Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Dynamics of Exciton and Polaron Formation in Structurally Tunable Low Dimensional Materials[1] JASON LEICHT, SUSAN DEXHEIMER, Washington State University — We present measurements of the coupled electronic and vibrational dynamics of exciton and polaron formation using femtosecond wavepacket techniques. The experiments are carried out on mixed-valence halide-bridged transition metal linear chain complexes in which the electronic excitations are confined to the one-dimensional geometry defined by the chain. The strength of the electron-phonon coupling that drives the localization dynamics can be systematically controlled via the chemical composition, and we compare the dynamics in PtCl and PtBr, which have strong and intermediate coupling strengths, respectively. In these materials, excitation well above the optical gap energy can result in the formation of charged polarons in addition to the self-trapped excitons that form following excitation near the band edge. Our measurements reveal formation of both types of excitations on femtosecond time scales, accompanied by coherent oscillations at distinct frequencies for each excitation. The rapid polaron formation time, together with the observation of the accompanying vibrational coherence, indicates that the polarons form directly from the initial photoexcitation, rather than by delayed dissociation of primary excitons.

[1]This work was supported by National Science Foundation grants DMR-1507538 and DMR-1106379.

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Date submitted: 11 Nov 2016 Electronic form version 1.4