

THEORETICAL PHYSICS IN CRISIS

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Abstract

Contemporary fundamental theoretical physics has been in crisis for a long time, as it cannot provide an answer to the most important question: “What is the basic structural unit of matter (space, time, energy) and how is the universe constructed of these elementary units?” The reason for this situation is explained below. Also shown, is the way to find answers to these basic questions.

Crisis of Contemporary Theoretical Physics

The contemporary crisis of thinking and knowledge is a consequence of **positivism** and its various branches leading to the extinction of philosophy and refusing to deal with the basic philosophical questions. Positivism became the basis for scientific knowledge replacing **Hegelian dialectical rationalism**, in which the classical philosophy had achieved its apex. Positivism tried to create the principles for scientific research based on the rules of formal logic and experiment, where the axiomatic approach became a starting point for finding the useful scientific results. Positivism refused to deal with the basic philosophical questions and categories regarding the nature of Being, God and the physical Universe. The way to the truth became “scientific” with many successful and useful discoveries and inventions. The dialectic logic was rejected as speculative, sophistic, metaphysical and useless and replaced by formal logic which together with mathematics and experimental verifications became the basic methods of scientific research mainly in the sphere of theoretical physics.

The range of knowledge was limited to the **phenomenological level** of reality. Mathematics and physics are considered to be the most suitable instruments for describing Nature. Positivism removed the language of dialectics and accepted only the language of formal logic. Looking for the truth was inserted into the simple schemes of statement logic.

Positivistic science is finding the true knowledge according to the following scheme: If statement **A** is valid, then the statement **B** is valid also ($A \Rightarrow B$). This means, if starting assumptions (axioms) **A** are valid, then all results **B** are valid too, if we obtain them by the rules of formal logic and correct mathematical procedures. Then we test whether some results **B** can be confirmed by experiment. If yes, we suppose that the starting axioms **A** are valid and the theory, based on them, is correct. If results **B** have not been experimentally tested, the starting system of axioms is considered to be a scientific hypothesis. But we can never be sure whether axiomatic theory is the only one, as the results **B** can also be derived from other theories with different initial axioms **A**.

The typical example of a positivistic axiomatic theory is Einstein’s **Special Relativity Theory (SRT)** based on two axiomatic assumptions:

1. Speed of light c is the same towards all uniformly moving systems.
2. All uniformly moving systems are equivalent from the viewpoint of physical laws.

SRT is mathematically consistent but unphysical theory as it doesn’t consider the fact that objects move in a physical environment - vacuum and **time dilation (deceleration of processes)** can be only the consequence of increasing intensity of interaction (mutual local

pressure) of moving objects with the **physical vacuum**. As uniformly moving systems can be in different relation to the vacuum, so time (speed of processes) decelerates in objects with more intensive local interaction (pressure) with a vacuum comparing to the others. Also bodies in places with different gravitational potentials have a different interaction with their surrounding space (vacuum). This is the reason why, according to **General Relativity Theory (GRT)**, the processes slow (time dilation) in places with higher gravitational potential (higher density of the vacuum). The reason for time dilation must be the same. It cannot be different in SRT (as a consequence of mutual symmetry of systems) in comparison with GRT (consequence of mutual asymmetry of systems). The higher is the velocity (or the greater the gravitational potential), the greater is the interaction with surroundings and the slower are the processes (time dilation).

Time dilation (deceleration) really exists but not as a consequence of SRT. Other effects of SRT like length contraction and relativity of simultaneity do not exist in reality and have never been verified experimentally.

The **ontological essence** of existence is not reachable from the viewpoint of positivism, so we do not need philosophy dealing with essential aspects of being. It is enough to study the logical structures and truthfulness of language statements which can be empirically verified (confirmed). Dialectical logic was replaced by the formal logical analyses of linguistic structure of thinking, mainly scientific (logical and scientific positivism). The form became the goal at the expense of contents. This victory of formal logic and mathematics is brought ad absurdum in contemporary **string theories**, where abstract and complicated mathematical forms totally erase the real physical and thought contents and reality is replaced by pure fiction. It is remarkable how precise evaluation of contemporary fundamental theoretical physics represents Nietzsche's declaration that all scientific notions used for explanation of the world are pure fictions and everything we consider to be a scientific true is only a useful kind of mistake and lie that is necessary in order that people can live in a world having no sense. Scientific positivism is in analogical situation. The science is a pure illusion of truth which can be only relative.

