



Allgemeines Physikalisches Kolloquium

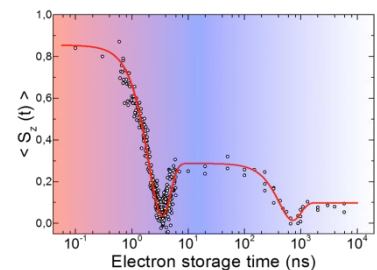
Donnerstag, 16.10.2014 um 16 Uhr c.t.

Prof. Dr. Jonathan Finley
Walter Schottky Institut
Technische Universität München



Optically probing electron spin dynamics in semiconductor artificial atoms

Over recent years the mechanisms that mediate spin relaxation and decoherence in III-V quantum dots have been elucidated by a variety of beautiful optical experiments [1,2]. For both electrons and holes, hyperfine coupling to the nuclear spin system sets the fundamental timescales for spin coherence at low temperatures. This talk will focus on recent efforts in which ultrafast optical methods are used to optically prepare and manipulate the spin wavefunction and probe spin relaxation over timescales ranging from picoseconds to milliseconds [3-6]. By performing ultrafast resonant fluorescence we explore how dissipation is not always detrimental for quantum control. Indeed, it can be exploited to achieve high fidelity exciton and biexciton initialization. Using detuned laser pulses we measure the spectrum of exciton phonon coupling [7]. Finally, we will discuss recent experiments in which spin storage devices are used to optically prepare single spins and trapped over long timescales in the dot, extending into the millisecond regime [8,9]. Such experiments allow us to monitor electron spin relaxation in a single dot for timescales up to $\sim 100\mu\text{s}$, revealing how the delicate interplay between the electron and nuclear spin systems govern the coherent evolution of the spin wavefunction.



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- [2] R. J. Warburton. Nature Materials, 12, 483, (2013).
- [3] K. Müller et al. Phys. Rev. Lett. 108, 197402, (2012). K. Müller et al. Phys. Rev. B 85, 241306, (2012).
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- [5] K. Müller et al., Scientific Reports, 3, doi:10.1038/srepor1906 (2013)
- [6] A. J. Ramsay et al. Phys. Rev. Lett. 104, 017402 (2010).
- [7] P. L- Ardelt et al, arXiv:1409.6014, (2014)
- [8] D. Heiss, et al., Appl. Phys. Lett. 94, 072108 (2009), V. Jovanov et al. Phys. Rev. B 84, 235321, (2011).
- [9] A. Bechtold et al, submitted (2014)

IG1 HS2, Wilhelm-Klemm-Straße 10
Kolloquiums-Kaffee ab 16.00 Uhr vor dem Hörsaal
Im Anschluss an den Vortrag findet ein geselliges
Beisammensein mit Getränken und Knabberereien statt.

Kolloquiumsbeauftragter: Prof. Dr. Bratschitsch
Einladender: Prof. Dr. Bratschitsch