Catalog of Spectral Positions
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A “typical” spectrum from the diode laser study of BiH (91). The BiH was made in a hot cell by the reaction of Bi vapour with 25 Torr of hydrogen at 1000 °C. The molecular lineshape is a second derivative because the technique of frequency modulation with lock-in detection at twice the modulation frequency was used. This modulation scheme gives a flatter baseline than lock-in detection at the modulation frequency.

Reference:
A part of the observed spectrum of \( \text{C}_3 \), produced by the 193 nm photolysis of an allene and \( \text{H}_2 \) mixture with the partial pressures of 0.1 and 0.35 Torr, respectively. The ordinate shows the absorption intensity in an arbitrary scale. Many strong lines of allene going downward were cut for the sake of clarity.

Reference:
The $R(16)$ transition of the $\nu_3$ band of $\text{C}_3$ recorded with a time-resolved infrared spectrometer. The $\text{C}_3$ molecule was produced by the 193 nm photolysis of an allene and $\text{H}_2$ mixture with the partial pressures of 0.1 and 0.35 Torr, respectively. The spectrum was obtained with a gate of 90 $\mu$s duration with 20 $\mu$s delay from the excimer laser shot.

Reference:
A portion of the spectrum of $C_5$, as recorded using a tunable diode laser source. The three most prominent bands analyzed in this paper are shown directly, while lines belonging to the $v_5 = 1$ hot band, whose assignment is somewhat less certain, are indicated with asterisks. Note that the intensity scale is not uniform due to laser power variations and also that the wave number scale is not necessarily exactly linear. The negative feature at 2172.76 cm$^{-1}$ is due to CO, present as an impurity in the discharge.

Reference:
Figure 1

Time resolved infrared spectra of products derived from the 193 nm photolysis of an acetylene and Ar mixture with the partial pressures of 0.8 and 1.2 Torr, respectively. Trace (a) was obtained with a gate of 1 μs duration without delay from the excimer laser shot at $t = 0$, trace (b) with a 1 μs gate with 1 μs delay and trace (c) with a 5 μs gate with 2 μs delay.

Figure 2

Time resolved infrared spectra obtained with the same conditions as for the spectra of Fig. 1, except that Ar is replaced by H₂ with the partial pressure of 1.2 Torr. A new line appears at 1849.1 cm⁻¹, whereas the line at 1849.9 cm⁻¹ reduces intensity very much.

Reference:
Time resolved infrared spectra of the $7\nu_2$ band, recorded under the same conditions as those applied to the spectra of Fig. 1. A Q-branch series is identified; it starts around 2165 cm$^{-1}$ and extends to higher frequency as $J$ or $N$ increases. The $N$ number is indicated. The splittings of high-$N$ lines are primarily due to spin-rotation interaction [Hund’s case (b)], whereas the spin-orbit interaction predominates in the splittings of a few lowest-$N$ transitions [Hund’s case (a)]. A strong line at 2165.6 cm$^{-1}$ is the $R(15)$ transition of carbon monoxide which is produced by the photolysis of acetone included in the sample of acetylene as an impurity.

Reference:
A part of the CCl spectra. Two $^3\Pi_{22}$ lines, $R(7.5)$ of $^{35}\text{Cl}$ and $R(12.5)$ of $^{37}\text{Cl}$ appear as second derivatives because of Zeeman modulation, whereas two $^3\Pi_{1/2}$ lines, $R(6.5)$ of $^{35}\text{Cl}$ and $R(11.5)$ of $^{37}\text{Cl}$, as well as two OCS lines are observed as first derivatives by “source” modulation due to stray magnetic field pick-up. The OCS $R(46)$ line is used as a standard. The lower trace shows fringe patterns obtained from the air-spaced etalon.

Reference:
The lower trace shows the observed spectrum of CCO near the band center of (100) – (000) of the $\tilde{a}^1 \Delta$ electronic state and the upper trace shows the etalon signal used for wave number interpolation. The five lowest $J$ lines in the $Q$ branch are identified. The line to the lower frequency side of $Q (6)$ has not been identified.

Reference:
The observed spectrum of CCO in the region of the R (18) line of the $2\nu_1 - \nu_1$ difference band. For the identification of the individual components see Table 1. The doublet to the higher frequency side of R (18) is the P (19) of the $\nu_1$ band.

Reference:
The $4_{04} - 4_{13}$ transitions in the $\nu_2$ fundamental bands of CH$_2$ (top) and CD$_2$ (bottom) observed using a tunable diode laser and Zeeman modulation. In each case the absorption path was about 8 m and the recorder time constant was 3 s. The F$_2$ spin component ($J = 4$) appears to be much weaker than F$_1$ ($J = 5$) and F$_3$ ($J = 3$) because it is less efficiently Zeeman modulated.

