

THE NATURE OF THE UNIVERSE

Quantum Dipole as Elementary Structural Unit of the Universe

Peter Kohut

Maly Saris 478, 080 01 Presov, Slovakia

Email: PeterKohut@seznam.cz

INTRODUCTION

“What is an elementary structural unit of the Universe (matter, space)?” I decided that in any case, I have to discover the answer to this and other questions. The studying of system science – cybernetics showed me, that information is constructed of two states represented by two digits 0 and 1. So, in order to construct a composite structure, the necessary and sufficient condition is to have two different states. The search for the substance of the Universe (matter, space) forced me not only to limit my interest in cybernetics but also to pay attention to philosophy. In Hegel’s philosophy and his “Logic”, I discovered the dialectical bipolar essence of matter. By in-deep study of this philosophy I was able to gradually find the answers to the basic questions of physics. After that, I tried to transfer my philosophical knowledge into mathematical form.

Having detected the elementary structural unit of matter and the basic principle of the Universe and its unity I started to create my theory, which I named “The Integral Theory of the Universe”.

My effort is direct towards giving classical beauty to physics through philosophy in order to discover the mystery of the material aspect of the Universe. The approach of bringing philosophy to physics provides results that are otherwise hardly accessible. I am sure that this approach enriches not only physics but philosophy as well, since its content is extended by concrete knowledge.

The philosophy deals with entire being, including the nature of life, spirit and God. The task of physics is to investigate matter in all its manifestations. If using the notion “Universe” it is not clear, it applies, not only to the material aspect of being, but includes life, Man, God, as well. In order to avoid notional inaccuracy, we will deal next with “material being of the Universe”. The discovery of the essence of material being of the Universe is the basic mission of my effort but does not limit my research.

SPACE AND TIME AS FORMS OF MATTER

Within living memory, humanity has been searched for the answers to the questions what are matter, space and time. These notions were formerly, the basic categories of philosophical thinking and later - objects of physical research. Philosophy with its instruments has found the most precise explanation of these categories in Hegelian dialectic logic. Physics has so far reached only a particular knowledge by its approach.

Dialectic philosophy considers space and time as forms of material being. The unity of matter, space and time manifests itself such that there is no matter without space and time and on the other hand there are no space and time without matter. Physics also accepts this general conception but its mission is to explain and describe a variety of forms and manifestations of matter.

The general forms of matter accepted by contemporary physics are:

- solid form (form of coupled energy),
- radiation (form of free energy of electromagnetic field),
- vacuum (space without particles).

Contemporary physics distinguishes four basic sorts of interactions with four types of force fields: gravitational, electromagnetic, weak and strong.

Philosophy does not investigate the specific laws of motion of separate forms of matter but it only explains the basic reason of motion. The integrating aspect of all these forms is their energy substance. All forms of matter are only different forms of energy. Energy, being a motion, has its basic reason in the dialectic relation of contradictions – bipolarity - connection of anti-poles. The fact that **the dynamic bipolar relation of anti-poles is the basic building block of matter, space and time** has not been accepted by physics so far in spite of that bipolarity manifests itself everywhere, e.g. bipolarity of electric charges and magnetic poles, action-reaction law, kinetic and potential energy, attraction – repulsion, etc. Without an acceptance of the bipolarity principle of matter it is impossible to explain how matter as space and time is structured and constructed. Physics has a problem in understanding the relation between continuity and discontinuity. It describes the fields (gravitational, electromagnetic) as a continuum but on the other hand engages the discrete quanta of radiation, particles and other material structures. The essence of a duality of continuity versus discontinuity is unknown yet, so physics accepts it as a manifestation of duality of nature. The clearest example is electromagnetic radiation, which is both the waves of the electromagnetic field and the quantum of energy, the photon. This phenomenon is explained as the complementary property of matter, that is, to be both wave and particle (corpuscle). But the nature of this phenomenon has not been discovered as yet. Classical theories like the Maxwell theory of electromagnetism and the Einstein theory of relativity describe the motion of material objects, electromagnetic and gravitational fields by accurate space-time parameters. On the other hand, quantum mechanics describes the motion of elementary particles by the functions of probability and statistics. The Heisenberg uncertainty principle says that the precise position in space and the momentum of particle cannot be measured at the same time.

Mentioned discrepancies and unexplained dualities of contemporary physics result from an ignorance of the dialectical principle of building up of matter and its spatial evolution in time. Space in classical Newtonian physics, is an empty arena for the motion of celestial bodies and for their power activities. Material objects are independent of space, which is absolute. In the field theories of Maxwell's electromagnetism and Einstein's gravity, free space (the vacuum) has physical property like the ability to transmit the electromagnetic and gravitational waves.

But the essence of the vacuum is still unknown. Fields are continuous, but electromagnetic fields are transmitted by the quanta of radiation – photons. Is space continuous or discrete? The notion of a field is something that is monotonous, unlimited and continuous, surrounding all bodies where the forces of their mutual actions “sowed”. But on the other hand, all bodies and particles are filled with force fields. The question is: Do the particles create force fields or force fields create particles? What reasoning detaches the particle as a discrete element of matter from the continuous field? As this reason is unknown, the solution is the so-called “complementary principle” that, indeed, accepts the duality of matter, including the 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 flow from their intrinsic nature. The dialectical relation between continuity and discontinuity has not yet been understood. Einstein supposed material objects as being only the field compressions but did not imagine how such a compression could occur. His theory of gravity is built as an imitation of the Maxwell theory of electromagnetism but he remembered that gravitational fields in contradiction to electromagnetic fields have their source outside - in material or electromagnetic form of energy. The Einstein gravitational fields are metric fields relative to the geometric properties of Riemann space. The Einstein equation for the gravitational field expresses the relation between the amount of energy and its spatial manifestation by Riemannian metrics. The left side of the equation represents the Riemannian tensor of curvature and right side is a tensor of momentum and energy. Einstein for the first time mathematically unified matter (energy) and space. But the nature of this unity has remained undiscovered.

Giving matter and space in a mathematical relation, show Einstein accepted the philosophical truth that space and time are only forms of material existence and so space has no absolute, but only a dependent existence in relation to matter.

Philosophical dialectical principle has had no adequate reflection in physics, despite its brilliant explanation of the essence of motion. So my mission is not only to describe it philosophically but also to put it into mathematical and physical forms.

