UNH Materials Science Seminar

13:10-14:00, Wednesday, Nov. 18, 2009
Kingsbury Hall N343
University of New Hampshire

Synthesis and characterization of molecules and atomic clusters embedded in helium nanodroplets

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Clusters of helium atoms were among the very first atomic clusters deliberately synthesized in the gas phase, spurred by an interest in understanding superfluidity in finite systems. Interest faded with the advent of more strongly bound clusters that showed unexpected features, including electronic shell structure in alkali metals, size-dependent chemical reactivity of transition metals, and new forms of carbon. Renewed interest in helium clusters awakened with the realization that helium droplets offer an avenue for synthesis and characterization of novel complexes at subkelvin temperatures. As aptly noted by Toennies and coworkers (M. Farnik and J. Toennies, J. Chem. Phys. 122, 014307 (2005)) helium droplets may serve as *flying nano-cryo-reactors*.

In this talk I will review some of the unique features of helium nanodroplets; I will also discuss specific experiments performed at the University of Innsbruck. This work probes the response of weakly bound clusters of hydrogen, argon, and water or ammonia co-embedded with C_{60} to electron impact ionization and low-energy electron attachment. Results include the formation of even-numbered hydrogen cluster cations that are not observable if bare hydrogen clusters are ionized, enhanced stability (magic numbers) of argon clusters containing nitrogen or water impurities, and novel ion-molecule reactions between C_{60} and small water or ammonia clusters that point to the importance of doubly charged intermediates. Another topic are abundance anomalies in the size distribution of small cations or anions complexed with helium, i.e. $He_nX^{\pm}$; these spectra make it possible to determine the size of ions solvated in helium.

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