

New directions in Attosecond Chemistry

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With the advent of attosecond light pulses at the dawn of the twenty first century, access to the time scale of electronic motion, i.e., the ultimate time scale responsible for chemical transformations, was finally at our reach. Since the first attosecond pump-probe experiments performed in molecules^{1,2}, the field has grown exponentially, leading to a discipline that we call attochemistry³. As a result, it is nowadays possible to follow in real time the motion of the "fast" electronic motion in molecules, mostly in the gas phase, and understand how this motion affects the "slower" motion of atomic nuclei and vice versa. There are, however, new scenarios⁴ that will allow one to extend the range of applications, including more complex molecular systems and the condensed phase, and to overcome some of the limitations of current attosecond technologies⁵⁻¹¹ such as the low intensity of attosecond pulses produced by high harmonic generation, the impossibility to generate such pulses in the visible and UV spectral regions to avoid molecular ionization, or the difficulties to combine them with truly imaging methods for direct time-resolved observations of the electron density without the need for reconstruction from measured photoelectron, photoion or transient absorption spectra. In this talk, I will describe current experimental and theoretical efforts aiming at overcoming the above-mentioned limitations, thus giving attochemistry the necessary push to investigate problems of real chemical interest.

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