Accelerating Expansion of the Universe Based on Archimedes' Principle

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Abstract. Natural phenomena are derived from dynamic space, which is structured with fundamental elements, namely dimension, electrically opposite units, and their forces. The finite dimensions of the universe and the opposition (principle of antithesis) between existence (the universe) and nonexistence (non-space) cause the spherical deformation of space. This deformation has resulted in the equality of peripheral and radial cohesive forces (universal symmetry) and a change in their cohesive pressure, leading to a universal antigravity force similar to buoyancy (Archimedes' principle), that supports Hubble's law. The breaking of this universal symmetry near the center of the universe leads to the creation of the primary form of the neutron as a vacuum bubble. The gravity of the particle is defined as the mutual stretching of dynamic space by the core vacuum (empty space hole) of the particle.

Keywords: Dynamic space; universal symmetry; cohesive pressure

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1. Introduction

The unified theory of dynamic space[1] has been conceived and written by Professor Physicist Naoum Gosdas, inspired by the principle of antithesis (opposition), through which all natural phenomena are created. This theory first refers to the structure of isotropic space, based on the electrical and dynamic antithesis (opposition) of positive and negative elementary units.

If isotropic space were infinite, then the attractive and repulsive forces of space elementary units would be in balance, forming a cubic grid of infinite dimensions as the sole existence. However, physical space (the universe) is not infinite. It has been created by the spherical deformation of isotropic space as its first deformation.

Through the first deformation of space described above, the universal symmetry of peripheral and radial cohesive forces occurs, resulting in the $P_{0x} \approx 10^{151}\mathrm{N/m^2}$ cohesive pressure (Eq. 59) in our region.[2] This also gives rise to the universal antigravity force[3] similar to buoyancy (Archimedes' principle), which is complemented by the nuclear antigravity force[4] and the particulate antigravity force.

In particular, the universal antigravity force causes the centrifugal accelerating motion of matter in a radial direction towards the periphery of the universe (Hubble's law). The nuclear antigravity force prevents nucleons from getting any closer, while the particulate antigravity force prevents the further gravitational collapse of black holes.

With the breaking of the universal symmetry mentioned above, close to the center of the universe, the primary form of the neutron is created as a vacuum bubble, identical to the Higgs boson. This creation is a reaction to the first deformation of space, namely the dynamic space (Higgs field). The bubble of the neutron core (of radius r) is the cause of the gravitational pressure $P_g = P_{0x}r^2/R^2$ (Eq. 63) at a distance R, serving as a new form of pressure within the gravitational field of the particle, which replaces part of the cohesive pressure P_{0x}. This gravitational pressure is responsible for the force of gravity between two particles.[5]

Furthermore, black holes (see subsection 3.5) resemble bubbles in a foamed liquid, consisting of empty space holes (bubbles). Therefore, matter takes the same fundamental form (bubbles) both during its creation as the primary neutron and during its final gravitational collapse in the cores of stars.[6]

2. First Deformation of Space - Antigravity

2.1. Quantum dipole length of antithesis

The structure of geometric space (as an abstract concept of Geometry) begins with the dimension (separation) of point P and the creation of the two ends of the line segment AB. Point P can be considered as a potential pair of opposite (separated) points, which create the one-dimensional line segment AB. This dimension or opposition is the linear antithesis.

The structure of geometric space is completed with the opposition (antithesis) of the line. If this line is rotated at a maximum angle of 90°, then the two opposite (in direction) lines created have a maximum divergence of 90°. Therefore, the two vertical lines are considered as opposites in direction, and this vertical position is the spatial or right antithesis. Hence, the two types of opposition in geometric space are linear antithesis and spatial or right antithesis.

The separation of the neutral point P into two points A and B, on which there exist (Fig. 1a) two electrically opposite elementary units (in short: units) at a distance L, gives us the electrical attraction force

$$F = kL, \tag{1}$$

where k is a constant ratio. This fact contradicts Coulomb's law‡ because the force must be proportional to the distance L, due to the linear antithesis of electric dipole at

‡ Coulomb's law applies to electric charges and their fields extending through space.

the foundations of nature. Note that these electrical units are defined as the ultimate structural entity of nature and have elementary positive or negative electric charges without gravitational or inertial mass.

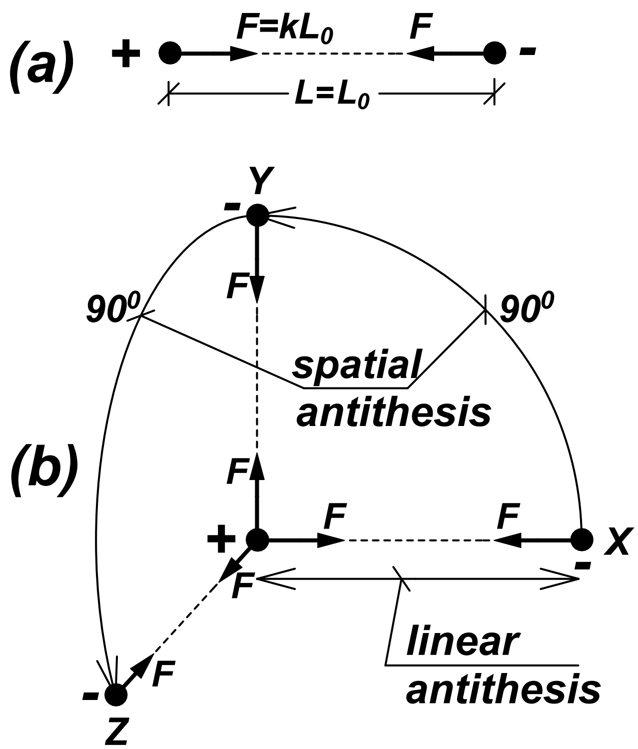

Figure 1. (a) The elementary electric dipole (linear antithesis $L_0 \approx 10^{-54}$m), and (b) the elementary orthogonal axes system XYZ of isotropic space (spatial or right antithesis)

This dimension or length L, calculated as $L = L_0 = 0.558 \times 10^{-54}$m (Eq. 61), is the quantum length of the antithesis dipole in our region (Fig. 1a). Therefore, the first structural element of the physical space is the electric dipole of the units.

With two successive spatial or right antitheses of the electric dipole, the elementary orthogonal axes system occurs (Fig. 1b). By repeating this spatial or right antithesis, the space is structured as a grid of cubic cells, initially as an infinite-dimensional isotropic space (Fig. 2).

2.2. Spherical deformation of dynamic space

The isotropic space is structured by the positive and negative units. These units are located at the vertices of the cubic cells according to the model of bipolar compounds like $NaCl$. The cubic cell is the elementary volume or the quantum of space, structured by the electric dipoles (Fig. 2).

The attraction forces exerted by the electric dipoles create cohesive pressure on the cells' seats. These forces are mutually neutralized between adjacent units, resulting in the creation of isotropic space in the form of a cubic grid of infinite dimensions as the sole existence.

