Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

The Dynamics of Squeezed Coherent States in the Superfuid-Mott Insulator Phase Transition[1] HYUNOO SHIM, THOMAS BERGEMAN, SUNY Stony Brook — We propose a theoretical model of number-phase squeezed coherent states in the superfluid to Mott insulator transition, which is capable of representing both quantum phases. We consider for an initial state the superfluid coherent state in a one dimensional Bose-Einstein condensate in a weak optical lattice confined by a harmonic trap. The system enters the Mott insulator phase and returns back to the superfluid phase as the optical lattice barrier height increases and decreases respectively. The evolution of the initial state is calculated via the time dependent variational principle with the Bose-Hubbard Hamiltonian including time dependent terms: optical lattice height, nonlinear on-site interaction, and site-to-site hopping terms. Accordingly the initial state transforms to a squeezed coherent state, a generalization of the coherent state that preserves the minimum uncertainty. We will demonstrate that the dynamics of the above squeezed coherent states is well-suited to understanding the superfluid to Mott insulator quantum phase transition at zero temperature. We will show numerical calculations of a superfluid order parameter, one body density matrix, number-phase variance, and coherence factor revealing that the system is effectively in transion from a superfluid to a Mott insulator.

[1]Supported by ONR and by NSF grant PHY0652459.

Hyunoo Shim
SUNY Stony Brook

Date submitted: 26 Jan 2009 Electronic form version 1.4