SNAPS & HUBS

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The theory of spectroscopic networks[1] offers a powerful instrument for the intelligent design and validation of precision-spectroscopy experiments, as well as the subsequent derivation of accurate rovibrational energies,[2,3,4,5] in particular those associated with hubs (high-degree nodes) of the network. Through a joint experimental and theoretical approach, absolute energies have been determined for a large number of hubs in the experimental spectroscopic networks of $H_2{}^{16}O$ and $H_2{}^{18}O$, with an accuracy of a few times 10^{-7} cm^{-1}. The Lamb-dip measurements utilized two noise-immune cavity-enhanced optical heterodyne molecular spectroscopy (NICE-OHMS) apparata[6,7] and three probe lasers covering different wavenumber ranges. The observed lines, whose lower states belong to the vibrational ground state and the bending fundamental, were selected *via* the spectroscopic-network-assisted precision spectroscopy (SNAPS) approach.[2] The accurately known energy levels are involved in thousands of unique transitions already measured, though at much lower accuracy, for $H_2{}^{16}O$ and $H_2{}^{18}O$. From the ultraprecise absolute energies a large number of benchmark-quality predicted transitions has been deduced, which could be employed as frequency standards in high-resolution Fourier-transform infrared spectroscopy.

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