EXPERIMENTAL LINE LISTS OF HOT METHANE

ROBERT J. HARGREAVES, PETER F. BERNATH, *Department of Chemistry and Biochemistry, Old Dominion University, Norfolk, VA, USA*; JEREMY BAILEY, *School of Physics, University of New South Wales, New South Wales, Australia*; MICHAEL DULICK, *Department of Chemistry and Biochemistry, Old Dominion University, Norfolk, VA, USA*.

Line lists of CH_4 at high temperatures (up to 900°C) have been produced between 2500 and 5000 cm^{-1}. This spectral range contains the pentad and octad regions, and includes numerous fundamental, overtone and hot bands. Our method makes use of a quartz sample cell that is heated by a tube furnace. Four spectra are then recorded at each temperature using a Fourier transform infrared spectrometer at high resolution (0.02 cm^{-1}). By combining these four spectra at each temperature, the emission and absorption from the cell and molecules are accounted for, and we obtain the true transmission spectrum of hot CH_4. Analysis of this series of spectra enables the production of line lists that include positions, intensities and empirical lower state energies.

We also compare our line lists to the best available theoretical line lists at high temperatures. Whilst our experimental line lists contain fewer lines than theoretical line lists, we are able to demonstrate the quality of our observed spectra by considering our observations as absorption cross sections. This is important at elevated temperatures, when numerous blended lines appear as a continuum.