

Abstract Submitted
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Kinematically-complete measurements of laser-induced dissociation of $C_2H_2^{q1}$ BETHANY JOCHIM, T. SEVERT, K. D. CARNES, I. BENITZHAK, J. R. Macdonald Laboratory, Department of Physics, Kansas State University, Manhattan, KS 66506, E. WELLS, Department of Physics, Augustana University, Sioux Falls, SD 57197 — We examine intense femtosecond laser-induced fragmentation of acetylene dications and monocations [1]. Probing these molecules as keV ion-beam targets and focusing on dissociation ensure that the dynamics occur in a single charge state. We observe both acetylene-like breakup ($CH^{q1} + CH^{q2}$) and vinylidene-like breakup ($C^{q1} + CH_2^{q2}$) of the initially linear HCCH configuration $C_2H_2^q$ molecules (where $q = q_1 + q_2$). For the acetylene dication, the triplet electronic states play a dominant role in the $CH^+ + CH^+$ channel, in contrast to previous photofragmentation studies of neutral C_2H_2 targets, e.g., [2,3], wherein the singlet states are likely the main contributors. Plausible pathways leading to $CH^+ + CH$ fragmentation of the acetylene monocation are also discussed. The dynamics underlying the vinylidene-like breakup channels are less clear and call for more complete structure calculations and better understanding of the isomerization process.

[1] B. Jochim *et al.*, Phys. Rev. A **101**, 013406 (2020); [2] A. S. Alnaser *et al.*, J. Phys. B **39**, S485 (2006); [3] T. Osipov *et al.*, J. Phys. B **41**, 091001 (2008).

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Bethany Jochim
J. R. Macdonald Laboratory, Dept of Physics, Kansas State Univ

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