

Lamb dip of a quadrupole transition in H₂

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The saturated absorption spectrum of the hyperfine-less S(0) quadrupole line in the (2-0) band of H₂ is measured at $\lambda = 1189$ nm, using the NICE-OHMS technique under cryogenic conditions (72 K). It is for the first time that a Lamb-dip of a molecular quadrupole transition is recorded. At high intracavity powers of 0.5-10 kW the line shape corresponds to a complex profile, comparable to previous measurements on HD by our team [1,2] and by the Hefei team [3]. Surprisingly, at low (150-200 W) saturation powers a single narrow Lamb-dip is observed. It is found that the linewidth of this resonance rules out an underlying recoil doublet of 140 kHz, as to be expected under saturation conditions. Systematic measurements on pressure shifts and power shifts were performed and extrapolations to zero-levels fitted. These procedures yield a transition frequency for the S(0) line of (preliminary) 252 016 361 165 (5.0) kHz, which is off by -2.6 (1.6) MHz from molecular quantum electrodynamical calculations [4] therewith providing a challenge to theory.

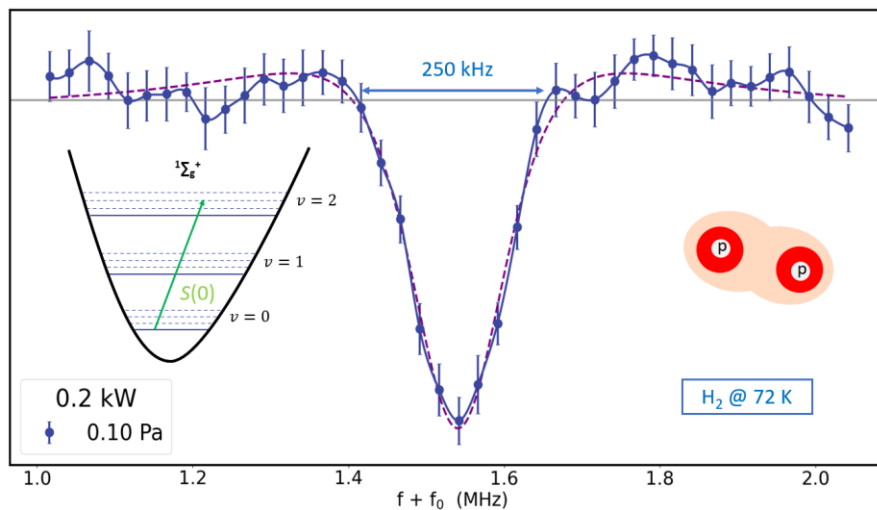


Figure 1: Spectrum of the S(0) quadrupole line of H₂ recorded with NICE-OHMS. The absolute frequency scale, calibrated by a frequency comb laser is given via $f_0 = 252\,016\,360$ MHz.

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