Bose-Einstein Condensation with Entangled Order Parameter

Yu Shi
Fudan University
Department of Physics
220 Handan Road
200433 Shanghai
CHINA

Abstract:

We propose a practically accessible non-mean-field ground state of Bose-Einstein condensation (BEC), which occurs in an interspecies two-particle entangled state, and is thus described by an entangled order parameter. A suitably defined entanglement entropy is used as the characterization of the non-mean-field nature, and is found to persist in a wide parameter regime. The interspecies entanglement leads to novel interference terms in the dynamical equations governing the single particle orbital wavefunctions. Experimental feasibility and several methods of probe are discussed. We urge the study of multi-channel scattering between different species of atoms.