

PHOTOELECTRON DIFFRACTION FROM FIXED-IN-SPACE MOLECULES OF HYDROCARBONS (C₂H₂ AND C₂H₄)*.

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Free molecules of acetylene (C₂H₂) and ethane (C₂H₄) have been photo-ionized by X-rays just above the carbon K-edge. This photoionization is followed with high probability by an Auger decay and subsequent molecular dissociation. Using a momentum-imaging technique, the momenta of the photoelectron and all charged molecular fragments were measured in coincidence. The photoelectron angular distribution, as a function of molecular orientation with respect to the polarization axis, was then obtained. The photoelectron yield, as a function of X-ray energy, shows the presence of a shape resonance around 15-20eV above the ionization potential of the carbon K-shell electron. From this the complex amplitudes of the partial waves describing the photoelectron outgoing wave were obtained. These amplitudes can be used to provide information about the molecular potential in which the photoelectron moves.

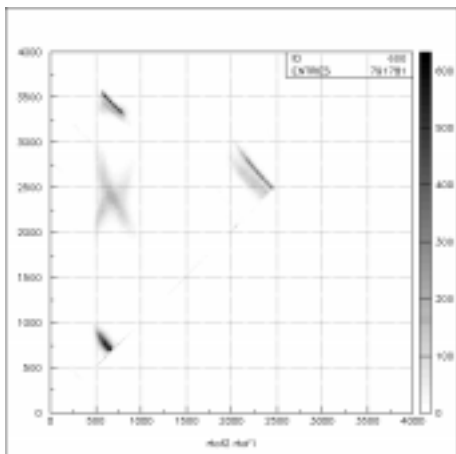


Figure 1: PIPICO specter: time-of-flight for the first recoil versus time-of-flight for the second recoil of the C₂H₂ molecule breakup. Different breakup channels of the molecule are clearly shown.

Presented analysis resolves the ongoing debate about the presence of the f-wave resonance in hydrocarbons [1].

References

[1]. B. Kempgens *et al.* Phys. Rev. Lett. 79, 35-38 (1997).

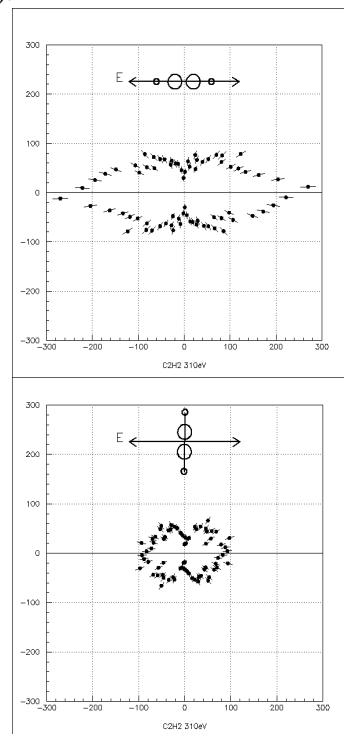


Figure 2: Angular distribution of 20eV K-photoelectrons from C₂H₂ by linearly polarized light. The plane of the figure is perpendicular to the light propagation. The orientation of the molecule with respect to the polarization axis is shown on the top of each picture.

* Supported by the Chemical Sciences, Geosciences and Biosciences Division, Office of Basic Energy Sciences, Office of Science, U. S. Department of Energy.

