

# Book of Abstracts

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**Fourier-transform study of the  $A^1\Sigma_u^+ \sim b^3\Pi_u \rightarrow X^1\Sigma_g^+$  laser induced fluorescence spectra and deperturbation analysis of the spin-orbit coupled  $A \sim b$  complex of  $Cs_2$  dimer**

**V. Krumins<sup>1</sup>, A. Kruzins<sup>1</sup>, M. Tamanis<sup>1</sup>, R. Ferber<sup>1</sup>, A. Znotins,<sup>\*1</sup>, E.A. Pazyuk<sup>2</sup>, A.V. Stolyarov<sup>2</sup>**

1. Laser Centre, University of Latvia, Rainis blvd. 19, Riga, Latvia, LV-1586

2. Department of Chemistry, Lomonosov Moscow State University, 119991 Moscow, Leninsky gory 1/3, Russia

In  $Cs_2$  molecule the lowest electronically excited  $A^1\Sigma_u^+$  and  $b^3\Pi_u$  states are strongly coupled due to pronounced spin-orbit interaction between them, and, hence, may be considered as a single singlet-triplet  $A \sim b$  complex with complicated energy level structure. There is great interest in accurate description of this complex, since it can serve as a gateway for excitation of higher singlet and triplet states manifold. Also, these fully mixed states are used as intermediate states to transfer weakly bound ultra-cold alkali diatomics to their absolute ground state, e.g. in case of  $Cs_2 X^1\Sigma_g^+$  ( $v = 0, J = 0$ ) [1]. Present work is continuation of the previous studies [2,3] in which the  $A \sim b$  complex of  $Cs_2$  was examined in a low energy region. The purpose of this work is to extend accurate spectroscopic data to higher vibrational levels as well as to apply a global deperturbation analysis to reproduce rovibronic energies and radiative properties of the  $A \sim b$  complex within the experimental accuracy.

In the experiment caesium dimers were produced in a stainless steel heat-pipe at 300°C. The titanium-sapphire laser (MBR 110, Coherent) and various diode lasers were used for excitation. Fourier transform spectrometer (Bruker IFS125 HR) was used to register laser induced fluorescence (LIF) spectra  $A \sim b \rightarrow X^1\Sigma_g^+$  with an instrumental resolution of 0.03 cm<sup>-1</sup>. A rotational analysis of the recorded LIF spectra provided about 4000 new rovibronic term values of the  $A \sim b$  complex covering  $J$  range from 4 to 380 in energy range from 9917 to 13439 cm<sup>-1</sup>. The experimental data undergone a rigorous 4 x 4 coupled channel deperturbation analysis. The deperturbed Expanded-Morse-Oscillator potentials of the both  $A$  and  $b$  coupled states as well as the morphed spin-orbit coupling functions reproduce overall 98% of the experimental term values of the  $A \sim b$  complex of  $Cs_2$  with a rms uncertainty of 0.01 cm<sup>-1</sup>. The relative intensity distributions measured in the long  $A \sim b \rightarrow X^1\Sigma_g^+(v'')$  LIF progressions confirm their theoretical counterparts calculated by the present multi-component (non-adiabatic) wavefunctions of the  $A \sim b$  complex and *ab initio* spin-allowed  $A \rightarrow X$  transition dipole moment [3].

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#### References

- [1] J. G. Danzl *et al.*, Nature Physics, **6**, 265, 2010.
- [2] Feng Xie *et al.*, The Journal of Chemical Physics, **128**, 204313, 2008.
- [3] Jianmei Bai *et al.*, Phys. Rev. A **83**, 032514, 2011.

\*Corresponding author: znotins.aigars@gmail.com