Nanoscale Electronic Order in Underdoped Iron Pnictides

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Studying nuclear magnetic resonance and electronic transport properties we have investigated short range order phenomena in $RFeAsO_{1-x}F_x$ (R = La;Sm) pnictide superconductors. The charge distribution in the FeAs layers is probed using As nuclear quadrupole resonance [1]. Whereas undoped and optimally doped or overdoped compounds feature a single charge environment, two charge environments are detected in the underdoped region. Spin-lattice relaxation measurements show their coexistence at the nanoscale. Together with the quantitative variations of the spectra with doping, they point to a local electronic order in the iron layers, where low- and high-doping- like regions coexist on the nanometer scale. In the same doping range a pronounced increase of the relaxation rate is found signalling a slowing down of Fe spin fluctuations with decreasing temperatures [2]. This clearly shows the proximity of static magnetic order, which is, however, absent according to our high sensitive μSR studies [3]. The appearance of the slow magnetic fluctuations as signalled by the NMR data correlates with clear-cut anomalies of the electronic transport properties resistivity [4] and Nernst coefficient [5]. On the basis of these data the possibility of nematic-like order of charges- orbitals – and/or spins in underdoped pnictides is discussed.

References:

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