Appendix B: Molecular Constants for $^1$H$^{35}$Cl

The following literature data for $^1$H$^{35}$Cl is listed from highest energy electronic state to lowest energy electronic state, which means that the ground electronic state is listed last (it is designated with the symbol $1\Sigma^+$). Many of the rotational and vibrational constants are given in the footnotes.

<table>
<thead>
<tr>
<th>State</th>
<th>$T_a$</th>
<th>$v_a$</th>
<th>$v_a'$</th>
<th>$v_a''$</th>
<th>$v_a'''$</th>
<th>$v_a''''$</th>
<th>$v_a'''''$</th>
<th>$\Delta \nu$</th>
<th>$\Delta \nu'$</th>
<th>$\Delta \nu''$</th>
<th>$\Delta \nu'''$</th>
<th>$\Delta \nu''''$</th>
<th>$\Delta \nu'''''$</th>
<th>Observed Transitions</th>
<th>References</th>
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</thead>
<tbody>
<tr>
<td>$^1$H$^{35}$Cl</td>
<td>$u = 0.97939272$</td>
<td>$2 \theta = 4.4335 \text{ eV}$</td>
<td>$1.7 \chi = 12.73 \text{ eV}$</td>
<td>Rydberg series corresponding to excitation of a 2p electron.</td>
<td>200-210 eV</td>
<td>DEC 1976 A</td>
<td>(50)(60)</td>
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<td></td>
<td>Numerous absorption bands above 133000 cm$^{-1}$, tentatively assigned to higher members of the Rydberg series starting with L and M and converging to a $1\Sigma^+$ of HCl$^*$.</td>
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<td>Many other absorption bands in the region 83000 - 93000 cm$^{-1}$ corresponding to Rydberg states strongly perturbed by the $\nu_2$ state which itself gives rise to many perturbed bands.</td>
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<td>$^1$H$^{35}$Cl</td>
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</tbody>
</table>

Molecular Constants for $^1$H$^{25}$Cl

Experimental Physical Chemistry

$^3$H$^{25}$Cl (continued)

'Applying the Dunham corrections (28) obtain $a_0 = 2991.0904$ and $b_0 = 10.59359$. Additional corrections (adiabatic, non-adiabatic) discussed by (49). Vibrational levels up to $v = 5$ have been observed in infrared absorption (28(19)(28) and emission (10), higher levels in the $v = 0$ bands (5)(9). Dunham potential coefficients (61). Most recent and extensive values of the ground state molecular constants (59).

\[
\begin{align*}
\bar{a} &= 0.2483, \quad \bar{a}_0 = 0.0123 \quad (28), \\
\bar{b} &= 0.0017722(45) + 6.0 \times 10^{-9}(45)^{3/2}, \quad \text{higher order terms in } (28). \text{ See also } (50).
\end{align*}
\]

Uncorrected value from the $b_0 = Y_{32}$ given in the table. The internuclear distance at the minimum of the Born-Oppenheimer curve is $r_0 = 1.2794149$ (49)(63).

\[\text{Average B, D values; } B(B^+) = B(B^-) = 0.066.\]

\[\text{Configuration } e_6^2 g_4^2.\]

\[\text{Comparison } e_6^2 g_4^2.\]

\[\text{Very extended progressions in absorption, not yet analyzed in detail. The higher vibrational levels are strongly perturbed by Rydberg states (46) (58). The vibrational and rotational constants given were obtained from the emission spectrum with } v \geq 8 (5)(9) \text{ but because of the perturbations}
\]

\[\text{Diffuse rotational structure; } I = 0 \text{ and } 3 = 0 \text{ are increasingly diffuse.}\]

\[\text{The } b_0 = X \text{ and } b_0 = X \text{ components have only } 0 \text{ of the intensity of } b_0 = X.\]

\[\text{Configuration } e_6^2 g_4^2.\]

\[\text{Absorption coefficient } k \approx 0.012.\]

\[\text{Absolute intensities (cm}^{-1}\text{) of the }\]

1-0 band: 130 (5)

2-0 band: 2.9 (5)

3-0 band: 3.70 (10)(39)


\[\text{Absolute intensity measurements (25)(54).}\]

\[\text{Dipole moment function (41)(54); see also (53)(35).}\]

\[\text{G_2 = 0.6594, also quadrupole and other hyperfine coupling constants (41)(45); see also (35)(55).}\]

\[\text{Proton spin - rotation interaction constant (15)(37).}\]

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