



590th ASRC Seminar

Date: 13:30 ~ 15:00, 28 April

Location: Meeting room 102, ASRC Building

Speaker: Dr. Akari Takayama
(University of Tokyo)

Title: Anomalous Rashba effect of Bi thin film
studied by spin-resolved ARPES

Spin-orbit coupling enables to separate and manipulate spin-polarized electrons solely by the electric field. In the 2-dimensional (2D) systems such as the surface or interface, the spin degeneracy is lifted by the breaking of the space inversion symmetry and the strong spin-orbit coupling, and resulting in the splitting of energy bands (Rashba effect).

Group-V semimetal bismuth (Bi) is well known as a typical material to indicate the Rashba effect because of the heavy atomic mass. However, Rashba effect of Bi has been discussed in simple vortical spin structure despite its anisotropic electron structure. To investigate the detailed spin structure of Bi(111) surface states, we have performed high-resolution spin- and angle-resolved photoemission spectroscopy (spin-resolved ARPES) on Bi thin film grown on Si(111).

The conventional Rashba theory has predicted that the spin configuration is only restricted to the in-plane direction while the magnitude of spin polarization is the same irrespective of the momentum direction. In this study, we have observed the asymmetric in-plane spin polarization and a giant out-of-plane spin polarization by specifying the k region with higher accuracy [1]. We also report the significant reduction in the spin polarization of Rashba surface states near the M point as decreasing film thickness [2], and the 1D band dispersion with a giant Rashba effect from the edge state of Bi islands [3].

[1] A. Takayama et al., Phys. Rev. Lett. 106, 166401 (2011).

[2] A. Takayama et al., Nano Lett. 12, 1776 (2012).

[3] A. Takayama et al., Phys. Rev. Lett. 114, 066402 (2015).



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