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Interaction-driven topological and nematic phases on the Lieb lattice WEI-FENG TSAI, National Sun Yat-sen University, CHEN FANG, Purdue University, HONG YAO, Stanford University, JIANGPING HU, Purdue University — We investigate the interaction-driven instabilities of the band crossing point (BCP), which occurs in the band structure resulting from spinless/spinful fermions moving on the (extended) Lieb lattice. In the non-interacting limit, we show the topological stability of the BCP both from momentum and real space arguments, provided time reversal 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. Possible physical realizations and the existence of a topological nearly flat band are also discussed.

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