Soft x-ray angle-resolved photoemission study on $SrRuO_3$ thin films

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Perovskite-type ruthenate exhibits the unusual physical properties such as the superconductivity-metal-insulator transition in $Ca_{2-x}Sr_xRuO_4$ and the ferromagnetic-paramagnetic transition in $Ca_{1-x}Sr_xRuO_3$. In order to clarify the origin of these physical properties, it is essential to obtain the information on the band structures of these oxides, especially the Fermi surface (FS) topology. Angle-resolved photoemission spectroscopy (ARPES) is one of the best experimental ways to directly determine the band structures. However, there are few ARPES studies on $Ca_{1-x}Sr_xRuO_3$ owing to the absence of any cleavage surfaces, which is in sharp contrast to the intensive ARPES studies on layered $Ca_{2-x}Sr_xRuO_4$ having cleavable planes.

In this study, we have performed soft x-ray ARPES studies on $SrRuO_3$ (SRO) thin films grown onto Nb-doped $SrTiO_3$ substrates by laser molecular beam epitaxy. ARPES spectra were recorded at 20 K where SRO thin films are in the ferromagnetic phase. Figure 1 shows the FS of SRO thin films in the ΓXM plane determined by the present ARPES measurements. The observed FS's are in good agreement with the prediction from the band structure calculations [1]. As shown in Fig. 1, there are two FS sheets centered at the Γand the M points in the ΓXM plane. In comparison to the band structure calculation, the FS sheets centered at the Γ point, which may be derived from two almost degenerated sheets, has electron-like character, while that centered at the M point has hole-like character.

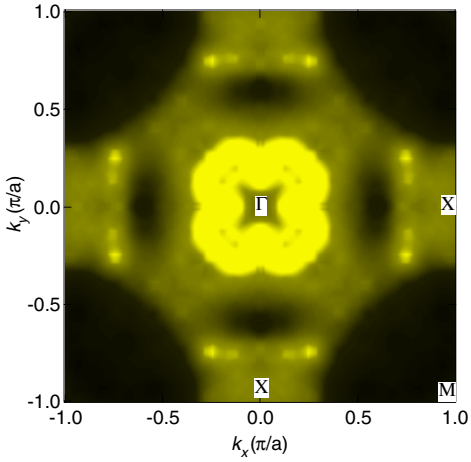

Figure 1: Fermi surface of $SrRuO_3$ thin film in the ΓXM plane.

[1] G. Santi *et al.*, J. Phys. Condens. Matter **9**, 9563 (1997).