Phase diagram and isotopic effect in high-Tc pnictide superconductors

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We will talk about the discovery of superconductivity with Tc higher than 40 K in Fe-based superconductors SmFeAsO\(_{1-x}\)F. Tc higher than McMillan limit of 39 K definitely proves pnictide superconductors high-Tc superconductivity\(^1,2\). In this talk, we present the transport properties: resistivity, Hall coefficient and transport properties under high magnetic field. These results suggest a quantum phase transition around x=0.14 in SmFeAsO\(_{1-x}\)F\(_x\) system. A electronic phase diagram is proposed, and coexistence of superconductivity and spin-density-wave is observed in Sm-1111 and Ba-122 system. We discuss the effect of isotopic effect on T\(_C\) and T\(_{SDW}\) in SmFeAsO\(_{1-x}\)F\(_x\) and Ba\(_{1-x}\)K\(_x\)Fe\(_2\)As\(_2\) systems. Our results show that oxygen isotope effect on T\(_C\) and T\(_{SDW}\) is very little, while the iron isotope exponent is about 0.35. Surprisingly, the iron isotope exchange shows the same effect on SDW transition as on superconductivity. Our results indicate that electron-phonon interaction plays some role in the superconducting mechanism, but simple electron-phonon coupling mechanism seems to be rather unlikely because a strong magnon-phonon coupling is included\(^3\). 1. Chen, X. H. et al. Nature 453, 761-762 (2008). 2. Liu, R. H. et al. Phys. Rev. Lett. 101, 087001 (2008). 3. R. H. Liu et al., Nature 459, 64-67(2009).