Classical Theory of Gravitational Field

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Abstract[1]

The relativistic theory of gravity (RTG) is constructed within the framework of special relativity theory. The density of the energy-momentum tensor of all fields of matter, including the gravitational field, serves as the source of the gravitational field. The theory icludes the conservation laws of energy-momentum and angular momentum. The concept of effective Riemann space arises, which is of field origin and has to exhibit a simple topology. The forces of gravity and of inertia are separated, and they differ in nature: the first are due to the presence of matter, while the origin of the latter is due to the choice of the reference system. The equality between the inertial and gravitational masses arises as a consequence of the density of the tensor of matter being the source of the gravitational field. Such an approach permits unambiguous construction of a theory of the gravitational field as a gauge theory. The theory unequivocally requires introduction of the graviton mass. The cosmological constant is expressed via the graviton mass. The set of RTG equations is hyperbolic and differs from the set of GRT equations. The theory unambiguously explains all known gravitational effects in the Solar system, reduced to an inertial reference system. Acceleration in RTG has an absolute sense. The Mach principle is fulfilled. According to RTG, a homogeneous and isotropic Universe can only be "flat", and it develops cyclically starting from a certain maximum density down to a minimum, etc. Problems that are known to exist in GRT: singularity, flatness, causality do not arise within the model of a homogeneous and isotropic Universe. The theory predicts the existence in the Universe of a large hidden mass of matter. "Expansion" of the Universe, and consequently, the red shift is not related to the motion of matter, but to a change of the gravitational field with time. Matter is at rest in an inertial system, so no relative motion of Galaxies exists. Only motions relative to the inertial system are possible with peculiar velocities that arise owing to the inhomogeneous distribution of matter.

The notion of collapse is altered. In accordance with RTG the existence in Nature of "black holes" (objects without material boundaries that are "cut off" from the external world) is excluded. A collapsing star cannot reach a radius inferior to its gravitational radius. Spherically symmetric accretion of matter onto an object of large mass at the conclusive stage of its development will be accompanied by a large release of energy due to matter falling onto the surface. Contrariwise, the release of energy in GRT in the case of spherically symmetric accretion of matter onto a "black hole" is quite insignificant, since the falling matter carries the energy toward the "black hole". Observational data on such objects could yield an answer to the question: do "black holes" actually exist in Nature? In RTG the concepts are revived of Newtonian theory and of special relativity theory (conservation laws, inertial reference systems, forces of gravity, acceleration relative to the space), while it retains the most valuable features inherent in GRT: the tensor character of gravity, Riemann space. But now Riemann space is no longer the primary space and fundamental, but only effective, arising because the energy-momentum tensor of all matter, including the gravitational field, is the source of the field. It is precisely for this reason that Riemann space has a simple topology.

In the work, the ambiguity is discussed of the predictions of general relativity theory and of the impossibility of its field formulation in Minkowski space.

[1]The book is published by "Nauka" Publishers in 2001.