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Some thoughts on geometries and on the nature of the gravitational field. (English)

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Summary: We show how a gravitational field generated by a given energy-momentum distribution (for all realistic cases) can be represented by distinct geometrical structures (Lorentzian, teleparallel, and nonnull nonmetricity spacetimes) or that we even can dispense all those geometrical structures and simply represent the gravitational field as a field in Faraday's sense living in Minkowski spacetime. The explicit Lagrangian density for this theory is given, and the field equations (which are Maxwell's like equations) are shown to be equivalent to Einstein's equations. Some examples are worked in detail in order to convince the reader that the geometrical structure of a manifold (modulus some topological constraints) is conventional as already emphasized by Poincaré long ago, and thus the realization that there are distinct geometrical representations (and a physical model related to a deformation of the continuum supporting Minkowski spacetime) for any realistic gravitational field strongly suggests that we must investigate the origin of its physical nature. We hope that this paper will convince readers that this is indeed the case.

MSC:

83D05 Relativistic gravitational theories other than Einstein's, including asymmetric field theories
51P05 Classical or axiomatic geometry and physics

Cited in **2** Documents

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