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Electric Field-Driven Coherent Spin Reorientation of Optically Generated Electron Spin Packets in InGaAs¹
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Full electric-field control of spin orientations is one of the key tasks in semiconductor spintronics. We demonstrate that electric field pulses can be utilized for phase-coherent 2- π spin rotation of optically generated electron spin packets in InGaAs epilayers using time-resolved Faraday rotation. Through spin-orbit interaction, the electric-field pulses act as local magnetic field pulses. By the temporal control of these pulses, we can turn on and off electron spin precession and thereby rotate the spin direction into arbitrary orientations in a 2-dimensional plane [1]. Moreover, we apply two subsequent electric field pulses of opposite field polarity to perform spin echo studies of the diffusing spin packet by reversing both the spin precession and the drift direction. In this spin-echo type spin drift experiment we find an unexpected spin rephasing, which is evident by a doubling of the spin dephasing time.

[1] S. Kuhlen et al., Phys. Rev. Lett. 109, 146603 (2012)

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