Quantum dot spins: an optical investigation

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Resonant laser spectroscopy is a powerful tool to investigate the spin properties of semiconductor quantum dots (QD). It allows access to both the spin of charge carriers (electrons and holes) trapped in the QD as well as to the nuclear spin ensemble.

In this talk I will discuss a peculiar but very prominent feature of the nuclear spin system of highly and inhomogeneously strained InGaAs/GaAs QDs that is revealed particularly by resonant laser spectroscopy: The strain induced quadrupolar moments of the nuclear spin lead to an additional term in the hyperfine Hamiltonian representing non-collinear interactions between electron and nuclear spins. In the presence of laser excitation resonance locking effects are observed allowing for resonant nuclear spin polarization. I will finish by giving an outlook for the potential application of this optical feedback to the nuclear spin ensemble for narrowing its random fluctuations.