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Physical Interpretation and Asymptotic Analysis of Particle's Energy Losses on the Polarization Radiation Process

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Dynamic polarization is a complex process of the rapid interchange of energy between the alternating electromagnetic fields and medium's atoms/molecules. In result of this process a part of the electromagnetic field free energy is expended in the moving of "free"electrons (the conduction current) and displacement of the latent electricity (the displacement current). The first component of the electromagnetic field energy losses brings about the well characterized effect - Joule heating of the target material. At the same time, the last part of the energy losses, which induces the electromagnetic radiation also known as polarization radiation, is not adequately investigated.
In this report, the energy losses of a particle electromagnetic field on the polarization radiation process will be asymptotically analyzed for the non-polar mediums with the arbitrary conductivity and the flat shape. The asymptotical behavior of the energy losses dependence on the medium dielectric properties, particle's energy and task's geometric pattern will be deemed in the frame of the classical electrodynamics and the solid state physics.
Since the dynamic polarization is part and parcel of the particle-medium interaction process, the presented results will be of especial interest for the electromagnetic radiation sources development, the wakefield acceleration and the particle beam diagnostics.
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