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Attosecond Coherent Control of the Photo-Dissociation of Oxygen Molecules[1] FELIX STURM, DIPANWITA RAY, TRAVIS WRIGHT, NIRANJAN SHIVARAM, IRINA BOCHAROVA, DANIEL SLAUGHTER, Lawrence Berkeley National Lab, PREDRAG RANITOVIC, Extreme Light Infrastructure, ALI BELKACEM, THORSTEN WEBER, Lawrence Berkeley National Lab — Attosecond Coherent Control has emerged in recent years as a technique to manipulate the absorption and ionization in atoms as well as the dissociation of molecules on an attosecond time scale. Single attosecond pulses and attosecond pulse trains (APTs) can coherently excite multiple electronic states. The electronic and nuclear wave packets can then be coupled with a second pulse forming multiple interfering quantum pathways. We have built a high flux extreme ultraviolet (XUV) light source delivering APTs based on HHG that allows to selectively excite neutral and ion states in molecules. Our beamline provides spectral selectivity and attosecond interferometric control of the pulses. In the study presented here, we use APTs, generated by High Harmonic Generation in a high flux extreme ultraviolet light source, to ionize highly excited states of oxygen molecules. We identify the ionization/dissociation pathways revealing vibrational structure with ultra-high resolution ion 3D-momentum imaging spectroscopy. Furthermore, we introduce a delay between IR pulses and XUV/IR pulses to constructively or destructively interfere the ionization and dissociation pathways, thus, enabling the manipulation of both the O_2^+ and the O^+ ion yields with attosecond precision.

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