



## Smart Lighting ERC Speaker Series

Wednesday, November 9<sup>th</sup>, 1:30 pm

JEC 3117

*(1 hour talk followed by 30 minute of networking – refreshments will be served)*

## Suppression of Non-Radiative Auger Processes

Dr. Alexander L. Efros

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### Abstract:

Colloidal nanocrystals randomly turn their photoluminescence (PL) “off” and “on” under continuous light illumination, despite intensive research efforts aimed at suppressing this phenomenon. Today there is a consensus that the blinking is caused by extra electrons or holes that repeatedly charge, and then neutralize, the NC. When a charged NC is excited by a photon the additional energy is not re-emitted as PL, but instead triggers a process known as “non-radiative Auger recombination” during which this energy is acquired by an extra electron or hole. The rate of Auger recombination is orders of magnitude faster than the rate of radiative recombination that produces PL in neutral NCs. As a result, PL is completely suppressed, or “quenched,” in charged NCs.

Recently, the soft-confinement (CdZnSe/ZnSe) nanocrystals have been grown that show complete absence of single molecule photoluminescence blinking. Other remarkable photophysical properties these nanocrystals exhibit include unique multi-peaked photoluminescence spectra, and unusually short photoluminescence lifetimes. These properties are consistent with the novel observation of charged exciton recombination in colloidal nanocrystals, and thus are quite unlike any of the typical nanocrystals currently being studied.



**Bio:** Alexander L. Efros has been a senior researcher at the Naval Research Laboratory (NRL) since 1999. He was and currently is PI and co-PI on several programs related to nanocrystal quantum dots. He received his PhD (1978) from St. Petersburg Technical University.

Dr. Efros’s primary expertise area is a theory of electronic, optical and transport properties of low-dimensional semiconductor structures. He has published more than 160 articles in refereed journals. His pioneering contributions to the theory of nanocrystal quantum dots including establishing the basic model used for describing their electronic and optical properties were instrumental for the creation of a new class of the optical materials.

Dr. Efros is recipient of the 2006 R.W. Wood Prize of the Optical Society of America (with L. E. Brus and A. Ekimov) for the “discovery of nanocrystal quantum dots and pioneering studies of their electronic and optical properties.” He also received of Humboldt Research Award for Senior U.S. Scientists in 2007 and 2006 Sigma Xi NRL Award for basic research.



### About the Naval Research Laboratory:

NRL is the corporate research laboratory for the Navy and Marine Corps and conducts a broad program of scientific research, technology and advanced development. NRL has served the Navy and the nation for over 85 years and continues to meet the complex technological challenges of today’s world. Heading the Laboratory with joint responsibilities are the Commanding Officer, Captain Paul Courtney Stewart, USN, and the Director of Research, Dr. John Montgomery. Line authority passes from the Commanding Officer and the Director of Research to four Associate Directors of Research and the Director of the Naval Center for Space Technology.

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