北京大学量子材料科学中心
International Center for Quantum Materials, PKU

Weekly Seminar

Theories for thermoelectric properties and switching dynamics of topological kagome magnets

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Abstract

In this talk, I will cover two topics related to the kagome magnets, one is on the electric and thermal transport properties and the other is on the all-electric switching of non-collinear anti-ferromagnetism.

The Wiedemann-Franz law and Mott relation are textbook paradigms on the ratios of the thermal and thermoelectric to electrical conductivity, respectively. Deviations from them usually reveal intriguing phases of matter. The topological kagome magnets $TbMn_6Sn_6$ and Mn_3Ge show confusingly opposite derivations in the Hall measurement. By theoretically considering the topological and disorder corrections, we find the dominance of the topological correction in the experiments. More importantly, we derive analytic correction formulas, which can universally capture the two opposite experiments with the chemical potential as the only parameter.

The non-collinear antiferromagnet Mn_3Sn have attracted extensive interests, because of its anti-ferromagnetic advantages of ultrafast spin dynamics and large anomalous Hall effect resulting from the Weyl fermion nature. However, the dynamics of its all-electrical control is not completely clear. We simulate the switching of Mn_3Sn using a pure electric current. Our simulations reveal the role of Mn_3Sn itself in terms of current-induced intrinsic non-collinear spin-orbit torques, instead of the spin-orbit coupling form heavy metals in the previous works.

Our theories will be helpful for future explorations on the magnetic topological matter.

About the speaker

卢海舟，2002年于兰州大学获得物理学学士学位，2007年于清华大学高等研究院获得物理学博士学位。2007年开始在香港大学做博士后研究，2012年转为研究助理教授，2015年加入南方科技大学，现在为讲席教授。主要从事凝聚态物理的研究，研究兴趣是拓扑物质等新物态中的电子输运等物性，已发表了100余篇论文。入选基金委杰出青年基金，教育部长江学者特聘教授，国家一流本科课程负责人，深圳自然科学一等奖，全球华人物理与天文学会亚洲成就奖等。