PROSPECTS FOR THE FORMATION OF ULTRACOLD NaRb MOLECULES IN THE GROUND $X^1\Sigma^+(v=0; J=0)$ STATE BY PHOTOASSOCIATION THROUGH THE INTERMEDIATE $A^1\Sigma^+ \sim b^3\Pi$ COMPLEX

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The direct deperturbation analysis of the singlet-triplet $A^1\Sigma^+ \sim b^3\Pi$ complex of $Na^{85}Rb$ and $Na^{87}Rb$ isotopomers was performed in the framework of the inverted channel-coupling approach [a]. Besides of Born-Oppenheimer potential energy curves of the mutually perturbed states and the off-diagonal spin-orbit (SO) $A \sim b$ coupling function, the SO splitting of the $b^3\Pi$ state was determined due to the pronounced electronic- rotation interaction between the $b^3\Pi_0$ and $b^3\Pi_1$ components observed for high J-levels. Overall 24 mass-invariant fitting parameters have been required to reproduce about 2300 experimental term values of both isotopomers with a standard deviation of 0.012 cm^{-1} which is consistent with the uncertainty of the Fourier transform spectra measurement. The experimental relative intensities in the $D^1\Pi \rightarrow A \sim b$ spectra highlighted the breakdown of the conventional oscillation theorem. The strong intensity borrowing effect caused by the SO coupling and enhanced by the violation of the Franck-Condon principle was analyzed. The calculated $A \sim b - a, X$ transition probabilities were applied for simulation of the stimulated Raman processes $a^3\Sigma^+ \rightarrow A \sim b \rightarrow X^1\Sigma^+$ which can lead to efficient formation of ultracold NaRb molecules in the ground level $v_X = 0; J_X = 0$. The quantitative transition moments predicted for favorable lambda schemes show that such experiments are feasible.

[a] O. Docenko, M. Tamanis, R. Ferber, E.A. Pazyuk, A. Zaitsevskii, A.V. Stolyarov, A. Pashov, H. Knöckel, E. Tiemann *Phys. Rev. A* accepted, 2007, in print