HL 43: Spin-dependent Transport II

Time: Tuesday 14:30–15:15 Location: POT 251

HL 43.1 Tue 14:30 POT 251

Electrical Spin injection into Zinc Oxide — •Christoph Schwark[1,3], Christian Weyer[1,3], Gernot Güntherodt[1,3], Matthias Althammer[2], Sebastian T.B. Goennenwein[2], Matthias Opel[2], Rudolf Gross[2], and Bernd Beschoten[1,3] — [1]II. Physikalisches Institut A, RWTH Aachen University, Aachen, Germany — [2]Walther-Meißner-Institut, Bayerische Akademie der Wissenschaften, Garching, Germany — [3]JARA - Fundamentals of Future Information Technology, Aachen, Germany

We have investigated the feasibility of electrically injecting spin-polarized carriers into ZnO. For this purpose we have used Co/n-ZnO heterostructures deposited on sapphire substrates by pulsed laser deposition. Electrical spin injection was demonstrated at 10 K by optical means using Kerr rotation measurements in Hanlé geometry. Spin injection can be observed up to a temperature of 35 K with a temperature independent spin dephasing time of 1 ns, which has been determined from the width of the Hanlé curves.

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HL 43.2 Tue 14:45 POT 251

Doping density dependence of electron spin relaxation in bulk wurtzite GaN — •Jan Heye Buss, Jörg Rudolph, Sebastian Starosielec, and Daniel Hägele — AG Spektroskopie der kondensierten Materie, Ruhr-Universität Bochum, Bochum, Germany

GaN is a prototypical wide-gap semiconductor with wurtzite structure. Nevertheless, the spin relaxation for moderate to very high doping densities has not been investigated so far. We measure the doping density dependence of electron spin relaxation in 11 different n-type bulk wurtzite GaN samples by time-resolved Kerr-rotation measurements up to a density of 1.5×10^{19} cm^{-3}. The spin relaxation time shows a non-monotonic dependence on doping density, with a decrease of the spin lifetime for increasing doping density in the highly degenerate regime. The decrease in spin lifetimes is much less dramatic than the decrease known from zincblende semiconductors. We present an analytical expression for the density-dependent spin relaxation tensor in wurtzite semiconductors based on Dyakonov-Perel theory in the degenerate regime that shows good agreement with the experiment.

HL 43.3 Tue 15:00 POT 251

Long room-temperature electron spin lifetimes in highly doped cubic GaN — •Jörg Rudolph[1], Jan Heye Buss[1], Thorsten Schupp[2], Donat As[2], Klaus Lischka[2], and Daniel Hägele[1] — [1]AG Spektroskopie der kondensierten Materie, Ruhr-Universität Bochum, Germany — [2]Universität Paderborn, Department Physik, Warburger Str. 100, 33095 Paderborn, Germany

The wide-gap semiconductor GaN is a promising material for spin-optoelectronic applications in the blue spectral region. The metastable cubic phase of GaN is especially interesting due to its higher symmetry and therefore weaker spin-orbit coupling as compared to the wurtzite phase. We demonstrate very long electron spin relaxation times in highly n-doped cubic GaN ($n_D = 1 \times 10^{19}$ cm^{-3}) exceeding 500 ps up to room-temperature. Time-resolved Kerr-rotation measurements show an almost temperature independent spin relaxation time between 80 and 295 K [1], confirming an early prediction of Dyakonov and Perel for a degenerate electron gas.

[1] J. H. Buß et al., Appl. Phys. Lett. **97**, 062101 (2010)