Let us come back to the Einstein theory. There are two reasons why Einstein was disquieted by quantum theory. Quantum physics asserts that a particle in motion has no precise place (coordinates) in space. The second much more significant reason resulting from quantum theory is the existence of non-local connections and direct communication between spatially separated particles. This fact is in contradiction with the Einstein theory of relativity and the concept of a continuous field. According to this concept, the field in accurate space-time coordinates depends on the field being quite near. The Maxwell equations make possible the prediction what will happen a bit farther and later if we know what is here and now. Direct non-local action not only contradicts the Einstein theory but represents a certain return to Newtonian mechanics on a higher level. Einstein considered quantum theory as incomplete and its uncertainties, probabilities and statistic character as a result of not knowing the deeper intrinsic nature of quantum phenomena. Since quantum mechanics was created, the problem of direct non-local connections is unavoidable. Some theories with hidden parameters try to support Einstein’s local principle. Every local theory has to meet Bell inequalities. Theoretical results of quantum mechanics manifest the violation of Bell inequalities and have been confirmed by many experiments. Theories with hidden parameters are not able to eliminate the awkward consequences of quantum physics. The problem of existence of non-local connections and direct action through space shows the failure of Einstein’s local principle, which follows from his special theory of relativity.

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 the two great physical theories are the results of misunderstanding the

dialectical nature of space, not knowing its elementary structural unit and the principle of Universe construction. These questions will be explained step by step. But first of all we will start with a general consideration.

It is easy to imagine the space as divided into its parts. But it is not easy to imagine the mutual motion of these parts to create space. They do not move in space but being parts of space, they perform mutual motion. Every selected part of space, however internally divided, is a holder of a certain part of space. In contemporary conception, every particle, object or electromagnetic field moves in space. But the correct statement is that the space, dragged by a particle or any material object, moves towards the rest space. Moving objects are mutually moving parts of space. Their mutual motion is possible only thanks to their mutual connections. These connections are also the parts of space. If the part is separated from the whole, it does not leave this whole, but remains jointed with it by its universal connection. The part obtains its relative independence only thanks to its universal connection, which allows the part to obtain the possibility for its relative motion and to remain connected with the whole at the same time. The connection between parts is also a part of space. So there are no difference between part and connection. Every connection is a part of space and every part of space is a network of elementary connections. The dialectical separation of the part out of the whole means its separation out of every part of the whole. Such separation means the creation of its connections with every part of the whole and it is possible only if the whole and every part consists of elementary bipolar connections (quantum dipoles (+,-)). The quantum dipole (+,-) represents the elementary structural unit of the Universe (space, matter). Every "+" pole is connected with all "-" poles of the Universe and reciprocally. So, **everything is connected with everything**. Every separated part is connected with all parts of the Universe. The principle of universal connection of everything with everything creates the general unity of the Universe. **The Universe is a network of non-local connections** and "perceives" all of its part. On the other hand every elementary quantum "perceives" the whole Universe. These non-local connections are in radical contradiction to the Einstein theory of relativity. They not only exist but represent the substance of the Universe. It means that the Universe is always universally interconnected. Thus, the principle of universal simultaneity is valid. What is simultaneous in one system is automatically simultaneous in all others.

So we have described a dialectical relation between the whole and the part. Next we will pay attention to the dialectical relation between continuity and discontinuity. Every separated part is a quantum of space (discontinuity) but at the same time it is a connection (continuity). Discontinuity manifests itself as a separation of parts out of the whole (space) and continuity is represented by reciprocal connections between parts. The field may be interpreted as an internal continuity of the quantum and on the other hand as its connections with all rest quanta of the Universe.

Every elementary particle represents a separated part of space with relatively independent existence. Every separated material object remains connected with the whole Universe. As a part of space it is in a dynamic relation (motion) with respect to rest space. The external relative motion as well as the intrinsic motion inside a material object (e.g. particle) is the motion of its internal and external connections. Such understanding of motion excludes the possibility of determining the precise space position of a particle. A particle cannot have the precise position in space as it is not a point of space but it is a part of space and as a space-holder, it moves in relation to rest space. The coordinate systems used by physical theories are only the auxiliary abstractions in order to make a precise description of motion. Quantum mechanics refuses the precise and allows only the probable particle behaviour influenced by the dynamics of particle internal connections and by the dynamics of the whole Universe that the particle is universally connected with. Hence, no hidden parameters are in the background

of particle behaviour. The non-local connections of particle with the whole Universe are hidden for contemporary physics.

The mentioned analysis of space shows that the relativity of simultaneity is not possible. The Einstein understanding of relative time is not correct. Time and space are relative because they cannot be independent of matter and matter cannot exist without them. Time is the manifestation of motion and motion means changes. Time flow is a manifestation of changes in matter states. Bipolar dialectic substance of matter–space causes the structural changes in such a way that space (the Universe) constantly detaches its new and new-elementary quanta (expansion phase) or incorporates them into itself (contraction phase). The Universe so passes from one quantum state to the next one. This quantum transition (jump) represents its elementary motion – etalon – an elementary quantum of time for the whole Universe.

Time manifests its relativity not only by its existence as a form of matter but also by the different speeds of identical processes in various systems. Despite this relativity of local times (speed of processes) the Universe as a whole has its universal motion – a quantum jump with corresponding universal time, which will be analysed later.

Einstein made a mistake in his interpretation of relative time in his Special theory of relativity and consequently deduced the wrong relativity of simultaneity.

BIPOLAR NATURE OF MATTER

The dialectic reason for the division of the whole into its parts is their bipolar nature. There are no differences between parts and connections. All they consist of elementary bipolar connections. **Every connection is a part and every part is a network of elementary connections. The elementary part (quantum) is a connection (relation) of two anti-poles and the connection (relation) of anti-poles is an elementary part (quantum). A quantum consisted of two anti-poles - is a quantum dipole that represents both - the part and the connection (relation, join).**

If we start our consideration with Being at the highest level we can only state that something “is”. This “something” remains undefined existence until we say that there is “something else” towards which “something” defines itself as a difference. “Something” and “something else” are not two independent existences but they are two anti-poles of the same “one”. The relation of anti-poles is not static but dynamic. It must be dynamic because static relation is nothing. For example, the relation between man and woman cannot exist without their mutual activity. The mutual activity creates relations. The simplest form of mutual activity of anti-poles, that creates the essence of matter, is their attraction and repulsion manifested as pulsation – vibration – oscillation. Plato already said that God created the world by connecting “one” with “other”. So he obtained something “third”. But this “third” is only “one” representing the relation of two anti-poles.

The material being of the Universe as a separated part of the whole Being is nothing without its intrinsic contradiction. “Something” excludes its anti-pole – “something else” by repulsion. But at the same time the anti-poles remain connected together thanks their attraction. Thanks to repulsion and attraction, the anti-poles remain in a unity (mutual relation) that cannot be broken. The bipolar “one” is a self-repulsion and self-attraction of its anti-poles that can be symbolically marked as “+” and “-“. It is the dynamics, motion, pulsation, oscillation, permanent approaching and merging (attraction) and receding (repulsion). This self-motion of quantum-dipole is the mutual motion of its anti-poles. Repulsion and attraction are two faces of the coin. One predicts the other. Such is the dialectical logic of “one” that is bipolar and represents both - the basic building block of matter and its basic principle.

