Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Fermion-induced quantum critical points: beyond Landau criterion HONG YAO, ZI-XIANG LI , YI-FAN JIANG, SHAO-KAI JIAN, Institute for Advanced Study, Tsinghua University, Beijing — According to Landau criterion, phase transitions must be first-order when cubic terms of order parameters in the Landau-Ginzburg free energy are allowed by symmetry. Here, from both renormalization group analysis and sign-problem-free quantum Monte Carlo simulations, we show that second-order quantum phase transitions can occur at such putatively-first-order quantum phase transitions in strongly-interacting Dirac semimetals in two spatial dimensions. Such type of Landau-criterion-violating quantum critical points are induced by massless fermionic modes at the quantum phase transitions. We call them "fermion-induced quantum critical points". From Majorana-quantum-Monte-Carlo simulations and renormalization analysis, we find that the critical exponentials at the kekule valence-bond-solid transition of the Dirac fermions on the honeycomb lattice are highly-nonclassical. We also discuss experimental signatures of the kekule quantum critical point which may be realized in graphene-like systems.

Hong Yao
Institue for Advanced Study, Tsinghua University, Beijing

Date submitted: 06 Nov 2015 Electronic form version 1.4