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Kinetic Energy and Hidden Violations of the Equivalence Principle MICHAEL HOHENSEE, HOLGER MÜLLER, University of California, Berkeley — A major challenge for modern tests of the Einstein equivalance principle (EEP) is to verify that gravity couples equally to both normal matter and antimatter particles. While the EEP has been validated to high precision in tests on normal matter, experimental tests on antimatter are ongoing. We consider the state of experimental constraints on "hidden," spin-independent, EEP-violation that do not manifest for free elementary particles, but do for their antimatter counterparts. We work in the context of the standard model extension, an energy and momentum-conserving effective field theory that describes multiple mechanisms for EEP-violation. We find that such hidden violations of EEP are nevertheless revealed in the gravitational acceleration of bound systems of normal matter, e.g., nuclei. This results from the interplay between EEP-violation and the internal kinetic energy of bound systems of particles. We calculate the kinetic energies of nucleons within nuclei using a Woods-Saxon potential, and estimate the sensitivities of a wide range of atomic species to EEP violation, hidden or otherwise. We make a survey of existing and planned experimental tests of EEP, and report limits on the degree to which the EEP can be violated for antimatter relative to normal matter.

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