About one sight at the Coulomb's law (YRA-sight)

Robert Yusupov
Free researcher, dialectical materialist
Laboratory of the dialectical materialism, physics and cosmology
YRA-academy, Virtual University
690018 Vladivostok, Russian Federation (USSR)

written: June 2013, reconsidered: November 2013, corrected: February 2016

In the present paper the brief analysis of the formula expressing the Coulomb's law about interaction of two dot electrical charges is presented. The coefficient of proportionality in the Coulomb's law formula has obviously the far-fetched sense. The moving of the far-fetched part of the coefficient, its constant factor into the value of the quantity of the electrical charge is viewed. In this case the physical quantity the electrical charge will accept the natural value. This change will demand improvement system of the Planck quantities. In the appendix the improved system of the Planck quantities is given.

Keywords: fundamental physical quantities, Planck's quantities, Coulomb's law.
PACS: 06.20.Jr, 06.20.fa, 06.30.Ft.

1. Introduction

In the present paper the results of the author's research on the matter of the sense and of the value of the coefficient of proportionality in the Coulomb's law about interaction of two dot electrical charges are presented. It is known the proportionality coefficient in the Coulomb's law in one of its shapes is the product of the speed of the light in the square and of a constant factor. It is absolutely not clear, why the nature should choose this factor for own law. It is a question about factor 10^{-7}. There are no rational explanations of it. It is represented quite logical to try to carry this factor to the quantity of an electrical charge. It will demand the corresponding redefinition of the quantity of an electrical charge. The numerical value of an electrical charge will decrease in $10^{3.5}$ times. The proportionality coefficient will become simpler. It becomes equal to the speed of light in the square. It will cease to be far-fetched. In the present paper majority numerical values are given with 6 significant figures as rule.

2. Basic part

We will be defined with concepts. Under the Planck's quantities we will understand physical quantities of the Planck masses, of the elementary charge, of the Planck length, of the Planck time. The values of these quantities are available on a site NIST[1]. Using these physical quantities as the basic quantities, it is possible to define the others some physical quantities as the derivative quantities. In labels of all these physical quantities we will use in addition the subscript symbol P. We will term this system of physical quantities as P-system. Together with this P-system we will enter into viewing the R-system of the physical quantities. Both systems will be to consist of the same physical quantities. But the basic physical quantities of the R-system will be the improved Planck's quantities. Therefore and all physical quantities of the R-system will be the improved quantities. In labels of all these physical quantities we will use in addition the subscript symbol R. In the appendix, table 1 the comparative list of some physical quantities for R-system and P-system is given. The improved basic physical quantities of the R-system are defined by the equalities:

$$m_R = m_P/6.52501,\ l_R = l_P/6.52501,\ t_R = t_P/6.52501,\ e_R = e_P/6.52501. \qquad (1)$$

Let's note that under the similar formula

$$q_R = q_P/6.52501$$

the value of the Planck charge will be recalculated. As a result of this definition (1) we will get the improved system of the Planck's quantities, R-system. In the R-system the numerical equality $m_R l_R = t_R$ is carried out. For the P-system it is not so. For the Planck's quantities for the P-system other numerical equality is carried out:

$$m_R l_R = 6.52501 \cdot t_R.$$

Instead of a concrete special case of use of the formula $m_R l_R = t_R$ we will use further the generalized shape for record of this formula $mr = t$. The equality $mr = t$ is the mathematical record of the nature law. In the "physics" language this law sounds so: "for each fundamental particle the product of its rest mass *m* and its Compton radius *r* is equal to the value of the Planck's time t_{Pl}, or in other words is equal to the reciprocal value of the Planck's frequency f_{Pl}". It would be more correct to term it as law of the existence of the fundamental particles. Let's note that the hypothetical fundamental particle with a rest mass equal to the Planck mass and the Compton radius equal to the Planck length satisfies to this law in R-system and does not satisfy to this law in P-system. The following equalities take place:

$$m_R l_R = t_R,$$

$$m_P l_P = 6.52501 \cdot t_P.$$

It can serve as indirect acknowledgement of existence of these particles in the nature. And the existence of these particles will be the direct proof of correctness of R-system. Let's calculate the value of the Planck momentum for the R-system. As a result we will get:

$$m_R c_R = 1 \cdot [\mathrm{kg\,m\,s^{-1}}].$$

[1] http://physics.nist.gov/sonstants

This is consequence of this law. It means that numerical values of the physical quantities of the Planck mass and of the speed of the light are the reciprocal values. We will note that for the R-system the equality:

$$\hbar_R/c_R = m_R l_R$$

takes place and the similar equality:

$$\hbar_P/c_P = m_P l_P$$

takes place for the P-system. The physical quantity $\hbar_R/c_R$ ($\hbar_P/c_P$ for P-system) is used in the formula of calculation of a Compton's wave length (also a Compton's radius) of the fundamental particle on its mass. It is the following formula:

$$\lambda_R = 2\pi\hbar_R/(m_R c_R).$$

It is other shape of the nature law. This is concrete expression of the nature law for the fundamental particles. It is clear that numerical values of a Compton wave length and a Compton radius will be different in the P-system and in the R-system. But their relation will be same for all fundamental particles and is equal to quantity:

$$\lambda_P/\lambda_R = \hbar_P/\hbar_R = h_P/h_R = (6.52501)^2 = 42.57579.$$

The value 6.52501 is, according to (1), coefficient of transition from the P-system to the R-system. A feeble link in a modern physics is the explanation of sense and value of coefficient of proportionality in the formula of the Coulomb's law, the law of the interaction of the dot electrical charges. As it is known this law is expressed by the following formula:

$$F_{Co} = 1/(4\pi\epsilon_0) \cdot q_1 q_2 r^{-2} = c_R^2 10^{-7} \cdot q_1 q_2 r^{-2} \text{ N}.$$

