Physikalisches Kolloquium des Fachbereich Physik
Arnimallee 14, D-14195 Berlin
Freitag, 12. April 2019, 15 h c.t., Hörsaal A (R. 1.3.14)

Transverse Spin Transport Phenomena

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Thermoelectric effects – arising from the interplay between thermal and charge transport phenomena – have been extensively studied and are considered well established. Upon taking into account the spin degree of freedom, however, qualitatively new phenomena arise. A prototype example for these so-called spin-caloritronic effects is the spin Seebeck effect, in which a thermal gradient drives a pure spin current. Interestingly, not all spin-caloritronic effects predicted from theory have yet been observed in experiment. One of these 'missing' phenomena was the spin Nernst effect, in which a thermal gradient gives rise to a transverse pure spin current. In 2017, we have observed the spin Nernst effect in yttrium iron garnet/platinum (YIG/Pt) thin film bilayers [1].

The first part of the talk will focus on the spin Nernst experiments just mentioned. I will start by discussing important charge-based transverse transport effects (Hall effect and Nernst effect), and then move on to their spin-based counterparts (spin Hall effect and spin Nernst effect). After motivating our approach for the detection of the spin Nernst effect, I will show the corresponding data, and compare our results to first-principles calculations. The second part of the talk will be devoted so-called topological contributions to the transverse transport response. More specifically, I will present our recent experiments resolving the topological Hall and topological Nernst response in thin Mn1.8PtSn films with non-collinear spin structure [2].

References:

[1] S. Meyer et al., Nature Materials **16**, 977 (2017).

[2] R. Schlitz et al., Nano Letters (advanced online publication) (2019)