ASSIGNMENT AND MODELING OF THE SPECTRUM OF ^{13}CH$_4$ RECORDED AT 80 K BETWEEN 5853 AND 6200 CM^{-1}

E. STARIKOVA, A. NIKITIN, S. TASHKUN, *QUAMER, Tomsk State University, 36 Lenin Av., 634050 Tomsk and LTS, V.E. Zuev Institute of Atmospheric Optics SB RAS, 1, Akademician Zuev square, 634021 Tomsk, Russia*; **M. REY, VL.G. TYUTEREV**, *Groupe de Spectrométrie Moléculaire et Atmosphérique, UMR CNRS 7331, UFR Sciences BP 1039, 51687 Reims Cedex 2, France*; **D. MONDELAIN, S. KASSI, A. CAMPARGUE**, *Université Grenoble 1/CNRS, UMR 5588 LIPhy, Grenoble, F-38041, France*

The absorption spectrum of the ^{13}CH$_4$ methane isotopologue has been recently recorded by Differential Absorption Spectroscopy (DAS) at 80 K in the $5853 - 6200$ cm^{-1} spectral range[1]. This range corresponds to upper part of the tetradecad dominated by the $2\nu_3$ band near 5988 cm^{-1}. An empirical list of 3700 lines was constructed from the DAS spectrum.

In this work, we present the first rovibrational assignments obtained using two theoretical approaches: *(i)* variational calculations[2] using *ab initio* dipole moment surface[3] and *(ii)* calculations based on effective Hamiltonian and effective dipole moment operators. Initial non-empirical effective Hamiltonian for the methane polyads was formed using high-order Contact Transformations (CT)[4] from an *ab initio* PES[5].

In total, 2300 lines were assigned to transitions of the tetradecad. Their positions were reproduced with an *rms* deviation of 5×10^{-3} cm^{-1}. About 1300 measured line intensities were modeled using the effective dipole transition moments approach with the *rms* deviation of about 10%. These new data were used for the simultaneous fit of the ^{13}CH$_4$ Hamiltonian parameters of the {ground state / dyad / pentad / octad / tetradecad} system and the dipole moment parameters of the {ground state – tetradecad} system.

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