PHOTOELECTRON EMISSION FROM HI USING NARROW-BAND, POLARIZED, COHERENT VUV-RADIATION

T. Huth, A. Mank, N. Böwering, G. Schönhense, R. Wallenstein, and U. Heinzmann

Universität Bielefeld, Fakultät für Physik, D-4800 Bielefeld, West-Germany

An experiment to study the Fano-effect[1] of molecules with very high resolution is in progress. The coherent VUV-radiation is generated by non-linear frequency-mixing of the radiation of two pulsed dye-lasers in Hg-vapor[2], producing typically 10^{10} photons/pulse at a repitition rate of 10 Hz. Linear or circular polarization of the VUV is selected by corresponding polarization of the dye-laser output. The spectral resolution of the VUV as determined by the bandwidth of the visible laser radiation is calculated to be $4.5 \cdot 10^{-4}$ nm.

In a first experiment the apparatus was used to measure the photoelectron yield of HI molecules in the autoionization region between the spin-orbit split $^2\Pi$ states. The set-up is shown in Fig. 1.

The photoelectrons were collected by an electrostatic quadrupole field[3] integrated over all emission angles and focused on a micro-channel plate. The charge of the electron pulse was detected and normalized to the VUV-intensity. A four-mirror-analyzer[4] probed the polarization of the VUV. For the measurement of the Fano-effect a Mott-scattering spin analyzer will be connected to the electron lens system, replacing the MCP (see Fig. 1).

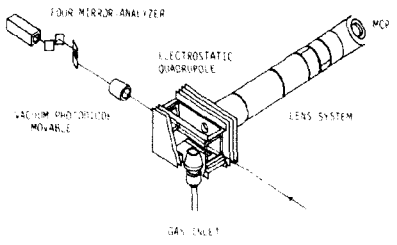

Fig. 1: Experimental set-up

First results are presented in Fig. 2 and compared with data from photoionization mass spectrometry[5] taken at a resolution of $7 \cdot 10^{-3}$ nm.

The highly resolved spectrum of Fig. 2c shows structure that cannot be explained completely by the results of a recent MQDT calculation[6]. Even with additional transitions taking into account vibrational excitation of the final state the complexity of the structure cannot be fully explained. The extent of the influence of rotational and vibrational excitation on the spectra will be discussed.

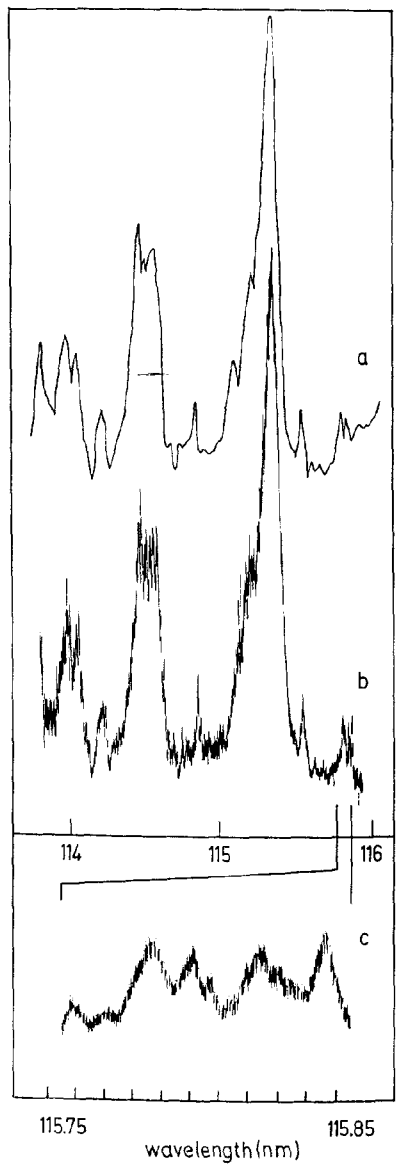

Fig. 2: Photoyield of HI
Comparison of the present data (b) with those of Ref. 5(a). A part of our spectrum is drawn on an expanded scale (c).

References

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