NMR Study of Pairing Symmetry and Spin Fluctuations in $K_yFe_{2-x}Se_2$ and $(Tl,Rb)_yFe_{2-x}Se_2$ Superconductors

Weiqiang Yu, L. Ma, G. F. Ji, J. Zhang, J. B. He, D. M. Wang, T.-L. Xia, G. F. Chen, and W. Bao

Department of Physics, Renmin University of China, Beijing, China

Distinctive properties have been observed in the newly discovered iron selenides by many probes. The NMR study, as a local probe, is found essential to reveal intrinsic properties of the superconducting phase. Here we discuss our recent NMR results on $K_yFe_{2-x}Se_2$ [1] and $(Tl, Rb)_yFe_{2-x}Se_2$ [2] with $T_c \approx 32$ K . Singlet superconductivity is decisively determined by a sharp drop of the Knight shift below T_c. However, the Hebel-Slichter coherence peak is not observed in the spin-lattice relaxation rate, inconsistent with conventional s-wave superconductivity. Just above T_c, the spin-lattice relaxation rate indicates a Fermi-liquid behavior, whereas Curie-Weiss type spin fluctuation is not found even though the T_c is high. Upon warming, however, the Knight shift increases dramatically with temperature, and then saturates at above 400 K. The spin-lattice relaxation rate also increases substantially with temperature up to 400 K. These behaviors indicate a pseudogap opening phenomenon at about 400 K, below which a thermal activation behavior of spin fluctuations is suggested. Our NMR disclosure of the pairing symmetry and the spin fluctuations puts strong constraints to the theory of magnetism and superconductivity in this new structure family of the iron-based superconductors.

[1] W. Yu *et al.*, arXiv:1101.1017, accepted in Physical Review Letters.
[2] L. Ma *et al.*, arXiv:1102.3888; W. Yu *et al.*, arXiv:1103.4960.