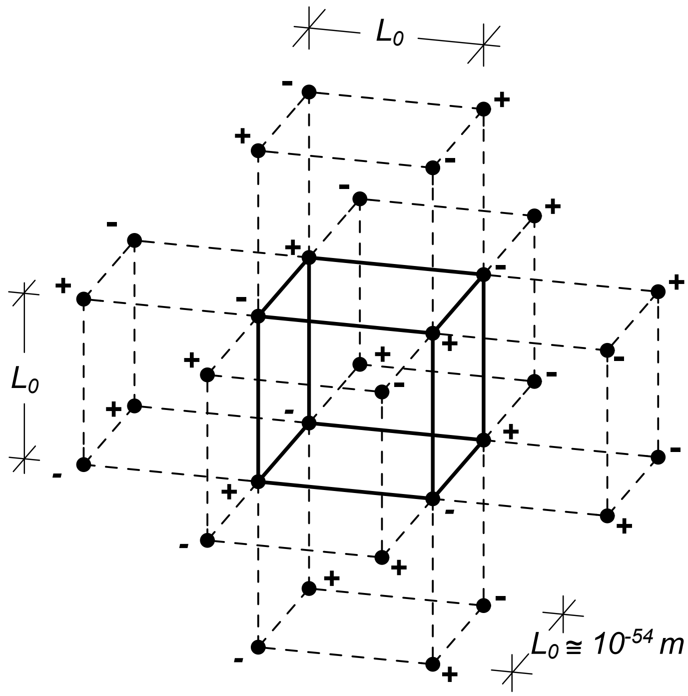

Figure 2. The cubic cell serves as an elementary volume, the quantum of isotropic space, which takes the form of an infinite-dimensional cubic grid as the sole existence

However, the physical space (the universe) is not infinite. At the limits of the universe, where space-existence is separated from vacuum-nonexistence, the principle of antithesis applies, resulting in maximum opposition between existence and nonexistence. This leads to mutual attraction from the vacuum-nonexistence to the space-existence. The vacuum-nonexistence attracts the existence of the units (Fig. 3).

Finally, due to this mutual attraction between the nonexistence of vacuum and the existence of space, a spherical deformity of space occurs under the influence of surface tension, similar to the surface tension on a mercury drop. Thus, the isotropic space, originally a unique existence of infinite dimensions, is transformed into a spherical deformation of dynamic space with finite dimensions (the universe). The cohesive forces developed from this first universal deformation are always directed towards the space-existence.

It is obvious that this spherical deformity of space distorts the cubic cells. Consequently, the dipoles lengthen more, moving away from the center to the periphery of the universe, resulting in the development of stronger cohesive forces. This is because the force $F = kL_0$ (Eq. 1) of the electric dipole (Fig. 1) is proportional to the distance L_0 between the units (linear antithesis) and is the cause of the space cohesiveness. Therefore, the cohesive pressure P_0, developed by the forces of the electric dipoles, is altered and increases from the center to the periphery of the universe in the same way as the distance L_0 of the units increases.

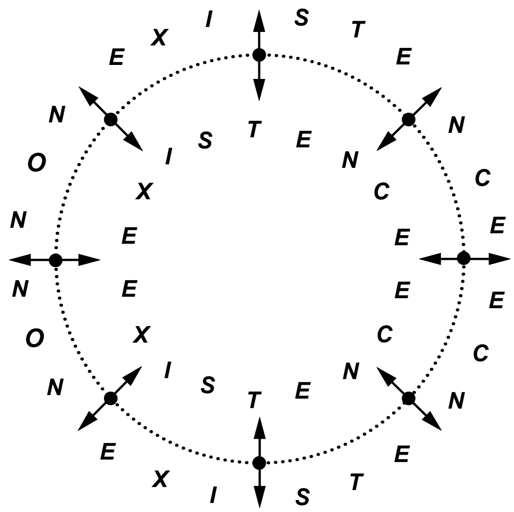

Figure 3. At the limits of the universe, the nonexistence of vacuum attracts the existence of units

The result of this first deformation of universal space is the development of the cohesive pressure $P_{0x} = 0.7777 \cdot 10^{151}$ N/m^2 (Eq. 59) in our region. Thus, dynamic space is a vast storehouse of energy, in which the fundamental cause of the force is the electric one between positive and negative units.

2.3. Dynamics of the universe

Using the mechanical analog of a maximum circle of the universe section and by studying the dynamics of the elastic stretched circular membrane, the cohesive pressure $P_{0x} = P_{0p}x^2/R_0^2$ (Eq. 29) of a region at a distance x from the universe center with a constant radius R_0, where P_{0p} is the constant cohesive pressure at the universe periphery, is calculated as follows:

The elementary external force F (Fig. 4), as a part of the total external force, is applied onto the node A of the dipoles and is balanced by the radial force F_r (transferred to the next underlying radial edge) and by the force F_p (consisting of two peripheral components f), so that

$$F = F_r + F_p \Rightarrow F_r = F - F_p. \tag{2}$$

It is noted that the curvature§ on the dynamic space of the universe is defined as

$$K_x = \frac{L_{0x}}{x} = \omega_x, \tag{3}$$

§ In mathematics, curvature is defined as an abstract geometric concept $K = 1/R$. Here the numerator is replaced with the actual unit of nature, namely the dipole length L_{0x}.

where L_{0x} (Eq. 61) is the elementary length of the electric dipole, and ω_x is the central angle by which the edge L_{0x} is observed at a distance x from the center of the universe with a constant radius R_0.

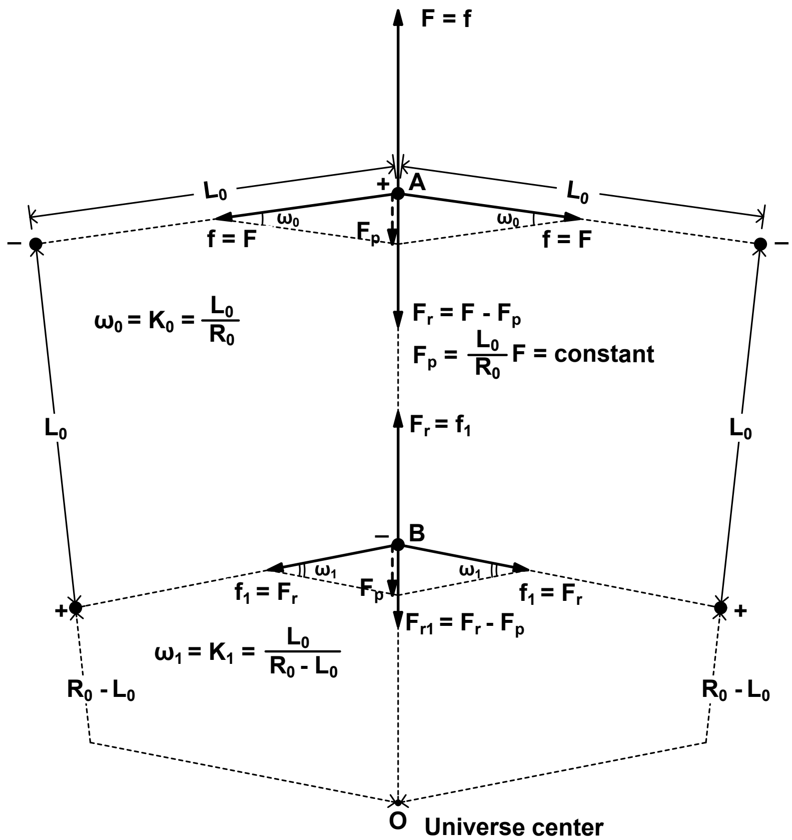

Figure 4. The elementary external force F (at the periphery of the universe) is balanced by the radial force F_r (transferred to the next underlying radial edge) and by the constant force F_p, which consists of two peripheral components $f = F$. This balance occurs because of the curvature $K_0 = L_0/R_0 = \omega_0$

At the universe periphery, it will be

$$F_p = K_0 F, \tag{4}$$

meaning the force F_p is proportional to the external force F and to the curvature (Eq. 3)

$$K_0 = \frac{L_0}{R_0} = \omega_0, \tag{5}$$

which is the cause of the lateral deviation of the forces. Therefore, Eq. 4, due to Eq. 5, becomes

$$F_p = K_0 F \Rightarrow F_p = \frac{L_0}{R_0} F. \tag{6}$$

The peripheral components f, due to Eq. 5, are

$$f = \frac{F_p}{2\sin(\omega_0/2)} = \frac{F_p/2}{\omega_0/2} = \frac{F_p}{\omega_0} = \frac{F_p}{K_0} \Rightarrow f = \frac{R_0}{L_0}F_p \tag{7}$$

and due to Eq. 6

$$f = \frac{R_0}{L_0}F_p = \frac{R_0}{L_0} \cdot \frac{L_0}{R_0}F \Rightarrow f = F. \tag{8}$$

This equality of peripheral components f with the external radial attractive force F is obvious. Throughout the universe, there is an equality of peripheral and radial forces (universal symmetry), corresponding to the elastic changes of lengths $\Delta l = 2\pi\Delta x$ of concentric peripheries that are proportional to the distance x from the universe center ($l = 2\pi x$).

