



A critical discussion of the recent test of General Relativity with the LAGEOS satellites

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A test of the general relativistic gravitomagnetic Lense-Thirring effect with the LAGEOS and LAGEOS II SLR satellites and the 2nd generation GRACE-only EIGEN-GRACE02S Earth gravity model over a time span of 11 years has recently been performed. The adopted observable is a suitable linear combination of the nodes Ω of LAGEOS and LAGEOS II for which the General Theory of Relativity predicts a secular trend with a slope of 48.2 milliarcseconds per year. Such combination allows to cancel out all the static and time-varying contributions due to the Earth's quadrupole mass moment J_2 . Indeed, the major source of systematic errors is represented by the larger aliasing classical node precessions induced by the mismodelled part of the even zonal harmonic coefficients of the multipolar expansion of the terrestrial gravitational potential. The claimed total accuracy is 5-10% at $1-3\sigma$ level. We critically discuss such result and show that the error budget is probably too optimistic. In particular, the impact of the secular variations of the uncanceled even zonal harmonics $\dot{J}_4$ and $\dot{J}_6$ might have been underestimated. According to more conservative quantitative estimates and by assuming that there is no inversion in the signs of $\dot{J}_4$ and $\dot{J}_6$ over the considered observational time span, the total error might amount to 11-45% at $1-3\sigma$ over 11 years. The a priori 'memory' effect of the Lense-Thirring signature itself on the adopted background Earth gravity model, which may drive the outcome of the test just towards the expected result, is also discussed. Some possible approaches to improve the reliability and the consistency of such important test of fundamental physics are presented.