CAVITY RING-DOWN SPECTROSCOPY OF HYDROGEN IN THE 784-852 NM REGION AND CORRESPONDING LINE SHAPE IMPLEMENTATION INTO HITRAN

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The hydrogen molecule as the most abundant neutral molecule in the universe is an important object of studies in different areas of science, especially astrophysics. The precision spectroscopy of the hydrogen molecule is particularly useful to verify the quantum electrodynamics theory (QED) in a molecular system. The electric quadrupole transitions of the second overtone of H_2 have been recorded with a high precision cavity ring-down spectrometer.[c] A total of eight lines including the extremely weak $S_3(5)$ line in the $784 - 852$ nm range have been observed. The line positions have been determined to an accuracy of 3×10^{-4} cm^{-1} and the line intensities were determined with a relative accuracy of about 1%. The deviations between the experimental and theoretical frequencies are less than 5×10^{-4} cm^{-1}, which is much smaller than the claimed theoretical uncertainty of 0.0025cm^{-1}. The data from this experiment along with other high-quality H_2 spectra have also been analyzed by the Hartmann-Tran[d] profile as a test case for incorporating[e] parametrization of this profile in the HITRAN[f] database. It was incorporated in the new relational structure of the HITRAN database (www.hitran.org) and into the HITRAN Application Programming Interface (HAPI)[g] for the case of H_2 spectra.

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