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Strong-Field Physics with Coherently Prepared Molecular Targets[1]

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Intense, short laser pulses can create rotational wavepackets in molecules, resulting in transient preferential molecular alignment in a field free environment. The availability of aligned rather than randomly oriented molecular samples is enabling new strong-field molecular physics experiments which offer additional insight into a variety of complex phenomena. For example, high harmonic generation (HHG) is mediated by electrons that are first tunnel-ionized and then driven back into their parent ions by an intense laser field. Both the initial ionization and recollision events can be strongly dependent on the orientation of the molecular axis with respect to the laser field. Once this dependence is well understood, information regarding the structure of the parent molecule at the instant of the electron/ion recollision might be extracted from the resulting electron and/or photon emission. I will describe methods for manipulating and probing molecular alignment, as well as our recent measurements of the dependence of intense laser ionization rates, HHG yields, and the polarization of high-order harmonics on the alignment of the molecular axis relative to the polarization direction of the intense laser field.

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