Comparing streaking and RABBITT measurements on a molecular target: H_2

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Photoionization dynamics of the simplest molecule H_2 continues to be of strong scientific interest as still new physical insight into fundamental processes can be gained.

In this study, we investigate how the dissociative ionization, i.e. $H_2 \rightarrow H+H^+ + e^-$, of parallel oriented H_2 molecule is influenced by the presence of Q_1 autoionizing states comparing the two most common techniques used in attosecond science, namely attosecond streaking [1] and RABBITT (Reconstruction of Attosecond Bursts by Interference of Two-photon Transitions) [2].

These experimental results are confirmed and complemented by a complete *ab initio* theoretical study incorporating both electronic and nuclear coordinates in the description of the molecular wave function [3,4]. Moreover, to extract the photoionization phase delay from both experimental and theoretical streaking spectrograms we used the new ACDC retrieval code [5], which does not need the central momentum and wavepacket approximation.

The experimental RABBITT results clearly appear to be very sensitive to the bond softening effect around the Q_1 threshold (27.8 eV), even at relatively low IR intensity ($I_0 \sim 1.4 \times 10^{11}$ W/cm^2). On the other hand, the streaking results show a bond-softening free phase delay profile in extremely good agreement with the theoretical calculations. In addition, the streaking technique offers the necessary energy resolution to accurately retrieve such a fast oscillating phase, an essential tool to be able to study even more complicated molecular targets.

References

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