Coexistence of superconductivity and magnetism in $LaFeAs(O_{0.94}F_{0.06})$

S. Takeshita[1], R. Kadono[1,2], M. Hiraishi[2], M. Miyazaki[2], A. Koda[1,2], Y. Kamihara[3], H. Hosono[4,5]

[1]*Institute of Materials Strucutre Science, High Energy Accelerator Research Organization, Tsukuba-shi, Ibaraki 305-0801, Japan*
[2]*The Graduate University for Advanced Studies, Tsukuba-shi, Ibaraki 305-0035, Japan*
[3]*ERATO-SORST, JST, in Frontier Research Center, Tokyo Institute of Technology, Mail Box S2-13, 4259 Nagatsuta, Midori-ku, Yokohama 226-8503, Japan*
[4]*Frontier Research Center, Tokyo Institute of Technology, Mail Box S2-13, 4259 Nagatsuta, Midori-ku, Yokohama 226-8503, Japan*
[5] *Materials and Structures Laboratory, Tokyo Institute of Technology, Mail Box R3-1, 4259 Nagatsuta, Midori-ku, Yokohama 226-8503, Japan*

Recent discovery of layered oxypnictide superconductor $LaFeAs(O_{1-x}F_x)$ with the highest critical temperature $T_c \sim 26$ K has evoked broad interest in the mechanism to yield the relatively high T_c on a new stage of FeAs layers. The pairing mechanism (its symmetry, in particular) is now at the central focus among various issues to be clarified for understanding the origin of such a high T_c. It is suggested by NMR and other measurements that the pairing symmetry is unconventional, having line-nodes in the energy gap. Meanwhile, multiband-like features are suggested from high magnetic field experiments.

We have performed detailed μSR measurements in a sample with $x = 0.06$ which is situated near the "underdoped" region in the superconducting phase. In zero and longitudinal field measurements, we observed a phase separation of the sample into superconducting and magnetic (spin glass-like) phases. Interestingly, it is also revealed from measurements under a transverse field that the magnetic phase develops in accordance with that of the superconducting phase below T_c (see Fig. 1). This is in close resemblance to the behavior of so-called A-phase in $CeCu_2Si_2$, suggesting the similarity of relationship between superconductivity and magnetism (e.g., that described by the "quantum criticality" scenario).

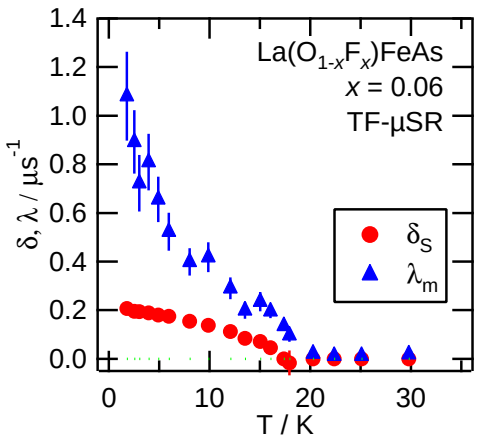

Fig. 1: Relaxation rate as a function of temprerature measured under a transvers field of 500 G. δ_s and λ_m denote the relaxation rate of superconducnting and magnetic phase, respectively.