The great progress has been made in science during the last centuries. Physics succeeded in the unification of matter and energy, electricity and magnetism. The important kinetic laws of macro-systems (gravitational theory) and micro-systems (quantum theory) have been postulated, but the basic questions concerning the essence of matter and motion have not yet been answered.

Many people within living memory have tried to understand the material unity of our Universe. The questions are: What is matter (space, energy, time) and what are elementary building blocks of which it is constituted? How is the Universe constructed of these elementary constituents? What is the mechanism of the unity principle?

Theoretical physics has an exceptional opportunity in searching for the answers to these questions, but now, at the beginning of the 21-th century, it is in a deep crisis. Two of its pillars – **gravitational theory** and **quantum physics** represent independent directions. Elimination of this duality and unification of these two pillars of contemporary theoretical physics became a great challenge for scientific research but efforts remain unsuccessful to this date. Let us review the reasons for this.

There are deep discrepancies between Einstein's theory of relativity and quantum mechanics. Einstein was clearly conscious of them. He did not want to accept some of results of quantum mechanics which contradict the cardinal postulates of his theory of relativity. He regarded the quantum description of reality as incomplete and was not able to come to the

terms with **Heisenberg's uncertainty principle** which predicates the impossibility of defining the precise velocity and spatial position of elementary particle at the same instant. In order to unify gravity with electromagnetism he constructed a field theory in competition to quantum mechanics. But he did not succeed. Einstein was sure, that despite the impossibility of making precise simultaneous measurement of velocity and position, the particle exhibited these characteristics, and they could be completely described without resorting to probability. Moreover, Einstein was concerned with the direct communication between distant particles resulting from quantum theory. He thought that something was wrong with quantum mechanics as his relativity of simultaneity denies direct action at a distance. However, the problem lies in his erroneous **relativity of simultaneity** as a consequence of his unphysical SRT.

The attempt to unify Einstein's theory of relativity with quantum mechanics can lead only to irrational theories having nothing common with reality. String theories are now the most popular and widespread fundamental physical theories trying to unify Einstein's theory of gravity (general relativity) with quantum physics and so create the so-called "theory of everything". But they stand on mistaken philosophical fundamentals and so cannot explain the uniform essence of the material existence of the Universe. The "sand legs" of string theories are evident: we have **one-dimensional strings** or **p-dimensional branes** and, on the other hand, specifically coiled **eleven-dimensional space-time**. Strings are not the building blocks of space and do not form it, only oscillate and coil in it. Space and strings have mutually independent existence. It is similar to the mutually independent existence of space and matter in Newtonian mechanics. Coiled spaces as the **Calabi-Yau manifolds** are only pure mathematical forms, abstracted shapes, without any content. They are voids having specific shapes. While the Newtonian empty space has no shape and is infinite, the Calabi-Yau spaces have shapes devoid of any content. Nay, these empty spaces contain holes. The configuration of the holes and bends in these empty shapes defines both the possible resonances of strings oscillation inside and outside these abstract spaces and the possible forms of their winding on these shapes. The relations between the strings and spaces are only external and formal. The strings, membranes and Calabi-Yau manifolds are pure abstractions based only on formal but not dialectical logic of being. String theories are only pure abstract mathematical forms trying to find some real content for their constructions, like mass and charge. But this attempt is quite artificial. String physicists meet new complications again and again and their mathematical apparatus becomes more and more complicated and inaccessible. If Einstein tried to unify matter and space, string theories separated them. There are only external relations between strings and eleven-dimensional space-time. Everything is hidden under the Planck scale where scientific fantasy is unlimited. String theories are mistaken in their philosophical basis and give no answers to the basic questions of physics, although these answers are quite easy from the viewpoint of dialectical logic. String theories are predestined not to become the **Theory of Everything** but **Theory of Nothing**.

