Space Equation – Basic Equation of Unified Field Theory

Ilgaitis Prūsis[1], Peteris Prūsis[2]

Since Maxwell successfully unified previously separated electrical and magnetic fields in a new electromagnetic field, the idea of theory common for all physical force fields became apparent. Until now the attempts to bind together separate equations of all physical force fields have been unsuccessful.

All forces act in space. Space is a common attribute of all interactions. Here we show that unification is possible on the basis of a new space conception.

In contemporary physics the force field is part of space where force acts. In contradiction to this very basic principle of contemporary physics, we here propose a new concept that space and physical force fields are mutually dependent entities of the same phenomena. If a force field does not exist, then the corresponding space does not exist either. And vice versa, if space does not exist, there is no force field present.

Change of the force field physics assumptions yields into the possibility to describe any known physical force field and the corresponding space by a uniform equation, which we call *Space Equation*. Therefore the *Space Equation* represents the basic equation of the Unified Field Theory (UFT).

Keywords: space---gravitation---Unified Field Theory

PACS Classification codes:

04. General relativity and gravitation; 03.50.-z Classical field theories; 12.10.-g Unified field theories and models

[1] Independent researcher;

[2] Independent researcher

Introduction

A review of the history of the classical aspects of unified field theories (UFT) in the 20th century shows that attempts to unify all force fields into one single law of nature until now have been unsuccessful. The main problem is how to bind together equations of gravitation and equations of electromagnetic fields. The situation is best described by Hubert Goenner with the words: In an unsuccessful hunt for progress with the deductive-hypothetical method alone, Einstein spent decades of his life on the unification of the gravitational with the electromagnetic and, possibly, other fields. Others joined him in such an endeavor, or even preceded him, including Mie, Hilbert, Ishiwara, Nordström, and others. At the time, another road was impossible because of the lack of empirical basis due to the weakness of the gravitational interaction. A similar situation remains even today when attempting to reach a common representation of all four fundamental interactions [1]… A methodological weak point in the process of the establishment of field equations for unified field theory was the constructive weakness of alternate physical limits to be taken:

· no electromagnetic field → Einstein's equations in empty space;

· no gravitational field → Maxwell's equations;

· "weak" gravitational and electromagnetic fields → Einstein–Maxwell equations;

· no gravitational field but a "strong" electromagnetic field → some sort of non-linear electro-dynamics [2].

...Space-time geometry used is rigidly fixed, and usually perceived as Minkowski space or, within string and membrane theory, some higher-dimensional manifold also loosely called “space-time”, although its signature might not be Lorentzian and its dimension might be 10, 11, 26, or some other number larger than four [3]. End of quotation.

In contemporary physics a force field is a vector field that describes a non-contact force acting on a particle at various positions in space. Therefore a force field is only part of space. Space is the boundless, three-dimensional extent in which objects and events occur – a large container.

Here we implement a new concept that the space and physical force field represents two types of manifestation of the same phenomenon. The presence and nature of the force field is linked to the presence and nature of the corresponding space and vice versa. Neither space nor the corresponding force field exists separately from each other, since they are just two different appearances of the same physical matter. One can claim that the space and corresponding force field are mutually interchangeable verbal synonyms describing the same process. The difference in the meaning of these terms is assumed by classical physics, but does not exist in reality. Given this postulate all physical fields can be described by one equation – space equation.

Space equation

Below we show how to derive the space equation from well-known basic expressions of classical non-relativistic field theory.

The energy of any force field is defined as: $W = \alpha\varphi$ **(1)**

Where: α – source of force field

φ – potential.

The source is an extensive physical quantity - cause of conservative forces. Here we assume that the source is point like. For example, for gravitation the source of energy is mass, for electricity the source is charge, for magnetism the source is Dirac monopoly and for a nuclear (strong) field the source is baryon charge.

Potential is the potential energy of one unit of source.

The source of force field is constant, but the intensity of field is dependent on Euclidean distance between the source point and the observable point of the corresponding space (force field).

Field intensity is: $I = d\varphi/dr = dW/\alpha dr = grad\varphi$ **(2)**

Where: r – distance from source to any point of space.

For homogeneous fields: $I = W/\alpha r$ **(3)**

Capacity of field is: $C = \alpha^2/W$ **(4)**

Propagation (Permittivity, Permeability) of field is: $\Pi = dC/dr = \alpha^2/rW$ **(5)**

For the description of propagation of field in contemporary physics different quantities are used: Permittivity for electric field, Permeability for magnetic field and the inverse value of Gravitation constant for gravitation field. Here we show how these quantities can be unified by the conception of propagation.

