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Dissociative Photoionization of Methane at the Carbon K-edge J.B. WILLIAMS, A.L. LANDERS, Auburn University, C. TREVISAN, California Maritime Academy, I. BOCHAROVA, F. STURM, C.W. MCCURDY, A. BELKA-CEM, TH. WEBER, Lawrence Berkeley National Laboratory, T. JAHNKE, M.S. SCHOEFFLER, R. DOERNER, University of Frankfurt — We have used Cold Target Recoil Ion Momentum Spectroscopy (COLTRIMS) to measure the momenta of the photoelectron and the molecular fragments arising from the dissociation of the methane molecule following Auger decay. Methane is one of the simplest 3dimensional polyatomic molecules and provides a testing ground to study the interplay between the electronic and the nuclear motion. Soft X-ray radiation from the Advanced Light Source (ALS) at LBNL was used to core-ionize the methane. One decay pathway resulting from this breakup is $C(1s^{-1})H_4^{+*} + e_{\gamma}^- \rightarrow CH_3^+ + H^+ + e_{\gamma}^ + e_{auger}^{-}$. In this channel we are able to determine the orientation of the bond axis (between the CH_3^+ and H^+ ions) using the axial recoil approximation; the result is an azimuthally symmetric Molecular Frame Photoelectron Angular Distribution (MFPAD). We are also examining the different accessible vibrational modes to see if there are correlated changes in the MFPADs and fragmentation branching ratios, as well as exploring the use of three-fragment dissociation to fully orient the molecule. The preliminary results of the experiment will be presented and compared to a preliminary theoretical calculation of the MFPADs for methane.

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