Contemporary physical theories are built on an axiomatic base, so they are only theories, and not the real knowledge of matter (space, energy). They only try to describe the manifestations of matter. Despite that, some physicists think they are capable of talking about the basic philosophical truths and detecting them. What philosophical truth have the string theories detected about the essence of matter and space? That one-dimensional string is the basic building block of matter and that there is also eleven-dimensional space-time? What is its elementary building block? Do the physicists, discovering the basic universal interaction as a unification of four known interactions, know what are they finding? They use a very complicated mathematical apparatus and hope to find the truth in this impenetrable jungle.

This truth will be so complicated and artificial that only some mathematicians will pretend to understand it. As the essence of unity is unknown, finding a mathematical form for it cannot be successful and can only complicate the situation more and more.

The significant successes achieved by physics, mainly at the first half of the 20-th century, have profoundly influenced philosophy. Despite the unsuccessful detection of the essence of matter, technology has achieved very useful results. This fact influenced philosophy and caused its decay. Such decadent movements as subjectivism with existentialism, pragmatic positivism (constructivism, analytical philosophy, operational philosophy) have appeared. They refuse to look for the answers to the basic questions of being, consider them useless, and confine their investigation to what is useful from the materialistic point of view. This decadence is one of the main reasons why the essence of matter has not been discovered. Physicists are not experienced in philosophy and philosophy often falls into line with physics and their operational results and consequently lapse into pragmatism.

Matter in Contemporary Physical Understanding

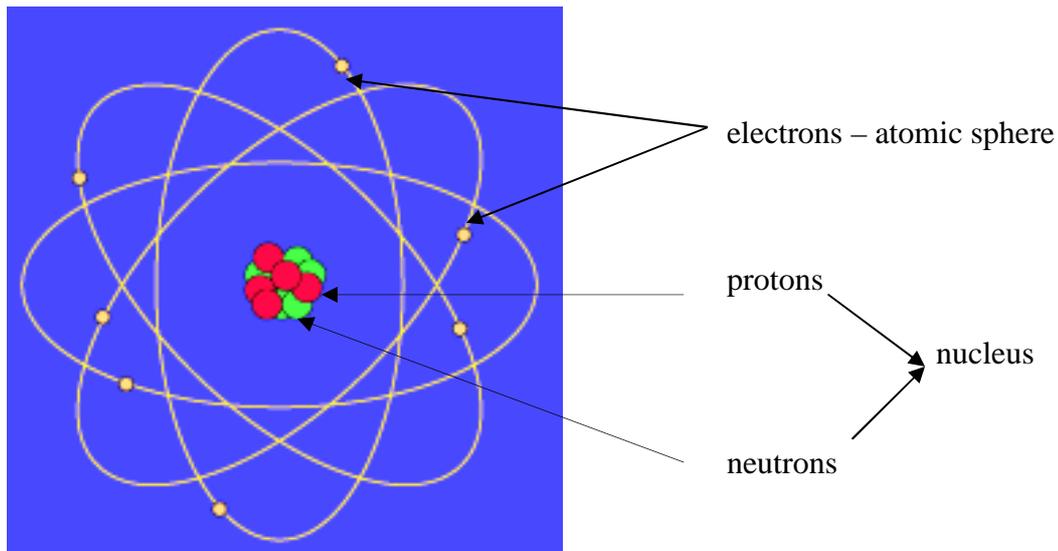
The most general forms of matter accepted by contemporary physics in its Standard model are:

- **material** (created by the basic building blocks - fermions),
- **fields** (created by the basic interactions with their carriers - bosons),
- **vacuum** (the space without particles).

ELEMENTARY PARTICLES – FERMIONS			
family	LEPTONS		Q A U R K S
I.	e electron	ν_e electron neutrino	u up d down
II.	μ muon	ν_μ mi neutrino	C charm S strange
III.	τ tauon	ν_τ tau neutrino	t top d bottom

The elementary particles obviously belong to the first family. The particles belonging to the second and third families are created only during exceptionally high-energy collisions. These particles have their antiparticles. The atoms are created from the particles of the first family. The atomic sphere consists of electrons circulating around nuclei created by protons and neutrons consisted of **u** and **d** quarks.

