**C6. A Neodymium Laser With Continuous Frequency Tuning Regime**

M.M. Makogon and A.M. Solodov

The single mode neodymium travelling wave laser with the dynamic passive optical valve (1) and the dynamic ring dispersion resonator is described. The laser operates in the continuous frequency tuning regime (2) and it has the following main parameters: the spectral line width $\approx 2$ MHz; the generation duration $\approx 1$ ms; the continuous frequency tuning range is $(0.04-1.8)$ cm$^{-1}$; the generation energy $\approx 10$ J. The laser operates in wide spectral range $\approx 300$ cm$^{-1}$ in the 1.06 $\mu$m band.

The constructed laser was used for investigation of contours of NH$_3$, absorption lines (3) and can be used in nonlinear laser spectroscopy of super-high resolution.

**References**


**C7. Pulsed Lasers With Dynamic Generation Frequency Sweeping**

V.P. Lopasov, M.M. Makogon, V.I. Serdyukov and A.M. Solodov

The main principles of operation of the solid
state lasers with continuous frequency tuning (cft-lasers) which have first been investigated at the Institute of Atmospheric Optics (1,2) are considered. The paper presents some data on constructed and used in high resolution laser spectroscopy cft-lasers.

The main cft-lasers radiation parameters are presented in the table.

<table>
<thead>
<tr>
<th></th>
<th>Ruby Laser</th>
<th>Nd-Glass Laser</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Spectral line width</td>
<td>0.01 cm⁻¹</td>
<td>2 MHz</td>
</tr>
<tr>
<td>2. Continuous frequency tuning range</td>
<td>0.5 cm⁻¹</td>
<td>1.8 cm⁻¹</td>
</tr>
<tr>
<td>3. Complete frequency tuning range from pulse to pulse</td>
<td>1.5 cm⁻¹</td>
<td>300 cm⁻¹</td>
</tr>
<tr>
<td>4. Generation power</td>
<td>~100 W</td>
<td>~1 kW</td>
</tr>
<tr>
<td>5. Generation duration</td>
<td>~300 s</td>
<td>~1 ms</td>
</tr>
</tbody>
</table>

References


S2. The Absorption Spectra of Linear Polyatomic Molecules in the 9240-9520 cm⁻¹ Spectral Region

The absorption spectra of linear polyatomic molecules CO₂, N₂O, and C₂H₂ between 9240 and 9520 cm⁻¹ have been obtained with a high sensitive intracavity neodymium glass laser spectrometer (resolution is
0.08 cm⁻¹, the effective absorption path is 10000 meters (1).

The lines of weak combination bands 1203, 0403, "hot" band 13²3 ← 01²0 of CO₂ and combination band 40⁶2 of N₂O have been measured and their rotation constants have been obtained. Band parameters for 13²3 ← 01²0 band of CO₂ are the following:

<table>
<thead>
<tr>
<th>n₀</th>
<th>B⁰(13²3)</th>
<th>B¹(13²3)</th>
<th>D⁰(13²3)</th>
<th>D¹(13²3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cm⁻¹</td>
<td>cm⁻¹</td>
<td>10⁻⁷ cm⁻¹</td>
<td>10⁻⁷ cm⁻¹</td>
<td></td>
</tr>
<tr>
<td>9478.11</td>
<td>0.3809</td>
<td>0.3822</td>
<td>0.1</td>
<td>0.6</td>
</tr>
</tbody>
</table>

The lines of two perpendicular bands of C₂H₂ have been registered for the first time and band parameters have been obtained, interpretation of vibration transitions has been made.

<table>
<thead>
<tr>
<th>Band</th>
<th>n₀</th>
<th>B⁰</th>
<th>B¹</th>
<th>D⁰</th>
<th>D¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>cm⁻¹</td>
<td>cm⁻¹</td>
<td>cm⁻¹</td>
<td>10⁻⁶ cm⁻¹</td>
<td>10⁻⁶ cm⁻¹</td>
<td></td>
</tr>
<tr>
<td>21001</td>
<td>9366.61</td>
<td>1.1617</td>
<td>1.1566</td>
<td>1.1</td>
<td>0.56</td>
</tr>
<tr>
<td>T2003</td>
<td>9407.74</td>
<td>1.1695</td>
<td>1.1592</td>
<td>2.8</td>
<td>3.6</td>
</tr>
</tbody>
</table>

923.2 cm\(^{-1}\) have been used by several research groups to identify and to measure the abundance of this molecule in the atmosphere. There are several overlapping bands in this region which are caused by the isotopic shifts due to chlorine. There are also several hot bands in this region.

We have begun a study of this spectral region by using diode laser spectra of the dominant Q-branch of the CF\(_2\)Cl\(_2\) molecule along with Fourier transform spectra of the entire region from 910 cm\(^{-1}\) to 935 cm\(^{-1}\). The main absorption band has been identified as a type A band. The overlap of many absorption bands and also the large density of lines make quantum identification difficult because even at the resolving power of the diode laser (< 0.0015 cm\(^{-1}\)) the observed lines are not pure. However, rotational constants have been found which reconstruct the Q-branch lines up to J=77. The profile of the R-branch calculated from these constants is in fair agreement with the Fourier transform spectra from 925 cm\(^{-1}\) to 935 cm\(^{-1}\) recorded at a resolution of 0.04 cm\(^{-1}\).
F6. Analyse de la structure rotationnelle de la bande
υ_j de HNO_3
V. Danu

La structure rotationnelle de la bande υ_j de l'acide nitrique a été interprétée à partir de deux spectres expérimentaux.

1) Un spectre de résolution 0,06 cm⁻¹ enregistré à l'aide d'un spectromètre à grilles [1] entre 860 et 900 cm⁻¹

2) Un spectre de résolution 10⁻³ cm⁻¹ obtenu à l'aide d'une diode laser entre 891 et 898 cm⁻¹ [2]

Sur le spectre diode laser 411 raies de la bande υ_j ont été interprétées ; elles ont permis de déterminer, par une méthode de moindres carrés, le centre de la bande et huit constantes rotationnelles relatives au niveau υ_j = 1. Dans nos calculs nous avons utilisé pour le niveau fondamental des constantes obtenues par spectroscopie microonde [3].


[3] G. Journel, communication privée

F6. A First Study of the υ_j Fundamental of CF₂Cl₂
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sité de Paris-Sud, Orsay, France, (3) NASA/Goddard
Space Flight Center, Greenbelt, U.S.A.

The strong absorption features of CF₂Cl₂ near

923.2 cm⁻¹ have been used by several research groups to identify and to measure the abundance of this molecule in the atmosphere. There are several overlapping bands in this region which are caused by the isotopic shifts due to chlorine. There are also several hot bands in this region.

We have begun a study of this spectral region by using diode laser spectra of the dominant Q-branch of the CF₂Cl₂ molecule along with Fourier transform spectra of the entire region from 910 cm⁻¹ to 935 cm⁻¹. The main absorption band has been identified as a type A band. The overlap of many absorption bands and also the large density of lines make quantum identification difficult because even at the resolving power of the diode laser (< 0.0015 cm⁻¹) the observed lines are not pure. However, rotational constants have been found which reconstruct the Q-branch lines up to J = 77. The profile of the R-branch calculated from these constants is in fair agreement with the Fourier transform spectra from 925 cm⁻¹ to 935 cm⁻¹ recorded at a resolution of 0.04 cm⁻¹.