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PS1-11: RADCHARM++: a Software to Simulate Electromagnetic Radiation Generated by Relativistic Electrons and Positrons in Crystals and Complex Structures

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When relativistic electrons and positrons transverse a medium bremsstrahlung radiation is emitted. The anisotropy of a crystalline medium can modify the dynamics of the charged particles and so the photon emission. Indeed, if the angle between a charged particle and crystalline planes or axes is small, the particle suffers a series of correlated collision with atoms in the same plane or row, i.e. coherent interaction, and its dynamics can be described by the continuous planar or axial approximations [1]. This results in an increase in radiation generation compared to the case of the Bethe-Heitler process.

The analytical theory of coherent bremsstrahlung [2] and channeling radiation [3,4] can describe well the process of radiation generation in crystals for some special cases. However, the treatment of complex situations requires the usage of a general approach.

In this report we present a Monte Carlo code named RADCHARM++ to simulate the e. m. radiation emitted by electrons and positrons in crystals and complex structures. RADCHARM++ is an expansion of the DYNECHARM++ code [5]. The model for the computation of radiation generation [6] is based on the direct integration of the quasiclassical formula of Baier and Katkov [7]. Such approach allows taking into account real trajectories, and so the contribution of incoherent scattering, which is very important in many cases, for instance for channeling of electrons.

The generality of the Baier-Katkov operator method permits to simulate the electromagnetic radiation emitted by e^\pm in very different cases, e.g., straight, bent and periodically bent crystals, and for different beam energy range, from sub-GeV to TeV.

References

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