The radial force $F_r = f_1 = F - F_p$ (Eq. 2), due to Eqs 6 and 8, becomes

$$F_r = f_1 = F - \frac{L_0}{R_0}F = (1 - \frac{L_0}{R_0})F \Rightarrow F_r = f_1 = \frac{(R_0/L_0) - 1}{R_0/L_0}F. \tag{9}$$

This is transferred to the next underlying radial edge (onto the node B), so that Eq. 4 will be $F_{p1} = K_1F_r$, where the curvature K_1 (Eq. 3) for $L_{0x} \approx L_0$ and $x = R_0 - L_0$, becomes

$$K_1 = \frac{L_0}{R_0 - L_0} = \frac{1}{(R_0/L_0) - 1} \Rightarrow F_{p1} = \frac{F_r}{(R_0/L_0) - 1}. \tag{10}$$

Substituting Eq. 9 into Eq. 10 and due to Eq. 6, we find

$$F_{p1} = \frac{L_0}{R_0}F \Rightarrow F_{p1} = F_p. \tag{11}$$

Consequently, the force F_p is constant throughout the universe (Fig. 4). However, the peripheral components of F_p are reduced towards the universe center and are equal to the corresponding radial force. Thus, the increase of the universe curvature is the cause that reduces the respective peripheral components f of the resultant constant force F_p (Eq. 6).

The radial force F_{r1} will be $F_{r1} = f_2 = F_r - F_p$ and substituting therein Eqs 6 and 9, we find

$$F_{r1} = f_2 = \frac{(R_0/L_0) - 1}{R_0/L_0}F - \frac{L_0}{R_0}F = \frac{(R_0/L_0) - 1}{R_0/L_0} \cdot \frac{L_0/R_0}{L_0/R_0}F - \frac{L_0}{R_0}F \tag{12}$$

$$\Rightarrow F_{r1} = F - 2\frac{L_0}{R_0}F \tag{13}$$

and due to Eq. 6, we have‖

$$F_{r1} = f_2 = F - 2F_p \Rightarrow F_{r1} = f_2 = F - (\frac{R_0}{L_0} - \frac{R_0 - 2L_0}{L_0})F_p. \tag{14}$$

‖ Factors 2 and 3 of Eqs 14 and 15 have been replaced by $2 = R_0/L_0 - (R_0 - 2L_0)/L_0$ and $3 = R_0/L_0 - (R_0 - 3L_0)/L_0$ respectively.

Also, the next underlying radial force is $F_{r2} = f_3 = F_{r1} - F_p$ (Eq. 2) and substituting therein $F_{r1} = F - 2F_p$ Eq. 14, we find

$$F_{r2} = f_3 = F - 3F_p \Rightarrow F_{r2} = f_3 = F - (\frac{R_0}{L_0} - \frac{R_0 - 3L_0}{L_0})F_p. \quad (15)$$

At the distance x from the universe center, $R_0 - 3L_0$ (Eq. 15) is identical to x, and the corresponding radial force $F_{r2} = f_3$ is identical to $F_{rx} = f_{x+1}$, namely the above Eq. 15 becomes

$$F_{rx} = f_{x+1} = F - (\frac{R_0}{L_0} - \frac{x}{L_0})F_p. \quad (16)$$

Therefore, due to Eq. 6, we find

$$F_{rx} = f_{x+1} = F - (\frac{R_0}{L_0} - \frac{x}{L_0})\frac{L_0}{R_0}F \Rightarrow F_{rx} = f_{x+1} = \frac{x}{R_0}F. \quad (17)$$

In the spherical three-dimensional space, the cell seats are oriented as tangents to the universe peripheries and as verticals to its radii (Fig. 5).

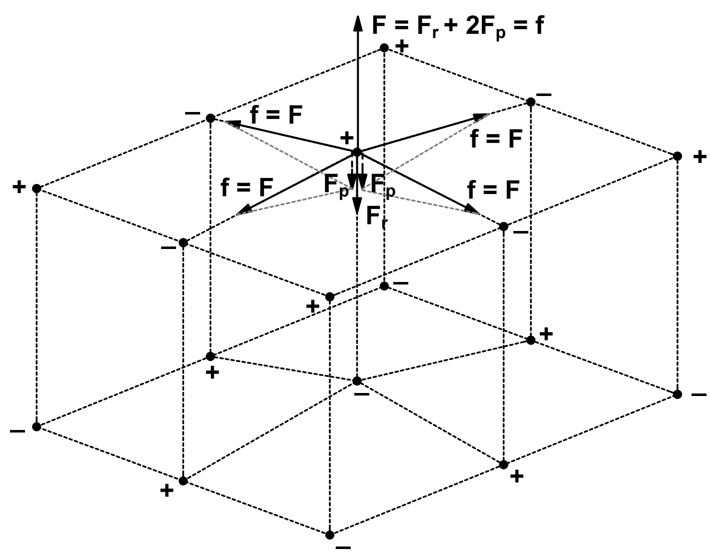

Figure 5. The elementary external force F (applied to the elastic membrane of the universe periphery) is balanced by the radial force F_r (transferred to the next underlying radial edge) and by two forces F_p, which consist of two pairs of peripheral components (where each $f = F$)

Therefore, at the limits of the universe, the two forces F_p consists of two pairs of peripheral components (where each equals f) at the tangent level of the periphery and is deducted twice ($2F_p$) from the external force F, so as to give equality with the corresponding radial force F_r. Namely, it is

$$F = F_r + 2F_p \Rightarrow F_r = F - 2F_p \quad (18)$$

and due to Eqs 6 and 8, we have

$$F_r = f_1 = F - 2\frac{L_0}{R_0}F = (1 - 2\frac{L_0}{R_0})F \Rightarrow F_r = f_1 = \frac{(R_0/L_0) - 2}{R_0/L_0}F. \quad (19)$$

The next underlying force is $F_{p1} = K_1 F_r$ (Eq. 4), where K_1 (Eq. 3) is

$$K_1 = \frac{L_0}{R_0 - L_0} \Rightarrow K_1 = \frac{1}{(R_0/L_0) - 1} \tag{20}$$

and due to Eqs 19 and 20, $F_{p1} = K_1 F_r$ becomes

$$F_{p1} = K_1 F_r \Rightarrow F_{p1} = \frac{(R_0/L_0) - 2}{(R_0/L_0) - 1} \cdot \frac{1}{R_0/L_0} F. \tag{21}$$

At the next peripheral zone, it is $F_{r1} = f_2 = F_r - 2F_{p1}$ (Eq. 18) and due to Eqs 19 and 21, we have

$$F_{r1} = f_2 = \frac{(R_0/L_0) - 2}{R_0/L_0} F - 2\frac{(R_0/L_0) - 2}{(R_0/L_0) - 1} \cdot \frac{1}{R_0/L_0} F \tag{22}$$

and so

$$F_{r1} = f_2 = \frac{(R_0/L_0) - 2}{(R_0/L_0) - 1} \cdot \frac{(R_0/L_0) - 3}{R_0/L_0} F. \tag{23}$$

Similarly, at the next peripheral zone, we find

$$F_{r2} = f_3 = \frac{(R_0/L_0) - 3}{(R_0/L_0) - 1} \cdot \frac{(R_0/L_0) - 4}{R_0/L_0} F. \tag{24}$$