Formal logic separates “something” (A) and “something else” (A') into two independent entities. Their mutual relation is only external. A' is the negation of A. A stands beside A' without self-return through its anti-pole. There is no negation of negation as self-determination of “one” through its “other”. Formal notation $A = A''$ (negation of negation) presents only the external relation, formal mathematical operation, where A stands outside A' . This relation is not a contradistinction in their unity but it is their separation into independent entities. Mathematics, which is the apparatus physics uses, is based on a formal logic. So physics is not able to penetrate into the material essence, and studies the separated parts of the whole through their external relations and acting each to other only locally. Einstein postulated the local action even as a universal principle and hardly struggled with the non-locality of quantum theory in order to save his mistaken postulate about relativity of simultaneity that has caused a lot of confusions.

Let us see the real dialectical logic of the whole and parts from another point of view. The whole – “one” thanks to its intrinsic contradiction differs and divides itself into parts (many “ones”) which remains not only in their mutual external connection but every part is connected with the whole, which means that every part is connected with all the rest parts of the whole. As all connections of these parts are also the parts so all parts are connections – links, relations, quantum dipole networks, too. Part and connection are the same as well as

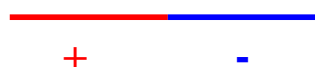
particle and interaction. Bipolar essence of matter can be discovered only by dialectical logic because dialectics have the universal power over the nature.

The inner contradiction of matter manifested by the mutual repulsion and attraction of anti-poles (“+” and “-“) represents the universal source of its motion. So, **the Universe is a dipole** performing its harmonic oscillations (pulsations) thanks to repulsion and attraction of its anti-poles. Repulsion of anti-poles is responsible for cosmic expansion and successive division of the whole into relative independent parts. The attraction of anti-poles is responsible for successive deceleration of cosmic expansion and consecutive reverse of this expansion to the cosmic contraction. The whole motional potential of the Universe, being its energy **E**, depends on its inner contradiction given by the size of the “charges” concentrated in its two anti-poles. This contradiction manifests itself as a tension between charges, changing into the motion of attraction and repulsion. If we name the charge of one pole as positive and other as negative we can present the Universe as a connection (relation) of positive and negative charge **Q** (or **Q⁺** and **Q⁻**) that create this connection. The charges **Q⁺** and **Q⁻** are the anti-poles of matter. Father and Son are anti-poles of God.

The relation of anti-poles, respectively the dynamic connection of anti-poles, is the basic building unit of matter (space). This unit being only the relation of repulsion and attraction of anti-poles is the simplest possible relation that forms the material aspect of the Being (Universe).

Every connection of anti-poles (“+” and “-“) represents the individual elementary quantum of matter-energy-space, the elementary quantum dipole symbolically marked as (+,-). It is the elementary building block of matter and the base for its structural composition in which everything is connected with everything.

Schematic representation of quantum dipole:



The penetration into the deepest essence of matter is impossible without thinking at the highest level of abstraction. The ultimate – final and at the same time the first in matter, its basic building block, is the something, everything of which emerges by its differentiation and arrangements into structures. The recovery of something first and finite in matter is the recovery of something that cannot be defined by something other but that which defines itself as something internally contradictory (bipolar). No more and no less.

In atomistic philosophy unlike dialectical philosophy the “one” is fixed as an atom (elementary particle). Its encounter with the “other” is considered as something external, accidental. Atomists consider the reality as a quantity of material objects (bodies, particles) moving in a vacuum (empty space). Matter is composed of elementary particles that get to their mutual relations thanks to the interaction of their forces. Such an atomistic philosophy Hegel named mechanical. It allows only the existence of local relations towards the nearest surroundings. Such conception is typical for Einstein. Existence of non-local connections of everything with everything is denied and undetected. Such philosophy is incapable to explain the relation between material objects and the vacuum as well as the relation of continuity and discontinuity, finality and infinity and other questions concerning the essence of matter.

Contemporary cosmological theories as a result of misunderstanding of dialectical essence of matter are not capable to explain the origin of cosmic expansion – the Big Bang - and the way out of singularity. Singularity as an internally undifferentiated existence (totality) is nothing. Anything cannot appear from nothing. Singularity does not have its own source for

plurality. It is only “one”. Only “one” as a relation of anti-poles contains the source for the plurality generation – cosmic expansion.

Quantum cosmological theories suggest the fluctuation of a previous vacuum as a source of cosmic expansion and mention some internal separation and fluctuation of energy density. But this fluctuation is not the existence of “one” as the relation of anti-poles. The so-called false vacuum contains the contradiction between the huge gravitational action of its energy and the repulsive action of its pressure, but the intrinsic bipolarity as a reason of this phenomenon is not detected. Therefore the reason for super-symmetry violation remains unknown. Such vague notions as accident, uncertainty, spontaneity and fluctuation are borrowed from quantum physics and used for this purpose. But the inner impulse for super-symmetry violation remains obscure.

RELATION OF FINITUDE AND INFINITY

The Universe is the “one” as a contradictory finite infinity. Finite “one” is without any end and limit. If the Universe is opened and has the infinite volume, all its parts must also have infinite volumes and the reciprocal transition between finality and infinity is impossible. Finite parts cannot be in any dialectical connection with such infinity. Exclusion of finite parts out of such infinity as well as their union into infinity is an invincible obstacle separating finality and infinity without creating their reciprocal connection. If the Universe as a whole has an infinite volume it is impossible to select a finite part. Neither the mathematical infinity can be divided into finite parts. On the other hand, adding the arbitrary immense number to the other one, we always remain in finality and never reach infinity. Finality and infinity remain external contradictions without common border (connection). Without dialectical logic neither the essence of matter nor the relation of finality and infinity can be detected.

The Universe as a whole is a dialectical unity of finality and infinity. It is finite as it is closed and infinite as it has no end and no limit. How can it be closed and unlimited at the same time? What is the solution of this apparent discrepancy? What form of the Universe? The next postulate is a solution:

The Universe as a space is a three-dimensional surface of a four-dimensional sphere.

