Coherent diffraction at FERMI

Emanuele Pedersoli

Elettra Sincrotrone Trieste, AREA Science Park, Trieste, Italy

FERMI is a seeded free electron laser providing ultrafast EUV light pulses with very specific characteristics of coherence, intensity and wavelength tunability and stability, temporal and spectral cleanliness, variable linear and circular polarization, intrinsic femtosecond synchronization with the seeding optical laser.

Experimental techniques like coherent diffraction imaging [1] and time resolved magnetic holography [2-3], transient grating and nonlinear EUV optics [3], ultrafast resonant diffraction [4] and spectroscopy take advantage of FERMI's many features to explore nanoparticle imaging, magnetization dynamics, vibrational behavior of matter, ultrafast chemical processes and much more.

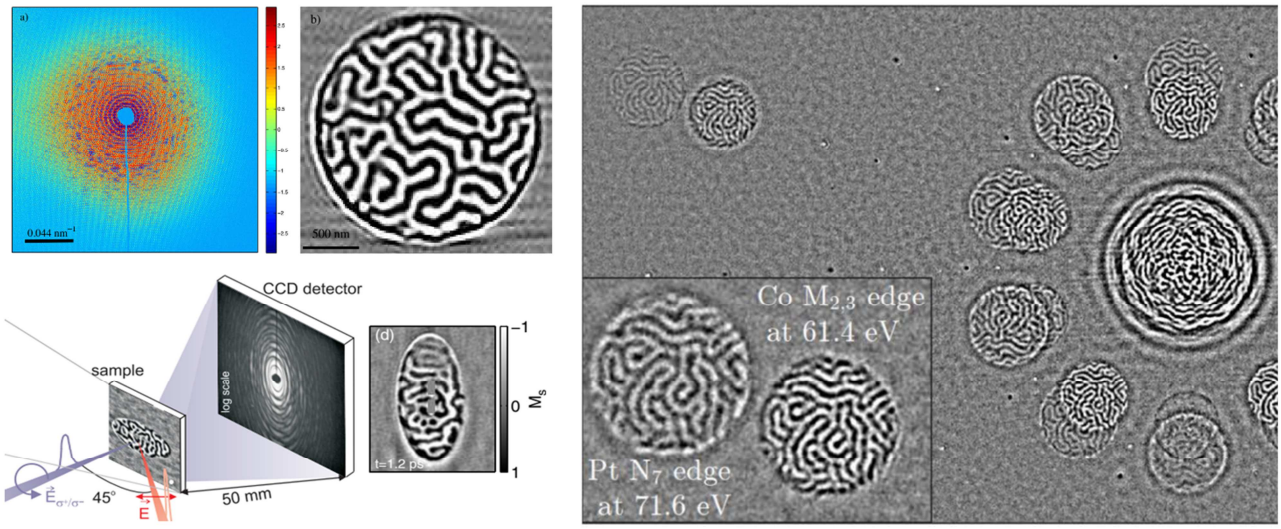

Fig.1: Examples of experimental layout, diffraction patterns and domain holographic reconstructions on magnetic metallic multilayers. In the right side a holographic image is showing domain patterns obtained with resonant two color pulses tuned on Co and Pt edges [5].

References:

[1] E. Pedersoli *et al.*, *Mesoscale morphology of airborne core–shell nanoparticle clusters: x-ray laser coherent diffraction imaging*, J. Phys. B: At. Mol. Opt. Phys. **46**, 164033 (2013). doi:10.1088/0953-4075/46/16/164033

[2] C. von Korff Schmising *et al.*, *Imaging Ultrafast Demagnetization Dynamics after a Spatially Localized Optical Excitation*, Phys. Rev. Lett. **112**, 217203 (2014). doi:10.1103/PhysRevLett.112.217203

[3] F. Bencivenga *et al.*, *Four-wave mixing experiments with extreme ultraviolet transient gratings*, Nature **520**, 205 (2015). doi:10.1038/nature14341

[4] E. Ferrari *et al.*, *Widely tunable two-colour seeded free-electron laser source for resonant-pump resonant-probe magnetic scattering*, Nat Commun. **7**, 10343 (2016). doi:10.1038/ncomms10343

[5] F. Willems *et al.*, *Multi-color imaging of magnetic Co/Pt heterostructures*, Structural Dynamics **4**, 014301 (2017). doi:10.1063/1.4976004