Nature of inertia and dynamic gravitational field

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Abstract

The mass accelerating in the space-time continuum develops inertial force. There is no need for any other mass for inertial force to be created, just the accelerating mass and the space-time continuum. Einstein says in his book The Meaning of Relativity: “Just as it was necessary from Newtonian standpoint to make both the statements, *tempus est absolutum, spatium est absolutum*, so from the standpoint of the special theory of relativity we must say, *continuum spatii et temporis est absolutum*. In this later statement *absolutum* means not only “physically real”, but also “independent in its physical properties, having a physical effect, but not itself influenced by the physical conditions.”

The general theory of relativity uses the concept of inertial force created by accelerating an inertial mass in the space-time continuum. E. Mach criticized the concept of inertia used in the general theory of relativity. Mach maintained the view that mass movement can be defined only in relation to the other masses. Mach was trying to remove the space-time continuum as an active participant in the creation of inertial force. Einstein regarded Mach's criticism as serious. When Einstein published his theory of general relativity, Mach was old and had never finished his work. He died without providing equations that would replace the concept of inertia at the heart of the general theory of relativity. The objections that E. Mach raised have never been tested by the experiment.

I am providing the candidate equations that satisfy "Mach's principle" that mass is accelerated relative to the centre of all the masses in the universe. The equation uses the concept of force field to explain the inertial force. The candidate equation makes it possible to answer by the experiment the question of whether inertial force produces reaction force like the weight of the mass does or if the inertial force is created without the reaction force. In a way, the experiment will close the chapter on Mach's objection by laboratory experiment rather than the lack of an alternative. I don't know what the experiment will show, but whatever it shows will be the answer that nature has for us.

The reaction forces calculated using the general theory of relativity are too small to account for the reaction to the inertial force. Einstein uses the word feeble to describe reaction forces developed by moving masses according to the general theory of relativity. Frame dragging forces are so small that we needed gravity probe B to detect them. If accelerating mass satisfies the principle of action and reaction, then the reaction force should come from a much stronger field than the gravitomagnetic field. Although it is much stronger than the gravitomagnetic field, this field is not strong enough to be detected without the instrument.

The equation for the dynamic gravitational field with continuous mass distribution ρ for other masses in the system can be written as

$$\vec{g}_{d1} = G\frac{m_1}{r^2}\frac{\vec{a}_1}{\int_V G\frac{\rho_i}{r_{1i}^2}dV}$$

Where is:

m_1 – mass accelerating relative to centre of all the other masses

G – gravitational constant

r – distance from accelerating mass to selected point in space

a_1 – acceleration of the mass m_1

ρ_i – density of other masses

r_{1i} – distance of other mass to the mass m_1

dV – differential volume

Mach's principle is present in the equation for the dynamic gravitation field. The inertial force is developed because the mass accelerates relative to the centre of all the masses in the universe. We can also estimate the error we introduce if we don't consider some of the masses when considering the inertial forces. Mach has failed to provide an equation that would mathematically define the inertial force by the field theory. The equation presented here is developed from the principle of action and reaction and satisfies Mach's principle without referring to it. We can say that Mach's principle is a subset of the more general principle of action and reaction.

The hypothesis that inertial force is developed by the force field that accelerating mass creates in the space around it has profound consequences on our concept of space-time. The hypothesis points to the existence of the space that is curved not only by the presence of other masses, but also by the acceleration of the masses relative to the centre of all other masses in the universe. That space is also carried by the moving masses. The movement of the space explains the aberration of the light that was observed in the nature.