At the peripheral zone, at a distance x from the universe center, the formulas $(R_0/L_0) - 3 = (R_0 - 3L_0)/L_0$ and $(R_0/L_0) - 4 = (R_0 - 4L_0)/L_0$ of Eq. 24 are identical to x/L_0 and $(x-1)/L_0$ respectively, and the corresponding radial force $F_{r2} = f_3$ is identical to $F_{rx} = f_{x+1}$. Therefore, Eq. 24 becomes

$$F_{rx} = f_{x+1} = \frac{x/L_0}{(R_0/L_0) - 1} \cdot \frac{(x-1)/L_0}{R_0/L_0} F. \tag{25}$$

In Eq. 25, it is obvious to replace $(x-1)/L_0$ and $(R_0/L_0) - 1$ with x/L_0 and R_0/L_0 respectively, whereby Eq. 25 becomes

$$F_{rx} = f_{x+1} = F\frac{x^2/L_0^2}{R_0^2/L_0^2} \Rightarrow F_{rx} = f_{x+1} = F\frac{x^2}{R_0^2}. \tag{26}$$

So, with Eq. 26, the established equal radial and peripheral forces of the lattice dynamic space (universal symmetry) are proportional to the square of the distance x from the universe center. These radial and peripheral forces, which stretch the cell edges, also stretch the cell seats, which occupy the elementary surface area L_{0x}^2. Therefore, the radial and peripheral forces are identical to the cohesive pressure P_{0x} at a distance x from the universe center, namely

$$F_{rx} = f_{x+1} \sim P_{0x}. \tag{27}$$

The same happens at the universe limits, where the external force F stretches the external peripheral cell-seat of an elementary surface area L_{0p}^2 (of the elastic membrane).

So, this external force F is identical to the cohesive pressure P_{0p} at the universe periphery, namely

$$F \sim P_{0p}. \tag{28}$$

Substituting the identities of Eqs 27 and 28 into Eq. 26, the cohesive pressure of a region at a distance x from the universe center becomes

$$P_{0x} = P_{0p}\frac{x^2}{R_0^2}. \tag{29}$$

2.4. Force and mass densities of space

The spherical deformation of space creates its dynamics, based on the force F and the dipole length L_0. The force density of space, $d_f = F_0/V$, is calculated from the gravitational force $F_0 = 27.043 \cdot 10^{43}$ N (Eq. 60) of the neutron of volume $V = 4\pi r^3/3$ of its core vacuum, where $r = 1.6639 \cdot 10^{-54}$ m (Eq. 58) is its radius. Thus, the force density of space is calculated as

$$d_f = \frac{F_0}{V} = 1.393 \cdot 10^{205} N/m^3 \Rightarrow d_f = 1.393 \cdot 10^{205} N/m^3. \tag{30}$$

Also, the force density of space is $d_f = F/V = kL_0/L_0^3 = k/L_0^2$. For the cohesive pressure of space $P_0 = F/L_0^2 = kL_0/L_0^2 = k/L_0$, it is

$$d_f = \frac{k}{L_0^2} = \frac{P_0}{L_0} \Rightarrow d_f = \frac{P_0}{L_0}. \tag{31}$$

In $F_{rx} = f_{x+1} = Fx^2/R_0^2$ (Eq. 26), $F_{rx} = f_{x+1} = kL_{0x}$ (Eq. 1) is the force of the electric dipole in a region, F the maximum external force (constant) on the universe periphery of constant radius R_0 (Fig. 5), and x is the distance of a region from the universe center. So, it is $kL_{0x} = Fx^2/R_0^2$, namely

$$L_{0x} = F\frac{x^2}{kR_0^2}. \tag{32}$$

Therefore, the cohesive pressure $P_0 = P_{0x}$ (Eq. 29) and the quantum dipole length $L_0 = L_{0x}$ (Eq. 32) vary depending on the square of the distance x from the universe center, and so the force density of space d_f (Eq. 31) is independent of x and remains a universal constant.

The mass density of space is $d_m = m/V$, where $m = E/c_0^2 = FL_0/c_0^2$. Then, $d_m = FL_0/c_0^2V$. For $d_f = F/V$, it is

$$d_m = d_f\frac{L_0}{c_0^2}. \tag{33}$$

Substituting the values $c_0 = 3 \cdot 10^8$ m/sec, $d_f = 1.393 \cdot 10^{205}$ N/m^3 (Eq. 30), and $L_0 = 0.558 \cdot 10^{-54}$ m (Eq. 61), the mass density of space is calculated as

$$d_m = 0.864 \cdot 10^{134} kg/m^3. \tag{34}$$

The dipole length $L_0 = L_{0x}$ (Eq. 32) is proportional to x^2, while the speed of light $c_0 = c_{0x} = xc_{0p}/R_0$ (due to Eqs 29 and 35) is proportional to x. Therefore, the ratio L_0/c_0^2 of Eq. 33 is independent of x, and consequently, the space mass density d_m is independent of the distance x from the universe center. Accordingly, the mass density d_m of space is a universal constant.

2.5. The speed of light

We replace $d_f = P_0/L_0$ (Eq. 31) into $d_m = d_f L_0/c_0^2$ (Eq. 33). Then we have $d_m = P_0/c_0^2$, hence

$$c_0 = \sqrt{\frac{P_0}{d_m}}. \tag{35}$$

So, the speed of light is determined as the transmission speed of the disturbance into the tense elastic-dynamic space, where P_0 is the space cohesive pressure and d_m is the universal constant mass density of space.

It becomes obvious that the speed of light $c_{0x} = \sqrt{P_{0x}/d_m}$ (Eq. 35) depends on the distance x from the universe center and therefore is not a universal constant, but a local constant equal to $c_{0x} = 3 \cdot 10^8$ m/sec¶ in our region.

2.6. Universal antigravity force

The change of cohesive pressure $P_{0x} = P_{0p}x^2/R_0^2$ (Eq. 29) causes a difference of pressure ΔP (Fig. 6) onto the volume V of a particle core vacuum (see subsection 3.1), resulting in the creation of buoyancy conditions on the bodies (Archimedes' principle).

This buoyancy generates the similar universal antigravity force F_a. Consequently, matter acquires centrifugal accelerating motion in a radial direction towards the periphery of the universe.

The cohesive pressures (Fig. 7) P_{0x1} and P_{0x2} (Eq. 29) are $P_{0x1} = P_{0p}x_1^2/R_0^2$ and $P_{0x2} = P_{0p}x_2^2/R_0^2$. Therefore, the forces F_1 and F_2 are

$$F_1 = SP_{0x1} \Rightarrow F_1 = SP_{0p}\frac{x_1^2}{R_0^2} \tag{36}$$

and

$$F_2 = SP_{0x2} \Rightarrow F_2 = SP_{0p}\frac{x_2^2}{R_0^2}, \tag{37}$$

since the cohesive pressure attracts the bubbles of empty space of the body particles. The resultant of forces F_1 and F_2 is

$$F_a = F_2 - F_1 = (x_2^2 - x_1^2)S\frac{P_{0p}}{R_0^2} = (x_2 + x_1)(x_2 - x_1)S\frac{P_{0p}}{R_0^2} \tag{38}$$

¶ The index x determines the distance from our region to the universe center.

