Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Gravity Probe Spin[1] DEREK JACKSON KIMBALL, California State University, East Bay, PAVEL FADEEV, Helmholtz Institute Mainz, Johannes Gutenberg University, TAO WANG, Princeton University, ALEXANDER SUSHKOV, Boston University, YEHUDA BAND, Ben-Gurion University, PETER GRAHAM, Stanford University, DMITRY BUDKER, Helmholtz Institute Mainz, Johannes Gutenberg University — Under conditions where the total angular momentum of a ferromagnet is dominated by its intrinsic spin, the ferromagnet is predicted to behave as a gyroscope [Kimball, Sushkov, and Budker, Phys. Rev. Lett. **116**, 190801 (2016)]. If such a ferromagnetic gyroscope (FG) can be sufficiently isolated from the environment, it has the potential to measure spin-dependent interactions with a sensitivity far surpassing that of other systems [Band, Avishai, and Shnirman, Phys. Rev. Lett. **121**, 160801 (2018)]. The high sensitivity is the result of rapid averaging of quantum noise. We propose to use a mm-scale FG in orbit around the Earth to investigate physics at the intersection between quantum mechanics and general relativity by measuring relativistic frame dragging (the Lense-Thirring effect) with intrinsic spin. The behavior of intrinsic spin in spacetime dragged by a massive rotating body is an experimentally open question, hence the results of such a measurement may have important theoretical consequences.

[1]This work was supported by the Moore Foundation, the Heising-Simons Foundation, and the National Science Foundation under grant PHY-1707875.

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Date submitted: 30 Jan 2020 Electronic form version 1.4