**Imaging of Optoelectronic Processes in Nanometer-Scale Structures and Composites.** *David Adams, Department of Chemistry, Columbia University*

There is growing interest in the underlying physical processes in optoelectronic devices based on composites of organic and inorganic electronic materials, including low-cost large-area solid-state solar cell and light emitting devices, photodetectors, and optical memories. Such devices are often thin-film multilayer structures involving nanostructured polymeric and/or crystalline organic layers and inorganic layers supported on conducting/transparent indium tin oxide glass electrodes. The unique electrooptic behavior of these devices and essential physical processes such as charge injection/separation at interfaces, charge and exciton mobilities, exciton decay processes, and exciton/charge-carrier interactions are often intimately controlled by the detailed nanostructured morphologies of the system. There is a need for experimental tools that allow for imaging (spatial resolution) of the physical properties and processes associated with nanometer scale structures. Ideally, simultaneous imaging of the layer morphology and physical processes would ultimately allow for a direct correlation of morphology and device physics in a functional device, device prototype, or isolated nanostructure. Nanometer scale structures are expected to impact broad areas of electronics and optics technology. The realization of the technological applications requires a greater understanding of how nanostructures are synthesized and fabricated and importantly requires a greater understanding of the intrinsic and potentially unique physical properties of nanostructures. Here we present recent results where two complimentary new methods are used to spatially and temporally resolve optoelectronic properties and processes in nanostructured thin films. Electric field modulated near-field scanning optical microscopy (NSOM) and light-modulated scanning electrostatic potential microscopy (SEPM) are used to investigate self-organizing liquid crystalline molecular semiconductors and photoconductors, and inorganic semiconductor particle/conducting polymer nanocomposites.