CFEL SCIENCE

SEMINAR

29th November 2013 – 10:00 a.m.
CFEL-bldg. 99, seminar room IV (O1.111)

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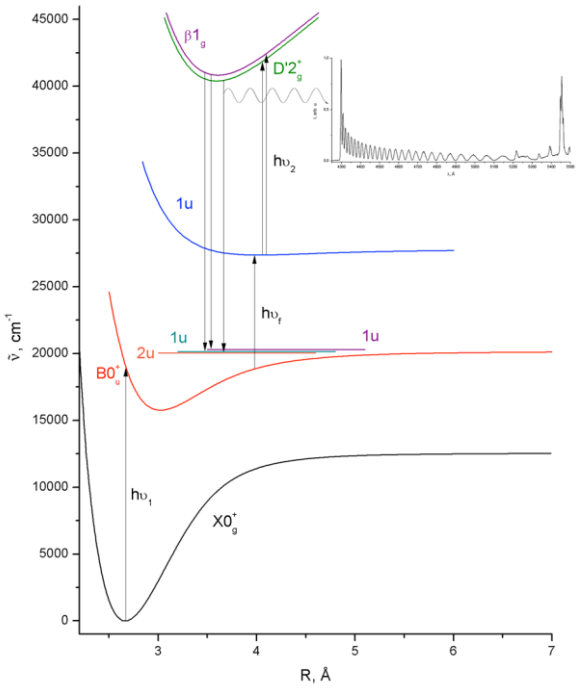
Optically and collisionally induced electronic transitions in iodine molecules in excited states

Several of the 23 valence states of the iodine molecule correlating to two neutral atomic fragments ^2P_J are experimentally unobserved. Goal of this work was to experimentally characterise two 1u and one 2u state correlating to the second dissociation limit with the atomic fragments $^2P_{\frac{3}{2}}$ and $^2P_{\frac{1}{2}}$.

Double resonance three photon three colour excitation of excited states of the iodine molecule have yielded for the first time experimentally determined Morse parameters for three hitherto unobserved potential energy curves as well as absorption cross sections for the depletion of the $B0_u^+$ state of the iodine molecule.
Spectrally resolved fluorescence was monitored for the transitions $\beta 1_g \rightarrow 1u(ab), 1u(ab)$ and $D'2_g^+ \rightarrow 2u(ab)$, after exciting the ion pair states via $X0_g^+ \overset{\lambda_1}{\rightarrow} B0_u^+ \overset{\lambda_f}{\rightarrow} 1u \overset{\lambda_2}{\rightarrow} \beta 1_g$ and $X0_g^+ \overset{\lambda_1}{\rightarrow} B0_u^+ \overset{\lambda_f}{\rightarrow} 1u \overset{\lambda_2}{\rightarrow} D'2_g^+$. The spectra were used for mathematical construction of potential energy surfaces by approximation of a Morse function to the experimental data and calculating a spectrum from this Morse function with the program COOLA. The calculated and experimental spectra were compared.
Cross sections for the transition from the $B0_u^+$ state to the first $(a1g, a'0_g)$ and third $(0_g^+, 1u)$ dissociation limit were determined from a rate equation analysis of time resolved fluorescence decay measurements. A cross section of $\sigma_{B0_u^+} = 2.7 \cdot 10^{-19}\, cm^2$ for $B0_u^+, 21{,}53$ is obtained for the joint absorption into the $a1g, a'0_g, 0_g^+, 1u$ states.



More experimental work is required to further improve the potential energy curve parameters for interfering states and for the determination of the cross sections on a state-to-state level.

Host: Jochen Küpper, CFEL Molecular Physics Seminar