TECHNISCHE UNIVERSITÄT CHEMNITZ

Institut für Physik
Physikalisches Kolloquium

Mittwoch, 01.11.2017, um **16:00 Uhr**
Ort: Reichenhainer Str. 90;
Zentrales Hörsaal- und Seminargebäude,
Raum 2/N013

Prof. Dr. Georg Schmidt
Martin-Luther-Universität Halle-Wittenberg

Spin pumping into and through organic thin films

Spin pumping describes the flow of a spin current from a ferromagnet into an adjacent material due to spin precession or due to thermal gradients in the ferromagnet. When the spin current flows into a material with spin orbit coupling it can be converted into a charge current by the so called inverse spin Hall-effect (ISHE). The latter is also called spin-charge conversion and has been discussed for example for energy harvesting by converting temperature gradients into charge current. Both, spin pumping and inverse spin Hall-effect have been investigated since a number of years. Only recently the inverse spin Hall-effect was also reported for organic materials, a compelling result because organic conductors are usually expected to have little spin orbit coupling and thus should show a very small ISHE, if any at all. Because of low cost fabrication methods and flexibility, however, organic materials would be very interesting candidates for spintronics especially as spin-charge converters in the above mentioned applications. We have investigated spin pumping and the inverse spin-Hall effect (ISHE) in organic hybrid systems. While in prototypical systems for spin-pumping like $Y_3Fe_5O_{12}$/Pt (YIG/Pt) detecting the ISHE is straight forward and side effects are small, organic systems present a different challenge because the low conductivity and high Seebeck coefficients of organic materials can lead to sizeable artefacts. Even the typical litmus test of the ISH voltage changing sign with the reversal of the external magnetic field is no longer reliable because the artifacts may share the same symmetry. Our experiments include for example studies on spin pumping from YIG into PEDOT:PSS, detected by the ISHE. Here we find that although the ISHE effect exists its detectability strongly depends on the conductivity of the material. Also the effect is approx. four orders of magnitude smaller than in comparable geometries using YIG/Pt. Moreover, the spin currents not only cause an ISHE in the polymer. As the spin diffusion length in the polymer is large they may diffuse through the layer and excite much bigger ISHE in the electrical metal contacts. Because the conductivity for the metal contacts is much higher than for the polymer this signal can be orders of magnitude bigger and completely disguise the real ISHE. It is thus indispensible to consider special boundary conditions for the the sample design which are not necessary in metallic systems. Another problem which needs to be taken into account is asymmetric heating due to non-reciprocal spin-waves. The resulting thermal gradients also reverse their sign with the magnetic field. The large Seebeck coefficients of conducting polymers can then result in thermovoltages which by far exceed the ISHE, however, are indistinguishable from the ISHE by sign, symmetry, and power dependence. We will discuss the design of experimental setups for the detection of ultra small ISHE signals and ways to avoid the artefacts described above. We will also present experimental results on the ISHE for metal layers into which spins are injected through organic systems like PEDOT:PSS or C60.

Alle Zuhörer sind ab 15:45 zu Kaffee und Tee vor dem Hörsaal eingeladen.

Informationen zum Vortrag erteilt:
apl. Prof. Dr. Georgeta Salvan, Tel. 0371 531- 33137

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