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Topological magnetic phase in $LaMnO_3$ (111) bilayer YAKUI WENG, XIN HUANG, Southeast University, YUGUI YAO, Beijing Institute of Technology, SHUAI DONG, Southeast University — Candidates for correlated topological insulators, originated from the spin-orbit coupling as well as Hubbard type correlation, are expected in the (111) bilayer of perovskite-structural transition-metal oxides. Based on the first-principles calculation and tight-binding model, the electronic structure of a $LaMnO_3$ (111) bilayer sandwiched in $LaScO_3$ barriers has been investigated. For the ideal undistorted perovskite structure, the Fermi energy of $LaMnO_3$ (111) bilayer just stays at the Dirac point, rendering a semi-metal (graphene-like) which is also a half-metal (different from graphene nor previous studied $LaNiO_3$ (111) bilayer). The Dirac cone can be opened by the spin-orbit coupling, giving rise to nontrivial topological bands corresponding to the (quantized) anomalous Hall effect. For the realistic orthorhombic distorted lattice, the Dirac point moves with increasing Hubbard repulsion (or equivalent Jahn-Teller distortion). Finally, a Mott gap opens, establishing a phase boundary between the Mott insulator and topological magnetic insulator. Our calculation finds that the gap opened by spin-orbit coupling is much smaller in the orthorhombic distorted lattice ($\sim$1.7 meV) than the undistorted one ($\sim$11 meV).

Yakui Weng
Southeast University

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