g-factor Properties of Electrons and Holes Confined in InAs Quantum Dots Emitting at Telecom Wavelengths

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Spins in semiconductor quantum dots (QDs) are considered as very attractive system for future applications in the solid-state quantum information processing. In that context, the characterization of *g*-factors is very important to assess the spin dynamics for the semiconductor physics in general and for tailoring nanostructures in particular, since the dynamics are sensitive to shape anisotropies as well as spin-state mixing. We study electron and hole *g*-factors and dephasing times in a novel InAs/InAlGaAs/InP quantum dot ensemble emitting in the telecom spectral range around 1.5 □m by measuring time-resolved pump-probe ellipticity [1].

All components of the electron and hole *g*-factor tensors are measured via tuning the excitation energy through the inhomogenously broadend QD ensemble. Surprisingly, the electron *g*-factor shows the largest anisotropy so far reported for QDs changing from $g_{e,x} = -1.63$ to $g_{e,z} = -2.52$ between directions perpendicular and parallel to the dot growth axis, respectively, at an energy of 0.82 eV. The hole *g* -factor anisotropy at this energy is even stronger: $|g_{h,x}| = 0.64$ and $|g_{h,z}| = 2.29$. We observe a strong deviation of the electron *g*-factors from the Roth-Lax-Zwerdling equation and a steep dispersion of the hole *g*-factor, which is affected by the strain and size of QDs with large confinement. The out-of-plane anisotropy is even more pronounced for the distribution of the *g*-factors among the QD ensemble, determined from the spin dephasing time [2].

[1] Belykh et al., Phys. Rev. B 92, 165307 (2015)
[2] Belykh et al., arXiv: 1512.03544v2 (2015).