"Probing primary photoinduced processes in organic molecules with tunable few-optical-cycle light pulses"

Giulio Cerullo
Dipartimento di Fisica, Politecnico Di Milano
P.za L. da Vinci 32, 20133 Milano, Italy
giulio.cerullo@fisi.polimi.it

Many light-induced processes in organic molecules, such as energy relaxation, energy/charge transfer and conformational changes, occur on ultrafast timescales, ranging from 10^{-14} to 10^{-13} s. The speed of such elementary processes is intimately linked to their efficiency, making ultrafast optical spectroscopy an invaluable tool for their investigation. Pump-probe spectroscopy requires both short pulses, in order to observe fast dynamics, and broad frequency tunability, to excite a system on resonance and probe optical transitions occurring at different frequencies. Optical parametric amplifiers (OPAs) are ideal tools for such experiments, because they provide frequency tunability and support broad gain bandwidths, enabling the generation of very short pulses.
In this talk we will describe a state of the art system, based on two synchronized OPAs, providing sub-10-fs temporal resolution over a very broad spectral range, from 400 nm to 2 μm. After reviewing the pulse generation techniques and the system performance, we will present selected examples of applications to the study of ultrafast processes, such as: energy transfer in photosynthetic light harvesting complexes, electronic and vibrational dynamics in carbon nanotubes, isomerization of rhodopsin.