



High-Field NMR Study of Magnetism and Superconductivity in Iron Pnictides

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Introduction

It has been an important issue to elucidate the unusual properties above the superconducting transition in strongly correlated electron systems. In iron pnictides, the proximity of superconductivity to an antiferromagnetic (AF) phase strongly suggests the importance of magnetism for the superconductivity. Previous nuclear magnetic resonance (NMR) proved that superconductivity can survive in the AF ordered state in under-doped regime.[1] In high-doped regime, although AF order disappears, there is still strong AF spin fluctuation (SF).[2] Application of a high magnetic field is useful to diagnose the interplay between various orders and fluctuations.[3] Here, we perform high field NMR measurements on a slightly underdoped sample $\text{Ba}_{0.72}\text{K}_{0.28}\text{Fe}_2\text{As}_2$.

Experimental

The single crystals of $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$ were grown by using the self-flux method. The samples with $x=0.28$ were selected for NMR measurements, which locate at underdoped regime and is adjacent to the optimal doping. ^{75}As -NMR measurements are carried out. The external field is applied along the c - axis. High magnetic fields up to 45 T are applied by using the Hybrid magnet in the National High Magnetic Field Laboratory, Tallahassee, Florida.

Results and Discussion

Figure 1 shows the ^{75}As -NMR spectra at 45T for various temperatures. The spectra intensity decreases with decreasing temperature due to the enhancement of magnetic fluctuations. Field dependence of T_c was measured by using temperature dependence of tuning frequency as show in Fig. 2. T_c decreases gradually with increasing magnetic field, which demonstrates it has a large upper critical field H_{c2} .

Conclusions

We performed HMF NMR measurements on the hole-doped iron-based superconductor $\text{Ba}_{0.72}\text{K}_{0.28}\text{Fe}_2\text{As}_2$. Our results indicate that magnetic fluctuations are enhanced by a high magnetic field, which suggests that these fluctuations play important role in the occurrence of high temperature superconductivity in iron pnictides.

Acknowledgements

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References

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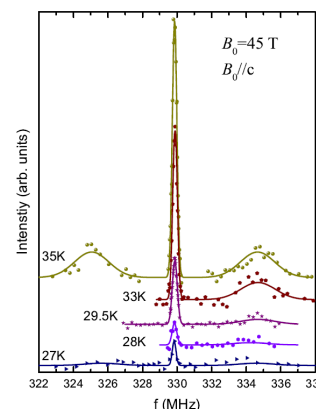


Fig.1 ^{75}As NMR spectra for $\text{Ba}_{0.72}\text{K}_{0.28}\text{Fe}_2\text{As}_2$ with $H//c$ (45T) at various temperature.

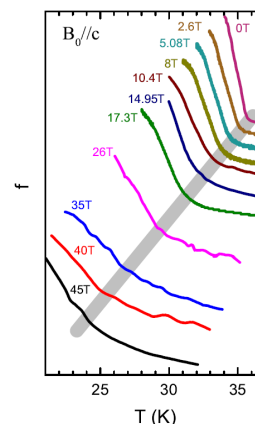


Fig. 2 Field dependence of T_c determined by the temperature dependence of tuning frequency.