(C2H2 AND C2H4)*

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Free molecules of acetylene (C_2H_2) and ethane (C_2H_4) 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.

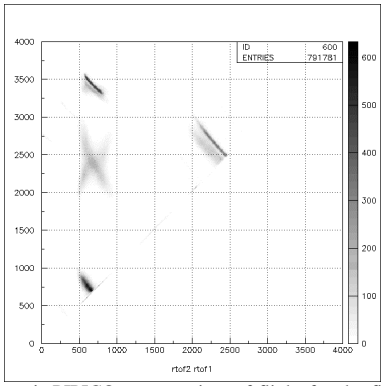

Figure 1: PIPICO specter: time-of-flight for the first recoil versus time-of-flight for the second recoil of the C_2H_2 molecule breakup. Different breakup channels of the molecule are clearly shown.

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).

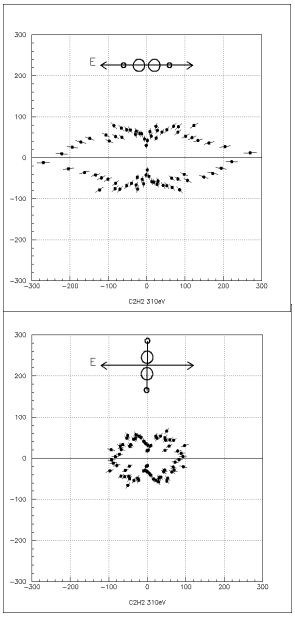

Figure 2: Angular distribution of 20eV K-photoelectrons from C_2H_2 by linearly polarized light. The plane of the figure is perpendicular to the light propagation. The orientation of the molecule with respect to the polarization axis is shown on the top of each picture.

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