MLF Experimental Report	提出日 Date of Report 2014/9/5
課題番号 Project No. 2014A0205 実験課題名 Title of experiment Special spin density distribution in T'-sturctured cuprate oxides studied by μSR 実験責任者名 Name of principal investigator 藤田全基 所属 Affiliation 東北大学	装置責任者 Name of Instrument scientist 幸田章宏、宮崎正範 装置名 Name of Instrument/(BL No.) D1 実施日 Date of Experiment 2014 5/24-26

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

$Pr_{1.40}La_{0.60}CuO_4$ (as-sintered)
$Pr_{1.32}La_{0.60}Ce_{0.08}CuO_4$ (as-sintered)
$Pr_{1.24}La_{0.60}Ce_{0.16}CuO_4$ (as-sintered)
Eu_2CuO_4 (as-sintered)

2. 実験方法及び結果 （実験がうまくいかなかった場合、その理由を記述してください。）
Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

Experimental method

We performed zero field and transverse field μSR measurements on the as-sintered $Pr_{1.4-x}La_{0.6}Ce_xCuO_4$ (PLCCO) (x=0, 0.08, 0.16) and Eu2CuO4 samples at low temperatures (12 K) to investigate the magnetic properties in the T'-structured cuprate oxide.

Experimental Results

Figure 1 shows the field-dependence (B_{ext}) of muon polarization rate along the field direction (P_z) for the x=0 and 0.16 samples measured at low temperature. The field-dependence of P_z in $Pr_{1.4}La_{0.6}CuO_4$ cannot be reproduced by assuming the single muon stopping site. This suggests the existence of two muon stopping sites in the x=0 sample and the different magnetic fields at these sites. In fact, the field dependence of P_z is well reproduce by taking the two field distribution into account. On the other hand, P_z in the PLCCO with x=0.16 sample as a function of field is reasonably fitted by assuming the single muon site and/or two sites

2. 実験方法及び結果（つづき） Experimental method and results (continued)

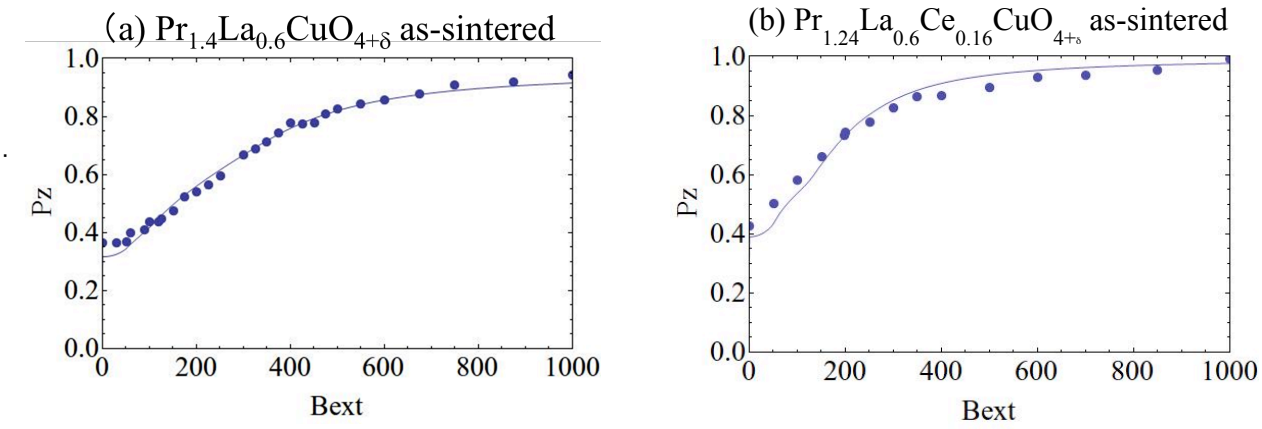

Figure1: Field-dependence of muon polarization rate for the as-sintered (a) $Pr_{1.40}La_{0.60}CuO_4$ and (b) $Pr_{1.24}La_{0.60}Ce_{0.16}CuO_4$ samples.

with the comparable magnetic fields. Figure 2 shows the Fourier transform of muon time spectrum. The field distribution in $Pr_{1.40}La_{0.60}CuO_4$ shows well-defined two peaks, while that in $Pr_{1.24}La_{0.60}Ce_{0.16}CuO_4$ has a broad peak. Interestingly, the field distribution in Eu_2CuO_4 shows a sharp single peak, which is in contrast to the spectrum in $Pr_{1.40}La_{0.60}CuO_4$, although both they are the undoped compound. This difference can be explained through the size of rear earth moment. We evaluated the magnetic fields at the muon stopping sites and confirmed that the comparable magnetic fields is induced at the muon sites in the case of non-magnetic rear earth ion. With increasing the moment size of rear earth ion, the difference of magnetic field at two muon sites becomes large, consistent with our observation in the $Pr_{1.40}La_{0.60}CuO_4$. Therefore, our result in the $Pr_{1.24}La_{0.60}Ce_{0.16}CuO_4$ suggests that the Pr moment is reduced by Ce doping. Since the electron carrier is doped by Ce substitution, the mobile carriers degrade the magnetic interaction between Pr and Cu ions, possibly resulting into the paramagnetic fluctuation of Pr ions.

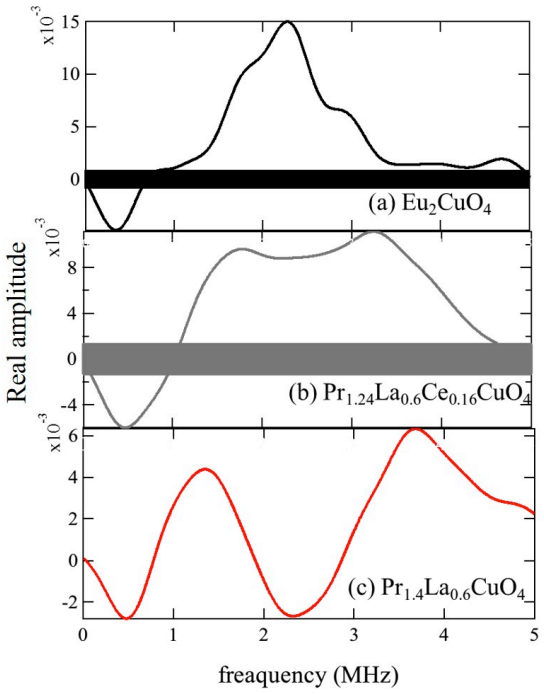

Figure 2: The real part of Fourier transform of muon time spectrum for (a) Eu_2CuO_4 (b) $Pr_{1.40}La_{0.60}CuO_4$ and (c) $Pr_{1.24}La_{0.60}Ce_{0.16}CuO_4$ at 12 K.