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Novel spin propertries of non-Rashba-type surface states with low symmetries KOKIN NAKAJIN, Tokyo Institute of Technology, SHUICHI MURAKAMI, TIES, Tokyo Institute of Technology — Surface states in Tl/Si(111)-(1×1) and β-Bi/Si(111)-($\sqrt{3}\times\sqrt{3}$) show non-Rashba-type spin splitting due to spin-orbit interaction. We construct effective tight-binding models on the triangular lattice for the surface states of Bi/Si and Tl/Si crystals with spin-orbit interaction, respecting the crystal symmetries. Consequently, our two results qualitatively agree with the experimental results. We find a new term in the Tl/Si model, which does not exist in Rashba systems. In addition, we apply the theory of persistent spin helix in semiconductors for the Tl/Si crystal because there are two nested hole pockets with opposite spin directions when doping holes to this crystal. As a result, we find spin helix states on the surface with a long spin life time. Furthermore, we numerically study the bound states at the junction between the two surface regions which have different signs of the spin-orbit interaction parameters in the Bi/Si system and in the Tl/Si system. As a result, we find bound states in these systems.

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