SPECIAL PHYSICAL CHEMISTRY SEMINAR

Monday **1:30 pm** **Room 8335**
August 11, 2014 **Chemistry**

Watching Silica's Dance: Imaging the Atomic (Re-)Arrangements in Glass

Dr. Pinshane Huang
School of Applied and Engineering Physics
Cornell University

Host: Mark Ediger

Even though glasses are almost ubiquitous—in our windows, on our iPhones, even on our faces—they are also mysterious. Because glasses are notoriously difficult to study, basic questions like: "How are the atoms arranged? Where and how do glasses break?" are still under contention. We use aberration corrected transmission electron microscopy (TEM) to image the atoms in the world's thinnest pane of glass (only 3-atoms thick) and take a unique look into these questions. Using atom-by-atom imaging and spectroscopy, we are able to reconstruct the full structure and bonding of this 2D glass and identify it as a bi-tetrahedral layer of SiO_2. Our images also strikingly resemble Zachariasen's original cartoon models of glasses, drawn in 1932. As such, our work realizes an 80-year-old vision for easily understandable glassy systems and introduces promising methods to test theoretical predictions against experimental data. We also use the electron beam to excite atomic rearrangements, producing surprisingly rich and beautiful videos of how a glass bends and breaks. Detailed analyses of these videos reveal a complex dance of elastic and plastic deformations, phase transitions, and their interplay. These examples illustrate the wide-ranging and fundamental materials physics that can now be studied at atomic-resolution via transmission electron microscopy of two-dimensional glasses.