and is directed towards the universe periphery. By substituting $x_2 + x_1 \approx 2x$, $x_2 - x_1 = \Delta x$, and $V = S\Delta x$ into Eq. 38, the universal antigravity force is calculated as

$$F_a = 2xV\frac{P_{0p}}{R_0^2}. \tag{39}$$

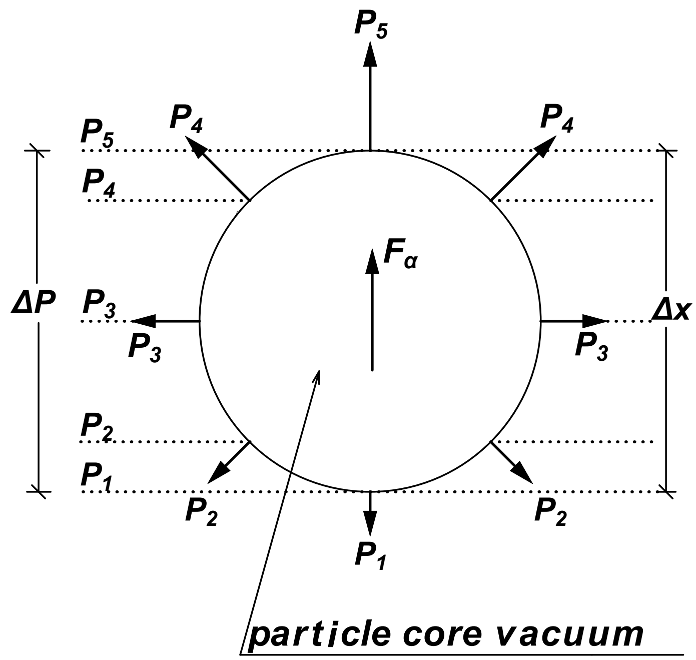

Figure 6. The pressure difference ΔP on the volume V of the particle core vacuum creates the universal antigravity force F_a similar to buoyancy (Archimedes' principle), which causes the accelerating expansion of the universe

Of course, the volume $V = S\Delta x$ equals the sum of the volumes of the vacuum bubbles of the body particles (core vacuums particles).

From Eq. 39, we have $F_a = 2xS\Delta x \cdot P_{0p}/R_0^2$, and $F_a/S\Delta x = 2xP_{0p}/R_0^2$. Thus, for $F_a/S = \Delta P$, the pressure gradient of the universal antigravity is

$$\frac{\Delta P}{\Delta x} = 2x\frac{P_{0p}}{R_0^2}. \tag{40}$$

The equation $F_a/S = \Delta P$ can be written as $F_a/S\Delta x = \Delta P/\Delta x$. With $V = S\Delta x$, the universal antigravity force becomes

$$F_a = \frac{\Delta P}{\Delta x}V. \tag{41}$$

The universal antigravity force is very weak, exerted on the small volume of the particle core vacuum (vacuum bubble) by a very small difference ΔP of cohesive pressure. However, the effects of the antigravity force, though evolving at a slow pace, are significant in the universe.

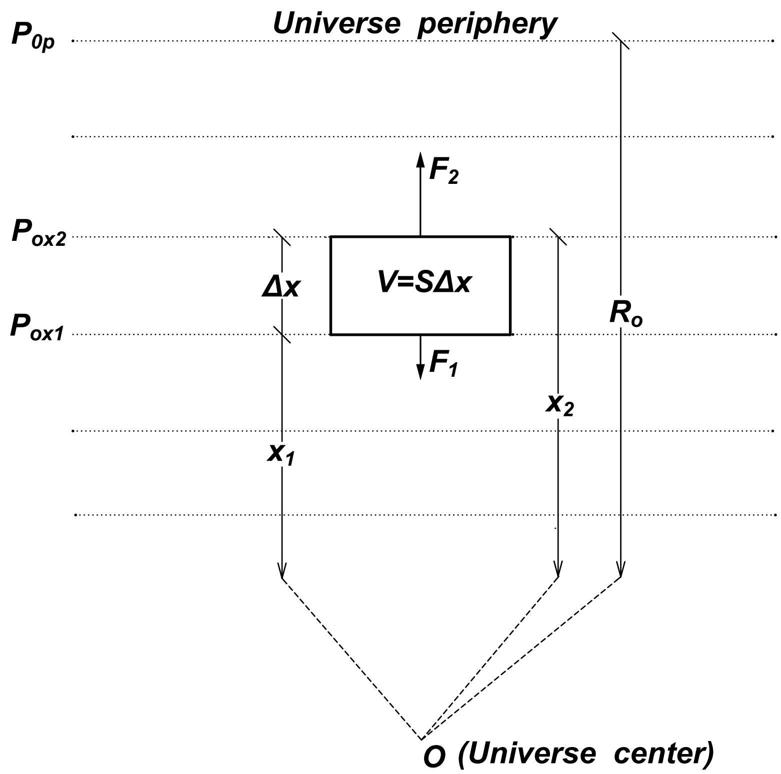

Figure 7. The volume $V = S\Delta x$ is identical to the sum of the volumes of the vacuum bubbles of the body particles

2.7. Expansion of the universe and Hubble's law

The universal antigravity force has been described as causing particles and the galaxies composed of them to follow an accelerating centrifugal motion. Therefore, the expansion of the universe is the relative motion of galaxies A and B (Fig. 8). As galaxies A and B move centrifugally from the universe's center toward its periphery at speeds u_1 and u_2 respectively ($u_1 < u_2$), the distance AB between them increases, since their components $\acute{u}_1$ and $\acute{u}_2$ are unequal ($\acute{u}_1 < \acute{u}_2$).

The radius of the particle core vacuum (Fig. 6) is $r_x = 3L_{0x}$ (Eq. 52), where $L_{0x} = Fx^2/kR_0^2$ (Eq. 32) is the quantum length of the dipole, and hence it is given by

$$r_x = \frac{3F}{kR_0^2}x^2 \Rightarrow r = ax^2, \tag{42}$$

meaning it is proportional to the square of the distance x from the universe center, where $a = 3F/kR_0^2$. If $V = 4\pi r^3/3$ is the spherical volume of the bubble, then, due to Eq. 42, we have

$$V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi a^3 x^6 \Rightarrow V = \frac{4}{3}\pi a^3 x^6. \tag{43}$$

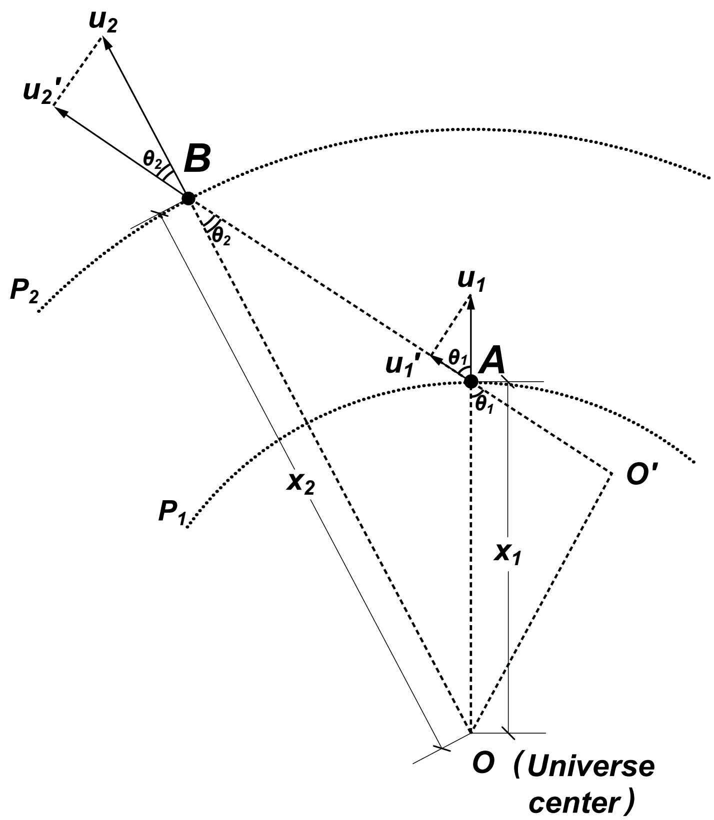

Figure 8. The relative motion of galaxies represents the expansion of the universe. Here, A is our own galaxy, B is the galaxy observed by Hubble, P_1 is the cohesive pressure in our region, P_2 is the cohesive pressure in the region of galaxy B, and x_1 and x_2 are the distances of galaxies A and B from the center of the universe, respectively

