Total light deflection in the gravitational field of solar system bodies

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Abstract

Future astrometry missions are aiming at the sub-micro-arcsecond and nano-arcsecond level in angular observations of stellar objects, which allow for stringent tests of general relativity in the solar system. At such ultra-high accuracies it is necessary to implement higher mass multipoles and spin-multipoles in the theory of light propagation. The upper limits of light deflection caused by these multipoles are determined. The fundamental quantity for these evaluations is the unit tangent vector of the light trajectory at future infinity. It is found that the tangent vector can be expressed in terms of Chebyshev polynomials. This fact allows to determine strict upper limits of light deflection for each individual multipole of solar system bodies. The results are applied to the case of light propagation in the gravitational fields of Jupiter and Saturn.

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