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Synchrotron ARPES studies of nodal line semimetal $LaTe_{1+x}Bi_{1-x}$

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$LaTe_{1+x}Bi_{1-x}$ is a layered material consisting of an insulating layer of LaTe and a conducting Bi square lattice layer. Band calculation predicted that it possesses a Dirac nodal-line along Γ-R in the Brillouin zone (BZ) (Fig. 1) [1], and therefore it can be classified as a nodal line semimetal for which exotic transport properties can be expected [2]. However, predicted nodal line of LaTeBi is located slightly above the Fermi level (E_F). To experimentally observe the nodal line and also determine its energy position relative to E_F are important to investigate the potential of $LaTe_{1+x}Bi_{1-x}$ to exhibit topological physical properties. In this presentation, we report synchrotron angle-resolved photoemission spectroscopy (ARPES) study of $LaTe_{1+x}Bi_{1-x}$, which was performed to directly observe the valence band electronic structure of $LaTe_{1+x}Bi_{1-x}$.

The samples measured were $LaTe_{1+x}Bi_{1-x}$ (x = 0.2) single crystals prepared by the flux method. Synchrotron ARPES experiments were performed by a high-resolution ARPES spectrometer at BL-1 of HiSOR, with linearly polarized light and with the light spot size of 40 (H) x 50 (V) μm. The energy resolution was set to ~ 40 meV and the measurement temperature was 20 K.

Figure 1 shows an ARPES intensity map measured along the ΓX line of the BZ. The black regions correspond to bands. Distinct dispersive bands symmetric with respect to the high symmetry points are clearly observed in the entire energy region shown. The observed bands were found generally consistent with the results of band calculations. Around X, one can find bands approaching E_F.

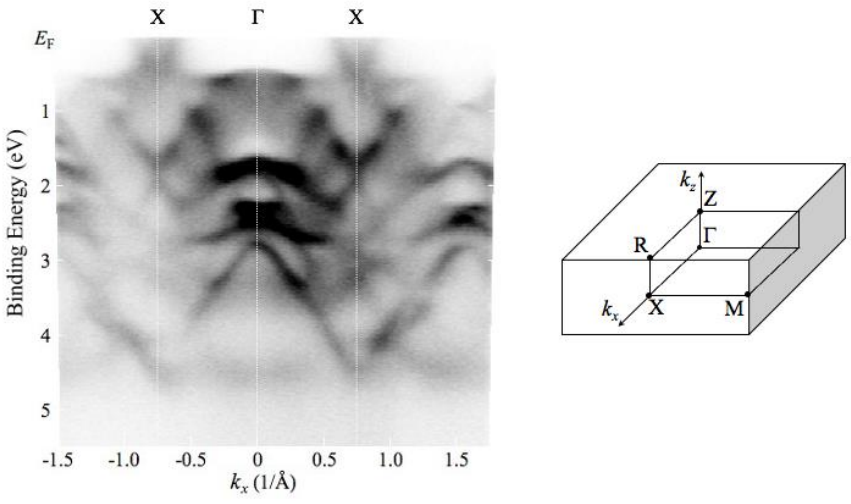

FIGURE 1. ARPES intensity map of $LaTe_{1.2}Bi_{0.8}$ and Brillouin zone

Figure 2 shows a minus second-derivative ARPES intensity map near E_F and around X. "W" shaped dispersive bands symmetric with respect to X are observed. The characteristic dispersion is consistent with calculation, indicating that a nodal line is located very close to E_F at X in $LaTe_{1.2}Bi_{0.8}$.

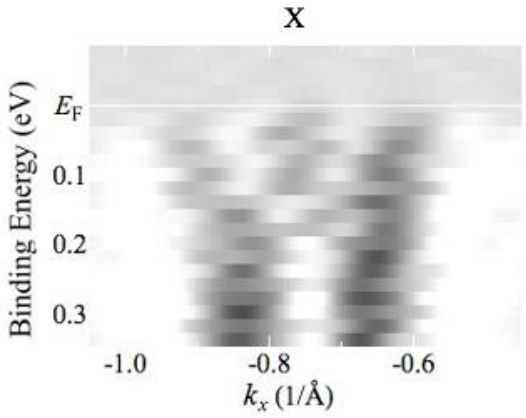

FIGURE 2. Minus second-derivative ARPES intensity map near E_F and around X of $LaTe_{1.2}Bi_{0.8}$

REFERENCES

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