Essay

Is Gravity Curvature of Space-time?

Emre Dil*

Physics/Energy Engineering Dept., Beykent University, İstanbul, Turkey

Abstract

In this essay, we propose a semi-classical approach to support the interaction force nature of gravity as opposed to its curved geometrical nature. By giving the 3-D and 1-D mass configurations in corresponding space-times claimed as curved, we present there still requires a force concept in order to explain the gravity and to start the motion due to gravity. Consequently, we infer that the curvature interpretation of gravity does not describe the underlying natural phenomenon, but behaves as a mathematical tool to predict the natural phenomena correctly.

Keywords: Gravity, curvature, general relativity.

Is gravity really curvature of space-time or is it just able to be explained by the curvature? This deep question really requires a dare to ask. In a previous work it has been tried to present a support for that the curvature is not a fact of the gravity, but just a mathematical tool and model to explain it on a gravitationally deflected light due to a black hole (Dil 2019). There has been proposed a mass induction process in order to explain the gravitational deflection of light due to a massive object instead of the followed curved path by the light. In the literature some other attempts can also be found to support gravity as an interaction force rather than the space curvature concept (Friedman, 2016; Friedman & Steiner, 2016; Friedman & Steiner, 2017).

In this paper, we give another support to present the gravity is just an interaction force instead of the misunderstood space-time curvature concept. In the commonly accepted model, we assume a flat sheet of space on which a massive source object M is to be placed as in the Figure 1a. Because the massive object forms a curvature on the sheet representing the space, we assume that if another test object with mass m gets closer to the horizon it is attracted toward the source object. However, if we assume that the figure is looked from another perspective as in Figure 1b because there is no a certain above-below direction in space, it does not make any sense that the test object has to be attracted toward the left side. The sense of attraction of test object in Figure 1a is just an unfortunate misconception, since we intuitively expect the below side is the direction of gravity. In Figure 1b this misconception really vanishes.

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*Correspondence: Emre Dil, Beykent University, İstanbul, Turkey. E-mail: emredil@beykent.edu.tr