So, the Universe is a limit of “something” thanks which it curves and encloses itself remaining without any own limit. This fact becomes evident by an analogy with a surface of a ball or globe. Their surfaces are closed and unlimited. Representing ourselves by two-dimensional plates we move on the surface of a ball and never meet a border. As two-dimensional plates we are not able to imagine the three-dimensional reality because we are closed in a two-dimensional reality. Indeed, as three-dimensional beings we are closed in a three-dimensional reality and incapable of imagining a four-dimensional reality. The fourth dimension is a necessary condition for curving and closing of the Universe. As the Universe is closed it has the certain finite volume of space in every moment and disposes of a constant amount of energy **E**. Cosmic expansion means the increasing of the entire volume **V** of the Universe that is not constant in time but changes as a function of time $V(t)$. Its average energy density $\rho(t)$ changes by the relation:

$$\rho(t) = E / V(t)$$

If the Universe would be a three-dimensional surface of a perfect four-dimensional ball with the radius r , the formula for its volume calculation is:

$$V = 2\pi^2 r^3$$

The Universe is a pulsating, expanding and contracting finitude without any limit.

VACUUM

Apart from very short quantum connections (dipoles) responsible for material form of matter - particles, photons, atoms, molecules, compounds, there are long and very long quantum connections that interconnect material objects and that are not available for detection by our material instruments. They create a space vacuum and manifest themselves by gravity as their reaction to cosmic expansion and as intermediaries of gravitational attraction between material objects. The longest quantum connections join the objects of mutually opposite sides of the Universe. Their length is half of the cosmic circumference, $\frac{c}{2}$. The speed of their increase is the quickest, so it is the speed of light in the vacuum.

We cannot exclude much more gentle structures in the Universe consisting of long, energetically weak connections unidentified for us. So, it seems possible that there are other gentle worlds created of long yet-unregistered quantum dipoles in our Universe.

The vacuum consists of quantum dipoles. We distinguish the vacuum in atoms and the vacuum in interstellar spaces. So a vacuum is a link of particles in atoms as well as celestial bodies. The vacuum consists of external quantum connections that are much longer than inner connections in objects. It depends on the point of view which quantum connections (dipoles) are external (vacuum) and which ones are internal (particles, bodies,...). In an atom, the internal quantum dipoles create the particles (proton, neutron and electron) and their mutual quantum connections create the **atomic vacuum**. In a molecule, the internal quantum dipoles create the atoms and the mutual quantum connections between atoms create the **molecule vacuum**. The long quantum dipoles connecting celestial bodies create the **cosmic vacuum**. A considerable part of cosmic energy is concentrated in these vacuum connections (cosmic vacuum).

Contemporary physics does not know that the nature of the vacuum is the same as the essence of any other form of matter. The length of quantum dipole defines whether it is a part of a material form (particles, atoms, bodies) or a vacuum. Every elementary quantum dipole is a holder of an elementary quantum of space.

The vacuum created by the long quantum dipoles represents the external quantum field that can manifest itself in various forms. If it represents the connections between electrically charged particles, it creates the electrostatic field. If it connects material bodies, it represents the gravitational field. If it connects the particles in atomic nucleons, it represents the field of strong and weak interactions.

MICROWORLD

Mutual connections between + and – poles permit the creation of their relative individual compositions like particles, atoms, molecules and higher material structures. At the same time they are the medium of all known interactions – electromagnetic, strong, weak and gravitational.

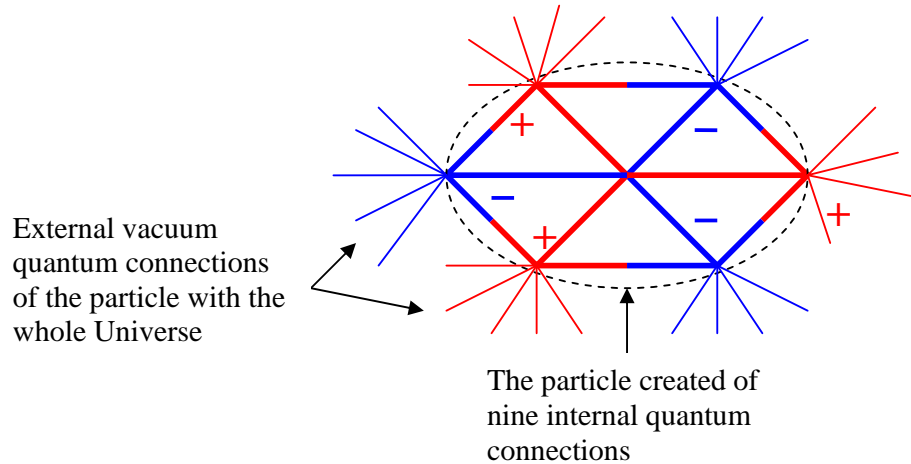
Dynamics of mutual action of quanta and their compositions cause some connections to weaken and become loose and others to intensify. In this manner, some particles can decay by the release of their intrinsic connections, others can join by intensification of their mutual connections. In these processes of aggregating and disintegration of relatively stable compositions, a repartitioning of positive and negative anti-poles can occur that positive poles prevail in some compositions (particles) and negative poles - in others. Particles with prevalence of positive poles are positively charged. Particles with prevalence of negative poles are negatively charged. The minimal possible quantity of prevalence is the elementary charge. The electron is the most well-known particle with negative charge, proton – with positive one. Particles with a balance of positive and negative poles are neutral. The basic elementary particle has only one connection between poles + and -. It is the elementary quantum of radiation – a photon. Its specific is the immediate mutual pulsation-oscillation of its anti-poles. The photon is a harmonic oscillator that during flight develops its oscillations into waves. The mutual connections of anti-poles in more composite particles make their motion more complicated.

Every particle is completely defined by the number of positive and negative poles and the intensity (energy) of their connections. This intensity defines their length and form of their mutual motion. These intrinsic properties of particles are manifested outwards as charge, mass, spin, magnetic torque and so on.

We can see than our original dialectical analysis now obtains a much more concrete form. Exclusion of a part out of the whole represents a selection of the specific structure, network of quantum connections, out of the whole cosmic network. The selected part is defined by its intrinsic connections of anti-poles. Other connections are external and enable its connection with its surroundings, exactly with the whole Universe. These external connections of the particle represent its border through which the particle is selected out of the whole Universe, remaining at the same time connected with it. Such selection occurs as a result of shortening of connections that the particle consists of, and that are intensive with a high level of energy. External connections of the particle are long with a low level of energy. Length and energy of the quantum dipole are indirectly proportional. Now we have no problem in understanding the relations between material objects and fields, continuity and discontinuity. The answer to the question whether the force fields create particles or are created by particles is clear, as well as the reason for the selection of discrete particle out of the continuous field. Now we know that force fields are the networks of bipolar connections that, as selected structures of anti-poles, represent the discrete parts of the whole, but as the intrinsic connections of particles, create their continuous interiors and the external connections of particles represent their connections (continuity) with rest space. Quantum bipolar connection as a basic building block of matter gives clear answers to the unsolved questions. The duality of nature can be exactly explained not by the complementary principle but by the deeper dialectical principle of bipolar matter.

