SPECTRAL LINE SHAPES IN THE ν_3 Q BRANCH OF $^{12}CH_4$ NEAR 3.3 μm

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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 $^{12}CH_4$ in the ν_3 fundamental band for a large number of transitions in the 3000 to 3023 cm^{-1} region by analyzing 13 room-temperature laboratory absorption spectra. Twelve of these spectra were recorded with 0.01 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$0.0011 cm^{-1}) low pressure ($\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 CH_4 volume mixing ratios of 0.01 or less. All 13 spectra were fit simultaneously covering the 3000-3023 cm^{-1} spectral region using a multispectrum nonlinear least squares technique[a] 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[b] was measured for a number of pairs of transitions for the CH_4-air collisional system. The results will be compared to values reported in the literature.

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

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