237.Title: Charge transport and localization in nanocrystalline CdS films: A time-resolved terahertz spectroscopy study

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Abstract: Assessment of characteristic length and time scales of the charge localization in nanostructured semiconductors is a key point for understanding the initial stage of carrier transport after photoexcitation. A concerted use of time-resolved terahertz spectroscopy and Monte Carlo simulations of the motion of confined electrons allow us to obtain this information and develop a quantitative microscopic model of the electron transport in a nanocrystalline CdS film. A weak localization is observed inside individual nanocrystals while much stronger localization stems from the existence of nanocrystal clusters partially surrounded by voids. The efficiency of the short-range transport is controlled by the excess energy of electrons: Its increase enhances the conductive coupling between adjacent nanocrystals and clusters. Relaxation of electrons with high excess energy then leads to a decrease of their mobility on a subpicosecond time scale. Filling of conduction-band states by increasing the optical pump fluence allows us to maintain a high level of conductive coupling even at later times