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Quartic Equation and Proportion of Physical Reality

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ABSTRACT

Considering a qurtic equation as polynomial of the 4th order with non-zero coefficients a,b,c,d & e can be considered as a sum of partial equations. In order to express coefficients of these equations with the help of functional dependence on a given parameter K, solution of individual partial equations can be found, using the numerical values for the sizes of regular 4-dimesinal polyhedron surfaces will then determine their volume ratios. These ratios will also be matching the mass ratios of fundamental particles of the physical realm as for example is the mass ratio of a proton and an electron or the mass ratio of Higgs boson and an electron including the Planck and the electron mass ratio. These mass proportionality in physical realm in terms of elementary particles then enables the solution of partial equations to determine black hole the final "gravity" after the collapse of two mass objects. By these proportions the most massive objects are determined whereas from the initial mass of two objects the mass of gravitationally collapsed object can also be established.

From those equations a new elementary particle representing the dark matter could be found with likelihood of finding other particles that could explain the essence of dark energy. On the bases of gravitational objects represented by a black hole, the property of those initial objects that exclude collapse into singularity could be determined.

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Introduction

In this paper partial equations and their sums are defined and their solutions found for the defined comon condition. The found roots of quadratic and cubic equations are then substituted as sides of regular multisided bodies1 in the 4 dimensional space. Resulting volume ratios of the selected multisided bodies are then compared with rations of non-moving masses of certain elementary particles Particle Data Group that are part of the standard model of microworld [1]. These volume rations show agreement with rations of non-moving masses that could be understood as proportions of the physical reality. The quadratic equation of its own defined as the „gravitational" enables us to find constants that are characterising the resulting mass of black holes. Similarly, as when using the method of numerical solutions [2]. By the same way the proportions of the physical microworld can be described as well as proportions of mass objects like black holes.

Quadratic Equation with Varing Coefficients

Using the general form of a quadratic equation in the form [3].

$$ax^4 + bx^3 + cx^2 + dx + e = 0 \qquad (1)$$

In order to find a solution of the above defined partial equations we substitute $x=R$. This being in direct reference to the gravitational radius of massive objects, black holes in particular, where $R=r/rg$. Where $rg = Gm/c^2$ is well known gravitational radius of an object with mass m, where G is gravitational constant and c being the speed of light.

After substituting coefficiets we get

$a=K^2(K^2-4)$, $b=K^2(18-6K^2)$, $c=13K^4-26K^2+1$, $d=12K^2(1- K^2)$ a $e=4K^4$,

where parameter K is the coefficient that represent the force size between objects. It siginificance will be shown in the following section of this paper. The general equation (1) can then be rewritten in the form

$$K^2(K^2-4)R^4 + 6K^2(3-K^2)R^3 + (13K^4 - 26K^2 + 1)R^2 + 12K^2(1-K^2)R + 4K^4 = 0 \qquad (2)$$

Using the above substitutions we have defined the equation of "vacuum". The use of the inverted comers is chosen deliberately, and similarly for other definitions so it can be used as a guide when comapring other numerical values with similar numerical values for physical reality. These values also include mass ratios of selected elementary particles. Using even powers only for parameter K, it is thus sufficient using only positive K values.

[1] https://cs.wikipedia.org/wiki/%C4%8Cty%C5%99rozm%C4%9Brn%C3%A1_plat%C3%B3nsk%C3%A1_t%C4%9Blesa

Limited Characteristics of the Equation for "Vacuum"

Taking $R=0$ as a limiting factor, when the parametner $K=0$ is determined by the equetion (2). In the physical sence it denotes zero interaction at the distance $r=0$. In order to find the solution for limiting factor $R\rightarrow\infty$, thus $R\neq0$, we can then rewrite equation (2) multipling by $1/R^4$ and getastroparticle, bleck hole physics

$$K^2(K^2-4)+6K^2(3-K^2)\frac{1}{R}+(13K^4-26K^2+1)\frac{1}{R^2}+12K^2(1-K^2)\frac{1}{R^3}+4K^4\frac{1}{R^4}=0.$$

Thus formed equation for limiting factor $R\to\infty$ determines K=2. We can when parameter K=2 call it the „annihilation“ parameter and use it when looking for solution of other partial equations. It also becomes meaningfull when K=2 for limiting factor $R\to\infty$.

