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Kinetic Energy and the Equivalence Principle HOLGER MÜLLER, MICHAEL HOHENSEE, University of California, Berkeley — Constraints on violation of the Einstein equivalence principle (EEP) can be inferred from tests of the universality of free fall or atom interferometry. In generalized models describing EEP as a perturbation to known physics, such as the standard model extension, the combination of a particle-specific modification of the space-time metric, along with interactions with to a field that is non-metrically coupled to spacetime, makes it possible for the total observable EEP-violation to cancel in the motion of free protons, neutrons, and electrons, while manifesting in the motion of free antiparticles. We show that such hidden forms of EEP-violation can be ruled out using ordinary matter, as modified metric violation of EEP also couples to the internal kinetic energy of bound systems of particles. Using a Woods-Saxon potential to calculate the kinetic energies of nucleons bound within a wide range of atomic nuclei, we estimate the sensitivity of existing and planned tests of EEP to such hidden forms of EEP violation. We show that existing limits on EEP-violation, hidden or otherwise, are significantly better than previously thought, with important implications for future tests of EEP.

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