Columbia University Optics and Quantum Electronics Seminar

"Ultrafast Surface Chemical Dynamics at the Nanoscale"

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Date/Time: Monday, September 24th, 11 – 12 noon

Location: Sindeband East 414/CEPSR

Abstract: Surface chemistry is a local ultrafast phenomenon: subnanometer nuclear motions occur on picosecond time scales. In general, the chemistry involves energy transfer mediated by surface electronic excitations. This is most obvious in the case of photoinduced surface chemistry, but the significance of electron-mediated surface–adsorbate energy transfer to thermal chemistry at metal surfaces is becoming increasingly appreciated. Tracking these dynamics at the complex surfaces of real world catalytic systems—with nanoscale inhomogeneities—remains a challenge. To understand these nanoscale effects on charge-carrier dynamics, and their correlation to photo- and thermal chemical activity, we investigate ultrafast surface dynamics investigations along two directions. First, we develop a laser-excited scanning tunneling microscopy approach to probing subpicosecond hot-carrier dynamics with nearatomic resolution. Progress in laser-excited STM has overcome fundamental issues related to interferometric thermal artifacts and is now beginning to examine local time-resolved detection of two-photon photoemission that may enable spatially resolved measurements of surface electron dynamics. Second, we probe the rates of energy transfer from supported metal nanoparticles to adsorbates using short-pulse NIR excitation to drive surface chemistry.

Bio: NICHOLAS CAMILLONE III is a scientist in the Chemistry Department at Brookhaven National Laboratory (BNL). He received his B.S. with a double major in Physics and Chemistry (Wheaton College, Wheaton, IL) and his Ph.D. in Chemistry (Princeton University). Nick did postdoctoral work at the University of North Carolina at Chapel Hill and Columbia University, and also held a research faculty position at Columbia. Nick joined BNL in 2001. In cooperation with scientists in the Chemistry Department and the Center for Functional Nanomaterials, Nick has since initiated two new programs in the area of ultrafast surface chemical dynamics. Broadly, his work aims to establish links between ultrafast surface–adsorbate energy-transfer dynamics and photo-excited and thermally-driven heterogeneous catalysis.

Hosted by Prof. Richard Osgood • For further information: call 854-4462