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Slow light using crystal lattice vibrations in coupled quantum dots ANDREW JACOBS, JOSHUA CASARA, CAMERON JENNINGS, MARK KERFOOT, MICHAEL SCHEIBNER, University of California, Merced — Phonons can induce an optical transparency in crystal structures, as was recently shown in an experimental study of asymmetric coupled quantum dots [1]. This transparency occurs due to Fano-type quantum interference between the discrete interdot exciton and continuum single dot-like polaron states. Here, we study this phonon-induced optical transparency as an avenue for slowing light. We find that slowdown factors up to 80,000 are possible, corresponding to a time delay of order 1 ps for a photon passing through a single coupled quantum dot pair. The optical slowdown is sensitive to both the Fano asymmetry factor and the homogeneous linewidth of the interdot exciton–we discuss the tunability of the slowdown factor using either parameter. Lastly, we investigate the effect of charge fluctuations, which are found to decrease the amount of optical slowdown. The experimentally measured interdot exciton linewidth is then used to theoretically infer the maximum possible optical transparency and slowdown factor without fluctuations present. [1] M. L. Kerfoot et al., Nat. Commun. 5, 3299 (2014).

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