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Dissociation and ionization of H_2^+ in intense femtosecond laser fields studied by coincidence 3D momentum imaging[1]

PENGQIAN WANG, A.M. SAYLER, K.D. CARNES, J.F. XIA, M.A. SMITH, B.D. ESRY, I. BEN-ITZHAK, J.R. Macdonald Laboratory, Physics Department, Kansas State University — Dissociation and ionization of H_2^+ in intense laser fields have been measured simultaneously using a coincidence 3D momentum imaging method. The H_2^+ beam is crossed by a laser beam (45-135 fs, 790 nm, 10^{13}-10^{15} W/cm^2), and the momentum of each fragment in H^++H and H^++H^+ is determined. The angular and kinetic energy release spectra are obtained. At similar intensities, the dissociation mechanisms in long and short pulses are found to be quite different, dominated by bond-softening and above threshold dissociation, respectively. The ionization of H_2^+ becomes measurable from about 2×10^{14} W/cm^2, increases rapidly with laser intensity, and aligns strongly along the laser polarization with a broad kinetic energy distribution. The overall ionization to dissociation ratio is less than previously predicted by theory.

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