

## The Low Density Matter beamline at the FERMI Free Electron Laser

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Free-Electron-Lasers (FELs) in the EUV and XUV photon energy range have greatly expanded the feasibility range of experiments at the crossroad between tabletop lasers and synchrotrons. The FERMI facility in Trieste (Italy) is unique in the FELs landscape because it has been designed as a seeded source, resulting in superior performances in terms of control and reproducibility of its light pulses [1]. Of particular interest for spectroscopic applications are its broad tunability, wavelength purity (approaching the Fourier-transform limit, with sub-linewidth stability), short pulse duration and timing jitter. Transverse and temporal coherence are those expected from a true laser, and have been exploited in a series of pioneering experiments [2].

The Low Density Matter (LDM) beamline at FERMI has been serving the atomic, molecular and cluster science community since its opening at the end of 2012 [3]. Through the use of interchangeable supersonic jet sources, it offers the possibility of studying atoms and molecules (including aligned ones), as well as more exotic systems such as superfluid helium droplets or metallic nanoparticles. Ion and electron spectroscopies (time-of-flight; velocity map imaging) and coherent diffraction imaging are available in one of the few different standard configurations of the endstation. Users' equipment can be accommodated as well, and several experiments have also been performed in non-standard configurations. A synchronized infrared laser (with second- and third-harmonic generation capability) is available for optical+FEL experiments [4]. The LDM beamline has worked in close synergy with the Machine Physics team to help characterize FERMI, and develop new modes of operation.

In this talk I will present the LDM beamline concept, the results of a few case studies performed as Users' experiments or as internal research and development, and some future perspectives.

The results presented originate from the joint effort of many international laboratories and a large number of researchers, whose work is gratefully acknowledged.

### References

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