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One-dimensional edge states with spin splitting in bismuth

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Abstract

A two-dimensional (2D) system with strong spin-orbit coupling like a topological-insulator surface and semiconductor-heterostructure interface has provided a useful platform for realizing novel quantum phenomena applicable to advanced spintronic devices. 1 bilyer (BL) bismuth is theoretically predicted to be 2D topological insulator and have a spin-polarized state at edge [1,2]. However, it is not certain experimentally because to preparer a free-standing 1 BL bismuth is very difficult. Here we challenged to observe a spin-polarized electric state at edge by different approach. As observed by the atomic force microscopy (AFM) of our Bi thin film (Figure 1a), triangular-shaped bismuth BL islands with typically ~0.1 μm edge length are formed on the top surface of the Bi thin film, and the edge of each island runs along the ΓK direction in the *k* space. And we have also observed the 1D band dispersion from the edge state of bismuth islands measured by ARPES. In this presentation, we show the result of ARPES and spin-resolved ARPES for bismuth thin film, and discuss the origin of the 1D spin-splitting band compared with our first-principles band-calculations.

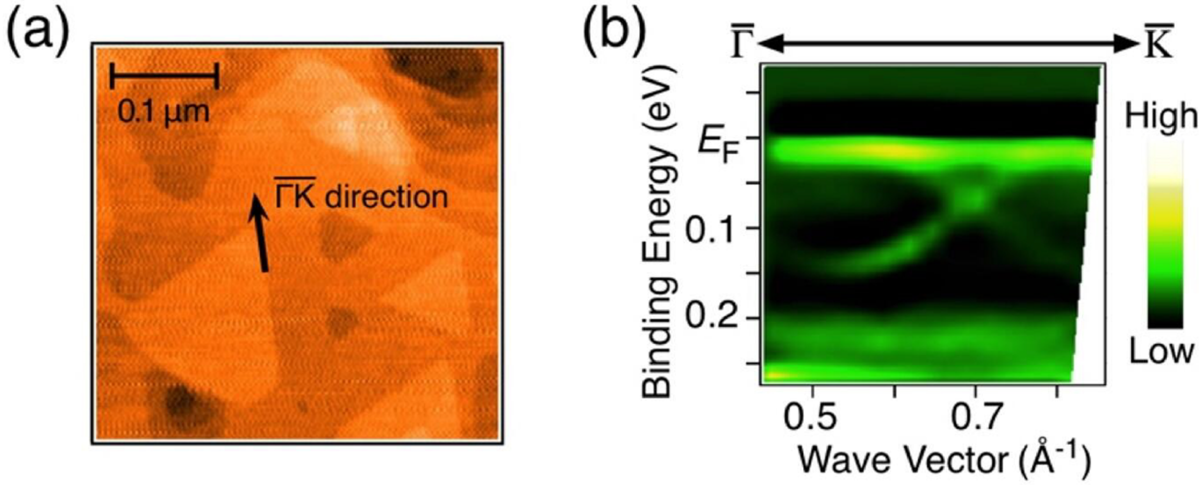

Figure 1. (a) AFM image measured at 300 K in Air and (b) Band dispersion near E_F along ΓK line measured at 30 K in UHV for a Bi thin film, respectively.

References

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