PURDUE UNIVERSITY

Birck Nanotechnology Center

# Magnon-Mediated Interlayer Coupling and Spin-Transfer Torques

Friday, May 11
11:00 am – 12:00 pm
MRGN 129

Dr. Ran Cheng received his Ph.D. in Physics from the University of Texas at Austin in 2014. He then became a postdoc at Carnegie Mellon University with a joint appointment in Physics and ECE departments. His research interest lies in the broad field of spintronics and magnetism. He studies novel physical phenomena and applications arising from the interplay between spin, charge, mechanical and thermal transport in a wide variety of materials, especially antiferromagnetic thin films and nanostructures.

Magnons, the quanta of spin-wave excitations, can transport information over long distances without incurring Joule heating. They are promising alternatives to electrons in building next- generation nanotechnology. However, to fully function as electrons, magnons should bear an intrinsic degree of freedom similar to the electron spin. In an antiferromagnet with uniaxial anisotropy, symmetry guarantees the coexistence of both spin-up and spin-down magnons, forming a unique degree of freedom capable of encoding information. Guided by the resemblance between antiferromagnetic magnons and electrons with spin being an active variable, we propose a magnonic analog of spin- valve composed of insulating ferromagnet/antiferromagnet/ferromagnet trilayer. We find that magnons inside the antiferromagnetic spacer can mediate an effective exchange coupling between the two ferromagnets similar to the RKKY interaction. Furthermore, a temperature gradient can deliver spin angular momenta from one ferromagnet to the other in the form of magnonic spin-transfer torque, which can be utilized to realize thermal switching.

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