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Precision Test of the Equivalence Principle¹

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We used a torsion balance instrument installed on a continuously rotating turntable to measure the acceleration difference of beryllium and titanium test bodies towards sources at a variety of distances. Our result $\Delta a_{N,Be-Ti} = (0.6 \pm 3.1) \times 10^{-15} \text{ m/s}^2$ improves previous limits on equivalence-principle violations with ranges from 1 m to ∞ by nearly an order of magnitude. The Eötvös parameter is $\eta_{Earth,Be-Ti} = (0.3 \pm 1.8) \times 10^{-13}$. By analyzing our data for accelerations towards the center of the Milky Way we find equal attractions of Be and Ti towards galactic dark matter, yielding $\eta_{DM,Be-Ti} = (-4 \pm 7) \times 10^{-5}$. Space-fixed differential accelerations in any direction are limited to less than $8.8 \times 10^{-15} \text{ m/s}^2$ with 95% confidence.

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