Spin texture of flatten Dirac-cone surface state on W(110)

Koji Miyamoto, Taichi Okuda, Henry Wortelen, Markus Donath

Hiroshima Synchrotron Radiation Center, Hiroshima University, Kagamiyama 2-3-13, 739-0046 Higashi-Hiroshima, Japan

Physikalisches Institut, Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Strasse 10, 28149 Münster, Germany

Corresponding Author. Email: kmiyamoto@hiroshima-u.ac.jp

Received: 18 May 2017, Accepted: 10 June 2017, Published Online: 31 October 2017


Abstract

Topological insulators and Rashba systems with spin-split energy band structure induced by strong spin-orbit interaction have attracted a great attention for the dissipationless spin current transport. The spin orientation of such spin-split state is locked with their crystal momentum and is strongly influenced by the symmetry of surface crystal. However, so-far, most of topological material and Rashba systems are sp-electrons system with C3v point group symmetry [1].

Recently, we have reported spin polarized Dirac-cone surface state on W(110) with C2v symmetry [2]. This surface state is formed by d-electrons and strongly influence by two-fold symmetry: the massless and massive band dispersion along ΓH and NΓ. Moreover, by model Hamiltonian based on k•p theorem, it have been predicted that the spin-polarized flatten Dirac-cone surface state shows quasi-one dimensional spin texture as shown in Figure 1 [3]. However, there is no evidence for the spin texture on W(110).

Figure 1. (a) Energy Contours of the surface state as function of kx, ky for energies around crossing point based on model calculation. (b) Spin texture for the constant-energy surface (solid line) at 0.02eV above crossing point. The in-plain spin components are shown as arrows.

In this presentation, we have clarified the spin texture of flatten Dirac-cone surface state on W(110) studied by spin- and angle-resolved photoemission spectroscopy. The observed spin texture is good agreement with our predicted one. This research is the model case of d-electron –based surface state with C2v symmetry. The finding opens a new avenue in the study of d-electrons-based spin texture with C2v symmetry. If I have remaining time enough to talk another symmetry surface of tungsten, I will introduce you.
References


Open Access
This article is licensed under a Creative Commons Attribution 4.0 International License. © The Author(s) 2017