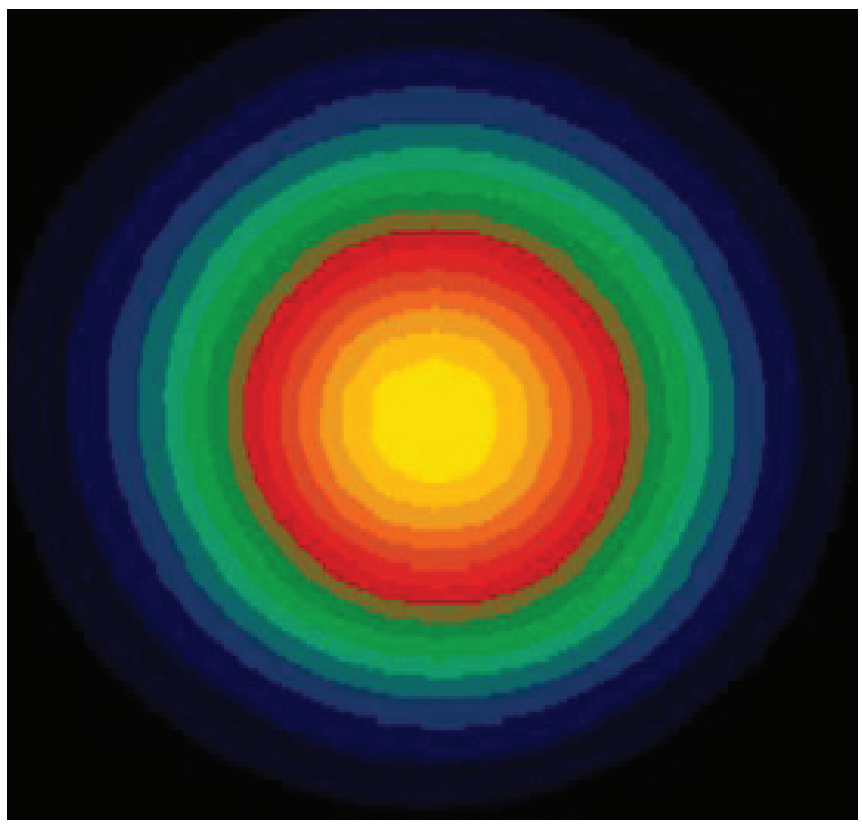
Argonne NATIONAL LABORATORY

Kwang-Je Kim

Prospects of an X-ray FEL Oscillator

Kwang-Je Kim was trained as an elementary particle theorist, but switched to accelerator physics in 1978, when he joined LBNL, serving as the Deputy Director of the Center for Beam Physics. He moved to Argonne in 1998, where he founded the Argonne Accelerator Institute. Currently, he is an Argonne Distinguished Fellow and a Professor of Physics at the University of Chicago. He has performed groundbreaking research in synchrotron radiation, free-electron lasers, and electron beam techniques. He became an APS Fellow in 1995, received the International FEL Award in 1997, the USPAS Award in 2013, and the Robert Wilson Prize in 2014.



An x-ray free-electron (FEL) oscillator (XFELO), a low-gain device in which an x-ray pulse trapped in an x-ray cavity formed by Bragg crystals receives repeated FEL interaction, will provide unprecedented brightness, full coherence, and ultrafine spectral resolution. These unique characteristics will provide several levels of scientific opportunities—extending the parameter space of established techniques, broadening the user communities by elevating the demonstration tools to tools of practical importance, and opening up new areas of investigation. Ultimately, a long sequence of the XFELO pulses can be stabilized, giving rise to an x-ray spectral comb for unprecedented x-ray metrology for fundamental physics. A super-conducting linear accelerator producing a constant stream of electron bunches is an ideal driver for an XFELO. By using a transverse gradient undulator, an XFELO is also feasible, albeit in a pulsed mode, in a large storage ring diffraction-limited at hard x-rays. The R&D efforts in beam dynamics and x-ray optics so far are encouraging toward the feasibility of this device.

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