System Theory, Proton Stability, Double-Slit Experiment, and Cyclotron

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Abstract

Every system is composed of constitutional elements that are stable. Unstable elements cannot build a system. The hydrogen atom, for example, is the system composed out of two stable elements: proton and electron. How proton could be a system made out of unstable elements as quarks and gluons is an unanswered question that particle physics need to face in order to strengthen its theoretical basis. System Theory offers an original interpretation of double-slit experiment and requires re-examination of cyclotron physics.

Keywords: bijective function, system theory, quarks, gluons, proton, double-slit experiment, cyclotron physics

1.   Introduction

The system theory model presented in this article is based on the set theory. The universe is the set X and the model of the universe is the set Y. Set X and set Y are related by the bijective function of set theory.
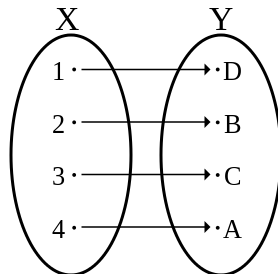
Figure 1: Bijective function of set theory

All physical objects we know in physics are elements of the universe. The universe is a stable system because its elements in the form of atoms are stable. If atoms would not be stable, the universe as we observe it today could not exist. We will denote these elements in the universe as 1x, 2x, 3x,…,Nx. In the model of the universe, we have correspondent elements 1y, 2y, 3y,…,Ny.

$$X:\{1x, 2x, 3x \dots, Nx\}$$

$$Y:\{1y, 2y, 3y, \dots, Ny\} \text{ (1).}$$

Atoms are made out of the elements we call "protons", "electrons" and "neutrons". Neutron, when it is not composed in the nucleus, is instable. Neutron lifetime is not stable, in about 15 minutes neutron will fall apart into proton and electron. From the view of system theory neutron is not the element of the system we call "atom". Atoms are composed only out of protons and electrons which are their real constitutive elements. Neutron is not a system because it is not stable. Stability in time is the inherent property of all systems. A physical object that has a lifetime of 15 minutes cannot be thought of as a system.

	orbit	nucleous
H	1 electron	1 proton
He	2 electrons	4 protons + 2 electrons
Li	3 electrons	6 protons + 3 electrons
Be	4 electrons	8 protons + 4 electrons
B	5 electrons	10 protons + 5 electrons
	N electrons	2N protons + N electrons

Figure 2: Protons and electrons in the nucleuses

Inside the nucleus of the Helium, we have 2 neutrons, which are composed out of 2 protons and 2 electrons and two more electrons. From the view of system theory inside the Helium's nucleus, they are 6 stable elements. 2 neutrons are not considered being elements of the Helium nucleus as the system because they are not stable. We can write following equation for matter M which made out of protons and electrons:

$$Mx: \{Pxn, Exn\}$$

$$My: \{Pyn, Eyn\} \quad (2).$$

Matter as a physical system is described by the set Mx. Model of the matter is described by the set My. In both sets, the matter is made out of protons and electrons as its constitutive elements. Set My and set My are related by the bijective function of set theory.

2.   Stability of the proton accordingly to the System Theory

In the model of the proton Py which we use in particle physics today, the proton is a system made out of several elements: two upper quarks, one down quark and the unknown number of gluons. We can describe model of the proton Py as a following set:

$$Py: \{Quy, Quy, Qdy, Gny\} \quad (3),$$

where Qu is an upper quark, Qd is down quark and Gn are gluons which are supposed to glue together quarks. We do not know if we can write yet the equation below and be sure it reflects some real elements in the physical world:

$$Px: \{Qux, Qux, Qdx, Gnx\} \quad (4),$$

because there a puzzle to be solved first. Quarks lifetime is about $10E^{-23}s$ [1]. About gluons lifetime there is no data in the literature. They are not supposed to be stable particles. The lifetime of quark-gluon plasma has a value about zero [2]. The System Theory regular question is: "How it is possible that proton is a system made out of unstable elements?". What mechanism makes it possible that proton as a system is stable? We have seen in this article that neutron is not a system because it is not stable despite it is composed out of stable elements. Proton is stable, it can be seen as a system. From the view of System Theory, we need to understand the origin of its stability. Particle physics needs to discover what mechanism makes proton stable. This is a challenge for particle physics from the perspective of System Theory.

