Absolute photodetachment cross sections of CN^- and C_3N^-

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Recent discovery of carbon chain anions in outer space [1] has generated a fresh interest in the study of astrophysical and astrochemical importance of anions in space. Abundance of these anions is strongly influenced by photodetachment, especially in photon dominated regions and circumstellar envelops. Out of very few anions identified so far in space, CN^- and C_3N^- [2, 3] are particularly interesting due to high electron affinities of their neutral counterparts (3.9 eV and 4.3 eV resp.). In the present work, absolute photodetachment cross sections of CN^- and C_3N^- were measured to be $[1.2 \pm (0.1)_{stat}\ (0.2)_{sys}] \times 10^{-17}$ cm^2 and $[1.4 \pm (0.1)_{stat}\ (0.4)_{sys}] \times 10^{-17}$ cm^2 respectively at ultraviolet wavelength 266 nm (4.66 eV). The experiment was carried out by measuring photodetachment decay rates of the ions trapped in an unconventional octupole ion trap as a function of the position of the UV laser pointed into the trap. Absolute cross sections were determined from the position dependent photodetachment rate maps (tomography images) as has been illustrated our previous works [4, 5].

It is noticed that the measured cross sections are much higher than the values used so far in model calculations. Thus the present results are particularly important as an input for model calculations to predict abundances of these anions in space where photodetachment plays a major role in their destruction mechanisms.

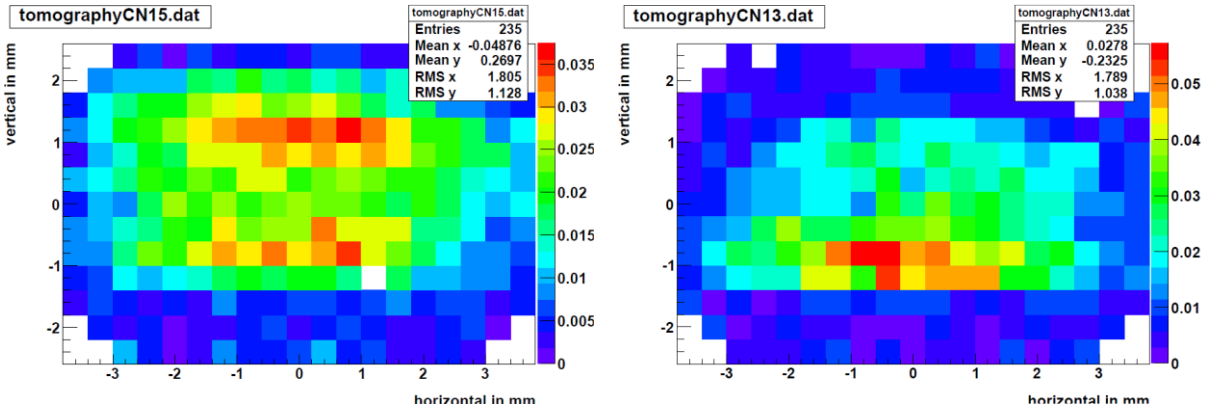

Fig 1: Tomography images of CN^- ion distribution inside the trap from two different measurements. Photodetachment cross sections determined from these measurements match within 5% illustrating that the cross section measurement is essentially independent of the shape of the ion distributions.

References:

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