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Charge dynamics and phonon induced oscillatory relaxation rates of indirect excitons in quantum dot molecules[1] J.E. ROLON, K.C. WIJESUNDARA, E.A. STINAFF, S.E. ULLOA, Ohio University — Optoelectronic control of quantum dots is a thriving area of research with impact on fundamental physics and quantum information devices. Time-resolved photoluminescence experiments, carried out in charge tunable coupled quantum dots, have demonstrated non-monotonic behavior of neutral indirect exciton lifetimes over a wide range of applied electric fields [1]. We present a model for neutral indirect exciton lifetimes in electric field tunable quantum dot molecules. Our model includes field-dependent oscillatory phonon-induced relaxation rates [2], carrier tunneling rates, and carrier relaxation into nearby charged exciton states. To this end we have used a multi-excitonic Hamiltonian, and calculated the exciton population dynamics using a master equation with electric field dependent rates. We find that lifetime suppression is dominated by scattering with LA phonons at low fields, and that the maximum lifetime gives information on the effective dimensions of the molecule. In contrast, at high fields the lifetime suppression is dominated by the interplay of carrier population exchange with nearby charged excitons. This prompts for ways of controlling exciton lifetimes and possible decoherence in quantum dots. [1] K. C. Wijesundara et al., (unpublished), [2] J. I. Climente et al., Phys. Rev. B 74, 035313 (2006).

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Juan Rolon
Ohio University

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