

# NEW FUNDAMENTAL ELEMENTS OF GRAVITON PHYSICS

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## ABSTRACT

Were established: the physically characteristics of graviton as the fundamental particle of matter and the structure of some atomic particles. The structure of the fields of fundamental forces and their correlation: field of nuclear forces, field of electric and electromagnetic forces, the photons structure, the electromagnetic waves and the gravitational field. Has been established new theoretical elements of cosmogonic and astrophysics concerning "Big-Bang" and "Black-Hole" phenomenon.

## INTRODUCTION

Most of fundamental and experimental physics researches in the world have been focused towards the discovery of new particles and their number is currently very high, most of them with very short lives.

Researches in theoretical physics are directed towards solving mainly the "Great Unification" of the four fundamental forces: nuclear (strong), electromagnetic, weak, and gravitational (GUT), among they are solved only theoretical unification of electromagnetic and weak forces, for which the authors Weinberg and Salam, received the Nobel Prize.

Fundamental theoretical physics research lead in the present to deeper mathematical abstractions, thus losing gradually the real character of physical phenomena, and various ambiguous working hypotheses.

A number of things physical findings, had remained unexplained in stage of hypotheses, which shows a certain crisis of present physics, recognized by most of researchers.

We remember only some of these issues:

- The density differences of the so-called "nuclear matter" of atomic particles: electrons, protons, neutrons, mentioning that the characteristics of this nuclear matter are not known, logically indicate variations in its density, that is a certain different intern structure of the respective particles. On the other hand, the appearance of many particles and the interactions between them, proving certain common elements to all particles. In this direction, the hypothesis of: quarks, gluons and so, are explanatory attempts, but only partial.

- Astronomical, astrophysical and cosmological modern researches revealed the existence in the Universe of some forms of collapsed and super-collapsed matter (Black-Hole) with enormous densities comparing with the "nuclear matter" of the atomic particles, which are practically completely crushed. The same is true in the initial cosmogonic situation Big Bang, where mathematical solution of "singularity" appears torn from logical physical reality. In this regard, it is unanimously acknowledged that in this situation, as in others, relativity and quantum physics cannot be applied.

On the other hand, it is known that all matter in the Universe whatever form in which it is: solid corps, liquids, gaseous, plasma, particles with or without electrical charge, photon, has a common element: their gravitational interaction, fact which involves a common cause in their internal structure.

Starting from the idea of a single microparticle that underlies all matter, that is of all existing particles, considering that the different characteristics of the particles are nothing but forms of interaction between these. This does not exclude the existence of new constituent particles, but which in turn are made up of these microparticles, the smallest that exist in the Universe.

To satisfy the condition of generality, were studied those three atomic particles of matter: the proton, the neutron and the electron, which have different sizes and different electrical charge features and further, the photon and fields.

It was put foremost the physical condition:  $m = n \cdot m_\phi$ , where:  $m$  is the mass of a particle,  $m_\phi$  is the microparticle mass and  $n$  is the number of these microparticles, that is the condition that total mass of a particle to be composed from these  $n$  microparticles.

Was finally found that the microparticle that was determined in detail is in fact the graviton predicted by physics, but not determined until now, fact that obvious explains the gravitational general characteristics of the matter and photons.

For uniformity all physical sizes of graviton were noted with index " $\phi$ ", the rest of notations keeping the commonly usual notations.

### **Determining the physical characteristics of graviton and the structure of some fundamental particles**

We considered that the mass of a particle has a certain degree of loosening, i.e. the component microparticles are not joined to each other, respective in the medium statistics value, each microparticle has a volume of vibration  $V_\phi$  with the radius  $R_\phi$ .

That is, noting with  $V_p$  the particle volume:

$$V_p = n_p V_\phi \quad (1)$$

or:

$$\frac{4\pi}{3} R_p^3 = n_p \frac{4\pi}{3} R_\phi^3 \quad (2)$$

where  $R_p$  is the particle radius and  $n_p$  is the number of component microparticles of the particle.

Result: 
$$R_\phi = \frac{R_p}{\sqrt[3]{n_p}} \quad (3)$$

It can be observed in this case, that matter density  $\rho_\phi$  of a volume  $V_\phi$  it is equal with particle's density  $\rho_p$ .

Inside of such microvolume  $V_\phi$ , we consider that the microparticle with mass  $m_\phi$  and radius  $r_\phi$ , is in state of vibration with kinetic speed  $v$ , its kinetic vibration energy being  $W_v = m_\phi v^2$ .

