The critical doping effects on the electronic structure of iron-based superconductors

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The diversities in their structures and ways of doping result in extremely diversified phase diagrams for iron-based superconductors. With angle-resolved photoemission spectroscopy (ARPES), we have systematically studied the effects of chemical substitution on the electronic structure of various series of iron-based superconductors.

In addition to the control of Fermi surface topology with hetero-valent doping, we found two more extraordinary effects: 1. the site and band dependencies of quasiparticle scattering; and more importantly 2. the ubiquitous and significant bandwidth-control by both isovalent and heterovalent dopants in the FeAs/FeSe layer. We found that such a bandwidth-control could be achieved by either applying the chemical pressure or doping electrons, but not by doping holes. Together with other findings provided here, these results complete the microscopic picture of the electronic effects of dopants, which facilitates a unified understanding of the diversified phase diagrams of various iron-based superconductors. In addition, it suggests that higher superconducting transition temperature can be achieved by introducing moderate electronic correlations while minimizing impurity in the FeAs/FeSe layer [1].

[1] Z. R. Ye et al. arXiv:1404.6716.