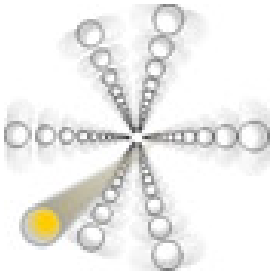

Contribution ID: **80** Type: **not specified**

Recent Progress in the Theory of the Crystalline Undulator

Thursday, 27 September 2012 09:50 (15 minutes)

The present state-of-the-art synchrotron radiation sources are capable for emitting electromagnetic radiation in a wide frequency range up to soft X rays. Moving further, i.e. into hard X ray and gamma-ray band, requires new technologies. One of the most promising ideas is using the phenomenon of charged particle channeling in single crystals.

A single crystal with periodically bent crystallographic planes can be used to force channeling particles to move along nearly sinusoidal trajectories and radiate in hard X ray and gamma ray frequency range. Such a device is known as {\it crystalline undulator}. Its advantage is due to the extremely strong electrostatic fields inside a crystal which are able to steer the particles much more effectively than even the most advanced superconductive magnets.

Initially, it was thought that a positron beam was needed to make the crystalline undulator feasible. Later, it was demonstrated that an electron based crystalline undulator was also possible, but it required an electron beam with the energy in the range of several tens of GeV.

Due to the recent development of a new Monte Carlo code, a detailed simulation of particle channeling and radiation emission in a periodically bent crystal could be performed.

According to the newest the findings, the energy of electron beam below 1 GeV may be sufficient for the study of the undulator effect in periodically bent crystals and for obtaining very important and interesting results in the field.

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Session Classification: S2.3 Channeling Radiation & Related Phenomena

Track Classification: Channeling Radiation & Related Phenomena