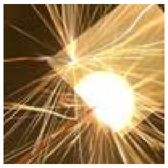
# Semi-annual student symposium highlights graduate work at CHESS

E. Fontes (10/3/2006)



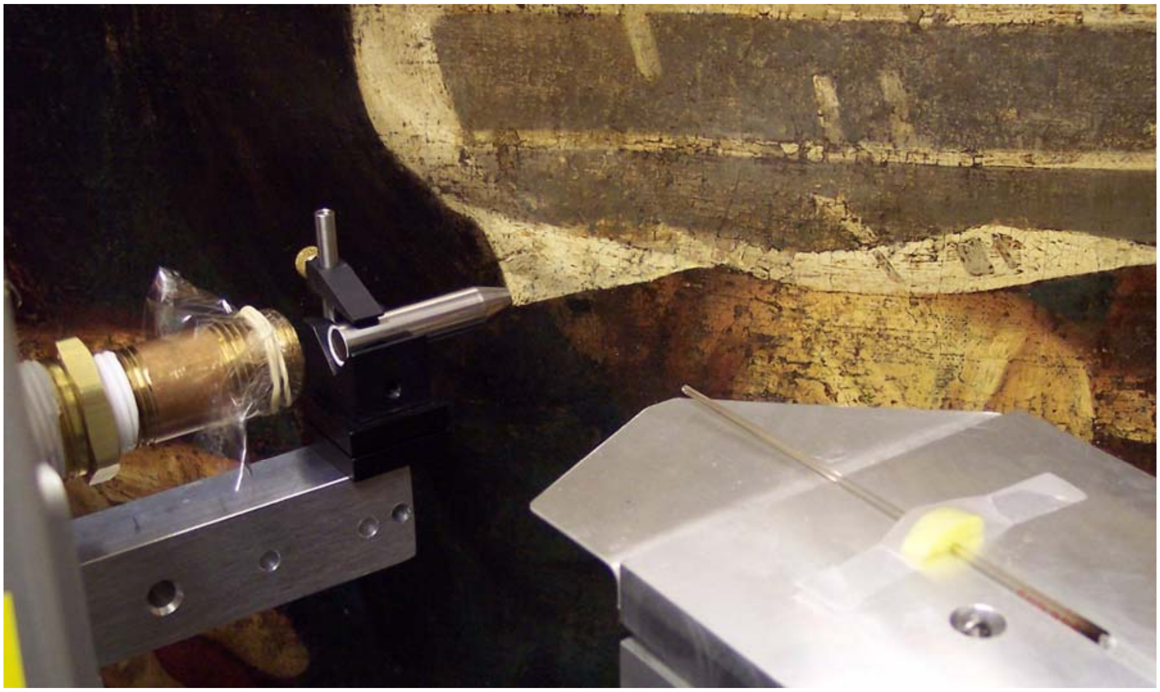
Ithaca, NY -- 30 students, faculty, postdocs and CHESS scientists shared dinner and three presentations at the fourth G-line Student Symposium convened at Wilson Laboratory on September 19$^{th}$. The symposium is held twice each year to highlight work by Cornell graduate students who perform x-ray science programs at the Cornell High Energy Synchrotron Source (CHESS). The three G-line experimental stations they use – G1, G2 and G3 - are maintained and run by the graduate students themselves. Given so much responsibility the students, in addition to doing unique x-ray science, also learn how to design and build the research instruments they need. This is a rare educational opportunity not commonly found at other national synchrotron lightsource facilities.

Arthur Woll, the G-line staff scientist, organized the meeting and introduced the speakers. The first speaker was Gökhan Arikan, a student with Joel Brock, professor of Applied and Engineering Physics. His presentation covered “Time-resolved X-ray Studies of the Energetic Mechanisms Operant During Pulsed Laser Deposition of $SrTiO_3$”. His motivation was to understand oxide and magnetic devices where the structure of interfaces often determines the properties of a device. Using the *in-situ* pulsed-laser deposition system at G3, he observed layer-by-layer growth while monitoring the substrate crystal truncation rod, and could distinguish the surface morphology and growth modes as a function of deposition rate.

