LOW ENERGY DIFFERENTIAL AND INTEGRAL ELECTRON EXCITATION CROSS SECTIONS FOR THE $2p^4\,^3P$-$3s\,^3S^o$ TRANSITION IN ATOMIC OXYGEN

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Electron-impact of atomic oxygen plays an important role in many natural systems. Earth's airglow and aurora contain strong vacuum ultraviolet (VUV) emissions due to electron-impact excitation of atomic oxygen. Similar emissions are seen in the atmospheres of other planets such as Mars and Venus. VUV emission lines of neutral atomic oxygen also appear in solar and stellar spectra. The presence of these emission lines provides a diagnostic tool capable of inferring the energy input and other physical characteristics of these systems.

Despite the importance of electron–oxygen collisions in nature, there has been little work done in the important "near-threshold" region, which corresponds to stellar temperatures where neutral species such as atomic oxygen are abundant. Currently, only Doering and Yang [1] have measured differential and integral cross sections of the $2p^4\,^3P$-$3s\,^3S^o$ (130.4 nm) transition at near threshold energies. We have therefore sought to compliment these results with an independent determination of the cross sections [2].

Electron energy-loss spectra of atomic oxygen were measured over an angular range of 0° to 25° at impact energies between 15 and 27.5 eV. A double hemisphere electrostatic gun provided a near mono-energetic beam of electrons that collided at 90° with a beam of atomic and molecular oxygen produced in an extended microwave cavity discharge source. Scattered electrons were detected as a function of their energy-loss with a double hemisphere energy detector at a given angle.

Cross sections of the $2p^4\,^3P$-$3s\,^3S^o$ transition were determined relative to the "Longest Band" (LB) of O_2. The cross sections were then put on the absolute scale by normalizing to absolute LB cross sections. These normalization standards were determined through extrapolation of the LB cross sections measured by Johnson and Kanik [3] and Shyn *et al.*[4].

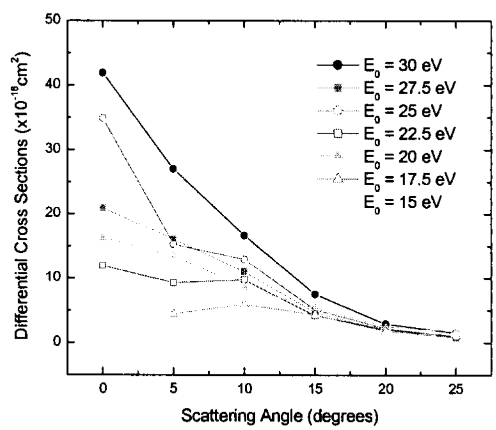

Fig. 1. Differential electron scattering cross sections of the 3s $^3S^o$ level of atomic oxygen from the $2p^4\,^3P$ ground state.

These differential cross sections are to be extrapolated out to 180° scattering angle using R-matrix theory as a guide to the correct high angle shape. The extrapolated cross sections will be integrated to provide integral cross sections at each impact energy.

References:

[1] Doering J. P. and Yang J. 2001 *J. Geophys. Res.* **106** 203
[2] Johnson P. V., Kanik I., and Tayal S. S. 2003 *J. Phys. B* to be submitted
[3] Johnson P. V. and Kanik I. 2001 *J. Phys.B* **34** 3041
[4] Shyn T. W., Sweeney C. J., and Grafe A. 1994 *Phys. Rev. A* **49** 3680