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**A Quantum Theory of Ultracold Atoms in Spatially Inhomogeneous Optical Lattices** DAGIM TILAHUN, BYOUNGHAK LEE — Ultracold atoms in optical lattices undergo a quantum phase transition from a superfluid to a Mott insulator as the potential depth is increased. But the interpretations of most cold atoms experiments are complicated by the fact that the experimental systems are inhomogeneous, for example due to the harmonic trapping potential that is always present. Or the focus of the study itself could be what causes the non-uniformity, such as disorder. Here We apply a theory developed by one of the authors and a collaborator to these inhomogeneous systems to discuss their ground state and elementary excitations.

Dagim Tilahun  
Texas State University

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