What's Wrong with General Relativity?

by Paul R. Gerber

Gerber Molecular Design, Forten 649, CH-8873 Amden

Email: Paul.Gerber@moloc.ch

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Abstract

The consistency and, hence, validity of the theory of General Relativity is questioned.

Remark

The theory of General Relativity (GR) is based on the Equivalence Principle [1] which states that the situation of a mass in a gravitational field is indistinguishable from the mass encountered in a accelerated environment. More pictorially, an experimenter in a labor cannot decide whether the labor rests on earth (assumed isolated in an inertial system) or is situated in a rocket that moves in free space with suitable constant acceleration. We just want to stress here that the two situations cannot be compared, even within the framework of GR. In contrast to a mass resting on earth, a mass in the rocket is accelerated and, thus, according to GR, emits a gravitational wave. Consequently, the two situations are distinguishable or, more bluntly, the Equivalence Principle is not a sensible principle, and GR is not a consistent theory.

We may elaborate somewhat on the accelerated situation. A resting mass (isolated in an inertial system) is locally in equilibrium with its gravitational field, i.e. (semi-correctly, but amenable to classical intuition) emission of gravitational waves and absorption from the field compensate to produce a stationary situation. Acceleration of the mass disturbs this equilibrium locally, and thus, destroys the stationary state. Consequently, an Equivalence Principle would only hold, if the whole gravitational field of the mass would also experience the same acceleration, which is, of course, neither the case nor experimentally feasible.

This consideration also clarifies the so-called twin paradox [1] of special relativity because the differing world lines of two bodies (twins) can only be brought together more than once by intermediate acceleration. But acceleration decreases the length of a world line (local-time interval) [1] between the two crossing events, and we can distinguish the acceleration of each body.

Clearly, the inconsistency will be most apparent in high-acceleration situations, i.e. near small high-density stars, and the question is certainly legitimate, whether the “black hole”-solutions of GR correctly describe these object or whether they are just artifacts of the theory [2]. Furthermore, the adherence to GR, in which mass is exclusively a non-negative quantity, has led to the development of corresponding quantum field theories (see zeroth axiom in [3]), with all their problems of infinities and renormalization.

For a proposal of a theory of gravitation within the framework of (a suitably modified) quantum field theory see [4-6].

References

1. See e.g. Penrose R., The Road to Reality, (2004), Jonathan Cape, London
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3. Streater R.F. And Wightman A.S., (1964), “PCT, Spin and Statistics, and All That”, Princeton University Press
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