PHOTODETACHMENT MICROSCOPY OF MOLECULAR ANIONS

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Photodetachment microscopy consists in recording the freed-electron interferogram produced when a negative ion undergoes photodetachment in the presence of an electric field. Sensitivity of the interference pattern to the ejection energy of the electron makes the apparatus the most accurate ever built for electron spectrometry. A precision in the μeV range can be reached, which was used to measure some atomic electron affinities with improved accuracy.

However the model used to describe the electron interference pattern is the free-electron approximation, which supposes that the excited electron undergoes no perturbation by the residual neutral core. This approximation becomes questionable when one deals with a molecular anion, the neutral residue of which may have a permanent electric dipole. This will produce a non-negligible external field, which could appreciably perturb the interfering electron trajectories.

The first molecular photodetachment experiment has been carried out on OH^-, which has the advantage of well separated vibrational and rotational detachment thresholds. Surprisingly enough, the electron interference pattern is still observable, even when OH happens to be left in a high angular momentum state, which shows that molecular rotation is not enough to blur the interference out. Electron interferograms and quantitative data will be presented at the conference.