Quantum Phase Transitions in an Ionic Hubbard Model in One Dimension

JI-WOO LEE, SUNG MOON KIM, KYO YEON CHO, Myongji University — We study quantum phase transitions in an ionic Hubbard model in one dimension. This model accounts for electrons in alternating potentials with a lattice period of 2. For a specified alternating potential of strength $\Delta$, we change the local repulsion between spin-up and spin-down electrons, $U$, for the model to exhibit a quantum phase transition from a band insulator to a Mott insulator. Via exact diagonalization with a modified Lanczos method, we find that, as we tune $U$, the ground-state energy shows a level crossing at half-filling. We obtain a phase diagram of the model by using a finite-size scaling method. Also, we find an interesting feature of double occupancy around the phase transitions.

Ji-Woo Lee
Myongji University

Date submitted: 11 Nov 2011

Electronic form version 1.4