Mechanical Dimensionalities of Electrodynamic and Gravidynamic Fields

Jaroslav G. Klyushin
University of Civil Avaiation, St. Petersburg, RUSSIA
e-mail klyushin7748848@live.ru

A system of mechanical dimensionalities is proposed for electrodynamics. It turns out that permittivity has the dimension of mass density. Therefore, the electric permittivity constant ε_0 is interpreted as ether mass density. The vacuum magnetic permeability μ_0 has dimension of compressibility, and it is therefore interpreted as free ether compressibility. The electric field has dimension of velocity. That enables us to compare its qualities with those of gravity, which has dimension of acceleration.

1. Introduction

A system of dimensionalities is actually the language in which we express our ideas in physics. The problem is that different parts of physics use different systems of dimensionalities; *i.e.*, they are expressed in different languages. As a result we don't understand the connections between these parts. Newtonian mechanics was formulated in terms of mass, meters, and seconds. We can easily understand and compare all assertions formulated in these terms. But we cannot explain many other facts; for instance, in thermodynamics because the concepts of temperature and heat are formulated in different terms. The situation in electrodynamics is even worse: there are many systems of dimensionalities here. Therefore, specialists using different systems often understand each other with certain problems. The aim of this paper is to introduce mechanical dimensionalities for electrodynamic quantities, and clarify the connections between electrodynamics, gravity, and hydrodynamics.

2. Analysis

We observe that the Static law of gravity means that mass M at distance r creates a static gravitational field:

$$g = \gamma M / r^2$$

Taking into account that the gravitational constant γ has mechanical dimensionality $m^3/kg\text{-}s^2$, one obtains that gravitational field has dimensionality of acceleration m/s^2.

The Electric charge at distance r creates static Coulomb field:

$$E = q / 4\pi\varepsilon_0 r^2$$

where ε_0 is electric 'permittivity' constant.

But we can say nothing about the mechanical dimensionality of E until the mechanical dimensionality of electric charge q is defined. If we could do this, we would obtain a clear formal relationship with mechanics, and between gravity and electricity.

In this author's papers [1] and [2], it is shown that the electric charge has dimensionality kg/s, and the electric field has dimensionality of velocity, *i.e.* m/s. The electric constant ε_0 has dimensionality of mass density, *i.e.* kg/m^3. Its physical meaning is mass density of free ether. The aim of the present paper is to extend these results on electrodynamic and gravidynamic fields.

In papers [3] and [1], it was proposed to describe the gravity field with the help of Maxwell type equations in which the first time derivatives are changed for the second time derivatives. This means, in particular, that gravitation is understood as a field of accelerations, in contrast to electricity, which is a field of velocities. Respectively, these fields are characterized with constants that have the dimensionality of acceleration for gravity and the dimensionality of velocity (light speed c) for electricity.

Gravity preserves its one natural mechanical dimensionality. It has dimensionality of acceleration, and its charge is mass. But several dimensionality systems are used in electrodynamics. To my knowledge, scientists who use a certain system are its devoted supporters, and do not see any problems with its usage.

All can agree on the following point. Really, physics in general, and electricity in particular, may be studied in any language: in English, Chinese, or even Russian. But for every individual, there is among all the languages just one unique, preferred language. This is our native language. In this language, our intuition works better, we understand the interdependence of different phenomena better, we express our ideas better, and we understand other persons better.

Do physicists have such a language? I am sure they have. This language is the language of mechanics. Therefore, the method of gravity description mentioned above should be considered natural and understandable, and all dimensionality systems used in modern electrodynamics should be recognized as artificial and inconvenient. If the electric field has dimensionality of velocity, then all electrodynamic values obtain mechanical dimensionalities. In particular, electric charge has dimensionality kg/s, *i.e.* mass time derivative.

In different times, different authors have come to this conclusion, although starting from different concepts. In this connection, papers by Aszukovsky [4] and Prussov [5] must be mentioned. But it is not enough for us to know dimensionalities of the described objects. We must translate electrodynamic values used in present-day terms into terms of mechanics.

That is what V.A. Aszukovsky writes in discussing this problem in his book [4, p. 49]. He comes to the conclusion that the electric constant ε_0 means mass density ρ of ether, and that dimensionality 'Farad' corresponds mechanical dimensionality kg/m^2. He concludes from here that ether mass density must be

equal to 8.85×10^{-12} kg/m³ because $\varepsilon_0 = 8.85\times10^{-12}$ F/m. But this conclusion is wrong, because it rests on a logical flaw. The fact that capacitance is measured in Farad and kg/m² does not mean that 1F = 1kg/m². And just such a correlation between units we must find in order to transform one dimensionality into another one. One easily sees that the assertion that mass may be measured in grams and kilograms does not mean that 1g = 1kg. Therefore, other quantitative evaluations in Aszukovsky book [4] seem to be unnatural.

