



Datum: 2/27/20

## IFMP Seminar

When: **12. March 2020, 14:50 h**

Where: **REC / B 214 H**

Speaker: **Alexander Mook**  
*University of Basel*

Title: **Magnetic Spin Hall and Spin Nernst Effect of Electrons and Magnons**

### Abstract:

The spin Hall effect (SHE) is a reliable working horse in the field of spintronics for the generation and detection of spin currents. Being a time-reversal even effect, the SHE is featured in normal metals like platinum. However, magnetic materials not only exhibit the SHE but also its "(time-reversal) odd cousin" [1], which was dubbed magnetic SHE (MSHE) [2]. In contrast to spin accumulations brought about by the SHE, those of the MSHE reverse direction under reversal of the magnetic texture.

We unveil the origin of the MSHE and connect it to the spin current vorticity, i.e., to the tendency of the spin current to rotate, shear or curve in reciprocal space [3]. This suggests the following illustrative explanation: Magnetic materials feature spin current whirlpools (or vortices) in reciprocal space for each of the three spin directions. Similar to water whirlpools (in real space), whose handedness leads to an asymmetric deflection of plane water waves, the spin current whirlpools (in reciprocal space) cause an asymmetric deflection of the respective spin components.

Considering thermally induced spin transport and the magnetic spin Nernst effect in magnetic insulators, which is brought about by magnons, our findings for electron transport can be carried over to the realm of spin caloritronics, heat-to-spin conversion, and energy harvesting [4].

[1] J. Železný et al., Phys. Rev. Lett. 119, 187204 (2017)

[2] M. Kimata et al., Nature 565, 627-630 (2019)

[3] A. Mook, R. R. Neumann, A. Johansson, J. Henk, and I. Mertig, preprint arXiv:1910.13375

[4] A. Mook, R. R. Neumann, J. Henk, and I. Mertig, Phys. Rev. B 100, 100401(R) (2019)