Unusual Doping Dependence of the Electronic Structure and Coexistence of Spin-Density-Wave and Superconductor Phases in Single Crystalline $Sr_{1-x}K_xFe_2As_2$

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The nature of the spin-density wave (SDW) and its relation with superconductivity are crucial issues in the newly discovered iron-pnictide superconductors. Particularly, it is unclear whether the Superconducting phase and SDW are truly exclusive from each other.

We report angle resolved photoemission spectroscopy (ARPES) measurements of $Sr_{1-x}K_xFe_2As_2$ (x = 0, 0.1, 0.18), single crystals[1]. We show with systematic data that the band splitting is a sign of the SDW on the electronic structure, and it occurs in $Sr_{1-x}K_xFe_2As_2$, with descending onset temperatures and amplitudes for x = 0, 0.1, 0.18. Since $Sr_{0.82}K_{0.18}Fe_2As_2$ has a superconducting transition temperature (Tc) of 25 K, we prove that superconductivity and the SDW indeed coexist even for single crystals, which sheds new light on the interplay of superconductivity and magnetism in iron-pnictide superconductors. Moreover, the unusual doping dependence of the splitting further highlights its complexity and correlated nature, providing new clues for sorting out its mechanism.

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