Substituting Eq. 43 into the antigravity force $F = F_a = 2xVP_{0p}/R_0^2$ (Eq. 39), we find

$$F = F_a = \frac{8\pi a^3 P_{0p}}{3R_0^2} x^7. \tag{44}$$

Hence, the work W accomplished until position x is

$$W = \int_0^x F dx = \int_0^x \frac{8\pi a^3 P_{0p}}{3R_0^2} x^7 dx \Rightarrow W = \frac{\pi a^3 P_{0p}}{3R_0^2} x^8. \tag{45}$$

This work W is converted into kinetic energy $E_k = mu^2/2$, where $m = Vd_m$, d_m is the constant mass density of space, and u is the centrifugal speed of a galaxy (Fig. 8). Thus, $E_k = Vd_m u^2/2$, and substituting Eq. 43 therein, we find

$$E_k = \frac{2\pi a^3 d_m u^2 x^6}{3}. \tag{46}$$

Therefore, because $E_k = W$, we calculate $2\pi a^3 d_m u^2 x^6/3 = \pi a^3 P_{0p} x^8/3R_0^2$, i.e.,

$$u = \frac{x}{R_0}\sqrt{\frac{P_{0p}}{2d_m}} \Rightarrow b = \frac{1}{R_0}\sqrt{\frac{P_{0p}}{2d_m}} \Rightarrow u = bx. \tag{47}$$

The centrifugal speed u_1 (Eq. 47) of galaxy A is $u_1 = bx_1$, and of galaxy B is $u_2 = bx_2$. So, galaxy B moves away with a relative speed $u_r = u_2' - u_1'$, namely $u_r = u_2 \cos\theta_2 - u_1 \cos\theta_1$ and $u_r = bx_2 \cos\theta_2 - bx_1 \cos\theta_1$, so by substituting $u_r = b(O'B) - b(O'A) = b(AB)$ and due to Eq. 47, we have

$$u_r = b(AB) = \frac{1}{R_0}\sqrt{\frac{P_{0p}}{2d_m}}(AB) \Rightarrow u = H(AB). \tag{48}$$

Equation 48 is identical with the Hubble's formula. Consequently,

$$H = \frac{1}{R_0}\sqrt{\frac{P_{0p}}{2d_m}} \tag{49}$$

is the Hubble's constant. Using the approximate values $P_{0p} \approx 10^{151}$ N/m^2 (Eq. 59), $R_0 \approx 10^{26}$ m,[5] $d_m \approx 10^{134}$ kg/m^3 (Eq. 34), and substituting in Eq. 49, we verify the size class of the Hubble's constant

$$H \approx 10^{-18} sec^{-1}. \tag{50}$$

3. Second Deformation of Space - Gravity

3.1. Creation of the primary neutron

Throughout the universe, there is equality (universal symmetry) between peripheral and radial forces.

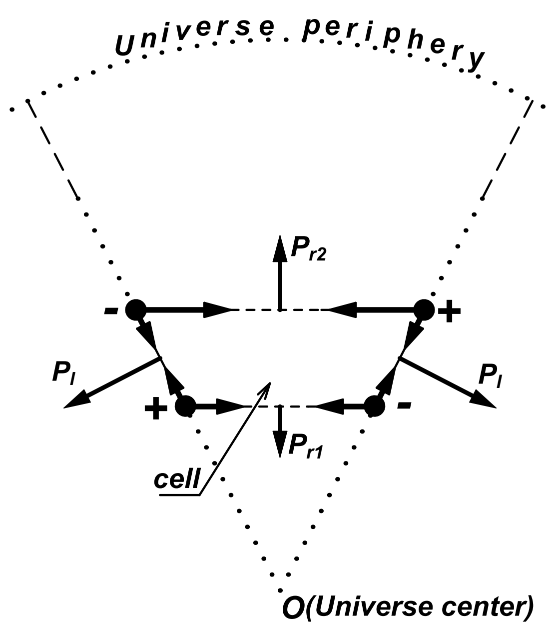

Figure 9. The breaking of universal symmetry close to the universe center leads to the formation of an empty space hole-vacuum bubble ($P_{r1} < P_{r2} < P_l$, where P_{r1} and P_{r2} are the radial cohesive pressures and P_l is the lateral one)

This equality does not apply in the area close to the universe center (breaking of universal symmetry), where the curvature of space (Eq. 3) is great. Thus, both the inequality of the lateral pressures P_l to the radial pressures P_{r1} and P_{r2} is created (Fig. 9), along with the inequality $P_{r1} < P_{r2}$ of the radial pressures due to Eq. 29. The result is the distortion of the cell, which evolves into a spherical formation of empty space (without units). This is the beginning of the creation of the particle-neutron, the primary form of matter, which is the opposite phenomenon to dynamic space.

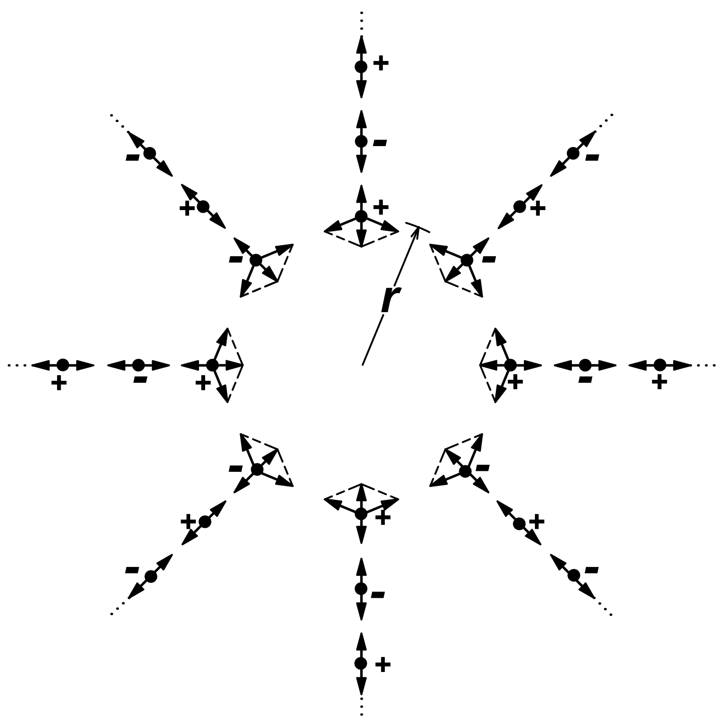

Figure 10. Indicatively, the presentation of the bubble's spherical formation ($F_0 = 4\pi r^2 P_0$, where F_0 is the force of the bubble, P_0 is the cohesive pressure of space, $4\pi r^2$ is the surface area of the bubble, and r is its radius)

The vacuum bubble is the second deformation of space (local), the sophisticated form of which is matter. The grid structure of the cell that surrounds the vacuum of the bubble has the properties of an elastic membrane. This membrane stretches the surrounding space with a force F_0 of its formation and balances the opposite attractive force of the space cohesive pressure P_0. This force F_0 is due to the elementary resultants (Fig. 10) that are formed by the component forces $F = kL_0$ (Eq. 1) of the electric dipoles on the spherical surface of the bubble. The forces developed in the surrounding space create the dynamic field of gravity. This force F_0 (Eq. 51) is the gravitational force of the particle core vacuum.

It is also noted that the vacuum bubble, which is identical to the Higgs boson, is created as a reaction to the first space deformation, namely the dynamic space (Higgs field). Just as the space-universe (with units) is surrounded by the non-space (without units), similarly, the space-universe (with units) surrounds the vacuum bubble (without units). Therefore, matter as a bubble-vacuum (without units) in the universe is conceptually the opposite of the universe.

