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Electron Spin Optical Orientation in Charged Quantum Dots A. SHABAEV, AL. L. EFROS, A.S. BRACKER, E.A. STINAFF, D. GAMMON, M.E. WARE, J.G. TISCHLER, D. PARK, Naval Research Laboratory, Washington DC, USA, D. GERSHONI, Physics Department, Technion-Israel Institute of Technology, Haifa, Israel, V.L. KORENEV, I.A. MERKULOV, A. F. Ioffe Institute, RAS, St. Petersburg, Russia — We present a theory of nonresonant optical orientation of electron spins localized in quantum dots. This theory explains the negative circularly polarized photoluminescence of singlet trions localized in quantum dots previously observed in experiments where trion polarization changed to negative with time and where the degree of the negative polarization increased with intensity of pumping light. We have shown that this effect can be explained by the accumulation of dark excitons that occurs due to the spin blocking of the singlet trion formation - the major mechanism of dark exciton recombination. The accumulation of dark excitons results from a lack of electrons with a spin matching the exciton polarization. The electron spin lifetime is shortened by a transverse magnetic field or a temperature increase. This takes the block off the dark exciton recombination and restores the positive degree of trion polarization. The presented theory gives good agreement with experimental data.

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