MEASUREMENT OF CH_3D ABSORPTION CROSS SECTIONS, PRESSURE BROADENING, AND SHFT COEFFICIENTS IN THE 1.65 μm SPECTRAL REGION BY USING CONTINUOUS AVE CAVITY RING-DOWN SPECTROSCOPY

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Quantitative spectroscopy of CH_3D in the near-IR is of importance for an ongoing project to build an instrument to measure the H/D isotopic ratio of methane gas. Continuous-wave cavity ring-down spectroscopy (CRDS) has been used to examine the absorption cross sections, the pressure-broadening and pressure-shift coefficients at around 1652 nm. The absorption cross sections of CH_3D were quantified in the wavenumber region between 6046 and 6060 cm^{-1}. The maximum peak is located at 6055.17 cm^{-1}, which gives $(8.58 \pm 0.37) \times 10^{-21}$ cm^2/molecule at the total pressure of ~ 8.2 Torr of the N_2 buffer gas. By using the small step size of the laser wavenumber scan, we measured the pressure-broadening effects, and the pressure-shift effects, on CH_4 and CH_3D absorption lines. The N_2, O_2 and CO_2 pressure broadening coefficients of CH_3D are 0.058, 0.054 and 0.049 cm^{-1}/atm, respectively, at the wavenumber we employed. Under the experimental conditions we used, N_2 and O_2 have very similar pressure broadening effects, and their effects on CH_3D is very similar to those of CH_4. At the wavenumber we employed, the same values of N_2 and O_2 pressure-shift coefficient , -0.012 cm^{-1}/atm, and a little higher value of CO_2, - 0.013 cm^{-1}/atm, were found.