What the Electric Charge is

Nobody knows the nature of the electric charge. Why? An answer to this question is very simple: because physics does not know its true dimensionality [1]. Beginning from the Coulomb's time, nothing changed in uncovering of the electric charge nature, rather vice versa, changes were, but unfortunately, leading to an impasse. Let us analyze the current status quo of this problem.

A functional dependence between two interacting, at the distance r, point charges q_1 and q_2, discovered first by Coulomb, is

$$F = k\frac{q_1 q_2}{r^2}, \tag{1}$$

where k is the unknown at that time coefficient of proportionality between the resulting force F and the functional dependence. At k=1 (that was accepted in *CGSE* units), Coulomb law has the following form (in vacuum)

$$F_{CGSE} = \frac{q_1 q_2}{r^2}. \tag{2}$$

The dimensionality of the electric charge at that ($CGSE_q$ unit) is

$$[q] = g^{1/2} cm^{3/2} s^{-1}. \tag{3}$$

In the modern system *SI*, Coulomb's law is

$$F_{SI} = \frac{Q_1 Q_2}{4\pi\varepsilon_0 r^2}. \tag{4}$$

The unit of the electric charge in *SI*, the ***coulomb***, is equal to $1C = 1A \cdot s$, i.e., $[Q] = A \cdot s$. At the same time, $1C = \frac{c_r}{10} CGSE_q \approx 3 \cdot 10^9\ CGSE_q$, where c_r is the relative speed of light equal $2.99792458 \cdot 10^{10}$ ($c_r = c/c_e$ and $c = 2.99792458 \cdot 10^{10}\ cm \cdot s^{-1}$, $c_e = 1\ cm \cdot s^{-1}$). The ***ampere*** is the derivative unit, defined from Ampere's law for interacting currents and expressed by half-integer powers of base units, $1A = \frac{c_r}{10} CGSE_I = \frac{c_r}{10} g^{1/2} cm^{3/2} s^{-2}$;

$$\varepsilon_0 = \frac{10^{11}}{4\pi c_r^2}\ F \cdot m^{-1} \approx 8.854187818 \cdot 10^{-12}\ F \cdot m^{-1} \tag{5}$$

is the so-called ***electric constant***, appeared first due to the tangled manipulations with "rationalization" (into *SI*) (uncovered and described in detail in [2], see pages 9-19).

One can see "with the naked eye" that ε_0 is the dimensionless magnitude. Indeed, the unit of capacity the ***farad*** F is $1F = \frac{c_r^2}{10^{11}} m \approx 9 \cdot 10^9\ m$, hence,

$$\varepsilon_0 = \frac{10^{11}}{4\pi c_r^2} \cdot \frac{c_r^2}{10^{11}} = \frac{1}{4\pi} \tag{6}$$

and we arrive at $F_{SI} = \frac{Q_1 Q_2}{4\pi(\frac{1}{4\pi})r^2}$ or $F_{SI} = \frac{Q_1 Q_2}{r^2}$. (7)

Thus, the true dimensionality of the charge in *SI* is $[Q] = kg^{1/2} m^{3/2} s^{-1}$, i.e., it is expressed by fractional powers of reference units like the electric charge in (2) is expressed in *CGSE* units (3). Since $1C = \frac{c_r}{10} g^{1/2} cm^{3/2} s^{-1}$, the unit of the charge represented in *SI* by three base units of matter (*kg*), space (*m*), and time (*s*) is

$$1C = \frac{c_r}{10} \cdot \frac{1}{\sqrt{10^9}} kg^{1/2} m^{3/2} s^{-1}. \tag{8}$$

What are results of such the "rationalization" into *SI*? As we see, these are not so fascinating because of serious faults, rather these are inept in essence (apart from one of them) and are as follows:

1. The unit of electric charge was called the ***coulomb***.

2. The ***senseless constants*** ε_0 and μ_0 (the magnetic constant) were introduced in physics.

3. Following the fictitious "rationalization", physicists obtained (for the next time) the lecture on ***how can invent*** any "physical" constants and, hence, they obtained the green light to act by this way further.

4. The ***derivative unit***, the unit of electric current the ***ampere***, was added to a ***triad of base units***. By this way, the problem of ***fractional powers of base units*** in formulae of electromagnetism was implicitly hidden but not solved actually.

5. Etc.

As we see, only an imitation of the reform in metrology of electromagnetic processes, but not the reform itself, was carried out. Such are the facts.

Let us turn to the law of universal gravitation

$$F = G\frac{m_1 m_2}{r^2}. \qquad (9)$$

Here, the coefficient of proportionality *G* (the gravitational constant) is $G = 6.6720 \cdot 10^{-8}\ g^{-1}cm^3s^{-1}$. So, all is O.K. in this case. The similar clear situation one should be also realized in the case with Coulomb's law.

Thus, without solving of the *k*-constant problem (in (1)), physics of electromagnetic phenomena (and related to it branches) will make no headway that we observe in reality now.

The erroneous form of Coulomb law gave rise to a phenomenological system of notions with measures having fractional powers of base units that are really senseless. ***Cognition of the nature of electric charges has become impossible***.

Since the erroneous system of measures of the electromagnetic field involves all physical formulae, *experiments* based on these formulae are *unable to detect the accumulated errors*. Thus, everything is formally "correct" and "consistent", although the electron charge is defined incorrectly, qualitatively and also quantitatively. This situation has given rise to numerous additional atomic constants, complicating cognition of the Universe on the atomic level yet more.

Wrong measures give rise to false theories, within the framework of which formally correct results are possible only on the basis of new errors in full agreement with the dialectical law of double negation: $No_1 \cdot No_2 = Yes$, where No_1 is the initial lie, No_2 is a new lie, and *Yes* is the formal truth. The result of this course of events can only be a dead end [2].

However, not all is so dark, there is a light at the end of the "tunnel". The matter is that the problem of dimensionality of electric charges has been analyzed in detail and described in two books (of 1996, 1998) of the authors [1, 2]. As follows from the data presented there, dimensionality of the "electric charge " most probably is $g \cdot s^{-1}$ and the dimensionality of the coefficient of proportionality *k* in the law (1) is $[k] = g^{-1} \cdot cm^3$. It means that the ***electric charge*** *apparently* ***is the mass rate of exchange*** (interaction) at the microlevel. The rate of exchange at the atomic level, as follows from [1, 2], is characterized by the fundamental frequency of exchange $\omega_e = 1.86916197 \cdot 10^{18}\ s^{-1}$ and by the wave radius $\lambda\!\!\!^{-}_e = 1.603886998 \cdot 10^{-8}\ cm$ characterizing discreteness of the atomic wave space.

Physicists must understand the great importance of the mentioned above problem sooner or later: such is dialectics. Indeed, it is impossible all time to conceal unsolved key problems, which restrain the further development of physics. In any case, discussions *on this theme* might be fruitful for physics.

[1]. L.G. Kreidik and G.P. Shpenkov, *Alternative Picture of the World*, Vol. 1-3, Bydgoszcz, 1996.

[2]. L.G. Kreidik and G.P. Shpenkov, *Foundations of Physics*; 13.644…*Collected Papers*, Bydgoszcz, 1998.