Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

A ^{3}He-^{129}Xe co-magnetometer probed by a Rb magnetometer with Ramsey-pulse technique[1] DONG SHENG, AARON KABCENELL, MICHAEL ROMALIS, Princeton University — We report the recent progress in development of a new kind of co-magnetometer, benifiting from both the long spin coherence time of a noble gas and a highly sensitive alkali metal magnetometer. Due to the Fermi-contact interaction between alkali metal electron spin and noble gas nuclear spin the effective magnetization of the noble gas is enhanced by a factor of 6 to 600, allowing near quantum-limited detection of nuclear spins. Collisions between polarized alkali atoms and noble gas also introduce a large shift to the nuclear spin precession frequency. We reduce this effect by using Ramsey pulse techniques to measure the noble gas spin precession frequency "in the dark" by turning off the pumping laser between Ramsey pulses. A furthur reduction of the back-hyperpolarization from the noble gas can be achieved by controlling the cell temperature on short time scale. We showed that a ^{3}He-^{129}Xe Ramsey co-magnetometer is effective in cancelling fluctuations of external magnetic fields and gradients and developed cells with sufficient ^{129}Xe T_2 time without surface coatings. The new co-magnetometer has potential applications for many precision measurements, such as searches for spin-gravity couplings, electric dipole moments, and nuclear spin gyroscopes.

[1]Supported by DARPA

Dong Sheng
Princeton University

Date submitted: 28 Jan 2013 Electronic form version 1.4