The quantum dipole is an elementary discrete quantum of matter as well as the connection of anti-poles. So it represents discontinuity as well as continuity of matter.

Scheme of a particle compound of three '+' and three '-' poles with nine internal connections (quantum dipoles) and indication of external connections:



Now it is clear that if new particle originates out of two particles it means not only a simple combination of two particles but also the transition of their mutual external connections into internal connections of the new particle. So the new particle obtained something that was absent inside the previous particles. On the other hand the decay is not only a simple division of one particle into two new particles but also a transition of some internal connections of one particle into external mutual connections of two new particles. So the summary of internal connections of two particles does not correspond to the summary of internal connections of the third particle that arose out of two particles or decayed into them. This third particle represents another new quality that is not a simple sum of qualities of the initial particles. Now we have a clear picture of interactions. There is no difference between particles and interactions. Both they are structures of bipolar connections that represent either external connections (interactions) of particles or their internal quantum dipoles. Saying that the photon is a medium of electromagnetic interaction, gluon – strong interaction, inter-medial boson – weak interaction, we are conscious of equality of particles and interactions. Interactions (particles) rearrange their connections, change internal connections into external or contrariwise. This wandering of connections is caused by the transition of energy from ones connections to the others. Connections weaken and lengthen by delivering energy and shorten and strengthen by its reception. These transitions of energies between connections are carried out by quantum jumps.

The decay of original particle **K** into two new particles **A**, **B** can be described by the next way: Let original particle **K** consists of k^+ positive poles and k^- negative anti-poles. Let one new particle **A** consists of a^+ , a^- anti-poles and the other one **B** of b^+ , b^- . As the number of anti-poles remains the same before and after decay, the next relations are valid:

$$k^+ = a^+ + b^+, \quad k^- = a^- + b^-$$

The number of quantum connections of anti-poles (quantum dipoles) of the original particle **K** is: $\mathbf{n}_k = \mathbf{k}^+ \cdot \mathbf{k}^-$. The number of quantum dipoles of new created particles **A** and **B** is: $\mathbf{n}_a = \mathbf{a}^+ \cdot \mathbf{a}^-$, and $\mathbf{n}_b = \mathbf{b}^+ \cdot \mathbf{b}^-$. We can see that the summary number of internal quantum connections of new particles is not equal to the number of internal connections of the original particle:

$$\mathbf{n}_k = \mathbf{k}^+ \cdot \mathbf{k}^- = (\mathbf{a}^+ + \mathbf{b}^+) \cdot (\mathbf{a}^- + \mathbf{b}^-) = \mathbf{a}^+ \cdot \mathbf{a}^- + \mathbf{a}^+ \cdot \mathbf{b}^- + \mathbf{b}^+ \cdot \mathbf{a}^- + \mathbf{b}^+ \cdot \mathbf{b}^- = \mathbf{n}_a + \mathbf{a}^+ \cdot \mathbf{b}^- + \mathbf{b}^+ \cdot \mathbf{a}^- + \mathbf{n}_b$$

Besides the internal connections of new particles with the number of \mathbf{n}_a and \mathbf{n}_b there are also their mutual external connections with the number of $\mathbf{a}^+ \cdot \mathbf{b}^- + \mathbf{b}^+ \cdot \mathbf{a}^-$ showing that the new particles, wherever they travel, remain connected in such a way that every positive pole of particle **A** is connected with every negative one of particle **B** (their number is $\mathbf{a}^+ \cdot \mathbf{b}^-$) and every positive pole of particle **B** is connected with every negative one of particle **A** (their number is $\mathbf{b}^+ \cdot \mathbf{a}^-$). The total energy of connections before and after decay must remain the same. We have to say that the whole Universe participates in an energetic balance of particles and interactions because the motion manifests itself by the change of lengths and energies in quantum dipoles, not only inside particles and interactions, but also in their external connections with the whole Universe. During the creation of more composite structures out of simple ones, for example the synthesis of nucleons into the atomic nucleus, not only a simple shortening of mutual external connections occurs but at the same time the energy releases in a form of separated quantum dipoles. The energy drifted during synthesis by the leaving particles, for example photons, represents the difference between the energy of separate nucleons and the energy of created atomic nucleus and is named the binding energy of nucleus.

We have demonstrated the general connection of everything with everything at the basic level and showed how relatively autonomous structures originate and decay. It is a remarkable feeling to realise the self-general connection with the whole Universe in such a way that every elementary quantum of my body is connected with it.

The question is: What structure of bipolar connections (quantum dipoles) with what intensity (length) and form of their motion (pulsation) do the known particles and interactions represent? This area should be the object of a deep research of particle physics. It is not the object of my research yet. My aim is to detect the intrinsic essence of micro-world and to get the principle basis for particle physics in order to open the new direction for future investigation.

Even so, I will do some reflections in this area. The contemporary world of discovered particles and interactions is huge and constantly increasing. Some particles as structures of quantum dipoles appear during collisions with a huge energy for only a very short time and decay in a moment. They are so-called resonances – particles with composite, high energetic and unstable intrinsic structure of quantum dipoles, which are doomed into immediate decay. The way of accretion of energy in accelerators does not lead to the detection of the essence of matter but only to the production and detection of other short-living resonances. The deeper essence of matter than the elementary bipolar connection of anti-poles does not exist. I hope that its detection will save the huge costs needed for building new and more efficient particle accelerators. **The basic building block of matter is known henceforward. It is an elementary quantum dipole.**

The increase of energy in accelerators makes equivalent the previous different interactions. This increase manifests by length shortening and creation of new compositions of quantum connections, in which it is not possible to differ between connections or structures of connections represented in the given interaction. The selection of separate types of interactions - the violation of original symmetry – occurs during the decrease of energy and consecutive unequal lengthening of separate connections. This leads to the selection of relatively independent and mutually different structures, representing the different types of interactions created out of the original unique structure. By reaching huge energy levels in accelerators and unifying all interactions, physicists can only detect something that cannot be interpreted without understanding and acceptance of the **elementary quantum dipole** as the deepest and elementary essence of matter – simple connection of anti-poles.

