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ULTRAFAST DYNAMICS OF PHOTO-EXCITED MOLECULES AT FERMI FREE ELECTRON LASER

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Abstract. Static and time-resolved studies of atomic and molecular targets by means of VUV and soft X-ray spectroscopy have greatly benefited from the advent of new experimental methods and from the interplay between complementary light sources. Spectral quality, tunability, low timing jitter between pump-and-probe pulses, are ideal specifications for light sources devoted to this class of experiments. These specifications are met by the seeded Free Electron Laser FERMI in Trieste [Allaria et al. 2015, Finetti et al. 2017]. FELs allow femtosecond time-resolved experiments with a much higher brightness than HHG sources, opening new opportunities for pump-and-probe experiments especially at higher photon energies. In the framework of atomic and molecular dynamics studies the Low Density Matter beamline [Lyamayev et al. 2013] of FERMI, celebrating 10 years of operation, offers a variety of consolidated spectroscopic techniques. Recent highlights will be presented in this progress report: the complete evolution of the photoinduced ring-opening reaction occurring in thiophenone molecules [Pathak et al. 2020]; how the synergy between experimental results and advanced quantum chemistry calculations allow one to go beyond the usually accepted picture of the ring-opening reaction of 1,3-Cyclohexadiene [Travnikova et al. 2022]; time-resolved photoelectron circular dichroism (TR-PECD) spectroscopy at the carbon edge on fenchone molecules [Facciala' et al. 2022].
The combination of above achievements with recent machine and endstation upgrades expands the possibilities for studying the dynamics of small biological molecules.
The results of these studies originate from the joint effort of many international laboratories and of a large number of researchers, whose work is gratefully acknowledged**.**

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