RECENT PROGRESS ON ACTION SPECTROSCOPY OF LOOSELY BOUND HYDROGEN-HELIUM COMPLEXES

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Abstract. Recent progress on action spectroscopy of loosely bound Hydrogen-Helium complexes will be presented on the example of He-H_3^+. The ro-vibrational predissociation spectrum of He-H_3^+ has been recorded via excitation of the ν_2 vibrational mode of the H_3^+ sub-unit in the 22-pole ion trap experiment COLTrap. The spectrum of bare H_3^+ consists of only a few ro-vibrational lines each for the para and ortho nuclear spin configuration, respectively. Instead, the spectrum of the complex is very rich (several hundred lines) even at the low temperature (4 K) of the trap experiment. Part of this complexity is associated with the (almost) free internal rotation of H_3^+. The experimental results are compared to theoretical predictions of ro-vibrational spectra on the basis of *ab initio* calculations of the He-H_3^+ potential energy surface (see Harding et al. 2022). The energy levels result in transitions which agree in many cases with experimental results within a few wavenumbers. In particular the typical band structures of a P- and R-branch associated with an effective diatomic complex seen in the experimental and predicted spectrum help in assigning the rich spectrum. Moreover, an experimental energy term diagram is reconstructed from the observed transitions which can be compared to the rather accurate theoretical predictions. The influence of the Coriolis interaction resulting from the H_3^+ internal rotation in a rotating He-H_3^+ frame will be discussed.

References

Harding, M. E., Lipparini, F., Gauss, J. , Gerlich, D. , Schlemmer , S. ,van der Avoird, A. : 2022, *J. Chem. Phys.*, **156**, 144307.