx \Delta_o t$ and the currents are $I_m \approx \rho_x \, m \, v$, where $\rho_x = N_x / \Delta x$ is the linear density of electrons that move with speed v in the conductors.

$$F = N_A(d, I_{m_1}, I_{m_2}, \, \Delta l) \, \nu_o \, p_{elem} \qquad p_{elem} = k \, m \, c \qquad \nu_o = \frac{1}{\Delta_o t} \qquad (116)$$

with

$$N_A(d, I_{m_1}, I_{m_2}, \, \Delta l) = \frac{b \, r_o^2}{64 \, k \, m^2 \, c^2} \, \frac{I_{m_1} \, I_{m_2}}{d} \int \int_{Ampere} \Delta l \qquad (117)$$

or

$$N_A(d, I_{m_1}, I_{m_2}, \, \Delta l) = 6.1557 \cdot 10^{17} \, \frac{I_{m_1} \, I_{m_2}}{d} \, \Delta l \qquad (118)$$

For a distance of $1m$ between parallel conductors with a length of $\Delta l = 1m$ and currents of $1A$ we get $N_A = 6.1557 \cdot 10^{17}$. The frequency of elementary momenta for this particular case

$$\nu_A = N_A(d, I_{m_1}, I_{m_2}, \ \Delta l) \ \nu_o = 7.6158 \cdot 10^{37} \ \ s^{-1} \tag{119}$$

11.3 Quantification of the induced force between aligned reintegrating BSPs.

From the general eq. (20) from sec. 5 for the induced force, the force between a pair of aligned reintegrating BSPs was deduced in [10] giving

$$F_i = \frac{k \, m \, c}{4 \, K \, d^{\,2}} \int \int_{Induction} \qquad with \qquad \int \int_{Induction} = 2.4662 \tag{120}$$

This equation was derived for two BSPs of two bodies, for which the gravitation force must be

$$F_G = F_i \, \Delta_{G_1} \, \Delta_{G_2} = G \, \frac{M_1 \, M_2}{d^{\,2}} \qquad with \qquad G = 6.6726 \cdot 10^{-11} \tag{121}$$

where Δ_{G_i} is the number of reintegrating BSPs of M_i independent of the sign of a BSPs. It is

$$\Delta_G = |\Delta_G^+| + |\Delta_G^-| \tag{122}$$

We get that

$$\Delta_{G_1} \, \Delta_{G_2} = G \, \frac{4 \, K \, M_1 \, M_2}{m \, k \, c \, \int \int_{Induction}} \tag{123}$$

and

$$\Delta_{G_1} \, \Delta_{G_2} = 2.8922 \cdot 10^{17} \, M_1 \, M_2 = \gamma_G^2 \, M_1 \, M_2 \tag{124}$$

and

$$\Delta_G = \gamma_G \, M \qquad with \qquad \gamma_G = 5.3779 \cdot 10^8 \ \ kg^{-1} \tag{125}$$

Eq. (120) we can write with $\Delta_o t = K \, r_o^2$ and $p_{elem} = k \, m \, c$ as

$$F_i = N_i \, \nu_o \, p_{elem} \qquad with \qquad N_i = \frac{r_o^2}{4 \, d^{\,2}} \int \int_{Induction} \tag{126}$$

We get for the total induced gravitation force F_G

$$F_G = F_i \, \Delta G_1 \, \Delta G_2 = N_G \, \nu_o \, p_{elem} \qquad with \qquad N_G = N_i \, \Delta G_1 \, \Delta G_2 \qquad (127)$$

Finally we get

$$F_G = N_G(M_1, M_2, d) \, \nu_o \, p_{elem} \qquad with \qquad N_G = 2.6555 \cdot 10^{-8} \, \frac{M_1 \, M_2}{d^2} \qquad (128)$$

The frequency with which elementary momenta are generated is

$$\nu_G = N_G(M_1, M_2, d) \, \nu_o = 3.2856 \cdot 10^{12} \, \frac{M_1 \, M_2}{d^2} \qquad (129)$$

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

11.4 Quantification of Ampere force between parallel reintegrating BSPs.

From sec. 8.1 we have for a pair of parallel reintegrating BSPs eq. (46) which is

$$dF_R = \frac{p_b}{\Delta_o t} = \frac{1}{2} \, \frac{h}{\Delta_o t} \, \frac{1}{d} \qquad (130)$$

which we can write as

$$dF_R = N \, \nu_o \, p_{elem} \qquad with \qquad p_{elem} = k \, m \, c \qquad and \qquad N = \frac{1}{2} \, \frac{h}{k \, m \, c \, d} \qquad (131)$$

where

$$k = 7.4315 \cdot 10^{-2} \qquad (132)$$

For Δ_{R_1} and Δ_{R_2} BSPs we get for the total force

$$F_R = dF_R \, \Delta_{R_1} \, \Delta_{R_2} = N_R \, \nu_o \, p_{elem} \qquad with \qquad N_R = N \, \Delta_{R_1} \, \Delta_{R_2} \qquad (133)$$

and with $\Delta_{R_1} \Delta_{R_2} = \gamma_R^2 M_1 M_2$ with $\gamma_R = 3.842 \cdot 10^{-7}$ we get

$$F_R = N_R(M_1, M_2, d, \Delta l) \, \nu_o \, p_{elem} \qquad with \qquad N_R = 2.4080 \cdot 10^{-24} \frac{M_1 \, M_2}{d} \qquad (134)$$