The hydrogen atom is a system with two stable components: the proton is positively charged, the electron is negatively charged, electromagnetic force holds them together. Proton is made out of many unstable elements. How unstable gluons are gluing together unstable quarks and make proton stable is important to understand. In technical terms, gluons are vector gauge bosons that mediate strong interactions of quarks in quantum chromodynamics (QCD). How the intermediation of unstable elements (gluons) between unstable elements (quarks) makes proton stable is an open question. From the view of System Theory, QCD is a theoretical description that is not giving a satisfying answer about the physical origin of proton stability.

From the view of a System Theory a given system to exist, to be stable, must be composed out of stable elements. For example, the table in order to be stable must have all 4 legs stable. One leg instable means the table is unstable. In a group of people where only one person is unstable, the group can become unstable. You imagine you take away Saturn out of our Solar system. The system would become unstable. The proton is a special case of a system where all elements are unstable. What gives proton stability, particle physics does not know yet.

If this missing mechanism which makes proton stable will not be found, we can assume that quarks and gluons are only the epiphenomena existing in accelerated protons collisions and do not exist in the proton at rest. My proposal is, that the proton is a vortex of superfluid quantum space [3] and has no constitutive elements.
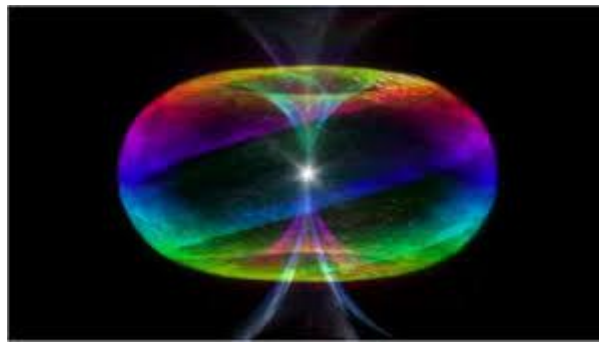
Figure 3: Proton is a vortex of superfluid quantum space

3.   Particle-wave duality in the perspective in system theory

Recent research suggested that universal space is primordial non-created energy of the universe which we call "super-fluid quantum space" [3]. In this model elementary particles are subsystems of superfluid quantum space. The variable density of space in which time is a mathematical parameter of given physical object motion is the origin of inertia and gravity [4]. In this model energy of space is actively related to the physical objects from the macro to the micro-scale. A given elementary particle in motion is interacting with the energy of space and creating a wave of space. "Particle" aspect and "wave" aspect cannot be approached separately. They are always together, which I call "wave-particle unity.

3.1.   Proton Vortex and Black Body Radiation

Proton as the vortex of quantum space is continuously exchanging the energy with the quantum space. This continuous flow of energy that every physical object is emanating is so called "black body radiation" discovered by Max Planck. Quantum space energy has no entropy, that's why proton is stable, practically it has unlimited lifetime. The idea of the proton as an isolated element in the space is false. Proton and electron are both vortexes of quantum space. Erving Schrodinger also regarded quantum space as the fundamental energy of the universe. He used to say: "What we observe as material bodies and forces are nothing but shapes and variations in the structure of space".

3.2.   The energy of wave-particle structure

Wave-particle structure energy which we can calculate with the following equation:

$$E = mc^2 = h\nu = (\rho_{Emax-}\rho_{Emin}) \times V \quad (5), [4],$$

where ρ_{Emax} is the energy density of the space on the surface of the wave-particle structure, ρ_{Emin} is the energy density of the space in the centre of the wave-particle structure, V is the volume of the wave-particle structure, ν is the frequency of the wave-particle structure, and h is the Planck constant.

