BROADENING AND SHIFT COEFFICIENTS IN THE $^{12}C^{16}O_2$ AND $^{13}C^{16}O_2$ LASER BANDS

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In a previous study[a] we had reported air- and N_2-broadening and pressure-induced shift coefficients for 46 rovibrational transitions in the $^{12}C^{16}O_2$ 00^01-$(10^00$-$02^01)_I$ and 00^01-$(10^00$-$02^01)_{II}$ laser bands near 10 μm These parameters were determined from spectra recorded with the McMath-Pierce Fourier transform spectrometer (FTS) of the National Solar Observatory on Kitt Peak, Arizona. We now report similar measurements of air- and N_2-broadening and shifts for the two $^{13}C^{16}O_2$ laser bands, plus new determinations of self-broadening and shifts in the $^{12}C^{16}O_2$ laser bands. These results were obtained from simultaneous analysis of 30 long-path absorption spectra using a multispectrum nonlinear least-squares technique[b]. In addition to the 10 spectra of air- and N_2-broadened natural CO_2 analyzed previously, we have included 20 new spectra recorded at room temperature and 0.005 cm^{-1} resolution using the McMath-Pierce FTS. These additional spectra include two low pressure, four air-broadened and four N_2-broadened spectra obtained with a 90% ^{13}C-enriched CO_2 sample and 10 self-broadened spectra obtained with a high purity natural CO_2 sample. The self-broadened spectra were recorded with pathlengths of 73, 97, 193 and 433 m and CO_2 pressures varying between 3 Torr and 400 Torr. The $^{13}CO_2$ spectra were obtained with a pathlength of 84 m with sample pressures ¡ 4 Torr for the low-pressure spectra and from 100 to 500 Torr for the air- and N_2-broadened mixtures. By combining the spectra of $^{12}CO_2$ and $^{13}CO_2$ in the same fit we were able to obtain a consistent set of line parameters for both molecules. The results obtained for the $^{12}CO_2$ and $^{13}CO_2$ laser bands will be compared with each other, with the values in the HITRAN database[c], and with available values reported in the literature.

[a] V. Malathy Devi, D. Chris Benner, M. A. H. Smith and C. P. Rinsland, *JQSRT* **59**, 137-149 (1998).
[b] D. Chris Benner, C. P. Rinsland, V. Malathy Devi, M. A. H. Smith and D. Atkins, *JQSRT* **53**, 705-721 (1995).
[c] L. S. Rothman et al., *JQSRT* **60**, 665-710 (1998).