

**EPSCoR Implementation Award  
DE-FG02-08ER46528**

## **Neutron Scattering Research Network for EPSCoR States**

***University of Tennessee at Knoxville***

PI: T. Egami

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Dates: Sept. 1, 2008 – Aug. 31, 2011



# Project Goals

- To promote collaborative research using neutron scattering, involving the University of Tennessee, Oak Ridge National Laboratory and other universities from the EPSCoR states.
- To provide travel support to researchers from the EPSCoR states who use the ORNL neutron facilities (SNS and HFIR).
- To carry out collaborative research on condensed matter physics, polymer science and biology.

## Neutron Travel Fellowships

- Supporting trips by researchers from the EPSCoR states:
  - To carry out research at SNS/HFIR.
  - Scientific discussion on the results.
  - Exploratory discussion for experiments with the machine scientists.
  - Contact Takeshi Egami at [egami@utk.edu](mailto:egami@utk.edu)
- Already over 30 person-trips.
- At present the budget is underspent, but expect increases as the SNS use increases.

# Personnel (PD and GS)

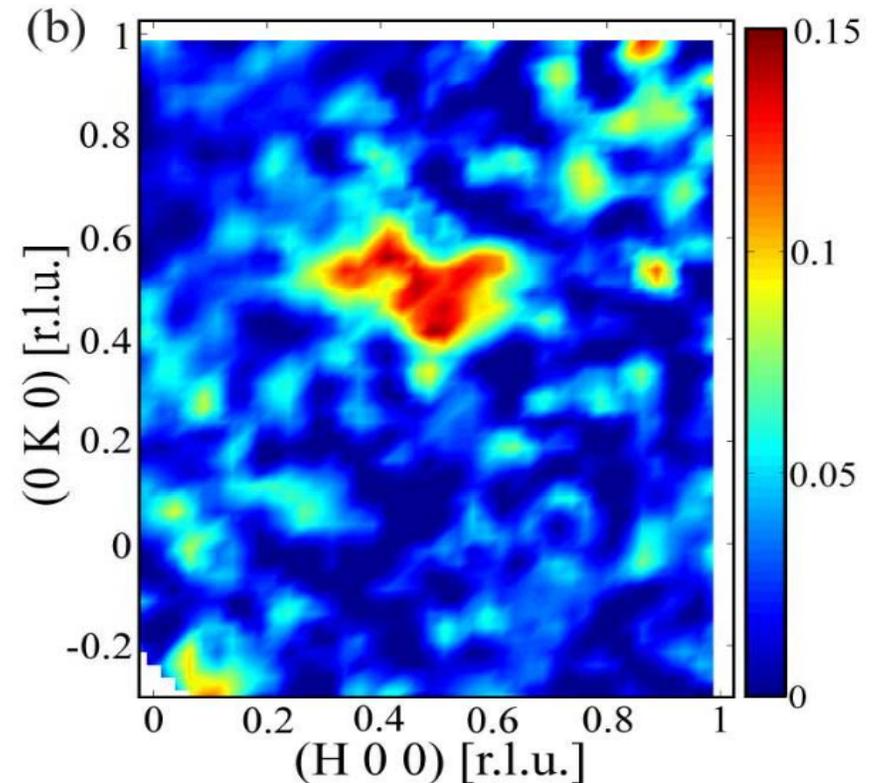
- *Condensed matter physics*
  - Konstantin Lokshin (PD) Sept. 1, 08 – Aug. 31, 09
  - Oliver Lipscombe (PD) June 1, 09 – May 30, 11
  - Daniel Parshall (GS) Sept. 1, 08 – Dec. 31, 09
- *Polymer science*
  - M. Shahinur Rahman (PD) June 1, 09 – May 30, 10
  - Sameer Rahatekar (PD) Aug. 1, 09 – July 31, 11
  - Onome Swader (GS) June 1, 09 – Aug. 31, 11
  - Mahdy M. Moghani (GS) June 1, 09 – Aug. 31, 11
- *Biology*
  - Yinglong Miao (PD) July 1, 09 – Dec. 31, 10
  - Adrienne Norris (GS) April 1, 09 – Aug. 31, 11

# Research Highlights

- A new family of Fe based high-temperature superconductors discovered last year in Japan, then soon developed in China.
- Share many similarities with the cuprate high-temperature superconductors.
- Since the origin of the cuprate superconductivity still is a deep mystery, the research on Fe superconductors is expected to shed lights on this long-standing mystery.
- First SNS measurement of inelastic scattering from single crystal, in collaboration between UT and ORNL.