Let us analyse why particles with considerably composite structure of quantum connections of anti-poles are considered to be elementary particles. Such a particle cannot be simply divided into two or more elementary particles of which the initial particle consists. As we showed before, the particles rising after decay of the initial particle are not its simple sum. So, why do we pretend that the atom decaying into protons, neutrons and electrons is not an elementary particle but compound one? It is because in the structure of atom, we can distinguish the strong inner connections creating its parts - proton, neutron and electron, from weaker and longer external connections between these parts, differing and at the same time joining them. This separation of intensive (short) and weak (long) connections enables us to select and see relatively independent structures in the whole structure of the atom. Weaker and longer quantum connections create a vacuum in atomic structure. If such a separation cannot be accomplished, then considerably composite structures act as elementary particles although only a quantum dipole is a real elementary particle. Every material structure – particle represents the specific intrinsic composition of quantum dipoles with different energy, length and inner motion. This completion of internal connections defines particle or interaction as qualities different from others with different internal structure, amount, organisation and motion of quantum dipoles. As such a structure – quality – is universally connected with the whole Universe, its inner nature manifests itself by its mutual interactions with all surroundings. So, this intrinsic nature completely manifests itself outwards. The unity of essence and its manifestation is clear. Only through the manifestation of essence and its mutual action with surroundings we can detect the real essence. Quality representing the given essence is a composition of certain quantities defining it. Quantity and quality have their unity in a measure overrun of which one quality jumps to the other. Quantitative changes in a given particle (increase or decrease of number and intensity of quantum connections) cause the transition of the particle from one quality to the other. It becomes the other particle with a different essence that manifests outwards. The change of essence (quality) means the change of its manifestation. Interactions of particles represent the changing of qualities thanks to quantitative changes. The dialectic unity of essence and phenomenon, quantity and quality is a manifestation of the dialectic unity of internal and external quantum connections. There is no essence, the so-called Kant thing-in-itself, which cannot manifest itself. Every elementary “something” is the relation to “everything else”. The universal unity of everything with everything does not allow the existence of something that can exceed this universal connection and remain an untouchable and unknowable “thing-in-itself”. So, the deepest and the most hidden essence manifests itself outwards and becomes knowable. The most hidden essence of matter – quantum dipole – is detectable and knowable and is discovered in this publication.

The Universe is a miraculous dance of quanta of its energy, mutually interconnected into a dynamic network of connections, creating one unique whole in permanent motion. It is a unity

of its anti-poles both in its macro-level (as a whole) and in its micro-level as an interconnected network of its quantum dipoles.

Considering anti-poles the next question appears: What is their relation to electric charges? The quantity of the whole charge Q of the Universe is the quantity of positive Q^+ and negative Q^- charges which the Universe disposed in its initial quantum state, when it was a single quantum dipole.

This whole charge is separated into the individual poles – k positive and k negative anti-poles of the whole Universe. Then the amount of a charge of one pole is:

$$Q_k = Q^+/k = Q^-/k$$

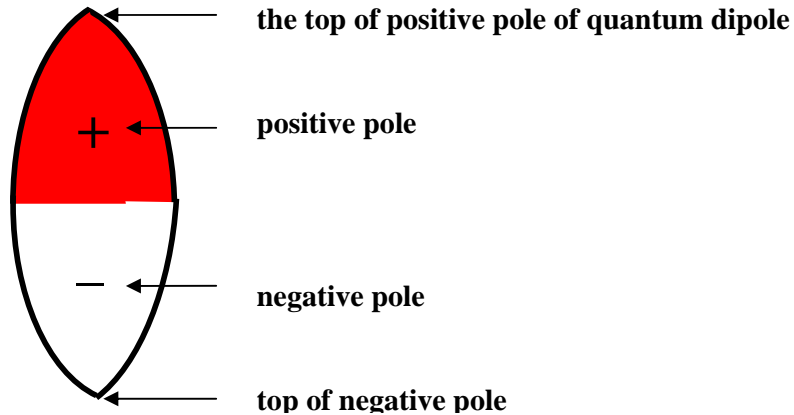
The charge of every pole (+ or -) is in equal portion distributed and melted into all elementary connections of this pole with all anti-poles of the Universe. As there are k connections of every pole with its anti-poles the amount of elementary electric charge equivalent to the elementary dipole is:

$$q_k = Q_k/k = Q/k^2$$

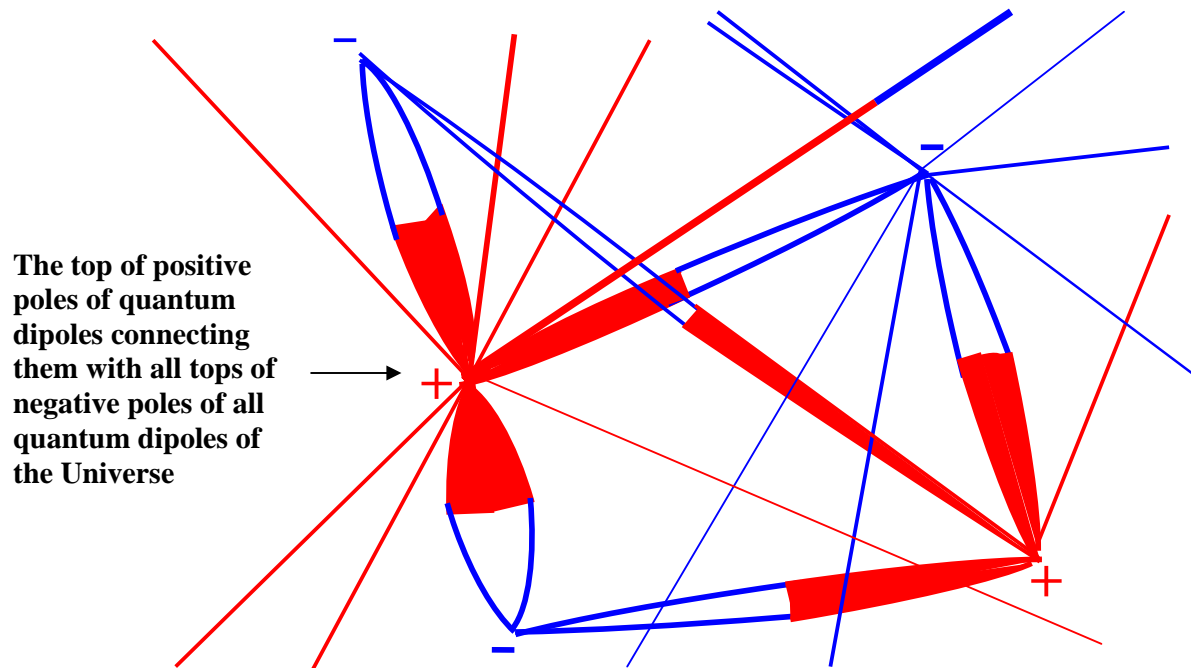
The charge of every pole (+ or -) of quantum dipole is its elementary charge.

Every pole is represented by its top and connections that go to all opposite anti-poles of the Universe. Schematically we can express the quantum connection (dipole) as a connection of two points. But these two points are only the tops of anti-poles that are extended to their quantum connection.

