

The Rovibronic Line fV Values of N₂ in the 91.6 nm Region: High-Resolution, High-Temperature

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We report measurements of the rotational f-values in the high temperature-dependent ultrahigh-resolution photoabsorption of N₂ in the 91.6 nm region. One of the important issues regarding the interpretation of the NII 91.6 nm extreme ultraviolet airglow emissions of the Earth, Titan, and Triton is the effect of temperature on the atmospheric extinction due to absorption by N₂ and O₂. Since the temperature of the upper atmosphere of the Earth is typically in the 200 to 900 K range it is therefore important to know these molecular cross sections at such temperatures. Absorption features in this region mainly involve the (11,0) band of the b-X transition, under room temperature conditions. We have carried out high resolution photoabsorption cross section measurements of N₂ with a resolution of 0.0003 nm and 0.0008 nm in the 91.5-91.728 nm region at temperatures of 600, 445, and 295 K. The 6VOPE (6.65-m vertical off-plane Eagle spectrograph) spectrometer facility available at the Photon Factory, KEK, Tsukuba, Japan, was employed in the present study. Additional intense rovibronic lines have been observed at high temperature conditions. They are tentatively identified as rovibronic transitions involving high rotational quantum numbers from the (12,1) band of the b-X, the (8,1) band of the b'-X, and the (3,1) band of the o3-X transitions. By integration over each individual absorption profile the rotational line f-values of N₂ are determined for the above-mentioned spectral region and experimental conditions. The most intense component of the NII multiplets at 91.6710 nm overlap with the rovibronic line Q₆ at 91.6703 nm. The NII 91.6710 nm feature is located slightly toward the line center of the Q₆ line of the (11,0) band of the N₂ b-X transition. However, at 445 K and 600 K this NII component completely falls inside the line shape of the Q₆ of N₂. Detailed results will be presented. This research is based on work supported by NSF grant ATM-0096761.