From propagation (Eq. 5) and intensity (Eq. 3) we get: $\alpha/\Pi = rW/\alpha = r^2(W/\alpha r) = r^2 I$

Result is space equation: $\alpha/\Pi = r^2 I$ **(6)**

The space equation is a basic equation for any physical force field. For description of any physical force field all what is necessary to know is the source of field, its propagation and intensity. The description of basic physical fields is shown below.

Gravitation field.

Source of gravity is mass: $\alpha = m$, intensity is: $I = g = - d^2r/dt^2$, propagation is: $\Pi = 1/G$

Therefore the space equation for gravity is: $mG = - r^2(d^2r/dt^2)$ or: $g = - mG/r^2$ **(7)**

It is Newton gravitation law.

Electric field

The source of electric field is charge: $\alpha = q$, intensity is: $I = E$,

propagation is: $\Pi = 4\pi\varepsilon_0$

Therefore the space equation for electric field is: $q/4\pi\varepsilon_0 = r^2E$ or: $E = q/(4\pi\varepsilon_0 r^2)$ **(8)**

It is Coulomb law.

Magnetic field

The source of magnetic field is Dirac monopoly: $\alpha = M$, intensity is: $I = H$,

propagation is: $\Pi = 4\pi\mu_0$

Therefore the space equation for magnetic field is: $M/4\pi\mu_0 = r^2H$ or: $H = M/(4\pi\mu_0 r^2)$ **(9)**

Induced force fields

If the source of the field changes its quantitative value during some time period, it may cause induction of vector-potential, which can act as a new source of another force field (and space). For example, the change of electric charge in time will induce a magnetic force field. The space equation is very much the same as for force fields with a static source.

Vector force fields

For the vector fields, such as magnetic field of solenoid or electromagnetic field of photon, the source is a vector potential. We here exemplify a vector potential based force field with a description of photon.

Photon

The photon has two vector potentials: $\varphi E = rot\ H$ and $\varphi H = -\ rot\ E$

Propagation is: $\Pi_E = 4\pi\varepsilon_0$ for electric field and $\Pi_M = 4\pi\mu_0$ for magnetic field.

Therefore the space of photon is described by a system of equations:

$$\begin{cases} 4\pi\ r^2 \vec{E} = \dfrac{W}{\varepsilon_0\ rot\ \vec{H}} \\ 4\pi\ r^2 \vec{H} = \dfrac{W}{\mu_0\ rot\ \vec{E}} \end{cases} \quad \textbf{(10)}$$

where: $W = \hbar\upsilon$ the energy of photon.

Nuclear (strong) field

The source of a nuclear field is baryon charge. Knowing baryon charge, intensity and propagation of the nuclear force field would allow obtaining the corresponding space equation. Unfortunately the value of baryon charge is unknown in SI units. Baryon charge in nuclear physics is represented by its quantum number, e.g. +1 for baryons, –1 for antibaryons and 0 for other particles. Therefore, baryon charge is a specific quality of baryons, which cannot be expressed by basic units of SI system. Therefore one must implement in SI system a new fundamental unit – baryon unit. Experimentally the baryon unit may be determined by measurement of interaction parameters of nucleons. The value of nuclear field propagation is unknown. It is only established that the nuclear field inside the nucleus is about 100 times stronger than electromagnetism and outside the nucleus it drops to a negligible value. Intensity in the one dimensional space (string) is constant, in two dimensional space (sheet) the intensity drops proportional to the distance from the source. Intensity in the three dimensional space drops in square of distance from the source (Coulomb law). Because the intensity of the nuclear field drops faster than the intensity of the electric field we assume that nuclear space has more dimensions that three, for example, four. Using this information we attempt to estimate what could be the values of baryon charge, the propagation and intensity of the nuclear force field in the SI system.

For example, we assume that baryon charge $B = 7E\text{-}13\ b_u$ and

propagation of nuclear field $\Pi_B = B^2/r^2 W_B = 2E16\ [b_u^2/m^2 J]$,

where: b_u baryon charge unit.

Intensity of nuclear field $I_B = -\ d^2r^2/d\zeta^2\ [kgm/b_u s^2]$

where: ζ parameter of nuclear space.

Space equation of nuclear field $B/\Pi_B = -\ r^2\ (d^2r^2/d\zeta^2\ )$ **(11)**

Force between two nucleons $F = -\ B^2/(\Pi_B\ r^3)$ **(12)**

The comparison of Coulomb (9) and nuclear forces (12) between two nucleons (protons) is represented in Fig. 1.