The frequency with which pairs of FPs cross in space is

$$\nu_R = N_R(M_1, M_2, d, \Delta l) \, \nu_o = 2.9792 \cdot 10^{-4} \frac{M_1 \, M_2}{d} \; s^{-1} \qquad (135)$$

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 $\nu_R = 2.4063 \cdot 10^{40} \; s^{-1}$ for parallel reintegrating BSPs. The frequency $\nu_G = 1.8041 \cdot 10^{45} \; s^{-1}$ for aligned BSPs is nearly 10^5 times grater than the frequency for parallel reintegrating BSPs and so the corresponding forces.

11.5   Quantification of the total gravitation force.

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

$$F_T = F_G + F_R = [N_G(M_1, M_2, d) \; + \; N_R(M_1, M_2, d, \Delta l)] \; p_{elem} \, \nu_o \qquad (136)$$

or

$$F_T = F_G + F_R = \; p_{elem} \, \nu_o \left[\frac{2.6555 \cdot 10^{-8}}{d^2} + \frac{2.4080 \cdot 10^{-24}}{d} \right] M_1 \, M_2 \qquad (137)$$

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

$$d_{gal} = \frac{2.6555 \cdot 10^{-8}}{2.4080 \cdot 10^{-24}} = 1.103 \cdot 10^{16} \; m \qquad (138)$$

12 Conventions introduced for BSPs.

Fig. 14 shows the convention used for the two types of electrons and positrons introduced.

The accelerating positron emits FPs with high speed $v_e = \infty$ and positive longitudinal angular momentum $\bar{J}_s^+$ $(\infty+)$ and is regenerated by FPs with low speed $v_r = c$ and negative longitudinal angular momentum $\bar{J}_s^-$ $(c-)$.

The decelerating electron emits FPs with low speed $v_e = c$ and negative longitudinal angular momentum $\bar{J}_s^-$ $(c-)$ and is regenerated by FPs with high speed $v_r = \infty$ and positive longitudinal angular momentum $\bar{J}_s^+$ $(\infty+)$.

The emitted FPs of the accelerating positron regenerate the decelerating electron and the emitted FPs of the decelerating electron regenerate the accelerating positron.
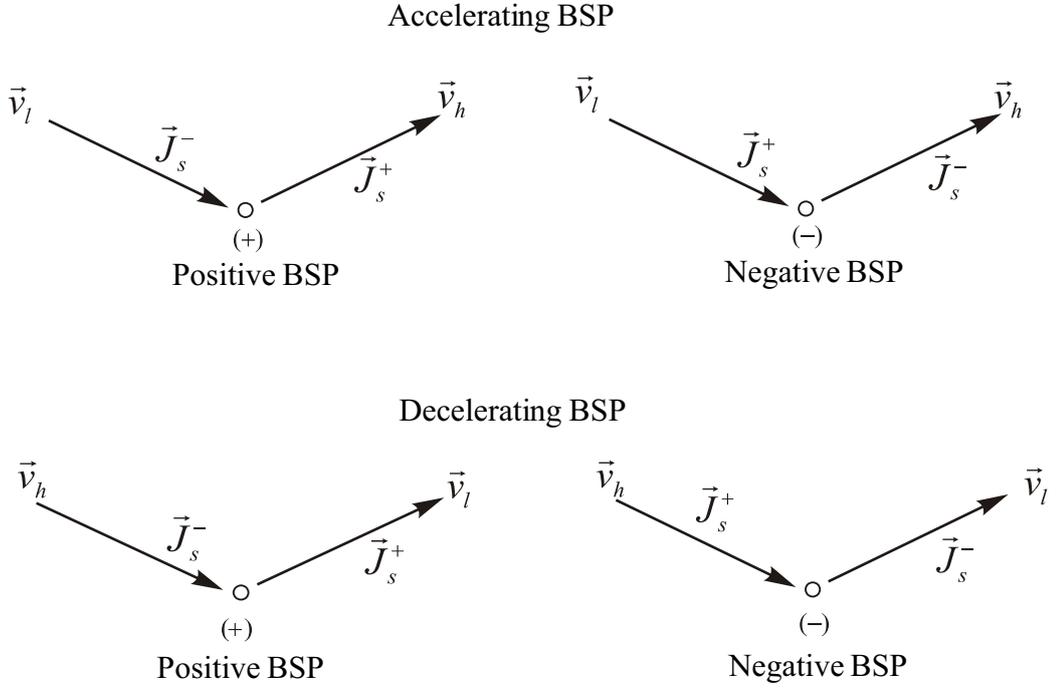

Figure 14: Conventions for BSPs

Fig. 15 a) shows a neutron with the internal and external rays for emitted and regenerating FPs. The complex SP is formed by accelerating positrons and decelerating electrons.

