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Effects of electronic interactions near the topological semimetal-insulator quantum phase transition in two dimensions[1] BITAN ROY, MATTHEW FOSTER, Rice University — The quasiparticle dispersion of gapless excitations residing at the quantum critical point (QCP) separating a two dimensional topological Dirac semimetal and a symmetry preserving band insulator, displays distinct power-law dependence with various components of spatial momenta. In this talk first I will review scaling of various thermodynamic and transport quantities at this QCP. Next I will demonstrate that even though such noninteracting QCP is stable against sufficiently weak but generic short-range interaction, the direct transition between the Dirac semimetal and band insulator can either (i) become a fluctuation driven first order transition, or (ii) get eliminated by an intervening broken symmetry phase, with staggered pattern in charge or spin being two prominent candidates, for sufficiently strong interactions. The novel quantum critical phenomena associated with the instability of critical excitations toward the formation of various broken symmetry phases will be discussed. Relevance of our study in strained graphene, black phosphorus, pressured organic compounds and oxide heterostructure will be highlighted.

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