Coupled mode theory for BECs in a square bipartite optical lattice.

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1 Abstract

We numerically investigate the stationary states of an interacting condensate in a 2D bipartite lattice potential. In particular, we apply the coupled-mode theory to investigate the condensates loaded into the p-band of 2D bipartite optical lattice potential. We demonstrate the possibility to create a superposition of Bloch states with a nontrivial orbital texture. Namely, we show that superposition of the two Bloch states at the quasi-degenerate energy minima of the first band can lead to formation of a 2D vortex array with global orbital angular momentum across the entire lattice.
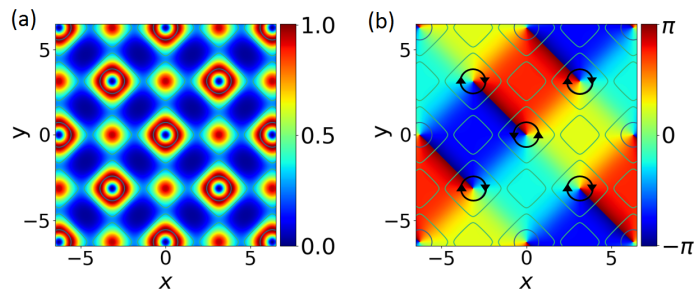
Figure 1: Steady state solution of an interacting condensate in the p-band of a 2D bipartite lattice. (a) The density distribution of the steady state solution $|(\psi_X + e^{i\pi/2}\psi_{-X})|^2$. (b) The phase structure with black arrows represent the circulation of each vortex.