UNIVERSITY OF TEXAS AT DALLAS - DEPARTMENT OF PHYSICS

PHYSICS COLLOQUIUM

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Wednesday, February 20, 2008; 4:00-5:00 PM
Room: ECSS 2.312

Resonant Organic-Inorganic Hybrid Nanostructures for Novel Light Emitting Devices and Solar Cells

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Integration of organic and inorganic semiconductors in a single *hybrid* nanostructure may lead to many novel devices which take advantage of the "better" properties of *both* classes of materials, thereby overcoming limitations of each individual class. Following this idea we discuss properties expected of hetero-nanostructures combining organic and inorganic semiconductors whose electronic excitations (Frenkel and Wannier-Mott excitons, respectively) are in resonance, that is, have nearly equal energies. We show that such resonant coupling between Frenkel (small-radius) states in organics and Wannier (large-radius) states in quantum wells/wires/dots should lead to striking effects that can be used in various optoelectronic devices: (i) strong enhancement of the resonant all-optical nonlinearity and (ii) highly efficient energy transfer between organics and inorganics. The latter effect may be especially important for applications in LEDs and solar cells. So in a suggested new concept of LED, the electrical pumping of excitations in the semiconductor quantum well is utilized to turn on the organic material luminescence. Alternatively, energy transfer can be employed in the opposite direction - from an organic overlayer to inorganic quantum wells/nanocrystals – and used thus in hybrid photovoltaic devices.

We will dedicate a substantial time to discuss recent *experimental* results obtained in Germany, UK and the US. These results strongly support our idea of using resonant organic-inorganic hybrids for novel nanoscale designs in light-emitting, photovoltaic and sensor applications.

About the speaker: "Vladimir Agranovich is known as a condensed matter physicist with a world-wide outstanding reputation. He is appreciated for his innovative ideas and his broad and profound contributions to a variety of fields in condensed matter physics, as a teacher transferring his ideas with enthusiasm to his younger colleagues and students and as an author and editor of scientific journals, books and book series" (Excerpt from the dedication of a special volume of Journal of Luminescence 110 (2004) 165 to honor Professor Agranovich.)