

## THE PHOTOIONIZATION OF METHYL IODIDE (CH<sub>3</sub>I). THE THRESHOLD PHOTOELECTRON AND CIS SPECTROSCOPY

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In a previous report we described the results obtained by the spectroscopic investigation of the methyl halides CH<sub>3</sub>X (X=F, Cl, Br) [1]. Threshold photoelectron (TPES) and absorption spectra were obtained. The examination of the Constant Ion State (CIS)-spectra were restricted to the first few vibrational levels of the ionic X<sup>2</sup>E ground electronic state. Furthermore, the photoionization efficiency of the parent and of several fragment ions has also been measured.

The main aim of these measurements is the search for and the identification of high energy Rydberg states suspected to be involved in the production of ionic fragments, as revealed particularly by the surprisal analysis of the CH<sub>3</sub><sup>+</sup> kinetic energy distribution in CH<sub>3</sub>F [2], CH<sub>3</sub>Cl, CH<sub>3</sub>Br and CH<sub>3</sub>I.

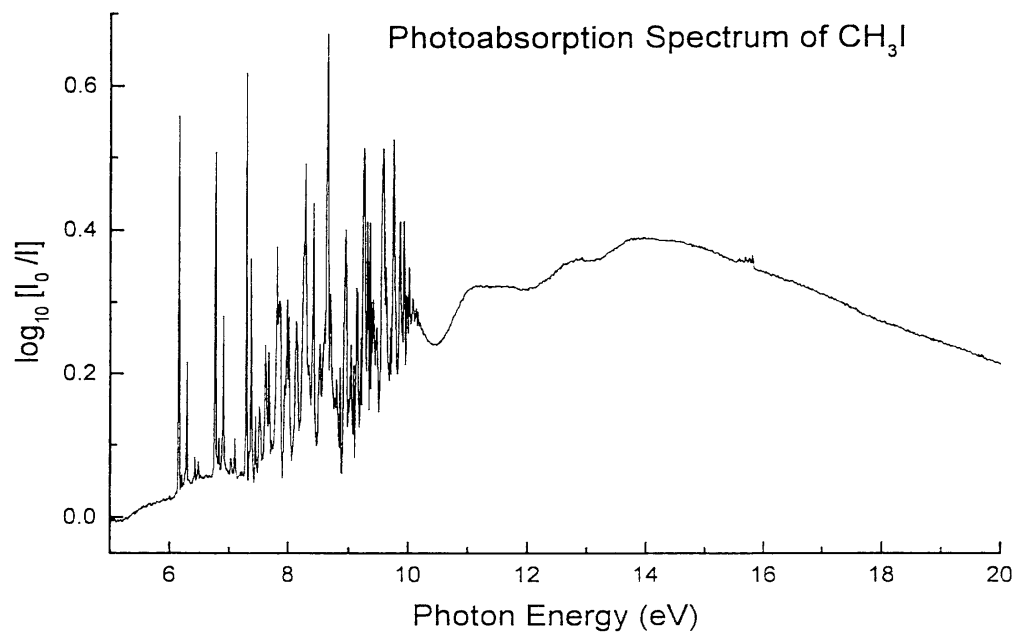
In the present contribution we will present the first results on the investigation of the photoionization of the methyl iodide (CH<sub>3</sub>I) molecule. Together with the threshold photoelectron spectrum and the CIS-spectra, results on the photoabsorption spectrum, recorded previously, will also be reported.

The present photoabsorption work was performed on the Im-NIM-1 beamline at the synchrotron radiation facility BESSY. Light is dispersed by a 1.5m-NIM monochromator equipped with a 1 200  $\ell$ /mm Al-grating and its entrance and exit slits were adjusted at 100 $\mu$ m [3]. The photoelectron spectroscopic work was carried out on the 3m-NIM monochromator (3m-NIM-1 beamline) equipped with a 2 400  $\ell$ /mm Pt-grating and for which entrance and exit slits were adjusted at 200 $\mu$ m. The photoelectrons were analyzed by a tandem electron spectrometer consisting of two 180° electrostatic deflectors working at constant pass energy [4].

