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Topological states of non-Dirac electrons on Si[111] surface[1] RUI YU, International Center for Materials Nanoarchitectornics (WPI-MANA) National Institute for Materials Science, Tsukuba 305-0044, Japan, QIFENG LIANG, Department of Physics, Shaoxing University, Shaoxing 312000, China, XIAO HU, International Center for Materials Nanoarchitectornics (WPI-MANA) National Institute for Materials Science, Tsukuba 305-0044, Japan — In the present work, we demonstrate the possibility of nontrivial topology of non-Dirac electrons. In particular, we show that, in two dimensional systems with C_3 crystal symmetry and time reversal symmetry, multiple p-orbits exhibit a degeneracy and quadratic non-Dirac band dispersions at Γ point. When the atomic spin-orbit coupling (SOC) is taken into account, a gap is opend at Γ point and a quantum spin Hall effect state is realized. We construct a $k \cdot p$ model to reveal the nontrivial topology which is associated with a meron structure with double vorticity in the pseudo spin texture, a mechanism different from that on honeycomb lattice and the band inversion. We propose that Si[111] surface with 1/3 regular coverage of Bi atoms is a realization of our idea. First-principles calculations show that this system takes a quantum spin Hall phase with topological gap as large as ~ 0.15eV.

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