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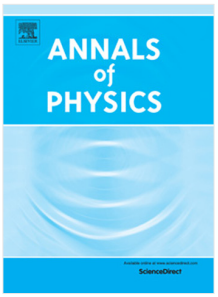

Classical tests of photons coupled to Weyl tensor in the Solar System

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Classical tests of photons coupled to Weyl tensor in the Solar System

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Abstract

With the purpose of deeply understanding the fundamental interaction between the electromagnetic and gravitational fields, photons coupled to the Weyl tensor was proposed, which could be derived from the Maxwell equation with a Weyl correction. This correction with respect to general relativity in a 4-dimensional spacetime can be characterized by a coupling strength parameter α. By taking such a coupling into account, we investigate its effects on the classical tests in the Solar System, including the deflection of light, the gravitational time delay and the Cassini tracking experiment, and constrain the parameter α with new datasets. None of these works were done before and these data of the experiments are used for testing the photons coupled to the Weyl tensor for the first time. We find that the experimental upper bounds are $|\alpha| \lesssim 4 \times 10^{11} - 5 \times 10^{13}$ m^2, in which the strongest bound comes from the Cassini tracking. Therefore, it is expected that when more sophisticated frequency standards can be implemented in the spacecrafts tracking in the future, this bound on α will be reduced further.

Keywords: Solar system experiments, Gravitation, light propagation, Relativistic process, Astrometry

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