（ ※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。 ）

CROSS TOKAI **Experimental Report** J-PARC

承認日 Date of Approval 2017/05/17
承認者 Approver Ryoichi Kajimoto
提出日 Date of Report 2017/05/17

課題番号 Project No.
2016B0263

実験課題名 Title of experiment
Phase competition and novel magnetic structure of $Ba_{1-x}K_xFe_2As_2$ as seen via inelastic neutron scattering

実験責任者名 Name of principal investigator
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装置責任者 Name of responsible person
Ryoichi Kajimoto

装置名 Name of Instrument/(BL No.)
BL01 4SEASONS

実施日 Date of Experiment
Mar. 1st – Mar.7th, 2017

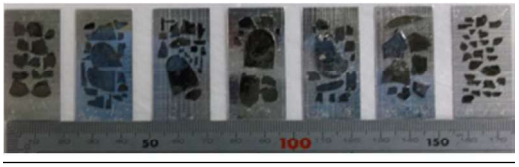
試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

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

Ba0.75K0.25Fe2As2, T_c = 27K

Total mass: ~4.0g

Hundreds of single crystals were aligned and glued onto aluminum plates.



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.

In the present research proposal, we performed inelastic neutron scattering (INS) experiment on single crystals of $Ba_{0.75}K_{0.25}Fe_2As_2$ which exhibits newly discovered C_4-magnetic phase. This phase probably arises as a result of phase competition between magnetism and superconductivity, and thus would provide a new insight into the underlying mechanism that gives rise unconventional superconductivity in iron-based superconductors.

Measurements were performed at 30K (C_4-magnetic phase), 40K (conventional C_2-magnetic phase), and 100K (paramagnetic phase). While some theoretical work suggests that magnetic excitation spectra show a marked difference between C_4 and C_2 magnetic phases, our experiment showed no detectable difference between 30K and 40 K. Nevertheless, we have succeeded in obtaining a good set of INS data up to an energy transfer of 200 meV (see Fig1). By comparing our INS data with random phase approximation (RPA) calculation, we find that the RPA calculation overestimates the spin excitation bandwidth by factor of 2.5. Such a discrepancy can be traced back to the fact that the realistic band structure is strongly renormalized compared with LDA

band structure due to electron correlation effect. Intriguingly, the renormalization factor of 2.5 revealed in the present INS experiment is comparable to band renormalization factor determined by angle-resolved photoemission spectroscopy (ARPES). The present work shows the sensitivity of magnetic excitations to the degree of electron correlation, and importantly serves to highlight the potential to use INS measurements as a direct measure of electron correlation effect in iron-based superconductors.

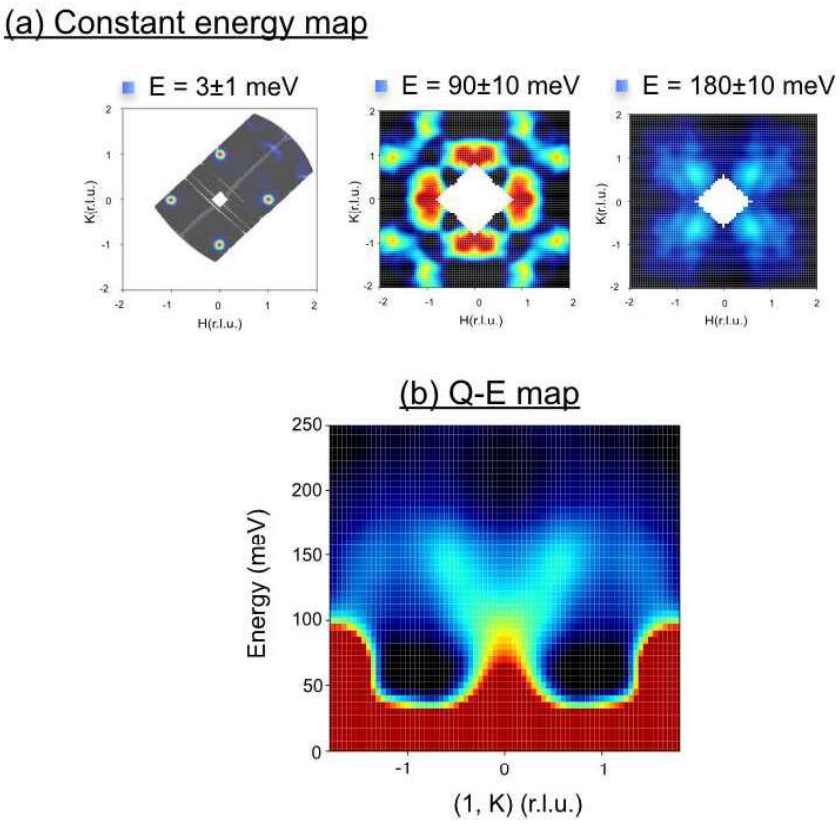


Figure1): (a) Constant energy scans through the magnetic excitation of $Ba_{0.75}K_{0.25}Fe_2As_2$ at energies of E = 3±1, 90±10 and 180±10 meV. (b) Energy dependence of the magnetic excitation along (1, K) direction measured with an incident neutron energy of E_i = 300 meV. All data were collected in the magnetically-ordered phase.