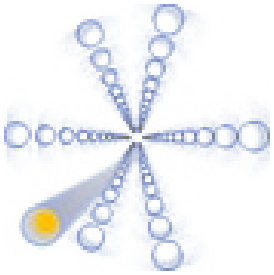

Contribution ID: **76** Type: **Oral**

Transition Radiation Formed on a Smoothly Varying Boundary Between a Medium and Vacuum: Exact Solution of the Problem

Monday, 6 October 2014 17:15 (15 minutes)

The radiation generated by a charged particle uniformly moving along Z axis is studied under assumption that the particle first travels inside a semi-infinite homogeneous medium (range ...), then passes an intermediate layer of inhomogeneous matter (...) and eventually to vacuum (...). Inside the intermediate layer the homogeneous medium (...) smoothly transforms into vacuum (...).

Spectral-angular distribution ... of the energy of radiation in vacuum (...) at large distances from the boundary between the matter and vacuum is derived. Two cases are studied when the charged particle is flying from the homogeneous medium (...) to vacuum and back, - from vacuum to medium. The obtained expressions for ... are based on corresponding exact solutions of the Maxwell equations with no limitations on amplitudes and profiles of variations of the dielectric permittivity ... and magnetic permeability ... of the matter inside the intermediate range ... (except that ... and ... are to be smooth functions of z).

The obtained final expression for ... is compared with the known approximate expressions (see, e.g., [1,2]) for the spectral-angular distribution of radiation. The final expression for ... at ... transforms to the spectral-angular distribution of transition radiation formed at the sharp interface between medium and vacuum [1,2].

Some characteristic features of the function ... due to the presence of a smoothly varying boundary between the medium and vacuum are revealed. A visual explanation of these peculiarities is given and its possible practical application is discussed.

References

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Session Classification: S2: Channeling & Radiations in Various Fields