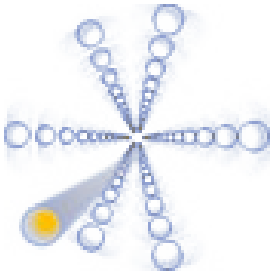

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Radiation from Multi-GeV Electrons and Positrons in Periodically Bent Silicon Crystal

Tuesday, October 7, 2014 3:30 PM (15 minutes)

The channeling process in periodically bent Si crystals is shown [1-3] to efficiently serve for producing highly monochromatic radiation in a gamma-ray energy spectral range. A short-period small-amplitude bending yields narrow undulator-type spectral peaks in radiation spectrum from multi-GeV electrons and positrons channeling through the crystal. Benchmark theoretical results on the undulator are obtained by simulations of the channeling with a full atomistic approach to the projectile-crystal interactions over the macroscopic propagation distances.

The simulations are facilitated by employing the MBN Explorer [4] package for molecular dynamics calculations on the meso- bio- and nano-scales. The classical relativistic equations of motion are used in order to describe the motion of a projectile. The radiation from the ultra-relativistic channeling projectiles is computed within the quasi-classical formalism. The effects due to the quantum recoil are shown to be significantly prominent in the gamma-ray undulator radiation.

We report the results of simulations of channeling of electrons and positrons in low-amplitude crystalline undulator for energies of 855 MeV and 10 GeV. The parameters of projectiles beam and a crystal are matching the parameters in recent and ongoing experimental studies in Mainz Microtron and SLAC facilities.

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