HIGH SENSITIVITY CRDS OF THE $a^1\Delta_g \leftarrow X^3\Sigma_g^-$ BAND OF OXYGEN NEAR 1.27 μm: MAGNETIC DIPOLE AND ELECTRIC QUADRUPOLE TRANSITIONS IN SPECTRA OF FIVE ISOTOPOLOGUES

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The knowledge of accurate spectroscopic parameters for the $a^1\Delta_g \leftarrow X^3\Sigma_g^-$ band of molecular oxygen near 1.27 μm is very important in the field of remote sensing. Although this band was studied by spectroscopists for over a century a lot of discrepancies still remain in the previously reported line positions and intensities. In this work the Continuous Wave-Cavity Ring Down Spectroscopy (CW-CRDS) technique has been used to record with high sensitivity the absorption spectrum of this band. The spectra were obtained between 7640 and 7917 cm^{-1} with "natural" oxygen and with a sample highly enriched in ^{18}O. The absolute intensities of 377 and 652 oxygen transitions were measured in the two spectra, respectively. They include the $a^1\Delta_g \leftarrow X^3\Sigma_g^-$ (0-0) bands of $^{16}O_2$, $^{16}O^{18}O$, $^{16}O^{17}O$, $^{17}O^{18}O$ and $^{18}O_2$. The (0-0) bands of $^{16}O_2$ and $^{18}O_2$ show (previously undetected) electric quadrupole transitions with line intensities ranging from 1×10^{-30} to 1.9×10^{-28} cm/molecule. They are accompanied by the $a^1\Delta_g \leftarrow X^3\Sigma_g^-$ (1-1) hot bands which are also reported for the first time. Accurate spectroscopic parameters for the observed bands were derived from a global fit of the experimental line positions, combined with microwave and Raman measurements available in the literature.