We can write this formula as follows:

$$E = mc^2 = h\nu = \Delta\rho_E \times V \quad (6),$$

where $\Delta\rho_E = \rho_{Emax} - \rho_{Emin}$.

3.3.   Vortex model of elementary particles and their spin

Valeriy Sbitnev has developed vortex model of elementary particles where a given particle is the vortex of superfluid quantum space: "A particle in question can be a vortex being created from the vacuum medium. More definitely, the particle is the helicoidal vortex ring. (One can guess that the helicoidal vortex rings are similar to strings [20] after reducing them onto the 3D-brane, to our three-dimensional space). Topologically the vortex ring can be transformed further to the vortex ball (in some sense it is the vortex bubble) having two poles - up and down. Flows on such an object can pose complicated patterns. It is important πto emphasize, that due to viscosity fluctuations near zero, exchange between the vortex and the zero-point vacuum fluctuations takes place [5]. In the Sbitnev model, we can imagine elementary particles as different vortexes of physical vacuum. In the vortex, variable energy density represents an important element that can describe particle spin. Without the variable energy density of the physical vacuum, the vortex cannot exist. Vortex is rotating and having its spin. Spin S is denoted by the following formula:

$$S = \frac{h}{4\pi} \sqrt{n(n + 2)} \quad (7) [6],$$

where h is Planck constant and n is the integer number of orbital angular momentum that can only take integer values of n.

Out of the formula (6) we can extrapolate the value of Planck constant h:

$$h = \frac{\Delta P_E V}{\nu} \quad (8),$$

Formula (8) shows that the relation between the difference of vacuum pressure Δp_E, volume V and frequency ν of a given wave-particle structure is constant, we call it Planck constant h. Planck constant is valid from the micro (proton) to the macro (black hole) world. The mass has origin in the variable density of the vacuum from the proton to the black hole scale [4].

We combine formula (4) and (5) and we get following formula:

$$S = \frac{\Delta\rho_E V}{4\pi\nu} \sqrt{n(n + 2)} \quad (9),$$

where we can see that the spin S depends on the difference of energy density $\Delta\rho_E$ and frequency ν of a given particle.

4.   Vortex model of elementary particles and the double-slit experiment

Let's imagine a double-slit experiment in the model of vortex model where particles are moving only through the upper slit. We are sending electrons through the upper slit. The interference pattern will appear also behind the down slit. Physics is searching for 100 years to solve this puzzle. It can be solved only with the understanding that space is not "empty", space is the fundamental energy of the universe, in physics, we call it "physical vacuum" [5]. Moving particles which are vortexes of space are creating waves of space and these waves are creating interference patterns behind the down slit. A given particle in motion will always create a wave in the physical vacuum.
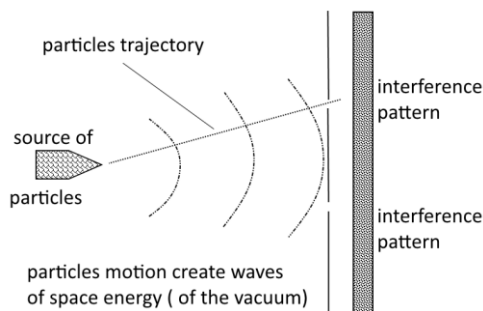
Figure 4: Wave-particle unity in the double-slit experiment with electrons

4.1.   Superposition and the double-slit experiment

In generally double-slit experiment has nothing to do with the superposition and with the observer. It is a pure technicality of the physical world. The obtained results of the experiment presented in the recent article [7] cannot be interpreted as the result of superposition. The only common-sense interpretation of the experiment is "particle-wave unity" proposed in this article. The proposed »three-slit interference experiment« [8] excludes the superposition as a possible interpretation of the double-slit experiment. The three-slit interference experiment is in theoretical accord with the "wave-particle unity" model presented in this article.

5. System Theory and cyclotron physics

Cyclotron physics has discovered several elementary particles with extremely short lifetime. These particles are sparkles of kinetic energy of accelerated protons and they immediately disappear back into the physical vacuum.

