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Dirac Fermions in heterostructures for designer topological phases[1] JI FENG, International Center for Quantum Materials, Peking University — Massless Dirac Fermions are found in graphene and on the surfaces of topological insulators, which are quasiparticles moving at a constant speed independent of its energy as governed by relativistic quantum mechanics. In this talk, I will show, via interfacial orbital design of Dirac states, emergent topological phases can be engineered in artificial heterostructures. As a first example, I will show that a novel class of half semi-metallic Dirac electronic phase emerges at the interface CrO_2 with TiO_2 in both thin film and superlattice configurations. With four spin-polarized Dirac points in the band structure, this system with simple, non-topological oxides displays spontaneous quantum anomalous Hall effect. In a second example, I will show that the superlattice valley engineering, starting with the SnTe topological mirror insulator, leads to designer topological phases with a remarkably rich phase diagram.

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