PHOTOABSORPTION SPECTROSCOPY AT MEDIUM RESOLUTION . THE C_2HXYZ (X,Y,Z = H, F, Cl and/or Br) MOLECULES.

R. Locht[1], B. Leyh[1], H.W. Jochims[2] and H. Baumgärtel[2].
[1]Département de Chimie, Université de Liège, Institut de Chimie, Bât. B6c, Sart-Tilman par B-4000 Liège 1, Belgium.
[2]Institut für Physikalische Chemie, Freie Universität Berlin, Takustrasse 3, D-14195 Berlin, Germany.

Since several years we proceed with the systematic investigation of halogenated derivatives of ethylene (C_2H_4). The photoabsorption and/or the photoionization of C_2H_3F and 1,1-$C_2H_2F_2$ [1], C_2H_3Cl [2,3] and C_2H_3Br [4,5] has been studied. The dissociaton dynamics of the $C_2H_3F^+$, 1,1-$C_2H_2F_2{}^+$ [1] and $C_2H_3Br^+$ [6] cations were investigated. The photoabsorption and photoionization spectroscopy of $C_2H_2Cl_2$ [7] and C_2H_2FCl [8] have also been examined by synchrotron radiation. Recently, the photodissociation of the cations and the kinetic energy distribution of the most abundant fragments have been measured by fixed wavelength photoionization (HeI, NeI and ArI/ArII resonance lines) in our laboratory.

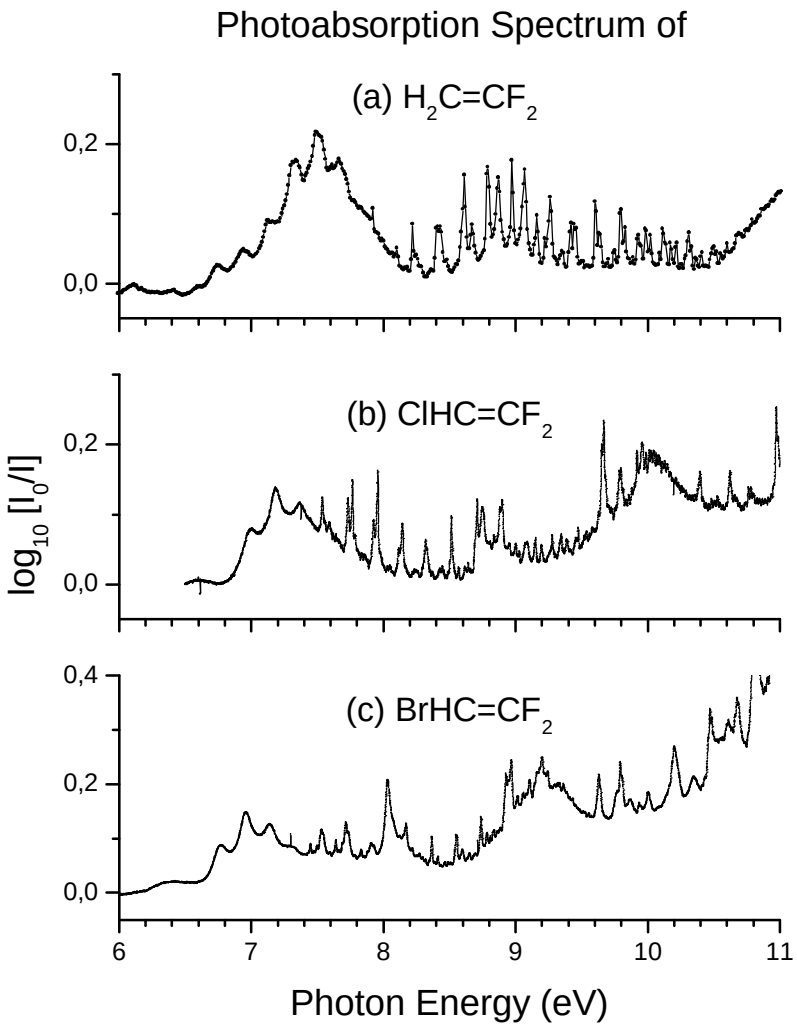

Fig.1 : Photoabsorption spectra in the 6-11 eV photon energy range : (a) 1,1-difluoro- (b) 1,1-difluoro-2-chloro- and (c) 1,1- difluoro-2-bromo-ethylenes.

