Spatial Dimensions

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Abstract

Here is analyzed the dimensionality of our Universe on the basis of multi space conception. The new space conception proposes that space is the manifestation of a force field. Space does not exist independently from a force field. Hence each forcefield has its own eigenspace with different dimensionality.

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Introduction

We live in a world defined by three spatial dimensions representing the length, width and height (or depth) of space. In other words, it only takes three numbers to pinpoint our physical location in space. Within the string and membrane theory the dimensions of space might be 10, 11, and even 16 [1, 2]. Only 3 dimensions are observable. All the others are extra dimensions. However, no experimental or observational evidence is available to confirm the existence of these extra dimensions.

These theories are based on the concept of space as an endless empty container in which everything is located and all events occur.

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According to our concept the space and forcefield are synonyms. They are different manifestations of the same phenomenon. Each forcefield has its own space which we call eigenspace.

Gravitation eigenspace

According to Newton's gravitation law the gravitational acceleration *g* is equal to the second derivative from distance as shown in equation (1):

$$g = \frac{d^2 r}{dt^2} = -\frac{GM}{r^2} \qquad \textbf{(1)}$$

where: *G* - gravitational constant
M – mass
r – distance.

Equation (1) can be transformed in differential equation (2):

$$r^2 \frac{d^2 r}{dt^2} + GM = 0 \qquad \textbf{(2)}$$

The differential equation (2) has solution only if at the initial moment of time $t = 0$, initial distance $r = 0$ and initial velocity $dr/dt = 0$.

The solution of equation (2) is shown in equation (3):

$$2r^3/3 = 3GMt^2 \qquad \textbf{(3)}$$

The Gravitation eigenspace emerges from mass *M* at the time moment *t* after *"Big Bang"*. Since all the directions of space are equal, the shape of the Gravitation space is a sphere. One gets the volume of sphere by multiplying both sides of the equation (3) by 2π as shown in equation (4):

$$V_G = 4\pi r^3/3 = 6\pi GMt^2 \qquad \textbf{(4)}$$

In this case we use the term "Gravitation eigenspace" because the physical cause of space is the gravitation of the Universe. The resulting equation (4) has distance *r* in power of three. Therefore the Gravitation eigenspace has 3 dimensions.

Electric eigenspace

From Coulomb law the intensity of electric field is $E = q/(4\pi\varepsilon_0 r^2)$, (5)

where: q - source of electric field (electric charge),
ε_0 – permittivity,
r – distance.

According to equation (5) the Electric eigenspace is an equipotent surface:

$$S_E = 4\pi r^2 = q/(\varepsilon_0 E) \quad (6)$$

Therefore the Electric eigenspace has 2 dimensions. In the Gravitation eigenspace it looks as the surface of sphere with radius r. For example, the Electric eigenspace of a proton is located in the surrounding Gravitation eigenspace as equipotent surfaces which make up shells of allowed energies of electrons.

Magnetic eigenspace

According to the Gilbert model of magnetism, the intensity of magnetic field is:

$$H = \mathfrak{M}/4\pi\mu_0 r^2, \quad (7)$$

where: $\mathfrak{M}$ - source of magnetic field (magnetic charge),
μ_0 – permeability,
r – distance.

From equation (7) the Magnetic Space is an equipotent surface:

$$S_M = 4\pi r^2 = \mathfrak{M}/\mu_0 H \quad (8)$$

Therefore the Magnetic eigenspace has 2 dimensions.

Electromagnetic eigenspace of photon

The photon has two force fields: electric and magnetic. Accordingly a photon has electric and magnetic eigenspaces simultaneously. Electric and magnetic eigenspaces have two dimensions each. Hence the photon eigenspace has 4 dimensions.

Nuclear eigenspace

The force between two nucleons (protons) [3] $F = I_B B = - B^2/(\Pi_B r^3)$, (9)

where: B – baryon charge;
r – distance between nucleons;
Π_B – propagation of field.

From equation (9) one gets the intensity of nuclear field $I_B = - d^2r/d\zeta^2 = - B/(\Pi_B r^3)$,
where: ζ – parameter of nuclear space.

It is a differential equation: $r^3 d^2r/d\zeta^2 + B/\Pi_B = 0$ (10)

The differential equation (10) has solution only at the initial conditions $\zeta = 0$, $r = 0$ and

$dr/d\zeta = 0$: $2r^4/3 = 3 \Pi_B B\zeta^2$ (11)

One gets the volume of glome by multiplying both sides of the equation (11) by $¾ \pi^2$ as shown in equation (12):

$$V_B = \pi^2 r^4/2 = {}^9\!/_4 \ \pi^2 GB\zeta^2 . \quad (13)$$

Therefore the Nuclear eigenspace has 4 dimensions.

Four dimensional (4D) Space

We live in the 3D gravitation eigenspace; hence it is difficult to imagine the 4D object. Therefore let us look closer at the properties of 4D object which is located in the 3D space.

The situation is similar to the case when we represent 3 dimensional objects in the plane. For example, 3D sphere can be described by equation:

$$x^2 + y^2 + z^2 = R^2 , \quad (14)$$

where: R radius of sphere.

