# TT 38: Transport: Spintronics and Magnetotransport (organized by TT)

Time: Tuesday 9:30–10:30 Location: BEY 81

TT 38.1 Tue 9:30 BEY 81

**Spin-population inversion in Co/Pd heterojunctions** — •Torsten Pietsch, Stefan Egle, and Elke Scheer — Department of Physics, Universitätstraße 10, University of Konstanz, 78457 Konstanz, Germany

Herein, we investigate experimentally the magneto-transport properties of nanosized Co/Pd hetero contacts and show that a spin-population inversion can be created by resonantly exciting magnetic heterojunctions with high-frequency waves in the GHz and THz regime. Recently, spin-flip photoemission in such metallic, magnetic heterojunctions was predicted theoretically but has not been observed experimentally. When an external magnetic field is applied the Zeeman splitting in the normal metal lifts the spin-degeneracy. Under a large current bias, hot electrons from the ferromagnet can be injected into the upper Zeeman level, thus creating a spin-population inversion in the normal metal. This non-equilibrium spin-population inversion decays via spin-flip transitions, which results in the creation of magnons, scattering at magnetic impurities and, under certain circumstances, photoemission. In the later, case, the energy of the emitted photon corresponds to the Zeeman energy, which can be tuned by the external magnetic field; typical frequencies are in the range of 0.1GHz to 60GHz. By resonantly exciting the Co/Pd point contacts using an external RF source while monitoring the transport properties, we evaluate the parameter space, where a spin-population inversion can be created at the ferromagnet-normal metal interface.

TT 38.2 Tue 9:45 BEY 81

**Tuning the ballistic anisotropic magnetoresistance in single-atom contacts via the apex atom** — •Fabian Otte[1], Yuriy Mokrousov[2], and Stefan Heinze[1] — [1]Instiut für Theoretische Physik und Astrophysik, Christian-Albrechts-Universität zu Kiel, D-24098 Kiel, Germany — [2]Peter Grünberg Institut and Institue for Advanced Simulation, Forschungszentrum Jülich und JARA, D-52425 Jülich, Germany

Recently, the tunneling anisotropic magnetoresistance has been demonstrated at the single-atom limit using scanning tunneling spectroscopy and was explained based on density functional theory calculations of the anisotropy of the vacuum local density of states (LDOS) [1]. In the contact regime the explanation via the LDOS breaks down due to overlap of the wave functions and therefore actual calculations of the conductance are necessary. Here, we report first-principles calculations of ballistic transport in model systems of such single-atom contacts using our recently developed Wannierfunction based approach [2]. We present the ballistic anisotropic magnetoresistance (BAMR) in contact and tunneling regime between two ferromagnetic Ni monowires terminated by single 4*d*- and 5*d*- transition metal apex atoms. We show that the BAMR in the tunneling regime can be enhanced by up to an order of magnitude from 20% for Ni- to 150% for 5*d*-apex atoms. We also observe a change of sign in the BAMR between tunneling and contact regime.

[1] N. Néel *et al.*, PRL **110**, 037202 (2013)
[2] B. Hardrat *et al.*, PRB **85**, 245412 (2012)

TT 38.3 Tue 10:00 BEY 81

**Electrical tuning of spin-orbit interaction in InAs nanowires** — •Zoltán Scherübl[1], Gergö Fülöp[1], Morten Hannibal Madsen[2], Samuel d'Hollosy[3], Christian Schönenberger[3], Jesper Nygård[2], and Szabolcs Csonka[1] — [1]Departement of Physics, Budapest University of Technology and Economic, Budapest, Hungary — [2]Center for Quantum Devices, Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark — [3]Departement of Physics, University of Basel, Basel, Switzerland

InAs nanowires are a promising platform to fabricate various quantum electronic devices, for instance they have strong spin-orbit interaction (SOI). The controlled tuning of the SOI is needed in spin based qunatum devices, for example spintronic applications, spin qubits. In this study we investigated the possibility of tuning the SOI by electrostatic field. The sources of the electric field were two sidegates paralel to the wire axis. The strength of the SOI was analyzed by weak-antilocalization. We demonstrated that the SOI can be strongly tuned, by a factor of 3 with the electric field across the nanowire, while the average electron density in the nanowire was kept constant.

TT 38.4 Tue 10:15 BEY 81

**Dissipationless spin current between two coupled ferromagnets** — •Wei Chen, Peter Horsch, and Dirk Manske — Max Planck Institute for Solid State Research, Stuttgart, Germany

We demonstrate the general principle which states that a dissipationless spin current flows between two coupled ferromagnets if their magnetic orders are misaligned. This principle applies regardless the two ferromagnets are metallic or insulating, and also generally applies to bulk magnetic insulators. On a phenomenological level, this principle is analogous to Josephson effect, and yields a dissipationless spin current that is independent from scattering. The microscopic mechanisms for the dissipationless spin current depend on the systems, which are elaborated in details. A uniform, static magnetic field is further proposed to be an efficient handle to create the misaligned configuration and stabilize the dissipationless spin current.