DAMOP05-2005-000167

Abstract for an Invited Paper
for the DAMOP05 Meeting of
the American Physical Society

Photoelectron Spectroscopy of Rare Gas Clusters Using Synchrotron Radiation[1]

JOHN BOZEK, Lawrence Berkeley National Laboratory

Clusters of atoms and molecules occupy an intermediate state of matter between gaseous and condensed phases and offer unique opportunities to study the effects of condensation on the electronic spectroscopy of matter in a controlled manner. The evolution of atomic and molecular orbitals into the electronic bands exhibited by solids can be examined as a function of cluster size using photoelectron spectroscopy, for example. A program to investigate the photoionization of clusters using synchrotron radiation has begun at the Advanced Light Source synchrotron at Lawrence Berkeley National Laboratory. A skimmed continuous supersonic beam source has been adapted to three existing photoelectron spectrometers; 1) a high resolution hemispherical analyzer, 2) a pair of high resolution time-of-flight (TOF) electron spectrometers, and 3) an electron spin sensitive Mott-TOF spectrometer [1]. Results from each of the three instruments will be discussed. Utilizing circularly polarized synchrotron radiation, we have studied the spin polarization of the Xe 4d photolines of large Xe clusters using the Mott-TOF spectrometer. Previous studies of the angular distributions of Xe 4d photoelectrons from these clusters identified a reduced anisotropy in the electron emission that was attributed to elastic scattering of photoelectrons by surrounding atoms in the cluster [2]. To further investigate this hypothesis we have used our spin-TOF spectrometer to measure the effect of clustering on the spin polarization of the electrons. Spin polarization measurements will be shown which show a reduced polarization for electrons emerging from the inner part of the cluster, supporting the proposed model of elastic scattering.
References: [1] N. Berrah *et al.*, J. Electron Spectrosc. Relat. Phenom. **101**, 1 (1999). [2] G. Öhrwall *et al.*, J. Phys. B **36**, 3937 (2003).

[1]This work was supported by the Director, Office of Science, Office of Basic Energy Sciences, of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.