Somehow here the factor 10^{-7} unnaturally looks as a part of coefficient. Why the nature should mark this factor? Probably, in the nature plans, this factor should be as a part of the value of the elementary charge. Let's make so, let's place this coefficient in the value of the quantity of an electrical charge. The formula of the Coulomb's law becomes easier. For the two dot elementary charges it will become:

$$F_{Coe} = 1/(4\pi\epsilon_0) \cdot e_R^2 l_R^{-2} = c_R^2 10^{-7} \cdot e_R^2 l_R^{-2} = c_R^2 \cdot (e_R/10^{3.5})^2 \cdot l_R^{-2} \text{ N}.$$

Let's write down it shortly:

$$F_{Coe} = c_R^2 \cdot (e_R/10^{3.5})^2 \cdot l_R^{-2} \text{ N}.$$

The coefficient of proportionality becomes equal to the speed of light in square. It is more natural. New unit of quantity of the electricity we will designate as usual a coulomb. But numerical value of a coulomb (a new coulomb) will be another. We will calculate numerical value of the elementary charge, without transferring to new labels. We will get following numerical value:

$$e_R = e_P/(6.52501 \cdot 10^{3.5}) = 2.45544 \cdot 10^{-20}/10^{3.5} = 7.76478 \cdot 10^{-24} \text{ C}.$$

For the Planck charge we will get following numerical value:

$$q_R = q_P/(6.52501 \cdot 10^{3.5}) = 2.87439 \cdot 10^{-19}/10^{3.5} = 9.08963 \cdot 10^{-23} \text{ C}.$$

For the new modified charges equality will take place:

$$e_R^2/q_R^2 = \alpha.$$

Here α is the fine-structure constant.

The formula of a modified Coulomb's law for two elementary charges will look like:

$$F_{Coe} = c_R^2 \cdot {e_R}^2 l_R^{-2} \text{ C}.$$

In the generalized view the Coulomb's law for two the dot electrical charges in R-system will look like:

$$F_{Co} = c_R^2 \cdot q_1 q_2 r^{-2} \text{ C}.$$

The labels are trivial. The proportionality coefficient is equal to the speed of light in square. The charges in the formula have the modified values. The formula of the recalculation the values of the charges for the transition from the P-system to the R-system will look like:

$$q_{new} = q_{old}/(6.52501 \cdot 10^{3.5}).$$

The elementary Coulomb forces for the modified Coulomb's law in the R-system will be equal to:

$$F_{Co} = c_R^2 \cdot q_R^2 l_R^{-2} = 1.21034 \cdot 10^{44} \text{ N},$$

$$F_{Coe} = c_R^2 \cdot e_R^2 l_R^{-2} = 8.83227 \cdot 10^{41} \text{ N}.$$

The values of forces of Coulomb interactions have not changed, remained former. It was the inside modification of the Planck's quantities of the charge and of the elementary charge of the R-system. It was the second transformation of the Planck's quantities. This transformation was related to modifying of a Coulomb's law. Values of some physical quantities have changed. These changes are presented in the appendix, table 2.

3. Inference

The defined in paper the improved R-system of physical quantities let's explain simply the interrelation of such substances of fundamental particles, as the mass, the Compton radius and the Planck time. It is the nature law. Any fundamental particle is characterized by an own rest mass and Compton radius. Product of these quantities is constant numerically equal to the value of the Planck time. Figuratively being expressed, any fundamental particle represents pulsing with the Planck frequency within the Compton radius object. Quite probably this object is a string. The improved R-system of physical quantities and the rethought Coulomb's law is more preferable than existing P-system and a Coulomb's law in the usual formulation. The far-fetched constant in the Coulomb's law is eliminated. But the most important thing that these improvements reflect the validity more precisely, they is fuller and is adequate in physics language feature the nature, they correspond to the nature is better. The author is grateful to grandson Maksim for joint walks during which time it was well thought over those questions which have found reflection in this article. The author expresses gratitude to the Emeritus professor A. Alfonso-Faus for the made valuable advices and remarks at the discussion of this paper. All remained errors remain for the author.

