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**Graphene based d-character Dirac Systems** YUANCHANG LI, National Center for Nanoscience and Technology, S. B. ZHANG, Department of Physics, Applied Physics, and Astronomy, Rensselaer Polytechnic Institute, Troy, New York 12180, USA, WENHUI DUAN, Department of Physics and State Key Laboratory of Low-Dimensional Quantum Physics, Tsinghua University, Beijing 100084, Peoples Republic of China — From graphene to topological insulators, Dirac material continues to be the hot topics in condensed matter physics. So far, almost all of the theoretically predicted or experimentally observed Dirac materials are composed of *sp*-electrons. By using first-principles calculations, we find the new Dirac system of transition-metal intercalated epitaxial graphene on SiC(0001). Intrinsically different from the conventional *sp* Dirac system, here the Dirac-fermions are dominantly contributed by the transition-metal *d*-electrons, which paves the way to incorporate correlation effect with Dirac-cone physics. Many intriguing quantum phenomena are proposed based on this system, including quantum spin Hall effect with large spin-orbital gap, quantum anomalous Hall effect, 100% spin-polarized Dirac fermions and ferromagnet-to-topological insulator transition.

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