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Plasma-generated X-ray pulses: betatron radiation opportunities at EuPRAXIA@SPARC_LAB

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EuPRAXIA is the first European project that develops a dedicated particle accelerator research infrastructure based on novel plasma acceleration concepts and laser technology. It focuses on the development of electron accelerators and underlying technologies, their user communities, and the exploitation of existing accelerator infrastructures in Europe.

Within this framework, the Laboratori Nazionali di Frascati (LNF) will be equipped with a unique combination of a high brightness GeV-range electron beam generated in a state-of-the-art X-band RF linac, a 0.5 PW-class laser system and the first 5th generation Free Electron Laser (FEL) source driven by a plasma accelerator. Wiggler-like radiation emitted by electrons accelerated in laser-plasmas wakefields gives rise to brilliant, ultra-short X-ray pulses, called betatron radiation. Some experience in this field was already gained at the FLAME laser facility of the INFN Frascati National Laboratory were betatron radiation was measured and characterized [1-3].

In this talk, we will describe the main features of the EuPRAXIA betatron radiation and will highlight the opportunities offered by its brilliant femtosecond pulses for ultra-fast X-ray spectroscopy measurements, as X-ray pump pulses for FEL experiments and as an ancillary tool for designing and testing FEL instrumentation and experiments.

[1] A. Curcio et al. Phys. Rev. Accel. Beams 20 (2017) 012801. DOI: 10.1103/PhysRevAccelBeams.20.012801
[2] A. Curcio, et al., Nucl. Instrum. Methods Phys. Res. Sect. B 402 (2017) 388. DOI: 10.1016/j.nimb.2017.03.106
[3] F.G. Bisesto, et al. Nucl. Instrum. Methods Phys. Res. Sect. A (2017): 388. DOI:/10.1016/j.nima.2018.02.027

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