QUANTUM DIPOLE



The illustration of the pole and its relations to all anti-poles of the Universe through quantum connections (dipoles):



The Universe regularly transits to new quantum states during its expansion, and new quanta with new positive and negative elementary electric charges accumulates in it after their expulsion out of existing charges. The elementary charge steadily decreases during cosmic expansion and represents significant cosmic constant whose essence was yet unknown.

The electron is a particle with an elementary negative charge, the proton with a positive one. Immediately, the quarks with one-third or two-third charge come into mind by consideration of the elementary charge. What is the actual elementary charge – of the electron (proton) or quark? Nevertheless, the classic charge of the proton and electron is the actual elementary charge. Visually we can imagine the quantum dipole as a gassy balloon representing its space in which two charges of anti-poles are melted. If pressing such a balloon in some place (e.g. external pressures of others balloons of nuclei) it divides itself as if into parts – quarks, but does not rip. So the whole elementary charge looks like it is divided into parts (quarks). The gassy balloon is the optimal visual aid for interpretation of the quantum dipole. The quantum dipole is an ideal balloon with constant volume independent of its extension or compression. The more energetic and shorter the dipole is, the higher pressure (force) of it space acts to the spaces of surrounding dipoles. Despite the segmentation of charges and spaces of nucleons into third parts – quarks, they cannot be really separated because of the impossibility of disrupting the quantum dipole into parts. The higher the force of extension of quarks, the stronger they attract each other. Quarks cannot be selected into individual existence. The nucleons do not behave as compact particles by their bombardment with high-energetic electrons but as aggregations of three scattered centres, the so called partons. In spite of this, they are, as well as other particles, only specific structures consisting of internal elementary quantum connections (dipoles).

The balloon model shows how the individual dipoles (balloons) of particle act on each other by their spaces. It gives the clear answer to the question of why some particles are stable but the others are short-lived. Thanks to the huge energy we can mutually approach the quantum dipoles - balloons and create a composite particle but the mutual repulsive pressures of spaces of separate balloons (dipoles) cause its decay into particles with smaller mutual pressures of these spaces. In a stable particle, the mutually repulsive pressures of dipole spaces are compensated by the attractive forces of dipoles, so the particle does not decay. The stability of the particle depends on the measure of equilibrium of its forces. In less stable particles their internal motions or negligible external impulses can cause such spatial unbalance of internal forces that the particles decay. This decay looks like accidental and spontaneous but it is caused by internal motion of quantum dipoles as well as by the motion of external connections of particle with surroundings.

Nucleons consist of very short quantum dipoles (balloons) with very strong attraction of anti-poles able to compensate for the strong mutual internal pressures of dipole spaces. These pressures cause such deformations of particle shape that it looks like it is composed of three charged centres called quarks.

The conception of quantum dipole like a balloon consisting of two anti-poles, all connections of which go out, shows how this dipole is qualified and at the same time connected with the surrounding world, how it reflects this world and is reflected in it. It alone, like a three-dimensional entity, has its border in a two-dimensional surface through which it locally acts on the other dipoles. But on the other hand, it is directly connected with the whole Universe. Such is the dialectics of local and non-local acting. Einstein denied non-local connections but they follow from quantum physics. Local actions of quantum dipoles manifest themselves by the pressure, and the resistance as a reaction to the pressure. It is a mechanical action. The local character of mutual mechanical actions of objects looks like if non-local connections of everything with everything do not exist. It is a misery of physics that the mechanical principle of local action was transferred from classical physics to all physics and now it is a problem to explain the reason for phenomena of non-local action in quantum physics.

Force fields and interactions are no more than structures consisting of quantum dipoles with energetic content and force manifestation. Let us look at what problems the contemporary physics meets by explaining the nature and manifestations of power fields. We will demonstrate it by electron as a medium of elementary negative electric charge being a source of electrostatic field changing into electromagnetic one by motion. Physicians meet the next questions without satisfactory responses. What is a field? What is it composed of? Why does the local electron overreach its spatial limitation and creates the field in order to be able to act on the other charged particle? Is the electrostatic field around the charged particle continuous or discrete? What distance does it reach to - to infinity? So, the charged particle exists together with its field extending to infinity. Every charged particle is firmly connected to its field. Is the electron also a field but different from the field around it? Is the discrete particle selected out of a continuous field or does the external field go out of particle? What is the relation between discrete particle and continuous field?

Let us see how the physicians explain the force action and interaction between electrically charged particles. The Coulomb interaction between two electrically charged particles is understood as the exchange of a virtual photon. One particle emits a photon flying to the other one, which absorbs it. This interaction runs in opposite direction, too. If there are a lot of electrically charged particles they mutually sling virtual photons at each other. The colossal number of electrically charged particles takes part in a mutual slinging of virtual photons. Every charged particle slings photons to all others in the Universe. Such a comprehension is

very close to the declaration that all electrically charged particles are mutually interconnected thanks their direct mutual connections – quantum dipoles as mediums of electromagnetic interaction. To finalise this thought and declare virtual photons as direct quantum connections between electrically charged particles is restrained by the Einstein principle of local action propagated only by the limited speed of light. Despite the direct connections between particles following from quantum physics, the full understanding of causes and consequences of this phenomenon is still beyond reach. So it meets a lot of paradoxes. This sea of paradoxes is however a result of internal schizophrenia of contemporary theoretical physics and causes the feeling of subtlety and the mystery of matter. I think it is time to say the truth about the essence of matter in order not to pay such great attention to it, so that we may concentrate more effort to studying our spiritual nature and relation to God.

Let us come back to the electrostatic fields around charged particles. We have to investigate the mutual relations between particles with equal and opposite charges. If two particles have equal charges, e.g. electrons, in which the number of negative poles exceed in one pole the number of positive anti-poles and if we imagine all connections going out of this prevailing pole to all positive anti-poles of the Universe, than the spaces of external connections of two electrons thanks to non-existence of one mutual connection, create the higher mutual resistance (repulsive pressure), the closer we push them together. The situation is contrary if particles have opposite charges, e.g. electron and proton. Then their mutual quantum connection between opposite charges attracts them the stronger the closer they are. But this approach can be made only to a certain distance where it is compensated by mutual repulsive pressure of spaces of others quantum connections going out of oppositely charged particles. There is a permanent fight between attractive forces of quantum dipoles and repulsive pressures of their spaces in the Universe. **This movement to the mutual equilibrium of internal forces of attraction and repulsion of anti-poles and external local pressures of spaces of quantum dipoles is manifested like an increase of entropy of the system. Entropy is not an independent law of motion of matter but only a movement to equilibrium, which is constantly violated by the cosmic dynamics and dynamics of elementary parts – quantum dipoles.**

The entropy increase law is not a universal law of motion of matter and cannot violate the whole dynamics of the Universe and its pulsation resulting from the dialectics of attraction and repulsion of anti-poles. The entropy increase law could have the determining influence on a cosmic fate only if there are merely local actions between the parts of the Universe. As the formal mechanistic approach to investigation of objects and their parts through their external local relations prevails, the false impression about the determining role of the entropy increase law in behaviour of the whole material reality occurs. Its dominant role is manifested just by the local external relationships of parts of systems. These relationships do not represent the whole material being of the Universe but only its selected mechanistic aspect. Why does the binding energy of more energetic structures, e.g. protons, not freely flow to energetically weaker structures like electrons or long vacuum quantum dipoles? It is because the dialectical law of motion is universal and the entropy increase law is only a local one valid for mechanical motion leading to the equilibrium of pressures.

