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Spin blockade in the optical response of a charged quantum dot ELEFTHERIA KAVOUSANAKI, GUIDO BURKARD, University of Konstanz, Germany — We theoretically model the population dynamics in a semiconductor quantum dot charged with a single electron in an optical pump-probe setup when the two lowest quantum dot levels are photoexcited. We calculate the differential transmission spectrum as a function of the time delay between the two circularly polarized optical pulses by using a density matrix formalism and treating intraband relaxation with the Lindblad equation. Taking into account both spin conserving and spin-flip relaxation processes we investigate the possibility for spin-dependent blocking of intraband relaxation due to the presence of the ground state electron for zero and finite magnetic fields. We show that the differential transmission spectrum is initially dominated by the fast spin-conserving mechanism before the slower spin-flip processes start to contribute at longer time scales. As a consequence of spin conservation for short time scales, we find a spin blockade effect in the optical recombination process.

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