MA 48: Poster: Spintronics (with TT)

Time: Thursday 17:00–20:00 Location: P1

MA 48.1 Thu 17:00 P1

Electrical detection of spin Hall effect in semiconductors — •Markus Ehlert[1], Cheng Song[1,2], Mariusz Ciorga[1], Thomas Hupfauer[1], Martin Utz[1], Dieter Schuh[1], Dominique Bougeard[1], and Dieter Weiss[1] — [1]Institute of Experimental and Applied Physics, University of Regensburg, Germany — [2]Key Laboratory of Advanced Materials, School of Material Science & Engineering, Tsinghua University, Beijing, China

We present different geometries which allow for the all-electrical detection of either direct spin Hall effect (DSHE) or inverse spin Hall effect (ISHE) in semiconductor microstructures. We describe our experimental methods and compare results to previous experiments and theory. In our DSHE experiments a spin-unpolarized charge current flows through a n-GaAs channel and induces, due to DSHE, a transverse spin current. Hence, spins accumulate at the boundaries of the channel and are detected by spin-sensitive Esaki diodes [1]. For ISHE experiments in p-GaAs we used spin-injecting contacts to generate a spin current, which, via ISHE, should lead to a measurable charge imbalance in a Hall bar geometry. Another ISHE device consists of the so-called H-bar geometry, where an electric current is driven in one leg of an H-shaped structure. This generates, due to DSHE, a transverse spin current, which flows along the connection between both legs of the "H". By means of ISHE a charge imbalance is then induced in the second leg of the "H" [2].

[1] M. Ehlert *et al.*, Phys. Rev. B **86**, 205204 (2012).
[2] M. Ehlert *et al.*, Phys. Status Solidi B (2013) (acc.).

MA 48.2 Thu 17:00 P1

Spin blockade effects in a GaMnAs double quantum dot system — Stefan Geissler[1], •Sebastian Pfaller[2], Andrea Donarini[2], Milena Grifoni[2], and Dieter Weiss[1] — [1]Institute for Exp. and Applied Physics, University of Regensburg, 93040 Regensburg, Germany — [2]Institute for Theoretical Physics, University of Regensburg, 93040 Regensburg, Germany

Spin polarized transport measurements of a double quantum dot defined in a GaMnAs nano constriction are presented. In the experimental setup, the polarization of the leads as well as of the quantum dot system can be controlled by an external magnetic field. In presence of a magnetic field, differential conductance measurements show a gap opening in the charge stability diagrams, that can be explained by spin blockade effects. Transport calculations of metallic quantum double dots coupled to spin polarized leads show excellent agreement with experimental data.

MA 48.3 Thu 17:00 P1

Exciton dynamics in transition metal dichalcogenides — •Igor Libman, Hendrik Kuhn, Jan G. Lonnemann, Julia Wiegand, Michael Oestreich, and Jens Hübner — Institute for Solid State Physics, Leibniz Universität Hannover, Appelstr. 2, D-30167 Hannover, Germany

Among the newly emerging two-dimensional transition metal dichalcogenides molybdenum disulfide (MoS_2) has attracted an increasing attention as promising material for transport, optical and spintronic applications [1]. A contrasting key feature to the ubiquitous mono- and bilayer graphene is the easily accessible direct optical band gap of single layer MoS_2 [2]. Furthermore, the two-component nature breaks the inversion symmetry [3] and leads jointly with spin-orbit interaction to a copious number of spin-optoelectronic effects. Here, we present a scheme for the investigation of the complex dynamics of A and B excitons and their excited states (A' and B') in single layer MoS_2 [4] by ultrafast two-color time-resolved laser spectroscopy with focus on distinct impact of the electron-phonon interaction [5] onto the spectral shape of the s- and p-equivalent excitons states.

[1] Q. H. Wang *et al.*, Nature Nanotech. **7**, 11 (2012).
[2] Andrea Splendiani *et al.*, Nano Lett., **10**, 1271 (2010).
[3] G. Sallen *et al.*, Phys. Rev. B, **86**, 081301(R) (2012).
[4] Diana Y. *et al.*, Phys. Rev. Lett, **111**, 216805 (2013).
[5] A. Marini, Phys. Rev. Lett. **101**, 106405 (2008).

MA 48.4 Thu 17:00 P1

Spin dynamics in quantum wells under surface acoustic waves — •Johannes Wanner[1], Cosimo Gorini[2], Peter Schwab[1], and Ulrich Eckern[1] — [1]Institute of Physics, University of Augsburg, 86135 Augsburg, Germany — [2]Service de Physique de l'Etat Condensé, CEA-Saclay, 91191 Gif sur Yvette, France

Various recent experiments have shown the flexibility of surface acoustic waves (SAW) as a mean for transporting charge and spin in quantum wells [1]. In particular, SAW have proven highly effective for the coherent transport of spin-polarized wave packets, suggesting their potential in spintronics applications. Motivated by these experimental observations we have theoretically studied the spin and charge dynamics in a quantum well under surface acoustic waves. Based on previous work by some of us [2], we show that the dynamics acquires a simple and transparent form in a reference frame co-moving with the SAW. The observed values for spin relaxation and precession length can thus be explained.