The principle of antithesis, which created the spherical deformation of the universe, continues to create the particles within it as reverse models of the universe; that is, it creates matter as small reverse universes.

Additionally, black holes (see subsection 3.5) resemble bubbles in a foamed liquid, consisting of core vacuums. Therefore, matter has the same fundamental form (bubbles) both during the beginning of the creation of primary neutrons and during their final gravitational collapse in the cores of stars.

3.2. Finding the radius r of neutron core vacuum, space cohesive pressure P_0, gravitational force F_0, and quantum dipole length L_0

The gravity force F_0 of the particle-neutron (Fig. 10) balances the attractive forces of the space cohesive pressure P_0. Therefore, it is

$$F_0 = 4\pi r^2 P_0 \tag{51}$$

and so the dynamic energy of the particle-neutron, due to Eq. 51, is

$$E = P_0 V = \frac{P_0 4\pi r^3}{3} = \frac{(P_0 4\pi r^2) r}{3} = \frac{F_0 r}{3} = F_0 L_0 \Rightarrow r = 3L_0, \tag{52}$$

where r is the radius of the core vacuum of the neutron.

The neutron energy is $E_n = m_n c_0^2$, and the neutron mass $m_n = 1.675 \cdot 10^{-27}$ kg,[7] where $c_0 = 3 \cdot 10^8$ m/sec, so $E_n = 1.5 \cdot 10^{-10}$ Joule.[7] If this value $E = E_n$ is introduced in $E = P_0 4\pi r^3/3$ (Eq. 52), then

$$\frac{P_0 4\pi r^3}{3} = 1.5 \cdot 10^{-10}. \tag{53}$$

The gravitational attraction between two particles, with radii r_1 and r_2 at a distance R, is $F_g = \pi P_0 r_1^2 r_2^2 / R^2$ (Eq. 64), and for the radius of the neutron $r_1 = r_2 = r$, it becomes

$$F_g = \pi P_0 \frac{r^4}{R^2}. \tag{54}$$

From Newton's law

$$F_g = G \frac{m_1 m_2}{R^2} \tag{55}$$

and for the mass of the neutron $m_1 = m_2 = m_n$, it is

$$F_g = G \frac{m_n^2}{R^2}. \tag{56}$$

From Eqs 54 and 56, it results $\pi P_0 r^4 = G m_n^2$. Therefore, setting the values $m_n = 1.675 \cdot 10^{-27}$ kg[7] and $G = 6.672 \cdot 10^{-11}$ Nm^2/kg^2,[7] it is

$$\pi P_0 r^4 = 1.87 \cdot 10^{-64}. \tag{57}$$

Finally, from Eqs 53 and 57, the radius

$$r = r_x = 1.6639 \cdot 10^{-54} m \tag{58}$$

of the neutron core vacuum and the cohesive pressure of space

$$P_0 = P_{0x} = 0.7777 \cdot 10^{151} N/m^2 \tag{59}$$

in our region are calculated.

The gravitational force $F_0 = 4\pi r^2 P_0$ (Eq. 51), with which the neutron stretches the dynamic space [$F_0 = 4\pi r^2 P_0 = 4\pi(1.6639 \cdot 10^{-54})^2 \cdot 0.7777 \cdot 10^{151}$ N], is

$$F_0 = F_{0x} = 27.043 \cdot 10^{43} N. \tag{60}$$

The quantum dipole length $L_0 = E/F_0$ (Eq. 52) of the units, where $E = E_n = 1.5 \cdot 10^{-10}$ Joule[7] ($L_0 = E_n/F_0 = 1.5 \cdot 10^{-10}/27.043 \cdot 10^{43} m$), is

$$L_0 = L_{0x} = 0.558 \cdot 10^{-54} m. \tag{61}$$

3.3. The gravitational pressure of the particle core vacuum

The gravitational force $F_0 = 4\pi r^2 P_{0x}$ (Eq. 51) of the particle core vacuum is transmitted unaltered, as a stretching of the elastic-dynamic space on a spherical surface of radius R. That is,

$$F_0 = 4\pi R^2 P_g, \tag{62}$$

where P_g is the gravitational pressure of the particle's core vacuum of radius r at a distance R from the particle. From Eqs 51 and 62, the gravitational pressure of the particle is given by

$$P_g = P_{0x} \frac{r^2}{R^2}. \tag{63}$$

The gravitational pressure P_g is a new form of pressure within the gravitational field of the particle and replaces part of the cohesive pressure P_{0x}. It converts the cohesive forces of space into gravity forces due to the presence of the vacuum bubble (local deformation). The fact that the gravitational pressure P_g (Eq. 63) of a particle is proportional to the cohesive pressure P_{0x} (Eq. 29) of the universe regions is the cause that affects the dynamics of motion[8] of distant galaxies. The result of this effect is the chaotic and unexplained motion of galactic systems.

It is also noted that the two deformations of space are, respectively, proportional to x^2 and inversely proportional to R^2 to their distances:

(i) Universal deformation (cohesive pressure) $P_{0x} = P_{0p} x^2 / R_0^2$ (Eq. 29).

(ii) Local deformation (gravitational pressure) $P_g = P_{0x} r^2 / R^2$ (Eq. 63).

Therefore, it is concluded that the cohesive pressure P_{0x} is proportional to the square of the distance x from the center of the Universal deformation (Universe center), while the gravitational pressure P_g is inversely proportional to the square of the distance R from the center of the local deformation (empty space hole of radius r).

Hence, the universal deformation creates the opposite local deformation, according to the fundamental principle of antithesis.

3.4. Gravitational force between two particles

At a distance R from the particle A with a core vacuum of radius r_1, let a second particle B with a radius r_2 be situated (Fig. 11). The gravitational pressure $P_g = P_{0x}r_1^2/R^2$ (Eq. 63) of particle A is not transmitted through the core vacuum of particle B since there are no electric units and dipoles present.

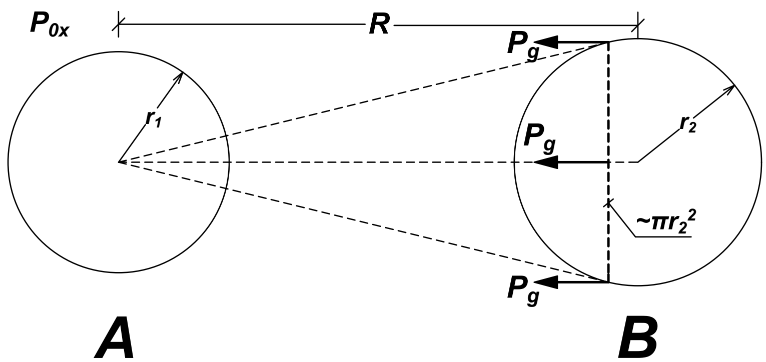

Figure 11. The gravitational force of particle A on particle B is due to the gravitational pressure $P_g = P_{0x}r_1^2/R^2$, where P_{0x} is the cohesive pressure of space

Thus, the entire gravitational pressure P_g appears as an attraction pressure on the surface of the larger circle of the particle B's core vacuum (with an approximate area of $\sim \pi r_2^2$).

Hence, the mutual gravitational force F_g between particles A and B is equal to the product of the surface area ($\sim \pi r_2^2$) and the gravitational pressure P_g (Eq. 63), so

$$F_g = \pi r_2^2 P_g \Rightarrow F_g = \pi P_{0x}\frac{r_1^2 r_2^2}{R^2}. \tag{64}$$

Equation 64 expresses the law of gravity.

Since $F_{01} = 4\pi r_1^2 P_{0x}$ and $F_{02} = 4\pi r_2^2 P_{0x}$ (Eq. 51), then $r_1^2 = F_{01}/4\pi P_{0x}$ and $r_2^2 = F_{02}/4\pi P_{0x}$. Substituting these into Eq. 64, we get

$$F_g = \frac{1}{16\pi P_{0x}} \cdot \frac{F_{01}F_{02}}{R^2}. \tag{65}$$

This is the law of gravity as a function of the gravitational forces F_{01} and F_{02} of particles A and B.

