Interaction Effects in Quantum Anomalous Hall Insulators

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The discovery of the quantum anomalous Hall effect in magnetically doped topological insulator thin films as well as the realization of Chern band systems in cold atom experimental setups raises the issue of interaction effects on such topological phases and at topological critical points. We consider simple models of quantum anomalous Hall transitions at which the Chern number changes by 2 due to a quadratic band touching critical point. We show that marginally relevant interactions drive the formation of a dome of emergent nematic order around such topological critical points [1]. We next turn to the Haldane model, where we show using mean field and strong coupling approaches that strong correlations convert this topological band insulator into a Mott insulator with various types of chiral magnetic orders [2,3]. Frustrating a specific noncoplanar triple-Q tetrahedral state is shown to lead to a chiral spin liquid with gapped semion excitations. We discuss the Chern-Simons Higgs theory of the chiral spin liquid to tetrahedral order transition [3].

References:

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