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Topological Quantum Phase Transition of Fermi Gases and its Detections in a Synthetic Non-Abelian Gauge Potential[1] FADI SUN, XIAO-LU YU, JINWU YE, Department of Physics and Astronomy, Mississippi State University, P. O. Box 5167, Mississippi State, MS 39762, USA, HENG FAN, WU-MING LIU, Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China — We investigate the topological quantum phase transition of Fermi gases trapped in a honeycomb lattice in the presence of a synthetic non-Abelian gauge potential. We develop a systematic fermionic effective field theory to describe a topological quantum phase transition tuned by the non-Abelian gauge potential and explore its various important experimental consequences. We obtain the critical exponents at zero temperature, dynamic compressibility, uniform compressibility, specific heat and Wilson ratio at finite temperatures. We analyze the effects of atom-atom interactions and possible disorders in generating the non-Abelian gauge fields. We also perform direct numerical calculations on the lattice scale and compare with the results achieved from the fermionic effective field theory. When discussing various feasible experimental detections of the topological quantum phase transition, we stress the important roles of the gauge invariance to distinguish gauge invariant quantities from non-gauge invariant ones.

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