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Constraints on Lorentz Violation with Precision Measurements of the Lunar Orbit JAMES BATTAT, JOHN CHANDLER, CHRISTOPHER STUBBS, Harvard University — Efforts to unify the fundamental forces of nature have produced theories that violate Lorentz symmetry. The Standard Model Extension (SME) has emerged as a comprehensive theoretical framework which parametrizes Lorentz violations. The SME was recently extended to include gravitational interactions, and it was shown that existing Lunar Laser Ranging (LLR) data is sensitive to violations of Lorentz symmetry. LLR measures the Earth-Moon separation by timing the round trip travel of pulsed laser light from a telescope on the Earth to corner cube retroreflectors on the lunar surface. LLR has provided precision measurements of the Earth-Moon separation for nearly 40 years. We present a new analysis of 35 years of archival, LLR data. Our work places the first constraints on six independent linear combinations of SME parameters and we find no evidence for Lorentz symmetry violation at the part in 10^{-6} to 10^{-11} level in these parameters. Forthcoming millimeter-precision LLR data from the Apache Point Observatory Lunar Laser-ranging Operation (see talk on APOLLO by Thomas Murphy) will further improve these constraints.

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