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Characteristics of radiation in ”light” and in conventional undulators. Classical and quantum approaches.

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As a rule, an intensity spectrum of undulator radiation (UR) is calculated in the classical approach even for electron energy larger than 10 GeV. Such a spectrum is determined by an electron trajectory in an undulator neglecting by radiation losses. Using the Planck's law, the UR photon spectrum can be calculated from the obtained intensity spectrum both for linear and nonlinear regimes.

The electron radiation process in a field of strong electromagnetic wave is considered in the quantum electrodynamics frame (Compton scattering process or radiation in a "light" undulator). Comparison of results obtained by both approaches for the UR spectra generated by 250 GeV electrons in the undulator with the 11.5 mm period has been shown that they coincide with high accuracy. Characteristics of the collimated UR beam (spectrum and circular polarization) were simulated with taking into account the discrete process of photon emission along an electron trajectory in both kinds of undulators. Due to this reason spectral photon distributions as well as the polarization dependence on the photon energy are "smoothed"in comparison with expected one for a long undulator, which is considering for the ILC positron source [1].

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