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Effective field theory of nematic QAH for interacting fermions YIZHI YOU, EDUARDO FRADKIN, University of Illinois at Urbana-Champaign — We consider 2D fermionic lattice models with quadratic band touching. By turning on a marginal relevant interaction of this system, the system condenses into a state that spontaneously breaks time reversal and/or rotation (point-group) symmetry. When both symmetries are broken the state is a nematic quantum anomalous Hall (QAH) phase. We derive an effective field theory which describes the quantum phase transition into this state from a spontaneous QAH state. The effective field theory has the form of Maxwell-Chern-Simons action for the hydrodynamic degrees of freedom of the spontaneous QAH state with a coupling to the nematic order-parameter field that induces a spatial anisotropy. The fluctuations of the nematic field modify the local spatial geometry and couples to the Maxwell term as the spatial components of a metric tensor. We will discuss the behavior at quantum criticality and the relation with recent theories that associate transitions of this type with quantum Lifshitz criticality [1]. We will also discuss extensions of our theory to nematic fractional QAH state. [1] M. Mulligan, C. Nayak, and S. Kachru, Phys. Rev. B 82, 085102 (2010); Phys. Rev. B 84,195124 (2011) This work was supported in part by the NSF grant DMR-1064319 at the University of Illinois.

Yizhi You
University of Illinois at Urbana-Champaign

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