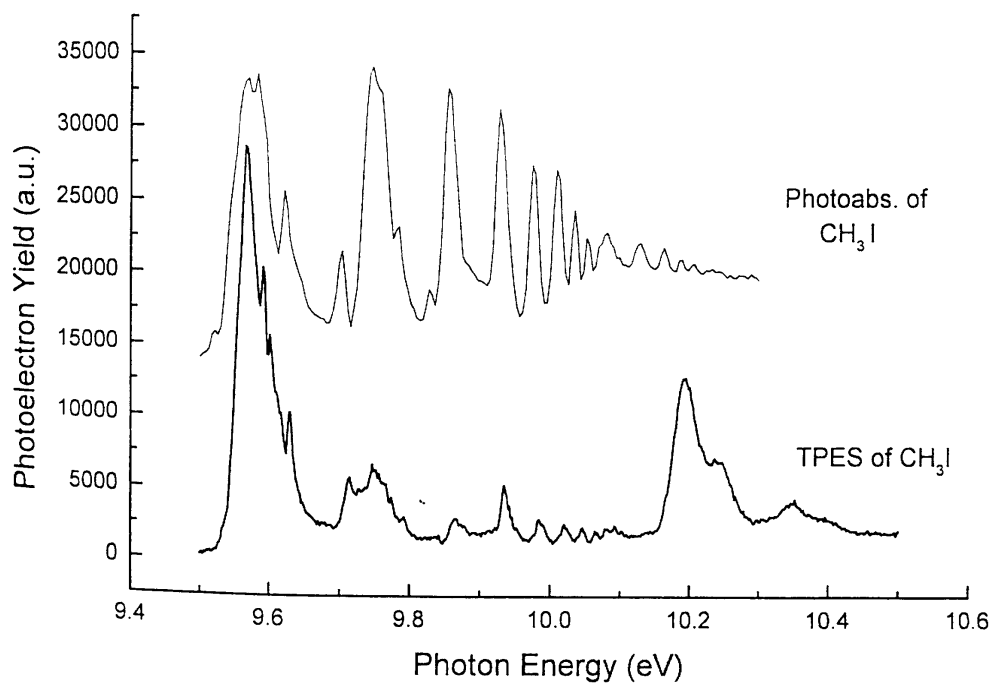
The VUV absorption spectrum of CH<sub>3</sub>I is shown in fig. 1 between 5-20 eV photon energy. Above 10 eV a few broad bands are observed at about 11.0 eV, 12.5 eV and 14.0 eV. Below 10 eV the fine structure has to be assigned to Rydberg series converging to the two CH<sub>3</sub>I<sup>+</sup> spin-orbit X(<sup>2</sup>E<sub>3/2</sub>-<sup>2</sup>E<sub>1/2</sub>) components. Each component shows its own vibrational structure. The part of the absorption spectrum consisting of Rydberg series converging to the X<sup>2</sup>E<sub>1/2</sub> ionization limit is shown on an expanded photon energy scale in fig.2, together with the TPES spectrum in the same energy range. The correlation is obvious. Fig.3 displays the

TPES spectrum and a high resolution CIS spectrum related to the  $X^2E_{3/2, v=0}$  vibronic state of  $CH_3I^+$ . This clearly shows that the preliminary analysis of the absorption spectrum is a powerful help for the interpretation of the TPES and the CIS-data.

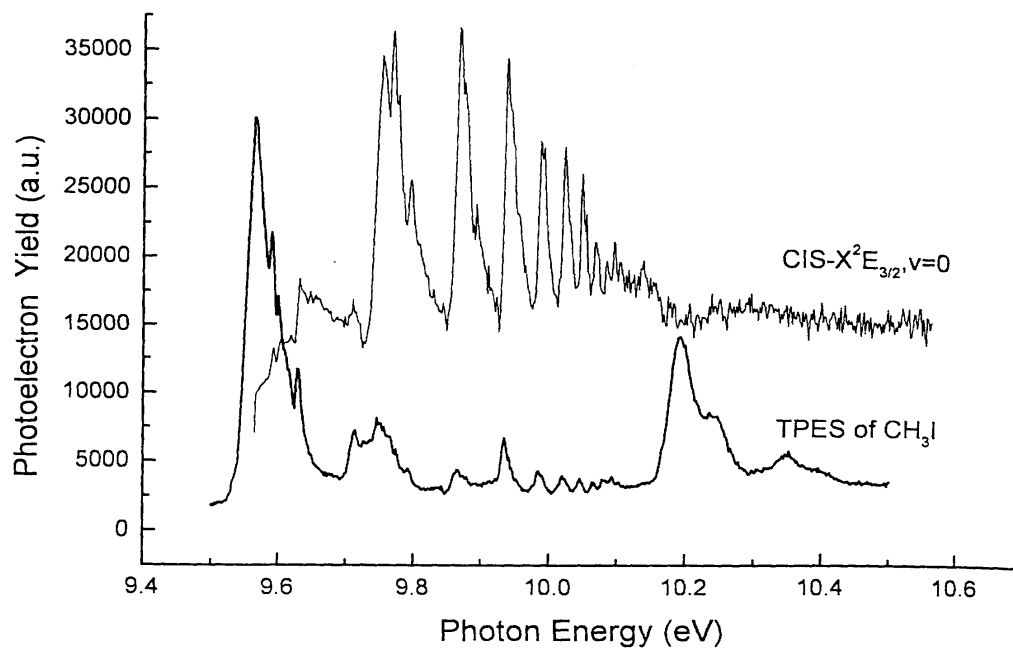
**Fig. 1:** The photoabsorption spectrum of methyl iodide between 5-20 eV photon energy.



**Fig. 2:** The threshold photoelectron (TPES) and the photoabsorption spectrum of methyl iodide between 9.5-10.5 eV photon energy.



**Fig. 3:** The TPES of methyl iodide and the CIS of the first vibrational level of the lowest spin-orbit  $X^2E_{3/2}$  component of  $CH_3I^+$  between 9.5-10.5 eV photon energy.



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### References.

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