Abstract Submitted
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Bose-Einstein Condensation in the P-band of a time-dependent double well optical lattice SAURABH PAUL, EITE TIESINGA, Joint Quantum Institute — We investigate the formation of a Bose Einstein Condensate in the P-band of an optical lattice [1]. The lattice traps the atoms in two dimensions while confinement in the third direction is provided by a weak harmonic trap. The lattice has shallower and deeper wells arranged in a chequerboard pattern. The 2D band structure is obtained using harmonic oscillator functions at each site, with a ground S-orbital in the shallower wells, and excited P orbitals in deeper wells. The on-site energy can be varied in real time. This allows us to study the transition from an array of 1D condensates, when the onsite energy of the S and P orbitals is off-resonant, to a 3D condensate, when the energy is resonant. We have estimated the band structure parameters and used these to perform thermodynamics on a non-interacting Bose gas. We then show for a sudden change in the lattice from the non-resonant to the resonant case, the final temperature decreases, and if the initial temperature is below the critical temperature for Bose condensation, this ensures that the final state is a 3D condensate.

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

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