Topic: **Wave-Guiding Nanomaterials: How to Make an Ultra-Fast X-Ray Detectors**

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This seminar intends to show how physical ideas find their implementation in photonics and electronics and eventually in technology that results in novel devices with unsurpassed performance.
One of the novel applications of molecular beam epitaxy is the technology of wave-guiding nanomaterials with engineered luminescence centers (quantum dots - QDs) embedded into a semiconductor waveguide. This type of structures can be designed to enable ultrafast scintillation detection of single x-ray photons and energetic particles. The ultrafast x-ray detection is essential for implementing low-dose x-ray 3D medical imaging, such as computer or positron-emission tomography, for improving spectroscopic accuracy and turnaround time in nuclear security, and for enhancement of particle identification capabilities in high-energy physics.

Due to relatively low bandgap in semiconductors in comparison to traditional solid-state scintillators, and very fast and efficient luminescence in InAs QDs, the wave-guiding nanostructures are expected to provide exceptional performance surpassing in several parameters the best traditional inorganic scintillators (such as LYSO): about 5x higher light yield (~240,000 photons/MeV), and 20x faster decay time, resulting in the unsurpassed speed (1-10 ps) and energy resolution (~1 % at 1MeV). The talk will cover physics and technology of the InAs/GaAs QD scintillation medium, integrated photodetector, and recent results of the properties of the QD wave-guiding nanomaterial, being the fastest scintillation medium reported.

Dr. S. Oktyabrsky has received his Ph.D. degree in Solid State Physics from Lebedev Physics Institute, Moscow, Russia, in 1988. He joined the University at Albany – SUNY in 1998 and is currently a Professor and a leader of a compound semiconductor team at the Colleges of Nanoscale Science and Engineering which is now a part of the SUNY Polytechnic Institute. His primary expertise is in the molecular beam epitaxy, group III-V semiconductor technology, materials, heterostructures and devices.