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Electronic structure and superconducting gap in $CaKFe_4As_4$

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In my talk I will utilize the density functional theory and high resolution angle resolved photoemission spectroscopy to study the electronic properties of $CaKFe_4As_4$. In contrast to related $CaFe_2As_2$ compounds, $CaKFe_4As_4$ has high Tc of 35K at stochiometric composition. This presents unique opportunity to study properties of high temperature superconductivity of iron arsenic superconductors in absence of doping or substitution. The Fermi surface consists of three hole pockets at Γ and two electron pockets at the M point. The values of the superconducting gap are nearly isotropic, but significantly different for each of the FS sheets. Most importantly one finds that the overall momentum dependence of the gap magnitudes plotted across the entire Brillouin zone displays a strong deviation from the simple cos(kx)cos(ky) functional form of the gap function, proposed in the scenario of the Cooper-pairing driven by a short range antiferromagnetic exchange interaction. Instead, the maximum value of the gap is observed for FS sheets that are closest to the ideal nesting condition in contrast to the previous observations in some other ferropnictides. These results provide strong support for the multiband character of superconductivity in $CaKFe_4As_4$, in which Cooper pairing forms on the electron and the hole bands interacting via dominant interband repulsive interaction, enhanced by FS nesting.

[1]* work done in collaboration with Daixiang Mou, Tai Kong, William R. Meier, Felix Lochner, Lin-Lin Wang, Qisheng Lin, Yun Wu, S. L. Bud'ko, D. D. Johnson, P. C. Canfield, Adam Kaminski