HIGH RESOLUTION INFRARED SPECTRA AND VIB-ROTATIONAL ANALYSIS OF THE $\nu_3$ AND $\nu_4$ REGIONS OF CHLORINE NITRATE IN THE TEMPERATURE RANGE 190 TO 297 K

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Chlorine nitrate plays an important role in upper atmospheric chemistry. It was first detected in the stratosphere by Rinsland et al.\textsuperscript{a} by observation of the $\nu_4$ band $\alpha$-type $Q$-branch. There have been a number of laboratory infrared spectroscopic studies on the $\nu_4$ band since that time.\textsuperscript{b} Among them is the work of Bell, Duxbury and Stuart\textsuperscript{c} who used a tunable diode laser to study and model the $\alpha$-type $Q$-branches of the two chlorine isotopic species $^{35}$Cl and $^{37}$Cl as well as that of the $\nu_4 + \nu_9 - \nu_9$ hot band. At room temperature, even at the high resolution of a diode laser, the bands are only partially resolved due to the overlapping of lines of the two main isotopic species and of lines from several strong hot bands. A beautifully resolved spectrum of the $\nu_4$ region over a limited range of $J$ and $K_a$ was obtained later by Xu, Blake and Sharpe\textsuperscript{d} from diode laser spectra of a molecular jet at about 7 K.

In this work, 29 spectra of the region 750 to 900 cm$^{-1}$ at temperatures ranging from 190 to 297 K and air pressures ranging from zero to 156 hPa were recorded at DLR with resolutions of 0.00094 to 0.0083 cm$^{-1}$. Using the ground-state constants of Müller et al.\textsuperscript{e} a vib-rotational analysis of the $\nu_4$ and $\nu_3$ fundamental bands as well the hot band, $\nu_4 + \nu_9 - \nu_9$, of the most abundant $^{35}$Cl isotopomer was carried out using the spectrum recorded at 191 K with the highest resolution and a zero air pressure. The corresponding cold bands for the lesser abundant isotope were partially assigned. Upper state rotational Hamiltonian constants were determined allowing precise modeling of the contours of the $\nu_4$ fundamental $Q$-branches over the temperature and pressure ranges studied as shown by comparisons with the other spectra.

\textsuperscript{a}C. P. Rinsland et al., J. Geophys. Res. D 90, 7931 (1985).
\textsuperscript{c}W. Bell, G. Duxbury, and D. D. Stuart, J. Mol. Spectrosc. 152, 283 (1992).
\textsuperscript{d}S. Xu, T. A. Blake, and S. W. Sharpe, J. Mol. Spectrosc. 183, 228 (1996).