Joint CQSE and CASTS Seminar

Weekly Seminar
Dec. 9, 2011 (Friday)

TIME Dec. 9, 14:30 ~ 15:30
TITLE Interaction-driven topological and nematic phases on the Lieb lattice
SPEAKER Prof. Wei-Feng Tsai
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Abstract

As an alternative route to search for new topological insulators (TIs), we investigate the interaction-driven instabilities of the band crossing point (BCP) for fermions moving on the (extended) Lieb lattice. In the non-interacting limit, we show the topological stability of the BCP both from Berry flux $\pm 2\pi$ at it and the existence of non-contractible loop states in the real space, provided time reversal (or similarly space+spin) and C_4 point group symmetries are preserved. With short-range repulsive interactions, we find that at zero temperature this BCP is marginally unstable against infinitesimal repulsions and results in topological quantum anomalous/spin Hall, charge nematic, and nematic-spin-nematic phases, separately, depending on the interaction strengths. Our work thus may shed some light on the experimental search of TIs in the layered perovskite materials. In addition, the existence of a nearly flat band with non-zero Chern number will also be discussed.