Temperature Dependent **Photoabsorption** Cross Section **Measurements of O_2** at Significant **Auroral** and **Airglow** Emission Lines

C. Norén, S. M. Ahmed and 1. Kanik

Jet Propulsion Laboratory, California lnst itute of '1'ethnology, Pasadena, CA 91109, USA

The analysis and interpretation of terrestrial ultraviolet (UV) airglow and auroral emissions require an accurate knowledge of absorption of the emission lines by the dominant atmospheric gases. In the terrestrial thermosphere, the only significant absorbing species at wavelengths longer than 1000 Å is OZ. The most prominent far ultraviolet (FUV) emission feature in the thermosphere, aside from scattered solar HI Lyman-a emission, is the 01 resonance triplet (^3P - 3_s,) near 1304 Å, for which the room-temperature measurements of Starr[1] remain the most commonly used values for the O_2 photoabsorption cross section[2,3]. However, Link et al.[4] pointed out that in the 100-200 km altitude region where absorption by O_2 is significant, the atmospheric temperature increases from 200 K to about 1000 K (the precise value being dependent upon solar activity), suggesting the need for temperature-dependent measurements for the important absorbing gases. Other important emission lines include the 01 1356 and 1641 Å emission lines and the NI 1200 Å triplet, 1492 Å triplet and 1742 Å doublet emission lines.

In this poster we present temperature-dependent measurements (at 295,373,473, and 573 K) of the O_2 photoabsorption cross sections at the aeronomically-important 01 (1304, 1356 and 1641 Å) and NI (1200, 1492 and 1742 Å) emission lines. A number of measurements of room temperature photoabsorption cross sections for O_2 in tbe UV region have been performed, however temperature-dependent photoabsorption cross section studies of O_2 are scarce[5]. While the temperature range (295 -573 K) used in the present measurements does not reach the highest temperature encountered in the thermosphere, absorption by O_2 is most important at the lower altitudes and temperatures[4]. The measured range should, therefore, suffice for aeronomic applications. A high current, low voltage argon mini-arc source was used as the light source and a 1 m sprectrometer was used to isolate each of the lines. The measurements were carried out at a spectral resolution of 0.5 Å (FWHM). Direct application of the Beer-Lar~~bert absorption equation yielded the absolute photoabsorption cross sections for O_2 at each line. To our knowledge, these measurements represent the first temperature-dependent 0_2 photoabsorpt ion cross sections at the aeronomically important emission lines of 01 and NI[6,7].

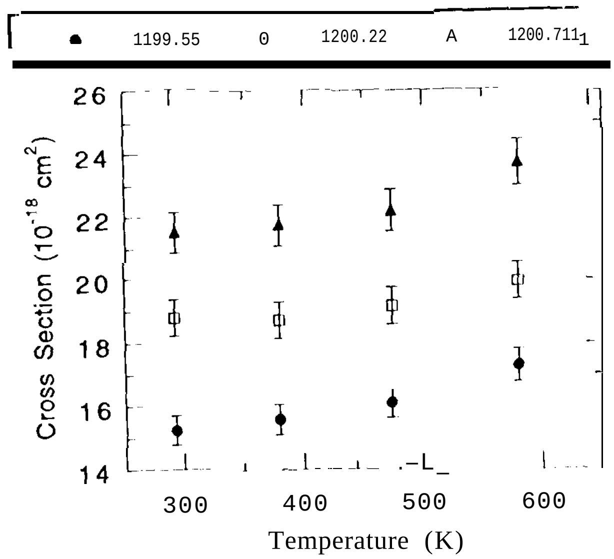

Fig. 1. Photoabsorption cross sections of O_2 at different temperatures for three NI wavelengths: 1199.5S, 1200.22, 1200.711 Å. The points are from experimental measurements. Error bars associated with the data arc also shown.

<u>References</u>

1. W. I.. Starr *J., Geophys. Res.* 81 (1976) 3363.

2. R. Link, S. Chakrabarti, G. R. Gladstone, and J. c. McConnell, *J. Geophys. Res.* 93 (1988) 2693.

3. R. Link, G. R. Gladstone, S. Chakrabarti, and J. C. McConnell, *J. Geophys. Res.* 93 (1988) 14,631.

4. R. Link, J. S. Evans, G. R. Gladstone, *J. Geophys. Res.* 99 (1994) 2121.

5. S .M. Ahmed, 1. Kanik and R. Link, *Chem. Phys. Lett.* 2S9 (1996) 545.

6. 1. Kanik, C Norén and S.M. Ahmed, *Chem. Phys. Lett.* (to be published, 1997).

7. C Norén, S.M. Ahmed and I. Kanik, *Chem. Phys. Lett.* (to be published, 1997).