Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Precise measurement of phase transitions in spinor Bose-Einstein condensates ANSHUMAN VINIT, CARLO SAMSON, CHANDRA RAMAN, Georgia Institute of Technology, CHANDRA RAMAN TEAM — We investigate out-of-equilibrium phenomena in sodium spinor Bose-Einstein condensates by studying the evolution of system following a dynamical instability. Sodium condensates are initially prepared in $|F = 1, m_F = 0\rangle$ state and are rapidly quenched across a quantum phase transition. It leads to pair formation of $|F = 1, m_F = +1\rangle$ and $|F = 1, m_F = -1\rangle$ atoms and results in their rapid amplification through spin-mixing instability. We reveal strong tunability of this amplification using magnetic field gradients. We observe a suppression of up to a factor of 10 in instability rates in the neighborhood of the phase transition. These observations show good agreement with predictions based upon numerical solutions to the Bogoliubov de-Gennes equations. We also observe a dramatic sharpening of the quantum phase transition point as magnetic field inhomogenieties are reduced, resulting in a resolution of the phase transition at the 1 Hz level.

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Date submitted: 25 Jan 2013 Electronic form version 1.4