

AN EMPIRICAL SPECTROSCOPIC DATABASE FOR ACETYLENE IN THE REGIONS OF 5850-9415 cm^{-1}

ALAIN CAMPARGUE, *UMR5588 LIPhy, Université Grenoble Alpes/CNRS, Saint Martin d'Hères, France*;
OLEG LYULIN, *Laboratory of Theoretical Spectroscopy, Institute of Atmospheric Optics, Tomsk, Russia*.

Six studies have been recently devoted to a systematic analysis of the high-resolution near infrared absorption spectrum of acetylene recorded by Cavity Ring Down spectroscopy (CRDS) in Grenoble and by Fourier-transform spectroscopy (FTS) in Brussels and Hefei. On the basis of these works, in the present contribution, we construct an empirical database for acetylene in the 5850 - 9415 cm^{-1} region excluding the 6341-7000 cm^{-1} interval corresponding to the very strong $\nu_1 + \nu_3$ manifold. The database gathers and extends information included in our CRDS and FTS studies. In particular, the intensities of about 1700 lines measured by CRDS in the 7244-7920 cm^{-1} are reported for the first time together with those of several bands of $^{12}\text{C}^{13}\text{CH}_2$ present in natural isotopic abundance in the acetylene sample. The Herman-Wallis coefficients of most of the bands are derived from a fit of the measured intensity values. A recommended line list is provided with positions calculated using empirical spectroscopic parameters of the lower and upper energy vibrational levels and intensities calculated using the derived Herman-Wallis coefficients. This approach allows completing the experimental list by adding missing lines and improving poorly determined positions and intensities. As a result the constructed line list includes a total of 10973 lines belonging to 146 bands of $^{12}\text{C}_2\text{H}_2$ and 29 bands of $^{12}\text{C}^{13}\text{CH}_2$. For comparison the HITRAN2012 database in the same region includes 869 lines of 14 bands, all belonging to $^{12}\text{C}_2\text{H}_2$. Our weakest lines have an intensity on the order of 10^{-29} cm/molecule, about three orders of magnitude smaller than the HITRAN intensity cut off. Line profile parameters are added to the line list which is provided in HITRAN format. The comparison to the HITRAN2012 line list or to results obtained using the global effective operator approach is discussed in terms of completeness and accuracy.