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## Design Considerations of High Repetition Rate VUV FEL

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A new concept of a high repetition rate VUV FEL is discussed. The FEL is envisioned to operate in the wavelength range from 50 to 250 nm with pulse energies of about 30  $\mu\text{J}$  throughout the wavelength range, and a pulse length of a few 100 fs. The SRF LINAC technology developed and used at the Helmholtz-Zentrum Dresden-Rossendorf for the Radiation Source ELBE is planned to be used for the driver-accelerator. This allows operating an electron beam with an average current of 1 mA on the order of magnitude, pulse repetition rate of up to 10 MHz, and the bunch charge of 100 pC, as used for the FEL design. We consider using the HGHG to allow the generation of fully coherent pulses. The high repetition rate electron beam makes it possible to construct an FEL oscillator that would be used as the high repetition rate seed of the HGHG amplifier. In the proposed scheme, the SRF LINAC provides beams for the seeding oscillator and the HGHG amplifier simultaneously. The described FEL would create new experimental regimes, not available at any other photon source. These could result in transformative changes in physical chemistry studies in the gas phase and at the interfaces, e.g., heterogeneous catalysis.

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