After finding the solution of equation (2) for limiting factor $K\to\infty$, thus $K\neq 0$. This eqation when multipling it by $1/K^4$ becomes

$$\left(1-\frac{4}{K^2}\right)R^4+\left(\frac{18}{K^2}-6\right)R^3+\left(13-\frac{26}{K^2}+\frac{1}{K^4}\right)R^2$$

$$+\left(\frac{12}{K^2}-12\right)R+4=0.$$

For $K\to\infty$ the above eqation can be simplified to

$$R^4-6R^3+13R^2-12R+4=0.$$

This equation becomes meaningfull when R_1=2 and also when R_2=1, thus for r_1=2r_g and also when r_2=r_g. These r values play important part in Newton's understading of the gravitation as well A Enstein's general theory of relativity where it determines both Schwazschileder's and gravitational diameter.

Special solution of the "vacuum" equation (2) for the „annihilation" parameter K=2 will be shown after difining partial quations and their solutions. Further defined equations when added up the eqaution (2) is optained.

Definition of the Partial „Fermion" Equation and Its Solution

We assume that "vacuum" equation (2) is given be summation of three partial equations. The first being named the „fermion" equation in the form:

$$(13K^4-26K^2+1)R^2-12K^2(K^2-1)R+K^4=0 \quad (3)$$

Solving this quadratic equation for the "annihilation" parameter K=2 and substituting it into the eqation (3) we obtain.

$$105R^2-144R+16=0, \quad (4)$$

whose two roots we will label R_{F1}=1,249472327 and R_{F2}=0,1219562443. These roots of equation (4) have the following attribute.

$\frac{1}{6}\frac{R_{F1}{}^4}{R_{F2}{}^4}$= 1836,281044. This ratio is with a small deviation in agreement with the mass ratio of a proton and an electron 1836,15267389 [1].

From the above R_{F2} is regarded as a side lenth of tesseract in 4-dimensional space whose volume is defined by forth power of the side length. One sixth of the forth power of the side R_{F1} is the volume of 16cell of the same space (volume), this being dual to tesseract.

Definition of the Partial "Boson" Equation and Its Solution

The "boson" equation is formed by the sumation of the „fermion and "gravitation" equations for "vacuum" and then becomes the cubic equation.

$$K^2(18-L)R^3-(13K^4-26K^2+1)R^2-12K^2(K^2-1)R-K^4=0. \quad (5)$$

Significance of the paramer L will become clear when the third equation is solved as shown below. For L=18 the equation (5) changes into the quadratic form.

$$(13K^4-26K^2+1)R^2+12K^2(K^2-1)R+K^4=0 \quad (6)$$

whose two roots when K=2 are in agreement with the roots of the equation (4) except for the change of sign.

The ratio $\frac{1}{6}\frac{R_{B1}{}^4}{R_{F2}{}^4}$= 1836,281044 has the same value as is the case in the equation (3).

Now let us solve the equation (5) for different parameters L. First for L=9,767 the value of which will be used later in the case that support the choice of this value.

After substituting K=2 in the equation (5) the eqation can be re-written in the standard form

$$R^3-\frac{105}{4(18-L)}R^2-\frac{144}{4(18-L)}R-\frac{16}{4(18-L)}=0. \quad (7)$$

After substituting for L the value found by solving the cubic equation (7) we obtain three factual roots.

R_{B1}=4,245334…, R_{B2}=-0,934478… a R_{B3}=-1,2246…. The ratio of volumes $\frac{1}{6}\frac{R_{B1}{}^4}{R_{F2}{}^4}$=2,44726·10^5.

Using the above figure and multiplying it by the mass of an electron 510,9989461 keVc^{-2} we obtain the mass of Higgs boson 125,05475 GeVc^{-2} [1]. The volume ratio of polyhedrons with sides R_{B1} and R_{F2} agree with the ration of the resting mass of Higgs boson and that of an electron. Special solution of the equation (5) for value close to 18 where parameter L=17,999707558 we obtain 3 factual roots i.e. R_{B1}=89762,75999…, R_{B2}=-1,249453… and R_{B3}= -0,121956284707267. These figures agree with volume ratios.

