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New Concept of Space

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Abstract

The perception of space in which objects and perhaps events have relative position and direction is one of the first things people learn in their lives. Ultimately space has always been an important part of the majority of physics theories, conceived as three linear infinite dimensions in classical mechanics or as four dimensional Einsteinian space-time.

If there is a force acting onto some object in space it would indicate the presence of some force field as the ultimate cause of the force itself. Contemporary physics would consider that all force fields found in space are contained by that space. According to the current main understanding of physics, space itself does not require any force field to be present.

However, there is no true evidence for the existence of space without any force field(s) as well and there is no pure evidence for infinity of the space. It is only a presumption.

In contradiction to this very basic principle of contemporary physics, we here propose the new concept that space and physical force field are mutually dependent entities of the same phenomena. If the force field does not exist, then the corresponding space does not exist as well. And vice versa, if space does not exist, there is no force field present. As a result of such a principle, it is possible to describe each specific force field with a universal space equation, which has significant consequences.

Keywords: Space; Gravitation; Unified field theory

Introduction

The concept of Space continuously proceeds throughout the history of mankind. The primitive hunter–collector perceived Space as distance and direction. In the Ancient and Middle Ages, one believed that space was part of God (attribute), which God created to place all creatures. According to Aristotle Space is synonymous with the place occupied by the object [1]. In AristoAristotle'son empty space (void) is not possible. A complete overview of the development of the concept of space through thousands of years is given in the book: "Concepts of Space" [1].

Several mutually controversial concepts of Space arose during the Renaissance era. Immanuel Kant said neither space nor time can be empirically perceived, they are elements of a systematic framework that humans use to structure all experiences [2]. According to Isaac Newton's concept, the size of the space is unlimited, it existed permanently and independently from all matter it includes inside [3]. Other natural philosophers, notably Gottfried Leibniz and Christian Huygens, thought instead that space was in fact a collection of relations between objects, given by their distance and direction from one another [4].

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The dispute between Newton and Leibniz is characterized by Albert Einstein's words: “These two concepts of space may be contrasted as follows: (a) space as the positional quality of the world of material objects; (b) space as a container of all material objects. In case (a), space without a material object is inconceivable. In case (b), a material object can only be conceived as existing in space; space then appears as a reality that in a certain sense is superior to the material world. ...Space of type (b) was generally accepted by scientists in the precise form of the inertial system, encompassing time as well. ...Both space concepts are free creations of the human imagination, means devised for easier comprehension of our sense experience” [5].

In contemporary physics space is the boundless, three-dimensional extent in which objects and events occur – a large container [6]. A force field is a vector field that describes non-contact force acting on a particle at various positions in space. Therefore force field is only part of space. From this one can conclude that there may be empty space (void), which does not have any forces and gravity field, but in reality, as Einstein notes: “There is then no “empty” space, that is, there is no space without a field.” [7]. In addition, there is no evidence that space is boundless – it is just an assumption.

Here we implement the new concept that the space and gravitation field (physical force field) are two types of manifestation of the same phenomenon. The presence and nature of the force field are linked to the presence and nature of the corresponding space and vice versa. Neither space nor 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 those 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.

All known objects are disposed and processes occur in the gravitation field of the Universe, which creates the space which we know. It would be more accurate to call it gravitation space. Other force fields represent the other spaces: electric, magnetic, electromagnetic, etc.

Space equation

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

The energy of any force field is defined as:

$$W = \alpha\varphi, \tag{1}$$

where: α – source of force field, φ – potential.

The source is 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 a charge, for magnetism the source is hypothetical Dirac monopoly, Gilbert magnetic charge, or electric current.

The potential is the potential energy of one unit of source. The source of the force field is constant, but the intensity of the field is dependent on the Euclidian distance between the source point and the observable point of corresponding space (force field).

Field intensity is:

$$I = \frac{d\varphi}{dr} = \frac{dW}{\alpha dr} = grad\varphi, \tag{2}$$

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

For homogenous fields:

$$I = \frac{W}{\alpha r} \tag{3}$$

The capacity of the field is:

$$C = \frac{\alpha 2}{W} \tag{4}$$

Propagation (Permittivity, Permeability) of field is:

$$\prod = \frac{dC}{dr} = \frac{\alpha^2}{rW} \tag{5}$$

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

From propagation (Equation 5) and intensity (Equation 3) we get:

$$\frac{\alpha}{\prod} = \frac{rW}{\alpha} = r^2\left(\frac{W}{\alpha r}\right) r^2 I \tag{6}$$

The result is the space equation:

$$\frac{\alpha}{\prod} = r^2 I \tag{7}$$

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

Gravitation field

Source of gravity is mass: α = m, intensity is: $I = g = -\frac{d^2 r}{dt^2}$, propagation is: $\prod = \frac{1}{G}$

Therefore space equation for gravity is:

$$mG = -r^2\left(\frac{d^2r}{dt^2}\right) \text{Or: } g = -\frac{mG}{r2} \tag{7}$$

It is Newton's gravitation law.

Electric field

Source of electric field is charge: α = q, intensity is: I = E, propagation is: Π = 4πε0

Therefore space equation for the electric field is:

$$\frac{q}{4\pi\varepsilon_0} = r^2E \text{ Or: } E = \frac{q}{\left(4\pi\varepsilon_0 r^2\right)} \tag{8}$$

It is Coulomb law.

Magnetic field

The source of the magnetic field is Gilbert magnetic charge or Dirac monopoly: α = M, intensity is: I = H, propagation is: Π = 4πμ0

Therefore space equation for the magnetic field is:

$$\frac{M}{4\pi\mu 0} = r2H \text{ Or: } H = \frac{M}{\left(4\pi\mu 0r2\right)} \tag{9}$$

It is Gilbert law.

Given examples demonstrate the possibility by space equation describes any force field.

Conclusions

All objects are displaced and all events are happening in gravitation space. Therefore, gravitation, not only as a force field but also as a space attribute (distance, area, volume), participates in all processes. It requires reviewing the role of gravitation in natural sciences. The application of new concepts can resolve many contemporary physics problems [8].

There are certain rules, which govern mutual interaction of the force fields, their spaces having different sources. The space (and force field) of the same type of source is additive. For example, the total gravitational force acting on an object 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 mass. As a consequence, the gravitational space of our observed Universe corresponds to the total mass of the Universe.

In the direct proximity of mass, the gravitation field is curved. Therefore the space locally is curved also. The largest curvature of space is on the equipotent surfaces of the gravitation field, which encircles mass. In principle, a local space curvature must be around each elementary particle with mass – around each nucleus of an atom, around each electron. In the distances comparable with the sizes of the nucleus (about 10 fm) the space is almost spherical. In the distances comparable with a few dozen of atoms (about 100 pm) the equipotent surfaces of gravitation are practically flat and the curvature of space is negligible. Said also applies to large dimensions and large mass objects. In the direct proximity of stars and galaxies, space is curved but far away space is flat [9].

The spaces and force fields of different kinds 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, the electron has a mass, consequently, it has its own gravitational space, it has charge, consequently, it has its own electrical space and it has a magnetic moment, which acts as a source of magnetic force field and space.

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