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A Compact, Rotating Co-Magnetometer for Tests of Fundamental Symmetries[1] JUSTIN M. BROWN, SYLVIA J. SMULLIN, THOMAS W. KORNACK, MICHAEL V. ROMALIS, Princeton University — We describe a compact K–^{3}He co-magnetometer on a rotating platform for tests of CPT and Lorentz invariance. Optical pumping polarizes electrons in a high-density K vapor. Spin-exchange collisions between alkali and noble gas atoms polarize the ^{3}He nuclei. An appropriately applied magnetic field cancels the ^{3}He magnetization allowing for magnetometer operation in the highly sensitive spin-exchange relaxation free (SERF) regime. The resulting co-magnetometer is insensitive to magnetic fields, but sensitive to electron and neutron couplings to anomalous fields. The co-magnetometer also behaves as a sensitive gyroscope. By reversing the direction of the experiment every ≈ 1 min, we can test for CPT and Lorentz violation on faster timescales than on a frame fixed to the Earth. This reduces many systematic long term drifts. We will discuss implementation of the rotating experiment and accounting for the gyroscopic signal from Earth's rotation in the CPT and Lorentz violation searches.

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