[1] H. Sanada et. al., Phys. Rev. Lett. **106**, 216602 (2011); O. Couto et. al., Phys. Rev. B **78**, 153305 (2008)
[2] P. Schwab et al., Phys. Rev. B **74**, 155316 (2006)

MA 48.5 Thu 17:00 P1

Electron spin control in Manganese doped GaAs/AlAs nanostructures — •Markus Kuhnert[1], Ilya A. Akimov[1], Vladimir L. Korenev[2], and Manfred Bayer[1] — [1]Experimentelle Physik 2, Technische Universität Dortmund, 44221 Dortmund, Germany — [2]2A.F. Ioffe Physical-Technical Institute, Russian Academy of Sciences, 194021 St. Petersburg, Russia

The field of spintronics, which in contrast to electronics, uses the spin instead of charge as information carrier, presents many interesting possibilities. For proper implementation of spintronic devices, research of adequate materials and methods is required. Here we present the results of our research into Manganese doped GaAs/AlAs quantum wells, which might offer long lived spin coherence as well as spin manipulation mediated by the magnetic Manganese ions. We use pump-probe Kerr effect measurement techniques and time resolved photoluminescence measurements to investigate properties such as spin coherence and spin lifetime of the Mn doped nanostructures. The temperatures at the time of measurement range from 2K to 8K. Further studies are done on optically induced EPR of the Mn ions by applying a microwave modulation to the excitation laser beam. Exchange interaction between the Manganese ions and electrons in the quantum well might function as a channel for spin manipulation or conservation.

MA 48.6 Thu 17:00 P1

Coherence Properties of Nitrogen Vacancy Centers in Nano Diamond — •Bernd Sontheimer, Niko Nikolay, Max Strauss, Andreas W. Schell, Janik Wolters, and Oliver Benson — Humbold Universität zu Berlin, Institut für Physik AG Nano-Optik, Newtonstr. 15, 12489 Berlin

The nitrogen vacancy (NV) center in diamond is a stable single photon emitter, combining optical transitions with a long-lived electronic spin with excellent coherence properties [1]. NV centers in nano diamonds are of special interest due to their integrability in photonic hybrid devices [2]. In our research we examine the coherence properties of nano diamonds based on optically detected magnetic resonance (ODMR) [3]. In particular the influence of surface treatments on the T_2 time is examined via spin-echo experiments [4]. Also a change of spectral diffusion is determined using correlation interferometry.

[1] G. Balasubramanian, et al., Ultralong spin coherence time in isotopically engineered diamond. Nat. Mater. 8, 383 (2009).
[2] J. Wolters, et al., Enhancement of the zero phonon line emission from a single nitrogen vacancy center in a nanodiamond via coupling to a photonic crystal cavity. Appl. Phys. Lett. 97, 141108 (2010).
[3] J. Wolters, et al., Measurement of the Ultrafast Spectral Diffusion of the Optical Transition of Nitrogen Vacancy Centers in Nano-Size Diamond Using Correlation Interferometry. Phys. Rev. Lett. 110, 027401 (2013).
[4] F. Jelezko, et al., Observation of Coherent Oscillations in a Single Electron Spin. Phys. Rev. Lett. 92, 076401 (2004).

MA 48.7 Thu 17:00 P1

Magnetic susceptibility of 2 dimensional electron gases with Rashba spin-orbit coupling — •Christiane Scholl, Tobias Hartenstein, and Hans Christian Schneider — TU Kaiserslautern

The transverse spin-spin correlation, or dynamical magnetic susceptibility, is an important quantity both from the experimental and theoretcial point of view. It determines light-scattering and spin noise spectra, as well as the dispersions of elementary excitations of the magnetic type, such as magnons or magneto-magnons. Here, we consider a two-dimensional electron gas including Rashba spin-orbit coupling and Coulomb interaction. We use a decoupling scheme to derive the equations of motion for the relevant Green functions. Approximating the full Coulomb matrix element by a local interaction U, a closed expression for the dynamic transverse magnetic susceptibility results, which we analyze numerically. We find a complex interplay of internal effective Rashba fields with the external magnetic field. Further, the elementary "magnetic" excitations arise from resonances of the magnetic suscpetibility that are very different from plasmon resonances [1,2] with Rashba spin-orbit coupling or magneto-magnon [3] resonances.

[1] M. Pletyukhov, V. Gritsev, Phys. Rev. B 74, 045307 (2006).

[2] S. M. Badalyan, A. Matos-Abiague, G. Vignale, and J. Fabian, Phys. Rev. B 79, 205305 (2009.)

[3] D. M. Edwards, J. Phys. C. 2, 84 (1969).