^{57}Fe-NMR/^{75}As-NQR studies in LaFeAsO-based Superconductors

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We report an ^{75}As-nuclear quadrupole resonance (NQR) study on heavily electron-doped $LaFeAsO_{1-x}F_x$ (nominal x=0.22) (La1111) with $T_c = 5$ K. Nuclear spin relaxation rate ($1/T_1$) measurement has revealed that a Hebel-Slichter (HS) peak partially recovers in heavily electron-overdoped regimes where the nesting condition of hole and electron Fermi surfaces(FSs) becomes significantly worse. This is in contrast to previous results reported in optimally doped La1111 with $T_c = 28$ K where a lack of the HS peak was reported. It indicates that the interband scattering between the hole and electron FSs is strongly suppressed by an almost vanishing hole FS through the heavily electron-overdoping. Our findings strongly support that the sign reversal of the gap functions on the different FSs, that is, $s_{\pm}$-wave state is realized in La1111 compounds. We remark that interband scattering on well-nested FSs is essential for stabilizing the $s_{\pm}$-wave state and enhancing the T_c up to 28 K in LaFeAsO-based superconductors[1]. We also compare the ^{57}Fe-NMR results on the other LaFeAsO-based compounds, yttrium-substituted $La_{0.8}Y_{0.2}$1111 (T_c=34 K) and hydrogen-doped La1111H (T_c=32 K), which have higher T_c than optimally doped La1111 ($T_c = 28$ K) [2].

[1]H. Mukuda et al. J. Phys. Soc. Jpn. **79** (2010) 113701
[2]H. Yamashita et al. J. Phys. Soc. Jpn. **79** (2010) 103703