Engineered Quantum Dots for All Tastes: From Light Emission to Solar Energy Conversion

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Using modern colloidal chemistry, semiconductor nanocrystals or "quantum dots" (QDs) can be synthesized with nearly atomic precision in a variety sizes, shapes, and compositions. They feature near-unity emission quantum yields and narrow emission bands, which results in excellent color purity. These properties make QDs attractive for applications in light-emitting diodes (LEDs), displays, and lasers. Colloidal nanostructures are also attractive for applications in solar energy as both light absorbers in solution-processed solar cells and color-tunable, highly-emissive fluorophores in luminescent solar concetrnators (LSCs). This presentation will focus on photophysical properties of the QDs discussed in the context of their applications in light-emitting and solar-energy-conversion devices. Specific topics will include suppression of nonradiative Auger recombination by manipulating QD interfaces, Stokes-shift engineering for large-area, high-efficiency LSCs, and carrier multiplication for boosting the efficiency of solar cells beyond a traditional Shockley-Queisser limit. This talk will also overview new techniques for probing early time carrier dynamics (picosecond-to-nanosecond time scales) directly in a photocurrent of device-grade QD films using methods of ultrafast electro-optical sampling.

Brief biography

Victor I. Klimov is a Fellow of Los Alamos National Laboratory and Director of the Center for Advanced Solar Photophysics of the U.S. Department of Energy. He received his M.S. (1978), Ph.D. (1981), and D.Sc. (1993) degrees from Moscow State University. He is a Fellow of both the American Physical Society and the Optical Society of America, and a recipient of the Humboldt Research Award. His research interests include photophysics of semiconductor nanocrystals, and fundamental aspects of solar cells, LEDs, and lasers based on semiconductor nanomaterials.

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Google Scholar profile: https://scholar.google.com/citations?user=V8bIp74AAAAJ