

Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

A dual-isotope rubidium magnetometer for probing anomalous spin-dependent interactions of the proton¹ IAN LACEY, L.R. JACOME, LOK FAI CHAN, RODRIGO PEREGRINA, DELYANA DELCHEVA, DEREK KIMBALL, California State University - East Bay — We report progress in our development of a dual-isotope rubidium magnetometer to be used to search for anomalous spin-dependent interactions of the proton, in particular 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. The majority of recent searches for similar effects limit anomalous couplings of either the neutron or electron spin, so the proposed experiments search a parameter space to some degree, depending on the theoretical model, orthogonal to that constrained by previous experiments.

¹This work was supported by the National Science Foundation under grant PHY-0652824.

Derek Kimball
California State University - East Bay

Date submitted: 22 Jan 2010

Electronic form version 1.4