APR05-2005-000307

Abstract for an Invited Paper
for the APR05 Meeting of
the American Physical Society

Collisions with molecular targets

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Something interesting and often unexpected happens when you excite a reaction close to its threshold. In threshold photoionisation the target is ionised just above a reaction onset. Photoelectrons are produced with energies that are typically in the range from zero to a few meV and these are detected by analysers tuned to these low energies. The studies are valuable because they give both dynamic and spectroscopic information. They also have a number of experimental advantages. Close to threshold, the low energy photoelectrons move only slowly away from the ion core allowing ample time for electron correlation effects to become dominant. These correlation effects are particularly important for double photoionisation Also, close to threshold, indirect processes can become dominant. In the case of molecules this can lead to the observation of vibrational excitation well outside the Frank-Condon region. On the experimental side, the threshold technique offers the advantages of very high resolution and simultaneously very high detection efficiency. This means that they can give spectroscopic information at the rotational level. The very high resolution is well matched to the high photon resolution provided by current synchrotron radiation sources. The very high detection efficiency facilitates the use of coincidence techniques that are required for the study of double ionisation, where both photoelectrons are detected simultaneously.