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October 22, 2007

**Departmental Colloquium**

***" Type Ia Supernovae "***

3:40 PM - Thursday, October 25, 2007  
109 Nicholson Hall

**Ron Webbink**  
**University of Illinois-Urbana-Champaign**

*Host - Juhan Frank*

• Refreshments served at 3:15 PM in 229 Nicholson Hall •

Key to the discovery of Dark Energy and the accelerating expansion of the Universe has been the use of supernovae of type Ia (SNe Ia) as standard candles to map that expansion as a function of redshift. These supernovae result from explosive carbon burning, and they occur among stellar systems of all ages, even those too old to retain single stars capable of reaching carbon ignition or core collapse. Evidently, they are the products of interacting binary star evolution. But what kind of binaries? Finding the answer to that question is itself key to identifying and unraveling any evolutionary effects which may bias their use as cosmological distance indicators. Are they single-degenerate binaries (white dwarf plus 'normal' stellar donor), or double-degenerates (merging double white dwarfs)? Both camps face major theoretical hurdles, and mounting observational evidence (all of it indirect) now further constrains the viability of these models. Still, the high frequency of SNe Ia implies that they are the evolutionary end-point of a very large fraction of intermediate-mass binaries...

**Special Seminar**  
**Material Science and Engineering**

***"Is a Nanoparticle's Beauty Skin Deep? Surface Effects on the Structure and Properties of Nanoparticles"***

3:40 PM - Tuesday, October 23, 2007  
109 Nicholson Hall

**Lou Terminello**  
**Lawrence Livermore National Laboratory**  
**Dave Ederer, CAMD - Host**

In collaboration with: T. van Buuren, T. M. Willey, R. W. Meulenberg, J. R. I. Lee, J. E. Dahl, R. M. K. Carlsson, C. Bostedt

In our work on the manipulation and quantitative interrogation of nanostructures, we use synchrotron radiation-based spectroscopies and scanned probe microscopies to determine the atomic and electronic structure of reduced dimensional and nanostructured materials. In many cases, these measurements are compared directly with first principles calculations to extract high-fidelity structure-property information from our measurements. The focus of this research is: how can we better understand the role a surface plays in the structure and properties of nanoparticles and nanostructured materials?

We have performed core and valence level photoemission, near-edge core level photoabsorption, and soft x-ray fluorescence experiments on a number of nanocluster, self-assembled monolayer, and implanted films, using synchrotron radiation. We explored the size, surface, and structure relationship of diamondoid molecules that represent the asymptotic size-limit for nanocrystalline diamond and are comparing these results to our earlier work on diamond nanoclusters and other Group 4 nanodots. We have also determined the unique properties of other CdSe-based nanoclusters correlating their structure with preparation, exposure, and surface conditions. This has had an impact on emerging biological/chemical sensor and molecular electronics technologies.

Lastly, I will present a brief view of where future scientific opportunities may lie in the use and development of future synchrotron radiation capabilities.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory, BES Materials Sciences under Contract DE-AC52-07NA27344; also W-DE-AC03-76SF00098 at the ALS (LBNL), DE-AC03-76SF00515 at the SSRL (SLAC). C. Bostedt acknowledges financial support from the German Academic Exchange Serv - ice DAAD in the HSP-III program

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## **Material Science and Engineering**

### **"Synthesis of classes of non-carbonaceous nanostructures"**

3:40 PM – Wednesday, October 24, 2007  
109 Nicholson Hall

Stanislaus S. Wong  
SUNY Stony Brook  
Jayne Garno, Chemistry – Host

We describe advances in the synthesis of non-carbonaceous nanoscale structures, such as nanoparticles, nanorods, nanowires, nanocubes, and nanotubes, which have attracted extensive synthetic attention as a result of their novel size-dependent properties. Many of the synthetic methods used to attain these goals have been based on principles derived from semiconductor technology, solid state chemistry, and molecular inorganic cluster chemistry. We describe a number of advances that have been made in the reproducible synthesis of various ternary oxide nanomaterials, including alkali-earth metal titanates, alkali metal titanates, bismuth ferrites,  $ABO_4$ -type oxides, as well as fluorides and other miscellaneous classes of ternary oxide materials

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### **Congratulations To:**

Dr. Ravi Rau who has been elected Vice-Chair of the APS (American Physical Society) Topical Group on Few-Body Problems.

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### **Publications:**

- "Do unbounded bubbles ultimately become fenced inside a black hole?" F.S. Guzman, L. Lehner and O. Sarbach. Phys.Rev.D76:066003,2007.