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Proposal for optical rotations of electron spin trapped in a quantum dot SOPHIA ECONOMOU, Naval Research Lab, LU SHAM, University of California, San Diego, YANWEN WU, DUNCAN STEEL, University of Michigan, THOMAS REINECKE, Naval Research Lab — The spin of an electron trapped in a semiconductor quantum dot and manipulated optically is an attractive qubit candidate, as it combines the merits of the solid state with those of laser technology. Optical rotation of the electron spin has not been experimentally demonstrated to date. In this work we propose a method for ultra fast U(1) spin rotation based on the analytical properties of the hyperbolic secant pulses. The method is tailored for systems with a dark state, such as the three-level system comprised of the two Zeeman split electronic sublevels and the trion state in GaAs quantum dots. For a system with a higher electronic g factor, such as self assembled InAs quantum dots, extra freedom arising from frequency selectivity allows us to combine these pulses with optically created dark states and design an arbitrary spin rotation through an exact solution of the three-level Λ system.

Sophia Economou
Naval Research Laboratory

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