TEMPERATURE DEPENDENCE OF AIR-BROADENING AND SHIFT COEFFICIENTS IN THE ν_3 BAND OF $^{12}CH_4$

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High-resolution (0.01 cm^{-1}) absorption spectra of a high-purity natural isotopic sample of methane and methane broadened by dry air were recorded at various temperatures ranging from -60^{0}C to 25^{0}C using the McMath-Pierce Fourier transform spectrometer of the National Solar Observatory on Kitt Peak, Arizona. The room temperature spectra were obtained using absorption cells with path lengths of 5, 25, 150, and 2500 cm while the cool spectra were recorded using a 50 cm long Pyrex coolable absorption cell. In addition, higher resolution (0.0027 cm^{-1}) room-temperature absorption spectra of a natural sample of methane were obtained using the Fourier transform interferometer of the Laboratoire de Physique Moleculaire et Applications at Orsay, France. Path lengths varying between 1.7 cm and 4 m and pressures varying from less than 1 Torr to more than 500 Torr were used in recording these spectra. We determined the temperature dependence of the air-broadened halfwidth and pressure-induced shift coefficients for over 250 transitions in the P branch side of the ν_3 band by analyzing over 40 spectra simultaneously using a multispectrum nonlinear least-squares fitting algorithm.[a] The variations of the measured parameters with the symmetry species and the rotational quantum numbers of the transitions involved will be discussed. Comparisons of the present results with previous measurements and calculations will be done.

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