

STUDIES OF TRANSIENT NEUTRAL MOLECULES BY DISSOCIATIVE PHOTODETACHMENT OF COOLED MOLECULAR ANIONS

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We have recently integrated and cryogenically cooled a “Zajfman-style” linear electrostatic ion trap^b with a Photoelectron-Photofragment Coincidence (PPC) spectrometer. We are able to trap precursor anions for several seconds in a cryogenic environment, allowing them to radiatively cool to ground or near-ground states. Our design features a time- and position-sensitive velocity map imaging electron detector intra-cavity to capture electrons photodetached at the center of the trap, and a multiparticle time- and position-sensitive neutral detector downstream to detect resultant neutral fragments. By recording coincidence events as a function of trapping time we remove ambiguities caused by internally excited anions. The experimental apparatus has been verified on the benchmark systems O₃ and O₄ by dissociative photodetachment of O₃⁻ and O₄⁻ respectively. While both systems have been extensively studied previously in our lab, new dynamics have been resolved in each beyond those already reported. We have also extended our previous investigation of the OH+CO → H+CO₂ radical reaction^c, which included significant contributions from internally excited anions, to cooled HOCO⁻ precursor anions. The new study reveals significant changes in our measurements of energetics and dissociation dynamics on the HOCO potential energy surface.

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