Fig. 15 b) shows a proton with the net external rays for emitted and regenerating FPs. The complex SPs is formed by accelerating positrons and decelerating electrons.

a)

Neutron
$n^+ = n^- = 919$

b)
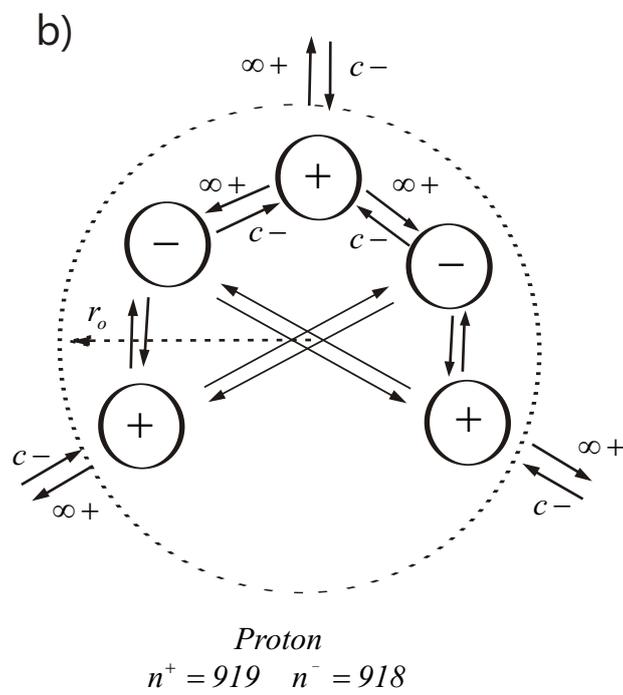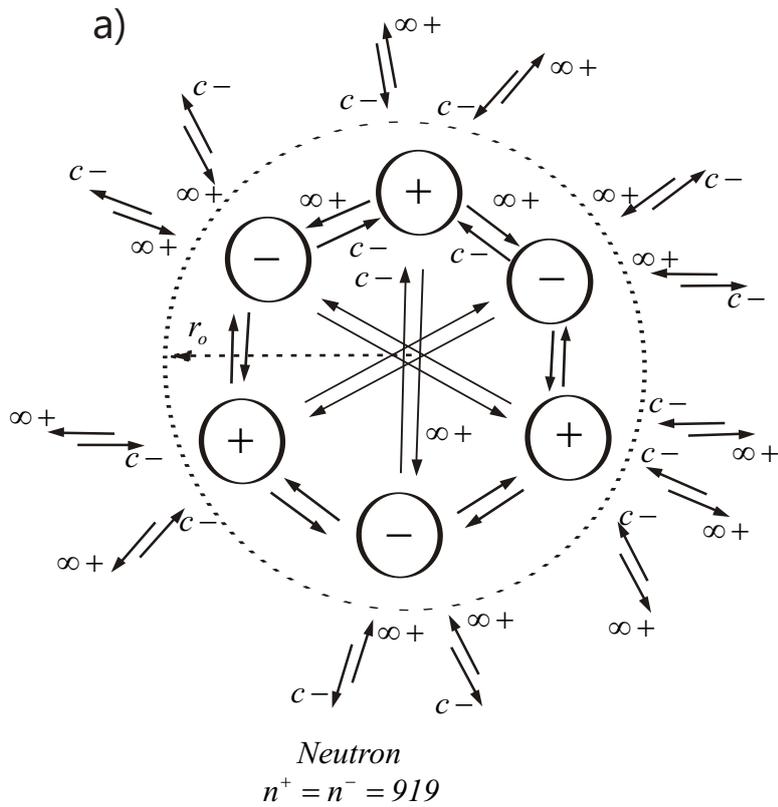
Proton
$n^+ = 919 \quad n^- = 918$

Figure 15: Neutron and proton
composed of accelerating positrons and decelerating electrons

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Fig. 16 shows a neutron with one migrated BSP and the net external field.
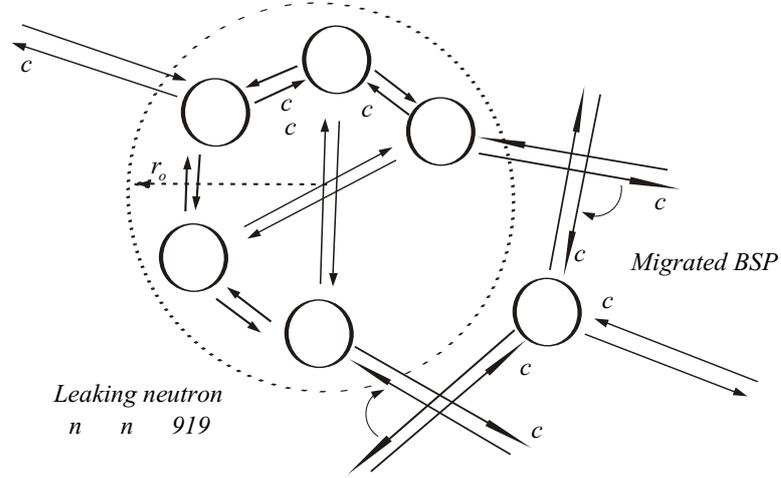
Figure 16: Neutron with migrated BSP

13 Flux density of FPs and scattering of particles.

13.1 Flux density of FPs.

At each BSP the flux density of emitted FPs is equal to the flux density of regenerating FPs although the different speeds of the FPs.