The next picture represents the Bohr model of the atom:



The world of elementary particles became broader and more complicated. Then it had been found that the strongly interacting hadrons (the protons and neutrons belongs to them) have an internal structure, that according to the **Standard model**, consists of bound quarks interacting mutually through gluons – immaterial vector particles. The non-abelian gauge quantum field theory describing the strong mutual interactions between quarks and gluons is named **chromo-dynamics (QCD)**. The independent existence of quarks and gluons is impossible. Their freedom is only asymptotic and so they can only be bound inside particles. When protons and neutrons were considered elementary particles, the pions were the mediators of strong interactions between them. The pions consist of one quark and one anti-quark according to the **quark model**.

According to the Standard model, the elementary particles are dimensionless point-like entities without any internal structure. It is clear that such an understanding is quite naive. These particles dispose of many properties (charge, mass, spin, ability to interact with other particles, different energies) thanks to which they differ from one another, so they possess various qualities, manifesting them outwards. The deep internal reason for this miscellaneous qualitative manifestation of these quasi-elementary particles is hidden in their different internal structure that cannot be detected by contemporary particle accelerators but can only be explained by the deep logical insight. The interpretation of elementary particles as points moving in space is in a deep contradiction with reality. Every real physical object, including elementary particle, is spatial, holding a certain part of space and moving in relation to other elementary holders of space thanks to their mutual relations which are also elementary parts. So, the elementary part is a relation as well as the elementary relation is a part of space. There is no principal difference between elementary parts of mater and space because space is material and matter is spatial. So the elementary unit of space must be at the same time the elementary unit of matter (energy). As theoretical physics does not accept this, no complicated mathematical theories can lead to the true understanding of the nature of the physical Universe and the very expensive particle accelerators cannot help with this.

The elementary particles – fermions according to the Standard model act mutually by exchanging of specific elementary particles – virtual bosons. Contemporary physics knows the four basic types of interaction with four types of force fields – gravitational, electromagnetic, strong and weak.

BASIC INTERACTIONS	MEDIATORY PARTICLES – BOSONS
Electromagnetic	Photons
Strong	Gluons
Weak	Inter-medial bosons W^{\pm} a Z^0
Gravitational	Gravitons

The understanding of interaction as an exchange of bosons between fermions is a consequence of mechanical approach to theoretical physics. For example, the electric attraction and repulsion between charged particles are represented by the mutual exchange of **virtual photons**. As the electrostatic force is a long distance one, every electron must exchange photons with an enormous number of protons and electrons in the Universe. It is remarkable that this absurd picture is more acceptable than much more logical picture of the direct connections (relations) between charged particles. The acceptance of particle interactions as direct relations between them is rather complicated for theoretical physics, because of Einstein's refusal to accept non-local actions. But **non-locality** as a direct communication between distant particles is a fundamental consequence of quantum physics, known as **entanglement** or **EPR non-locality**. If theoretical physics were not blocked by erroneous dogmas, it could have detected much earlier, that the vacuum is not an empty space between point-like particles, but is created by direct connections between them. All particles and interactions are space-creating and space-carrying direct connections and not point-like dimensionless particles without any internal structure.

Using the instruments of dialectical logic, theoretical physics could have already detected the nature of matter and would not have a problem of understanding the vacuum as being created by direct space-carrying connections joining everything with everything.

The dialectical logic does not investigate the specific laws of motion of separate forms of matter, but only explains the basic reason for motion. The integrating aspect of all these forms is their energetic substance. All forms of matter are only different forms of energy. Energy, being motion or potential for motion, has its basic reason in the dialectical relation of opposites. This means that **bipolarity as the dynamic relation of two opposite poles (anti-poles) is the basic building block of matter, energy, space and time**. This fact has not been understood by physics in spite of the fact that bipolarity manifests itself everywhere, for example, bipolarity of electric charges and magnetic poles, action and reaction laws, kinetic and potential energy, attraction and repulsion, etc. Without an acceptance of the bipolar principle of matter, it is impossible to explain how matter as space and time is structured and constructed.

