Abstract Submitted
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Progress toward a search for anomalous spin-mass couplings with a dual-isotope rubidium magnetometer[1] JULIAN VALDEZ, IAN LACEY, RODRIGO PEREGRINARAMIREZ, DEREK JACKSON KIMBALL, California State University - East Bay — We report progress in our development of a dual-isotope rubidium magnetometer to be used to search for a long-range coupling between proton spins and the mass of the Earth. The valence electron dominates magnetic interactions and serves as a precise co-magnetometer for the nuclei in a simultaneous measurement of Rb-85 and Rb-87 spin precession frequencies, enabling accurate subtraction of magnetic perturbations. Both Rb nuclei have valence protons, but in Rb-87 the proton spin is parallel to the nuclear spin and magnetic moment while for Rb- 85 the proton spin is anti-parallel to the nuclear spin and magnetic moment. Thus anomalous interactions of the proton spin produce a differential shift between the Rb spin- precession frequencies, whereas many sources of systematic error produce common-mode shifts of the spin-precession frequencies which can be controlled through auxiliary measurements. We discuss significant enhancement of the sensitivity through the use of new alkene-based antirelaxation coatings, and methods to control systematic effects due to light shifts, collisions, and the gyro-compass effect.

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Derek Kimball
California State University - East Bay

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