In a complex SP formed by more than one BSP (Fig.15), a mutual internal regeneration between the BSPs of the complex SP exists. Part of the emitted positive rays of FPs with $\bar{J}_e^{(+)}$ of the positive BSPs of the complex SP regenerate the negative BSPs of the complex SP, and part of the emitted negative rays of FPs with $\bar{J}_e^{(-)}$ of the negative BSPs regenerate the positive BSPs. The other part of the emitted and regenerating rays of FPs respectivelly radiate into space and regenerate from space.

At a complex SP with equal number of positive and negative BSPs Fig.15 a) the flux density of FPs radiated into space with positive angular momenta is equal to the flux density of FPs radiated into space with negative angular momenta. The same is valid for the flux density of regenerating FPs.

At a complex SP with different number of positive and negative BSPs Fig.15 b) the flux density of FPs radiated into space with positive angular momenta is not equal to the flux density of FPs radiated into space with negative angular momenta. If the complex SP has more positive BSPs in the nucleous, the flux density of FPs radiated

into space with positive angular momenta is bigger than the flux density of FPs radiated into space with negative angular momenta and vice versa.

13.2   Scattering of particles.

Elastic scattering.

There are two types of elastic scatterings according the smallest scattering distance d_s that is reached between the scattering partners.

"Electromagnetic" scatering we have when the smallest scattering distance d_s is in the fifth region of the linear momentum curve p_{stat} of Fig.6 where the Coulomb force is valid.

"Mechanical" scatering we have when the smallest scattering distance d_s is in the fourth region of Fig.6.

Plastic or destructive scattering.

Plastic or destructive scattering we have when the smallest scattering distance d_s enters the third and second region of the linear momentum curve p_{stat} of Fig.6.

The internal distribution of the BSPs is modified and the acceleration disturbs the internal mutual regeneration between the BSPs. The angular momenta of each BSP of the scattering partners interact heavily, and new basic configurations of angular momenta are generated, configurations that are balanced or unbalanced (stable or unstable).

In today's point-like representation the energy of a BSP is concentrated at a point and scattering with a second BSP requires the emission of a particle (gauge boson) to overcome the distance to the second BSP which then absorbs the particle. The energy violation that results in the rest frame is restricted in time through the uncertainty principle and the maximum distance is calculated assigning a mass to the interchanged particle (Feynman diagrams).

Conclusion: In the present approach the emission of FPs by BSPs is continuous and not restricted to the instant particles are scattered. In the rest frame of the scattering partners no energy violation occurs. When particles are destructively scattered, during a transition time the angular momenta of all their FPs interact heavily according to the three interaction postulates defined in chapter 4 and new basic arrangements of angular momenta are produced, resulting in balanced and unbalanced configurations of angular momenta that are stable or unstable, configurations of quarks, hadrons, leptons and photons. The interacting particles (force carriers) for all types of interactions (electromagnetic, strong, weak, gravitation) are the FPs with their longitudinal and transversal angular momenta.

14 Spin of level electrons and the formation of elements

In sec. 12 two types of electrons and positrons were identified according the velocities of their regenerating and emitting fundamental particles; they were named accelerating and decelerating BSPs.

We know, that orbital electrons form pairs with opposed spins in each individual atomic level. This is interpreted in the present model that two electrons of any individual orbit must be of opposed type, namely accelerating and decelerating electrons.

For each type of level electron, a corresponding opposed type of positron must exist in the atomic nucleus, to allow that the emitted fundamental particles of one can regenerate the other. This leads to the conclusion, that protons and neutrons are also composed of BSPs of different types.

Neutron: Composed of 919 electrons and 919 positrons. The 919 electrons are composed of 459 accelerating, 459 decelerating and 1 acc/dec electrons. The 919 positrons are composed of 459 accelerating, 459 decelerating and 1 dec/acc positrons.

Proton; Composed of 918 electrons and 919 positrons. The 918 electrons are composed of 459 accelerating and 459 decelerating electrons. The 919 positrons are composed of 459 accelerating, 459 decelerating and 1 acc/dec positrons.

The definition of two types of electrons and positrons has let to protons that are formed of BSPs that complement each other and which are of two types:

- Protons formed of accelerating positrons and decelerating electrons and

- Protons formed of decelerating positrons and accelerating electrons

The level electron associated to a proton is of the same type as the electrons of the proton. Elements in the Periodic Table are classified according to the growing number of protons in their nuclei and with level electrons that alternate their spin. In the present approach the elements of the periodic table are built with alternating types of protons and the two types of electrons with opposed spin from our standard theory are replaced by the accelerating and decelerating electrons.

