Contribution ID: **28** Type: **Invited Talk**

Magnon-mediated Dzyaloshinskii-Moriya torques, heat pumping, and spin Nernst effect.

Wednesday 22 February 2017 10:48 (36 minutes)

We predict that a temperature gradient can induce a magnon-mediated spin Hall response in a collinear antiferromagnet with Dzyaloshinskii-Moriya interactions [1]. We have developed a linear response theory based on the Luttinger approach of the gravitational scalar potential which gives a general condition for a Hall current to be well defined, even when the thermal Hall response is forbidden by symmetry. We applied our theory to honeycomb lattice antiferromagnet and studied a role of magnon edge states in a finite geometry. As examples, we considered single and bi-layer honeycomb antiferromagnets where the nearest neighbor exchange interactions and the second nearest neighbor Dzyaloshinskii-Moriya interactions were present. From our analysis, we suggest to look for the magnon-mediated spin Nernst effect in insulating antiferromagnets that are invariant under (i) a global time reversal symmetry or under (ii) a combined operation of time reversal and inversion symmetries. In both cases, the thermal Hall effect is zero while the spin Nernst effect can be present. We have also considered transport of magnons and its relation to non-equilibrium magnon-mediated spin torques [2]. In particular, a temperature gradient can induce a magnon-mediated intrinsic torque in systems with broken inversion symmetry and spin-orbit interactions. With the help of a microscopic linear response theory of nonequilibrium magnon-mediated torques and spin currents we identify the interband and intraband components that manifest in ferromagnets with Dzyaloshinskii-Moriya interactions. To illustrate and assess the importance of such effects, we have applied the linear response theory to the magnon-mediated Nernst and torque responses in a kagome and honeycomb lattice ferromagnets. With the help of Onsager reciprocity principle we establish a connection to magnon-mediated contribution to Dzyaloshinskii-Moriya interactions. We suggest that magnons can lead to temperature dependence in Dzyaloshinskii-Moriya interactions. Finally, in a system with broken inversion symmetry and spin-orbit interactions we predict the magnon-mediated heat and spin pumping by magnetization precession.

[1] arXiv:1606.03088

[2] Phys. Rev. B 93, 161106 (2016)

Primary author: Dr KOVALEV, Alexey (University of Nebraska-Lincoln)

Co-author: ZYUZIN , Vladimir (Texas A&M University)

Presenter: Dr KOVALEV, Alexey (University of Nebraska-Lincoln)