

Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Identifying the Role of Multielectron Excitations in Rydberg State Dissociation of Oxygen with Ultrafast Photoelectron Spectroscopy¹

ALEXANDER PLUNKETT, ARVINDER SANDHU, University of Arizona — We investigated the fragmentation dynamics of highly excited states of molecular oxygen using femtosecond transient photoelectron spectroscopy. An XUV pump populates neutral Rydberg states converging to the $c^4\Sigma_u^-$ state and a delayed IR probe serves to photoionize the Rydberg wavepacket, producing low energy electrons. We obtained transient photoelectron spectra by subtracting the XUV+IR and XUV alone photoionization data at various time delays and thereby studied the competing mechanisms of molecular autoionization and ultrafast dissociation. We observed the formation of 4p excited atomic oxygen fragment, which is not an expected dissociation product of the $(c^4\Sigma_u^-)nl\sigma_g$ Rydberg series. We show that this fragment results from previously unexplored $(^4\Pi_g)4p$ repulsive state and, contrary to expectations, this multielectron excitation pathway presents a substantial cross section. Our study demonstrates that two-color time-resolved photoelectron spectroscopy is an excellent tool to study the fragmentation dynamics of such states, which are not easily probed by other means due to their repulsive nature.

¹This work was supported by the U. S. Army Research Laboratory and the U. S. Army Research Office under grant number W911NF-14-1-0383 and by the National Science Foundation (NSF) award number PHY-1505556.

Alexander Plunkett
University of Arizona

Date submitted: 01 Feb 2019

Electronic form version 1.4