Competing order in Fe-based superconductors

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We have examined the magnetic and superconducting order parameters and electronic phase diagrams in several classes of iron pnictide superconductors by μSR and Mössbauer spectroscopy [1,2,3,4]. The results prove the competition between SDW magnetism – often combined with an orthorhombic lattice distortion – and superconducting order. The temperature dependence of the superconducting order parameter reveals two gap multiband superconductivity. We examined the interplay of iron and rare earth magnetic order in $ReO_{1-x}F_xFeAs$ [5]. The undoped compounds show different magnetic coupling strength of the rare earth ion to the antiferromagnetic iron layers ranging from independent order to strong polarization of the rare earth moments by the ordered iron. For Cerium, the strong hybridization of the 4f electron with states at the Fermi energy leads to a rich phase diagram in $CeO_{1-x}F_xFeAs$ and $CeOFFeAs_{1-x}P_x$. Finally, we present recent studies on Cs0.8Fe2Te2 based chalcogenide superconductors where high temperature magnetic order (T_N 500K) may coexist with superconductivity below 30 K [6].

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