The $2^1\Pi \sim 2^3\Pi \sim 3^3\Sigma^+$ states system in the KCs molecule

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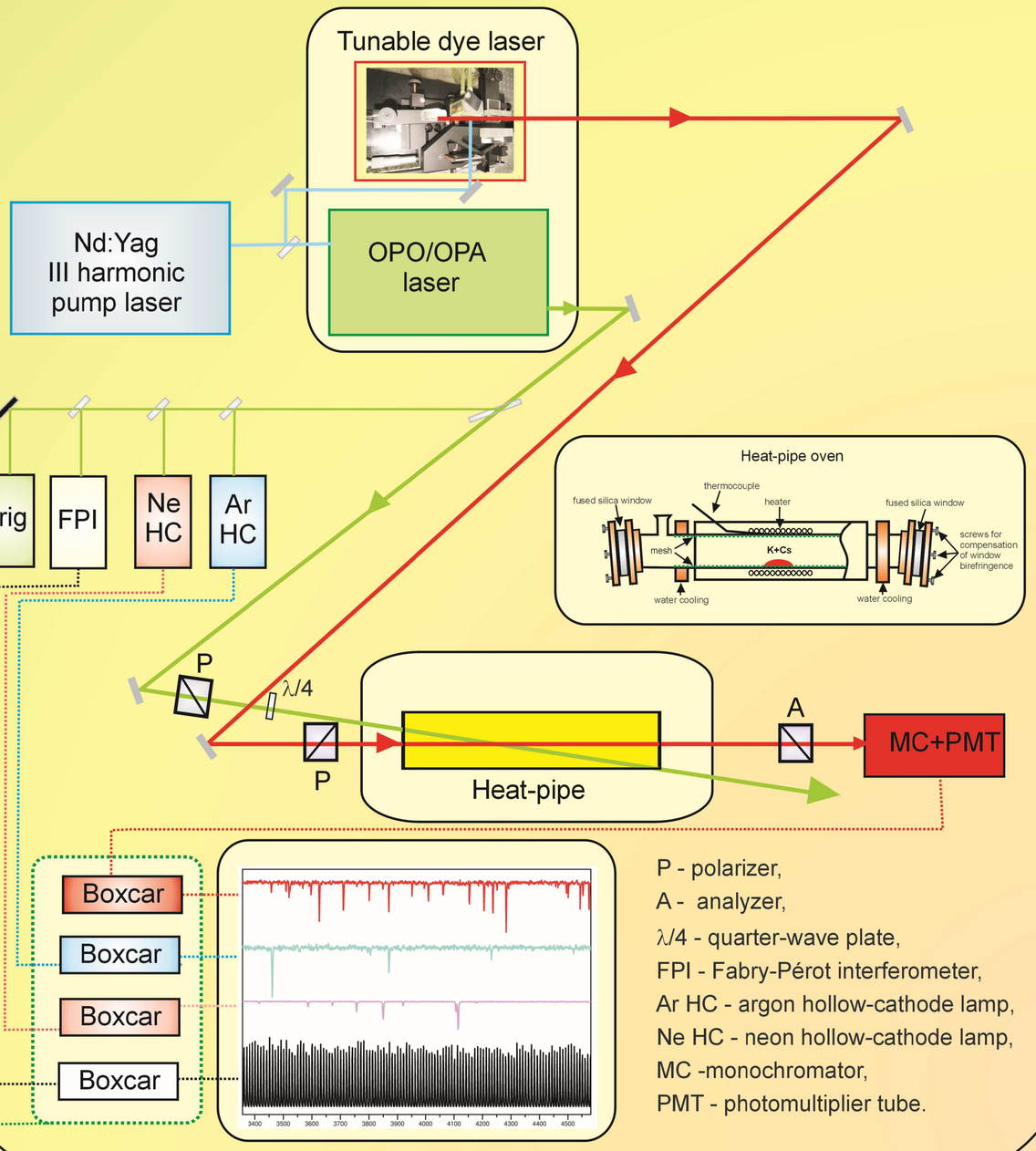
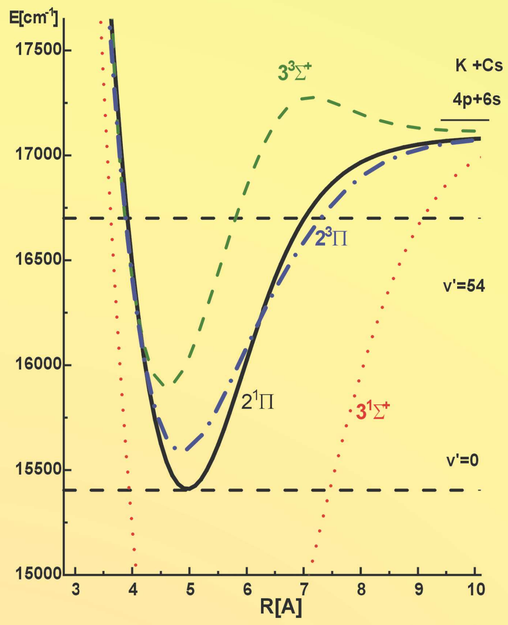
Experimental setup

for polarization labelling spectroscopy (PLS)



