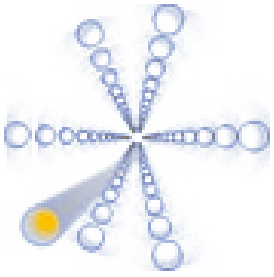

Contribution ID: **98** Type: **Oral**

Polarization Radiation from Metamaterials

Monday, October 6, 2014 3:30 PM (15 minutes)

Left-handed metamaterials are known to demonstrate unusual optical properties, like negative refractive index, inverse Doppler effect, backward waves (the waves with contrary directed phase and group velocities), focusing beyond the diffraction limit. On the other hand, polarization radiation of charged particles has much in common with the processes of scattering of light in matter. Correspondingly, some unusual effects in physics of radiation take place: inverse Vavilov-Cherenkov radiation, inverse Smith-Purcell radiation and so on. These phenomena have been predicted and experimentally investigated recently [1, 2]. Practical potential of these phenomena is caused by some interesting and important features: noticeably more intensive radiation in THz frequency region from left-handed metamaterials in comparison with the natural materials; the surface waves at interfaces between natural and meta-materials arise more readily which is important for Free Electron Lasers; unusual angular distribution of radiation opens new opportunities for bunch diagnostics.

In this article polarization radiation in metamaterials is investigated by the example of Cherenkov and Smith-Purcell radiations and compared with the same for usual materials [3]. Role of magnetic currents as against the usually considered electrical ones is considered. Nature of the enhancement of radiation from metamaterials compared with the usual materials is discussed.

References

1. Yu.O. Averkov and V.M. Yakovenko, Cherenkov radiation by an electron bunch that moves in a vacuum above a left-handed material, Phys. Rev. B 72, 205110 (2005).
2. D. Li, M. Hangyo, Z. Yang et al, Smith-Purcell radiation from a grating of negative-index material, Nucl. Instrum. and Meth. A 637, 135 (2011).
3. A.A. Ponomarenko, M.I. Ryazanov, M.N. Strikhanov, A.A. Tishchenko, Terahertz Radiation from Electrons Moving through a Waveguide with Variable Radius, Based on Smith-Purcell and Cherenkov Mechanisms, Nucl. Instrum. and Meth. B 309, 223 (2013).

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Session Classification: S2: Channeling & Radiations in Various Fields