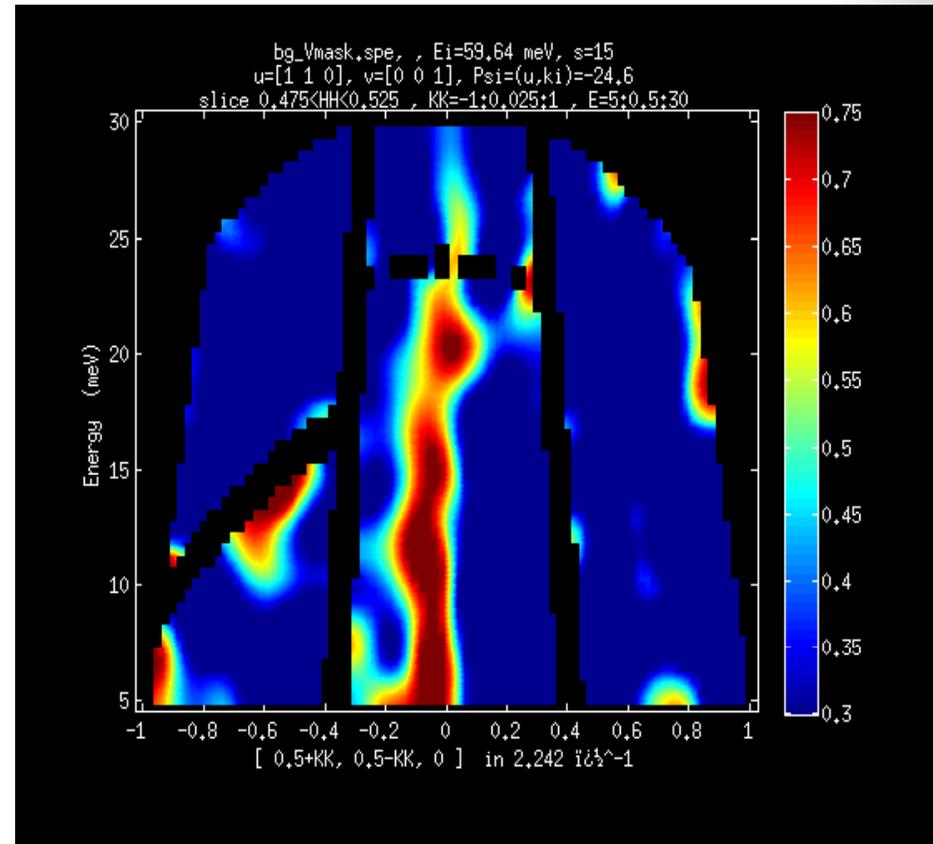
## Data from ARCS, SNS

Spin excitation intensity measured by the ARCS spectrometer of the SNS, energy integrated from 5 to 25 meV, for a single crystal of  $\text{Ba}(\text{Fe}_{0.92}\text{Co}_{0.08})_2\text{As}_2$  at  $T = 16$  K [1]. The intensity is centered at  $(0.5, 0.5, L)$ , where scattering due to anti-ferromagnetic order is seen in the parent (undoped) compound.



M. D. Lumsden, A. D. Christianson, D. Parshall, M. B. Stone, S. E. Nagler, H. A. Mook, K. Lokshin, T. Egami, D. L. Abernathy, E. A. Goremychkin, R. Osborn, M. A. McGuire, A. S. Sefat, R. Jin, B. C. Sales, and D. Mandrus, "Two-Dimensional Resonant Magnetic Excitation in  $\text{BaFe}_{1.84}\text{Co}_{0.16}\text{As}_2$ ", *Phys. Rev. Lett.*, **102**, 107005 (2009).

Spin excitation intensity measured by the ARCS spectrometer of the SNS for single crystals of  $\text{Ba}(\text{Fe}_{0.92}\text{Co}_{0.08})_2\text{As}_2$  at  $T = 16$  K [2]. The vertical axis is excitation energy in meV, and the horizontal axis is  $Q = (0.5+h, 0.5+h, L)$ . Intensities away from  $h = 0$  are noise due to the detector edges. A column of excitation spectrum is seen at  $Q = (0.5, 0.5, L)$ , corresponding to Fig. 1.



D. Parshall, K. Lokshin, Jennifer Niedziela, A. D. Christianson, M. D. Lumsden, H. A. Mook, S. E. Nagler, M. A. McGuire, M. B. Stone, D. L. Abernathy, A. S. Sefat, B. C. Sales, D. G. Mandrus, and T. Egami, “Spin Excitations in  $\text{BaFe}_{1.84}\text{Co}_{0.16}\text{As}_2$  Superconductor Observed by Inelastic Neutron Scattering”, *Phys. Rev. B*, **80**, 012502 (2009).

# Future Plans



- We move into the JINS building, to be completed by March, 2010, next to the SNS.

- Fe pnictide superconductors
  - New collaboration with Academia Sinica, Beijing.
  - Spin-polarized neutron scattering at Tokai, Japan.
  - Theory of spin-channel electron-phonon coupling.
- Polymer Science
  - Alexei Sokolov joins as Governor's Chair; interdisciplinary research on glass transition
  - Research on self-healing polymers and dynamics of complex fluids
- Biology
  - Structure and dynamics of enzymes.
  - Modeling of the environmental effects.

## Neutron Fellowships

- More travelers, as the user program of the SNS develops.
- We support travels to plan experiments through discussion with beamline scientists. Often young researchers are not fully aware of the potential and capability of the beamlines.
- Sabbatical leaves.
- Workshops and schools.

Contact Takeshi Egami at [egami@utk.edu](mailto:egami@utk.edu)

# Summary

- Our project is fully functioning to support the travel program and collaborative research.
- We will make efforts to expand the neutron travel program.
- We will launch an interdisciplinary research project on glass transition with the supplementary funding.

