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Microscopic mechanism of optically pumped NMR in bulk GaAs[1]
PATRICK COLES, JEFFREY REIMER, University of California, Berkeley — In the past decade, optical nuclear polarization in semiconductors has been used as a tool for basic solid-state physics [1], and has been proposed as a means towards sensitivity-enhanced NMR for biological systems [2] and towards information storage in quantum computing architectures [3]. The microscopic mechanism of this process, however, has been debated recently even in the model system of bulk GaAs [4]. We review our modeling and experimental results towards differentiating between recently considered mechanisms for optical nuclear polarization in GaAs based on localized and delocalized electrons. We discuss a simple experiment that quantifies the amount of localization. Results are consistent with localized electrons cross-relaxing with nearby nuclei, and gradual polarization of the bulk by nuclear spin diffusion. [1] A.E. Dementyev et al. Sol. State Comm. 119: 217 (2001) [2] R. Tycko. Sol. State Nuc. Mag. Res. 11:1 (1998) [3] T.D. Ladd et al. Phys. Rev. Lett. 89:017901 (2002) [4] A.K. Paravastu et al. Phys. Rev. B 69:075203 (2004)

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