Comparing the law of gravity (Eq. 65) with Newton's law (Eq. 55), the following reciprocal concepts $m_1 \sim F_{01}$, $m_2 \sim F_{02}$ and $G \sim 1/16\pi P_{0x}$ result. So, the masses of particles correspond to the gravitational forces of particles. They are the gravitational forces of particles, with which the space is stretched.

Consequently, the gravitational mass is the expression of the gravitational force of the particle, which stretches space, while inertial mass is its property of reacting to any change in movement.

The dynamic energy of the particle is $E = P_0 V = F_0 L_0$ (Eq. 52). For $E = mc_0^2$, the gravitational mass is

$$mc_0^2 = F_0 L_0 \Rightarrow m = \frac{F_0 L_0}{c_0^2}. \tag{66}$$

3.5. Particulate antigravity force and black holes

On the spherical surface of the vacuum bubble (core of the particle), the cohesive pressure P_{0x} has been completely substituted by the gravity pressure P_g, namely it is $P_{0x} = P_g$. At a distance R from the particle, the cohesive pressure is given by

$$P = P_{0x} - P_g, \tag{67}$$

namely, it decreases by the measure of the corresponding gravity pressure P_g, which prevails at the above position.

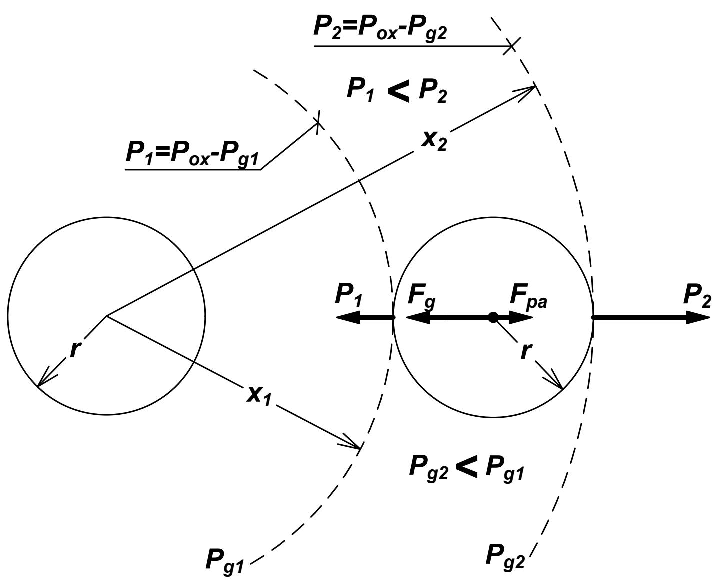

Figure 12. The inequality of gravitational pressures $P_{g2} < P_{g1}$ on the left particle implies the inequality of cohesive pressures $P_1 < P_2$ in its proximal area, causing a repulsive force onto the right particle of antigravity F_{pa}, opposing the gravitational attraction force F_g

The residual cohesive pressure P of space in the area close to the particle is $P = P_{0x} - P_g$ (Eq. 67), where P_{0x} is the cohesive pressure of space far from the gravitational field of the particle, $P_g = P_{0x} r^2/R^2$ (Eq. 63) is the gravitational pressure of the particle, r is its radius of the core vacuum, and R is the distance from the particle. At distances $R = x_1$ and $R = x_2$ from the particle (where $x_1 < x_2$, resulting in $P_{g2} < P_{g1}$), the residual cohesive pressures are $P_1 = P_{0x} - P_{g1}$ and $P_2 = P_{0x} - P_{g2}$. For $P_{g2} < P_{g1}$, it is $P_1 < P_2$ (Fig. 12), namely, a difference of cohesive pressure $\Delta P = P_2 - P_1$ is created. This difference in space cohesive pressure generates buoyancy conditions (Archimedes' principle) on a second particle, which is immersed in the proximal area of the first particle. This results in a repulsive antigravity force F_{pa} acting opposite to the gravitational attraction force F_g. This repulsive force is the particulate antigravity force and is mutual for the two particles since each one is forming its own gravitational pressure, created against the cohesive pressure of space.

The residual cohesive pressure P (Eq. 67) at a distance $R = x$ from the particle is $P = P_{0x} - P_g$. For $P_g = P_{0x}r^2/x^2$ (Eq. 63), it is $P = P_{0x} - P_{0x}r^2/x^2$. So its derivative with respect to x is

$$\frac{\Delta P}{\Delta x} = 2P_{0x}\frac{r^2}{x^3} \tag{68}$$

as the pressure gradient of particulate antigravity. From Eq. 68, it is concluded that the particulate pressure gradient decreases inversely to the cube of the distance x from the particle, and therefore it is very strong at small distances and declines rapidly as the distance increases. Hence, this phenomenon attributes theoretical significance concerning the structure of black holes as a form of grid space matter, consisting of polyhedral cells, like bubbles in a foamed liquid.

The particulate pressure gradient causes a repulsive force of antigravity on the same particle (neutron) of bubble volume $V = 4\pi r^3/3$ (Fig. 12). Due to Eq. 68, it is equal to (see the identical Eq. 41)

$$F_{pa} = \frac{\Delta P}{\Delta x}V \Rightarrow F_{pa} = 2P_{0x}\frac{r^2}{x^3}\cdot\frac{4}{3}\pi r^3 \Rightarrow F_{pa} = \frac{8\pi r^5 P_{0x}}{3x^3}. \tag{69}$$

It is reminded that the gravitational attraction force $F_g = \pi P_{0x}r_1^2 r_2^2/R^2$ (Eq. 64) between these two neutrons for $r_1 = r_2 = r$ and for $R = x$ is

$$F_g = \pi P_{0x}\frac{r^4}{x^2}. \tag{70}$$

The resultant force of the attractive F_g (Eq. 70) and repulsive F_{pa} (Eq. 69) is

$$F = F_g - F_{pa} = \pi P_{0x}\frac{r^4}{x^2} - \frac{8}{3}\pi P_{0x}\frac{r^5}{x^3} = (1 - \frac{8r}{3x})\pi P_{0x}\frac{r^4}{x^2}. \tag{71}$$

Therefore, the corrected law of gravity is

$$F = (1 - \frac{8r}{3x})\pi P_{0x}\frac{r^4}{x^2}. \tag{72}$$

Respectively, the corrected Newton's law is

$$F = (1 - \frac{8r}{3x})G\frac{m^2}{x^2}. \tag{73}$$

If

$$k = 1 - \frac{8r}{3x} \tag{74}$$

is the reduction factor of gravity, then for $x = 2r$ (the minimum distance between two identical particles-neutrons), we find $k < 0$.

A negative reduction factor of gravity means the resultant $F < 0$ (Eq. 72). Therefore, neutrons at the distance $x = 2r$ (i.e."in contact") are repelled because the particulate antigravity force prevails.

For

$$k = 1 - \frac{8r}{3x} = 0 \Rightarrow x = \frac{8r}{3}, \tag{75}$$

the resultant is $F = 0$ (Eq. 72). Thus, for

$$2r < x < \frac{8r}{3}, \tag{76}$$

the particulate antigravity force prevails, and the neutrons are repelled, while for

$$\frac{8r}{3} < x, \tag{77}$$

the force of gravity prevails and they are attracted.

These conditions apply to black holes, which are constructed from the core vacuum (vacuum bubble) of neutrons. Hence, it is proved that the dipole length $L = L_{0x}$ (see subsection 2.1, Eq. 61) has the role of the first structural element of space, as a physical entity that cannot become zero.

Consequently, the particulate antigravity force prevents further gravitational collapse and destruction of these bubbles. So, black holes are sustainable forms of matter in dynamic space.

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