

MEASUREMENTS OF ABSOLUTE, SINGLE CHARGE EXCHANGE CROSS SECTIONS OF H^+ , He^+ AND He^{2+} WITH H_2O AND CO_2

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Absolute measurements have been made of single electron, charge exchange cross sections of H^+ , He^+ , and He^{2+} in H_2O and CO_2 in the energy range 0.3 - 7.5 keV/amu. The results are relevant to the recent interesting problem of the interaction of the solar wind with comets.

Charge exchange (ce) is an important process in solar and stellar atmospheres, the interstellar medium, planetary ionospheres, and in comets. The present work connects with recent satellite observations of X-rays produced through ce, in collisions of highly-charged solar wind ions with neutral species "boiling off" a comet nucleus as it approaches the Sun¹.

Described herein are results obtained with a new beam line on the JPL highly-charged ion facility using the *Caprice* electron-cyclotron resonance (ECR) ion source². Details of the experimental apparatus will be described elsewhere^{3,4}. In the present measurements collimated beams of H^+ , $^3He^+$ and $^3He^{2+}$ were produced in the ECR and focused into a collision cell with H_2O or CO_2 as targets. Single ce cross sections in $^3He^{2+}$ were measured by transmitting only He^+ and reflecting the parent He^{2+} using biased apertures. In the case of incident H^+ , He^+ , where the product is uncharged, the attenuation of the singly-charged ion was used to monitor the ce.

Results for the H_2O and CO_2 targets are shown in Figs. 1 and 2, respectively. Present results for H^+ agree within experimental errors with measurements of Ref. 5. Data of Koopman⁷ for H^+ and He^+ are roughly

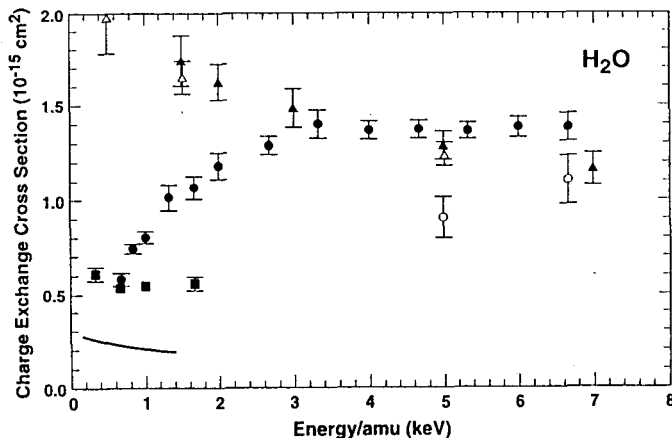


Figure 1. Absolute, single ce cross sections of H^+ , $^3He^+$, and $^3He^{2+}$ in H_2O for the energy range 0.3 - 7.5 keV/amu. Present data are H^+ (filled triangles), He^+ (filled squares), and He^{2+} (filled circles). Open triangles are data from Ref. 5 for H^+ , and open circles from Ref. 6 for He^{2+} . Solid line are data for H^+ from Ref. 7.

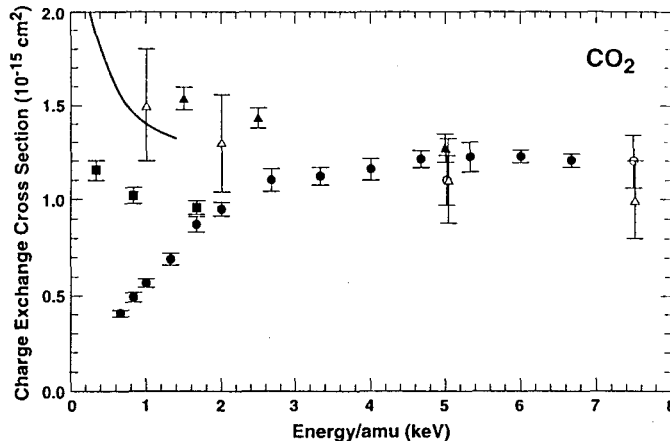


Figure 2. Absolute, single ce cross sections of H^+ , $^3He^+$, and $^3He^{2+}$ in CO_2 . Legend is the same as in Fig. 1 except for additional H^+ data from Ref. 8 (open triangles).

an order of magnitude smaller than present results for H_2O , but in better agreement for CO_2 .

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