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Systematic investigation of the electron Fermi surface dominated FeSe based systems

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FeSe-based superconductors exhibit very rich phenomena. We systematically investigate the behavior of isovalent doping and electron carrier doping effects in a variety of FeSe-based superconductors with angle-resolved photoemission spectroscopy (ARPES). For the isovalent-doped $A_xFe_2(Se, S/Te)_2$, a continuous decreasing bandwidth is observed from the heavily S doped side to the highly Te doping side, while the system ground state evolves from a metal to a superconductor, and eventually to a correlation-driven insulator. On the other hand, when electron doping is introduced by surface K dosing on bulk FeSe or thick FeSe films, the system ground state evolves from a nematic metal to a superconductor, and then an insulator before it becomes a metal again. Correlation is found to increase with electron doping as well. These two intriguing phase diagrams of FeSe-based superconductors highlight the important role of correlations on the ground state, and provide a microscopic understanding of various FeSe-based superconductors, including the recently discovered (Li,Fe)OHFeSe. Reference [1] X. H. Niu et al. Phys. Rev. B 92, 060504(R) (2015). [2] C. H. P. Wen et al. arXiv:1508.05848. [3] X. H. Niu et al. arXiv:1506.04018.