Radiation Losses of Relativistic Electrons via Cherenkov Diffraction Radiation Mechanism

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For an electron moving in a vacuum near the flat surface of the infinite radiator in which Cherenkov radiation (ChR) is generated [1], radiation losses are estimated. Calculation for such a stationary case were based on the existing model [2].

In the report, we considered the similar case but with a finite length radiator along the trajectory of the charge. Such a radiator possesses input and output planar faces perpendicular to the path of the charge. In this case, the Coulomb field of a relativistic charge with a transverse size of $\sim \gamma\lambda/2\pi$ (γ is the Lorentz-factor, λ - wavelength), interacts with the front entrance face of the dielectric radiator and generates diffraction radiation (DR) [3]. Recently such kind of the radiation mechanism, so-called Cherenkov Diffraction radiation (ChDR), was experimentally observed in the optical range [4]. Obviously, in the case under consideration, radiation losses are generated by the ChDR mechanism (or, in other words, by ChR and DR [5]). We have developed the model to calculate the radiation losses based on the polarization currents method [6]. We have shown that the losses via the ChDR mechanism are higher by 2-3 orders of magnitude compared to charge radiation moving near an infinite radiator.

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