北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Weekly Seminar

SPIN WAVE, SKYRMION, AND SPIN-ORBIT TORQUE DEVICES

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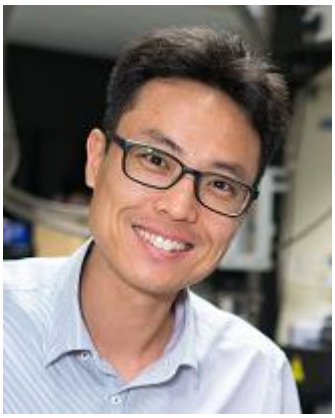

Time: 4:00pm, Oct. 11, 2017 (Wednesday)

时间：2017年10月11日 （周三）下午4:00

Venue: Room W563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

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)

About the speaker

Yang Hyunsoo is a Globalfoundries Chaired associate professor in the Department of Electrical and Computer Engineering, National University of Singapore (NUS). He obtained his Bachelor degree from the Department of Electrical Engineering, Seoul National University, Korea. He had worked at C&S technology, LG Electronics in San Jose, and Intelligent Fiber Optic Systems, California. He received his Master and Doctorate from Stanford University, California. He worked on photonic devices for fiber communication at Stanford University. From 2004-2007, he was at IBM-Stanford Spintronic Science and Applications Center with Dr. Stuart Parkin. He has won several awards including an Outstanding Dissertation Award for 2006 from the American Physical Society (GMAG). He is working on various magnetic materials and devices for spintronics applications since he joined National University of Singapore in 2007. He has authored ~ 400 journal/conference papers and ~15 issued patents, and is a frequent invited speaker at magnetism/spintronics-related conferences.