Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Group velocity slowdown using phonon-induced transparencies in a quantum dot molecule ANDREW JACOBS, CAMERON JENNINGS, MARK KERFOOT, MICHAEL SCHEIBNER, Univ of California - Merced — In a recent study we have demonstrated coherent, non-dissipative behavior of phonons due to optical excitation, which is revealed via optical transparency [1]. Using a single external driving field, the absorption of the molecule demonstrates a marked reduction as a Fano-type resonance of a spatially indirect exciton and direct polaron form a molecular polaron state. The phonon coherence contrasts the typical role of these particles as a channel for non-radiative state decay or pure state dephasing. The optical response of the system is indicative of a coherent phenomenon, similar to electromagnetically induced transparency. Here we investigate theoretically how this phonon coherence affects the optical response of a 3-level V-type system in a tunnel-coupled quantum dot molecule. From the properties of the molecular polaron, we are able to determine the slowdown factor of the driving field group velocity, as well as the dependence of the slowdown on system parameters such as polaron and exciton lifetimes, tunneling strength, and transition dipole moments. The presence of slow light suggests this system is suitable for use in quantum computational components such as optical storage or qubit logic gates.

[1] M. Kerfoot et. al. “Optophononics with coupled quantum dots” (submitted)

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Date submitted: 15 Nov 2013

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