ROTATIONAL TRANSITIONS IN THE INTERACTING ν_2, ν_3, ν_4 AND ν_6 BANDS OF FORMALDEHYDE IN $H_2^{12}C^{16}O$ THE MILLIMETER RANGE FOR ASTROPHYSICAL USE

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This work, besides its fundamental interest, is motivated by the astrophysical importance of formaldehyde. For example formaldehyde was detected by millimeter techniques in Orion-KL and in several low-mass protostars [a]. However, no line parameters are presently available in the spectroscopic databases for the rotational transitions within the 2^1, 3^1, 4^1 and 6^1 first excited vibrational states of formaldehyde. The goal of this study is to generate a list of line parameters for these "hot" transitions in order to help such - may be - future identifications in astrophysical spectra. For this reason, submillimeter spectra were recorded at Lille and at Köln in the 150-650 and 850-900 GHz spectral ranges, respectively. These sub millimeter data were combined in a least squares fit calculation with the infrared experimental data available in the literature for the ν_3, ν_4 and ν_6 bands [b], and for the ν_2 band [c]. The Hamiltonian model accounts for the various Coriolis-type resonances which perturb the energy levels of the 3^1, 4^1 and 6^1 vibrational states. In addition a weaker and somehow unexpected anharmonic resonance coupling the 2^1 and 3^1 energy levels was accounted for.Using this theoretical model, it proved possible to reproduce satisfactorily the experimental data and to generate a list of line positions and intensities for the $\nu_2 \leftrightarrow \nu_2, \nu_3 \leftrightarrow \nu_3, \nu_4 \leftrightarrow \nu_4$, and $\nu_6 \leftrightarrow \nu_6$ rotational transitions.

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