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**Strong Field Probes of Ultrafast Molecular Dynamics: Dissociation of $NO_2$** RUARIDH FORBES, University College London; University of Ottawa, ANDREY E. BOGUSLAVSKIY, Department of Physics, University of Ottawa, IAIN WILKINSON, Institute Methods for Material Development, Helmholtz Centre Berlin and National Research Council of Canada, JONATHAN G. UNDERWOOD, Department of Physics and Astronomy, University College London, ALBERT STOLOW, Department of Physics and Chemistry, University of Ottawa and National Research Council of Canada — Strong laser-field based methods such as high-harmonic generation and strong field ionization (SFI) are considered novel probes of ultrafast excited state molecular dynamics. We present an experimental femtosecond time-resolved SFI study of the excited state dynamics of $NO_2$ using channel-resolved above-threshold ionization (CRATI) as the probe technique. CRATI makes use of PhotoElectron-PhotoIon COincidence (PEPICO) spectroscopy to study correlations in fragmentation dynamics in molecular systems. The use of PEPICO and covariance methods allows us to correlate ATI photoelectrons associated with a particular ionic fragment and, hence, SFI electron orbital ionization channel. In all ionization channels considered, we observed variations in the ion and photoelectron yields as a function of pump-probe delay as well as the observation of persistent ATI combs at long time delays. In disentangling the excited state dynamics of $NO_2$, we examine the complex roles of one-photon excitation, multi-photon excitation to higher lying excited neutral states, non-adiabatic excited state dynamics and several neutral and ionic dissociation channels.

Ruaridh Forbes
University College London; University of Ottawa

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