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Quantum-beat imaging of the nuclear dynamics in D_2^+: Dependence of bond softening and hardening on laser intensity, wavelength, and pulse duration MAIA MAGRAKVELIDZE, FENG HE, THOMAS NIEDERHAUSEN, IGOR LITVINYUK, UWE THUMM — Based on a quantum mechanical model, we calculate the time evolution of an initial nuclear vibrational wave packet in D_2^+ generated by the rapid ionization of D_2 in an ultrashort pump-laser pulse. By Fourier transformation of the nuclear probability density with respect to the time delay between the pump pulse and the wave packet's instant destructive Coulomb explosion imaging at the high-intensity spike of an intense probe-laser pulse, we provide two-dimensional, internuclear distance (R) dependent power spectra that serve as a tool for visualizing and analyzing the nuclear dynamics in D_2^+ in an intermittent external laser field. The external field models the pedestal to the central ultra-short spike of a realistic probe pulse. Variation of the intensity, wavelength, and duration of this probe-pulse pedestal, allows us to identify optimal laser parameters for the observation of field-induced bond softening (BS) and bond hardening (BH) in D^+ $_2$ and suggests a scheme for quantitatively testing the validity of the Floquet picture that is commonly used for the interpretation of short-pulse laser-molecule interactions.

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