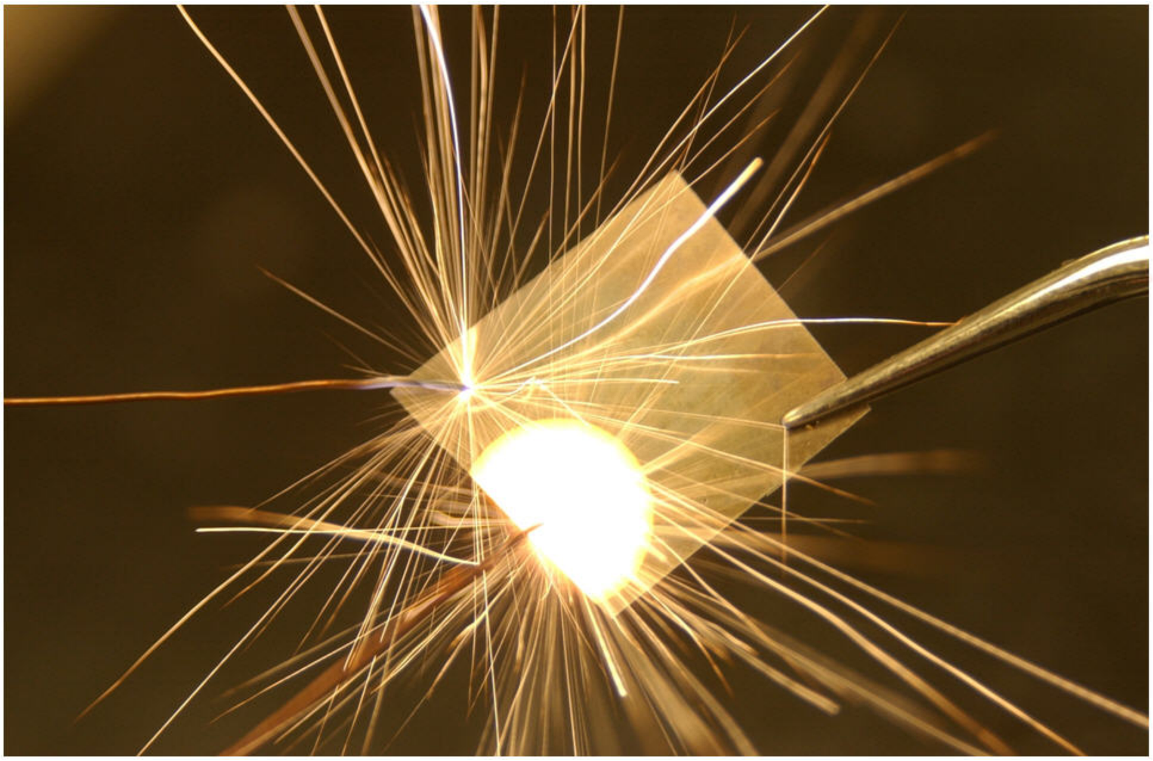
Sterling Cornaby, studying under Don Bilderback, the associate director of CHESS, spoke on “Testing Single-Bounce Monocapillary X-ray Optics at G-line.” After giving an overview of capillary optics and the new glass drawing tower, he described how, during the last CHESS run, glass capillary optics were used simultaneously on three independent x-ray stations. One of the many new features of the puller is an optical micrometer that automates measuring the exact shape of the glass tubes after the draw. He described a LabView program that automates the drawing process, and how the divergence and spot size of each optic are tailored to match the requirements of each application. Recent optics have featured spot sizes up to 50 microns, and as low as 5 microns in diameter. The quality of the optics are well matched to the x-ray source sizes experienced at CHESS.

Post Doctoral fellow Xiangyun Qiu, working in the Pollack group in Applied and Engineering Physics, discussed their recent publication “Measuring the Force Between DNAs in Solution” [Physical Review Letters **96**, 138101 (2006)]. Xiangyun talked about solution scattering from well-defined DNA molecules, and how x-ray data yield a quantitative measure of the inter-DNA potentials. Being acids, DNA molecules in solution are highly charged and repel one another. As salt is added to the solution, the repulsive forces are screened and the molecules interact more. The Pollack group used small-angle x-ray scattering (SAXS) to probe thermodynamic information and measure the size and shape of molecules. Numerical predictions of electric field isosurface models agree well with their x-ray measurements.

The audience was actively engaged during the presentations with discussions about existing G-line capabilities, experimental techniques and needed improvements. As in the past, this symposium proved to be a valuable educational exercise, with the audience sated by both pizza and an excellent discourse in science.



Shown at right is a tapered glass capillary optic used to focus x-ray beams down to 10 microns or so in size. The input end is stained brown by long-term x-ray damage to the glass. This optic was fabricated by graduate student Sterling Cornaby and is pictured in use to focus a small x-ray beam onto an oil painting. Confocal x-ray fluorescence mapping is used to examine buried paint layers.



A thin foil multilayer, with alternating aluminum and nickel layers, releases heat and light as the layers react to form a metallic compound. At the CHESS A2 station small x-ray beams focused by a tapered glass capillary records the structure of the compound as the reaction front moves across the foil. [**Photograph by:** Maximilian Franz courtesy of Reactive NanoTechnologies (RNT). From the Hufnagel and Weihs groups at Johns Hopkins University]