$\frac{1}{6}\frac{R_{B1}{}^4}{R_{F2}{}^4}$=4,8912219891·10^{22}. Numerical ration of these volumes agrees with numerical ration of the Planck and electron masses, that is m_P=2,499409289.10^{19} GeV/c^2. The ratio $\frac{1}{6}\frac{R_{B2}{}^4}{R_{F2}{}^4}$=1836,1676.

The ratio of these volumes is numerically close to the mass ratio of a proton and an electron, where m_p/m_e=1836,15267389 while m_p=938,2720813 MeV/c^2 [1]. While $R_{F2}+R_{B3}$ = −4,04·10^{-8}, the solution of equation (5) for parameter L=18,00619440927, we get three factual roots R_{B1}=-0,1219558644…, R_{B2}=-4236,32038… and R_{B3}=-1,2498880831434211. This R_{B2} figure agrees with the volume ratio $\frac{1}{6}\frac{R_{B2}{}^4}{R_{F2}{}^4}$=2,4265·10^{17}. Providing we multiply this ratio with the mass of an electron we get 1,23996·10^{14} GeV/c^2. Value of R_{B3} agrees with the volume ratio $\frac{1}{6}\frac{R_{B3}{}^4}{R_{F2}{}^4}$=1838,683562.

This ratio of volumes with a small deviation is geting close to the numerical value of a neutron and an electron masses where where m_n/m_e=1838,683661 and m_n=939,565413 MeVc^{-2} [1]. Similarly as in the previous case we find that $R_{F2}+R_{B1}$=3,799·10^{-7}.

Definition of the Partial "Gravitational" Equation and Its Solution

Following the third equation obtained by sumation of equations (3) and (5) we obtain equation (2) in the form

$$K^2(K^2-4)R^4+K^2(L-6K^2)R^3+(13K^4-26K^2+ +1)R^2+12K^2(K^2-1)R+4K^4=0 \quad (8)$$

The equation (8) can be re-written for K=2 in the form

$$R^3+\frac{105}{4(L-24)}R^2+\frac{144}{4(L-24)}R+\frac{64}{4(L-24)}=0 \quad (9)$$

The equation (9) can then be use to solve for any arbitrary value of L. However, when comparing volumes of regular polyhedrons in 4 diemsional space and when comparing it with masses of particles in the microworld we can solve this eqation for two chosen values of L. First, we find the solution when L=24. For this case the equation (9) changes into the quadratic equation.

$$105R^2+144R+64=0 \quad (10)$$

The equation (10) has two complex roots. This solution is the boundary limit between solution equation (9) for L>24 and solution for 0<L<24. In this interval we are interested in the solution of equation (9) for L=18,006195695 followed by R_{G1}=5,54868083091149 and further for $\frac{1}{6}\frac{R_{G1}^4}{R_{F2}^4}$=7,14153971·10^5.

These volume ratios with a small deviation is close to a quadruple mass of intermediate boson Z^0 to the mass of an electron, where $4m_Z/m_e$=7,13798·10^5 where m_Z=91.1876 GeV/c^2.

The equation (9) has two special solution. When L=17,875, we can obtain one root R_{G1}=2 and two roots R_{G2}=1,142857097002739 and R_{G3}=1,1428578871115. For the root R_{G1} we get

$\frac{R_{G1}^4}{R_{F2}^4}$=72327,56. This ratio corresponds to the mass of 36,9593 GeV/c^2.

In the case of roots R_{G2} a R_{G3} the volume ratio $\frac{R_{G2}^4}{R_{F2}^4}$=7711,725.

In this case the equivalent mass being multiple of an electron mass that equates to 3,94 GeV/c^2.

Bearing in mind the numerical value of roots R_{G2} a R_{G3} mutualy differ numeriacally up to by the order of seven decimal places and in the same order will differ the mass, here rounded to 3,94 GeV/c^2.

Second special solution of the equation (9) for L=17,75 the first root being R_{G1}=1,600000003441276, the second root R_{G2}=1 and the third root R_{G3}=1,599999996558724. In this case the volume

ratio being $\frac{R_{G2}^4}{R_{F2}^4}$=4520,47 with the equivalent mass of 0,385 GeV/c^2. For both roots R_{G1} a R_{G3} volume ration is $\frac{R_{G1}^4}{R_{F2}^4}$=183195,12.

By multipling the mass of an electron with the given figure we get mass of 93,61 GeV/c^2, that can be comapred with the mass of the intermediate mezonu Z^0=91,1876 GeV/c^2.