The concept is shown in Fig. 17.
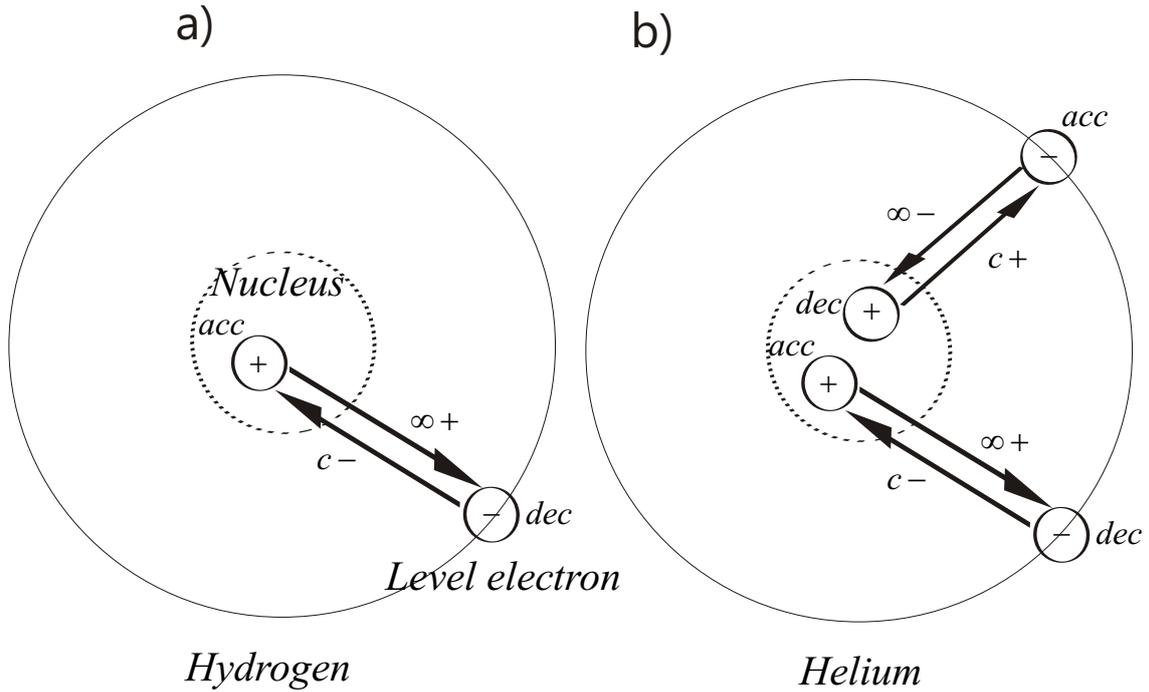
Figure 17: Level electrons of Hydrogen and Helium Atoms

14.1 Stern-Gerlach experiment and the spin of the electron.

In the Stern-Gerlach experiment neutral particles are shot through a strong inhomogeneous magnetic field and observed deflections are attributed in standard theory to the magnetic angular momentum of the external unpaired electron. Stern-Gerlach experiments with charged particles are not possible because of the strong Lorentz force that makes impossible to verify the spin and supposed associated magnetic momentum of an isolated electron.

In the present approach there are two types of electrons and positrons that explain the two different states electrons take in energy levels of atoms, states that in standard theory are attributed to the spin of the electron. It remains the question how to explain with the present approach the deflections of neutral particles in the Stern-Gerlach experiment.

In the present approach the deflections are attributed to the interactions between the two parallel currents of BSPs, namely, the currents I_1 and $-I_1$ that generate the magnetic inhomogeneous field and the currents i_m due to reintegration of BSPs at the nuclei of the neutral particles of the atomic ray (see Fig. 18). The interactions between parallel currents of BSPs are quantized in energy quanta equal to the rest energy of an

electron, what explains the quantization of the deflection of the atoms of the ray.

The bending momentum and force for pairs of parallel currents were deduced in sec. 8 eq. (41) and are

$$p_b = \frac{h}{d_A}\, n \qquad\qquad F_b = \frac{1}{2}\,\frac{h}{d\,\Delta_o t} = \frac{1}{2}\,\frac{E_o}{d}\, n \qquad\qquad (139)$$

In the Stern-Gerlach experiment the pairs of currents are formed by the current I_m and the reintegrating current $i_m = k\, m\, c/(2\, r_o) = 2.6313 \cdot 10^{-11}\ kg\ s^{-1}$.

The concept is shown in Fig. 18.