The essence of the vacuum is unknown. The force fields are supposed to be continuous but on the other hand they are transmitted by point-like particles – virtual bosons. For example, the electromagnetic field is transmitted by the quanta of radiation – photons.

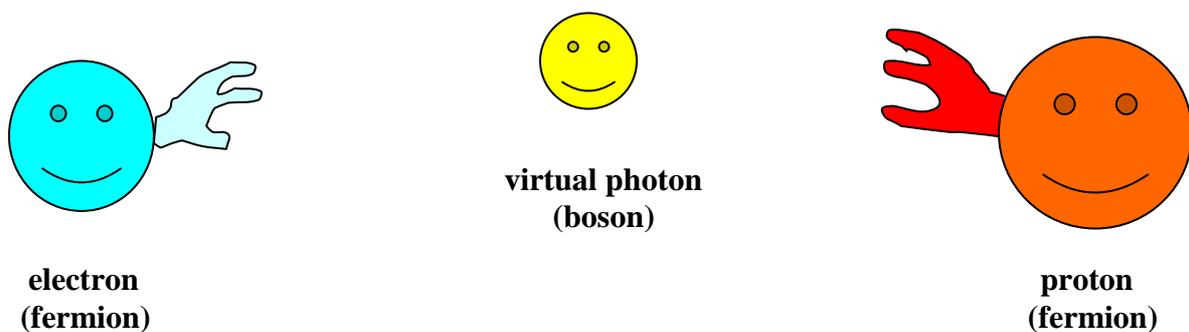
Is space continuous or discrete? The notion of a field is an indication of something monotonous, unlimited and continuous, surrounding all bodies where the forces of their mutual acting are “sowed”. The question is: Do the particles create the fields or are they created out of fields? By what reason is the particle as a discrete element of matter detached from a continuous field? As this reason is unknown, the solution is the so-called “complementary principle” that indeed, accepts matter duality, including the wave-particle duality of the photon, electron and other particles, but does not explain the deeper unity of this

duality. Continuity and discontinuity are only mutually complementary moments in this principle. Their relation is only external and does not follow from their intrinsic nature. The dialectical relation between continuity and discontinuity is not yet understood.

Philosophical dialectical principle has had no adequate reflection in physics, despite its brilliant explanation of the essence of motion.

The duality between field continuity and discontinuity of energy quanta, the misunderstanding of the relation between bodies (particles), fields and vacuum and the contradictions between two grand physical theories are the result of misunderstanding of the dialectical nature of space, not knowing its elementary structural unit and the unity principle of construction of the Universe. These questions will be explained step by step.

Let us see how simply and clearly the problem of duality of continuity and discontinuity can be removed, looking at the mutual interaction between two fermions. Let the electron and proton represent the fermions, so the virtual photon as a boson carries their mutual electromagnetic interaction. Particle physics interprets this interaction in the following way:



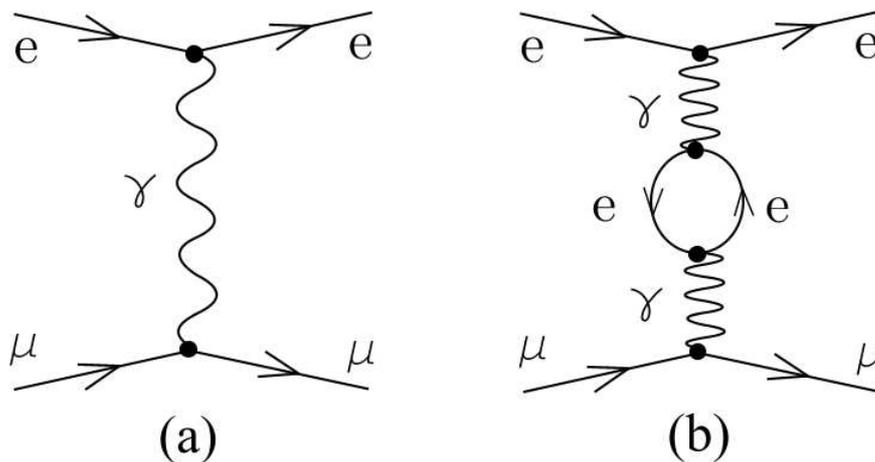
Electron and proton exchange a virtual photon so they create their mutual **electromagnetic interaction**. These three particles do not carry space inside and do not create it, but only move towards each other in empty space - vacuum. This naïve presentation of electromagnetic interaction creates the following serious problems:

