

Beam Heating due to Coherent Synchrotron Radiation

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We discuss the fine structure of the field dynamics of coherent synchrotron radiation (CSR). The details of the time-domain field distributions have been investigated using a recently developed method for the numerical solution of Maxwell's equations for a very short bunch moving in a magnetic field. We have discovered a transverse variation of the particle energy loss in a bunch due to CSR fields. It explains the slice emittance growth in bending magnets of the bunch compressors and transverse decoherence in undulators. This effect could be very important for the future ultra-short high power FEL designs. It can also play the same role as the effect of quantum fluctuations of synchrotron radiation in damping rings. It can limit the minimum achievable emittance in the synchrotron light sources for short bunches.

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