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EUV laser mass spectrometry and photoelectron spectroscopy of mass selected neutral clusters and molecules

A long standing set of goals for studies of systems of inhomogeneous, neutral clusters (e.g., MmXn or (molecule)p) has been to mass sort and select them individually for determination of physical and chemical properties of each neutral cluster by spectroscopic techniques. We have constructed appropriate instrumentation to achieve these important goals employing photoelectron spectroscopy (PES), driven by both visible (for MmXn-) and EUV (for MmXn0) radiation. Our 26.5 eV/photon EUV laser can ionize any neutral cluster or molecule (EUV PES) that can be identified and isolated. The algorithm includes the following steps: 1. generation of cluster negative ions in a laser ablation supersonic source with the addition, as required, of low energy electrons from a Y2O3 disk; 2. separation of these anionic clusters in a reflectron time of flight mass spectrometer (RTOFMS); 3.selection and slowing of specific, chosen clusters in a mass gate/momentum deceleration stage; 4.threshold photo-detachment of the sorted and selected negative ion clusters with a tunable VIS/UV laser to generate neutral, isolated clusters; and 5. EUV PES of these neutral clusters. Such studies generate vibrational and structural information on the ground states of the neutral clusters (through VIS/UV PES), and information on the ion states of the clusters (through EUV PES). The presentation will include PES results on various metal oxides, sulfides, and other cluster systems and molecules.

Biography

Bernstein received his Ph.D. degree from Caltech and was a post doctoral fellow at the University of Chicago. He has been at CSU since 1975 where he has studied molecular crystal vibrational and electronic excitons and phase transitions, cryogenic liquids, and gas phase clusters with a central focus on intermolecular interactions. Recently his research has focused on chemical reactions of neutral and ionic clusters. This latter research area has involved catalytic and photocatalytic cluster systems, solute/solvent systems, the reactions of ionized molecules and clusters, and initial steps in the release of stored energy molecular species.

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