STRONG-FIELD INDUCED DISSOCIATIVE IONIZATION OF VINYL BROMIDE PROBED BY FEMTOSECOND EXTREME ULTRAVIOLET (XUV) TRANSIENT ABSORPTION SPECTROSCOPY

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A table-top high harmonic XUV light source (50 eV to 70 eV) has been successfully utilized to explore the ultrafast dynamics of vinyl bromide (CH$_2$=CHBr) with electronic state specificity and elemental sensitivity. Strong-field ionization (SFI) provides a method to produce ions in different ionic states. The production and dissociation dynamics of these ionic states are investigated by femtosecond XUV transient absorption spectroscopy. The XUV photons probe the time-dependent spectroscopic features associated with transitions of the Br (3d) inner-shell electrons to vacancies in molecular and atomic valence orbitals. The experimental observation shows that two ionic states are produced by SFI. The first ionic excited state is dissociative, leading to C-Br bond dissociation which is observed in real time as a shift in the absorption energy. The results offer powerful new insights about orbital-specific electronic processes in high field ionization, coupled vibrational relaxation and dissociation dynamics, and the correlation of valence hole-state location and dissociation in polyatomic molecules, all probed simultaneously by ultrafast table-top XUV spectroscopy.

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