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Quantum phase transition in shaken optical lattices JIAO MIAO, BOYANG LIU, WEI ZHENG, Institute for Advanced Study, Tsinghua University, COLD ATOM TEAM — Lattice shaking technique generates phonon modes coupling different Bloch bands resonantly. For 1D case, in which shaking is along only one direction, experimental observation of effective ferromagnetic domain has been explained by Ising transition. Inspired by these, we generalize to 2D case, in which shaking is along two orthogonal directions. Analogy to 1D case, we find quantum phase transition from normal superfluid(NSF) phase to D_4 symmetry breaking superfluid(D_4SF) phase. And interaction effect is confirmed to be one factor responsible for modified critical shaking amplitude. We demonstrate, unlike 1D case, shaking types can modify critical shaking amplitude. We introduce a low-energy effective field theory to study quantum criticality of bosons near the tri-critical point between NSF, D_4SF and MI phases. Furthermore, we show Bose-Einstein condensation can be turned into non-condensed Bose gases by tuning shaking amplitude to the critical value.

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