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**A co-magnetometer-based nuclear spin gyroscope**[1] THOMAS KORNACK, RAJAT GHOSH, MICHAEL ROMALIS, Princeton University — We describe a new atomic gyroscope based on an alkali metal–noble gas co-magnetometer. Unlike atomic and laser gyroscopes based on the Sagnac effect, nuclear spin gyroscopes do not require a large enclosed area and can be made quite compact. A high density alkali-metal magnetometer operating in a spin-exchange relaxation free (SERF) regime is used to polarize the noble gas atoms and detect their gyroscopic precession. In this arrangement it is also possible to cancel the response to the magnetic fields as well as their gradients and transients between the two atomic species, giving a clean signal proportional to the rotation. Using a K–$^3$He co-magnetometer we demonstrated rotation sensitivity of $2 \times 10^{-7}$ rad/sec/Hz$^{1/2}$. The rotation signal can be increased by an order of magnitude using Ne-21 atoms which have a smaller magnetic moment, while the fundamental limit on the gyroscope sensitivity is about $10^{-10}$ rad/sec/ Hz$^{1/2}$ for a 10 cm$^3$ measurement cell. We will also present data on the long-term stability of the gyroscope obtained during a search for Lorentz violation using the K–$^3$He co-magnetometer.

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