

Abstract Submitted  
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**Observation of a novel dissociation path in deuterium molecules fragmented via a two-photon process**<sup>1</sup> WEI CAO, ITZIK BEN-ITZHAK, CHARLES LEWIS COCKE, J.R. Macdonald Laboratory, Physics Dept, Kansas State University, Manhattan, KS, U.S.A. — A recently developed VUV monochromator combined with a COLTRIMS detection system is used to study deuterium molecules with the pump-probe method. A single high-order harmonic with photon energy near 17 eV is used to promote D<sub>2</sub> via a single-photon process. A delayed 800 nm infrared (IR) pulse feeds the promoted system with an additional photon of 1.54 eV and opens the dissociative ionization channel energetically. The two-photon process was identified from electron-ion coincident measurements and both spectroscopic and time-resolved measurements were made. A previously unobserved channel is found for which the dissociation direction does not follow the polarization of the IR. We interpret this channel as corresponding to VUV excitation of D<sub>2</sub> followed by pre-dissociation into two separated atoms (D(*1s*)+D(*nl*)), with the excited atom subsequently ionized by the IR pulse. When the VUV photon is blueshifted to 17.4 eV and above, the more familiar dissociation channel is opened whereby VUV ionization of D<sub>2</sub> is followed by electronic excitation (bond softening) by the IR pulse. The dissociation direction does follow the polarization of the IR for this channel.

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