



Seminar

Spintronics with magnetic insulators

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Time: 2: 00 pm, April. 16, 2019 (Tuesday)

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Venue: Room W563, Physics building, Peking University

地点: 北京大学物理楼, 西563会议室

Abstract

The spintronics based on magnetic and non-magnetic elemental metals and their alloys has been very successful in the last decade. Discoveries such as the giant magnetoresistance (GMR), tunnel magnetoresistance, spin-transfer torque, (inverse) spin Hall effect, spin-orbit torques etc. not only lead to fundamental new physical insights, but also to functionalities that are employed in new nanoscale devices such as switches, memories, and sensors.

Another class of materials are magnetic insulators, which are very versatile materials of great technological importance. While central to the research in magnetism up to the 80's of the last century [1], they were almost forgotten when metal-based spintronics took off. However, recently magnetic insulators have attracted much interest from the spintronics community [2], because K. Uchida, E. Saitoh c.s., demonstrated thermal and electrical actuation [3] that allows its integration into conventional electronic and thermoelectric devices.

The most important magnetic insulator is arguably the synthetic yttrium iron garnet (YIGs), a ferrimagnets with Curie transitions far above room temperature and record magnetic, acoustic and optical quality. The discovery of entirely new phenomena, such as the spin Seebeck effect, raised the hope for new applications for a sustainable future electronics. Recent progress includes an understanding of the temperature-dependent spin dynamics even of a complex magnet such as YIG with 80 atoms in the unit cell [4], interaction with the crystal lattice [5] and optical fields [6], and chiral pumping of spin waves [7].

I will present an overview of recent progress in the spintronics with magnetic insulators and its heterostructures with normal metals.

References:

- [1] V. Cherepanov, I. Kolokolov, V. L'vov, Phys. Rep. **229**, 81 (1993).
- [2] M. Wu and A. Hoffmann (eds.), Solid State Physics **64**, 1 (2013).
- [3] G.E.W. Bauer, E. Saitoh, and B.J. van Wees, Nat. Mat. **11**, 391 (2012)
- [4] J. Barker and G.E.W. Bauer, Phys. Rev. Lett. **117**, 217201 (2016); arXiv:1902.00449.
- [5] S. Streib, H. Keshtgar, G.E.W. Bauer, Phys. Rev. Lett. **121**, 027202 (2018).
- [6] S. Sharma et al., Phys. Rev. Lett. **121**, 087205 (2018); arXiv:1903.01718.
- [7] T. Yu et al., arXiv:1901.09182.

About the speaker

Gerrit Ernst-Wilhelm Bauer (*1956) holds an Engineering Degree (1980) in Chemical Technology from Twente University (The Netherlands) and Doctor Degree in Physics (1984) from the Technical University Berlin (Germany) for research carried out at the Hahn-Meitner-Institute of Nuclear Research. After a postdoc at the Institute for Solid State Physics of the University of Tokyo (1984-86), he became a member of the Scientific Staff of the Philips Research Laboratories (1986-92). He was appointed Professor of Physics at Delft University of Technology in 1992, Professor at the Institute for Materials Research of Tohoku University in 2011 and Affiliated Professor at the Advanced Institute for Materials Research (AIMR) of the World Premier International Research Centers Initiative at Tohoku University in 2013. He (co)authored many scientific papers in the area of condensed matter physics, in the last two decades mainly in nanomagnetism and spintronics, see <http://www.researcherid.com/rid/F-8273-2010>. He received the Wilhelm-Conrad-Röntgen Award from Würzburg University (2000), the Outstanding Referee Award by the American Physical Society (2008), the Lars Onsager Medal from the Norwegian University of Science and Technology (2009). He became Fellow of the American Physical Society in 2010 "for exposing the interaction between spin transport, magnetization dynamics, charge and heat transport, and mechanical motion" and 2012 Distinguished Lecturer of the IEEE Magnetics Society on the topic of "Spin Caloritronics". He occupied the Donders Chair of Utrecht University in 2015 and the 2016 Zernike Visiting Professorship of Groningen University. In 2018 he became "State High-end Project Foreign expert in China" and "Clarivate Highly-Cited Researcher".