Reference:
SPECTRUM 1252.5

Start wavelength
\[ \lambda = 1252.5 \text{ cm}^{-1} \]

End wavelength
\[ \lambda = 1254.2 \text{ cm}^{-1} \]

Molecules: CF$_2$

$^8$Q$_2$(N1) branch of CF$_2$(X$^1$A$_1$) near 1253 cm$^{-1}$, with superimposed N$_2$O calibration spectra. The fringe pattern from the 7.6 cm Ge etalon used for relative calibration is shown at the bottom of the diagram.

Reference:
Portion of the atmosphere in the laboratory recorded at reduced pressure using a path length of 101 m. The laser drive current was 5A, the pulse length 232 ns, the repetition rate 5 kHz and the substrate temperature -1.52 °C. An average of 64000 scans was used: (a) cell pressure 50.5 Torr, (b) pressure 104.5 Torr, (c) carbon dioxide contained in human breath that was added to the sample; the pressure was then reduced to 103.2 Torr. The very weak water line has almost the same percentage absorption in traces (b) and (c). However, it is evident that a large increase in the percentage of absorption due to carbon dioxide has occurred in trace (c) in comparison to trace (b).

Reference:
The IR absorption spectrum of CF₄.

Start wavelength
\[ \lambda = 1250 \text{ cm}^{-1} \]

End wavelength
\[ \lambda = 1300 \text{ cm}^{-1} \]

Reference:
The $4_{04} - 4_{13}$ transitions in the $\nu_2$ fundamental bands of CH$_2$ (top) and CD$_2$ (bottom) observed using a tunable diode laser and Zeeman modulation. In each case the absorption path was about 8 m and the recorder time constant was 3 s. The $F_2$ spin component ($J = 4$) appears to be much weaker than $F_1$ ($J = 5$) and $F_3$ ($J = 3$) because it is less efficiently Zeeman modulated.

Reference:
The Q(2,2) and Q(3,3) absorption lines of the $\nu_2$ fundamental of the methyl radical recorded with 2f detection. The radical was produced in a discharge mixture containing 200 m Torr CH$_4$ and 200 m Torr H$_2$.

Reference:
The Q(2, 2) and Q(3, 3) transitions of the ν₂ fundamental band of the methyl radical, generated in the pulsed thermolysis nozzle. The distances between the nozzle and the laser are (a) 10 mm and (b) 5 mm, respectively.

Reference:
A portion of the CH₃ spectrum of the ν₂, out-of-plane bending mode, N = K Q branch head. Depicted, left to right, are the N = K = 2, 3, 1, 4, 5 transitions. Also shown is the N₂O absorptions used to calibrate the wavenumber of the CH₃ transitions and the etalon interference pattern used to interpolate between the upper two traces.

Reference:
The Q(6,6) rotational feature of the ν₂ fundamental vibrational mode of the CH₃ radical is presented as the middle trace in the right hand portion of the figure. A portion of the N₂O reference spectrum is shown on the lower trace. The left side of the figure displays the relevant energy levels involved in this transition. The methyl radical was formed by the decomposition of the TMG over the susceptor at 600 °C.

Reference:
Results of an infrared diode laser scan of the \((\nu_4 + \nu_5 - \nu_2)\) Q-branch band head near 716 cm\(^{-1}\). The traces shown are (a) absorption from the deposition gas-phase environment (20 passes, effective path length \(\sim 0.5\) m), (b) absorption from a room-temperature cell containing \(\sim 0.1\) Torr of \(\text{C}_2\text{H}_2\), and (c) etalon trace (free-spectral range \(\sim 0.01\) cm\(^{-1}\)). The average \(\text{C}_2\text{H}_2\) temperature in the deposition chamber is estimated from the relative line intensities of the \(U = 8 - 211\) Q-branch lines and found to be in the range 200-300\(^\circ\) C. The linewidths in (a) are larger than (b) because of pressure broadening.

Reference:
SPECTRUM 2968.5

Start wavelength
\[ \lambda = 2968.5 \text{ cm}^{-1} \]

End wavelength
\[ \lambda = 2970 \text{ cm}^{-1} \]

Molecules: \(^{13}\text{CH}_4,^{12}\text{CH}_4,^{12}\text{CH}_3\text{D}\)

Simulated sample cell transmission for a suitable set of lines for CH\(_4\). The upper panel shows the transmission through a 36 m pathlength and the lower panel shows the transmission through a 40 cm pathlength. The lower state energy levels (in cm\(^{-1}\)) are noted below the lines.

Reference:
SPECTRUM 500

Start wavelength
\( \lambda = 500 \text{ cm}^{-1} \)

End wavelength
\( \lambda = 4000 \text{ cm}^{-1} \)

Molecules: CO, CO\(_2\), H\(_2\)O, CH\(_4\)

Reference:
SPECTRUM 1273.7

Start wavelength
\( \lambda = 1273.7 \text{ cm}^{-1} \)

End wavelength
\( \lambda = 1273.8 \text{ cm}^{-1} \)

Molecules: CH₄, C₂H₂

Infrared spectral region used in CH₄ dissociation fraction and temperature measurement (lower trace, plasma off, upper traces, plasma on).