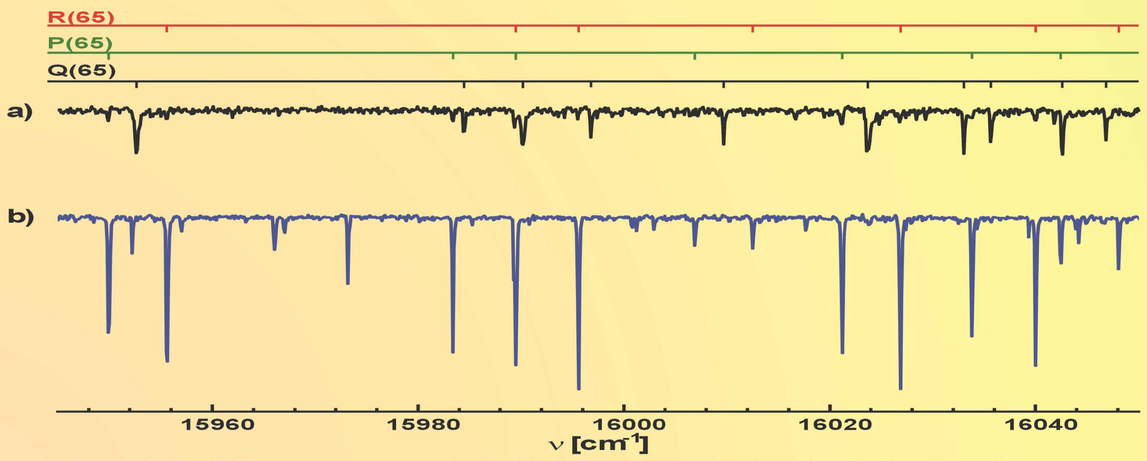
P - polarizer,
A - analyzer,
λ/4 - quarter-wave plate,
FPI - Fabry-Pérot interferometer,
Ar HC - argon hollow-cathode lamp,
Ne HC - neon hollow-cathode lamp,
MC -monochromator,
PMT - photomultiplier tube.

Data



Theoretical potential energy curves for KCs [1,2].

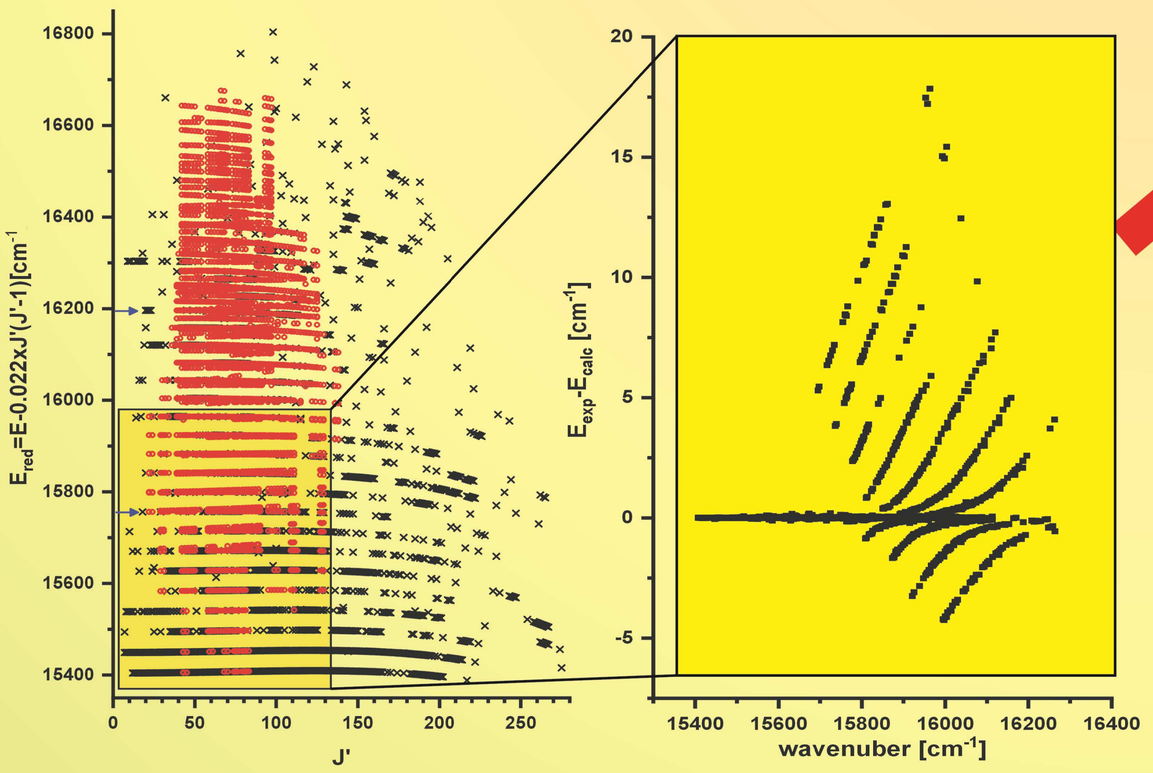
- The co-propagating pump and probe laser beams are crossed in the molecular sample.
- The probe laser is set at a fixed wavelength resonant with known $X^1\Sigma^+ \rightarrow 4^1\Sigma^+$ rovibronic transition [3], thus labelling the involved rovibrational level in the ground state.
- The pump laser is tuned across the investigated bands system ($15000 \div 16700 cm^{-1}$).
- The information about the excitation spectrum of the molecules is contained in the intensity of the probe light transmitted through the polarizer-analyzer system.



