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Asymmetric Core-Photoelectron Angular Distributions of Fixed-in-Space CO_2 F.P. STURM, Goethe Univ. Frankfurt, LBNL, M. SCHOEFFLER, S. LEE, T. OSIPOV, LBNL, N. NEUMANN, H.-K. KIM, S. KIRSCHNER, Goethe Univ. Frankfurt, B. RUDEK, Goethe Univ. Frankfurt, LBNL, J.B. WILLIAMS, J.D. DAUGHHETEE, Auburn University, C.L. COCKE, Kansas State University, K. UEDA, Tohoku University, A.L. LANDERS, Auburn University, TH. WEBER, M.H. PRIOR, A. BELKACEM, LBNL, R. DOERNER, Goethe Univ. Frankfurt
— We report a kinematically complete experiment of carbon 1s photoionization of CO_2 including Auger decay and fragmentation. By measuring in coincidence of CO_2 C(1s) photoelectrons and ion fragments using synchrotron light at several energies above the C(1s) threshold, we determine photoelectron angular distributions as well as Auger electron angular distributions with full solid angle in the molecular fixed frame. Our measurement confirms earlier results showing a weak but definite asymmetry of the photoelectron emission with respect to the central carbon atom. Additionally, it reveals new asymmetric features in the photoelectron angular distribution which change as a function of the kinetic energy release. Our explanation for this puzzling asymmetry is that the angular dependence of the outgoing photoelectron is modified by the instantaneous dipole moment of the vibrating $CO_2{}^+$ ion, registering information about its asymmetric vibrational motion at the time of photoejection.

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