



Contribution ID: 156

Type: Oral

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

Tuesday, 7 October 2014 15:30 (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.

References

1. G. B. Sushko, V. G. Bezchastnov, I. A. Solov'yov, A. V. Korol, W. Greiner, A. V. Solovyov, Simulation of ultra-relativistic electrons and positrons channeling in crystals with MBN Explorer, *Journal of Computational Physics* 252 (2013) 404-418.
2. G. Sushko, A. Korol, W. Greiner, A. Solov'yov, Sub-GeV electron and positron channeling in straight, bent and periodically bent silicon crystals, *Journal of Physics: Conference Series* 438 (2013) 012018.
3. <http://arxiv.org/abs/1405.6525>
4. Solov'yov I A, Yakubovich A V, Nikolaev P V, Volkovets I and Solov'yov A V, *J. Comp. Chem.* 33, 2412 (2012); <http://www.mbnexplorer.com/>

Primary author: Dr KOROL, Andrey (Physics Department, Goethe University, Max-von-Laue Str. 1, D-60438 Frankfurt am Main)

Co-authors: Dr SOLOV'YOV, Andrey (Physics Department, Goethe University, Max-von-Laue Str. 1, D-60438 Frankfurt am Main); Mr SUSHKO, Gennady (Physics Department, Goethe University, Max-von-Laue Str. 1, D-60438 Frankfurt am Main)

Presenter: Dr KOROL, Andrey (Physics Department, Goethe University, Max-von-Laue Str. 1, D-60438 Frankfurt am Main)

Session Classification: S1: Channeling & Radiations in Crystals