The Equation of "Vakuum"

The "vakuum" equation (2) is obtain by adding up three previous eqations "fermion" (3), "boson" (5) and "gravitational" (8). In the introduction the range of validity is mentioned for 0≤R<∞ and parametr 0≤K<∞. At the same time the use of parametr K=2 is justified. Solving eqution (2) and similarly as equations (3), (5) and (6) for K=2. By substituting into the equation (2) the „vakuum" equation can be written in the standard form

$$R^3-\frac{35}{8}R^2+6R-\frac{8}{3}=0 \quad (11)$$

The equation (11) has one real and two complex roots. The real root R_{V1}= 2,19496887746… is valid for $\frac{1}{6}\frac{R_{V1}^4}{R_{F2}^4}$=17488,2378

or provided we use the volume ration of tesseract with given sides, then $\frac{R_{V1}^4}{R_{F2}^4}$=104929,4268. From physical point of view the vakuum as such is interpreted as a range of virtual particles that can appear in some actual proceses. Gravitina and graviton could be such virtual particles that constitute the gravitational field. From the above mentioned numerical values we could speculate about gravitin with lower mass m_{gd}=8,93647 GeV/c^2 because mgd/m_e=17488,2378 and also gravitin with upper mass m_{gu}=53,6188 GeV/c^2 because mgu/me=104929,4268. This speculation is based on similar arranagement of the fermion couple thus an electron and a proton carrying elementary electrical charge. In case of gravitin their masses are elementary entity of the „gravitational charge".

Sumation of the "Fermions" Equation (3) and the „Bosons" Equation (5)

Adding up equation (3) and (5) we obtain the equation

$$K^2(18-L)R^3-24K^2(K^2-1)R=0 \quad (12)$$

Its solution has three real roots R_{FB1}=0 for any K. Thus ration $\frac{R_{FB1}^4}{R_{F2}^4}$=0.

If we consider that the stationary mass of a foton is zero than its ratio corresponds to mf/me=0.

We can find two factual roots for K=2 as

K=2 as $R_{FB2,3}$=±√72/(18-L). Chosing parametr L=9,369258288 will define the ratio $\frac{R_{FB2,3}^4}{R_{F2}^4}$=314595,5584.

This volume ratio of tesserakts is equal to the mass ratio 2mW±/m_e=314595,5584 from which mW±=80,379 GeVc^{-2}. The mass ratio of an electron and to double mass of intermediate boson W±.

Sumation of the "Fermion" Eqation (3) and the "Gravitation" Eqation (8)

Adding up equations (3) and (8) we get

$$K^2(K^2-4)R^4+K^2(L-6K^2)R^3+2(13K^4-26K^2+1)R^2+5K^4=0 \quad (13)$$

Considering K=2 after some manipulation we obtain standard cubic equation without a linear part.

$$R^3+\frac{210}{4(L-24)}R^2+\frac{80}{4(L-24)}=0 \quad (14)$$

The solution of eqation (14) has one real root and two complex roots when L=0.

The real root R_{FG1}=2,339725… and its corresponding volume ratios To this numerical value of ratios corresponds the particle mass of 11,5375 GeV/c^2 in ratio to the mass of an electron. For L=18 the equation (14) has one real root R_{FB1}=8,791115… and corresponding volume ratios

$\frac{1}{6}\frac{R_{FG1}{}^4}{R_{F2}{}^4}$=4,504·10^6. To this numerical value of ratios corresponds the mass particle 2,3 TeV/c^2 in ratio to the electron mass.

The special case of the equation (14) solution, which we multiply by a factor 4(L-24), for L=24, the imaginary root R_{FB1}=80/210i. The forth power, thus the volume of a regular polyhedron in four dimensional space is positive and represent the regular volume. This volume when multiplied by the numerical coeficient of a corresponding regular polyhedron in four dimensional space can be used to determine the volume ratio $R_{FG1}{}^4$=0,02106118335. Because of the existance of six regular polyhedrons in four dimensional space we obtain six volume ratios that correspond to six mass particles. The individual volume ratios are as follows:

5cell- tesseract $\frac{\sqrt{5}}{96}\frac{R_{FG1}{}^4}{R_{F2}{}^4}$=2,21758 and corresponds to the mass of 1,133 MeVc^{-2},

