SFB/TRR 21 - Seminar

9. April 2013, Stuttgart

Rakshyakar Giri
(Université Montpellier 2, France)

Nuclear Faraday effect in n-GaAs

In this work we demonstrate non-destructive detection of nuclear magnetization in n-GaAs via cavity enhanced Faraday rotation of an off-resonant light beam. We use a two-step protocol, where preparation and measurement are separated in time. During the measurement, initially prepared nuclear magnetization is in equilibrium with electron gas and is detected via small conduction levels spin splitting, and the equilibrium electron spin polarization in the hyperfine effective field. This detection scheme is sensitive to (i) nuclear spins situated within the localization radius of donor-bound electrons and characterized by fast dynamics, as well as to (ii) all other nuclear spins in the sample characterized by much slower relaxation rate. Contributions to the Faraday rotation related to the magnetization of different nuclear species with different localizations in the sample are identified in nuclear magnetic resonance experiments. Our results provide new insight in the mechanisms of nuclear relaxation in metallic n-GaAs: diffusion limited nuclear spin relaxation dominates over Korringa mechanism.

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Universität Stuttgart, NWZII, Raum 3.531
Pfaffenwaldring 57, 70569 Stuttgart

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