

# Frustration effects in rapidly rotating square and triangular optical lattices

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We discuss the ground state of the two-dimensional Bose-Hubbard (BH) Hamiltonian, relevant for rotating gaseous Bose-Einstein condensates, by employing quantum rotor approach and the topologically constrained path integral that includes a summation over topological charge. We derive an effective quantum action for the BH model, which enables a non-perturbative treatment of the zero-temperature phase transition. We calculate the ground-state phase diagram, analytically deriving maximum repulsive energy for several rational values of the frustration rotation parameter and for the square and triangular lattice, which improves upon previous theoretical treatments. The ground state of the rotating Bose-Einstein condensates on a triangular lattice appears to be most stable against the effects of rotation. Performed calculations revealed strong dependence of the critical ratio of the kinetic energy to the repulsive on-site energy, that separates the global coherent from the insulating state, on topology of the lattice.

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