Color Superfluid of Three-Component Fermionic Atoms with Repulsive Interaction in Optical Lattices

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Motivated by recent intensive studies on cold fermionic atoms with multiple internal degrees of freedom such as ^{6}Li and ^{173}Yb, we have investigated the repulsively interacting three-component (color) fermionic atoms in optical lattices.[1] [2] [3] We have shown that the system undergoes a Mott transition even in the incommensurate half filling. At the transition point, two atoms with the weakest repulsion form pairs so as to avoid stronger two repulsions, which leads to the paired Mott insulator (PMI). This result suggests that pair fluctuations are strongly enhanced and the color superfluid (CSF) may appear close to the transition point. In this study, we investigate the CSF of this system. Using the dynamical mean-field theory combined with an iterative perturbation theory and the self-energy functional approach, we calculate the CSF order parameter, the quasiparticle weight, and the double occupancy as functions of the interaction and temperature for several fillings. We discuss the zero- and finite-temperature phase diagrams for the characteristic states: the CSF, the PMI, and the color-selective Mott state.

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[3]S. Miyateke, K. Inaba, and S. Suga, Physica C **470**, S916 (2010).