

DAMOP06-2006-000424

Abstract for an Invited Paper  
for the DAMOP06 Meeting of  
the American Physical Society

**X-Ray Emission Cross Sections following Charge Exchange by Multiply-Charged Ions of Astrophysical Interest<sup>1</sup>**  
RONALD OLSON, Physics Department, University of Missouri-Rolla

State selective *nl*-electron capture cross sections are presented for highly charged ions with  $Z = 6-10$  colliding with molecules. The energy range investigated was from 1 eV/amu ( $v = 1.4 \times 10^6$  cm/s) to 100 keV/amu ( $v = 4.4 \times 10^8$  cm/s). The K-shell x-ray emission cross sections are determined by using the calculated state-selective electron capture results as input and then applying the branching and cascading values for the photon emission. A major shift in the line emission from being almost solely Lyman-alpha transitions at the highest collisions energies to strong high- $n$  to 1s transitions at the lowest energies is observed. The calculated emission cross sections are in reasonable accord with measurements made by Greenwood *et al*<sup>1</sup> for  $O^{8+}$  and  $Ne^{10+}$  on various targets at 3 keV/amu. The calculations are also in accord with x-ray emission cross section data obtained on the EBIT machine at LLNL where  $O^{8+}$  and  $Ne^{10+}$  high resolution measurements were made at a temperature of 10 eV/amu for a series of targets with varying ionization potentials. The  $Ne^{10+}$  data clearly show the contribution from multiple capture followed by Auger autoionization in the line emission spectra. Our calculated line emission cross sections are used to provide an *ab initio* determination of the soft x-ray spectrum of comet C/Linear 1999 S4 that was observed on the Chandra X-ray Observatory. The calculations reproduce the measured spectrum and show that it is due to charge exchange of the neutral gases in the comet's coma with the ions of the slow solar wind. Details of the calculations are presented in a recent paper by Otranto *et al*<sup>2</sup>. 1. J. B. Greenwood, I. D. Williams, S. J. Smith and A. Chutjian, *Phys. Rev. A* **63**, 062707 (2001). 2. S. Otranto, R. E. Olson, and P. Beiersdorfer, *Phys. Rev. A* (in press).

<sup>1</sup>Work supported by the Office of Fusion Energy Sciences, DOE.