High-temperature NMR Evidence of Pseudogap Opening in Superconducting $Tl_{0.47}Rb_{0.34}Fe_{1.63}Se_2$

Long Ma, G. Ji, J. Dai, J. B. He, D. M. Wang, G. F. Chen, W. Bao, and Weiqiang Yu

Renmin University of China,Beijing,China

In many iron-based superconductors, the increase of the susceptibility with temperature has been widely reported, whereas its origin is still controversial. The NMR Knight shift, as a local probe of intrinsic susceptibility, also shows an increase with temperature in many superconducting compounds. In the newly discovered iron selenide $K_yFe_{2-x}Se_2$ and $(Tl,Rb)_yFe_{2-x}Se_2$, a substantially increase of the Knight shift with temperature, as well seen in the spin-lattice relaxation rate, has been observed in the normal state of the nonmagnetic, superconducting phase [1]. High-temperature NMR study on $Tl_{0.47}Rb_{0.34}Fe_{1.63}Se_2$ indicates that the Knight shift levels off above 400 K [2]. The change of the temperature behavior clearly suggests a pseudogap opening phenomenon, observed for the first time in the iron-based superconductors. The Knight shift is nearly isotropic with field orientation, and shows three-dimensional coupling characters, which set strict constraints to the possible scenario of the pseudogap formation. We propose that the pseudogap is associated with a low-temperature spin gap, which draws a possible correlation between superconductivity and magnetism in the newly discovered iron selenide superconductors.

[1]L. Ma, G. F. Ji, J. Zhang, J. B. He, D. M. Wang, G. F. Chen, Wei Bao and Weiqiang Yu arxiv:1102.3888.
[2]Weiqiang Yu, L. Ma, G. F. Ji, J. Dai, J. B. He, D. M. Wang and G. F. Chen arxiv:1103.4960.