

Lightwave-driven quantum dynamics: the molecular selfie

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Electron recollision in an intense laser field gives rise to a variety of phenomena, ranging from electron diffraction to coherent soft X-ray emission. We have, over the years, developed intense sources of waveform-controlled mid-IR light to exploit ponderomotive scaling, quantum diffusion and quasi-static photoemission. I will describe how we leverage these effects to “teach” electrons to take a selfie of the dynamics of a single molecule. This permits visualizing for the first time, with combined attosecond temporal and atomic spatial resolution, molecular bond breaking and deprotonation. The results provide first insight into the dynamics of molecules with the future possibility to address fundamental and long-standing questions such as molecular isomerization and the connection between molecular structure and function.

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