Chemistry 501 Seminar
Thursday, October 25, 2012
3:45 p.m. Buehler 555
Seminar is not Webcast
Refreshments, 3:30pm, Buehler 513

Dr. Zhenxian Liu
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Hosted by: Dr. Jan Musfeldt

“Synchrotron Infrared Spectroscopy under High Pressure:
Application to Simple Molecular Systems”

Biography
Dr. Zhenxian Liu obtained his PhD degree in Solid State Physics at Jilin University in Changchun, China in 1990. After a postdoctoral position at the Institute of Semiconductors at the Chinese Academy of Sciences, he moved to a Staff Scientist Position at the same institute. He was then a Visiting Scientist at the Max-Planck Institute for Solid State Research in Stuttgart, Germany for a couple of years. Following his time in Europe, he moved to the US in 1998 to become a Research Scientist/Beamline Scientist at the Geophysical Laboratory of the Carnegie Institution of Washington. His research interests include the high-pressure behavior of materials, particularly Earth and planetary materials and the development of high-pressure methods and analytical techniques such as micro-optical spectroscopy, synchrotron infrared spectroscopy, laser heating, moissanite anvil cells, and high-pressure cryogenic methods.

Abstract
The study of the effects of pressure on materials is fundamental to understanding a broad range of problems in chemistry, Earth and planetary sciences, physics, biology, materials science, and high-technology. Increasing pressure on materials can radically alter the physical and chemical properties of materials. Tremendous progress and breakthroughs in the development of ultrahigh-pressure diamond-anvil cell techniques have been made in the past several decades. For example, the behavior of materials at pressures comparable to those found near the Earth’s inner core (i.e., roughly to >300 GPa) can be studied under sustained conditions with unprecedented accuracy, precision, and sensitivity. High-pressure spectroscopy provides essential and often unique information about the properties of materials under these conditions. For instance, vibrational infrared (IR) spectroscopy provides detailed information on bonding properties of crystals, glass, and melts, thereby yielding a microscopic description of thermochemical properties. Infrared measurements also provide information on electronic excitations including crystal-field, charge-transfer, excitonic spectra of insulating and semiconducting materials, interband and intraband transitions in metals, and pressure-induced metallization of insulators.

Using synchrotron radiation for infrared studies substantially improves our ability to probe microscopic samples including in situ measurements under extreme conditions due to its high brightness, broad-spectrum distribution, and diffraction-limited performance. The infrared radiation at the VUV ring of the National Synchrotron Light Source (NSLS), Brookhaven National Laboratory has world-class performance with up to ~10^4 times the brightness of a conventional thermal (lamp) source. The dedicated high-pressure beam line U2A on the VUV ring of the NSLS is an integrated facility for a wide range of microspectroscopic studies from ambient to ultrahigh pressures and at variable temperatures. In this presentation, I will introduce the development of high-pressure diamond-anvil cell techniques; synchrotron based infrared spectroscopy and their application to simple molecular systems including cyclopentane, H_2O, and dense hydrogen above 300 GPa.

Website: https://www.gl.ciw.edu/bios/zliu