The resulting forces are given by the different possible combinations of the currents I_1 and the reintegrating currents i_m.
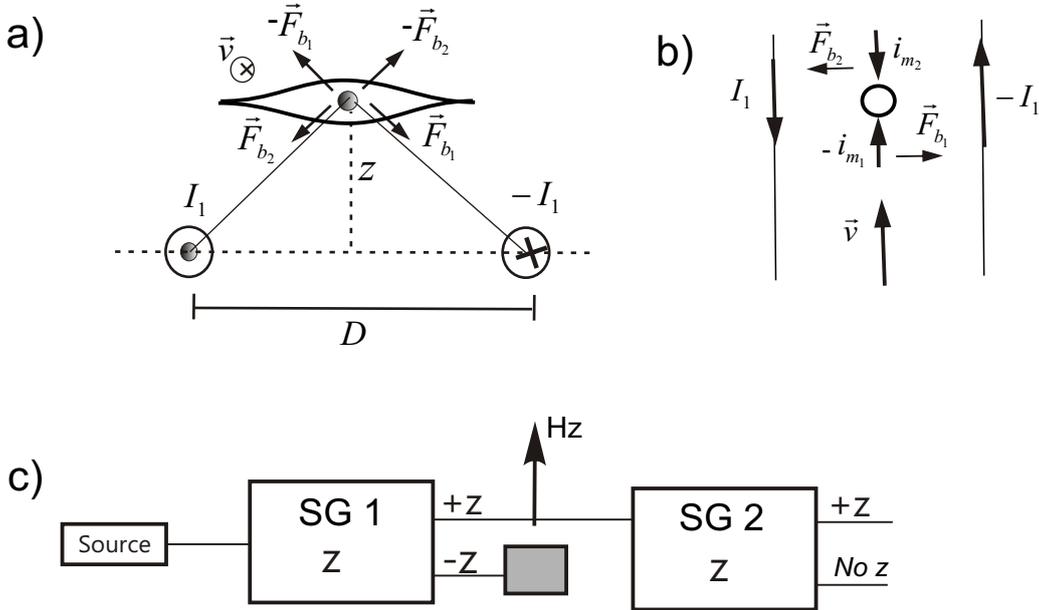

Figure 18: Stern-Gerlach experiment

At **a)** the forces are shown which can appear individually or combined depending of how many regenerating BSPs interact simultaneously with the currents I_1.

At **b)** a top view of **a)** is shown with the regenerating currents i_m of the atomic nucleus which are parallel to the currents I_1, and the resulting forces F_b.

At **c)** a sequential Stern-Gerlach experiment is shown where the particles $+Z$ from $SG1$ are passed through $SG2$ and where only particles $+Z$ are obtained if a homogeneous magnetic field H_z is applied between $SG1$ and $SG2$. The explanation given by standard theory is that the magnetic momentum of the valence electron must hold unchanged during the pass from $SG1$ to $SG2$.

The present approach explains the up or down deflection in an SG device with the

special combination of the interacting currents I_1 and i_m, which are defined by the special configuration the orbital electrons and reintegrating BSPs of the atom have, when entering the inhomogeneous magnetic field of the SG device. To have the same combination of interacting currents with the same deflection at a second SG device, it is necessary to hold the configuration of the orbital electrons and reintegrating BSPs of the atoms applying the homogeneous magnetic field H_z between the two SG devices.

The approach concludes that the deflections are a characteristic only of complex particles like the neutrons, protons, and atoms and not a characteristic of BSPs like electrons, positrons and neutrinos, which have no reintegrating BSPs.

To introduce in standard theory the spin of an electron the assumption is made, that at the Ag atom for instance, 46 of the electrons form together with the nucleus a close inner core of total angular momentum zero and that the one remaining electron has no orbital angular momentum. This would mean that the remaining level electron is static without the possibility to compensate with its centrifugal force the attracting force of the nucleus and collapse.

An other argument against the spin of an electron is that all theoretical efforts made to explain the magnetic moment of an electron as a rotating charge have let to not acceptable conclusions.

15   BSP with light speed.

BSPs with speeds $v \neq c$ emit and are regenerated continuously by fundamental particles that have longitudinal and transversal angular momenta. With $v \to c$, eq. (7) becomes zero and so the longitudinal field $d\bar{H}_s$ and the corresponding angular momentum $\bar{J}_s$. According eq. (8) only the transversal field $d\bar{H}_n$ and the corresponding angular momentum $\bar{J}_n$ remain. With $v \to c$, the BSP reduces to a pair of FPs with opposed transversal angular momenta $\bar{J}_n$, with no emission (no charge) nor regeneration.

The concept is shown in Fig. 19

Fig. 19 shows at **a)** a BSP with parallel $\bar{p}_c^{\parallel}$ linear momentum and at **b)** with transversal $\bar{p}_c^{\perp}$ linear momentum. At **c)** a possible configuration of a photon is shown as a sequence of BSPs with light speed with alternated transversal linear momentums $\bar{p}_c^{\perp}$, which gives the wave character, and intercalated BSPs with longitudinal momentums $\bar{p}_c^{\parallel}$ that gives the particle character to the photon.

