PRESSURE BROADENING, SHIFTS, AND LINE MIXING IN THE ν_4 BAND SYSTEM OF CH_4

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A multispectrum nonlinear least squares technique[a] has been used to examine self- and air-broadening, pressure-induced shifts, and line mixing in infrared spectra of methane (CH_4) in the 7-9 μm region. The temperature dependences of these parameters have also been determined for numerous transitions in the ν_4 and ν_2 bands of $^{12}CH_4$. The laboratory absorption spectra used in this study were recorded at high resolution (0.006-0.01 cm^{-1}) with the McMath-Pierce Fourier transform spectrometer of the National Solar Observatory. Sample temperatures ranged from 210 to 314 K, and broadening gas pressures were between 0.06 and 0.72 atm. The line broadening, shift and mixing parameters (off-diagonal relaxation matrix elements) were obtained by using the multispectrum technique to fit selected regions of 20 or more spectra simultaneously. In addition, accurate line center positions and absolute intensities were determined. Line mixing was observed in the Q branches and in the J-manifolds of the P and R branches of the ν_4 bands of $^{12}CH_4$ and $^{13}CH_4$. The mixing parameters resulting from the present study are compared to the results of other studies of line mixing in CH_4, and the effect of line mixing on the retrieved values of the line shifts will be discussed.
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[a] D. Chris Benner et al., *JQSRT* **53**, 705-721 (1995).