Abstract Submitted
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Creating and manipulating vibrational wavepackets of the D_2^+ molecular ion.[1] JARLATH MCKENNA, CHRIS CALVERT, DOMHNALL MURPHY, JIM MCCANN, IAN WILLIAMS, Queens University Belfast, WILLIAM BRYAN, ELIZABETH ENGLISH, JOSEPH WOOD, ROY NEWELL, University College London, EDMOND TURCU, Rutherford Appleton Laboratory — The creation of a vibrational wavepacket within a molecular system shows great promise as an active method of both tracking and controlling nuclear motion on femtosecond timescales. However the coherent excitation of the vibrational eigenstates of the molecule, and the subsequent imaging of the bond vibration, requires pulse durations on the order of the vibrational period. For the theoretically tractable hydrogen molecular ions, such timescales are on the order of 20 fs or less. As such, intense few-cycle infrared laser pulses are required. We present here a study where we excite and subsequently map out the quantum revival of a vibrational wavepacket of D_2^+, tracking the nuclear motion over hundreds of femtoseconds. By rigorous modeling of the nuclear motion the experimental results are reproduced to high agreement, and new methods to control both molecular dissociation and vibrational state population are proposed.

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