Is considered theoretical a gravitational collapsed state of particle until, the Schwarzschild radius (situations existing in astrophysics). In this situation, the radius of compressed particle becomes[4]:

$$R_c = \frac{Gm_p}{c^2} \quad (4)$$

where  $G$  is Universal constant of gravity.

In this state, proceeding similar, the microvolume vibration radius of microparticle becomes:

$$R_{\phi_c} = \frac{R_c}{\sqrt[3]{n_p}} \quad (5)$$

Considering the imposed condition:  $m_p = n_p m_\phi$  (6)

equation (4) becomes :

$$\frac{Gm_\phi}{R_{\phi_c}} = \frac{c^2}{\sqrt[3]{n_p^2}} \quad (7)$$

In this situation, the density of a microvolume  $V_{\phi_c}$  is equal with the density of compressed particle  $\rho_c$ .

In equation (7) the term:  $\frac{c^2}{\sqrt[3]{n_p^2}} = w_{\phi_c}^2$  has the signification of a square of speed vibration in this compressed state.

Therefore, the kinetic energy of vibration of a microparticle will be:

$$W_{\phi_c} \cong \frac{m_\phi c^2}{\sqrt[3]{n_p^2}} \quad (8)$$

Between two states, normally and theoretical collapsed, we can write the known relation between corresponding densities[3]:

$$\rho_p = \rho_v = \rho_{\phi_c} e^{-\frac{W_{\phi_c}}{W_v}} \quad (9)$$

that is:

$$\rho_{\phi_c} = \rho_v e^{-\frac{W_{\phi_c}}{W_v}} \quad (10)$$

Logarithmizing the equation (10) and performing term substitutions and algebraic reductions is finally obtained:

$$v^2 \sqrt[3]{n_p^2} = \frac{\log e}{\log \frac{R_p^3}{R_c^3}} c^2 \quad (11)$$

Also, we can write homological equation between those two states of a microparticle which composes a particle [1]:

$$\frac{P_{\phi v}}{\rho_v^{4/3}} = \frac{P_{\phi c}}{\rho_{\phi c}^{4/3}} \cdot a \quad (12)$$

where:  $P_{\phi v}$  and  $P_{\phi c}$  are the corresponding pressures of a microparticle in those two states

Particle as a whole can be considered, as an enclosure occupied by  $n_p$  microparticles, and the pressure of the entire enclosure is therefore proportional with sum of vibration energies of all microparticles, that is:

$$m_p v^2 = n_p m_\phi v^2 \quad (13)$$

Therefore, the vibration pressure of the entire particle will be the sum of all kinetic vibration pressures of all  $n_p$  microparticles:  $P_v = n_p P_{\phi v}$ , that is:

$$P_{\phi v} = \frac{P_v}{n_p} \quad (14)$$

We can write equation (12) as:

$$\frac{P_v}{n_p \rho_v^{4/3}} = \frac{P_{\phi c}}{\rho_{\phi c}^{4/3}} \cdot a \quad (15)$$

The exponents 4/3 from denominator are usual values of polytrophic factor in this case.

Because in the collapsed state relations are:  $P_{\phi c} = P_c$  and  $\rho_{\phi c} = \rho_c$ , the pressure and density in any point within the particle are the same as in the entire particle, we can write the equation (15) as:

$$\frac{P_v}{n_p \rho_v^{4/3}} = \frac{P_c}{\rho_c^{4/3}} \cdot a \quad (16)$$

We can write the pressures  $P_v$  and  $P_c$  in well known form:

$$P_v = \frac{1}{3} \rho_v v^2 \quad (17)$$

$$P_c = \frac{1}{3} \rho_c c^2 \quad (18)$$

Because  $\rho = \rho_c$ , through substitute and simplification, the equation (16) finally becomes:

$$\frac{v^2}{n_p} = c^2 \frac{R_c}{R_p} \cdot a \quad (19)$$

Where:

a - is a factor of proportionality,

$R_p$  - the particle radius in normal state

$R_c$  - the particle radius in theoretical collapsed state, which can be easily calculated with equation (4).

