Abstract Submitted
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Progress toward making spin squeezed states with ions in a Penning-Malmberg trap.[1] N. SHIGA, W.M. ITANO, J.J. BOLLINGER, NIST, Boulder, CO 80305 — We describe plans and summarize initial progress towards making spin squeezed states with a few tens to ∼1000 $^9Be^+$ ions in a Penning-Malmberg trap. We use the ground-state electron spin-flip transition, which in the 4.5 T magnetic field of the trap has a transition frequency of 124 GHz, as the ion qubit. With a 30 mW Gunn diode oscillator we have observed Rabi flopping rates as high as ∼1 kHz. We will summarize experimental progress on realizing projection noise limited spectroscopy on this transition, which is a prerequisite for demonstrating spin squeezing. For entangling the ions we plan to use a generalization of the few ion qubit phase gate developed at NIST [2] to generate an $\exp(i\chi {J_z}^2 t)$ interaction between all of the ion qubits. This interaction can be implemented on a single plane of ions [3] with a motional sideband, stimulated Raman transition.

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[2]D. Leibfried, et al., Nature **438**, 639 (2005).
[3]T.B. Mitchell, et al., Science **282**, 1290 (1998).

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