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Bridging the Gap of Storage Ring Light Sources and Linac-Driven Free-Electron Lasers

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High-gain free-electron lasers (FELs) are driven by short, high-charge density electron beams as only produced at dedicated single pass or recirculating linear accelerators. We describe new conceptual, technical, and modeling solutions to produce subpicosecond, up to ~100 μJ-energy extreme ultra-violet and soft x-ray FEL pulses at high and tunable repetition rates, from a diffraction-limited storage ring light source. In contrast to previously proposed schemes, we show that lasing can be simultaneous to the standard multibunch radiation emission from short insertion devices, and that it can be obtained with limited impact on the storage ring infrastructure. By virtue of the high-average power but moderate pulse energy, the storage ring-driven high-gain FEL would open the door to unprecedented accuracy in timeresolved spectroscopic analysis of matter in the linear response regime, in addition to inelastic scattering experiments.

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Primary authors: DI MITRI, Simone (Elettra-Sincrotrone Trieste S.C.p.A.); Dr SOTTOCORONA, Filippo (University of Trieste, Elettra Sincrotrone Trieste); Dr PEROSA, Giovanni (University of Trieste, Elettra Sincrotrone Trieste); Dr DIVIACCO, Bruno (Elettra-Sincrotrone Trieste S.C.p.A.); Dr SPAMPINATI, Simone (Elettra-Sincrotrone Trieste S.C.p.A.); Dr CORNACCHIA, Massimo (Elettra-Sincrotrone Trieste S.C.p.A.)

Presenter: DI MITRI, Simone (Elettra-Sincrotrone Trieste S.C.p.A.)

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