NEW ANALYSIS OF THE ν_1, ν_5, $2\nu_4$, ν_4+ν_6, $2\nu_6$, ν_3+ν_4, ν_3+ν_6, ν_2+ν_4, $2\nu_3$, ν_2+ν_6, AND ν_2+ν_3 BANDS OF FORMALDEHYDE $H_2{}^{12}C^{16}O$. LINE POSITIONS AND INTENSITIES IN THE 3.6 μm SPECTRAL REGION.

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This work is mainly motivated by the tropospheric importance of formaldehyde. The 3.6μm region is indeed widely used for remote sensings of this molecule in the troposphere by various ground based or portable techniques (diode laser, difference frequency generation (DFG), Fourier transform, and by mid-infrared cavity leak-out spectroscopies). On the other hand the line list which is presently available in HITRAN [a] for this molecule in this spectral range is of poor quality. Using Fourier transform spectra recorded at high resolution at LPMA Paris and at GSMA Reims, it has been possible to perform a new study of the formaldehyde absorption spectra in the 2400-3400cm^{-1} spectral range. This analysis was started using the results obtained by previous studies performed in the same spectral regions [b c]. The analysis of the strongest bands, namely ν_1 and ν_5 (symmetric and antisymmetric stretching modes) was complicated by the existence of numerous dark overtones or combination bands namely $2\nu_4$, ν_4+ν_6, $2\nu_6$, ν_3+ν_4, ν_3+ν_6, ν_2+ν_4, $2\nu_3$, ν_2+ν_6, and ν_2+ν_3. The Hamiltonian model accounts for the various A-type, B-type and C-type Coriolis-type resonances and of the Fermi or anharmonic resonances which perturb the energy levels of the 4^2, 4^1+6^1, 6^2, 3^1+4^1, 3^1+6^1, 1^1, 5^1, 2^1+4^1, 3^2, 2^1+6^1, and 2^1+3^1 vibrational states. This is also the case for the line intensity calculations which allow one to reproduce satisfactorily the line by line intensity measurements available in the literature.

[a] L. H. Rothman, et al. http://cfa-www.harvard.edu/HITRAN/
[b] L. R. Brown, R. H. Hunt, and A. Pine, J. Mol. Spectrosc. 75, 406 (1979).
[c] F. Ito, T. Nakanaga, and H. Takeo, Spectrochimica Acta. 50A, 1397 (1994).