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Atom interferometric test of the isotropy of Post-Newtonian gravity. SHENG-WEY CHIOW, Stanford University, SVEN HERRMANN, HOLGER MUELLER, STEVEN CHU — We present a test of the local Lorentz invariance of post-Newtonian gravity by monitoring Earth's gravity with a Mach-Zehnder atom interferometer. The interferometer is realized in an atomic fountain that launches Cs-atoms, cooled by Raman sideband cooling in an optical lattice. With pulse separation times of 400 ms, a resolution of up to $8 \times 10^{-9}\,\mathrm{g}/\sqrt{Hz}$ was obtained, the highest reported so far. Here we analyze a continuous 60 h measurement of the local gravitational acceleration g obtained from this setup and two measurement runs from a previous setup (A. Peters et al. Metrologia 38, 2001). In addition to the modulation of local g due to tidal forces, we search for a modulation of local g with Earth's rotation as it would be caused by anisotropic gravity. Expressed within the standard model extension (SME) or Nordtvedt's anisotropic universe model, the analysis limits four coefficients describing anisotropic gravity at the ppb level and three others, for the first time, at the 10 ppm level. Also, we use the SME to explicitly include possible violation of Lorentz invariance in electrodynamics. This demonstrates how the experiment actually compares the isotropy of two sectors of the SME, i.e. gravity and electromagnetism.

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