Channel competition in strong-field dissociation of CS$^{+1}$

BETHANY JOCHIM, M. ZOHRABI, K.J. BETSCH, U. ABLIKIM, BEN BERRY, T. SEVERT, A.M. SUMMERS, K.D. CARNES, B.D. ESRY, I. BEN-ITZHAK, J. R. Macdonald Laboratory, Department of Physics, Kansas State University, Manhattan, KS USA 66506 — We study intense ultrafast laser-induced dissociation of a CS$^+$ ion beam, utilizing a coincidence 3-D momentum imaging technique. Over a laser intensity range of $10^{10}$–$10^{16}$ W/cm$^2$, we find clear intensity-dependent behavior of the C$^+$+$S$ and C+$S^+$ branching ratios. Specifically, we observe that the branching ratios are nearly equal at low intensities ($\sim 10^{10}$–$10^{12}$ W/cm$^2$) and deviate from each other at higher intensities ($>10^{13}$ W/cm$^2$), where C+$S^+$ dominates. We propose that the low-intensity branching ratio behavior is due to strong mixing of states corresponding to the relevant dissociation limits mediated by the non-adiabatic couplings, and we identify possible dissociation pathways involving these couplings. Another aspect of channel competition, closing and opening of the two dissociation channels as a function of total energy, is distinctly observed, and this behavior is characterized using the well-known Wigner law for near-threshold behavior [1,2].


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Bethany Jochim
Kansas State University

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