# 光誘起ポテンシャルドットにおける電子スピンダイナミクス

# Spin dynamics of electrons accumulated in light induced potential dots

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Confining carriers in micro/nano-scale structures is essential technique for controlling spin coherence in semiconductor spintronics. However, conventional ways of constructing confinement potential using advanced crystal-growth and lithographic techniques are not always flexible enough to control spin-orbit interactions in appropriate positions and timings. Here we report a different mechanism, which enables us to design temporal and reconfigurable potential dots generated by simple light exposure in semiconductors [1].

We carried out time- and spatially-resolved magneto-optic Kerr rotation (KR) measurements on a single undoped GaAs/AlAs quantum well (QW). We observed a notable enhancement of KR decay time when we shrunk the pump spot size (Fig. 1). Because the pump light with a photon energy of 1.530 eV can co-excite carriers both in the QW and in the bulk GaAs buffer layer located 230 nm below the QW, we expect that the photo-induced space charges distributed locally in the buffer layer create a potential dot for electrons in the QW layer. Probable causes of the space charges are electrons and holes trapped in dilute background impurities, which survive for a time longer than 10 ns. This interpretation is supported by our numerical simulation (Fig. 2), which shows a light-induced potential dot induced by positive and negative charges with 2D Gaussian distributions with slightly different FWHM diameters in the buffer layer. A Monte-Carlo simulation reproduces the enhancement of spin lifetime due to the confinement. The demonstrated optical mean of confining spins is appealing for designing novel functionalities requiring the flexible motion of spins in spintronics applications.

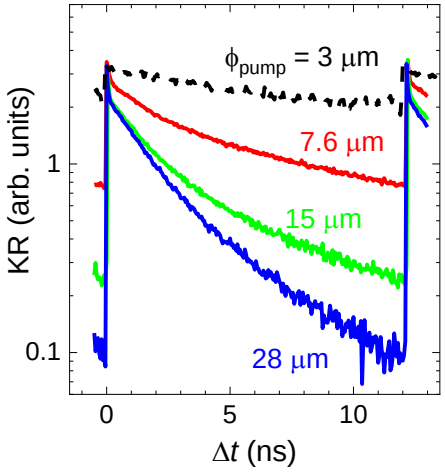


Fig. 1 Kerr rotation as a function of pump and probe delay (Δt) measured for different pump spot sizes

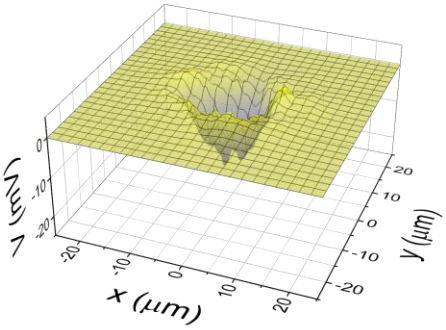


Fig. 2 Calculated electro-static potential profile for electrons in the QW.

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