Laser-ARPES study on Fe-pnictides superconductors

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We developed laser angle-resolved photoemission spectroscopy (ARPES) with high bulk sensitivity, high resolution of 150 μeV and low temperature of 1.8 K. Laser-ARPES is employed to investigate the electronic structure of $BaFe_2As_2$ and several Fe superconductors across the magneto-structural transition and superconducting transition.

For $BaFe_2As_2$, we found a drastic transformation in Fermi surface (FS) topology with the rearrangement of its orbital component across the transition at T_N = 140 K[1]. Polarization-dependent ARPES enables us to separately observe the electronic structure from single domains in the low-temperature twinned structure. It is suggested that single Fe 3d orbital component dominates the highly 3-dimensional FSs in antiferromagnetic (AF) state. We conclude that $BaFe_2As_2$ shows AF state coexisting with orbital-polarized metallic state.

We will also discuss on the superconducting gap and its anisotropy of each Fermi surface on $(Ba_{1-x}K_x)Fe_2As_2$, $BaFe_2(As,P)_2$[2], and KFe_2As_2 measured by polarization-dependent laser-ARPES. We found that orbital fluctuation mechanism is also important as well as the spin fluctuation mechanism in the superconductivity.

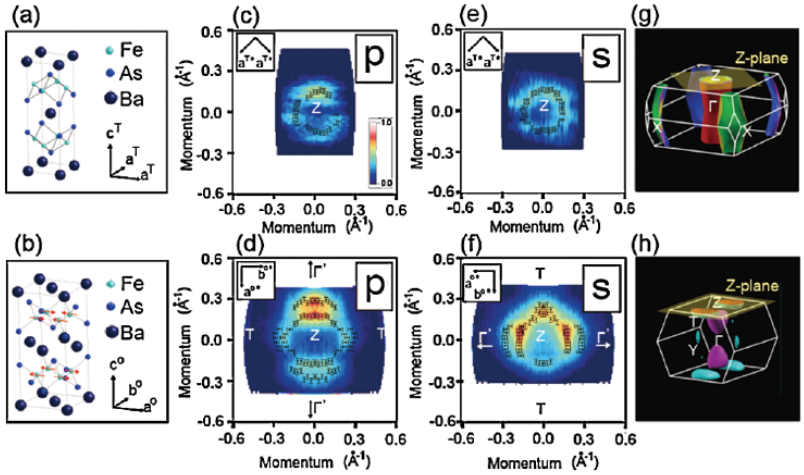

Figure 1: (a) Crystal structure of $BaFe_2As_2$ in the tetragonal structure. (b) Crystal and magnetic structure in the stripe-type AF ordered orthorhombic structure. (c),(d) FS of $BaFe_2As_2$ measured by p polarization at 180 K (above TN) and 30 K (below TN), respectively. (e),(f) FS of $BaFe_2As_2$ measured by s polarization at 180 K (above TN) and 30 K (below TN), respectively. (g),(h) Whole FS in the first BZ obtained by LDA calculation considering PM tetragonal and stripe-type AF orthorhombic structure, respectively, using the experimentally obtained structural parameters.

[1] T. Shimojima *et al.*, PRL **104**, 57002(2010).
[2] T. Shimojima *et al.*, submitted.