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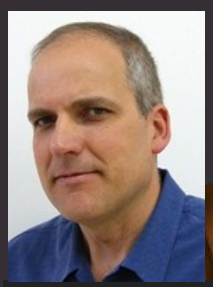

Prof. Uri Banin

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"Semiconductor nanocrystals and hybrid semiconductor-metal nanoparticles; From basic science to applications"

Wednesday,
17 May, 2017

12:00 refreshments
12:30 lecture

Wang Auditorium
The Dalia Maydan Building
Faculty of Materials Science and Engineering

RBNI Monthly Seminar Series 2017

TECHNION
Israel Institute of Technology

Semiconductor nanocrystals and hybrid semiconductor-metal nanoparticles;

From basic science to applications

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Semiconductor nanocrystals manifest fascinating size, composition and shape dependent optical and electronic properties. A first aspect aims at electron-hole recombination yielding highly emissive quantum dots and rods. Better design and control of the particle structure is required to achieve maximal fluorescence quantum yield and stability, with relevance for a wide range of technological applications. In this context we will discuss various synthesis routes for shape controlled semiconductor nanorods and report several effects involving the 0D to 1D transition in semiconductor nanocrystals. Various applications of semiconductor nanocrystals and nanorods including in displays and in biomedical directions will be presented.

An additional concept that we will present concerns hybrid nanoparticles that combine disparate materials onto a single nanosystem. This provides a powerful approach for bottom-up design of novel architectures. Beyond the fundamental development in synthesis, the interest in such hybrid nanoparticles arises from their combined and often synergetic properties exceeding the functionality of the individual components. These ideas are well demonstrated in hybrid semiconductor-metal nanoparticles pioneered by us in formation of metal tipped semiconductor nanorods over a decade ago. The synergistic optical and chemical properties of such hybrid nanoparticles resulting in light-induced charge separation and charge transfer, allow photocatalytic activity which can promote redox reactions, and open a pathway for converting solar energy to chemical energy stored in a fuel. We will report on the effects of the surface coating and the co-catalyst metal size on the photocatalytic function of metal tipped semiconductor nanorods as a model hybrid nanoparticle system. Both tested parameters were found to influence the photocatalytic efficiency and charge transfer dynamics. The understanding of the effects of the hybrid nanosystems properties on the photocatalytic processes contribute to the rational design of hybrid nanostructures in photocatalytic applications. An additional aspect concerns the use of the hybrid nanoparticles in generation of reactive oxygen species and its application for light-controlled enzymatic activity, and in additional areas where on-demand light-induced radicals formation is of relevance.