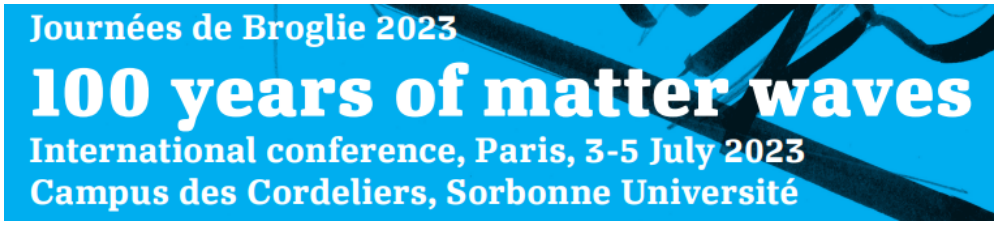


# Attosecond scattering delays in photo-ionized molecules

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## Abstract

Electrons are very accurate probes of matter at the fundamental level. In electron microscopy, their quantum nature and short De Broglie wavelength permits to obtain high spatial resolution. In photoionization spectroscopy, the electron momentum allows us to determine the electronic structure of bulk matter, molecules and atoms. In this context, attosecond experiments, which aim at studying electron dynamics on the angstrom length scale, have opened up a wide variety of novel opportunities to study dynamical properties of matter such as ionization.

Photoionization as a half-scattering process is not instantaneous. Usually, ionization delays are of the order of few tens of attoseconds (1 as = 10 −18 s). Attosecond technology allows to measure the phase and related time delays associated to this electron scattering process. While it has been applied to the case of isolated atoms, the case of polyatomic systems offer new experimental and theoretical challenges. Here, we have studied how quantum scattering phase can be measured and interpreted in terms of attosecond delays, in the case of three dimensional and planar molecular systems. We find that the time delays in 2D molecules can significantly be smaller than those of the corresponding 3D counterparts. These findings are supported by first-principles calculations based on static-exchange density functional theory and offer new perspectives in terms of attosecond measurements in complex objects.