

Energy Spectrum of Two-Component Bose-Einstein Condensates in Optical Lattices

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Abstract: With the method of Green's function, we investigate the energy spectra of two-component ultracold bosonic atoms in optical lattices. We find that there are two energy bands for each component. The critical condition of the superfluid-Mott insulator phase transition is determined by the energy band structure. We also find that the nearest neighboring and on-site interactions fail to change the structure of energy bands, but shift the energy bands only. According to the conditions of the phase transitions, three stable superfluid and Mott insulating phases can be found by adjusting the experiment parameters. We also discuss the possibility of observing these new phases and their transitions in further experiments.

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Key words: energy spectrum, phase transition, Bose-Einstein condensates, optical lattice

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