NANOSCIENCE COLLOQUIUM

Attosecond chronoscopy of plasmon dynamics

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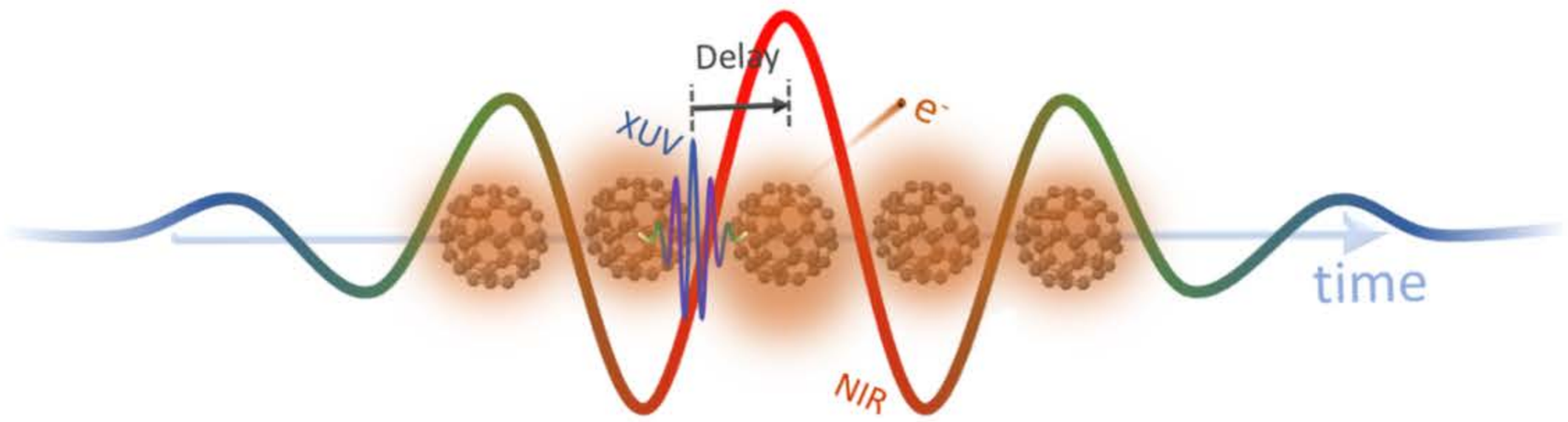
Abstract: Extreme light confinement through plasmon excitation in nano or sub-nanometer systems enables novel applications in photonics, sensor technology, energy harvesting, biology, and quantum information processing. With the size of the plasmonic system approaching the atomic scale the dynamics of collective electron motion transitions from the classical to the quantum limit. In this limit, the intrinsic quantum dynamics and related plasmon dephasing occur at extremely fast time scales (down to the attosecond domain).

Attosecond science is nowadays a well-established research field, which offers formidable tools for the realtime investigation of electronic processes [1]. In this context, we recently employed this technology to initiate and track charge migration in large molecules such as aromatic amino-acids [2] and nucleobases [3]. In this talk, I will show how a similar approach can be used to extract valuable information about the collective electron dynamics initiated in plasmonic systems by ultrashort laser pulses. In particular, I will first discuss how attosecond metrology can be used to uncover the dominant role of electron correlations in the dephasing dynamics of the giant plasmon resonance (GPR) of the sub-nanometer system C60. I will then introduce a novel approach for the optical sampling (at PHz frequencies) of the plasmonic field originated from the interaction of an ultrashort infrared laser pulse with gold nanoparticles and a route for mapping dephasing effects in the time domain.

[1] F. Calegari et al., J. Phys. B 062001, 49 (2016)
[2] F. Calegari et al, Science 346, 336 (2014)
[3] E. P. Månsson al. Communications Chemistry 4, (2021).



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