

Seminar

Prof. Mauro NISOLI

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Attosecond Science: the art of making electron movies

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Aula Magna, Physics Department, via Pietro Giuria 1, Torino

Webex: <https://unito.webex.com/meet/ettore.vittone>

Abstract

The Nobel Prize in Physics 2023 was awarded jointly to Pierre Agostini, Ferenc Krausz and Anne L’Huillier “for experimental methods that generate attosecond pulses of light for the study of electron dynamics in matter.” Attosecond Science represents one of the frontiers in Ultrafast Physics, since it offers the possibility to monitor, influence and control the motion of electrons in atoms, molecules and solids.

After a general introduction on Attosecond Science, I will concentrate on applications of attosecond pulses to molecular physics. The investigation of ultrafast processes initiated in molecules by light absorption is of crucial importance in various research areas, from molecular physics to material science, from chemistry to biology. They are at the heart of emerging technological applications, where photo-induced charge transfer plays a key role. In the last few years, the use of attosecond pulses has demonstrated to be a very powerful tool for the investigation of physical processes evolving in molecules on timescales ranging from a few femtoseconds down to tens of attoseconds. The introduction of new attosecond spectroscopic techniques, together with the development of sophisticated theoretical methods for the interpretation of the experimental outcomes, allowed unravelling and investigating physical processes never observed before. The application of attosecond methods to molecular physics has opened new research frontiers. Experimental advances, in terms of new sources, devices and techniques, are still required, together with new theoretical tools and approaches, but attosecond molecular physics has firmly established as a mature research field.

The speaker:

Mauro Nisoli is Professor at Politecnico di Milano since 2011. From 1990 to 2000, he was a Researcher of the National Research Council (CNR), Center of Quantum Electronic and Electronic Instrumentation; from 2001 to 2010, he was an Associate Professor with the Department of Physics, Politecnico di Milano. He is the Head of the Attosecond Research Center at the Department of Physics of Politecnico and he is co-director of the International School "The Frontiers of Attosecond and Ultrafast X-ray Science". He is author of more than 210 research papers in international journals and several invited and tutorial communications at international meetings and schools. His research interests are as follows: attosecond science and technology; ultrafast phenomena in atomic, molecular and condensed matter physics, with temporal resolution down to the attosecond regime; ultrashort-pulse laser technology; extreme nonlinear optics; atoms and molecules in strong laser fields.

He was awarded a European Research Council (ERC) Advanced Grant in 2009 (Electron-scale dynamics in chemistry, ELYCHE) and an ERC Synergy Grant in 2020 (The ultimate time scale in organic molecular opto-electronics, the attosecond, TOMATTO). He is OSA Fellow for innovative contributions to the field of attosecond science and technology, particularly for groundbreaking applications of attosecond pulses to molecules.

Ref. Prof. Ettore Vittone