ELECTRON-IMPACT CROSS SECTIONS OF ATOMIC OXYGEN

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Electron-impact cross sections for the $2p^4\ ^3P$-$3s\ ^3S^o$ (130.4 nm), $2p^4\ ^3P$-$3d\ ^3D^o$ (102.7 nm), $2p^4\ ^3P$-$3s'\ ^3D^o$ (98.9 nm) and $2p^4\ ^3P$-$3s''\ ^3P^o$ (87.8 nm) transitions of atomic oxygen are presented [1].

Emission cross sections were measured using a magnetically confined electron beam in collision with atomic oxygen produced by an extended microwave discharge source in a crossed-beam arrangement. A 0.2 m vacuum ultraviolet (VUV) diffraction spectrometer was used to record the emission. Excitation functions were measured with and without a discharge in the microwave cavity. These data, along with the dissociation fraction of the discharge source (measured by monitoring the emission of the second negative band system of O_2^+ under discharge-on and -off conditions [2]) allowed for the isolation of the atomic emission signal from that due to dissociative excitation of O_2. The excitation functions were put on the absolute scale by normalizing to the O I (130.4 nm) cross section produced by dissociative excitation of O_2 at 100 eV impact energy [3].

A 60-state model of the O I electron reaction structure has been used to extract the excitation cross sections (emission and direct excitation) from the experimental measurements. The cross sections in the architecture have been adjusted to conform to the measured emission cross sections reported here. The calculations of the emission system given here are carried out in exact statistical equilibrium at the fine structure level. The modeled cross sections are calculated analytically using a combination of collision strength gaussian functions simulating resonance or electron exchange processes in combination with a modified Born approximation [4]. The modeled cross sections are established on the basis of consistency of the results with the four excitation functions obtained in the present experiment.

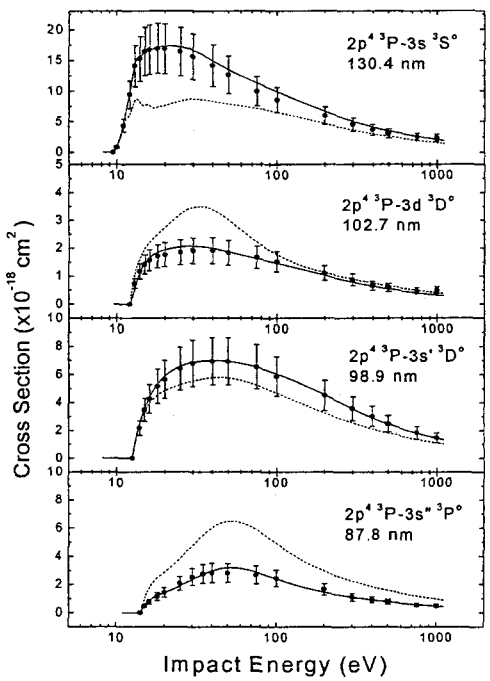

Fig. 1. Electron-impact cross sections of atomic oxygen (experimental emission cross sections-solid circles, modeled emission cross sections-solid line, modeled direct excitation cross sections-dash line).

References:

[1] Johnson P. V., Kanik I., Shemansky D. E., andLiu X., 2003 *J. Phys. B* submitted

[2] Noren C., Kanik I., Johnson P. V., McCartney P., James G. K. and Ajello J. M 2001 *J. Phys. B* **34** 2667

[3] Noren C., Kanik I., Ajello J. M., McCartney P. and Makarov O. P. 2001 *Geophys. Res. Lett.* **28** 1379.

[4] Shemansky D. E. and Liu X. 2003 to be submitted to *J. Geophys. Res.*