Electronic phase diagrams of Co, Ni, and P-doped BaFe₂As₂ and spin dynamics in P-doped BaFe₂As₂

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Phase diagrams of copper oxide and iron arsenide superconductors.



Mazin, Nature 464, 183 (2010).

There are three possible scenarios:
Superconductivity terminates antiferromagnetism
Two superconducting states are separated by a QCP with AF order coexists with SC microscopically
AF order co-exists with SC mesoscopically



Shibaushi, Annu. Rev. Condens. Matter Phys, 5, 113 (2014).

Antiferromagnetic order in Ba122 and the hole/electron doping effect in itinerant picture



Dai, Hu, and Dagotto, Nat. Phys. (2012).

The phase diagram of hole and electron-doped Ba122 systems



Avci et al, PRB (2012); Nani et al, PRL (2010).

The phase diagram of electron-doped Ba122



X. Y. Lu et al, PRL (2013).

The microscopic origin of the incommensurate AF order?



Two-axis and three axis measurements on x=0.092 sample with incommensurate AF order



Three-axis and Spin Echo measurements of the incommensurate AF order



This is consistent with mSR experiment demonstrating the no direct oscillation.



Revised electronic phase diagram in Ni-doped Ba122 superconductor



Revised electronic phase diagram in Co-doped Ba122 superconductor (PRB Berhard, 2012)



The phase diagram of P-doped Ba122



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Coincident structural and magnetic order in $BaFe_2(As_{1-x}P_x)_2$ revealed by high-resolution neutron diffraction

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Structural and Magnetic Phase Transitions near Optimal Superconductivity in $BaFe_2(As_{1-x}P_x)_2$

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The phase diagram of P-doped Ba122



The phase diagram of P-doped Ba122, The system shows spin-glass like behavior Much similar to Co/Ni doped system



Temperature dependence of the structure transitions of the system, suggesting 1st order.



NMR evidence indicates that the magnetic ordered does not have 100% volume fraction.



Doping dependence of the magnetic moment and lattice distortion (Hu et al, PRL, this week, 2015)



Summary

The AF to SC occurs in the first order fashion, this is true for electron, and P-doped Ba122 family of materials, avoiding a QCP.

New data on spin dynamics of P-doped Ba122.