TEMPERATURE DEPENDENCE OF THE ABSORPTION OF THE R(6) MANIFOLD OF THE 2NU3 BAND OF METHANE IN AIR IN SUPPORT OF THE MERLIN MISSION

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Fifty nine high sensitivity spectra of the R(6) manifold of the $2\nu_3$ band of methane in air, near 1.64 μm, have been recorded in support of the MERLIN mission. For this purpose, a cavity ring down spectrometer (CRDS) with a spectrally narrowed and stable (sub-kHz) laser source was coupled to a temperature regulated high-finesse optical cavity. The frequency scale of each spectrum was accurately determined from measurements of the beat note between a part of the laser light and the closest tooth of a frequency comb referenced to a rubidium clock. Series of spectra were recorded between 243 and 313 K with a 10 K temperature step. For each series, total pressure values of 50, 100, 250, 500 and 750 Torr were adopted. A multi-spectrum fitting procedure with the Hartmann-Tran (HT) line profile, including the first-order line-mixing parameter, has been used to derive the spectroscopic parameters for each of the six R(6) components, along with the temperature dependence of the line-shape parameters. The results show that the fitted model is able to reproduce the experimental spectra with a relative precision better than 0.2% for the entire R(6) manifold spectral region and better than 0.05% at the ON-line position of the MERLIN mission for the 250, 500 and 750 Torr spectra. The relative precision increases to 0.3% and the residuals at the ON-line position to 0.1% when including the 50 and 100 Torr spectra. Comparisons with ground-based atmospheric measurements show that these data significantly improve the modeling of methane absorption in this spectral region. We propose here a new complete line list of the methane spectrum in the region of the R(6) manifold allowing reducing notably the residuals at the ON-line position of the MERLIN mission.

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