

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.

^aR. R. Laher and F. R. Gilmore, *J. Phys. Chem. Ref. Data* **20**, 685 (1991).

^bL. Zheng et. al, *J. Mol. Spectrosc.* **229**, 131 (2004).

^cL. Zheng et. al, *J. Mol. Spectrosc.* **226**, 81 (2004).

^dSee 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.