Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Phonon-induced Transparency in Quantum Dot Molecules M. KERFOOT, University of California, Merced, A. GOVOROV, Ohio University, D. LU, R. BABAOYE, University of California, Merced, A. BRACKER, D. GAMMON, Naval Research Laboratory, M. SCHEIBNER, University of California, Merced —
Quantum dot molecules (QDMs) formed by vertically stacked quantum dots provide a rich test ground for the investigation of elementary semiconductor excitations in a zero dimensional system. A high level of control over the mutual interactions between charges, spins and photons has been achieved with the enormous tunability of electronic states in QDMs [1]. In this work, we investigate the interaction of phonons with the QDM electronic states and demonstrate that, contrary to their usual dephasing role, phonons can actually increase control over a quantum system. This novel employment of phonons arises from the formation of a resonance-enhanced polaron. It is revealed via a Fano effect that arises from the interference of two competing optical absorption pathways, which results in a transparency of the system. One pathway involves a discrete electronic excitation with charges localized in separate quantum dots. The other pathway is for a polaron state, a hybrid of an electronic excitation with an optical phonon that results in a continuum of energy states. The pathways are coupled by the tunneling of a single hole, resulting in a Fano interference in the absorption lineshape characterized by stark dips (transparency) and peaks in the absorption. We show that the phonon-induced transparency is highly controllable by electric field, excitation energy and power.
[1] M. Scheibner, et. al., *Essential concepts in the optical properties of quantum dot molecules*, Solid State Comm. **149**, 1427-1435 (2009).

M. Kerfoot
University of California, Merced

Date submitted: 21 Nov 2012 Electronic form version 1.4