

Spin-Orbit Coupled Bose-Einstein Condensates in Optical Lattices

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We study theoretically the ground state of Bose gas with synthetic spin-orbit coupling in two-dimensional optical lattices, showing that a vortex lattice state will appear because the interplay between optical lattices potential, spin-orbit coupling and spin-dependent atomic interactions. We obtained the Bloch state for Gross-Pitaevskii equation(GPE) without the nonlinear terms by numerical and analysis calculations, and compared with stationary solutions to the GPE with nonlinear terms. In the case that the interatomic interaction is weaker compare with intra-atomic one, the vortex lattice state will into a ferromagnetic order. In the other case, the state will into a complicated phase consists of ferromagnetic and antiferromagnetic orders.

Section: QG - Quantum gases

Keywords: vortex lattice, spin-orbit coupling, Gross-Pitaevskii equation, Bose-Einstein condensate, optical lattice