Review of: "Geodesics as Equations of Motion"

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Potential competing interests: No potential competing interests to declare.

The paper is improved, since a manifest numerical error has been corrected. Still, the basic presuppositions of the paper are misleading. Let us see:

``The compatibility between the SI operational definitions of spatial distance and temporal duration for the space-time coordinates of the theory of general relativity is a priori not obvious. It seems, however, that it is the time coordinate t that is measured using the SI operational definitions. In fact, with respect to the interpretation of the cosmic redshift and the gravitational displacement of spectral lines the time coordinate is taken to be the SI time. A conceptual problem appears, however, with the introduction of the additional hypothesis that the motion of a material body, described as a point particle, is a geodesic in space-time. The evolution parameter is then an affine parameter, i.e. a parameter linearly related to the proper time *s* which itself is an affine parameter. Any affine time parameter differs from the coordinate SI time*t*. This is the problem discussed in the following by considering the description of the Sun-Mercury system and its Newtonian approximation.''

What is an SI second? Per definition, it is measured by a Cesium clock or any other device related to it, and a second is the unit of *proper time* measured by that clock. The SI second is thus not a coordinate time. For the cosmic redshift, the time taken is a very specific conventional coordinate time, the cosmic time. It is not the ``SI time'' of anything specific.

The author appears to be asking the question ``which of coordinate time and pro'er time describes a given motion (Mercury's in this case) correctly?'' This is a wrong question. We may, for instance, describe the motion of a satellite with respect to the fixed stars, or with respect to Earth. We may ask when it is above Paris, or when it is at 30 degrees above the ecliptic. The two sets of numbers are very different, but once it is understood what they refer to, both describe the same motion.

Time on Earth is rather tricky to define because of Earth's rotation and its gravity. So you need to do some work to convert Mercury's proper time to Earth time. GR gives you Mercury's orbit in terms of proper time, describing the motion as a function of the time a Cesium clock on Mercury would give, if the effect of Mercury's gravity is corrected for. Since we cannot conveniently measure this, we use math to convert this time to Earth time.

There is thus no way in which an experimental contradiction could arise from your data. In fact, there are for instance pulsars for which the GR effects are much larger. But again the proper time has a specific meaning, and to compare with observations, we need to ask about the way in which we measure time as opposed to proper time. We may in principle also need to worry about measurements of distances and angles, since light propagation is not rectilinear.

Summarising, I am afraid your claim to be able to test relativity by such observations is untenable.