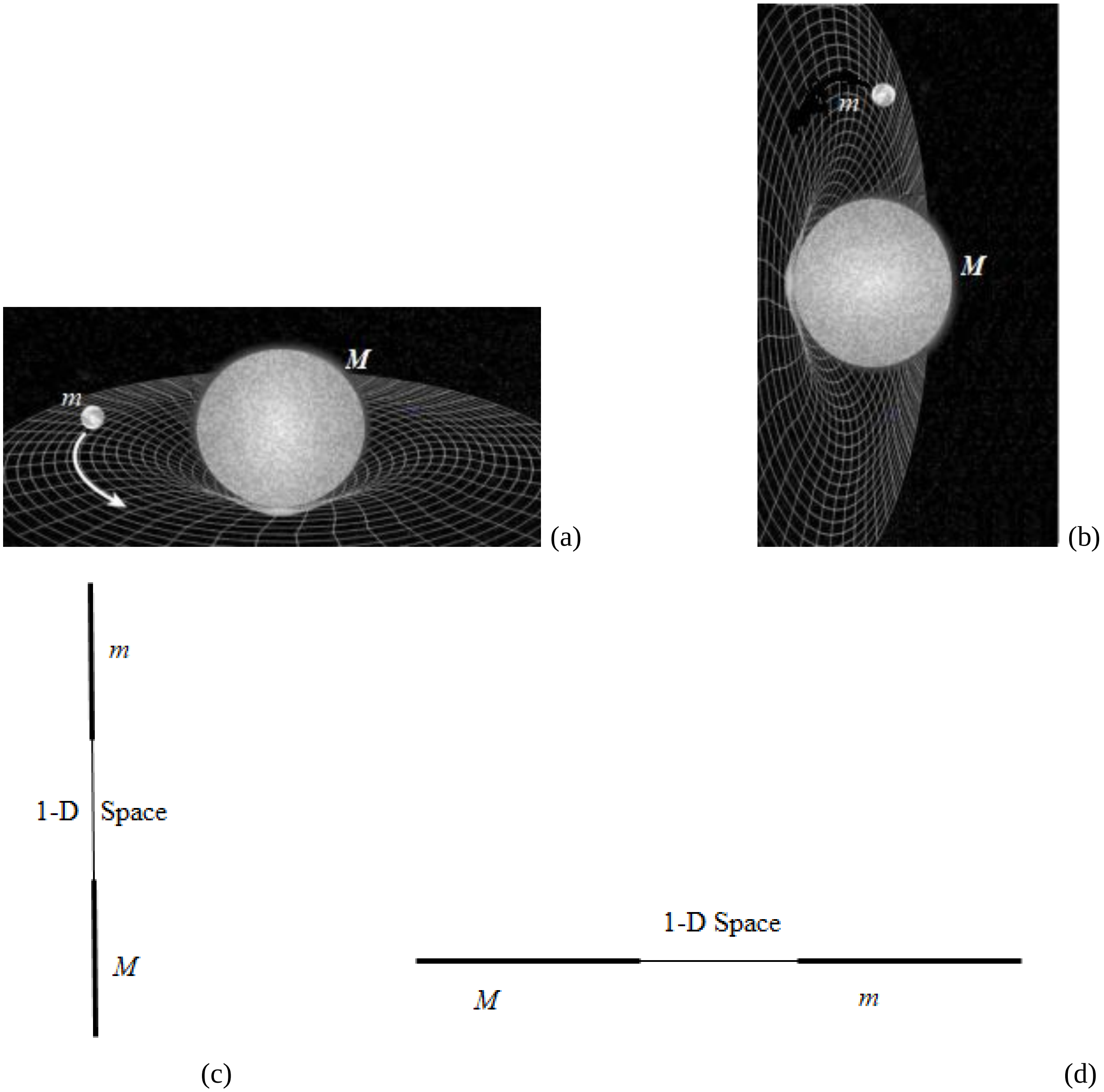

Figure 1. Source mass M and test mass m are placed into: (a) Space viewed from top, (b) Space viewed from right, (c) 1-D space viewed from front, (d) 1-D space viewed from side with strain curvatures on it.

The curvature cannot solely start the motion of test object m toward the source object M in Figure 1b. However, gravity in Newtonian perspective is an interaction force between massive objects, therefore it can start the motion from rest. From the point of view of Figure 1b, even if we accept a massive source curves the space time, there is not any reason to attract a test object toward left side. In another word, there is no reason for the curvature to start the motion of a test particle. We may accept there is a curvature, but this does not require a motion to start. When we assume a curvature leads to an attraction and motion in fact we still become under the effect of traditional gravity concept because we perceive the below side like the direction of gravity as on earth for Figure 1a, but in Figure 1b terminates this perceive.

How can the curvature be responsible from the gravity and motion due to gravity inferred from the curvature? When we assume there places a test object on the horizon in Figure 1b and it is at rest, how can curvature lead to a motion for this test particle toward the left side? Is there a force toward the curvature? We traditionally expect a force toward the curvature although curvature theory rejects the force concept. So, how can a curvature behave as a force. Assume a parabola on the sheet in Figure 1b, how can we say if we place a point object *m* at the starting point of the parabola, it should move on the parabola? Can geometry solely force the particle to move? We intuitively invoke an interaction force directed toward the curvature although we terminate the force concept by introducing the curvature concept.

Another important question is that what will happen if we take another test object from the left side of the source in Figure 1b? Will not the source attract the test object because the curvature is toward left side in figure? Or, is there another curvature toward right side with respect to the new test object? If so, what kind of curvature is that? Or, what kind of space is that? How can a space be curved through in every direction when we place a mass *M* on itself?

To understand the last question better let us imagine a 1-Dimensional system as in Figure 1c. A 1-Dimensional source mass *M* and a 1-Dimensional test mass *m* with a rod shape are placed to a 1-Dimensional space. Then, curvature corresponds to a downward strain on the 1-Dimensional space. If we accept the curvature in the strain form can attract the test object toward down side, what happens if we place another 1-Dimensional test particle below the source particle? Because we accept the strain curvature is directed toward down side, what will the below test particle happen? Shall we say it will not be attracted, or it will be attracted upward direction? If we say the latter, this means there is another curvature toward above side but this is impossible because the strain curvature is toward downward. On the other hand, how can a strain curvature start the motion as considered in Figure 1d. It makes no sense that a horizontal strain curvature leads to a motion on a test object as considered a gravitational attraction. Obviously, we need a force interpretation for gravity other than a curvature interpretation.

We should stop being single minded, and thinking the traditionally accepted interpretations are concrete truths about the nature. We should re-think the curvature interpretation of general relativity. Is it just a mathematical tool and model to predict the phenomena in nature, or is it the concrete phenomenon in nature? According to the above criticisms it seems that the curvature interpretation is just a useful mathematical tool to predict the phenomena in nature, rather than the phenomenon itself.

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