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Optical-Cavity Based Seeded FEL Schemes toward Higher Repetition Rate and Shorter Wavelengths

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More and more high-gain SASE FELs operate at high repetition rates, either in burst or in continuous wave mode of operation, offering an unprecedented number of electron bunches per second. External seeding techniques provide high quality FEL pulses of full coherence and shot-to-shot stability but cannot keep up with MHz repetition rates of such FELs due to their dependence on the seed laser repetition rate. One attractive solution to overcome this limitation is to employ an optical cavity to store radiation that acts as a seed for the electron bunches arriving at high repetition rates. Such a scheme not only allows seeded operation at multi-MHz repetition rates but also introduces the possibility to achieve seeded radiation at shorter wavelengths, overcoming the hurdle of insufficient power availability of seed laser systems in the vacuum ultraviolet (VUV) wavelength range. Here, we present different optical-cavity-based schemes and we give an overview of their unique capabilities together with simulation results.

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