Conception

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The conception of abitrary (deterministic and stochastic) particle dynamics is constructed. A conception differs from a theory in the relation that a conception describes interrelations between concepts of a theory. The conception cannot been tested experimentally. For instance, conception of deterministic particle dynamics states that any deterministic particle is described by the Lagrange function. One cannot test experimentally whether or not a detetermin-istic particle dynamics is described by the Lagrange function. One can choose a concrete deterministic particle and ascribe to it a concrete Lagrange function. Calculating parameters of the particle motion, one can test whether the calculated parameters coincide with experimentally measured. If these quantities coincide, it does not mean that the conception of the particle dynamics is valid, because such a coincidence can be not take place for other particle. Only if such a test appears to be valid for many particles of some class of particles, one may say that the conception of the particle dynamics is valid for some class of determinisic particles.

In the twentieth century there were conception of the deterministic particle dynamics, but there were not a conception of stochastic particle dynamics. There was a description of stochastic particle motion with some kind of stochasticity (for instance, for Markovian stochasticity). But a conception of arbitrary stochastic particle dynamics was absent. For instance, a conception describing quantum particles as classical stochastic particles was absent. We succeeded to create a conception of arbitrary particle dynamics. It describes deterministic and stochastic particles in the same way. The deterministic particles appear to be a special case of stochastic particles, when their stochasticity vanishes.

The mathematical formalism is the same for deterministic and stochastic particles. The basic object of the formalism is a statistical ensemble of particles. The statistical ensemble $\mathcal{E}[S]$ is defined as a set of N ($N \to \infty$) independent particles S. The statistical ensemble $\mathcal{E}[S]$ is a dynamic system of type a continuous medium. There are dynamic equations for $\mathcal{E}[S]$ independently of the type of particle S (deterministic or stochastic). Dynamic equations for $\mathcal{E}[S]$ describe a mean motion of the particle S. In the case of deterministic particle S one can obtain dynamic equations for a single particle S. In the case of stochastic particle S dynamic equations for a single particle do not exist.

Using the conception of the arbitrary particle dynamics, one obtains that quantum particles are simply classical stochastic particles. They can be described by classical conception of particle dynamics. The quantum principles are not used.

Then the following problem arises. Why is the motion of free microparticles stochastic? Apparently, the stochasticity of microparticle is a result of influence of the medium on the microparticle motion. This medium may be considered as an ether or as a vacuum. But in any case one should ascribe some properties to the medium. A choice of these properties is rather arbitrary. It is desirable to ascribe the most simple properties to the medium. The most simple situation appears, when one supposes, that the medium is simply the space-time.

The space-time geometry is described completely by the world function σ, which is a function of two space-time points The world function of the space-time at small distances may be such one, that the motion of free particles appears to be stochastic. In particular, if the space-time geometry is discrete, or if it is close to the discrete geometry, the particle motion appears to be stochastic. The geometry is discrete, if the world function σ_{d} of the discrete space-time geometry $\mathcal{G}_{\mathrm{d}}$ satisfies the constraint

$$\left|\rho_{\mathrm{d}}\left(P,Q\right)\right| \neq \left(0,\lambda_{0}\right), \quad \forall P,Q\in\Omega, \quad \rho_{\mathrm{d}}=\sqrt{2\sigma_{\mathrm{d}}} \tag{1}$$

where Ω is the set of points, where the space-time geometry is given, λ_0 is the minimal distance between the points (the distance $\rho_{\mathrm{d}}\left(P,Q\right)=0$ is possible, for instance, if $P=Q$). The set of points Ω may be an arbitrary set of points. In particular, Ω may coincide with the manifold Ω_{M}, where the space-time geometry of Minrowski is given. The relation (1) is a constraint on the form of the world function σ_{d}.

In particular, the world function σ_{d} may have the form

$$\sigma_{\mathrm{d}}=\sigma_{\mathrm{M}}+\frac{\lambda_{0}^{2}}{2}\operatorname{sgn}\left(\sigma_{\mathrm{M}}\right) \tag{2}$$

where σ_{M} is the world function of the geometry of Minkowski. It is easy to verify that σ_{d} from (2) satisfies the constraint (1). The symmetry properties of σ_{d} are the same as those of σ_{M}.