Reference:
SPECTRUM 1305.3

Start wavelength
\( \lambda = 1305.3 \text{ cm}^{-1} \)

End wavelength
\( \lambda = 1306.2 \text{ cm}^{-1} \)

Molecules: \( \text{CH}_4 \)

Sample calculated (a) and experimental (b) spectra in the \( v_4 \) band region of methane. Symbols are ♦ for octad-pentad lines and • for pentad-dyad lines.

Reference:
Transmission spectra in the 1553 cm$^{-1}$ region. The 50 cm$^2$ samples of either cigarette smoke (C) or room air containing 11.73 mm H$_2$O (B) were examined at a cell pressure of 12 Torr. Lock-in amplifier gain was 25 mV with a 0.3-sec time constant. Scan rate was 0.0077 cm$^{-1}$ sec$^{-1}$. The background (A) and etalon calibration spectra (D) are also shown.

Reference:
Start wavelength
\[ \lambda = 2968.5 \text{ cm}^{-1} \]

End wavelength
\[ \lambda = 2970 \text{ cm}^{-1} \]

**Molecules:** $^{13}\text{CH}_4$, $^{12}\text{CH}_4$, $^{12}\text{CH}_3\text{D}$

Simulated sample cell transmission for a suitable set of lines for CH$_4$. The upper panel shows the transmission through a 36 m pathlength and the lower panel shows the transmission through a 40 cm pathlength. The lower state energy levels (in cm$^{-1}$) are noted below the lines.

**Reference:**
Simulated sample cell transmission for a suitable set of lines for CH$_4$. The upper panel shows the transmission through a 36 m pathlength and the lower panel shows the transmission through a 40 cm pathlength. The lower state energy levels (in cm$^{-1}$) are noted below the lines.

Reference:
Results of an infrared diode laser scan of the \((\nu_4 + \nu_5 - \nu_4)\) Q-branch band head near 716 cm\(^{-1}\). The traces shown are (a) absorption from the deposition gas-phase environment (20 passes, effective path length \(\sim 0.5\) m), (b) absorption from a room-temperature cell containing \(\sim 0.1\) Torr of \(\text{C}_2\text{H}_2\), and (c) etalon trace (free-spectral range \(\sim 0.01\) cm\(^{-1}\)). The average \(\text{C}_2\text{H}_2\) temperature in the deposition chamber is estimated from the relative line intensities of the \(U = 8-21\) Q-branch lines and found to be in the range 200-300° C. The linewidths in (a) are larger than (b) because of pressure broadening.

Reference:
Portion of spectrum #2 of Table 1, around the Q-branch of the $v_3$ band of $C_2H_2$ at 730 cm$^{-1}$. 

Reference: 
SPECTRUM 1273.7

Start wavelength
\[ \lambda = 1273.7 \text{ cm}^{-1} \]

End wavelength
\[ \lambda = 1273.8 \text{ cm}^{-1} \]

Molecules: CH₄, C₂H₂

Infrared spectral region used in CH₄ dissociation fraction and temperature measurement (lower trace, plasma off, upper traces, plasma on).

Reference:

Reference:
The $^3P_2(13)$ and $^3P_3(5)$ transitions of the vinyl radical, observed in the same way as trace B of Fig. 1. The latter shows spin-rotation splittings as well as K-type doubling, whereas only one K-doubling component is seen for the former. The spin-rotation splitting is not resolved for this transition. Lines pointing downward correspond to depletion of the precursor, vinyl bromide.

Reference:
A comparison of the $R(6)$ transitions of $\text{C}_2\text{H}_3^+$ and $^{13}\text{C}_2\text{H}_3^+$. The latter transitions split into more components because of the symmetry argument summarized in Table III in reference.

Reference:
Transmission spectrum of a gas mixture typical for emissions of technical combustion containing H\(_2\)O, CO\(_2\), NH\(_3\) and C\(_2\)H\(_2\) in N\(_2\) at 470 K and 1 m optical path. (Taken from ref. 2). Such a mixture can be found in combustion exhaust to the atmosphere. While at atmospheric pressure the absorption lines merge, at low pressure (50 mbar) lines are only Doppler broadened and well isolated.

**Molecules: CO\(_2\), H\(_2\)O, C\(_2\)H\(_4\), NH\(_3\)**

**SPECTRUM 795**

Start wavelength 
\[ \lambda = 795 \text{ cm}^{-1} \]

End wavelength 
\[ \lambda = 800 \text{ cm}^{-1} \]

Reference 1:

Reference 2:
Transmission spectra in the 1553 cm\(^{-1}\) region. The 50 cm\(^2\) samples of either cigarette smoke (C) or room air containing 11.73 mm H\(_2\)O (B) were examined at a cell pressure of 12 Torr. Lock-in amplifier gain was 25 mV with a 0.3-sec time constant. Scan rate was 0.0077 cm\(^{-1}\) sec\(^{-1}\). The background (A) and etalon calibration spectra (D) are also shown.

