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Dynamic optical spin switch in a single quantum dot photodiode
JOSE M. VILLAS-BOAS, SERGIO ULLOA, ALEXANDER GOVOROV, Ohio University — The spin degree of freedom constitutes a naturally defined qubit; the basic element in quantum information processing that has been the subject of intense research. Optical pumping to generate a photocurrent in quantum dots that monitors the coherent state of the system has been used recently with great success [1,2]. In this paper we show that it is possible to switch the polarization of the photocurrent signal obtained from a *single* self-assembled quantum dot photodiode under the effect of elliptically-polarized light. This can be achieved by just increasing the light *intensity* without having to change the initial polarization of light. This response can be used as a dynamical switch to invert the spin-polarization of the extracted current. We use a multi-exciton density matrix formalism that includes the anisotropic e-h exchange in the quantum dot. The electron and hole tunneling is introduced by rates obtained from a microscopic description, and other parameters also describe realistic systems. We report on the role of the excitation detuning and mixed polarization for this optical source of spin-polarized electrons.Supported by the Indiana 21st Century Research and Technology Fund, and FAPESP- Brazil. [1] A. Zrenner *et al.* Nature (London) **418**, 612 (2002); Q. Q. Wang *et al.*, cond-mat/0404465. [2] J. M. Villas-Bôas, Sergio E. Ulloa, and A. O. Govorov, cond-mat/0408570.

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