Of course, in the discrete space-time the world lines of particles cannot be smooth. Instead a particle is described by a world chain $\mathcal{C}$ which is a broken line

$$\mathcal{C}: \quad \bigcup_{s}P_{s}, \quad \rho_{\mathrm{d}}\left(P_{s},P_{s+1}\right)=\mu, \quad s=...0,1,... \tag{3}$$

where $\mu=\sqrt{2\sigma_{\mathrm{d}}\left(P_{s},P_{s+1}\right)}>\lambda_{0}$ is the length of the world chain link, which is the same for all links of the chain. The world chain wobbles. Description of the statistical ensemble of world chains for a free particle coincides with the quantum description in terms of the Schrödinger equation, if the particle mass m connected with the minimal length λ_0 by means of the relation

$$\lambda_{0}^{2}=\frac{\hbar}{bc} \tag{4}$$

where $\hbar$ is the quantum constant, c is the speed of the light and b is an universal constant, defined by the relation

$$m = b\mu \tag{5}$$

This relation connects the particle mass m with the length μ of the world chain link. Note that at such a description the particle mass m is a geometric property of the world chain.

A use of the discrete space-time geometry instead of continuous space-time geometry equipped by quantum essencies admits one to describe arrangement of elementary particles. The quantum paradigm considers elementary particles as pointlike objects equipped by different quantum numbers, whereas the geometrical paradigm (discrete space-time geometry) admits one to describe structure and arrangement of elementary particles. The situation is analogous to the situation in theory of atomic structure. Periodical system of chemical elements considers atoms as indivisible essencies and ascribes them characteristic numbers, wheras the atomic physics considers the atomic structure (nucleus and electronic envelope).

Consideration in the framework of the geometric paradigm shows that any elementary particle generates a force field (κ-field) which is responsible for pair production. The Dirac equation can be represented as a dynamic equation for a statisitcal ensemble $\mathcal{E}\left[S_{\mathrm{D}}\right]$, where S_{D} is a particle having 10 degrees of freedom. World line of S_{D} is a helix with timelike axis. Six degrees of freedom are connected with translation, and four degrees of freedom are connected with rotation along the helix. This rotation is a reason of the spin and of the magnetic moment of the Dirac particle S_{D}

Further development of the geometric paradigm leads to the skeleton conception of elementary particles. In this conception any elementary particle is described by its skeleton $\mathcal{P}_n = \{P_0, P_0, ...P_0\}$, which is a set of $n+1$ points. The points of the skeleton are connected rigidly in such a way, that $\sigma\left(P_i, P_k\right) =$const $i, k = 0, 1, ...n$. The world chain $\mathcal{C}$ has the form

$$\mathcal{C}: \quad \bigcup_s \mathcal{P}_n^{(s)}, \quad P_n^{(s)} = P_0^{(s+1)}, \quad s = ...0, 1, ... \tag{6}$$

The world chain (3) is a special case of (6), when $n = 1$.

Note that the skeleton conception is only a conception. To obtain a theory of elementary particles which could be experimentally tested, one needs to ascribe a concrete skeleton to any elementary particle and to determine the space-time geometry in microcosm. Besides, the problem of the elementary particles interaction is not yet developed in the skeleton conception.

The Euclidean conception of geometry, when one supposes that the space-time geometry is a logical construction, has been replaced by the metric conception of geometry, when one supposes that the space-time geometry is described completely by metric $\rho\left(P, Q\right)$ or by the world function $\sigma\left(P, Q\right) = \frac{1}{2}\rho^2\left(P, Q\right)$. The geometry described completely by the world function is called the physical geometry. A set of physical geometries is more powerful, than the set of

Riemannian geometries, which are used conventionally for description of the general relativity. In the extended general relativity (EGR) the physical space-time geometry is used instead of the Riemannian geometry.

In EGR a formation of black holes is impossible because of the induced antigravitation, which appears at large lensity of the matter. Besides, in the physical geometry a single tachyon cannot be detected because of infinite wobbling of its world line. However, the tachyon gas can be detected because of its gravitational field. Tachyon gas appears to be the best candidate for the dark matter.