A portion of KCs spectra recorded with linear a) or circular b) polarisation of the pump laser scanned over the investigated spectral region. In both cases the probe laser was fixed on the same transition: $X^1\Sigma(v''=2,J''=65) \rightarrow 4^1\Sigma^+(19,64)$

Modeling of the $2^1\Pi \sim 2^3\Pi$ states system

Experimental Data



Reduced experimental term values E_{red} of rovibrational levels of the $2^1\Pi$, $2^3\Pi$ and $3^3\Sigma^+$ states in $^{39}K^{133}Cs$ molecule, obtained either in the present experiments (red circles) or in the experiment of the Riga group [10] (crosses).

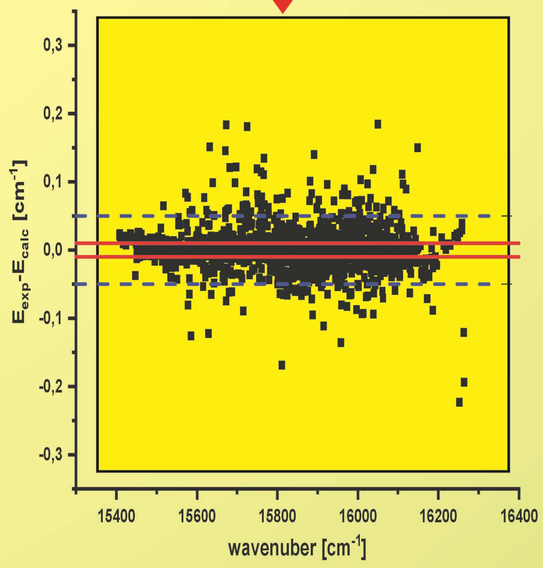
Differences between the experimental term energies and values calculated with a single channel approach [4]

Effective Hamiltonian description

$$\begin{pmatrix} T\ {}^1\Pi(v_S=0,J) & 0 & 0 & (H_{so})_{0,0} & \cdots & (H_{so})_{0,6} \\ 0 & \ddots & 0 & \vdots & \cdots & \vdots \\ 0 & 0 & T\ {}^1\Pi(v_S=12,J) & (H_{so})_{12,0} & \cdots & (H_{so})_{12,6} \\ (H_{so})_{0,0} & \cdots & (H_{so})_{0,12} & T\ {}^3\Pi_1(v_T=0,J) & 0 & 0 \\ \vdots & \cdots & \vdots & 0 & \ddots & 0 \\ (H_{so})_{6,0} & \cdots & (H_{so})_{6,12} & 0 & 0 & T\ {}^3\Pi_1(v_T=6,J) \end{pmatrix}$$

T– term energy expressed by Dunham type coefficients
Hso – off-diagonal spin-orbit coupling element

- **Over 6000 term values determined for the $2^1\Pi \sim 2^3\Pi \sim 3^3\Sigma^+$ system with rotational resolution.**
- **Local perturbations observed due to the interactions between neighbouring electronic states, namely $2^1\Pi$, $2^3\Pi$, $3^3\Sigma^+$.**
- **Over 2000 energy levels assigned to the $2^1\Pi \sim 2^3\Pi$ states system and reproduced by two-channel analytical model with accuracy better than 0.03 cm^{-1}.**



More info

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