Conclusion: BSPs with light speed are composed of pairs of FPs with opposed angular momenta $\bar{J}_n$, they don't emit and are not regenerated by FPs. They are not bound to en environment that supplies continuously FPs to regenerate them. The potential linear momentum $\bar{p}_c$ of each pair of opposed angular momenta can have any orientation relative to the speed $\bar{c}$. BSPs with light speed can be identified with the
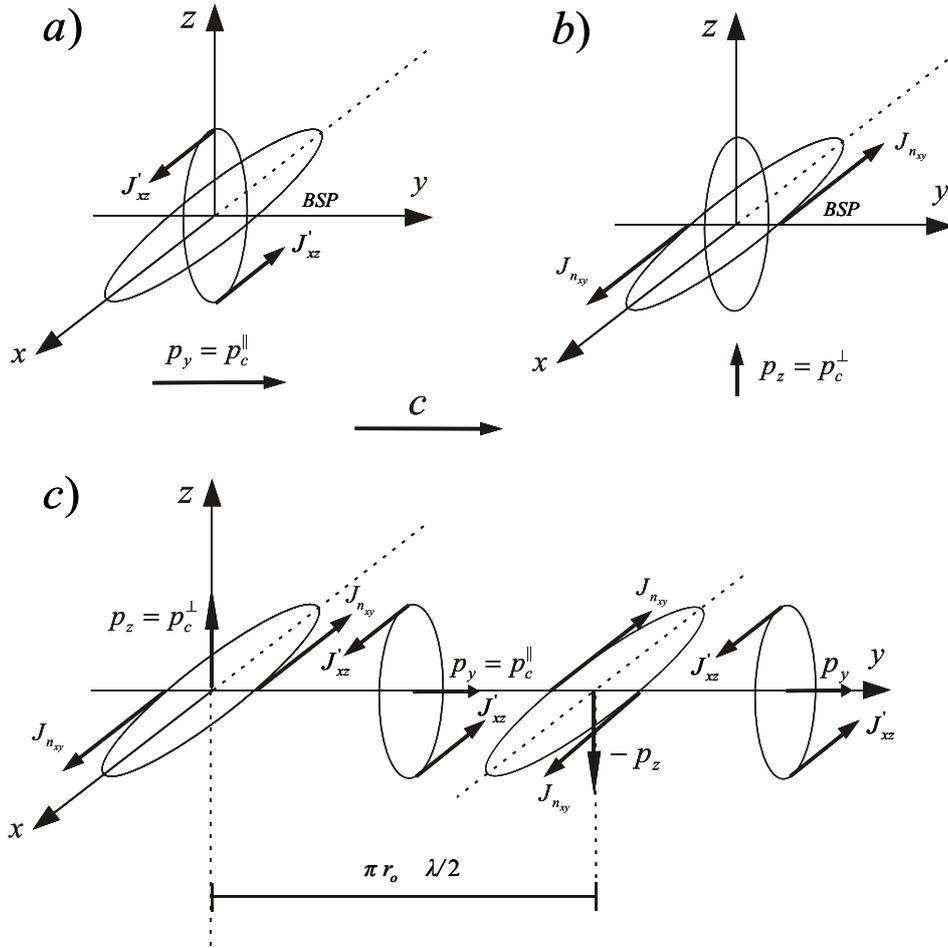
Figure 19: Different forms of BSP with light speed

neutrinos.

15.1 Redshift of the energy of a complex BSP with light speed (photon) in the presence of matter.

Fig. 20 shows a sequence of BSPs with light speed (photon) with their potential linear momenta p before and after the interaction with the ray of regenerating FPs of the BSPs of matter. When the regenerating rays are approximately perpendicular to the trajectory of the opposed dH_n (dots and crosses) fields of the photon, part of the energy of the dH_n field is absorbed by the regenerating FPs of the ray and carried to the BSPs of the matter. The photon doesn't change its direction and loses energy to the BSPs of the matter shifting its frequency to the red. The inverse process is not possible because the BSPs of the photon (opposed dH_n fields) have no regenerating rays of FPs that can carry energy from the BSPs of matter and shift the frequency to the violet.
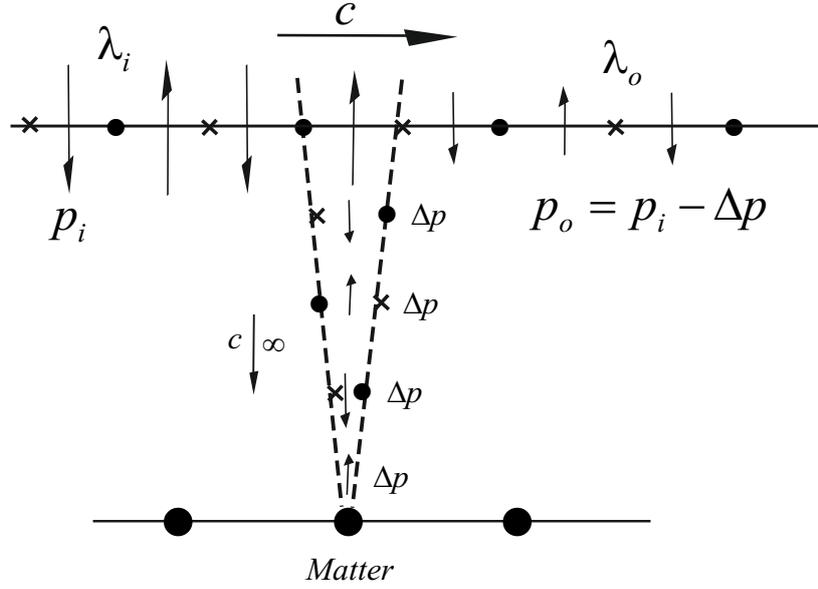
Figure 20: Loss of energy of a BSP with $v = c$

The process of loss of energy is according the interaction law **3)** of sec. 4 which postulates that pairs of regenerating FPs with longitudinal angular momenta from a BSP can adopt opposed pairs of transversal angular momentum from another BSP (see Fig. 11). As photons have no regenerating FPs they can only leave pairs of transversal angular momentum to other BSPs and lose energy. During the red shift, two adjacent opposed potential linear momenta of the photon compensate partially by passing part of their opposed linear momenta to the BSP of matter.