To answer our question, an experiment in which electric and gravitational forces are compared is needed. The best-known one is the experiment in which gravitational attraction and electric repulsion between two electrons is compared.

$$F_{\text{elec}} / F_{\text{grav}} = q^2 / \gamma\varepsilon_0 m^2 = 4.17\times10^{42} \tag{1}$$

This number is taken from Feynman [6]. Here q is electron charge, m is electron mass, ε_0 and γ are electric and gravitational constants.

In order to use this equality, we must adopt a certain model of elementary particles in general, and of the electron in particular. Some authors (in addition to above-mentioned Aszukovsky and Prussov, F.M. Kanarev [7] should be mentioned) proposed models of elementary particles as follows: ether particles form a torus performing two curling movements: in equatorial and meridional planes. The Similarity between models of this author and the above-mentioned authors stop here, as these rotations are given different physical meanings. The present author believes that the equatorial rotation determines electric charge, and the meridional rotation determines the spin of the particle.

The electron's charge is:

$$q = m\omega \tag{2}$$

where m is its mass and ω is the equatorial rotation angular velocity.

Such a description of the charge is a natural consequence of the idea of translational movement in kinematics. As my reader may remember, the velocity of translational movement of a massive point is linked with rotation, and described there with the help of vector product of the radius vector and the angular velocity vector. This author used exactly this idea in paper [2].

Substituting (2) into (1) one obtains:

$$\omega^2 / 4\pi\gamma\varepsilon_0 = 4.17\times10^{42} \tag{3}$$

We are compelled now to adopt some suppositions linking the gravitational constant γ and electric constant ε_0. Papers [1, 2] yield that the electric field is a special case of the gravitational one. This means that ε_0 and $1/\gamma$ must be numerically equal (perhaps with the accuracy of 2π). The difference in dimensionalities is a consequence of the dimensionality difference between electric charge and mass. The difference in static gravitational and electric forces is determined by the angular velocity value ω in (2). $1/\gamma$ has dimension kg/m³s², and the mechanical dimension of ε_0 is kg/m³.

Assumption: $$8\pi\gamma\varepsilon_0 = 1 \text{ rad}^2/\text{s}^2 \tag{4}$$

Angular velocity squared unit is in the right hand part here. In other words, we suppose that $1/4\pi\gamma$ and ε_0 are numerically equal with the accuracy of 2π.

Taking (4) and (3) into account, one obtains

$$\omega = 8.1\times10^{20} \text{ rad/s} \tag{5}$$

This number is close to the Compton electron angular velocity

$$\omega_S = 7.8\times10^{20} \text{ rad/s} \tag{6}$$

We can take (6) as accurate equatorial angular velocity for electron taking experimental errors into account. This number is in accord with the spectral analyses data in the framework of ethereal (non Bohr) model of elementary particles. [8, 9] The author does not know of any experimental facts contradicting the evaluation (6).

Equality (6) enables us to express all electrodynamic units in mechanical terms. Some of them are reproduced below:

Electric charge: $$e = 7.1\times10^{-10} \text{ kg/s} \tag{7}$$

Correspondingly: $$1\text{C} = 4.44\times10^{9} \text{ kg/s} \tag{8}$$

Electric constant: $$\varepsilon_0 = 1.9\times10^{8} \text{ kg/m}^3 \tag{9}$$

Magnetic constant: $$\mu_0 = 5.84\text{x}10^{-26} \text{ m-s}^2/\text{kg} \tag{10}$$

Note that 'electric constant' means 'free ether mass density' and 'magnetic constant' means 'free ether compressibility'.

Free ether impedance: $$1/\varepsilon_0 c = 1.75\times10^{-17} \text{ m}^2\text{-s/kg} \tag{11}$$

It is known that it is equal to 377 Ohm. Thus:

$$1 \text{ Ohm} = 4.65\times10^{-20} \text{ m}^2\text{-s/kg} \tag{12}$$

$$1 \text{ Ampère} = 4.44\times10^{9} \text{ kg/s}^2 \tag{13}$$

$$1 \text{ Volt} = 1 \text{ Ohm} \times 1 \text{ Ampère} = 2.07\times10^{-10} \text{ m}^2/\text{s} \tag{14}$$

Aszukovsky [4] was right: the mechanical dimensionality of capacitance is kg/m². But

$$1 \text{ Farad} = 1\text{C} / 1 \text{ Volt} = 2.14\times10^{19} \text{ kg/m}^2 \tag{15}$$

One can in the same way express other electrodynamic values in mechanical terms.

There is no dimensionality problem for the gravidynamic field. Just as in the static case, the gravidynamic field has dimension of acceleration, and is characterized with a certain acceleration constant a that plays the same role for it that light speed c plays for the electrodynamic field.

