ROTATIONAL LEVEL INTERVALS IN HD FROM CRYO-COOLED SUB-DOPPLER ROVIBRATIONAL SPECTROSCOPY

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The spectroscopic investigation of the hydrogen molecule and its isotopologues has played a crucial role in the advancement of quantum mechanics in the molecular domain. Particularly, highly accurate measurements of rovibrational transitions allow for various tests of fundamental physics including searches for physics beyond the Standard Model[a].

Recent Doppler-free measurements performed at room temperature[bcd], in the (2,0) overtone band of the hydrogen deuteride molecule spurred a stimulating debate on the interpretation of the spectra which significantly differ from typical Lamb-dips. New measurements were performed in a cryogenically cooled cavity with the hope of resolving the underlying hyperfine structure. However the resulted spectra observed shared the same unusual lineshapes which still hinder the extraction of the absolute rovibrational positions. With the goal of extracting the rotational interval with a better accuracy, pairs of P and R transitions were considered. This leads to accurate values for rotational energy intervals and to a precise test of molecular QED theory[e].

[a] W. Ubachs, J.C.J. Koelemeij, K.S.E. Eikema, E.J. Salumbides, J. Mol. Spectr. 320, 1-12 (2016)
[b] F.M.J. Cozijn, P. Dupre, K.S.E. Eikema, E.J. Salumbides, W. Ubachs,, Phys. Rev. Lett. 120, 153002 (2018)
[c] M.L. Diouf , F.M.J. Cozijn, B. Darquie, E.J. Salumbides, W. Ubachs, Opt. Lett. 44, 4733 (2019)
[d] M.L. Diouf, F.M.J. Cozijn, K.F. Lai, E.J. Salumbides, W. Ubachs , Phys. Rev. Res. 2, 023209 (2020)
[e] P. Czachorowski, M. Puchalski, J. Komasa, K. Pachucki, Phys. Rev. A 98, 052506 (2018)