In theoretically supercollapsed state (under Schwarzschild radius in astrophysics, the black holes situation), it can be considered that theoretical radius of a particle becomes :  $R_x < R_c$ , and the volume  $V_{R_x}$  of supercollapsed particle is the sum of all merged  $n_p$  microparticle volumes  $V_\phi$ :

$$V_{R_x} = n_p V_\phi \quad (20)$$

It results: 
$$R_x = r_\phi \sqrt[3]{n_p} \quad (21)$$

where  $r_\phi$  is the radius of one microparticle. In this situation, the density of the particle  $\rho_x$  is equal with itself density  $\rho_\phi$  of a microparticle:

$$\rho_x = \rho_\phi = \frac{3}{4\pi} \frac{m_\phi}{r_\phi^3} \quad (22)$$

We can also write the homologic relation between those two states: the collapsed state of the particle until the equivalent of Scharzschild radius  $R_c$  and supercollapsed state with radius  $R_x$ .

$$\frac{P_c}{P_c^{4/3}} = \frac{P_x}{P_x^{4/3}} \quad (23)$$

Where the terms values are [2]:

$$P_c = \frac{1}{3} \rho_c c^2; \rho_c = \frac{3}{4\pi} \cdot \frac{m_p}{R_c^3}; \rho_x = \rho_\phi = \frac{3}{4\pi} \cdot \frac{m_p}{R_x^3} = \frac{3}{4\pi} \cdot \frac{m_\phi}{r_\phi^3} \quad \text{and} \quad P_x = \frac{1}{3} \rho_\phi c^2 \sqrt[3]{n_p^2} \quad (24)$$

In equation (24), the term  $c^2 \sqrt[3]{n_p^2}$ , which represent a teoretical energetic speed, results simple thus:

For a microparticle the potential equation is:

$$\frac{K_\phi m_\phi}{r_\phi} = c^2 \quad (25)$$

where  $K_\phi$  is a constant of proportionality.

Multiplying the first member of equation with  $n_p$  and knowing that:  $R_x = r_\phi \sqrt[3]{n_p}$  from equation (21), the equation (25) becomes:

$$\frac{K_\phi m_\phi n_p}{r_\phi \sqrt[3]{n_p}} = c^2 \sqrt[3]{n_p^2} = \frac{K_\phi m_p}{R_x} \quad (26)$$

Replacing the terms  $P_c$  and  $P_x$  in equation (23) and calculating results:

$$\frac{1}{\rho_c^{1/3}} = \frac{\sqrt[3]{n_p^2}}{\rho_x^{1/3}}, \text{ that is: } \frac{1}{\sqrt[3]{\rho_c}} = \left(\frac{\rho_c}{\rho_x}\right)^{1/3} = \frac{R_x}{R_c}, \text{ where; } R_x = \frac{R_c}{\sqrt[3]{n_p^2}} \quad (27)$$

$$\text{or: } R_c = R_x \sqrt[3]{n_p^2} = n_p r_\varphi \quad (28)$$

It is observed that:  $R_c > R_x$ , which confirms the working assumption.

Using the equations (1-28) for those tree particle: the proton, the neutron and the electron we found for all these particles the same physical characteristics of the component microparticle, the graviton, which are:

Graviton mass	$m_\varphi = 1,842 \cdot 10^{-46} \text{ g}$
Graviton radius	$r_\varphi = 1.366 \cdot 10^{-74} \text{ cm}$
Graviton density	$\rho_\varphi = 1,725 \cdot 10^{175} \text{ g/cm}^3$
Graviton pulsating frequency	$\nu_\varphi = 2,194 \cdot 10^{84} \text{ s}^{-1}$
Graviton vibrating energy	$W_{\omega v} = 2,781 \cdot 10^{-41} \text{ erg}$
Internal energy of graviton ( $m_\varphi c^2$ )	$W_\varphi = 1,655 \cdot 10^{-25} \text{ erg}$

From equation (25) we calculated the value of  $K_\varphi$  constant and found:

$K_\varphi = 6,667 \cdot 10^{-8} \frac{cm^3}{gs^2}$  which is in fact the universal gravitational constant, so the microparticle that we found and which is part of the composition of all particles, it is in fact the graviton.

By analogy with electrical charges, we define the concept of „gravitonic charge”, note with  $q_\varphi$ , this having an attractive feature.

From equation:

$$m_\varphi c^2 = \frac{q_\varphi^2}{r_\varphi}$$

Results:  $q_\varphi = 4,755 \cdot 10^{-50} \text{ usg}$  (gravitonic charge units)

We found by calculations that the graviton is a very stable particle, which doesn't have an antiparticle and the spin is  $S_\varphi=2$ , i.e. have a statistical distribution Bose-Einstein.

In this paperwork we present the field of nuclear forces (strong) in which the graviton is exclusively involved as a theoretical result. As we know the nuclear forces are neighboring forces, with a saturation characteristic between nucleons, being achieved by the virtual mesons.

