

Abstract Submitted
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A ^3He - ^{129}Xe co-magnetometer with ^{87}Rb magnetometry¹ MARK LIMES, DONG SHENG, MIKE ROMALIS, Princeton Univ — We report progress on a ^3He - ^{129}Xe co-magnetometer detected with a ^{87}Rb magnetometer. The noble-gas co-magnetometer is insensitive to any long-term bias field drifts, but the presence of hot Rb can cause instability in the ratio of ^3He - ^{129}Xe precession frequencies. We use a sequence of Rb π pulses to suppress the instability due to Rb-noble gas interactions by a factor of 10^4 along all three spatial axes. For detection, our ^{87}Rb magnetometer operates using single-axis ^{87}Rb π pulses with σ_+/σ_- pumping—this technique decouples the ^{87}Rb magnetometer from bias fields, and allows for SERF operation. We are presently investigating systematic effects due to combinations of several imperfections, such as longitudinal noble gas polarization, imperfect ^{87}Rb π pulses, and ^{87}Rb pump light shifts. Thus far, our ^{87}Rb magnetometer has a sensitivity of $40 \text{ fT}/\sqrt{Hz}$, and our ^3He - ^{129}Xe co-magnetometer has achieved a single-shot precession frequency ratio error of 20 nHz and a long-term bias drift of 8 nHz at 7 h. We are developing the co-magnetometer for use as an NMR gyro, and to search for possible spin-gravity interactions.

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