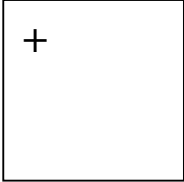
The energy needed for mutual approaching of particles with identical charges is indirectly proportional to the distance of their approach. The energy of coupling of two particles with opposite charges is likewise indirectly proportional to their mutual distance and represents the energy of quantum dipole which creates this connection of two particles with opposite elementary charges. Both energies are with equal value but different manifestations of the Coulomb potential energies.

If two particles are mutually approached to the certain distance and exceed the border of electrostatic forces, all mutual external quantum connections of both particles become internal and create new particle. The mutual attraction increases to the level able to balance repulsive pressures of spaces of their quantum dipoles. If the stable equilibrium of these forces is achieved, the new microstructure (particle) does not decay. But if this equilibrium is temporary installed by the action of external energies, the repulsion of internal pressures of particle corrupts this equilibrium and particle decays soon after its creation. This microstructure cannot keep its internal equilibrium of forces without great external energies and so it decays. The unstable short-living structures (resonances) occur thanks to great energies in particle accelerators.

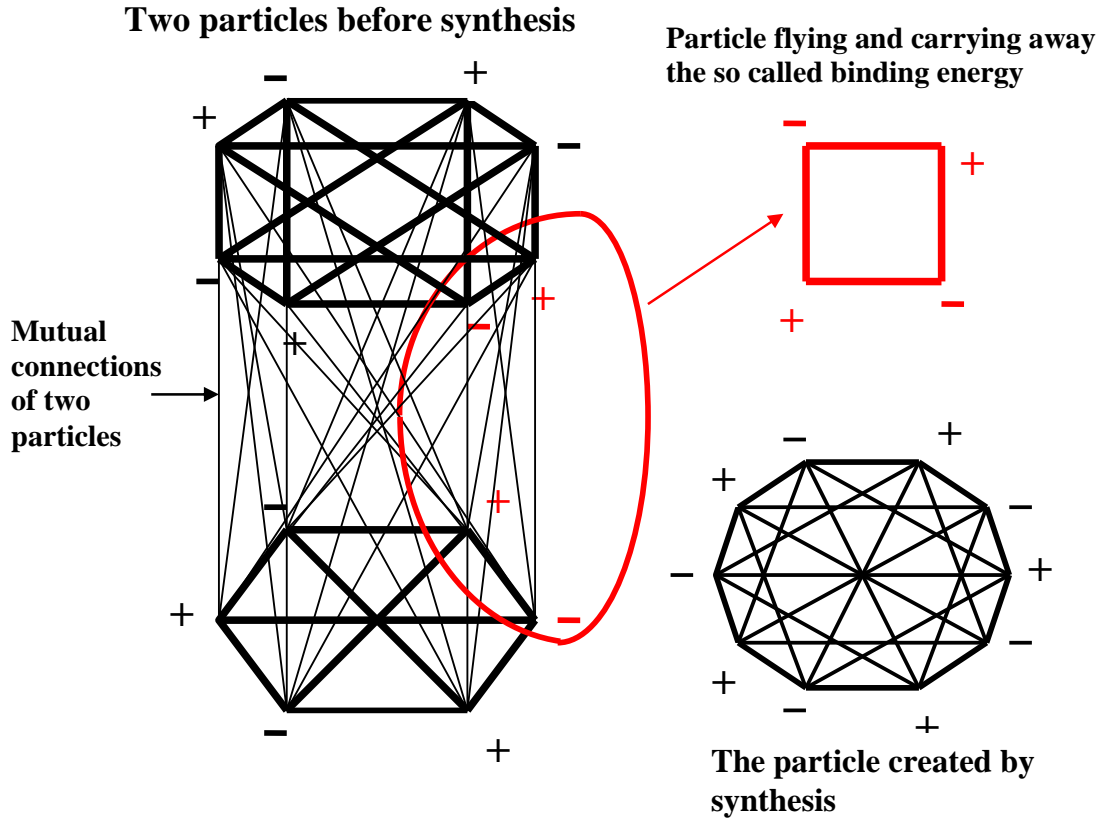
The electrostatic connection of two opposite elementary charges creates a quantum dipole - photon as a medium of electromagnetic interaction. Such an interaction is there between the proton and electron in the atom. If the atom absorbs into its structure more photons than necessary, it becomes excited. This excited state is created by redundant photon dipoles which do not change the nature of the atom. They only change the energetic content. A separate electron or any particle can also be in excited state thanks to the ability of the photons to associate without changing their internal nature. It means that the mutual connection between a photon and particle is much weaker (longer) than quantum dipoles creating this particle.

The weak or strong interactions are specific structures of quantum dipoles – particles, whose internal connections are much shorter and energetic than electrostatic ones. So they are able to compensate internal repulsive pressures of their spaces in stable particles. The medium of nuclear forces is represented by structures able to couple the nucleons mutually. After selection of these structures to their individual existence, they represent particles called pi-mesons. Contemporary physics presents the interaction of nucleons as mutual exchanging of pi-mesons in a similar manner to electromagnetic interaction represented by the exchange of virtual photons.

Nuclear or other syntheses of particles make their mutual connections internal and this is accompanied by the release of a part of these connections carrying a part of the energy in a form of escaping structures – particles. Just the release of these structures enables successful synthesis. The atomic nucleus as a result of synthesis of nucleons, contains the internal connections (dipoles) being before their mutual external connections. Moreover a part of mutual connections of both nucleons are selected into individual structures – particles - carrying away anti-poles being earlier, the constituents of individual nucleons.



The synthesis of two particles can be displayed by the next scheme:



Present analysis clearly shows that particles are not compact corpuscles without internal structures but they are formations with more or less composite structures of their internal quantum connections (dipoles). Moreover elementary quantum dipole – photon - is the simplest structure created by the simple connection of anti-poles.