Top quark	171,2 GeV/c2	10E-23 s	1995
Higgs boson	125 GeV/c2	1,56 x 10E-22 s	2013
Z boson	91 GeV/c2	3 x 10E-25 s	1983
W boson	80 GeV/c2	3 x 10E-25 s	1983
Bottom quark	4,2 GeV/c2	10E-23 s	1977
Charm quark	1,27 GeV/c2	10E-23 s	1974
proton	938 MeV/c2	stable lifetime	1886
strange quark	104 MeV/c2	10E-23 s	1968
Down quark	4,8 MeV/c2	10E-23s	1968
Up quark	2,4 MeV/c2	10E-23 s	1868

**Figure 5**: Lifetime of particles discovered in cyclotrons

From the view of system theory these particles are subsystems in the model of universe. We can write following formula:

$$Y : \{ 6quarksy, Higgs.bosony, Wbosony, Zbosony\} \qquad (10).$$

The trouble is these articles are artificially produced in cyclotrons. We do not have any experimental evidence that these particles exist in physical universe on their own. This still is an unproven hypothesis. We have no right to write the formula below and think it represents physical reality:

$$X : \{ 6quarksx, Higgs.bosonx, Wbosonx, Zbosonx\} \qquad (11).$$

Discovery of quarks and Higgs boson is theoretically supported with the Big Bang theory, these particles theoretically had appeared into existence when energy of the universe was in the state of superposition, every particle had its super partner. Recent research confirms Big Bang never happened, universe is non-created system in permanent dynamic equilibrium, cosmological principle is time-invariant [9,10]. The picture of the universe development on the figure below is false.
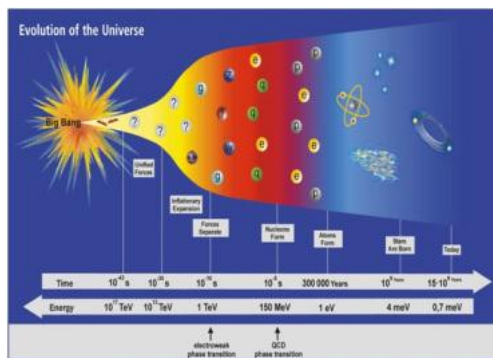
Figure 6: Hypothetical evolution of the universe belongs to the history of physics

There was no Big Bang, there is no supersymmetry. Quarks, Higgs boson, W boson and Z boson are artificially made momentary fluxes of protons kinetic energy released in collisions. They immediately disappear back into the physical vacuum. There is no Higgs field giving mass to the elementary particles. Every elementary particle has its own energy and its correspondent mass. The inertial mass of the proton has the origin in the variable density of the superfluid quantum vacuum [4], in this article also named "physical vacuum". W boson and Z boson are not carrying weak nuclear force which is non-existent. Elements with an atomic number above 90 are unstable because of "complexity instability". Inside their nucleus, the complexity is such that they become unstable. The picture below of how basic forces came into existence is not right.
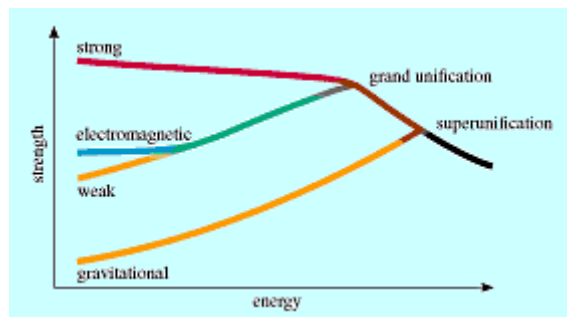
Figure 7: The false imagine of fundamental forces appearance in Big Bang

Universe is non-created system. There was no appearance of fundamental forces. There was no super unification. Strong nuclear force and gravity force never split. They both have the origin in the variable density of superfluid

quantum vacuum. Variable density of the vacuum is carrying the same force which is attracting protons inside the nucleus and stellar objects [4]. We have only two fundamental forces in the universe: gravity which has origin in variable density of superfluid quantum vacuum and electromagnetism which has the origin in superfluid quantum vacuum excitation. Proton and electron are vortexes of vacuum, photon is the excitation of the vacuum.

