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Multimode Vibrational Wave Packet Dynamics of Strong-Field-Ionized Methyl Iodide Probed by Femtosecond XUV Absorption Spectroscopy[1] ZHI-HENG LOH, ZHENGRONG WEI, JIALIN LI, Nanyang Technological University — Studies of vibrational wave packets (VWPs) created on the neutral electronic ground-state by intense laser fields have identified R-selective depletion (RSD) as the dominant mechanism for their generation. Another mechanism that is proposed to give rise to VWPs, bond softening (BS), remains hitherto unobserved. Here, we employ femtosecond XUV absorption spectroscopy to investigate the VWP dynamics of CH_3I induced by intense laser fields. Analysis of the first-moment time traces computed about the neutral depletion region reveals both the fundamental and the hot bands of the CI stretch mode. The initial oscillation phases of these vibrations distinguishes the contributions of RSD and BS to the generation of the VWP in the neutral species. The relative oscillation amplitudes that are associated with the two phases suggest that the CI VWP is generated predominantly by BS. In the case of the CH_3I^+ $\tilde{X}\ ^2E_{3/2}$ ion state, VWP motion along the CI stretch mode is dominant over the CH_3 umbrella mode. Moreover, the amplitudes of the VWPs are only 1 pm (CI distance) and 1° (HCI bond angle). The ability to resolve such VWP dynamics points to the exquisite sensitivity of femtosecond XUV absorption spectroscopy to structural changes.

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