



DEPARTMENT OF ELECTRICAL ENGINEERING Distinguished Speaker

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“Exciton-Exciton Interactions in Semiconductor Nanocrystals from the Perspective of Solar-Energy Conversion”

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Knox 109

ABSTRACT

A usual assumption is that absorption of a single photon by a material produces a single electron-hole pair (exciton), while the photon energy in excess of the energy gap is dissipated as heat. In 2004, we reported for the first time that nanocrystals of PbSe could respond to absorption of a single photon by producing two or more excitons with the unity probability (Phys. Rev. Lett. 92, 18660, 12004). Most recently we observed the formation of 7 excitons per single photon, which corresponded to the ultimate limit allowed by energy conservation (Nano Lett. 6, 424, 2006). This presentation reviews our recent follow-up work on this carrier multiplication phenomenon, which addresses such issues as its mechanism (Nature Phys. 1, 189, 2005), statistics of carrier populations produced via carrier multiplication (Phys. Rev. Lett. 96, 097402, 2006), and implications of this process in photovoltaics and photocatalysis (App. Phys. Lett. 89, 123118, 2006).

BIOGRAPHY

Victor I. Klimov is a Fellow of Los Alamos National Laboratory (LANL) and the leader of the "Softmatter Nanotechnology and Advanced Spectroscopy" team at the Chemistry Division of LANL. He also leads the "Nanophotonics & Optical Nanomaterials" thrust of the Center for Integrated Nanotechnologies of the US Department of Energy. He received his MS (1978), Ph.D. (1981), and D.Sc. (1993) degrees from Moscow State University. He is a Fellow of the American Physical Society, a Fellow of the Optical Society of America, and a former Fellow of the Alexander von Humboldt Foundation. Klimov has (co)authored more than 150 articles and book chapters and edited 2 books. His current research interests include physics and chemistry of semiconductor quantum dots, nanoplasmonics, femtosecond spectroscopy, and near-field microscopy/spectroscopy.