LINE-SHAPE PARAMETERS AND THEIR TEMPERATURE DEPENDENCIES FOR THE AIR-BROADENED OXYGEN B-BAND LINES

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The B band $\left(b^1\Sigma_g^+\,(v=1) \leftarrow X^3\Sigma_g^-\,(v=0)\right)$ is the second most intense atmospheric band of molecular oxygen located in the spectral range near 690 nm. Considering its growing importance for the remote sensing and the need for reliable spectroscopic reference data, we present the first complete set of the line-shape parameters and their pressure and temperature dependencies, going beyond the Voigt profile, for the air-broadened oxygen B-band transitions measured under controlled laboratory conditions. The measurements were performed with the frequency-stabilized cavity ring-down spectroscopy (FS-CRDS) technique. The spectrometer[1] was linked to the optical frequency comb (OFC), which provided the absolute frequency axis. The line-shape analysis was done with the speed-dependent Nelkin-Ghatak profile (SD-NGP)[2], which is a limiting case of the recommended Hartmann-Tran profile (HTP)[3]. This approach enabled us to account for the line narrowing mechanisms as well as for the line asymmetry.

We determined the temperature dependence of the collisional broadening and the collisional shift. However, we did not observe a significant temperature dependence of the speed-dependent parameters and the Dicke narrowing. The pressure broadening as well as its temperature dependence are very close to oxygen A band corresponding values[4], whereas the pressure shift for the B band is up to 100% larger. We demonstrated that the temperature dependence of the collisional broadening can be estimated based on its speed dependence.

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