

# Hard X-ray FEL Oscillators - R&D Progress

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Free-electron lasers for hard x-rays can be constructed in oscillator (XFELO) configuration, providing ultra-high spectral purity and brightness [1-3]. The average brightness is expected to be several orders of magnitude higher than, and peak brightness comparable to that of SASE XFELs. XFELs 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 XFELs. The requirements to the x-ray cavity components are demanding: diamond crystals and curved grazing incidence mirrors must have near-perfect reflectivity, negligible wave-front distortions, and subject to very tight tolerances on the angular, spatial, and thermal stability under high heat load of the XFEL radiation. This presentation will give an overview of the recent progress and future plans on the R&D on the feasibility of XFELs. In particular, experimental and simulation studies results [4-6] provide strong evidence for the feasibility of x-ray cavities for XFELs.

1. K-J. Kim, Yu. Shvyd'ko, S. Reiche, PRL 100 (2008) 244802
2. K-J. Kim, Yu. Shvyd'ko, PR-STAB 100 (2008) 244802
3. R. Lindberg, K-J. Kim, Yu. Shvyd'ko, W.M. Fawley, PR-STAB, 2010
4. Yu. Shvyd'ko, et al., Nature Phys. 6 (2010) 196
5. S. Stoupin, Yu. Shvyd'ko, PRL 104 (2010) 085901
6. S. Stoupin et al., Rev. Sci. Instr. 81 (2010) 055108

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