Let us note that the static gravitational force $m\mathbf{g}$ and static electric force $q\mathbf{E}$ may be considered as two items in the Newtonian definition of the force as impulse time derivative.

$$d(m\mathbf{v}) / dt = m\mathbf{g} + q\mathbf{E} \tag{16}$$

Here $\mathbf{g} = d\mathbf{v} / dt$, and $q = dm / dt$, $\mathbf{E} = \mathbf{v}$.

Links between electricity and gravity are investigated in greater detail in paper [11].

3. Comment on Morton Spears' Paper

What follows is the author's short comment to a paper by Morton F. Spears, [10] but related to this paper.

The author finds gravitational attraction between charges by electrostatic methods and concludes that gravitational constant $G = 6.68541\times10^{-11}$ Coulomb-Volt-meter/kg^2 is numerically in good accordance with experimental values differing from $G = 6.6656(6)\times10^{-11}$ m^3/kg-s^2 to $G = 6.71540\times10^{-11}$ m^3/kg-s^2. Then the author considers many interesting problems which could be solved if the dimensionality problem in the above mentioned values was understood. Dependence between gravitational constant G and permittivity ε_0 is considered in particular. I hope that the answer has been already found. Actually if we measure a value and obtain equal numerical values, that can take place only if the units are equal (certainly measurements should be correct as well), i.e.

$$1 \text{ Coulomb-Volt-meter/kg}^2 = 1 \text{ m}^3/\text{kg-s}^2 \tag{17}$$

Is it really? Yes. One can look into this paper to find mechanical dimensions of electric units

$$1 \text{ Coulomb} = 4.44\times10^9 \text{ kg/s} \tag{18}$$

$$1 \text{ Volt} = 2.07\times10^{-10} \text{ kg}\times\text{m}^2/\text{s}^2 \tag{19}$$

$$1 \text{ Coulomb}\times 1 \text{ Volt} = 0.919 \text{ kg-m}^2/\text{s}^2 \tag{20}$$

From here $$1 \text{ C-V-m/kg}^2 = 0.919 \text{ m}^3/\text{s}^2\text{-kg} \tag{21}$$

This result is based on the Compton experiment, which predicts a 7.8×10^{20} rad/s frequency for the electron (Eq. (6)).

In paper [2] corresponding calculations were based on experiments on gravitational attraction and electric repulsion between two electrons. It predicts 8.1×10^{20} rad/s for electron frequency (Eq. (5)). Corresponding calculations give

$$1 \text{ Coulomb} = 4.6\times10^9 \text{ kg/s} \tag{22}$$

$$1 \text{ Volt} = 2.19\times10^{-10} \text{ kg}\times\text{m}^2/\text{s}^2 \tag{23}$$

$$1 \text{ Coulomb}\times 1 \text{ Volt} = 1.0074 \text{ kg-m}^2/\text{s}^2 \tag{24}$$

$$1 \text{ C-V-m/kg}^2 = 1.0074 \text{ m}^3/\text{s}^2\text{-kg} \tag{25}$$

I hope that these calculations will help to find answers on other questions put in Prof. Spears' paper. This author would be grateful to anybody who could find time to analyze papers [1] and [2] and propose his (her) critical notes.

4. Conclusion

Mechanical units of dimensionality bring a degree of unification to disparate branches of physics; in particular, electrodynamics and gravitation theory.

References

[1] J.G. Klyushin, "Electro- and Gravidynamics", *Journal of New Energy* **7** (3): 57 (2003).

[2] J.G. Klyushin. "Mechanical Dimensionality for Electrodynamic Quantities", *Journal of New Energy* **7** (3): 51 (2003).

[3] J.G. Klyushin, "On the Maxwell Approach to Gravity", Report in seminar of St. Petersburg Physical Society (St. Petersburg, Russia, 1993).

[4] V.A. Aszukovsky. **General Etherodynamics**, (Russian, Energoizdat, Moscow, 1990).

[5] P.D. Prussov, **Physics of the Ether** (Russian, Nikolaev, 2003).

[6] R. Feynman. R. Leighton. M. Sands, **Feynman Lectures on Physics**, Vol. 1, p. 138 (Russian Edition, Mir, Moscow, 1977).

[7] F.M. Kanarev. **Principles of Microworld Physchemics** (Russian Krasnodar, 2002).

[8] J.G. Klyushin, "Proton Structure: an Experimental Approach", *Proceedings of the NPA* **1** (1):51 (Spring 2004).

[9] J.G. Klyushin, "Hydrogen Atom Construction: a Non-Bohr Approach", Ibid, p.45.

[10] Morton F. Spears, "An Electrostatic Solution for the Gravity Force and Value of G", *Galilean Electrodynamics* **21** (2) (Mar 2010).

[11] J.G. Klyushin, "Fundamental Problems in Electrodynamics and Gravidynamics", Appendix 1, *Galilean Electrodynamics*, (2009).