

Abstract Submitted  
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**Progress toward a search for a coupling of the proton spin to gravity**<sup>1</sup> DEREK JACKSON KIMBALL, JORDAN DUDLEY, YAN LI, SWECHA THULASI, JULIAN VALDEZ, Department of Physics, California State University - East Bay, Hayward, California 94542-3084, USA — We present an overview of progress in our search for a hypothetical long-range coupling between rubidium (Rb) nuclear spins and the mass of the Earth [D. F. Jackson Kimball et al., *Annalen der Physik* **525**(7), 514-528 (2013)], which can be interpreted as a search for a long-range monopole-dipole interaction or a spin-gravity coupling. The experiment consists of simultaneous measurement of the spin precession frequencies of overlapping ensembles of Rb-85 and Rb-87 atoms contained within an evacuated, antirelaxation-coated vapor cell. Because of the nuclear structure of Rb-85 and Rb-87, the experiment is particularly sensitive to anomalous spin-dependent interactions of the proton [D. F. Jackson Kimball, arXiv:1407.2671 (2014)]. We have studied a number of important systematic effects related to vector and tensor light shifts, optical pumping effects, the ac and nonlinear Zeeman effects, magnetic field gradients, and the rotation of the Earth. We anticipate that our experiment can improve sensitivity to anomalous long-range spin-mass couplings of the proton compared to previous experiments by more than an order of magnitude.

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Derek Kimball  
Cal State Univ East Bay

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