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Cluster Experiments at the Free Electron Laser FERMI at Elettra

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The ionization dynamics of atomic clusters in intense ultrashort laser pulses has been an active area of research in recent years at near-infrared (NIR), vacuum-ultraviolet, and soft x-ray wavelengths. The dynamics of multi-component nanoplasmas turns out to be interesting model systems for realizing single-shot ultrafast diffraction imaging of large biomolecules in the x-ray domain. Helium nanodroplets are particularly attractive for studying strong field ionization due to the simple electronic structure and due to the homogeneous density distribution of He droplets.Furthermore, the property of He droplets to pick up dopant atoms which aggregate either in the droplet interior or at the droplet surface makes it possible to study heterogeneous systems. Recent experiments of doped helium droplets performed at the LDM beamline [1] at the XUV Free-Electron-Laser FERMI at Elettra are presented, demonstrating the importance of highly collective processes driving nanoplasma formation [2,3]. Furthermore, water clusters are probed by XUV-UV pump-probe spectroscopy in order to study fundamental dynamics of electron hydration and atmospheric chemistry processes. The solvation dynamics triggered by the XUV FEL leads surprisingly to 3 isomers of the hydrated electron having individually different formation times. [1] V. Lyamayev, et. al, J. Phys. B 46 164007 (2013) [2] A. LaForge, et al., Scientific Reports, 4, 3621 (2014) [3] Y. Ovcharenko, et al., Phys. Rev. Lett. 112, 073401(2014)

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