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Do nuclei move on an attosecond timescale in strong-field photodissociation?¹

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Without the ready availability of single attosecond pulses with sufficient energy to perform pump-probe experiments, the push to measure electronic dynamics on its natural timescale of attoseconds has enlisted less direct measurements. Photoionization “time delays”, in particular, have been measured and calculated to be on the attosecond timescale and thus have attracted considerable attention. The ultimate goal of such attosecond-scale measurements is the molecular movie — *i.e.*, making movies of the electronic motion during chemical reactions. It has been universally assumed, however, that any measured attosecond timescales in observables relate exclusively to electronic dynamics, even during a reaction which necessarily includes nuclear motion. I will explore some of the limits of this assumption and highlight a few specific cases where it fails, emphasizing in the process that phases should be favored over “time delays”.

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