16cell-tesseract $\frac{1}{6}\frac{R_{FG1}{}^4}{R_{F2}{}^4}$=95,2065… and corresponds to the mass of 8,108 MeVc^{-2},

8cell-tesseract $\frac{R_{FG1}{}^4}{R_{F2}{}^4}$=15,86775… and corresponds to the mass of 48,65 MeVc^{-2},

24cell-tesseract $2\frac{R_{FG1}{}^4}{R_{F2}{}^4}$=190,413… and correspons to the mass of 97,3 MeVc^{-2},

120cell-tesseract $\sqrt{(2207+987\sqrt{5})}\frac{1125}{8}\frac{R_{FG1}{}^4}{R_{F2}{}^4}$=75009,106

and correspons tothe mass of 38,3 GeVc^{-2},

600cell-tesseract $\frac{25(2+\sqrt{5})}{4}\frac{R_{FG1}{}^4}{R_{F2}{}^4}$=2520,63… and corresponds to the mass of 1,288 GeVc^{-2}.

Considering the last three most massive volume ratio from above we obtain evarage (0,0973+38,3+1,288)/3=13,228 GeVc^{-2}. Providing we look at the value representing the dark energy at ≈68% then when considering k ≈5% of barion mass then the mass of barion particle is 5·13,228/68=0,977GeVc^{-2} which is amost the same as the mass of proton 0,936GeVc^{-2}. When considering the imagianry type R_{FG1}=80/210i it can be speculated that the dark energy is in essence as an effect of this mixture of these "virtual" masses as bacground of physical vakuum.

Sumation of the "Boson" Eqation (5) and the "Gravitation" Eqation (8)

Adding up equation (5) and (8) we get

$$K^2(K^2-4)R^4+K^2(18-6K^2)R^3+3K^4=0 \quad (15)$$

Considering K=2 and after some manipulation we obtain equation.

$$-24R^3+48=0 \quad (16)$$

The solution of the equation (14) shows one real root $R_{BG}=\sqrt[3]{2}$.

Volume ratio of the tesseract with the site R_{F2} to the volume of tesseract with the site R_{BG} has a numerical value $\frac{R_{BG}{}^4}{R_{F2}{}^4}$=11387.

If we multiply this value with the the mass of an electron we then obtain mass of 5,819 GeVc-2, which corresponds to six times the mass of a proton thus that eqates approximately to six times of the barion mass when the composition of the universe is considered. Considering the above we can assume that a particle with this mass is the particle of the dark matter we search for. This would suppose that these particles have the same numerical density as the barion in the compossition of the universe.

Solution of the "Gravitational" Eqation for black Holes

Equation (8) in the form

$$K^2(K^2-4)R^4+K^2(L-6K^2)R^3+(13K^4-26K^2+1)R^2+12K^2(K^2-1)R+4K^4=0$$

We can first solve for R_1=2 and L=9,767, that we used to solve the "boson" eqation (5) to determine the volume ratio that is equal to the mass ration of an electron and the mass of a Higgs boson. This solution enables us to determine the mass of a black hole.

For given values of R_1 and L we find corresponding value of K_1=0,18885409673659085. The same value of parametru K1 also corresponds in this eqation for R_3=0,012362917264635. For given R_3 solution of the equation also corresponds for K_2=0,0321331428386. Values of K_1 and K_2 can be used to calculate directly the mass of the black hole that is created by the colapse of two objects with mass m_1 a m_2, where $m_1 \geq m_2$. The mass of the black hole we can then determine by the following eqation

$$M_S=m_1+C_s m_2 \quad (15)$$

where

$$C_s=1-\frac{(K_1+K_2)}{2}\sqrt{1+2sin\omega cos\omega)} \quad (16)$$

and ω is combined angle of the average of the two parameters K_1 a K_2. With the help of the resultant mass of the black hole M_S, where index S denotes the mass acquired by combination of two states, the equivalent mass of the gravitational waves we can be determined from

$$M_{gws}=m_1+m_2-M_S. \quad (17)$$

Values of M_S, C_S and M_{gws} defined by equations (15), (16) a (17) are shown in the Table 1 together with entry parameters of masses m_1, m_2 and the parameter ω. The unit of mass is the mass of the Sun as quated in the original colaborative work of LIGO-Virgo [2,4,5].

