MULTISPECTRUM ANALYSIS OF THE ν_4 AND ν_2 BANDS OF $^{12}CH_4$

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Self- and air-broadened halfwidth and pressure-induced shift coefficients and their temperature dependences have been determined for a number of transitions in the ν_4 and ν_2 bands of $^{12}CH_4$ from laboratory absorption spectra recorded at room temperature and below with the McMath-Pierce Fourier transform spectrometer of the National Solar Observatory. In addition, accurate line center positions and absolute intensities were determined. The results were obtained by using a multispectrum nonlinear least squares technique[a] to fit simultaneously 20 or more spectra recorded at high resolution (0.006-0.01 cm^{-1}) with path lengths between $\sim$ 1 and 150 cm and sample temperatures ranging from 210 to 314 K. For both self- and air broadening in the J-manifolds of the P and R branches of the ν_4 band, we observed line mixing between certain transitions within the same manifold. In these cases the off-diagonal relaxation matrix elements were determined in the fits. Most of the air-broadened widths of unmixed ν_4 lines retrieved using the multispectrum fits agree well with earlier values determined from single-spectrum fits,[b] and the multispectrum results have smaller statistical uncertainties. The inclusion of line mixing in the fits was seen to have a greater effect on the retrieved values of the line shifts than on the retrieved values of other parameters.

[a] D. Chris Benner et al., *JQSRT* **53**, 705-721 (1995).
[b] M. A. H. Smith et al., *Spectrochimica Acta* **48A**, 1257-1272 (1992).