In coupling situation proton-neutron, the coupling energy is [1]:

$$W_{p-n} = W_{\pi^+} * e^{-\gamma} = n_{\pi^+} * W_\varphi e^{-\gamma} = n_{\pi^+} * m_\varphi c^2 e^{-\gamma} = n_{\pi^+} * \frac{q_\varphi^2 e^{-\gamma}}{r_\varphi} = n_{\pi^+} * \frac{G m_\varphi^2 e^{-\gamma}}{r_\varphi} \quad (29)$$

Where:

$n_{\pi^+}$  is the number of gravitons of meson  $\pi^+$

$\gamma = \frac{2\pi R_p}{2R_p} = \pi$  it is a coupling factor (the ratio between the circumference of a nucleon and its diameter in coupling direction)

G – the gravitational constant

$m_\phi, r_\phi, q_\phi$  - the physical characteristics of the graviton

Performing calculations, we obtain the value  $W_{p-n} = 6,034$  MeV which is in accordance with experimental and empirical values already known for a nucleon of light nuclei.

Similar, for coupling neutron-neutron we found:  $W_{n-n} = 5,835$  MeV, and for  $W_{p-p}$  a similar value.

Also, we calculated the spin interaction contributions between nucleons which is in accordance with known data and has a physical correspondence. It was calculated the “spin-flip” phenomenon at interaction between nucleons, as well as explaining nuclear forces of repulsion at distances lower than  $10^{-13}$  cm.

Using the new graviton physics we could calculate the field of electric and electromagnetic forces and conclude that the graviton is involved in these too.

Thus, from equation: 
$$m_p c^2 = \frac{e^2}{R_p} \quad (30)$$

where:  $m_p$  and  $R_p$  are mass and electron radius and „e” is elementary electric charge.

Knowing equations (1-28) and  $m_p = n_p m_\phi$ , finally the equation becomes:

$$e = \sqrt{n_p R_p} \cdot \sqrt{m_\phi c^2} = \sqrt{n_p R_p} \cdot \sqrt{\frac{q_\phi^2}{r_\phi}} = \sqrt{n_p R_p} \cdot \sqrt{\frac{G m_\phi}{r_\phi}} \quad (31)$$

where:  $m_\phi, r_\phi, q_\phi$  - are the physical characteristics of the graviton

Results the value:  $e = 4,804 \cdot 10^{-10}$  ues, the exact value of electrical elementary charge.

As a qualitative explanation of opposite signs of electric charges, choosing a convenient coordinate system, those two electric charges may be due to the opposite meanings of the proper pulsation amplitudes of the component gravitons.

Using the new graviton physics we could calculate accurately the spectral lines of hydrogen atom using the known equation for the energy of the photon emitted by the electron when returning from a level 2 to a level 1 [1]:

$$\Delta W = -W_2 - (-W_1) = W_1 - W_2 = h\nu = m_\phi c^2 (n_1 - n_2) = \frac{G m_\phi^2}{r_\phi} (n_1 - n_2) = \frac{q_\phi^2}{r_\phi} (n_1 - n_2) \quad (32)$$

Where  $n_1$  and  $n_2$  are the number of gravitons of electric field at levels 1 and 2. These can be easily obtained from equation:

$$\frac{n_e}{2n_{1,2}} = \frac{z}{R_e} \quad (33)$$

where  $n_e$  and  $R_e$  are the gravitons number of electron and its radius, and  $z$  is the distance between nucleus and electron.

The calculated results compared to those of the spectral lines characteristics of the hydrogen atom are perfectly consistent with those from classical physics.

We can determine by calculation not only the gravitonic structure of the electric field but also the gravitonic structure of the accompanying magnetic field for electrical charges in motion.

For an electrical charge in motion with velocity  $v_e$  the intensity of generated magnetic field  $H$  (scalar) is:

$$H = \frac{ev_e}{r^2} \quad (34)$$

Where  $r$  – is distance to the electric charge

For  $Q_c = N_c e$  charges in motion,  $N_c$  is the number of electric charges, so:

$$H = \frac{Q_e v_e}{r^2} \quad (35)$$

Replacing the terms, the intensity of magnetic field  $H$  become:

$$H = v_e \sqrt{\frac{n_{cm}}{r^3}} \cdot \sqrt{m_\phi c^2} = v_e \sqrt{\frac{n_{cm}}{r^3}} \sqrt{\frac{Gm_\phi^2}{r_\phi}} = v_e \sqrt{\frac{n_{cm}}{r^3}} \cdot \sqrt{\frac{q_\phi^2}{r_\phi}} \quad (36)$$

Where:  $G$ ,  $m_\phi$ , and  $r_\phi$  are graviton characteristics and  $n_{cm}$  is the number of gravitons of magnetic field at distance  $r$ , which can be found easily from equation:

$$\frac{n_e}{2n_{cm}} = \frac{r}{R_e} \quad (37)$$

Where:  $n_c$  and  $R_c$  represent the number of gravitons of the electron and its radius.



