Commentary
Volume 12:6, 2021

Journal of Physical Mathematics

ISSN: 2090-0902 Open Access

Observations on Geometries and the Gravitational Field

Xie Ling*

Department of Applied Mathematics and Theoretical Physics, Chinese Academy of Sciences, Beijing, China

About the Study

The General Relativity (GR) theory of gravitation is the modern theory of gravitation. In that theory, each gravitational field generated by an energy-momentum tensor is represented by a Lorentzian space-time (M, D, g, τg, ↑). M is a noncompact (locally compact) 4-dimensional Hausdorff manifold, g is a Lorentzian metric on it, and D is its Levi Civita connection. Moreover, M is supposedly oriented by the volume form τg, and the symbol ↑ indicates time orientable space-time. Based on the geometrical objects in the structure (M, D, g, τg, ↑).

The Riemann curvature tensor R of D can be calculated, and a nontrivial GR model is one where R 6=0. In that way, textbooks often claim that in GR space-time is curved. However, most of the people confuse the curvature of a connection D on M with the fact that M may eventually be a bent surface in an (pseudo) Euclidean space with a sufficient number of dimensions.

As a result of this confusion, many people believe that they can bend space-time if they have a suitable kind of some exotic matter, forgetting that GR does not fix the topology of M that needs to be put in "by hand" when solving a problem. Additionally, the insistence on supposing that the gravitational field is geometry has led to the dismissal of the pursuit of the real nature of the gravitational field entirely (see a discussion of this issue instead). Most of the textbooks fail to mention that many physicists regard GR as the most beautiful physical theory (See, for example, the excellent book by Sachs and Wu).

The conservation laws of energy-momentum and angular momentum do not exist unless space-time has some additional structure that does not exist in a Lorentzian space-time. Until recently, only a few people have developed theories in which the gravitational field (at least from the classical point of view) is a field in Minkowski space-time in Faraday's sense.

In this paper, we summarize two important results that we hope will lead to the realization that it is time to reveal the true nature of the gravitational field. First and foremost, the representation of gravitational fields by Lorentzian space-time is a function of Einstein and Grossmann's differential geometry knowledge when they were looking for a way to describe gravitational fields consistently.

There are some geometrical structures that are equivalent to (M, D, g, τg, ↑) that can represent such a field. The second result is that (in all known situations) the gravitational field can also be nicely modeled as a field in Faraday's sense living in a fixed background space-time. For the alternative geometrical models, I will discuss the particular cases of tele-parallel connections (i.e., metrically compatible, null Riemann curvature tensor, and non-null torsion tensor) and non-metrically compatible connections (i.e., its non-metricity tensor A η 6=0). It is eventually worth recalling some historical facts concerning attempts by Einstein (and others) to build a geometrical unified theory of gravitational and electromagnetic fields in order to appreciate how those alternative geometrical models (and the physical model) might be constructed.

How to cite this article: Ling, Xie . "Observations on Geometries and the Gravitational Field." *J Phys Math* 12 (2021) : 338

***Address for Correspondence:** Xie Ling, Department of Applied Mathematics and Theoretical Physics, Chinese Academy of Sciences, Beijing, E-mail: 29997609@qq.com*

Received: 27 September, 2021; **Accepted:** 11 October, 2021; **Published:** 18 October, 2021