Novel Coexistence of Superconductivity with Short-Range Magnetic Order in Electron-Doped High-T_c T'-Cuprates

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In order to investigate the electronic state relating to the Ce-non-doped superconductivity in the parent compound of electron-doped high-T_c cuprates with the so-called T' structure [1,2], we have performed muon-spin-relaxation (μSR) and specific-heat measurements of T'-$Pr_{1.3-x}La_{0.7}Ce_xCuO_{4+\delta}$ (PLCCO) single crystals and Ce-non-doped T'-$La_{1.8}Eu_{0.2}CuO_{4+\delta}$ (LECO) polycrystals. The μSR spectra of x = 0.10 in PLCCO with T_c = 27 K shown in Fig. 1 have revealed that in the ground state, a short-range magnetic order of Cu spins with the volume fraction of ~ 80% is formed, while the superconducting volume fraction has been estimated to be more than 60% from the electronic specific heat. The μSR spectra of LECO with T_c = 18 K have revealed that a short-range magnetic order with the volume fraction of 100% is formed in the ground state. These results suggest that in the T'-cuprates including the parent compound, the coexistence of the superconductivity with the short-range magnetic order is an intrinsic feature. These results can be explained in terms of the band picture based on the strong electron correlation [3].

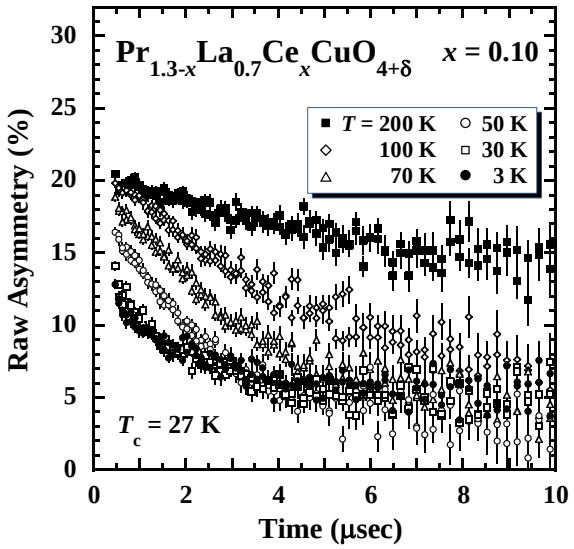

Fig. 1 Zero-field μSR time spectra of $Pr_{1.3-x}La_{0.7}Ce_xCuO_{4+\delta}$ with x = 0.10.

References

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