REVISION OF SPECTRAL PARAMETERS FOR THE B- AND γ-BANDS OF OXYGEN AND THEIR VALIDATION USING ATMOSPHERIC SPECTRA WITH THE SUN AS SOURCE

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Until recently the B ($b^1\Sigma_g^+$ (v=1)$\leftarrow X^3\Sigma_g^-$ (v=0)) and γ ($b^1\Sigma_g^+$ (v=2)$\leftarrow X^3\Sigma_g^-$ (v=0)) bands of oxygen in the visible region had not been used extensively in satellite remote sensing. However, these bands (in particular the B-band) are now being considered for future satellite missions. In this light, it is important to make sure that the reference spectroscopic parameters are accurate enough to provide means of deducing important physical characteristics from the atmospheric spectra. The energy levels and intensities currently given for these bands in the HITRAN spectroscopic database[a] had not been updated for over two decades.

We have collected the best available measured line positions that involve the $b^1\Sigma_g^+$ (v=1 and v=2) states for the three most abundant isotopologues of oxygen and performed a combined fit to obtain a consistent set of spectroscopic constants. These constants were then used to calculate the line positions. A careful review of the available intensity and line-shape measurements was also carried out, and new parameters were derived based on that review. In particular, line shift parameters that were not previously available were introduced. The new data have been tested in application to high-resolution atmospheric spectra measured with the Fourier transform spectrometers at Park Falls, WI (B-band) and Kitt Peak, AZ (γ-band) and have yielded substantial improvement. In addition, we report the first direct observation and analysis of the $^{16}O^{18}O$ lines in the γ-band.

[a] L.S. Rothman, I.E. Gordon, A. Barbe, D.Chris Benner, P.F. Bernath, et al, "The HITRAN 2008 Molecular Spectroscopic Database," JQSRT 110, 532-572 (2009).