Table 1: STRUCTURAL CHARACTERISTICS OF PHOTONS

No.	Domain Spectrum Type		Photon $\lambda_\phi(\text{\AA})$ cm	Frequency $\nu_\phi$ s <sup>-1</sup>	Energy $W_\phi=h\nu_\phi$ erg	Mass of inertia $m_\phi = \frac{h\nu_\phi}{c^2}$ g	No of gravitons $n_\phi = \frac{m_\phi}{m_\phi}$	Photon radius $R_\phi$ cm
0	1	2	3	4	5	6	7	8
1	$\gamma$	Nuclear photons	$(10^{-3}\text{\AA})10^{-11}$	$2,998\cdot 10^{21}$	$1,986\cdot 10^{-5}$	$2,210\cdot 10^{-26}$	$1,199\cdot 10^{20}$	$1,44\cdot 10^{-18}$
2	X	X rays	$(1\text{\AA})10^{-8}$	$2,998\cdot 10^{18}$	$1,986\cdot 10^{-8}$	$2,210\cdot 10^{-28}$	$1,199\cdot 10^{17}$	$8,83\cdot 10^{-27}$
3	U.V.	Ultraviolet $\lambda_\phi=100-4000\text{\AA}$	$(1215,7\text{\AA})$ $1,2157\cdot 10^{-5}$	$2,466\cdot 10^{15}$	$1,634\cdot 10^{-11}$	$1,818\cdot 10^{-32}$	$9,871\cdot 10^{13}$	$5,02\cdot 10^{-35}$
4	Visible $\lambda_\phi=100-4000\text{\AA}$	Violet	$(4000\text{\AA})4\cdot 10^{-5}$	$7,495\cdot 10^{14}$	$4,965\cdot 10^{-12}$	$5,525\cdot 10^{-33}$	$2,999\cdot 10^{13}$	$1,98\cdot 10^{-36}$
5		Indigo	$(4350\text{\AA})4,35\cdot 10^{-5}$	$6,891\cdot 10^{14}$	$4,566\cdot 10^{-12}$	$5,081\cdot 10^{-33}$	$2,758\cdot 10^{13}$	$1,65\cdot 10^{-36}$
6		Blue	$(4900\text{\AA})4,9\cdot 10^{-5}$	$6,118\cdot 10^{14}$	$4,054\cdot 10^{-12}$	$4,510\cdot 10^{-33}$	$2,449\cdot 10^{13}$	$1,17\cdot 10^{-36}$
7		Green	$(5500\text{\AA})5,5\cdot 10^{-5}$	$5,451\cdot 10^{14}$	$3,611\cdot 10^{-12}$	$4,018\cdot 10^{-33}$	$2,182\cdot 10^{13}$	$8,10\cdot 10^{-37}$
8		Yellow	$(5900\text{\AA})5,9\cdot 10^{-5}$	$5,081\cdot 10^{14}$	$3,367\cdot 10^{-12}$	$3,746\cdot 10^{-33}$	$2,034\cdot 10^{13}$	$6,62\cdot 10^{-37}$
9		Orange	$(6200\text{\AA})6,2\cdot 10^{-5}$	$4,835\cdot 10^{14}$	$3,204\cdot 10^{-12}$	$3,564\cdot 10^{-33}$	$1,935\cdot 10^{13}$	$6,57\cdot 10^{-37}$
10		Red	$(7400\text{\AA})7,4\cdot 10^{-5}$	$4,051\cdot 10^{14}$	$2,684\cdot 10^{-12}$	$2,986\cdot 10^{-33}$	$1,622\cdot 10^{13}$	$3,67\cdot 10^{-37}$
11	$\lambda_\phi=7500-5\cdot 10^7\text{\AA}$	Infrared	$(10^5\text{\AA})10^{-3}$	$2,998\cdot 10^{13}$	$1,986\cdot 10^{-13}$	$2,210\cdot 10^{-34}$	$1,199\cdot 10^{12}$	$4,35\cdot 10^{-40}$
12	$\lambda_\phi>5\cdot 10^7\text{\AA}$	Micro-wave	$(5\cdot 10^7\text{\AA})5\cdot 10^{-1}$	$5,996\cdot 10^{10}$	$3,973\cdot 10^{-16}$	$4,420\cdot 10^{-37}$	$2,399\cdot 10^9$	$1,85\cdot 10^{-47}$

