# Laboratory Measurements of Solar-Wind/Comet X-Ray Emission and Charge-Exchange Cross Sections

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The detection of X-rays from comets such as Hyakutake, Hale-Bopp, d'Arrest, and Linear as they approach the Sun has been both unexpected and exciting. This phenomenon, moreover, should be quite general, occurring wherever a fast solar or stellar wind interacts with neutrals in a comet, a planetary atmosphere, or a circumstellar cloud. Comet-modeling calculations to date have (a) used an approximate, over-barrier expression for the charge-exchange (CE) cross section, (b) assumed a flat energy dependence of cross section, and (c) neglected multiple charge exchanges. In support of the understanding of the X-ray emissions (their intensity and spatial extent) laboratory measurements have been carred out at the JPL Highly-Charged Ion Facility [1]. The projectiles have been partially- and fully-stripped H, He, C, N, O, and Ne ions interacting with the comet molecules $He, H_2, CO, CO_2$, and $H_2O$. Absolute CE cross sections have been measured, and normalized X-ray emission cross sections reported for these *major* HCI components of the solar wind [2-5]. The *minor*, heavier HCI components will produce high-energy X-rays. A large body of data has been acquired on $Fe^{(5-13)+}$[6]. The experimental approach will be discussed and results given. Future work will be extended to $Mg^{q+}$ charge states, and include as well $NH_3$ as the target.

**References**:

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