Promising topological surface states with persistent high spin polarization across Dirac point in Bi$_2$Te$_2$Se and Bi$_2$TeSe$_2$

KOJI MIYAMOTO, AKIO KIMURA, TAICHI OKUDA, HIROKAZU MIYAHARA, HIROFUMI NAMATAME, MASAKI TANIGUCHI, Hiroshima University, SERGEY EREMEEV, Tomsk State University, EVGUENI CHULKOV, Donostia International Physics Center, OLEG TERESHCHENKO, Novosibirsk State University — Topological insulators (TIs) have attracted a great deal of attention as key materials for spintronics technology. Among the established TIs, Bi$_2$X$_3$ (X=Se, Te) has been mostly studied because of their relatively large energy gap and the simplest topological surface state (TSS) with helical spin texture. However, an absence of the topological natures of TSS below Dirac point ($E_D$) has been shown by spin- and angle-resolved photoemission spectroscopy (SARPES) and scanning tunneling spectroscopy under perpendicular magnetic field. It could be a disadvantage for extending its spintronic applications. Recently, one of the ternary tetradymite compounds, Bi$_2$Te$_2$Se was shown to be a TI by the ARPES measurement. Importantly, a highly bulk resistive feature in this compound has successfully led to the observation of its surface-derived quantum oscillations in the magnetotransport experiment. We have unambiguously clarified the spin feature of TSS in Bi$_2$Te$_2$Se and Bi$_2$Se$_2$Te for the first time by our novel SARPES. The markedly high spin polarization of topological surface states has been found to be 77% and is persistent in the wide energy range across $E_D$ in those compounds. The finding promises to extend the variety of spintronic applications.

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