Reference:
High resolution IR-CRLAS spectra obtained in the 3 micron region in a 37.5 Torr CH₄/N₂/O₂ (upper trace) and H₂/N₂/O₂ (lower trace) flame. Comparison of the two scans readily identifies likely H₂O features, which frequently overlap methyl transitions. In these data, the unique ability to obtain data for reactants (# = fuel and x = C₂H₂), intermediates (CH₃) and products (+ = H₂O and * = CO₂) in the infrared spectral region is demonstrated.

Reference:
A small portion of the FTIR spectrum of the \( \nu_9 \) band of \( \text{C}_2\text{H}_6 \). The \( J \) numbering of the two \( Q \) branches in the figure is indicated by integer labels. \( P \)-branch transitions falling in the region are indicated.

Reference:
L. Henry et al., Ethane Spectrum
Observed spectrum of the C$_3$H$_2$ $\nu_3$ band (P branch). The spectral lines marked by an asterisk are assigned to the C$_4$H$_2$ (diacetylene $\nu_5 + \nu_3$ band and its vibrational hot bands.

Reference:
Diode laser absorption spectrum of the a-type Q-branch of the P-O stretch in CIPO. The lines are labelled according to the value of $K_a$ and consist of unresolved $J$ components.

Reference:
The IR absorption spectrum of CO$_2$.

Molecules: CO, CO$_2$, H$_2$O, CH$_4$

Reference:
High resolution diode laser spectrum of the $\nu_3$ vibration-rotation spectrum of HC$_3$N. Three successive $J$ lines of the P branch are displayed. The P 1171 CO line (CO appears as an impurity in the sample) is used as a calibration standard in this section of the spectrum. The weaker doublet lines in the spectrum are hot band transitions and exhibit $I$-type splitting. The spectrum was recorded by using frequency modulation and is displayed in second derivative form. It may be noted that reflection of laser power back into the laser causes weak energy modulation which produces errors in the baseline.

Reference:
Example for a multi-component can with CO and N$_2$O, multireflection cell with 9.5 m optical pathlength, $p_{N_2O} = 35$ Torr, $p_{CO} = 0.007$ Torr.

Reference:
A portion of the spectrum of $C_5$, as recorded using a tunable diode laser source. The three most prominent bands analyzed in this paper are shown directly, while lines belonging to the $\nu_5 = 1$ hot band, whose assignment is somewhat less certain, are indicated with asterisks. Note that the intensity scale is not uniform due to laser power variations and also that the wave number scale is not necessarily exactly linear. The negative feature at 2172.76 cm$^{-1}$ is due to CO, present as an impurity in the discharge.

Reference:
The IR absorption spectrum of CO₂.

Reference:
CO₂ and H₂O absorption.

Start wavelength
\[ \lambda = 637.6 \text{ cm}^{-1} \]

End wavelength
\[ \lambda = 638.6 \text{ cm}^{-1} \]

Molecules: CO₂, H₂O

Reference:
Transmission spectrum of a gas mixture typical for emissions of technical combustion containing H$_2$O, CO$_2$, NH$_3$ and C$_2$H$_2$ in N$_2$ at 470 K and 1 m optical path. (Taken from Ref. 2). Such a mixture can be found in combustion exhaust to the atmosphere. While at atmospheric pressure the absorption lines merge, at low pressure (50 mbar) lines are only Doppler broadened and well isolated.

Reference 1:  

Reference 2:  
Transmission spectrum of a gas mixture consisting of 100 ppm NO, 15% CO₂ and 15% H₂O in N₂ at 470 K and 1 m optical path. At atmospheric pressure (lower curve) the NO lines appear on the background of the other gases, at 30 mbar (needle-shaped minimal) the NO lines can be traced nearly free of interference by other gases.

Reference:
SPECTRUM 2190

Start wavelength
\( \lambda = 2190 \text{ cm}^{-1} \)

End wavelength
\( \lambda = 2220 \text{ cm}^{-1} \)

Molecules: CO₂

Detailed CO₂ spectrum, including hot bands in the region of the P-branch of \(^{14}\text{C}^{}\text{O}_2\). All lines are normalised to the strong lines in the fundamental of \(^{12}\text{C}^{}\text{O}_2\).

Reference:
CO₂

Calculated spectrum of CO₂ in the 4.4 μm region. The ν₃ fundamental bands of most of the relevant isotopic species are included. The relative strength of each band is normalised to the ¹²C¹⁶O₂ band strength on a logarithmic scale, but the individual lines in each band are plotted in a linear fashion. The ¹⁴C¹₆O₂ ν₃ band is offset for clarity and is displayed with an intensity corresponding to a modern carbon sample (¹⁴C/¹²C ~ 10⁻¹²).