- How do the electron and proton know how to exchange the virtual photon if there is no direct relation between them? How does the moving virtual photon know what fermions it needs to get into an interaction if it does not carry any information about them? Do virtual photons only freely fly between electrons and protons in empty space, accidentally collide with them and so cause an electromagnetic interaction?
- What is the **electromagnetic field** like? Is it something continual, emanating from every charged particle and reaching an unlimited distance or is it an unbelievable flow of virtual photons flying from or in every charged particle in order to mediate interactions between all charged particles in surroundings? Einstein's dogma of local action does not allow virtual photon to know where these points (electrons) are, but nevertheless, virtual photons come to and go from a concrete point (electron) in order to transfer an electromagnetic interaction to all other electrons (points) and protons being in the near and distant surroundings - even in the whole Universe.

The great barrier for correct thinking is the ban on the existence of direct action **at-a-distance** as a consequence of the special theory of relativity (relativity of simultaneity). Despite the experimental evidence of the existence of non-local connections, quantum physics looks as if it is having problems with their full acceptance. Otherwise it would have had to discover that the interactions between particles are caused by their mutual direct connections not by point-like virtual bosons flying between them at limited speed.

QED is the quantum theory of the electromagnetic field with a photon as a quantum. Although **Richard Feynman** (the famous creator of QED and its mathematical apparatus and formalism) tried to find an illustrating interpretation of applied mathematical procedures for describing electromagnetic processes, the results of his effort are unsatisfactory. But they represent a certain aid for physicists because of considerable simplification of computation.

He created the form of graphic illustration of mathematical expressions that appeared during calculations known as Feynman's diagrams which represent, at the same time, the graphical illustrations of processes.



(a) the tree diagram
 (b) the diagram with one closed sling

The above pictures are examples of Feynman's diagrams of electromagnetic interaction between electrons and muons. External direct lines represent the motion of particles – electron **e** and muon **μ** before and after interaction. The electromagnetic interaction is represented by the tops (knot points) of the diagrams, where two direct lines of charged particles meet the one wavy line of photon **γ**. In this case the photon is “virtual”, not real, and so it cannot be detected. Now we meet one serious problem with interpretation, where the nature of the electromagnetic interaction is unclear. Although the photon is virtual only, it moves with the limited speed of light and carries a certain energy and momentum. If the interaction in diagram (a) is interpreted as an emission of a virtual photon by an electron and its consequent absorption by muon, the result is a change of energy and momentum for both particles, where the whole energy and momentum of the system is conserved in both tops of the diagram. In diagram (b), the process of electromagnetic interaction is supplemented by the virtual inter-process of rising and extinction of an electron-positron pair. We could continue in

complicating this situation, but the exchange of virtual photons is the basic sense of these processes. In order to guarantee the permanent continuity of the electromagnetic interaction of separate particle with all charged particles in the Universe, the quantum electromagnetic field of every charged particle must be represented by an infinite sea of virtual photons which are emitted and absorbed by the charged particle.

