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Dissociation dynamics of O_2^+ in intense laser fields[1] M. MAGRAKVELIDZE, S. DE, C.L. COCKE, U. THUMM, J. R. Macdonald Laboratory, Kansas State University — We investigated the nuclear dynamics of the electronically and vibrationally excited O_2^+ molecules by applying intense ultrashort IR probe pulses and measuring the fragment kinetic energy release (KER) spectra as a function of the pump-probe delay. To analyze these spectra, we performed vibrational-wave-packet-propagation calculations on adiabatic O_2^+ potential curves. First, to identify relevant transiently populated electronic states of O_2^+, we modeled the pump step in Franck-Condon approximation and calculated the time evolution of initial O_2^+ vibrational wave packets separately for selected molecular potential curves. The comparison of calculated KER spectra as a function of delay, quantum beat frequency, and vibrational revival times for one adiabatic curve at a time with experimental spectra serves as a guide for selection of relevant O_2^+ electronic states. Next, we included probe-laser-induced dipole couplings between the relevant molecular potential curves and compared the improved calculated KER spectra with the experiment, in an attempt to reveal non-adiabatic effects in measured KER spectra that are due to the coupled motion of vibrational wave packets in different electronic states.

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M. Magrakvelidze

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