We do not have any data that particles discovered in cyclotrons are existing in the physical universe. The cyclotron physics is not falsifiable and is not bijective. It will never give any technological application. Positron and antiproton are two discovered particles accordingly to the supersymmetry model. Positron is the antiparticle of the electron. It has been found in cosmic rays, but in the contact with ordinary matter is unstable. It has a lifetime about 10E-10 seconds. Antiprotons are also found in cosmic rays. They are unstable, they are typically short-lived since any collision with a proton will cause both particles to be annihilated in a burst of energy. Their lifetime, when kept in artificially made physical circumstances in lab is about 32 hours [11].

In system theory, unstable elements cannot build a stable system. The idea that antimatter is existing in the physical universe is unproven speculation. CERN research on antihydrogen will not give positive results [12] because the idea of antimatter existence is based on wrong assumptions: "In 1928, British physicist Paul Dirac wrote down an equation that combined quantum theory and special relativity to describe the behaviour of an electron moving at a relativistic speed. The equation – which won Dirac the Nobel Prize in 1933 – posed a problem: just as the equation $x^2 = 4$ can have two possible solutions (x = 2 or x = −2), so Dirac's equation could have two solutions, one for an electron with positive energy, and one for an electron with negative energy. But classical physics (and common sense) dictated that the energy of a particle must always be a positive number. Dirac interpreted the equation to mean that for every particle there exists a corresponding antiparticle, exactly matching the particle but with opposite charge. For example, for the electron there should be an "antielectron", or "positron", identical in every way but with a positive electric charge. The insight opened the possibility of entire galaxies and universes made of antimatter" [13]. Yes, the equation $x^2 = 4$ has two possible solutions. But we cannot use this mathematical fact in cosmology and think that antimatter exists. Between this equation and the physical world, there is no bijectivity, the entire idea of antimatter is not falsifiable.

Cyclotron physics has introduced a new thought in physics, namely, something is meant to be discovered without knowing where it is. The top quark, for example, has 183 bigger mass than the proton. How top quark could be a part of proton cyclotron physics did not explain yet. Also, it is not known where in the universe top quark could be. From the system theory, this is not allowed. We cannot say a given element is a part of physical reality without knowing where this element exists. Cyclotron physics needs to answer these basic questions. If the answers will not be found the cyclotron physics did not enrich physics, on the contrary, it has brought in physics contradictions. In the universe, there are no contradictions. All runs smoothly and is perfect. The aim of physics is to adequately describe the perfection of the universe. Bijective physics goal is to develop physics without the mathematical tool of re-normalization. The universe runs smoothly without using re-normalization. In Einstein's view on time, the universe does not run in some physical time. It runs in space only that is time-invariant. Big Bang model which sees the universe existing in some physical time, belongs to the history of physics [14]. There was no Big Bang, there was no supersymmetry, there was no inflation, there was no recombination. Cosmological principle is time-invariant. Universe is eternal non-created system. Black holes are rejuvenating systems of the universe [9]. The idea that in cyclotrons some physical circumstances are recreated as they have been at the hypothetical Big Bang explosion has no support in experimental data. The physical circumstances of elementary particles in cyclotrons are artificial, manmade. These particles do not exist in the physical universe.

6.   Conclusions

Particle physics has managed to break the proton. What keeps proton together is still an open question. From the view of the System Theory, there should exist an undiscovered mechanism that keeps proton, which is made out of unstable elements, stable. This unknown mechanism is the challenge of today's particle. System Theory suggests the motion of a given particle creates a wave of the quantum space which is a common-sense logical

explanation of a double-slit experiment which has nothing to do with the phenomenon of superposition. Cyclotron physics needs re-examination in order to fulfil the requests of System Theory which requires bijectivity as the necessary standard for a given theory becoming valid.

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