

MULTISPECTRUM ANALYSIS OF THE ν_4 AND ν_2 BANDS OF $^{12}\text{CH}_4$

MARY ANN H. SMITH, *Science Directorate, NASA Langley Research Center, MS 401A, Hampton, VA 23681-2199*; D. CHRIS BENNER and V. MALATHY DEVI, *Department of Physics, The College of William and Mary, Williamsburg, VA 23187-8795*.

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 $^{12}\text{CH}_4$ 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 ($0.006\text{-}0.01\text{ cm}^{-1}$) with path lengths between ~ 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.

^aD. Chris Benner et al., *JQSRT* **53**, 705-721 (1995).

^bM. A. H. Smith et al., *Spectrochimica Acta* **48A**, 1257-1272 (1992).