Review of: "On the existence of precession of planets' orbits in Newtonian gravity"

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Potential competing interests: No potential competing interests to declare.

The paper analyzes the motion of two bodies in orbital motion around a common center. In the Newtonian framework the solution of this problem leads to the Kepler orbits. This centuries old problem has been solved using the classical mechanics Laplace-Runge-Lenz vector. The LRL vector is conserved in Newtonian gravity, and for inverse-square central forces in general, but the introduction of perturbations has many interesting implications. For example, the introduction of a perturbation in the inverse square law (the addition of a small $1/r^3$ perturbation) can be matched to the predictions of general relativity for the anomalous precession of planets.

The study of orbital motion in different reference frames, as proposed by the author, is an interesting problem, but must be made in the context of special relativity since the frames are accelerating. A frame change in this problem involves both a velocity change and a rotation of the coordinates (Thomas-Wigner rotation). The frame change should lead to a LRL vector perturbation related to the Thomas precession. In quantum mechanics Thomas precession is a correction due to spin-orbit interaction, but in the motion of planets orbit-orbit interaction must be considered (spin-orbit interaction would lead to the much weaker Lense-Thirring effect). I think that a derivation of the perturbation in the LRL vector as a result of a correct handling of the (relativistic) transformation to non-inertial frames would result in a beautiful paper.

The failure of Newtonian dynamics in explaining the anomalous precession, as well as many other phenomena, derives from the neglect of mass currents and associated gravitomagnetic effects (kinetic effects of gravity). These effects were included in the beautiful analogy between electromagnetism and relativistic gravitation put forward by Oliver Heaviside in 1893 (before general relativity). A detailed derivation of the anomalous shift of planetary precession in the gravitoelectromagnetic framework can be found in G.O. Ludwig, Eur. Phys. J. Plus (2021) 136:465.