

Scientists develop brightest ever x-ray source

The x-ray has just got 100 million times brighter, thanks to next-generation light sources like free electron laser oscillator - or the X-FELO.

X-FELO will open up breakthrough scientific opportunities in various research fields. Its characteristics are ideally suited for bulk-sensitive, hard x-ray photo-emission spectroscopy.

Existing technology uses undulators to create bright x-ray beams of spontaneous emission at the Advanced Photon Source (APS) at Argonne.

Much of the research for x-ray free electron lasers has been concentrated on self-amplified spontaneous emission (SASE), which would amplify them by a factor of a million or more in a single pass.

A user of SASE will see x-ray brightness that is about 10,000 times brighter than what the APS is delivering, Argonne's Kwang-Je Kim said.

X-FELO, devised by US Department of Energy scientists, the electron pulse enters an undulator and generates an x-ray that is reflected back into the undulator entrance by crystals and connects with the next electron bunch and again travels back along the undulator. This pattern is repeated indefinitely with the x-ray intensity growing each time until equilibrium is reached.

An X-FELO will enhance the flux by six to eight orders of magnitude, shortening the data collection times by the same factor.

The intensity of individual x-ray pulse from an X-FELO is lower by about three orders of magnitude. However the X-FELO pulse has extremely narrow bandwidth, three to four orders of magnitude narrower than the SASE.

Accordingly an X-FELO user will see a brightness which is about six to eight orders of magnitude brighter than any previously created and three to four orders of magnitude brighter than proposed SASE technology.

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