Reference:
Results of diode scans over the $P(16)$ and $P(14)$ lines of $^{13}$CO$_2$. The lower trace was taken with a pathlength of 200 m trough CO$_2$ at a pressure of 30 Torr. For the upper trace the multipass cell was evacuated and a small cell of $^{13}$CO$_2$ inserted in the laser beam. Note that the $P(16)$ line is overlapped by line A, while the $P(14)$ line is relatively free from interference. All the strong absorption lines observed in the lower trace were identified using the date of [4-11]. However, there was insufficient spectral data available to identify many of the weaker lines, including line A.

Reference:
SPECTRUM 2314.2

Start wavelength
\[ \lambda = 2314.2 \text{ cm}^{-1} \]

End wavelength
\[ \lambda = 2314.5 \text{ cm}^{-1} \]

Molecules: CO\textsubscript{2}

TDL spectrometer scan near 2314 \text{ cm}^{-1}, showing CO\textsubscript{2} isotopomere lines for \(^{12}\text{C}^{16}\text{O}_2, ^{13}\text{C}^{16}\text{O}_2, ^{12}\text{C}^{16}\text{O}^{18}\text{O}\), using the long pathlength of 36.51 m, at 16 Torr and ambient CO\textsubscript{2} mixing ratio of 380 ppm.

Reference:
High resolution IR-CRLAS spectra obtained in the 3 micron region in a 37.5 Torr CH₄/N₂/O₂ (upper trace) and H₂/N₂/O₂ (lower trace) flame. Comparison of the two scans readily identifies likely H₂O features, which frequently overlap methyl transitions. In these data, the unique ability to obtain data for reactants (# = fuel and x = C₂H₂), intermediates (CH₃) and products (* = H₂O and + = CO₂) in the infrared spectral region is demonstrated.

Reference:
Transmission spectra for $^{12}\text{CO}_2$ and $^{13}\text{CO}_2$. Shown in (a) are spectra over a broad wave number range; the two right-most lobes are the spectra for $^{12}\text{CO}_2$ and the left ones are $^{13}\text{CO}_2$. The individual absorption lines used by the TDL for each isotope are shown in (b).

Reference:
Transmission spectra for $^{13}$CO$_2$ and $^{12}$CO$_2$. Shown in (a) are spectra over a broad wave number range; the two right-most lobes are the spectra for $^{12}$CO$_2$ and the left ones are $^{13}$CO$_2$. The individual absorption lines used by the TDL for each isotope are shown in (b).

Reference:
A diode laser spectrum of CS and N₂O. Traces a–d are, respectively, zero transmittance, etalon fringes, CS + N₂O spectra, N₂O spectrum. Traces b and c were recorded simultaneously while trace d was recorded later with slightly increased gain and the CS₂ discharge turned off. The N₂O pressure-path length product was 660 Pa * 50 cm. Line identifications are by ν 'ΔJ'/"(". The vibrational designations for N₂O, 10⁰0, and 02⁰0 refer, respectively, to [10⁰0, 02⁰0] states.

Reference:
Close-up view of part of the R-branch of D₂O-CO, showing the splitting of each line into A and B tunnelling components; the magnitude of this splitting is about 0.003 cm⁻¹. The lines marked with asterisks are due to HOD-CO and the pairs of lines marked with arrows are due to the K = 1 - 1 transitions of D₂O-CO.

Reference:
Comparison of data and fit for transmission spectra. The best fit is obtained by convolving a 0.007 cm\(^{-1}\) laser linewidth (Gaussian HWHM) with the calculated transmission spectrum based on the HITRAN database.

Reference:
High resolution diode laser spectrum of the $\nu_3$ vibration-rotation spectrum of HC$_3$N. Three successive $J$ lines of the P branch are displayed. The P 117 CO line (CO appears as an impurity in the sample) is used as a calibration standard in this section of the spectrum. The weaker doublet lines in the spectrum are hot band transitions and exhibit $l$-type splitting. The spectrum was recorded by using frequency modulation and is displayed in second derivative form. It may be noted that reflection of laser power back into the laser causes weak energy modulation which produces errors in the baseline.

Reference:
$K = 3$ parallel $Q$ branches of the CH stretching fundamental of HCO. 50 transient digitizer points each of 500 ns duration are averaged immediately before and after each excimer shot and subtracted. The laser is stepped 20 MHz in scanning with 30 shots averaged per step. The asymmetry splittings are not resolved. Conditions: He pressure = 5 Torr, acetaldehyde pressure = 2.5 Torr, XeCl pulse energy = 75 mJ, repetition rate = 20 Hz. Pictured as well are the 500 MHz etalon fringes used in laser scanning and calibration.

Reference:
The effect of the $\nu_5$, $\nu_2 + \nu_4$ interaction of Fig. 3 as observed in the H$_2$CO spectrum at 2882 cm$^{-1}$ where $^6Q_2$ of $\nu_2 + \nu_4$ and $^4Q_2$ of $\nu_5$ overlap. The $J = 9$ transition of $\nu_5$ is displaced toward lower frequency while the $J = 9$ line of $\nu_2 + \nu_4$ is displaced toward higher frequency. The intensity enhancement of $\nu_2 + \nu_4$ is greatest for $J = 8$ and 9.

