HIGH-RESOLUTION NEAR-INFRARED SPECTROSCOPY OF THE SECOND NEGATIVE SYSTEM OF O_2^+

CHRISTOPHER P. MORONG, JENNIFER L. GOTTFRIED, and TAKESHI OKA, *Department of Chemistry, Department of Astronomy & Astrophysics, and the Enrico Fermi Institute, University of Chicago, Chicago, IL 60637*.

The second negative system ($A^2\Pi_u - X^2\Pi_g$) of O_2^+ has been spectroscopically studied for over 70 years[a] due to the significant role it plays in the chemistry of the upper atmosphere. More recently, the (2,18), (4,20), (6,20),[b] (3,18), (3,19), and (4,19)[c] bands were observed in the near infrared. While scanning for N_2^+ lines in a pure helium discharge containing N_2 as an impurity (<8 ppm) for another experiment,[d] we serendipitously found two new bands of O_2^+, (2,19) and (5,21). The O_2^+ ions were produced in a liquid-nitrogen-cooled positive-column plasma containing 1 Torr of He, where most likely the dominant source of oxygen in the plasma is a small leak in the vacuum system. The spectra were obtained with a Ti:sapphire laser (11,000-13,000 cm^{-1}) using velocity modulation, phase modulation with heterodyne detection, noise subtraction, and optical multi-passing. A detailed analysis of the newly observed bands will be presented.

[a] R. R. Laher and F. R. Gilmore, J. Phys. Chem. Ref. Data **20**, 685 (1991).
[b] L. Zheng et. al, J. Mol. Spectrosc. **229**, 131 (2004).
[c] L. Zheng et. al, J. Mol. Spectrosc. **226**, 81 (2004).
[d] See talk titled "High-Resolution Near-Infrared Spectroscopy of He/N_2/H_2 Positive-Column Plasmas" by J. L. Gottfried, C. P. Morong, and T. Oka.