SELF- AND AIR-BROADENING, SHIFTS, AND LINE MIXING IN THE $\nu_2$ BAND OF $^{12}CH_4$

MARY ANN H. SMITH, *Science Directorate, NASA Langley Research Center, Hampton, VA 23681-2199*; D. CHRIS BENNER, V. MALATHY DEVI, *Department of Physics, The College of William and Mary, Williamsburg, VA 23187-8795*; and A. PREDOI-CROSS, *Department of Physics, University of Lethbridge, Lethbridge, AB, T1K 3M4 Canada*.

Self- and air- broadened Lorentz half widths and pressure-induced shift coefficients and their dependences on temperature have been measured from laboratory absorption spectra for over 100 transitions in the $\nu_2$ band of $^{12}CH_4$. Accurate line positions and absolute line intensities were also determined for these transitions, and the off-diagonal relaxation matrix elements that characterize line mixing were determined for 11 pairs of transitions, for both self- and air-broadening. The 29 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 226 to 297 K, and broadening gas pressures were between 0.01 and 0.85 atm.
The line positions, intensities, broadening, shift and mixing parameters (off-diagonal relaxation matrix elements) were obtained by using the multispectrum nonlinear least squares technique[a] to fit selected short (5-15 $cm^{-1}$) regions of 20 or more spectra simultaneously. Transitions up to $J'' = 16$ were included in the analysis. Variations of the measured parameters with the rotational quantum number index and tetrahedral symmetry species are examined. The present results are compared to the results of other studies of line broadening, shifts, and line mixing in $CH_4$. This research was supported by NASA's Upper Atmosphere Research Program.

[a] D. Chris Benner et al., *JQSRT* **53**, 705-721 (1995).