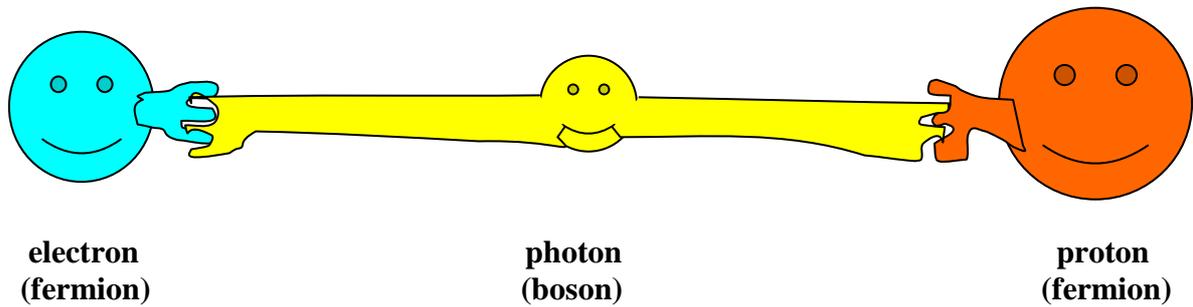
Of course, quantum physicists realize that this interpretation is rather naïve since virtual photons cannot be detected. They note that the internal wavy line of the diagram represents only a mathematical value known as the propagator of electromagnetic or electron-positron fields. So now we can clearly see the root of interpretation problem. The reality is replaced by mathematics which definitely obscures the real nature of electromagnetic interaction instead of disclosing it. Well, the very effective and useful QED is only one of many theories where reality is successfully replaced by mathematical formalism without any possibility of making a clear and simple interpretation of real processes. Saying that the direct lines of electron and muon represent the quantum **wave functions** of these charged particles cannot make the understanding of these phenomena more clear. The interpretation problem of quantum physics remains unsolved and physicists try to persuade us that it is not necessary to try to interpret the mathematical procedures as it is not clear what reality they hide. This situation inspires the feeling of secrecy and mystery. Theoretical physics should give the simple and logical explanation of physical reality but instead, leads us into the sphere of puzzles and paradoxes hidden in complicated mathematical relations.

The interpretation problem with virtual photons is a consequence of non-acceptance of direct non-local interactions. The fact that the virtual photons are not real, but only the mathematical propagators of electromagnetic interaction, is clear evidence that this interaction must be represented by direct connection between charged particles. As Feynman wanted QED to be relativistic, he preferred the existence of virtual photons moving with limited speed instead of direct connections. So the next paradox appeared - the real electromagnetic field is only a consequence of virtual, i.e. mathematical existence of virtual particles. Such a mathematical approach was also transferred to the other quantum field theories like:

- quantum theory of weak interactions trying to unify them with electromagnetic interactions into the quantum theory of electroweak interaction,
- quantum theory of strong interactions – quantum chromodynamics QCD,
- quantum theory of gravity as an attempt for quantisation of gravitational field.

In these theories the virtual particles – bosons are also the carriers of forced fields. In order to be exact, these particles – photons and inter-medial bosons Z^0 a W^\pm can also exist like real particles. As the carriers of interactions between fermions they become unreal virtual mathematical spooks. Gluons as intermediaries of strong interaction cannot exist as free particles and have never been detected as well as gravitons.

Let us have a look at the real picture of force interactions between particles that is devoid of thought inconsistency and unexplained paradox of matter duality. In this picture, the interacting particles and their mutual interactions represent structures consisting of elementary quantum connections. Their nature will be explained later. Both the particles and interactions are composed of the same elementary connections and so there is no difference between them. Particles and interactions are not points moving in space, but they are carriers and creators of space and also vacuum and fields. Let us have a look at the following picture of an electromagnetic interaction between two charged particles:



In this interpretation, the photon represents a direct connection (relation) between the electron and proton. It is not a virtual photon as an object of mutual exchange between particles, but the real direct connection whose structure is the same as the structure of a free photon. So the electromagnetic interaction between electron and proton is not a permanent exchange of virtual photons but the direct connection whose intensity depends on the distance between particles and their mutual motion. Other interactions have an analogical character, including gravity, which is created by the huge number of elementary quantum connections between massive objects, even though these elementary quantum connections emerge from every elementary particle connecting it with the whole universe. All known interactions are represented by the certain structures of elementary connections. The vacuum is not an empty space but the space of quantum relations connecting everything with everything. There is no difference between vacuum, matter and fields. All consist of the same elementary bipolar connections creating the basic building blocks of the physical Universe as shown in [1]. Now there is no problem to understand the relation between continuity and discontinuity. The particles and interactions represent discontinuity as they are separate parts (quanta) of space, but at the same time being the structures of quantum connections they represent the continuity of space.

References

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