NITROGEN- AND SELF-BROADENING AND SHIFT COEFFICIENTS IN THE $\nu_3$ FUNDAMENTAL BAND OF $^{12}$CH$_3$D

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A multispectrum nonlinear least-squares fitting technique has been used to determine Lorentz broadening and pressure-induced shift coefficients for a large number of transitions in the $\nu_3$ fundamental band of $^{12}$CH$_3$D in the region from 1150 to 1430 cm$^{-1}$. We analyzed a total of 14 high-resolution (0.006 cm$^{-1}$) room temperature absorption spectra recorded with the 1-m Fourier transform spectrometer (FTS) at the McMath-Pierce facility of the National Solar Observatory at Kitt Peak. The data set included 10 spectra of 98% pure CH$_3$D and 4 spectra of CH$_3$D in N$_2$. Our multispectrum analysis technique allowed us to simultaneously analyze both self-broadened and N$_2$-broadened spectra. The measurements in the $\nu_3$ band included transitions with rotational quantum numbers as high as $J'' = 16$ and $K'' = 16$. We determined N$_2$-broadening and shift coefficients for about 300 transitions and self-broadening and shift coefficients for over 400 transitions. The broadening coefficients (both self and N$_2$) range between 0.02 and 0.10 cm$^{-1}$ atm$^{-1}$ at 296K. Both the self-shift and the N$_2$-shift coefficients vary between about -0.012 and +0.009 cm$^{-1}$ atm$^{-1}$. At least 95% of the measured shift coefficients are negative, and the small number of positive shift coefficients often involve transitions with $J'' = K''$. The $J'' = K''$ transitions in the $\delta Q$ sub-band show the smallest broadening coefficients. The present results will be compared to previous measurements in this parallel band and in the nearby perpendicular $\nu_5$ and $\nu_6$ bands.

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