K-Shell Photoionization of Singly Ionized Atomic Nitrogen

M F Gharaibeh, J-M Bizau, D Cubaynes, S Guilbaud, N El Hassan, M M Al Shorman, C Blancard and B M McLaughlin

Synopsis

Satellites Chandra and XMM-Newton currently provide a wealth of x-ray spectra of astronomical objects; however, a serious lack of high-quality atomic data impedes the interpretation of these spectra [1]. Spectroscopy in the soft x-ray region (5-45 Å) including K-shell transitions of C, N, O, Ne, S and Si, in neutral, singly or doubly ionized states and L-shell transitions of Fe and Ni, provides a valuable tool for probing the extreme environments in active galactic nuclei (AGN’s), x-ray binary systems, cataclysmic variable stars (CV’s) and Wolf-Rayet stars [2]. Our work provides benchmark values for cross sections on photoabsorption of x rays in the region of the n=2 inner-shell resonance states of singly atomic nitrogen.

Absolute K-shell photoabsorption cross sections for singly ionized atomic nitrogen have been obtained, using experimental and state-of-the-art theoretical methods. $N^+$ ions are produced in the gas-phase using a 12.6 Ghz electron-cyclotron-radiation ion-source (ECRIS). The photon beam is monochromatized synchrotron radiation from the PLEIADES beam line at SOLEIL. Two undulators with 256 mm and 80 mm period deliver photons in the 10 - 100 eV and 100 eV - 1000 eV energy ranges, respectively, with all types of polarization above 55 eV.

The interplay between experiment and theory has enabled the identification and characterization of the strong 1s $→$ 2p resonances observed in the energy region 398 eV - 402 eV. Figure 1 shows a sample of the experimental photoionization cross-section measurements compared with MCDF and R-matrix calculations in the photon energy range 398 eV - 406 eV. In the energy region 398 eV - 402 eV the observed peaks in the experimental cross-section data are due to the 1s2e$^2$2p$^3$ and 1s2e$^2$2p$^4$ resonances. Further details and a comprehensive set of results will be presented at the meeting.

References

[1] McLaughlin B M 2001 Spectroscopic Challenges of Photoionized Plasma (ASP Conf. Series vol 247) ed G. Ferland and D. W. Savin (San Francisco, CA: Astronomical Society of the Pacific) p 87

[2] Skinner S L et al. 2010 Astronom. J. 139 825

E-mail: mgharaib@yahoo.com
E-mail: b.mclaughlin@qub.ac.uk