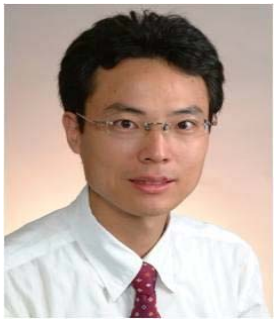
DEPARTMENT OF PHYSICS AND ASTRONOMY

CONDENSED MATTER SEMINAR

Friday, November 3, 2017
11:30 AM, Room 111 Physics
Refreshments 11:15 AM Room 242 Physics



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Spin Wave, Skyrmion, and Spin-orbit Torque Devices

Nonreciprocity in spin waves is of great interest in both fundamental science and applications because it offers an extra knob to control the flow of waves for the technological fields of logics and switch applications. We show a high nonreciprocity in spin waves from Ta/Py bilayer systems with out-of-plane magnetic fields [1].

The magnetic tunnel junction (MTJ) is a central element for the magnetoresistive random access memory (MRAM). We show that the tunneling magnetoresistance (TMR) of the MTJ is strongly influenced by strain in MTJs, and demonstrate flexible MTJs on various substrates [2], which can be utilized for future flexible MRAMs.

Current induced spin-orbit torques (SOTs) provide a new way to manipulate the magnetization in MTJs. We examine the role of oxygen bonding in Pt/CoFeB/MgO, and find that a full sign reversal of SOTs occurs as the oxygen bonding level increases, which evidences an interfacial SOT mechanism. We show current induced SOTs from multilayer nanowires such as Co/Pd and ferrimagnetic CoGd systems [3]. SOTs in a topological insulator Bi_2Se_3 as well as an oxide heterostructure LAO/STO show the largest SOTs obtained to date, which generate strong spin currents to switch the magnetization in SOT-MRAM.

We also report on the direct imaging of chiral spin structures including skyrmions in an exchange-coupled Co/Pd multilayer at room temperature with Lorentz transmission electron microscopy. [4] Finally, we discuss the generation of THz for heavy metal/ferromagnet structures using spin orbit torques [5].

[1] J. H. Kwon et al., Sci. Adv. **2**, e1501892 (2016)
[2] L. M. Loong et al., Adv. Mat. **28**, 4983 (2016)
[3] R. Mishra et al., Phys. Rev. Lett. **118**, 167201 (2017)
[4] S. Pollard et al., Nat. Commun. **8**, 14761 (2017)
[5] Y. Wu et al., Adv. Mat. **29**, 1603031 (2017)