Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Phase-space representations of thermal Bose-Einstein condensates PETER DRUMMOND, Swinburne Univ of Tech — Phase-space methods allow one to go beyond the mean-field approximation to simulate the quantum dynamics of interacting fields. Here, we obtain a technique for initializing either Wigner or positive-P phase-space simulations of Bose-Einstein condensates with quantum states at a finite temperature. As a means to calculate the initial states, we introduce the idea of a nonlinear chemical potential, which removes the zero-momentum phase-noise divergences of Bogoliubov theory to give a diagonal Hamiltonian. The resulting steady-state quantum theory is then directly applicable to calculations of initial conditions for quantum simulations of BEC dynamics using phase-space techniques. These methods allow efficient and scalable simulation of large Bose-Einstein condensates. We suggest that nonlinear chemical potentials may have a general applicability to cases of broken symmetry. The technique is applied to simulating an experimental two-state BEC interferometer in three dimensions. The resulting calculations of fringe visibility in an interacting BEC are in excellent agreement with experimental fringe measurements over time-scales of seconds. This gives an improved estimate of BEC temperature well below the critical point, and allows a new dynamical calculation of condensate fraction.

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Date submitted: 30 Jan 2019 Electronic form version 1.4