Abstract

X-Ray Free Electron Lasers (XFELs)

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Fourth-generation light sources use X-ray free electron lasers (XFELs) to produce extraordinary bright and coherent X-rays, with peak brightnesses about 10 orders of magnitude greater than what is available at third generation light sources. These $B-class tools enable new science in biology, chemistry, and materials science, and experimental time on them is in high demand. There are three operating fourth generation light source facilities worldwide, with more in the construction and design phase, including a future 42-keV XFEL at the Los Alamos. This short course will cover the basics of XFEL theory and operation and will provide a review of existing and planned XFELs. Specific design challenges and required preliminary research for the Los Alamos XFEL will be included to illustrate how these devices are designed and built.

Biographical Summary

Bruce Carlsten is an accelerator physicist at the Los Alamos National Laboratory. His main research interests are the generation and manipulation of high-brightness electron beams, development of high-frequencies RF sources, and X-ray free electron laser theory and technology. He was a pioneer in the development of RF photoinjectors and is credited with the discovery of the emittance compensation technique which has allowed photoinjectors to generate exceptionally bright electron beams. He was also a pioneer in the development of electron-bunch compressors, including early research in the effects of coherent synchrotron radiation. He is a Fellow of the IEEE, the American Physical Society, and the Los Alamos National Laboratory. He is also a Member-at-Large of the Executive Committee of the IEEE Plasma Sciences and Applications Technical Committee and is on the Editorial Board of *Physical Review Accelerators and Beams.*