Appendix

Table 1

Comparable physical quantities

name quantity	symbol and the defining formula (for P-system)	R-system	P-system
Planck mass, kg	$m_R\ (m_P)$	$3.33564 \cdot 10^{-9}$	$2.17651 \cdot 10^{-8}$
elementary charge, C	$e_R\ (e_P)$	$2.45544 \cdot 10^{-20}$	$1.602\,18 \cdot 10^{-19}$
Planck charge, C	$q_R = e_R/\alpha^{0.5}\ (q_P)$	$2.87439 \cdot 10^{-19}$	$1.87555 \cdot 10^{-18}$
Planck length, m	$l_R\ (l_P)$	$2.47693 \cdot 10^{-36}$	$1.61620 \cdot 10^{-35}$
Planck time, s	$t_R\ (t_P)$	$8.26214 \cdot 10^{-45}$	$5.39106 \cdot 10^{-44}$
Planck frequency, c^{-1}	$f_R = t_R^{-1}\ (f_P)$	$1.21034 \cdot 10^{44}$	$1.85492 \cdot 10^{43}$
speed of light, m s^{-1}	$c_R = l_R/t_R$	299 792 458	299 792 434
constant of gravitation, $m^3\ kg^{-1}\ s^{-2}$	$G_R = l_R^3 m_R^{-1} t_R^{-2}$	$6.67384 \cdot 10^{-11}$	$6.67384 \cdot 10^{-11}$
Planck energy, J	$E_R = m_R c_R^2 = c_R$ $(E_P = m_P c_P^2)$	299 792 458	$1.95615 \cdot 10^{9}$
Planck energy, eV	$E_R/e_R\ (E_P/e_P)$	$1.22093 \cdot 10^{28}$	$1.22093 \cdot 10^{28}$
Dirac constant, J s	$\hbar_R = E_R/f_R = l_R$ $(\hbar_P = E_P/f_P)$	$2.47693 \cdot 10^{-36}$	$1.05457 \cdot 10^{-34}$
Dirac constant, eV s	$\hbar_R = E_R/(f_R \cdot e_R) = l_R/e_R$ $(\hbar_P = E_P/(f_P \cdot e_P))$	$1.00875 \cdot 10^{-16}$	$6.58212 \cdot 10^{-16}$
Planck constant, J s	$h_R = 2\pi\hbar_R$	$1.55630 \cdot 10^{-35}$	$6.62607 \cdot 10^{-34}$
Planck constant, eV s	$h_R = 2\pi\hbar_R$	$6.33818 \cdot 10^{-16}$	$4.13567 \cdot 10^{-15}$
Planck momentum, kg m s^{-1}	$m_R c_R\ (m_P c_P)$	1.0	6.52501
ml, kg m	$m_R l_R\ (m_P l_P)$	$8.26214 \cdot 10^{-45}$	$3.51767 \cdot 10^{-43}$
$\hbar/c$, kg m	$\hbar_R/c_R = l_R/c_R = t_R$ $(\hbar_P/c_P)$	$8.26214 \cdot 10^{-45}$	$3.51767 \cdot 10^{-43}$
Planck time, s	$t_R\ (t_P)$	$8.26214 \cdot 10^{-45}$	$5.39106 \cdot 10^{-44}$
elementary Planck force between the two Planck masses, N	$F_{Pl} = G_R \cdot m_R^2 l_R^{-2}$	$1.21034 \cdot 10^{44}$	$1.21034 \cdot 10^{44}$

elementary Coulomb force between the two Planck charges, N	$F_{Co} = 1/(4\pi\epsilon_0) \cdot q_R^2 l_R^{-2}$ $= c_R^2 10^{-7} \cdot q_R^2 l_R^{-2}$	$1.21034 \cdot 10^{44}$	$1.21034 \cdot 10^{44}$
elementary Coulomb force between the two elementary charges, N	$F_{Coe} = 1/(4\pi\epsilon_0) \cdot e_R^2 l_R^{-2}$ $= c_R^2 10^{-7} \cdot e_R^2 l_R^{-2}$	$8.83227 \cdot 10^{41}$	$8.83227 \cdot 10^{41}$

Table 2

The improved values of the elementary charge and other quantities

name quantity	symbol and the defining formula (P-system)	R-system (table 1)	P-system
elementary charge, C	e_R (e_P)	$7.76478 \cdot 10^{-24}$ $(2.45544 \cdot 10^{-20})$	1.602 18 $\cdot 10^{-19}$
Planck charge, C	q_R (q_P)	$9.08963 \cdot 10^{-23}$ $(2.87439 \cdot 10^{-19})$	$1.87555 \cdot 10^{-18}$
Planck energy, eV	E_R/e_R (E_P/e_P)	$3.86093 \cdot 10^{31}$ $(1.22093 \cdot 10^{28})$	$1.22093 \cdot 10^{28}$
Dirac constant, eV s	$\hbar_R = E_R/(f_R \cdot e_R) = l_R/e_R$ $(\hbar_P = E_P/(f_P \cdot e_P))$	$3.18995 \cdot 10^{-13}$ $(1.00875 \cdot 10^{-16})$	$6.58212 \cdot 10^{-16}$
Dirac constant, eV s	$h_R = 2\pi\hbar_R$	$2.00431 \cdot 10^{-12}$ $(6.33818 \cdot 10^{-16})$	$4.13567 \cdot 10^{-15}$