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Strong Correlation and Topological States in Orbital-Active Dirac Materials SHENGLONG XU, CONGJUN WU, University of California, San Diego — Two dimensional Dirac materials, starting with graphene, have drawn tremendous research interests in the past decade. Instead of focusing on the p_z orbital as in graphene, we go a step further and study its two orbitals counterpart, namely the p_x and p_y orbitals on a honeycomb lattice. The model applies to both optical lattices and several solid state systems including organic material, fluoridated tin film, BiX/SBX (X=H.F.CI.Br). In the band structure, besides the well known Dirac points in the graphene band structure, the orbital degrees of freedom give rise to flat bands as well as quadratic band touching points. These new features provide an even wider playground for searching exotic states of matter. With help of mean field theory and functional renormalization group (FRG) method, we explore the effects of interaction on the system and investigate the consequential interesting states such as ferromagnetism, Wigner crystallization, quantum anomalous Hall states and f-wave superconductivity.

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