We already measured the threshold- (TPES) and HeI-photoelectron spectra of the last mentioned compounds. The photoabsorption spectra recorded earlier with the 1.5m-NIM monochromator at BESSY I were of to low resolution. The aim of this work was to obtain the desired resolution, i.e. at least comparable to that obtained in the TPES spectra.

With the help of the 3m-NIM (on the 3m-NIM-2 beamline), equipped with the 2 400 l/mm Pt-grating, we didn't succeed to record any reliable photoabsorption spectrum over 1 eV photon energy range. This has been observed in the 5-25 eV region. Therefore, we switched over to the 600 l/mm

Al-grating coated with a MgF_2 layer. An important disadvantage of this type of grating is the presence of a reflectivity gap between 15-18 eV photon energy. Entrance and exit slit widths were adjusted at 25µm and 10µm respectively. Under these experimental conditions a resolution of 5000 is obtained.

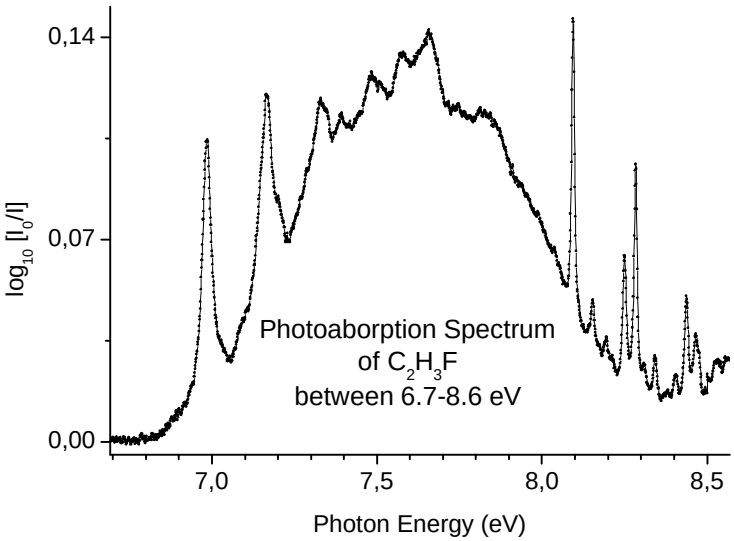

Fig.2 : Detail of the C_2H_3F photoabsorption spectrum between 6.7-8.6 eV photon energy.

Fig.1 shows typical photoabsorption spectra of 1,1-$C_2H_2F_2$, 1,1-difluoro-2 chloro- and 1,1-difluoro-2-bromoethylene between 6-11 eV photon energy. In fact, spectra have all been recorded between 5-25 eV photon energy. The resolution achieved in the present experiment, as shown in fig.2, allows us to reconsider the Rydberg series assignments and to make a detailed vibrational analysis, in most cases, for the first time. Many spectra show extended vibrational structures, with long progressions, at high energies, i.e. above 12 eV excitation energy. These results require careful investigations and further analysis for assignments.

Acknowledgment.

R.L. and B.L. gratefully acknowledge the Communauté Française de Belgique for the " Actions de Recherche Concertée" (A.R.C.) contract.

References.

[1]. F. Güthe, R. Locht, B. Leyh, H. Baumgärtel and K.M. Weitzel, J. Phys.Chem. 103 **(1999)** 8404.
[2]. R. Locht, B. Leyh, K. Hottmann, and H. Baumgärtel, Chem.Phys. 220 **(1997)** 207.
[3]. R. Locht, B. Leyh, K. Hottmann and H. Baumgärtel, Chem.Phys. 220 **(1997)** 217.
[4]. A. Hoxha, R. Locht, B. Leyh, D. Dehareng, K. Hottmann and H. Baumgärtel, Chem.Phys. 256 **(2000**) 239.
[5]. A. Hoxha, R. Locht, B. Leyh, D. Dehareng, K. Hottmann, H.W. Jochims and H. Baumgärtel, Chem.Phys. 260 **(2000)** 237.
[6]. A. Hoxha, R. Locht. A.J. Lorquet, J.C. Lorquet and B. Leyh, J. Chem.Phys. 111 (**1999**) 9259.
[7]. G. Tornow, R. Locht, R. Kaufel, H. Baumgärtel and H.W. Jochims, Chem.Phys. 146 **(1990)** 115.
[8]. R. Locht, B. Leyh, K. Hottmann and H. Baumgärtel, BESSY Jahresbericht **(1999)** 150.