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## Recent progress in scattering and imaging experiments at the DiProI CDI end station of the FERMI seeded FEL.

Wednesday, 15 March 2023 15:40 (20 minutes)

In this presentation we will report about the recent progress in time resolved scattering and imaging experiments performed at DiProI end-station [1,2], one of the user dedicated instrument of FERMI seeded FEL user facility [3]. In the first part of the talk I will show the possibility, offered by mini-Timer split and delay unit [4], to tomographically illuminate the sample from two different view angles, allowing for stereoscopic imaging of the investigated object [5]. In the second part, I will present the advancements performed at FERMI Free Electron Laser (FEL) user facility in the generation of light beams possessing orbital angular momentum (OAM) either using conventional diffractive optics or directly by means of direct source emission [6]. I will report the results of two recent experiments performed at DiProI beamline using XUV-OAM modes taking advantage of the peculiar features of the FERMI source. More specifically:

- we have studied the interaction of phase spiral beams with spin magnetic vortices, showing that the far field scattering profile encodes the vortex symmetries in a way that depends on the sign and value of  $\ell$ , giving rise to a new kind of magnetic helicoidal dichroism (MHD) [7].
- we have exploited the possibility of achieve super-resolution imaging using OAM in diffraction-based imaging technique at FEL [8], showing how the speckles forming the diffraction pattern encode information on the light orbital angular momentum.

For both experiments the possibility to extend the developed techniques in the time-domain realm to either study the spin topology dynamics and plasmonic excitation in metallic nanostructures will be addressed with preliminary results.

[Fig. 1 (a) Sketch of the experimental setup to generate OAM beam from spiral Zone Plate. (b) –(e) Far field image of the interference pattern between Laguerre-Gaussian OAM beam and planar wave for different  $\ell = 0, 1, 2, 3$ . ]

### References

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