FEASIBILITY OF X-RAY CAVITIES FOR HARD X-RAY FEL OSCILLATORS

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Abstract

Free-electron lasers for hard x-rays can be constructed in oscillator (XFELO) configuration, providing ultra-high spectral purity and brightness. The average brightness is expected to be several orders of magnitude higher than, and peak brightness comparable to that of SASE XFELs. XFELOs can enable revolutionary scientific opportunities as well as drastically improve experimental techniques developed at third-generation x-ray facilities. Low-loss x-ray crystal cavity and ultra-low-emittance electron beams are two major technical challenges in the realization of XFE-LOs. The requirements to x-ray cavity components are demanding: diamond crystals and curved grazing incidence mirrors must have near-perfect reflectivity, negligible wavefront distortions, and are subject to very tight tolerances on angular, spatial, and thermal stability under high heat load of the XFELO radiation. This paper gives an overview on the recent progress and future plans in the R&D on the feasibility of x-ray cavities for XFELOs. The experimental and simulation studies results provide strong evidence for the feasibility of the x-ray cavities.

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