Ultrafast Science:

from Picosecond to Attosecond Laser Pulses

Orazio Svelto

Physics Department, Polytechnic School of Milano

Milano, Italy, orazio.svelto@fisi.polimi.it

In a first part of this seminar, a review will be presented of the development of ultrafast science starting from the initial generation of pulses with a few picoseconds (1 ps = 10^{-12} s) from mode-locked solid-state lasers and ending with the generation of pulses with ~ 100 femtosecond (1 fs = 10^{-15} s) duration. Examples of applications of these sub-picosecond pulses to several fields, from Physics to Chemistry and Biology and leading to the Nobel Prize for Chemistry awarded in 1999 to Ahamed Zewail, will be discussed. In as second part of the seminar, the most recent activities to generate laser pulses with duration of a few femtosecond (few-cycle laser pulses) of high energy and the application of these pulses to high-order harmonic generation and to the studies of electron dynamics in simple molecules such as D_2, molecule will be discussed. High-order harmonic generation with few-cycle laser pulses and with stabilization of the carrier-envelope phase has then allowed our group to recently obtain isolated XUV pulses with record duration of only 130 attoseconds (1 as = 10^{-18} s). The potentiality of these pulses to studying electron dynamics in atoms, molecules and nanostructures will also briefly be considered.