Abstract Submitted for the MAR10 Meeting of The American Physical Society

Percolation and localization dynamics in silicon nanocrystal films¹ L.V. TITOVA, T.L. COCKER, X.Y. WANG, D.G. COOKE², A. MELDRUM, F.A. HEGMANN, Department of Physics, University of Alberta, Edmonton, Alberta T6G2G7 Canada — We apply time-resolved THz spectroscopy [1] to probe the time progression of the ac-conductivity in optically excited Si nanocrystal (NC) films with varying Si vol %, NC sizes and separations. A percolation transition is observed at 38 ± 1 vol % Si. Above this threshold, we observe a transition form initial (<50 ps) long-range percolative inter-NC transport characterized by a non-zero DC conductivity to eventual localization of carriers at individual NCs. Below percolation threshold, early-time (<25 ps) inter-NC tunneling conduction is observed in films with sub-nm separations, followed by the final localization of the photoexcited carriers in the largest NCs. In the films with larger (> 1 nm) inter-NC spacing, long-range transport is suppressed suggesting strong photoexcited carrier localization. Comparison of the observed dynamics to Monte Carlo simulations will be discussed. [1] D. G. Cooke et al, Phys. Rev. B **73**, 193311 (2006).

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