In the 2D space there are only 2 dimensions. Hence one dimension must be equal to zero and the sphere can be displayed as 3 projections (Fig. 1):

a) if $z = 0$, $x^2 + y^2 = R^2$
b) if $y = 0$, $x^2 + z^2 = R^2$
c) if $x = 0$, $z^2 + y^2 = R^2$

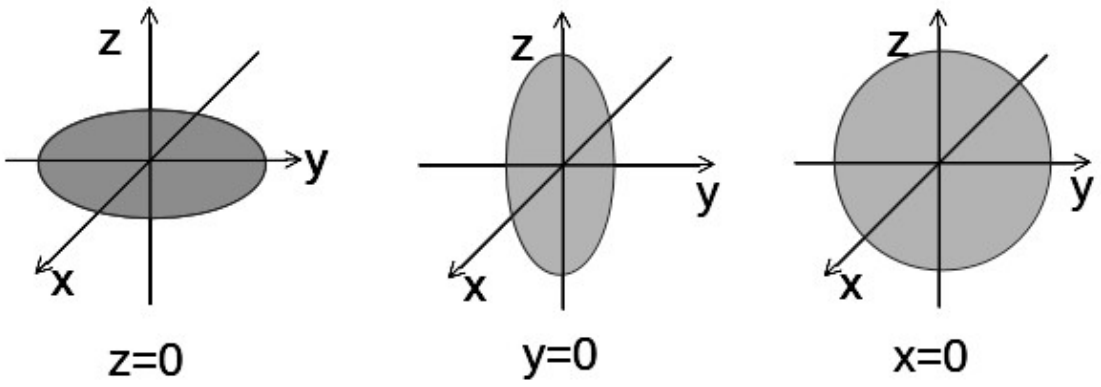

Fig. 1. Possible images of sphere in the plane.

All three projections are orthogonal and therefore independent. The opaque sphere looks like a circle (Fig. 1. at x=0). When the sphere is transparent one can find inside two orthogonal independent circles (Fig. 2.).

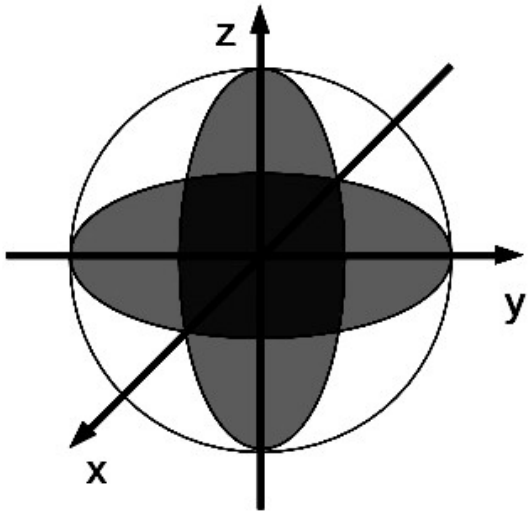

Fig. 2. Projections of sphere. The look from 2D space.

A glome is a 4D sphere. The equation of glome is: $x^2 + y^2 + z^2 + w^2 = R^2$ (15)

In 3D space the glome can be displayed as 4 projections:

1) if x = 0, then $y^2 + z^2 + w^2 = R^2$,
2) if y = 0, then $x^2 + z^2 + w^2 = R^2$,
3) if z = 0, then $x^2 + y^2 + w^2 = R^2$,
4) if w = 0, then $x^2 + y^2 + z^2 = R^2$.

All 4 projections are 3D spheres, independent and orthogonal. If one looks at the opaque glome he sees only one of the 3D spheres. If the glome is transparent, one can see that the other three spheres are inside of the glome. It can be best displayed with an image of 4D cube – the tesseract (Fig. 4).

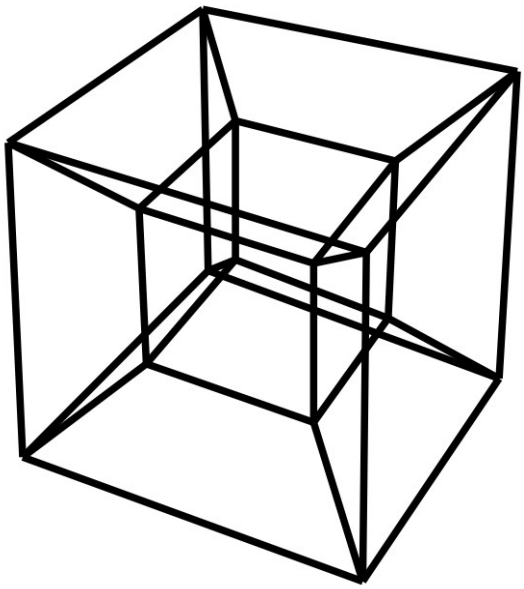

Fig. 3. The tesseract.
Actually all lines have equal length. All planes are the outer surface of tesseract.

The tesseract projection looks that there are several cubes inside, but in fact all cubes are outside of tesseract [3].

Baryons (neutrons, protons etc) have a 4D forcefield, therefore 4D space. They look like glomes. The analysis of electron scattering in the high energy electrons collisions with protons showed that protons contained some number of noninteracting constituent particles [5]. Experimentalists called them quarks. Since glome projections cannot be separated from the glome as separate spheres, so the quarks cannot be separated from the baryon as separate particles. Therefore, there is a reason to believe that the quarks are just baryon projections in the 3D gravitation space. Obviously there are three projections inside the proton; hence three quarks.

Conclusions

We live in a multidimensional world. There are 3 dimensions of gravitation eigenspace which we encounter every day. There are 4 dimensions of electromagnetic eigenspace which are hidden from direct observation. There are 4 dimensions of nuclear eigenspace in each atom. Totally our Universe is 11 dimensional. All dimensions are observable.

References

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