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Three-Dimensional Electronic structure of Li1+xFeAs

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LiFeAs is an intriguing iron-based superconductor because it exhibits superconductivity (TC = 18 K) without any structural phase and SDW/AFM transitions [1]. In pristine LiFeAs, we have demonstrated that the electronic structure can be fundamentally explained by LDA band structure [2]. In this system, both of the excess and deficiency of Li-ions (Li1+xFeAs) from the stoichiometry suppresses the superconductivity [3] and enlarges spin fluctuation [4]. Up to date, the reason of the suppression of the superconductivity has not been clarified yet. To elucidate the effect of the Li excess or deficiency, we investigated the electronic structure of non-superconducting Li1+xFeAs by a polarization-dependent three-dimensional angle-resolved photoemission spectroscopy (3D-ARPES). As a result, we observed the difference in the low-energy electronic structure between pristine LiFeAs and Li1+xFeAs. We also found two kink structures in the band dispersions near the center of the Brillouin zone; one is located at about 20 meV, which originates from phonons, and the other at about 100 meV, which cannot be explained by the phonon origin. The higher-energy kink is considered to originate from magnetic excitations.

[1] X. C. Wang et al., Solid State Commun. 148, 538-540 (2008).
[2] T. Hajiri et al., to be published in Phys. Rev. B.
[3] M. Wang et al., Phys. Rev. B 83, 220515(R) (2011).
[4] L. Ma et al., Phys. Rev. B 82, 180501(R) (2010).

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