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R&D progress of cavity based EUV/X-ray free electron lasers at Shanghai

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The development of short-wavelength, fully coherent Free Electron Lasers (FELs) represents a pivotal direction for advancing X-ray source technology. Promising solutions under consideration include cavity-based X-ray Free Electron Lasers (CBXFELs), such as the X-ray Regenerative Amplifier FEL (XRAFEL) and the X-ray FEL Oscillator. We are pursuing the development of advanced FEL schemes and the experimental validation of optical cavity technologies at SARI. This report outlines our progress in the development of CBXFEL for the hard X-ray and Extreme Ultraviolet (EUV) regions. We are currently testing the operation of a rectangular cavity with Bragg-reflecting crystals based on the SSRF. Ringdown of a small 1-meter silicon crystal cavity has been experimented, and preparations for a diamond crystal-based cavity are underway. Concurrently, we have developed a suite of EUV reflective optics utilizing multilayer technologies, aiming to provide high average power with RAFEL mode at a wavelength of 13.5 nm in the future. Additionally, we are advancing the manipulation of CBXFEL performance, including the generation of controlled polarization and Orbital Angular Momentum (OAM).

Footnotes

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