TOKAI CROSS **Experimental Report** J-PARC

課題番号 Project No. 2012A0030 実験課題名 Title of experiment Anomalously Strong Effects of Mn-doping on the Superconductivity of Fe-pnictides 実験責任者名 Name of principal investigator Yoshiaki Kobayashi 所属 Affiliation Nagoya University	提出日 Date of Report 2013/04/01 装置責任者 Name of responsible person Ryoichi.Kajimoto and 装置名 Name of Instrument/（BL No.） BL-01 実施日時 Date and time of Experiment 3 June 2012, 11：00 ～ 8 June 2012, 11：00

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.

Superconducting sample, $LaFe_{1-x}Mn_xAsO_{0.89}F_{0.11}$ (x=0) with superconducting transition temperature, T_c = 26 K from temperature dependence of magnetization in magnetic field of 10 Oe. and
samples which the superconductivity is suppressed, $LaFe_{1-x}Mn_xAsO_{0.89}F_{0.11}$ (x =0.003 and 0.075).
For neutron scattering measurements, each powder sample of ~20g is perpetrated.
Their Mn concentrations are nominal values.

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.

The measurements of the magnetic excitation spectra of $LaFe_{1-x}Mn_xAsO_{0.89}F_{0.11}$ (La11Mn11) powder samples with x =0.0, 0.003 and 0.0075 was carried out. The first one is superconducting below T_c ~26 K. and the third is in the non-superconducting spin-glass-like states by NMR and μSR measurements. For x =0.003, it is neither in the superconducting nor spin-glass-like states. At low temperatures, the magnetic excitation peak can be found for x = 0.0 at the absolute scattering vector Q, which corresponds to the vector connecting Γ and M points in the reciprocal space at around 11 meV (energy transfer), as we have already observed at the very early stage of the study.

We measured the magnetic excitation spectra around Q =1.1 $Å^{-1}$ for all La11Mn11 samples and the results were showed in the figure below. This is an energy transfer ω dependence of wave vector $\boldsymbol{q}$-integrated intensity divided by (n+1), where the n is bose factor.

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

For x =0 sample, the spectra at ~100K above T_c and ~6K below T_c have a peak at ω ~11 meV, and the spectra at the low temperature indicates a gapped feature in the lower energy region due to the superconducting transition. This is the same results gotten by our and the other groups.

For La11Mn11 with x =0.003 and 0.0075, the similar gapped features even at low temperature region of ~5 K did not observed as you can see in the figure below. These indicate that at that temperature, no superconducting transition occurs, or the volume fraction is very small, if it exists.

For x =0.003, the magnetic excitation spectra seem to remain even in small ω region at both ~5 K and ~100 K. On the other hand, for x =0.0075 samples, the spectra do not show such features even at the low temperature of ~5 K.

From the μSR measurements, the spin-glass states were not observed for x =0.003 and were observed below ~65 K for x =0.0075. Even if samples with x =0.003 had the component with higher x than 0.003 due to distribution of Mn-concentration, the feature of magnetic excitation spectra at ~100 K for x =0.003 is not explained well.

The observed x dependence of the magnetic excitation spectra in the low temperature region is different from our initial expectations from the μSR measurements.