Reference:
A pair of HeH\(^+\) lines one observed in absorption \((J = 17 \leftarrow 16, \nu = 0)\) and the other \((J = 7, \nu = 6 \rightarrow J = 8, \nu = 5)\) in emission.

Reference:
A portion of the P-branch of the $\nu_3$ band of H$_2$F$^+$, recorded with a colour-centre laser$^{33}$. Note the 3:1 relative intensity of the 4$_j$-5$_j$ asymmetry doublet.
Derivatives of spectra of both nitric and nitrous acids when the laser is simultaneously swept and frequency modulated (8 KHz) at low amplitude corresponding to less than 0.1 linewidth. The amplitudes of the derivative signals are used as an indicator of relative changes in concentrations of the molecules. Several regions of similar overlap of the \( \nu_2 \) band of HNO2 and the \( \nu_2 \) band of HNO3 existed in the 1690–1700 cm\(^{-1}\) region covered by this particular diode laser.

Reference:
J. S. Wells, Tunable Semiconductor Laser Applications to air pollution measurements, Division 524, Final Report, Part one.
Derivatives of spectra of both nitric and nitrous acids when the laser is simultaneously swept and frequency modulated (8 KHz) at low amplitude corresponding to less than 0.1 linewidth. The amplitudes of the derivative signals are used as an indicator of relative changes in concentrations of the molecules. Several regions of similar overlap of the $\nu_2$ band of HNO$_2$ and the $\nu_2$ band of HNO$_3$ existed in the 1690 – 1700 cm$^{-1}$ region covered by this particular diode laser.

Reference:
J. S. Wells, Tunable Semiconductor Laser Applications to air pollution measurements, Division 524, Final Report, Part one.
HO$_2$ absorption lines (second derivate) from the \(P\) branch of the \(\nu_3\) band. Predicted positions are from Johns et al. (Ref. 5). The middle trace shows the OCS reference line whose frequency of 1081.6522(5) cm$^{-1}$ is determined from Maki et al. (Ref. 20). The frequency scale is determined by the etalon fringes from the multipass cell. The fringe spacing is 6.20 x 10$^{-3}$ cm$^{-1}$.

Reference:
SPECTRUM 1392

Start wavelength
\( \lambda = 1392 \text{ cm}^{-1} \)

End wavelength
\( \lambda = 1393 \text{ cm}^{-1} \)

Molecules: HO\(_2\)

Q-branch transitions with \( K_0 = 1 \) of the HO\(_2\) \( \nu_2 \) band, recorded by Zeeman modulation.

Reference:
Part of the $\nu_2$ band of the HO$_2$ radical recorded with a diode laser$^{27}$. The lineshape arises from the use of Zeeman modulation. The two Q-branches shown arise from the effects of spin doubling.

Reference:
SPECTRUM 1410.9

Start wavelength
\[ \lambda = 1410.9 \text{ cm}^{-1} \]

End wavelength
\[ \lambda = 1411.3 \text{ cm}^{-1} \]

Molecules: HO\(_2\)

HO\(_2\) absorption spectra obtained in the 100-m path length fast-response flow cell.

Reference:
The IR absorption spectrum of CO$_2$.

Reference:
M. Morová, Czechoslovak Journal of Physics, 47 (2), 11997.
SPECTRUM 637.6

Start wavelength
$\lambda = 637.6 \text{ cm}^{-1}$

End wavelength
$\lambda = 638.6 \text{ cm}^{-1}$

Molecules: H$_2$O, CO$_2$

CO$_2$ and H$_2$O absorption.

Reference:
Transmission spectrum of a gas mixture typical for emissions of technical combustion containing H₂O, CO₂, NH₃, and C₂H₂ in N₂ at 470 K and 1 m optical path. (Taken from ref. 2). Such a mixture can be found in combustion exhaust to the atmosphere. While at atmospheric pressure the absorption lines merge, at low pressure (50 mbar) lines are only Doppler broadened and well isolated.

Reference 1:

Reference 2:
Transmission spectra in the 1553 cm\(^{-1}\) region. The 50 cm\(^2\) samples of either cigarette smoke (C) or room air containing 11.73 mm H\(_2\)O (B) were examined at a cell pressure of 12 Torr. Lock-in amplifier gain was 25 mV with a 0.3-sec time constant. Scan rate was 0.0077 cm\(^{-1}\) sec\(^{-1}\). The background (A) and etalon calibration spectra (D) are also shown.

**Reference:**
Derivatives of spectra of both nitric and nitrous acids when the laser is simultaneously swept and frequency modulated (8 KHz) at low amplitude corresponding to less than 0.1 linewidth. The amplitudes of the derivative signals are used as an indicator of relative changes in concentrations of the molecules. Several regions of similar overlap of the \( \nu_2 \) band of HNO\(_2\) and the \( \nu_2 \) band of HNO\(_3\) existed in the 1690–1700 \( \text{cm}^{-1} \) region covered by this particular diode laser.

