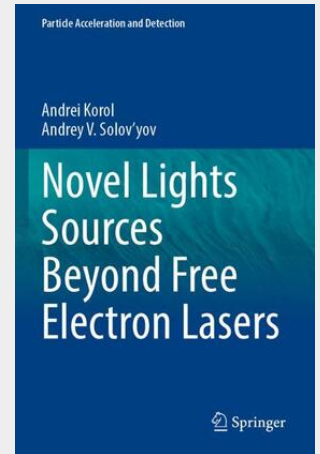


Novel Lights Sources Beyond Free Electron Lasers

This book discusses possibilities and perspectives for designing and practical realization of novel intensive gamma-ray crystal-based light sources that can be constructed through exposure of oriented crystals—linear, bent and periodically bent, to beams of ultrarelativistic positrons and electrons. The book shows case studies like the tunable light sources based on periodically bent crystals that can be designed with the state-of-the-art beam facilities. A special focus is given to the analysis of generation of the gamma rays because the current technologies based on particle motion in the magnetic field become inefficient or incapable to achieve the desired gamma rays' intensities. It is demonstrated that the intensity of radiation from crystal-based light sources can be made comparable to or even higher than what is achievable in conventional synchrotrons and undulators operating although in the much lower photon energy range. By exploring the coherence effects, the intensity can be boosted by orders of magnitude. The practical realization of such novel light sources will lead to the significant technological breakthroughs and societal impacts similar to those created earlier by the developments of lasers, synchrotrons and X-rays free-electron lasers. Readers learn about the underlying fundamental physics and familiarize with the theoretical, experimental and technological advances made during last two decades in exploring various features of investigations into crystal-based light sources. This research draws upon knowledge from many research fields, such as material science, beam physics, physics of radiation, solid-state physics and acoustics, to name but a few. The authors provide a useful introduction in this emerging field to a broad readership of researchers and scientists with various backgrounds and, accordingly, make the book as self-contained as possible.

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