COLLOQUIA

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Controlling chemistry at extreme time scales

Abstract

The Nobel Prize in Physics awarded in 2023 underscored the transformative potential of attosecond light sources[1] which now grant us unprecedented insights into the electron time scale within matter. This advancement has paved the way for the emergence of attochemistry[2,3], a novel field aiming at manipulating chemical reactivity through the precise driving of electronic motion.

In this presentation, I will start by explaining the process of attosecond pulse generation[4,5], followed by an overview of our latest achievements in producing remarkably short light pulses across both ultraviolet (UV)[6,7] and soft X-ray spectral ranges. Additionally, I will highlight a variety of applications for these ultrashort light transients, such as the real-time observation of ultrafast charge migration and dissociative dynamics in photoexcited molecules[8,9,10], as well as the study of plasmon dynamics in fullerenes[11] and nanoparticles[12]. A key focus will be on our novel approach to instigating well-controlled charge migration in chiral neutral molecules, which represents a significant step toward achieving charge-directed reactivity[13]—the ultimate objective of attochemistry.

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