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3D Dirac Electrons on a Cubic Lattice with Noncoplanar Multiple-Q Order SATORU HAYAMI, TAKAHIRO MISAWA, YOUHEI YAMAJI, YUKITOSHI MOTOME, Dept. of Appl. Phys., Univ. of Tokyo — Noncoplanar multiple-Q orders often lead to new low-energy excitations and/or topologically nontrivial states. In particular, triple-Q orders have attracted much interest due to the emergence of topological (Chern) insulators and associated anomalous quantum Hall effects. In the present study, we explore the possibility of such multiple-Q orderings on a simple cubic lattice and their influence on the electronic structure. We find that a four-sublattice triple-Q magnetic order significantly affects the low-energy single-particle spectrum which is described by the three-dimensional massless Dirac electrons. In order to clarify the stability of such noncoplanar magnetic order in microscopic models, we investigate the ground-state phase diagram of an extended periodic Anderson model on a cubic lattice by mean-field approximation. As a result, we find that the triple-Q phase appears in a wide range of parameters at 3/2 filling. The 3D Dirac nature gives rise to a characteristic gapless surface state. We discuss the bulk and surface electronic states in details. We also discuss a possible realization of a topological insulating phase by opening an energy gap in the triple-Q phase.

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