No.	Photon volume $V_\phi$ cm <sup>3</sup>	Photon density $\rho_\phi$ g/cm <sup>3</sup>	Distance radius between gravitons $R_{\phi\phi}$ cm	Medium vibration velocity of graviton $v$ cm/s	Vibrating energy of photon's gravitons $W_{\nu\phi}$ erg	The electromagnetic field amplitude of photon $A$ cm
	9	10	11	12	13	14
1	$1,250\cdot 10^{-53}$	$1,768\cdot 10^{17}$	$2,892\cdot 10^{-25}$	$3,839\cdot 10^2$	$1,285\cdot 10^{-19}$	$1,592\cdot 10^{-12}$
2	$2,882\cdot 10^{-78}$	$7,667\cdot 10^{48}$	$1,861\cdot 10^{-32}$	$4,476\cdot 10^3$	$1,746\cdot 10^{-20}$	$1,592\cdot 10^{-9}$
3	$5,296\cdot 10^{-103}$	$3,432\cdot 10^{70}$	$1,058\cdot 10^{-39}$	$4,883\cdot 10^4$	$2,709\cdot 10^{-24}$	$1,936\cdot 10^{-6}$
4	$3,250\cdot 10^{-107}$	$1,700\cdot 10^{74}$	$6,369\cdot 10^{-41}$	$7,472\cdot 10^4$	$1,217\cdot 10^{-21}$	$6,369\cdot 10^{-6}$
5	$1,881\cdot 10^{-107}$	$2,701\cdot 10^{74}$	$5,458\cdot 10^{-41}$	$7,678\cdot 10^4$	$1,181\cdot 10^{-21}$	$6,927\cdot 10^{-6}$
6	$6,705\cdot 10^{-108}$	$6,726\cdot 10^{74}$	$4,037\cdot 10^{-41}$	$7,935\cdot 10^4$	$1,180\cdot 10^{-21}$	$7,802\cdot 10^{-6}$
7	$2,225\cdot 10^{-108}$	$1,806\cdot 10^{75}$	$2,882\cdot 10^{-41}$	$8,497\cdot 10^4$	$1,144\cdot 10^{-22}$	$8,758\cdot 10^{-6}$
8	$1,215\cdot 10^{-108}$	$3,084\cdot 10^{75}$	$2,424\cdot 10^{-41}$	$8,761\cdot 10^4$	$1,134\cdot 10^{-21}$	$9,395\cdot 10^{-6}$
9	$1,187\cdot 10^{-108}$	$3,002\cdot 10^{75}$	$2,445\cdot 10^{-41}$	$8,369\cdot 10^4$	$9,847\cdot 10^{-22}$	$9,873\cdot 10^{-6}$
10	$2,069\cdot 10^{-109}$	$1,443\cdot 10^{76}$	$1,449\cdot 10^{-41}$	$9,382\cdot 10^4$	$1,037\cdot 10^{-21}$	$1,178\cdot 10^{-6}$
11	$3,446\cdot 10^{-118}$	$6,413\cdot 10^{84}$	$4,567\cdot 10^{-44}$	$2,603\cdot 10^5$	$5,907\cdot 10^{-22}$	$1,592\cdot 10^{-4}$
12	$2,651\cdot 10^{-140}$	$1,667\cdot 10^{103}$	$1,318\cdot 10^{-50}$	$1,956\cdot 10^6$	$6,667\cdot 10^{-23}$	$7,962\cdot 10^{-2}$

Regarding to electromagnetic filed were found the corresponding situations as: the photon which have those two fields, electric and magnetic perpendicular, it is a particle with constant velocity which doesn't exist in static state. To found structural characteristics of photons we use the similar methodology as in the case of particle, presented in the paper. In this way we found by calculations all detailed characteristics for photons, including the radius and the number of component gravitons (Table 1). Detailed results are presented in our complete work "New Fundamental Elements of Graviton Physics". Also, in this work are presented structural calculation elements of the gravitonic characteristics of electromagnetic waves (Table 2). The results of our research are indicated in Table 3.

