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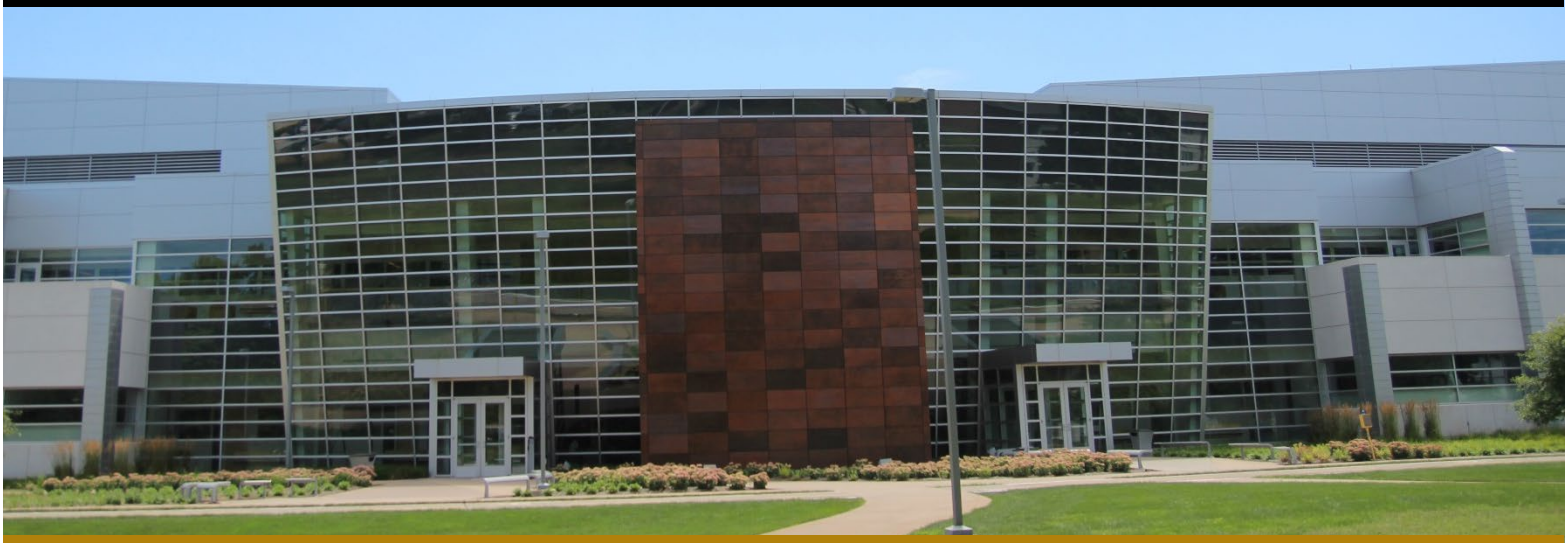

Joint PQSEI/Birck/Spintronics Seminar

"Rectification effects in a superconducting vortex liquid with magnet proximity"

Jana Lustikova
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Tohoku University

Friday, June 21, 2019
1:00-2:00 p.m., PHYS 111

Rectification appears in systems which exhibit a difference in resistivity depending on the polarity of the current, i.e. nonreciprocity, leading to a conversion of a d.c. input into an a.c. output. One of the requirements for rectification is broken inversion symmetry. In electronic systems, inversion symmetry has to be broken at atomic scale due to the short coherence length of electrons in condensed matter. As a result, electronic rectification effects are observed at interfaces and junctions [1] or in materials with noncentrosymmetric crystalline structure [2].

In this talk, I will report our observation of nonreciprocal resistivity and rectification in a vortex liquid phase of a superconducting material without lowered crystalline symmetry [3]. Superconducting vortices can be deleted or created only at the edges of the sample and their flow is a conserved quantity in the bulk. Owing to this property, nonreciprocal vortex flow can be realized just by imposing asymmetric magnetic environment on the edges of a specimen.

We have used an amorphous superconducting alloy with weak vortex pinning, and by putting it close to the ferrimagnetic insulator $Y_3Fe_5O_{12}$, successfully observed nonreciprocal electric resistivity. In addition, this system generates d.c. electric power from electromagnetic noise in the measurement equipment.

[1] C.O. Avci *et al.*, Nature Physics **11**, 570 (2015).
[2] T. Ideue *et al.*, Nature Physics **13**, 578 (2017).
[3] J. Lustikova *et al.*, Nature Communications **9**, 4922 (2018).

Jana Lustikova is an Assistant Professor at the Center for Science and Innovation in Spintronics, and Advanced Institute for Materials Research, Tohoku University. Jana's current work focuses on spintronics and transport phenomena in superconductors.

Jana completed a Ph.D. in condensed matter physics in the research group of Professor Eiji Saitoh at Tohoku University. She is now working closely with Professor Yong P. Chen's group.

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