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Bose-Einstein Condensation in the second band of an optical lattice, a tight binding analysis and numerical estimate of its formation and decay[1] SAURABH PAUL, EITE TIESINGA, Joint Quantum Institute — We investigate the formation of a Bose Einstein condensate in the p-band of a double well optical lattice [1]. The lattice traps the atoms in two dimensions while confinement in the third direction is provided by a weak harmonic trap. We estimate the band structure using a tight binding (TB) model, using local simple harmonic oscillator functions. We are interested in the case when the ground s-orbital of shallow wells and the excited p-orbital of adjacent deep wells is tuned to resonance, by varying the onsite energy real time. A numerical estimate of the band structure using a plane wave basis, and comparison of the tunneling parameters with that of the TB model reveals that the TB model is not a good approximation for higher bands. In the TB limit, we estimate the life time of the condensate, which is mainly dominated by a two body collision aided decay process to the ground band. Numerically, we find corrections to this, where simultaneous transitions to the ground and an excited band also contributes to the decay of the condensate.

[1] G. Wirth et al., Nature Physics doi:10.1038/nphys1857

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