Reference:
J. S. Wells, Tunable Semiconductor Laser Applications to air pollution measurements, Division 524, Final Report, Part one.
A “typical” spectrum from the diode laser study of BiH (91). The BiH was made in a hot cell by the reaction of Bi vapour with 25 Torr of hydrogen at 1000 °C. The molecular lineshape is a second derivative because the technique of frequency modulation with lock-in detection at twice the modulation frequency was used. This modulation scheme gives a flatter baseline than lock-in detection at the modulation frequency.

Reference:
Transmission spectrum of a gas mixture consisting of 100 ppm NO, 15% CO₂ and 15% H₂O in N₂ at 470 K and 1 m optical path. At atmospheric pressure (lower curve) the NO lines appear on the background of the other gases, at 30 mbar (needle-shaped minimal) the NO lines can be traced nearly free of interference by other gases.

Reference:
High resolution IR-CRLAS spectra obtained in the 3 micron region in a 37.5 Torr CH$_4$/N$_2$/O$_2$ upper trace and H$_2$/N$_2$/O$_2$ (lower trace) flame. Comparison of the two scans readily identifies likely H$_2$O features, which frequently overlap methyl transitions. In these data, the unique ability to obtain data for reactants (# = fuel and x = C$_2$H$_2$), Intermediates (CH$_3$) and products (*=H$_2$O and + = CO$_2$) in the infrared spectral region is demonstrated.

Reference:
A portion of the LiBr vibration-rotation spectrum recorded with a diode laser spectrometer (104). The LiBr molecule was made by simply heating the salt to 800 °C. The spectrum was very dense because at this high temperature many vibrational and rotational levels are populated and because there are four isomeric forms of LiBr, $^{6}\text{Li}^{81}\text{Br}$, $^{7}\text{Li}^{81}\text{Br}$, $^{6}\text{Li}^{79}\text{Br}$, and $^{7}\text{Li}^{79}\text{Br}$.

Reference:
SPECTRUM 1908.6

Start wavelength
\( \lambda = 1908.6 \text{ cm}^{-1} \)

End wavelength
\( \lambda = 1909 \text{ cm}^{-1} \)

Molecules: NCO

Spectrum with reference gas, two NCO absorption lines \([P_3/2(14.5), P_1/2(15.5)]\), intensity, and marker channel.

Reference:
Transmission spectrum of a gas mixture typical for emissions of technical combustion containing $\text{H}_2\text{O}$, $\text{CO}_2$, $\text{NH}_3$, and $\text{C}_2\text{H}_2$ in $\text{N}_2$ at 470 K and 1 m optical path. (Taken from ref. 2). Such a mixture can be found in combustion exhaust to the atmosphere. While at atmospheric pressure the absorption lines merge, at low pressure (50 mbar) lines are only Doppler broadened and well isolated.

Reference 1:

Reference 2:
Observation of atmospheric pressure NH$_3$ lines. An experimental ammonia spectrum at 1 atm in air is compared to a simulated spectrum of low pressure NH$_3$ assuming a laser linewidth of 0.007 cm$^{-1}$. The frequency scale is determined from the ethylene reference cell shown in the top panel.

Reference:
High resolution diode spectra of NH$_3$ lines near 1140 cm$^{-1}$. The upper trace was taken with conventional amplitude detection using a 10 cm sample cell containing $< 1$ Torr NH$_3$. For the lower trace, the lines were broadened by adding 20 Torr N$_2$ to the cell and second harmonic detection was employed.

Reference:
J. Reid, J. Shewchun, B. K. Garside, E. A. Ballik, OPTICAL ENGINEERING 17 (II), 119781.
A portion of the CH₃ spectrum of the ν₂, out-of-plane bending mode, N = K Q branch head. Depicted, left to right, are the N = K = 2,3,1,4,5 transitions. Also shown is the N₂O absorptions used to calibrate the wavenumber of the CH₃ transitions and the etalon interference pattern used to interpolate between the upper two traces.

Reference:
D. K. Gaskill, V. Kolubatev, N. Bottka, R. S. Sillmon and J. E. Butler, J. Crystal Growth 77, 119861.
The Q(6,6) rotational feature of the \( \nu_2 \) fundamental vibrational mode of the \( \text{CH}_3 \) radical is presented as the middle trace in the right hand portion of the figure. A portion of the \( \text{N}_2\text{O} \) reference spectrum is shown on the lower trace. The left side of the figure displays the relevant energy levels involved in this transition. The methyl radical was formed by the decomposition of the TMG over the susceptor at 600 °C.

