High sensitivity Cavity Ring Down spectroscopy of ^{18}O enriched carbon dioxide between 5851 and 6690 cm^{-1}

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The absorption spectrum of highly ^{18}O enriched carbon dioxide has been recorded by very high sensitivity CW-Cavity Ring Down spectroscopy between 5851 and 6990 cm^{-1} (1.71-1.43 μm). The achieved sensitivity (noise equivalent absorption $\alpha_{min} \sim 5\times10^{-10}$-$5\times10^{-11}$ cm^{-1}) has allowed the detection of more than 19000 transitions of 291 bands belonging to 11 isotopologues of carbon dioxide. The rovibrational assignment has been done on the basis of the predictions performed within the framework of the method of effective operators. The band-by-band analysis has allowed deriving accurate spectroscopic constants for the majority of the observed bands. The studied spectral region is formed by ΔP= 8, 9 and 10 series of transitions, where $P=2V_1+V_2+3V_3$ is the polyad number (V_i are vibrational quantum numbers). A number of perturbations have been evidenced in the spectrum. Among them, interpolyad anharmonic resonance perturbations were found to affect a few bands of asymmetric species.

Using the large set of newly measured line positions and those collected from the literature, the global modelling of the line positions within the framework of the effective Hamiltonian approach was performed and new sets of Hamiltonian parameters are obtained for the $^{16}O^{12}C^{18}O$, $^{18}O^{12}C^{18}O$, $^{16}O^{13}C^{18}O$ and $^{18}O^{13}C^{18}O$ isopotologues. Using a similar approach, the global fits of the obtained intensity values of the ΔP= 8, 9 and 10 series of transitions were performed to determinate the respective sets of the effective dipole moment parameters.

The obtained results will help to improve importantly the quality of the spectral line parameters of the minor isopotologues in the most currently used spectroscopic databases of carbon dioxide.