



Seminar

Magneto-Rotation Coupling between Surface Acoustic Waves and Spin Waves

Prof. YoshiChika Otani

Institute for Solid State Physics, University of Tokyo

Time: 3:00pm, Mar. 22, 2021 (Monday)

时间: 2021年3月22日 (周一) 下午3:00

Venue: Room W563, Physics building, Peking University

地点: 北京大学物理楼, 西563会议室

Abstract

A rectification generally consists of passing signals in one direction while suppressing those in the opposite direction in a counter propagation scenario. The best-known example of a rectifier is the electronic diode that converts AC to DC, allowing the development of the substantial electronic industry we have today. Challenges remain open, such as efficient rectifiers of small dimensions at high frequencies despite the electronic rectifier's great success. Therefore, another form of rectification has been intensively explored, in the form of acoustic rectifiers [1, 2], thermal rectifiers [3], magnon rectifiers [4], and photon rectifiers [5].

In this talk, I will show the giant nonreciprocal behavior of an on-chip acoustomagnetic rectifier at room temperature and gigahertz frequency. Our device exploits the magnon-phonon coupling by which surface acoustic waves (SAWs) interact with ferromagnetic (FM) films and consequently generate spin waves [6].

[1] X.-F. Li, X. Ni, L. Feng, M.-H. Lu, C. He, Y.-F. Chen, Tunable unidirectional sound propagation through a sonic-crystal-based acoustic diode. *Phys. Rev. Lett.* **106**, 084301 (2011).

[2] B. Liang, X. S. Guo, J. Tu, D. Zhang, J. C. Cheng, An acoustic rectifier. *Nat. Mater.* **9**, 989–992 (2010).

[3] C. W. Chang, D. Okawa, A. Majumdar, A. Zettl, Solid-state thermal rectifier. *Science* **314**, 1121–1124 (2006).

[4] T. Nomura, X.-X. Zhang, S. Zherlitsyn, J. Wosnitza, Y. Tokura, N. Nagaosa, S. Seki, Phonon magneto-chiral effect. *Phys. Rev. Lett.* **122**, 145901 (2019).

[5] L. Feng, M. Ayache, J. Huang, Y.-L. Xu, M.-H. Lu, Y.-F. Chen, Y. Fainman, A. Scherer, Nonreciprocal light propagation in a silicon photonic circuit. *Science* **333**, 729–733 (2011).

[6] M. Xu, K. Yamamoto, J. Puebla, K. Baumgaertl, B. Rana, K. Miura, H. Takahashi, D. Grundler, S. Maekawa & Y. Otani, Nonreciprocal surface acoustic wave propagation via magneto-rotation coupling, *Sci. Adv.* **6**, 1724-1~4 (2020).