**Table 2: STRUCTURAL CHARACTERISTICS OF ELECTROMAGNETIC WAVES**

No .	Type of electromagnetic wave	Length wave $\lambda_u$ cm	Frequency $\nu_u$ s <sup>-1</sup>	Energy $W_u= h\nu_u$ erg	Inertial mass $m_u$ g	No. of gravitons $n_u$	
0	1	2	3	4	5	6	
1	Radio waves	Long	$10^6$	$2,998 \cdot 10^4$	$1,986 \cdot 10^{-22}$	$2,210 \cdot 10^{-43}$	$1,199 \cdot 10^3$
2		Medium	$10^5$	$2,998 \cdot 10^5$	$1,986 \cdot 10^{-21}$	$2,210 \cdot 10^{-42}$	$1,199 \cdot 10^4$
3		Short	$10^4$	$2,998 \cdot 10^6$	$1,986 \cdot 10^{-20}$	$2,210 \cdot 10^{-41}$	$1,199 \cdot 10^5$
4		Ultra-short	$10^3$	$2,998 \cdot 10^7$	$1,986 \cdot 10^{-19}$	$2,210 \cdot 10^{-40}$	$1,199 \cdot 10^6$
5		Hertzian	$10^1$	$2,998 \cdot 10^9$	$1,986 \cdot 10^{-17}$	$2,210 \cdot 10^{-38}$	$1,199 \cdot 10^8$
6	T.F.F.	$3 \cdot 10^5$	$3,999 \cdot 10^4$	$6,621 \cdot 10^{-22}$	$7,367 \cdot 10^{-43}$	$3,999 \cdot 10^3$	

**Table 3: GRAVITONIC STRUCTURE OF THE GRAVITATIONAL FILED FOR SOME CELESTIAL BODIES**

Note: For Earth, z is distance Earth – Moon. For Moon z is distance Moon – Earth

N o.	Celestial Body		External energy of the gravitational field. $\Delta_{z-R}$ (erg)	Volume of the equivalent field sphere $V_{ech.}$ (cm <sup>3</sup> )	Equiv. radius of the volume. $V_{ech.} R_{ech.}$ (cm)	Mass of the gravitational field $m_{cgz}$ (g)	Number of field gravitons $n_{cgz}$
0	1		2	3	4	5	6
1	Sun	Sun - Earth	$3,774 \cdot 10^{48}$	$1,201 \cdot 10^{40}$	$1,379 \cdot 10^{13}$	$2,794 \cdot 10^{34}$	$1,517 \cdot 10^{80}$
		Sun -Pluto	$3,971 \cdot 10^{48}$	$8,598 \cdot 10^{44}$	$5,9 \cdot 10^{14}$	$1,831 \cdot 10^{35}$	$9,943 \cdot 10^{80}$
2	Earth		$3,673 \cdot 10^{39}$	$2,378 \cdot 10^{31}$	$1,720 \cdot 10^{10}$	$3,078 \cdot 10^{28}$	$1,671 \cdot 10^{74}$
3	Moon		$2,064 \cdot 10^{36}$	$2,378 \cdot 10^{32}$	$3,835 \cdot 10^{10}$	$1,089 \cdot 10^{27}$	$5,915 \cdot 10^{72}$

No.	Average density of the gravitational field. $\rho_{cg} \text{ (g/cm}^3\text{)}$	No. of gravitons of body $n=m/m_\phi$	$R_\phi = \frac{R}{\sqrt[3]{n}}$ (cm)	Distance between bodies: z (cm)	$R_{\phi z} = \frac{R_\phi}{R} z$ (cm)	$V_{R_{\phi z}} = \frac{4\pi}{3} R_{\phi z}^3$ (cm <sup>3</sup> )	$\rho_z = \frac{m_\phi}{V_{R_{\phi z}}}$ (g/cm <sup>3</sup> )
0	7	8	9	10	11	12	13
1	$2,325 \cdot 10^{-6}$	$1,080 \cdot 10^{79}$	$2,991 \cdot 10^{-16}$	$1,496 \cdot 10^{13}$	$6,430 \cdot 10^{-14}$	$1,113 \cdot 10^{-39}$	$1,655 \cdot 10^{-5}$
	$2,129 \cdot 10^{-10}$			$5,9 \cdot 10^{14}$	$2,536 \cdot 10^{-12}$	$6,827 \cdot 10^{-35}$	$2,698 \cdot 10^{-12}$
2	$1,294 \cdot 10^{-3}$	$3,245 \cdot 10^{73}$	$1,981 \cdot 10^{-16}$	$3,844 \cdot 10^{10}$	$1,194 \cdot 10^{-14}$	$7,128 \cdot 10^{-42}$	$2,584 \cdot 10^{-5}$
3	$4,581 \cdot 10^{-6}$	$3,991 \cdot 10^{71}$	$2,360 \cdot 10^{-16}$	$3,844 \cdot 10^{10}$	$5,220 \cdot 10^{-14}$	$5,956 \cdot 10^{-40}$	$3,113 \cdot 10^{-5}$

