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Quantum projection noise and squeezing with ions in a Penning-Malmberg trap. N. SHIGA[1], W.M. ITANO, J.J. BOLLINGER, NIST, Boulder, CO 80305 — We summarize initial progress towards making spin squeezed states with $\sim$100 $^9Be^+$ ions in a Penning-Malmberg trap. We use the ground-state electron spin-flip transition, which in the 4.5 T trap magnetic field has a 124 GHz transition frequency, as the ion qubit. With a 30 mW Gunn diode oscillator we have observed π-times as short as 100 μs. We have realized projection noise limited spectroscopy[2] 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[3] 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[4] with a motional sideband, stimulated Raman transition. We have observed fast ($\sim$1 ms) magnetic field fluctuations of our magnet through spin-echo spectroscopy. These fluctuations limit the amount of time that can be used to apply the squeezing.

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