Figures for the mass of black holes M_{gtr} were taken from the above publications together with emitted graviational waves Mgwgtr for masses of colapsing objects m_1 and m_2. Ratios M_S/M_{gtr} and M_{gws}/M_{gwgtr} show a degree of agreement with calculation presented in this paper.

The second solution of the equation when R_2=1 and L=9,767. For the above values of R_2 and L the value of K_3=0,1782579959600742 was found. The resultant K_3 also agrees with this equation when R_4=0,01100197289968. The solution of this eqation for resulting R_4 also agrees for K_4=0,0303569329137. Combiantion of these parameters is not discussed in this paper since the above applies only for distances smaller then 2rg.

They are nonsingular inner states of a black hole, that could be described in terms of elementary particles in connection with denisities of given volumes multiplied by 0,011r_g.

Value of R_4=0,01100197289968 in connection with volume ratio is notable. Since $\frac{\sqrt{5}}{96}\frac{R_4{}^4}{R_{F2}{}^4}$=1,54269·10^{-6} (the ratio of 5 regular four dimensional 5cell and regular four dimensional 16cell), then multiplying mass of an electron by this number defines the mass of 0,7883 eVc^{-2}. This mass is in the area of predicted neutrinos masses.

Bearing in mind the existance of of independant solution of eqaution (8) for R_1=2 a R_2=1 it is possible to chose when trying to determine the mass of a black hole extended mixture of states represented by parameters K_3 a K_4. It is however not addressed in this paper.

Summary Solution of Defined Eqations for K=2

In order to facilitate the overview of obtained solutions of individual equations and compared volumes of regular polygons in four-dimensional space the results are arranged and listed in Table 2. The first column of the table refer to equations that are dependent on the parameter *L*. The second column in the table are copied values of volume rations of regular polygons in four-dimensional space. The sides of these polygons have been obtained by solving the the above given equations that were simplified by substitution for *K*=2 to cubic equations and a quadratic equation in case of varying *R*. The values in the third column were obtained by multiplying resting mass of an electron where me=0,5109989461 MeVc^{-2}. The fourth column is used to designate the calculated values using the conventional name/title for particles used in the standard model [6].

Table 1

Object	m_1	m_2	ω	»	C_s	M_s	M_{gws}	M_{gtr}	M_{gwgtr}	M_s/M_{gtr}	M_{gws}/M_{gwgtr}
GW150914	35,6	30,6	94,600	»	0,8987	63,1009	3,0991	63,1	3,1	1,000	1,000
GW151012	23,3	13,6	90,100	»	0,8897	35,3999	1,5001	35,7	1,5	0,992	1,000
GW151226	13,7	7,7	78,800	»	0,8701	20,4001	0,9999	20,5	1	0,995	1,000
GW170104	31	20,1	90,550	»	0,8906	48,9005	2,1995	49,1	2,2	0,996	1,000
GW170608	10,9	7,6	85,700	»	0,8815	17,5996	0,9004	17,8	0,9	0,989	1,000
GW170729	50,6	34,3	71,400	»	0,8600	80,0992	4,8008	80,3	4,8	0,997	1,000
GW170809	35,2	23,8	88,450	»	0,8866	56,3001	2,6999	56,4	2,7	0,998	1,000
GW170814	30,7	25,3	91,900	»	0,8932	53,2987	2,7013	53,4	2,7	0,998	1,000
GW170817	1,46	1,31	123,730	»	0,9695	2,7300	0,0400	2,73	0,04	1,000	1,000
GW170818	35,5	26,8	94,850	»	0,8992	59,5997	2,7003	59,7	2,7	0,998	1,000
GW170823	39,6	29,4	89,100	»	0,8878	65,7009	3,2991	65,6	3,3	1,002	1,000
GW190425*	2,39	1,195	53,000	»	0,8453	3,4001	0,1849	3,4	0,185	1,000	1,000
GW190425*	1,88	1,595	90,400	»	0,8903	3,3000	0,1750	3,3	0,175	1,000	1,000
GW190412**	31,7	8	73,350	»	0,8625	38,5998	1,1002	38,6	1,1	1,000	1,000
GW190412**	27,5	9	76,400	»	0,8666	35,2996	1,2004	35,3	1,2	1,000	1,000
GW190412**	29,7	8,4	78,100	»	0,8691	37,0004	1,0996	37	1,1	1,000	1,000

*) Variation of entry values m_1 & m_2 for GW190425.
**) Variation of entry valus m_1 & m_2 for GW190412.

