A COMPACT (OPTICAL KLYSTRON) VUV-SASE FEL

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Abstract

Recently schemes are presented to realize compact VUV/X-ray range FELs utilizing ultrahigh current beams in conjunction with short period undulators. Here we adopt a different approach for a compact VUV-FEL by using of a short period undulator and a low emittance, low current 100-150 MeV beam with rho < 1·10⁻3. As shown in a previously studied long-wavelength case, the undulator length needed for reaching saturation can be reduced considerably (~halved with regard to a conventional SASE FEL) by employing an 'optical klystron amplifier' where the prebuncher comprises four relatively short undulator sections and bends located in between, building a ring configuration. The short electron pulses that become microbunched after a number (<5) of circulations in the prebuncher are injected subsequently into the radiator section. Modeling of the scheme is carried out by an FEL code based on Lienard-Wiechert fields and GENESIS. In the context of short period undulators the design of a new hybrid/superconducting undulator is also reported which produces high on-axis magnetic fields while offering the possibility of switching the polarization between helical and planar.

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