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Macroscopic Quantum Tunneling and Entangled States in Bose-Einstein Condensates DIMITRI DOUNAS-FRAZER, LINCOLN CARR, Physics Department, Colorado School of Mines, Golden, CO 80401 — We use a multi-band Bose-Hubbard model to study the quantum dynamics of ultracold bosons in a two-well potential. We describe the energy eigenstates in detail. These consist of oscillator-like solutions, non-degenerate entangled states, and degenerate entangled states which include extreme cat-states. The ground state ranges from a single number state to a coherent, or superfluid, state. In the dynamics we find harmonic breathing and quantum revivals. Finally, we describe the macroscopic quantum tunneling of a dark soliton between two wells. We show how the oscillation frequency depends on the band spacing and the ratio of the tunneling energy to the interaction potential.

Donald Griffin
Rollins College

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