ABOUT THE DOUBLE IONIZATION OF NH$_3$ AND CO$_2$. A COMPARISON BETWEEN PHOTOIONIZATION AND ELECTRON IMPACT


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The double ionization of NH$_3$ as well as the dissociative ionization of NH$_3$ into N$^{2+}$ has been investigated by electron impact. More recently Samson et al.$^2$ published the photoionization cross-section for NH$_3$ production down to 3.4 nm. No double ionization energy was determined.

In the frame of a dissociative electroionization work on CO$_2$, still in progress, the double ionization of this molecule has been investigated by electron impact in the 30-100 eV energy range.

The aim of this contribution is to report on the double photoionization of NH$_3$ and CO$_2$ and a comparison will be made with the electron impact results. The synchrotron radiation from the Berlin storage ring BESSY is dispersed by a TGM-monochromator in the wavelength region of 20-45 nm. A quadrupole filter is used for mass analysis.

Fig. 1. Electron impact (E.I.) and photoionization (P.I.) efficiency curves of NH$_3^{2+}$/NH$_3$.
Though of very low intensity, the \( \text{NH}_3^{2+} \) ion current could be recorded with an acceptable signal-to-noise ratio, at least in the threshold region (see fig.1). For comparison the earlier published first differentiated electroionization efficiency curve\(^1\) of \( \text{NH}_3^{2+} \) is reproduced in the same figure. Good agreement is found between the two experiments concerning the shape of the curves and the threshold energy. The lowest ionization energy is 34.8\(\pm\)0.2 eV by electron impact\(^1\). By photoionization this energy is measured at 34.5\(\pm\)0.1 eV. Both measurements disagree with the electron impact results of Dorman and Morrison, i.e. 33.7\(\pm\)0.2 eV and 36.5 eV.

Fig.2. Electron impact (E.I) and photoionization (P.I.) efficiency curves of \( \text{CO}_2^{2+}/\text{CO}_2 \)

The results of the investigation of \( \text{CO}_2^{2+} \) by photoionization and electron impact are shown in fig.2. The lowest onset is 37.5\(\pm\)0.1 eV by photoionization. By electron impact this onset is observed at 38.0 \(\pm\) 0.2 eV. These results disagree with some previous determinations made by photoionization\(^4\) and electron impact\(^3\). Good agreement is found with Auger electron spectroscopy\(^5\).

References