北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Weekly Seminar

Non-von Neumann Spin Wave Computing: A Theoretical Scheme

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Time: 4:00pm, Nov. 1, 2017 (Wednesday)

时间：2017年11月1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

As a collective quasiparticle excitation of the magnetic order in magnetic materials, spin wave, or magnon when quantized, can propagate in both conducting and insulating materials with little dissipation. Magnetic material with non-trivia magnetic texture provides a unified information memory and processing platform.

Here we study the behaviors of the spin waves in ferromagnetic and antiferromagnetic domain walls. [1, 2] Specifically, we investigate the role of the polarization degree of freedom of spin waves in the antiferromagnet. We found that the domain wall can be used for complex spin wave manipulations, including conducting, reflecting, refracting, and polarizing spin waves. Therefore, simple textures like domain wall can be used to construct various spin wave devices. [3] Inversely, we study the back reaction of spin waves on the domain wall, and show that domain wall can be effectively moved by controlling the linear polarization direction of spin waves. [4] Utilizing the polarized spin waves to control the domain walls in antiferromagnetic wires, we propose a theoretical scheme to realize non-von Neumann spin wave computing with processing-in-memory architecture. [5]

[1]. Lan, J., Yu, W., Wu, R. & Xiao, J. Spin-Wave Diode. *Phys. Rev. X* **5,** 041049 (2015).
[2]. Yu, W., Lan, J., Wu, R. & Xiao, J. Magnetic Snell's law and spin-wave fiber with Dzyaloshinskii-Moriya interaction. *Phys. Rev. B* **94,** 140410(R) (2016).
[3]. Lan, J., Yu, W. & Xiao, J. Antiferromagnetic domain wall as spin wave polarizer and retarder. *Nature Communications* **8,** 178 (2017).
[4]. Yu, W., Lan, J., & Xiao, J. Polarization dependent spin wave driven domain wall motion in antiferromagnets. *In preparation* (2017).
[5]. Yu, W., Lan, J., & Xiao, J. Non-von Neumann spin wave computing. *In preparation* (2017).