

SPECTRAL LINE SHAPES IN THE  $\nu_3$  Q BRANCH OF  $^{12}\text{CH}_4$  NEAR  $3.3\ \mu\text{m}$ 

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Detailed knowledge of spectroscopic parameters for prominent Q branches of methane is necessary for interpretation and modeling of high resolution infrared spectra of terrestrial and planetary atmospheres. We have measured air-broadened line shape parameters in the Q branch of  $^{12}\text{CH}_4$  in the  $\nu_3$  fundamental band for a large number of transitions in the 3000 to 3023  $\text{cm}^{-1}$  region by analyzing 13 room-temperature laboratory absorption spectra. Twelve of these spectra were recorded with 0.01  $\text{cm}^{-1}$  resolution using the McMath-Pierce Fourier transform spectrometer (FTS) of the National Solar Observatory (NSO) on Kitt Peak, and one higher-resolution ( $\sim 0.0011\ \text{cm}^{-1}$ ) low pressure ( $\sim 1$  Torr) spectrum of methane was obtained using the Bruker IFS 120HR FTS at the Pacific Northwest National Laboratory (PNNL) in Richland, WA. The air-broadened spectra were recorded using various absorption cells with path lengths of 5, 20, 25, and 150 cm, total sample pressures between 50 and 500 Torr, and  $\text{CH}_4$  volume mixing ratios of 0.01 or less. All 13 spectra were fit simultaneously covering the 3000-3023  $\text{cm}^{-1}$  spectral region using a multispectrum nonlinear least squares technique<sup>a</sup> to retrieve accurate line positions, absolute intensities, Lorentz air-broadened widths and pressure-shift coefficients. Line mixing using the off-diagonal relaxation matrix element formalism<sup>b</sup> was measured for a number of pairs of transitions for the  $\text{CH}_4$ -air collisional system. The results will be compared to values reported in the literature.

<sup>a</sup>D. C. Benner, C. P. Rinsland, V. Malathy Devi, M. A. H. Smith, D. Atkins, *JQSRT* **53** (1995) 705-721.

<sup>b</sup>A. Levy, N. Lacombe, C. Chackerian, Collisional line mixing, in *Spectroscopy of the Earth's Atmosphere and Interstellar Medium*, Academic Press, Inc., Boston (1992) 261-337.