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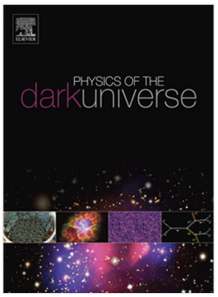

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Cosmic Transients, Einstein's Equivalence Principle and Dark Matter Halos

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Abstract

Cosmic transients, such as gamma-ray bursts and fast radio bursts, have been used to constrain the Einstein's Equivalence Principle (EEP) trough the parametrized-post-Newtonian (PPN) formalism. In this approach, the time delay of photons with different energies from these cosmic transients are used to obtain upper bounds on the difference of the PPN γ parameter. In this work we assume that an important contribution to the time delay is due to the dark matter halo of the Milky Way and consider the dark matter mass distribution given by the Navarro–Frenk–White profile. We obtain the upper limit on the difference of the PPN parameter γ for the polarized gamma-ray emission of GRB 110721A, $\Delta\gamma < 1.06 \times 10^{-28}$, the most stringent limit to date on the EEP. In addition, we show that a very similar upper bound is obtained if, instead of having a dark matter component, a visible matter density profile and a non-minimal gravitational coupling between curvature and matter are present.

Keywords: gamma-ray bursts, fast radio bursts, gravitational waves, dark matter, Einstein's equivalence principle

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