# THE MILLIMETER-WAVE SPECTRUM OF METHACROLEIN. TORSION-ROTATION-VIBRATION EFFECTS IN THE EXCITED STATES

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Last year we reported the analysis of the rotational spectrum of *s-trans* conformer of methacrolein $CH_2$=C($CH_3$)CHO in the ground vibrational state[a]. In this talk we report the study of its low lying excited vibrational states. The study is based on room-temperature absorption spectra of methacrolein recorded in the frequency range 150 – 465 GHz using the spectrometer in Lille. The new results include assignment of the first excited torsional state (131 $cm^{-1}$), and the joint analysis of the $v_t$ = 0 and $v_t$ = 1 states, that allowed us to improve the model in the frame of Rho-Axis-Method (RAM) Hamiltonian and to remove some strong correlations between parameters. Also we assigned the first excited vibrational state of the skeletal torsion mode (170 $cm^{-1}$). The inverse sequence of A and E tunneling substates as well as anomalous A-E splittings observed for the rotational lines of $v_{sk}$ = 1 state clearly indicate a coupling between methyl torsion and skeletal torsion. However we were able to fit within experimental accuracy the rotational lines of $v_{sk}$ = 1 state using the RAM Hamiltonian. Because of the inversion of the A and E tunneling substates the rotational lines of the $v_{sk}$ = 1 states were assumed to belong to a virtual first excited torsional state. Finally, we assigned several low-$K_a$ rotational transitions of the excited vibrational states above 200 $cm^{-1}$ but their analysis is complicated by different rotation-vibration interactions. In particular there is an evidence of the Fermi-type resonance between the second excited torsional state and the first excited state of the in-plane skeletal bending mode (265 $cm^{-1}$).

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[a]Zakharenko O. et al., 69th ISMS, 2014, TI01