

Study of $(3)^1\Pi$ and $(5)^1\Sigma^+$ states of RbCs based on $(3)^1\Pi \rightarrow (A - b)$ and $(5)^1\Sigma^+ \rightarrow (A - b)$ Fourier transform spectra analysis

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Recently observation and analysis of laser induced fluorescence (LIF) spectra to the $A^1\Sigma^+$ and $b^3\Pi$ states ($A - b$ complex for short) from $(3)^1\Pi$, $(4)^1\Sigma^+$ and $(5)^1\Sigma^+$ states in RbCs was reported [1]. It was shown that high accuracy of the $A - b$ complex description based on coupled-channels deperturbation treatment achieved in [1], allowed us to use the latter as an alternative to the ground state for the purpose to assign the observed $(3)^1\Pi \rightarrow A - b$ and $(5)^1\Sigma^+ \rightarrow A - b$ transitions and to determine the term values of the upper states with experimental accuracy 0.01 cm^{-1} . We report here of a continuation of the study of the $(3)^1\Pi$ and $(5)^1\Sigma^+$ states in RbCs. These states were first observed by REMPI method and partly described in [2, 3]. The aim of the present work was to obtain systematic term values data for the rovibronic levels and to construct the respective adiabatic potential energy curves.

In the experiment RbCs molecules were produced in a linear heat pipe at $310 \text{ }^\circ\text{C}$. The radiation of a single mode laser (CR 699-21) with Rhodamine 6G dye excited transitions from the ground state to the $(3)^1\Pi$ and $(5)^1\Sigma^+$ states. The LIF spectra to the $A - b$ complex were recorded by Fourier transform spectrometer (IFS 125-HR, Bruker) in the $6000\text{-}10000 \text{ cm}^{-1}$ spectral range. Excitation frequencies were selected within the range $16900 - 17700 \text{ cm}^{-1}$ by monitoring the LIF signal in the Preview Mode of the spectrometer. The recorded spectra contained also the $(4)^1\Sigma^+ \rightarrow A - b$ transitions excited accidentally by the same laser frequency. These transitions could be used as a test of assignment procedure, since the $(4)^1\Sigma^+$ state is very accurately described in [4]. The assignment of the LIF progressions allowed us to determine the energy and the rotational quantum number J' of the rovibronic levels of the $(3)^1\Pi$ and $(5)^1\Sigma^+$ states. Vibrational numbering v' of these states was based on the data from [2,3]. In several spectra rotational relaxation lines were observed around strong lines of the main progression, thus increasing the amount of term values data. The obtained term values of the $(3)^1\Pi$ and $(5)^1\Sigma^+$ states were included in the single potential fit using the Inverted Perturbation Approach to construct the point wise potentials.

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References

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