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Extensions of the Bose-Hubbard Model for BEC in a Double-Well Potential[1] DAVID ANANIKIAN, THOMAS BERGEMAN, SUNY at Stony Brook — To connect 1D theoretical results and experiments on Bose condensates trapped in a double-well longitudinal potential in quasi-1D waveguides, there are two possible effects to consider: a) the "tight-binding" approximation may not apply, and the wavefunctions in a well may vary with atom number due to atom- atom repulsion; and b) the transverse confinement may not be tight enough to ensure a uniform transverse wavefunction factor. We have developed a series of successively more complete approaches: a) an "exact" 1D two-mode model, based on symmetric and anti-symmetric solutions of the Gross-Pitaevskii (GP) equation in 1D, exhibits two-particle tunneling effects; b) a multimode model; c) numerical solutions of the 1D time- dependent GP equation match the two-mode results for small interactions; d) numerical calculations of the TDGP in 3D using split-operator techniques take into account behavior in the transverse direction. Our results with d) are in good agreement with experimental observations by the Oberthaler group in Heidelberg.

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