北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Topological Spin Dynamics and Magnonic Spin Transport

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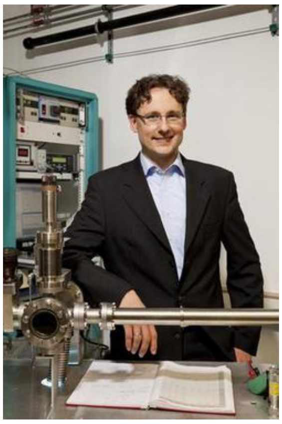

Time: 4:00pm, Sep. 26, 2017 (Tuesday)

时间：2017年9月26日 （周二）下午4:00

Venue: Room W663, Physics building, Peking University

地点：北京大学物理楼，西663会议室

Abstract

In our information-everywhere society IT is a major player for energy consumption. Novel spintronic devices can play a role in the quest for GreenIT if they are stable and can transport and manipulate spin with low power. Devices have been proposed, where switching by energy-efficient approaches, such as spin-polarized currents is used [1], for which we develop new highly spin-polarized materials and characterize the spin transport using THz spectroscopy [2]. Firstly to obtain ultimate stability, topological spin structures that emerge due to the Dzyaloshinskii-Moriya interaction (DMI) at structurally asymmetric interfaces, such as chiral domain walls and skyrmions with enhanced topological protection can be used [3-5]. We have investigated in detail their dynamics and find that it is governed by the topology of their spin structures [3]. By designing the materials, we can even obtain a skyrmion lattice phase as the ground state of the thin films [4]. Secondly, for ultimately efficient spin manipulation, we use spin-orbit torques, that can transfer more than 1ħ per electron by transferring not only spin but also orbital angular momentum. We combine ultimately stable skyrmions with spin orbit torques into a skyrmion racetrack device [4], where the real time imaging of the trajectories allows us to quantify the new skyrmion Hall effect [5]. Finally to obtain efficient spin transport, we study graphene and low damping ferro- and antiferromagnetic insulators as spin conduits for long distance spin transport [6] and explore the superfluid spin current regime in antiferromagnets [7]. We find that we can control magnonic spin currents by a newly developed magnon spin valve device [8].

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[2] M. Jourdan et al., Nature Commun. **5**, 3974 (2014); Z. Jin et al., Nature Phys. **11**, 761 (2015).
[3] F. Büttner et al., Nature Phys. **11**, 225 (2015).
[4] S. Woo et al, Nature Mater. **15**, 501 (2016).
[5] K. Litzius et al., Nature Phys. **13**, 170 (2017).
[6] A. Kehlberger et al., Phys. Rev. Lett. **115**, 096602 (2015); S. Geprägs et al., Nature Commun. **7**, 10452 (2016).
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[8] J. Cramer et al., arxiv:1706.07592