Hole- and Electron-Doping Effect on the Magnetism in the Ce-Free Superconductor T'-$La_{1.8-x}Eu_{0.2}Sr_xCuO_{4-y}F_y$

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Since the discovery of the undoped (Ce-free) superconductivity in Ln_2CuO_4 (*Ln*: lanthanide elements) with the Nd_2CuO_4-type (so-called T'-type) structure [1,2], the electronic and magnetic states have attracted great interest. Two kinds of electronic states have been suggested to explain the superconductivity in undoped T'-Ln_2CuO_4. One is a semimetal-like electronic state without charge-transfer (CT) gap [3]. The other is an electronic state with a CT gap, where the undoped superconductivity appears by the electron doping due to oxygen defects [4]. Recently, we have succeeded in the synthesis of Ce-free hole-doped samples of T'-$La_{1.8-x}Eu_{0.2}M_xCuO_4$ (*M* = Sr, Ca) [5,6] and electron-doped ones of T'-$La_{1.8}Eu_{0.2}CuO_{4-y}F_y$ [7]. Therefore, we have investigated the magnetism of these samples by the muon spin relaxation (μSR) experiment. From the analysis of the μSR spectra, it has been found that the carrier-concentration dependence of T_N, defined as the temperature below which the magnetic correlation is developed, shows a peak at $x = y = 0$ and decreases with both hole and electron doping. This behavior supports the semimetal-like electronic state without CT gap in undoped T'-Ln_2CuO_4 rather than the electronic state with a CT gap.

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