The work presents the correlation of the fields of fundamental forces: nuclear, electromagnetic and gravitational. This correlation is presented as a group of six synthesized equations:

1. The field of nuclear forces : 
$$W_1 = n_1 \cdot \frac{q_\phi^2}{r_\phi} e^{-\gamma}$$

2. The field of electrostatic forces: 
$$W_2 = n_2 \frac{q_\phi^2}{r_\phi}$$

3. The force field of the electric current: 
$$W_3 = n_3 \frac{q_\phi^2}{r_\phi}$$

4. Constant electromagnetic field of electric currents: 
$$W_4 = C n_4 \frac{q_\phi^2}{r_\phi}$$

5. The variable electromagnetic field: 
$$W_5 = n_5 \frac{q_\phi^2}{r_\phi}$$

6. The field of gravitational forces: 
$$W_6 = D \cdot n_6 \frac{q_\phi^2}{r_\phi}$$

In these very similar equations,  $W_{1-6}$  represents the energies of the fields,  $n_1 - n_6$  represent the number of gravitons of the fields at a certain interaction distance, C and D are characteristic of the field propagation environment,  $e^{-\gamma}$  factor characteristic of nuclear forces ( $\gamma=\pi$ ) and  $r_\phi$ ,  $q_\phi$  are characteristics of the graviton.

These six equations represents the connection between those three fields of fundamental forces: nuclear, electromagnetic and gravitational.

The paper also presents some completely new cosmogonic and astrophysical theoretical elements regarding the Big Bang and Black Holes phenomena determined on the basis of the new graviton physics.

Regarding to the new theoretical elements about the birth of the universe, until this paper the theoretical limit known as “initial time” was Planck time ( $t=10^{-43}$ s) which corresponds to  $T=10^{32}$ K, the energy  $W=10^{19}$ GeV and  $R=10^{-33}$ cm.

Using the known cosmogonic equation  $t_0 = \frac{2}{n} \cdot \sqrt{\frac{3}{8\pi\rho G}}$ , for  $n=3$  (matter) and  $\rho=\rho_\varphi$  result:

$$t_0 = 2,1479 \cdot 10^{-85} s$$

This is the moment of Big Bang.

Because the inverse of the pulsation frequency of the initial sphere mass corresponds to that of graviton matter that is

$$t_{v_{u0}} = t_\varphi = \frac{1}{v_\varphi} = 4,56704 \cdot 10^{-85} s$$

it means that between the time  $t=0$  and  $t_{v_{u0}} = 10^{-85} s$  when the Big Bang explosion took place, a single vibration of the initial sphere occurred, that is “a quanta of time”.

Inside the paper was recalculated the total mass of the Universe by adding to Eddington mass the masses of neutrinos, photons and gravitational field. The total mass of the Universe becomes [2,4]:

$$\overline{M}_U = 9,529 \cdot 10^{59} g$$

The density of the Universe mass is:  $\rho_u = \frac{\overline{M}_U}{V_u} = 3,3327 \cdot 10^{-26} \div 7,8998 \cdot 10^{-26} g/cm^3$  according to considered values. Because the known critical density of Universe is  $\rho_{cr} = 4,5 \cdot 10^{-30} g/cm^3$ , results that  $\rho_U > \rho_{cr}$  so the Universe is of oscillating type.

Were calculated the initial radius of the Universe  $R_{u0} = 2,3184 \cdot 10^{-39}$  cm, the internal energy of initial sphere  $W_{u0} = 2,612 \cdot 10^{151}$  erg and initial temperature  $T_{u0} = 1,892 \cdot 10^{167} K$ .

Using graviton physics as the new calculation methodology was calculated as an example a Black Hole with equivalent mass of three solar masses, that is  $m_{GN} = 3M_O = 5,987 \cdot 10^{33}$  g, containing  $n_{GN} = 3,2399 \cdot 10^{79}$  gravitons. We found the final collapsed radius for this Black Hole:

$$R_{GN} = r_\varphi \sqrt[3]{n_{GN}} = 4,295 \cdot 10^{-48} \text{ cm,}$$

that is similar with a photon dimension from microwave field.

It must be mentioned that full theoretical details and calculations are presented in our paper “New theoretical elements of graviton physics”.

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