

Introduction to X-ray Free Electron lasers

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The X-ray free electron laser (XFEL) is a revolutionary tool that can produce unprecedented intensity, transverse coherent, and femtosecond X-ray pulses. This XFEL has opened new opportunities for many areas of science. The XFEL has been developed by tailoring the electron or X-ray beam to improve x-ray source quality and various types of pulses such as narrow spectral bandwidth, two-color pulses, variable pulse length, and attosecond scale. The various R&D programs have been demonstrated, especially self-seeded XFEL that provides a world record peak brightness.

For future XFEL, new projects are ongoing such as attosecond x-ray pulses, TW (10^{12} W) scale intensity in few femtoseconds, and external seeding techniques. Recently, a proof and principle experiment of the compact future XFEL using an advanced plasma accelerator has been demonstrated.

In this talk, I will introduce XFEL and its current status of R&D and future perspectives, and compact future XFEL using an advanced plasma accelerator.