Reference:
A diode laser spectrum of CS and N$_2$O. Traces a-d are, respectively, zero transmittance, etalon fringes, CS + N$_2$O spectra. N$_2$O spectrum. Traces b and c were recorded simultaneously while trace d was recorded later with slightly increased gain and the CS$_2$ discharge turned off. The N$_2$O pressure-path length product was 660 Pa $\cdot$ 50 cm. Line identifications are by $\nu$ $^\Delta J$. The vibrational designations for N$_2$O, 10$^0$0, and 02$^0$0 refer, respectively, to [10$^0$0, 02$^0$0]$_{II}$ states.

Reference:
Example for a multi-component can with CO and N$_2$O, multireflection cell with 9.5 m optical pathlength, $p_{N_2O} = 35$ Torr, $p_{CO} = 0.007$ Torr.

Reference:
Nitric oxide transmission spectrum with 1-second averaging time using TE-cooled laser and detector. The fit is obtained with a laser linewidth of 0.010 cm\textsuperscript{-1} HWHM. The simulation without laser broadening for the NO doublet is shown by the dashed line.

Reference:
Transmission spectrum of a gas mixture consisting of 100 ppm NO, 15% CO$_2$ and 15% H$_2$O in N$_2$ at 470 K and 1 m optical path. At atmospheric pressure (lower curve) the NO lines appear on the background of the other gases, at 30 mbar (needle-shaped minima) the NO lines can be traced nearly free of interference by other gases.

Reference:
SPECTRUM 2145.8

Start wavelength
\( \lambda = 2145.8 \text{ cm}^{-1} \)

End wavelength
\( \lambda = 2147 \text{ cm}^{-1} \)

Molecules: NO₃

Observed spectrum of the NO₃ 2155 cm⁻¹ band. Numbers in parentheses denote N and K values in \(^3\)P branch transitions.

Reference:
A portion of the observed spectra. Source modulation was used with 2f detection. The P(2.5) and P(3.5) transitions of the NS fundamental band appear along with N₂O lines. The upper trace shows fringes produced by a Ge etalon; the fringe spacing is about 0.016 cm⁻¹. All N₂O lines used as standards are R branches of the following bands: A for 2ν₂, B for 3ν₂ (1e) – ν₂ (1e), C for 3ν₂ (1f) – ν₂ (1f), and D for 2ν₂ (2e). The numbers attached denote the J values.

Reference:
Assigned lines forming part of the $A^2_{v_{1/2}} \rightarrow \Pi \chi^2 \Sigma^+ \leftarrow 01$ subband of $\text{Si}_2^+$ recorded in a silane plasma using infrared laser velocity modulation spectroscopy. Lines indicated by (+) are cation lines appearing with opposite phase to the anion lines.

Reference:
Fundamental and hot band transitions of $^{28}\text{Si}^{35}\text{Cl}^+$ (1I) and $^{28}\text{Si}^{37}\text{Cl}^+$ (2I) near 637 cm$^{-1}$: (a) 1 4, 36 left arrow 13, 37; (b) 2 1, 45 left arrow 0, 46; (c) 1 6, 22 left arrow 5, 23; (d) 1 2, 49 left arrow 1, 50; (e) 1 5, 29 left arrow 4, 30; (f) 1 1, 55 left arrow 0, 56; and (g) 2 2, 38 left arrow 1, 39

Reference:
The silane-plasma emission recorded with the Fourier interferometer and partly shown at low resolution. Boxed insert: upper trace, the same doublet from the diode laser as in Fig. 4. Lower trace, very small portion with full resolution of the Fourier-transform spectrum.

Reference:
The silane-plasma emission recorded with the Fourier interferometer and partly shown at low resolution. Boxed insert: upper trace, the same doublet from the diode laser as in Fig. 4. Lower trace, very small portion with full resolution of the Fourier-transform spectrum.

Reference:
Experimental and theoretical transmission spectra for SO$_2$ in the 1142 cm$^{-1}$ region. A pathlength of 60 m is used, with a 1000 ppm mixture of SO$_2$ in N$_2$ at a total pressure of 10 Torr. Many weak SO$_2$ absorption lines which are obtained experimentally are not predicted by the theoretical compilation of Clough$^9$, a few of these are indicated by an asterisk.

Reference:
J. Reid, J. Shewchun, B. K. Garside, E. A. Ballik, APPLIED OPTICS 17 121, (1978)
Start wavelength
\( \lambda = 1141.8 \text{ cm}^{-1} \)

End wavelength
\( \lambda = 1142.4 \text{ cm}^{-1} \)

Molecules: SO\(_2\)

Three different SO\(_2\) detection schemes. Upper trace: direct absorption detection; middle trace: first harmonic detection; lower trace: second harmonic detection. A 1-kHz diode modulation is used for the harmonic detection. Conditions are 1000-ppm SO\(_2\) in N\(_2\) 10-Torr total pressure, 40 m path.

Reference:

Trotz gründlicher Recherche kann keine Verantwortung für die Richtigkeit der Inhalte übernommen werden. Technische Änderungen ohne Ankündigung vorbehalten.
