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Dimer of Two Bosons in a One-dimensional Optical Lattice
JEROME SANDERS, OTIM ODONG, JUHA JAVANAINEN, University of Connecticut — Using a Bose-Hubbard model, we theoretically examine the stationary states of two bosons in a one-dimensional optical lattice with periodic boundary conditions. A partial separation of the center-of-mass and relative motions of the two-atom lattice dimer is utilized to determine the eigenstates in a finite lattice. The eigenstates are then analyzed in the limit of an infinitely long lattice. Closed-form analytic expressions for the bound state and the dissociated states of the dimer are found. To confirm the results in momentum representation, an analogous investigation is done in position representation. Three examples for the detection of the dimer are discussed: measuring the momentum distribution of the atoms, measuring the atom number correlations at two sites, and dissociating a bound state of the dimer with a modulation of the lattice depth.

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