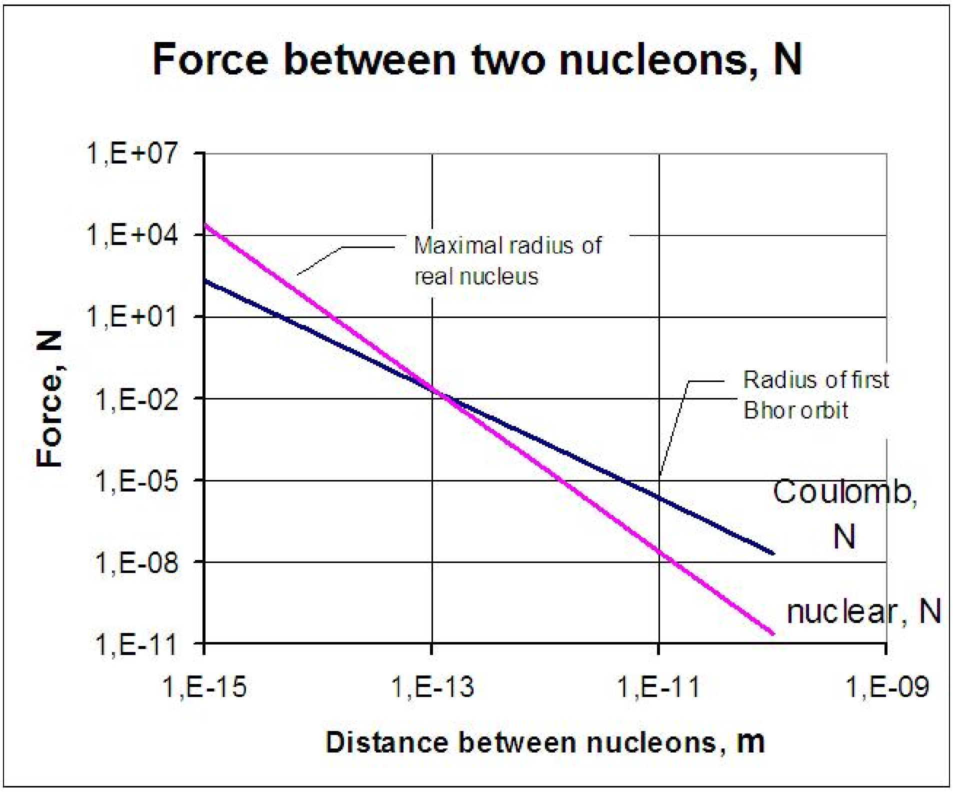

Fig. 1. Coulomb and nuclear forces between two nucleons

At distances between nucleons 1 fm the Nuclear force is about 100 times stronger than Coulomb force. At distances about 10 fm the strength of Nuclear force drops 1000 times. At distances about 100 fm the strength of Nuclear force becomes comparable with Coulomb force. At distances about 10 pm the Nuclear force drops to a 1% value of Coulomb force. Therefore the results agree with the observations.

Additivity of space – force field

There are certain rules, which govern the mutual interaction of force fields, their spaces having different sources. The space (and force field) of the same type of source is an additive. For example, the total gravitational force acting on a body in gravitational space containing multiple objects with mass would be the sum of their gravitational forces. Since the space and its corresponding force field is a manifestation of the same phenomenon, consequently we would observe one space, which would be the sum of all spaces caused by all bodies with a mass. As a result, the gravitational space of our observed Universe corresponds to the total mass of the Universe. The spaces and force fields of different kind of sources may overlap each other, but they are not additive. For example, electrical space and gravitational space overlap, but do not affect each other. Moreover, the same physical object can act as a source of several force fields and spaces. For example, electron has a mass, though it has its own gravitational space, it has a charge, though it has its own electrical space and it has a magnetic moment, which act as the source of solenoidal magnetic force field and space.

Conclusions

The given examples demonstrate a possibility to use the space equation for description of any force field. Formally, it can also describe weak interactions. However, the basic parameters of weak interactions (source of field and propagation) are not known.

References

1. Goenner H., 2004. On the History of Unified Field Theories. *(Living Reviews, Relativity* 7. 2*),* p.6. http://www.livingreviews.org/lrr-2004-2

2. Ibidem, p. 10.

3. Ibidem, p. 9.

4. Schwarz J., STATUS OF SUPERSTRING AND M-THEORY. arXiv:0812.1372

Acknowledgements: We are very grateful to Ieva Mazere and Valda Kalniņa for valuable discussions and assistance.

Correspondence and requests for materials should be addressed to I.P. (ilgaitis@gmail.com).