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Spin-orbit and hyperfine interaction mediated spin relaxation in a single electron GaAs quantum dot LIUQI YU, L. C. CAMENZIND, D. M. ZUMBUEHL, Department of Physics, University of Basel, Switzerland, P. STANO, Center for Emergent Matter Science, RIKEN, Japan, J. ZIMMERMAN, A. C. GOSSARD, Materials Department, University of California, Santa Barbara, USA — Understanding and controlling spin relaxation is of great importance for spin qubit. The spin-orbit interaction (SOI) and hyperfine interaction are two most important ones that can couple the electron spin states to its orbital states so that spins can relax. In a magnetic field, it has been shown that spin relaxation is primarily caused by spin-phonon coupling mediated by SOI [1, 2]. Here we present measurements of the spin relaxation rate in a gate defined single-electron GaAs quantum dot. The spin relaxation rate W is measured in a magnetic field up to 14 T in the plane of the 2D electron gas. The shape of the quantum dot can be well controlled. Due to the interplay of Rashba and Dresselhaus SOIs, W shows strong anisotropy with varying directions of applied in-plane magnetic fields. Along crystal axis [1-10] where the overall SOI coupling is weak, spin relaxation time T1 of more than 30 s has been obtained at a magnetic field of 0.6 T. However, this long T1 time is still much shorter than the expected value within the scope of SOI mediated spin relaxation. Given the field dependence of W, particularly in low field regime, the shorter T1 times are attributed to the hyperfine interaction mediated spin relaxation via phonons [3], which is observed for the first time. [1] S. Amasha *et al.*, PRL. **100**, 046803 (2008). [2] V. N. Golovach et al., PRL **93**, 016601 (2004). [3] S. Erlingsson *et al.*, PRB. **66**, 155327 (2002).

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