Comparison of laser-induced fragmentation channels of CS$^+$ and CO$^+$: a study in chemically similar molecules

K.J. BETSCH, T. SEVERT, U. ABLIKIM, M. ZOHRABI, B. JOCHIM, K.D. CARNES, I. BEN-ITZHAK, J. R. Macdonald Laboratory, Department of Physics, Kansas State University, Manhattan, KS 66506, USA — In an effort to address how well the idea of chemically similar molecules extends into strong field phenomena, we explore similarities and differences in ultrafast laser-induced fragmentation channels from CS$^+$ and CO$^+$ molecular ion beams. We find similar fragmentation channels and features of interest, such as a laser-intensity-dependent high kinetic-energy-release (KER) peak in the dissociation channels of both molecules. However, molecule-specific features, such as the relative abundances and KERs of individual channels, are also observed. For example, we observe that, in the asymmetric-charge breakup channel CS$^+ \rightarrow$ CS$^{2+} \rightarrow$C + S$^{2+}$, the carbon atom is neutral. This is opposite to the asymmetric-charge breakup from CO$^+$, where the carbon fragment carries the charge. Based upon their chemical similarity, we would expect similar asymmetric breakup for the two molecules. We will discuss why the actual behavior differs from our expectations.

1This work has been supported by the Chemical Sciences, Geosciences and Biosciences Division, Office of Basic Energy Sciences, Office of Science, U.S. Department of Energy Grant DE-FG02-86ER13491.