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Distinct Fe-induced magnetic states in the underdoped and overdoped regimes of $La_{2-x}Sr_xCu_{1-y}Fe_yO_4$ revealed by muon spin relaxation KENSUKE SUZUKI, TADASHI ADACHI, YOUICHI TANABE, HIDETAKA SATO, Department of Applied Physics, Tohoku University, RISDY RISDIANA, YASUYUKI ISHII, TAKAO SUZUKI, ISAO WATANABE, Advanced Meson Science Laboratory, Nishina Center for Accelerator-Based Science, RIKEN, YOJI KOIKE, Department of Applied Physics, Tohoku University — Zero-field muon-spin-relaxation measurements have been performed in partially Fe-substituted $La_{2-x}Sr_xCu_{1-y}Fe_yO_4$ in a wide range of hole concentration, to investigate the magnetic state induced by the Fe substitution recently suggested from the neutron-scattering measurements [1]. It has been found that a static magnetic order is formed in 1% Fe-substituted $La_{2-x}Sr_xCu_{1-y}Fe_yO_4$ in a wide range of hole concentration where superconductivity appears in Fe-free $La_{2-x}Sr_xCuO_4$. In the underdoped regime, the Fe-induced magnetic order can be understood in terms of the concept of stripe pinning by Fe. In the overdoped regime, on the other hand, the Fe-induced magnetic order is short-ranged, which is distinct from the stripes. It is plausible that a spin-glass state of Fe spins derived from the RKKY interaction is realized in the overdoped regime. These results suggest a change of the electronic state from the strongly correlated electron state to the Fermi-liquid-like state with hole doping in La-214 high-T_c cuprates [2,3].

[1] R.-H. He et al., Phys. Rev. Lett. 107, 127002 (2011).
[2] K. Suzuki et al., Phys. Procedia 30, 275 (2012).
[3] K. M. Suzuki et al., Phys. Rev. B 86, 014522 (2012).

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