
Berezinskii-Kosterlitz-Thouless transition of ultracold atoms in optical lattice

Tadeusz Kopec*¹ and Tomasz Zaleski

¹Institute of Low Temperature and Structure Research, Polish Academy of Sciences – Institute address: ul. Okólna 2, 50-422 Wrocław, Poland Mailing address: Skr. p. nr 1410, 50-950 Wrocław 2, Poland, Poland

Abstract

We study the behavior of interacting ultracold bosons in two-dimensional optical lattice. We use the quantum rotor approach to the Bose-Hubbard model to derive the effective phase-only Hamiltonian and calculate the Berezinskii-Kosterlitz-Thouless phase transition temperature. It appears that quantum nature of the problem manifested in strong dependence of the particle effective mass on the particle density has negligible effect on the bound vortex-antivortex phase-field configurations of the ordered state. Instead, it is mostly determined by the kinetic energy of atoms and the chemical potential.

*Speaker