From very high sensitivity absorption spectra of the eight most abundant CO_2 isotopologues to databases

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We have undertaken an exhaustive study of the absorption spectrum of the different isotopologues of carbon dioxide by CW-Cavity Ring Down Spectroscopy in the 1.71-1.26 μm region [1-3]. This ultra sensitive laser technique allows measuring absorption coefficients as small as $\alpha_{min}\sim 2\times10^{-10}$ cm^{-1} corresponding to a 1% intensity depletion for a 500 km path length.

The improvement compared to previous studies by Fourier Transform Spectroscopy is considerable: for instance, in the 1.40-1.26 μm region, more than 3800 transitions with intensities as low as 1×10^{-29} cm/molecule were assigned to the $^{13}C^{16}O_2$, $^{16}O^{13}C^{17}O$, $^{16}O^{13}C^{18}O$, $^{17}O^{13}C^{18}O$ and $^{13}C^{18}O_2$ isotopologues, while only 104 $^{13}C^{16}O_2$ lines were previously reported in the literature.

The rovibrational assignments were performed on the basis of accurate predictions of the effective Hamiltonian model of the respective isotopologues. The spectroscopic parameters of more than 400 bands were derived from the band-by-band analysis. The obtained results have been used for a critical review of the most currently used spectroscopic databases of carbon dioxide: HITRAN, HITEMP and CDSD databases. Part of our new data has been adopted in the most recent version of the HITRAN database. These observations are extensively used by our colleagues at IAO-Tomsk to refine the sets of effective Hamiltonian parameters and effective dipole moment parameters needed to generate the Carbon Dioxide Spectroscopic Databank. The present status of the CDSD database (available via ftp://ftp.iao.ru/pub/) will be presented.

[1] A. Campargue *et al* J. Quant. Spectrosc. Radiat. Transfer. 111(2010) 659-674
[2] B.V. Perevalov *et al* J. Mol. Spec. 252 (2008) 143-159
[3] K.F. Song *et al* J. Quant. Spectrosc. Radiat. Transfer. 111(2010) 332-344