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Channel asymmetry in the dissociation of HD^+ using an intense ultrafast single color laser field[1] M. ZOHRABI, B. RIGSBEE, U. ABLIKIM, K.D. CARNES, B.D. ESRY, I. BEN-ITZHAK, J.R. Macdonald Laboratory, Physics Department, Kansas State University, Manhattan, KS 66506 — We have studied laser-induced fragmentation of molecular-ion beams using a coincidence 3D momentum imaging technique, which affords us the ability to measure both neutral and ionic fragments. These measurements provide detailed kinetic energy release (KER) and angular distributions of the different fragmentation processes. We focus mainly on the simplest heteronuclear molecule, HD^+, (using 25-65 fs laser pulses) as a model for more complex systems. We use deuterium tagging to distinguish different final products and thus study how to control one outcome over another. The preference for HD^+ to dissociate into either $H^+ + D$ or $H + D^+$ is a good example of this kind of control - usually referred to as controlling the branching ratio. One would expect the $H^+ + D$ channel, associated with the HD^+ electronic ground state, to dominate over dissociation into $H + D^+$ for very slow fragmentation. Our measured branching ratio confirms this prediction, but it also exhibits differences between these two channels in the higher KER region (0.5-1.2 eV). Furthermore, theoretical calculations show similar features in both KER regions.

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