Table 2

Equation for *K*=2	Values of Volume Rations	Multiplier of Electron Mass	Conventional Particle Designation
"vacuum" (2)	17488,2378	8,93647 GeVc^{-2}	? (gravitino down)
"vacuum" (2)	104929,4268	53,6188 GeVc^{-2}	? (gravitino up)
"fermion" (3)	1836,281044	938,33767 MeVc^{-2}	proton
"boson" (5), L=18	1836,281044	938,33767 MeVc^{-2}	proton
"boson" (5), L=9,767	2,44726·10^{5}	125,05475 GeVc^{-2}	Higgs boson
"boson" (5), L=17,9997…	4,8912219891·10^{22}	2,499409289·1019 GeVc^{-2}	Plancks mass
"boson" (5), L=17,9997…	1836,1676	938,26438 MeVc^{-2}	proton
"boson" (5), L=18,00619…	2,4265·10^{17}	1,2399·1014 GeVc^{-2}	Mass of monopóle?
"boson" (5), L=18,00619…	1838,683562	939,5653624 MeVc^{-2}	neutron
"gravitation" (8), L=18,00619…	7,14153971·10^{5}	364,932 GeVc^{-2}	4x boson Z0
"gravitation" (8), L=17,875	72327,56	36,9593 GeVc^{-2}	?
"gravitation" (8), L=17,875	7711,725	3,94 GeVc^{-2}	?
"gravitation" (8), L=17,75	4520,47	2,31 GeVc^{-2}	?

"gravitation" (8), L=17,75	183195,12	93,61 $GeVc^{-2}$	≈ boson Z^0
"fermion+boson" (12), L≠0	0	0	foton
"fermion+boson" (12), L=9,369	314595,5584	160,758 $GeVc^{-2}$	2x boson $W^{\pm}$
"fermion+gravitation" (13), L=0	22579,67	11,5375 $GeVc^{-2}$	?
"fermion+gravitation" (13), L=18	$4{,}507 \cdot 10^6$	2,3 $TeVc^{-2}$	?
"fermion+gravitation" (13), L=24	2,2.. to 75009,1	1,133 $MeVc^{-2}$ to 38,3 $GeVc^{-2}$	dark energie?
"boson+gravitation" (15)	11387	5,819 $GeVc^{-2}$	dark mass?

Conclusion

Standard solution of partial equations when added up determine quartic equation with changing coefficients introduced in this paper have suprising congruence with proportions of physical reality. This was achieved by substituting $R=r/r_g$ and this mathematical solution enable us to compare it with proportions of microworld in sense of finding congruence of volume rations of regular polygons with mass rations of selcted elementary particles with the mass of an electron. Chosing an electron was as a result of being the lightest of the known elementary particles. This was particularly due to the mass ration of an electron and a proton, a neutron mass and an electron, the mass of Higgs boson to the mass of an electron and the mass of an electron and particles of intermedial bosons $W^{\pm}$, Z. The same way it is possible to determine the Plancks' mass, which is the combination of the universall constant c (speed of light), h (Plancks constant) and G (graviational constant). The wider group of equation solutions and the interpretation of volume rations includes the predication of probable mass of particle identiy of dark energy and probable a virtual mass particle identiy of the dark energy and the estimate of neutrino mass.

The „boson“ equation enable us to determine the the mass of a proton just by knowing the universal constant c, h, G and by their combination to determine the Plancks mass. The „ fermion“ eqation then based on knowing the mass of a proton determines the mass of an electron.

The congruence of volume ratio with masses of elementary particles is not incidental, since the special solution of partial eqaution for graviation enable us to form mathamatical formula to calculate the mass of a black hole after the colapse of two mass objects. In such a case it can be considered as being a proportion of the macroworld. The calculated masses of black holes are in general congruent with masses that are quoted in documents LIGO-Virgo [2,4,5].

Simplified names of individualy defined eqations and their sumation are used in Table 2, which also shows the defined rations of regular polygons and their multipliers of the mass of electron that is 0,5109989461±0,0000000031 MeVc-2 (Particle Data Group [1].

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Data Availability

The datasets were derived from sources in the public domain:

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