The energy exchanged between a photon and an electron is

$$E_i = \frac{h\,c}{\lambda_i} \qquad\qquad E_b = \frac{p_b^2}{2\,m_p} \qquad\qquad (140)$$

The frequency shift of the photon is with $E_i = E_o + E_b$

$$\Delta\nu = \nu_i - \nu_o = \frac{1}{h}(E_i - E_o) = \frac{E_b}{h} \qquad z = \frac{\Delta\nu}{\nu_i} \qquad\qquad (141)$$

where $E_i = h\,c/\lambda_i$ is the energy before the interaction, $E_o = h\,c/\lambda_o$ the energy after the interaction and E_b the energy carried to the BSP of matter.

Light that comes from far galaxies loses energy to cosmic matter resulting in a red shift approximately proportional to the distance between galaxy and earth (Big Bang).

Light is not bent by gravitation nor by a bending target, it is reflected and refracted by a target.

15.1.1 Cosmic Microwave Background radiation.

From Fig. 20 we have learned how a photon passes energy to matter shifting its frequency to red. The transfer of energy takes place according postulate 8 from rays that not necessarily hit directly matter. If we put on the place of the matter the microwave detector of the COBE satellite we see how microwave radiation from radiating bodies that are not placed directly in front of the detector lenses can reach the detector. What is measured at the FIRAS (Far-InfraRed Absolute Spectrophotometer), a spectrophotometer (Spiderweb Bolometer) used to measure the spectrum of the CMB, is the energy lost by microwave rays that pass in front of the detector lenses. The so called Cosmic- Background Radiation is not energy that comes from microwave rays that have their origin in the far space in a small space angle around the detector axis. As the loss of energy from rays of photons to the microwave detector that don't hit directly the detector is very low, the detector must be cooled down to very low temperatures to detect them.

16 Findings of the proposed approach.

The main findings of the proposed model [10], from which the present paper is an extract, are:

- The energy of a BSP is stored as rotations in FPs defining the longitudinal angular momenta of the emitted fundamental particles. The rotation sense of the longitudinal angular momenta of emitted fundamental particles defines the sign of the charge of the BSP.

- All the basic laws of physics (Coulomb, Ampere, Lorentz, Maxwell, Gravitation, bending of particles and interference of photons, Bragg) are derived from one vector field generated by the longitudinal and transversal angular momenta of fundamental particles, laws that in today's theoretical physics are introduced by separate definitions.

- The interacting particles (force carriers) for all types of interactions (electromagnetic, strong, weak, gravitation) are the FPs with their longitudinal and transversal angular momenta.

- Quantification and probability are inherent to the approach.

- The incremental time to generate the force out of linear momenta is quantized.

- Gravitation has its origin in the induced momenta when BSPs that have migrated outside their nuclei are reintegrated.

- The gravitation force is composed of an induced component and a component due to parallel currents of reintegrating BSPs. For galactic distances the induced component can be neglected, what explains the flattening of galaxies´ rotation curve. (dark matter).

- The photon is a sequence of BSPs with potentially opposed transversal linear momenta, which are generated by transversal angular momenta of FPs that comply with specific symmetry conditions.

- Permanent magnets are explained through closed energy flows at static BSPs stored in transversal angular momenta of FPs.

- The addition of a wave to a particle (de Broglie) is effectively replaced by a relation between the particles radius and its energy. Deflection of particles such as the electron is now a result of the quantified bending linear momenta between BSPs.

- The uncertainty relation of quantum mechanics form pairs of canonical conjugated variables between "energy and space" and "momentum and time". The Schrödinger equation results as the particular time independent case of a more general wave differential equation where the wave function is differentiated two times towards time and one towards space.

- The new quantum mechanics theory, based on wave function derived from the radius-energy relation, is in accordance with the quantum mechanics theory based on the correspondence principle.

- The present approach has no energy violation in a virtual process at a vertex of a Fynmann diagram.

- As the model relies on BSPs permitting the transmission of linear momenta at infinite speed via FPs, it is possible to explain that entangled photons show no time delay when they change their state.

- The two possible states of the electron spin are replaced by the two types of electrons defined by the present theory, namely the accelerating and decelerating electrons.

- The splitting of the atomic beam in the Stern-Gerlach experiment is explained with the interaction of parallel moving BSPs, interaction that is quantized in energy quanta of one resting electron.

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Note: The present approach is based on the concept that fundamental particles are constantly emitted by electrons and positrons and constantly regenerate them. As the concept is not found in mainstream theory, no existing paper can be used as reference.

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