MOTIONS BY INERTIA AND THE COULOMB FIELD

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ABSTRACT. It is proved that there exist accelerated motions by inertia which dropped out of the field of view of classical mechanics. The Coulomb law is not shown to be a universal and fundamental law of physics. Universal formula for the force of interaction between two particles does not exist.

Key words: Galileo's principle of inertia, accelerated motion by inertia, Coulomb's law.

According to Galileo's principle of inertia, there exists a frame of reference in which free body moves uniformly and rectilinearly. Newtonian mechanics is based on the assumption that this motion (called translational inertia) is the only kind of motion by inertia existing in nature. As the analysis of the motion problem shows [1, 2], a huge class of motions, which are natural extensions of translational inertia to curvilinear motions, drops out of sight of Newtonian mechanics. The case in point is the motions of particles with acceleration, which does not require any energy expenditure. We call them the accelerated (curvilinear) motions by inertia.

To reveal the physical nature of the phenomenon of curvilinear motion by inertia, let us turn to the equation of motion in classical mechanics $m\vec{a} = \vec{F}_{ext}$, where m and $\vec{a}$ are mass and acceleration of particle, $\vec{F}_{ext}$ is the force acting on the particle from its surroundings (the external force). This equation determines the forced motion of the particle under the action of external force, which is the cause of acceleration.

Consider now the motion of particle in terms of kinematics. According to the definition of the force accepted in mechanics, if a particle moves along a trajectory, there acts on the particle the force $\vec{F} = m\ddot{\vec{r}}$, where $\vec{r} = \vec{r}(t)$ is the radius vector of the particle at time t. Let us formulate the following problem: to find such a particle motion, in which the force acting on the particle does not do any work at any displacement of it along its trajectory. In this formulation, the force $\vec{F}$ is not the cause of accelerated motion, as in the equation of motion of mechanics, but its consequence. It does not force the particle to move, but only is an accompaniment of motion: the particle moves freely, without coercion and without any energy expenditure, i.e. by inertia. Solutions to the problem stated above describe a huge class of motions, which are accelerated motions of particles by inertia. So, there may exist both the motions, in which the force acts as an external force and is the cause of acceleration, and the motions, in which the force is generated by acceleration and is of purely kinematic origin. Arbitrary motion D of particle can be represented as a superposition of the accelerated motion by inertia D_{in} and the forced motion D_f: $D = c_1 D_{in} + c_2 D_f$ (c_1, c_2 are const). If the components of motion D are plotted on the axes of plane coordinate system, to Newtonian mechanics there corresponds only one point of the D_{in} axis: $c_1 = 0,\ c_2 = 1$. Thus, a continuum of motions is outside the field of view of the theory– such is the degree of incompleteness of Newtonian mechanics as a method of studying nature.

Accelerated motions by inertia are due to the inhomogeneity and anisotropy of space in which the particle moves [1,2]. In the inhomogeneous and anisotropic space, the particle tends to move without any energy expenditure. It is just this motion which represents the accelerated (curvilinear) motion by inertia and which may last infinitely long.

According to the conventional notions, the material body having charge (electric or gravitational) generates in surrounding space the Coulomb field, the physical nature of which is still not known [3]. Analysis of curvilinear motion by inertia of two-particle system [1] shows that the form of the law for the interaction force between the particles essentially depends upon relative motion of particles and upon the motion of the center of mass of the system. A wide variety of the force fields, connecting the moving particles in two-particle system, testifies that it is impossible in principle to specify a single, universal formula for the interaction force acting between the particles. The physical nature of the Coulomb field is not established so far for the reason that the Coulomb force as a single universal force of interaction between particles does not exist in nature. Obviously, because the character of the force interaction between particles is determined by a huge number of physical factors, any math tricks, such as the introduction of curvature or tortion of space, the involvement of the most fundamental physical principles, and many others, will not help us to find the universal force of interaction.

References

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