Abstract Submitted
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Search for long-range anomalous spin dependent forces using a K-^{3}He co-magnetometer[1] GEORGIOS VASILAKIS, JUSTIN M. BROWN, THOMAS W. KORNACK, MICHAEL V. ROMALIS, Princeton University — Various theories propose new long-range forces. We test the existence of long range spin dependent forces between neutrons. We use a K-^{3}He co-magnetometer with a sensitivity of 1 fT/Hz$^{1/2}$ and a spin-source of hyperpolarized ^{3}He gas with about 10^{22} polarized spins. The co-magnetometer is insensitive to ordinary magnetic fields but sensitive to interactions with anomalous coupling to electronic or nuclear spin. Nuclear spin polarization of a 12 amagat ^{3}He cell is achieved through spin exchange optical pumping. The separation of the spin-source from the co-magnetometer is approximately 50 cm. The ^{3}He spin polarization is reversed using Adiabatic Fast Passage every 10 sec with losses of about 2×10^{-5} per flip. We look for a signal in the co-magnetometer correlated with the modulation of the spin source. Present sensitivity of the experiment to the neutron spin coupling constant $(g_n^2/4\pi)$ for light pseudoscalar particles is in the range of 10^{-9}, about an order of magnitude better than existing limits from gravitational weak equivalence principle and inverse square law tests, with further improvement anticipated.

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