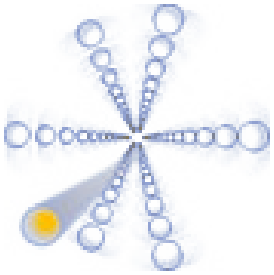

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Cherenkov Radiation from Relativistic Channelled Particles

Tuesday, October 7, 2014 5:30 PM (15 minutes)

The well-known Tamm-Frank theory [1] describes the Cherenkov radiation (ChR) from relativistic charged particles moving uniformly and rectilinearly in an optically transparent radiator. There are two main reasons leading to deviations from this ideal character of motion: 1) multiple scattering –particle's velocity vector changes [2]; 2) stopping in a radiator –particle's velocity magnitude changes. This second effect is more significant in the case of relativistic heavy ions (RHI) when the stopping in a radiator leads to appearance of the specific diffraction-like structure of the ChR spectral and angular distributions [3-6]. The third reason, which breaks the condition of uniform and rectilinear motion of relativistic particle in a target is the channelling effect.

Here, we investigate in detail the ChR from channelled relativistic electrons, positrons and RHI in an optically transparent crystal. We analyze: a) broadening of the Cherenkov cone connected with periodic deviation of the channelled particle velocity vector from the average one; b) peculiarities of ChR spectral distribution at the fixed emission angle in vicinity of the Cherenkov cone; c) influence of slowing-down due to ionization energy loss in the case of RHI; d) breaking of the axial symmetry of angular distribution of ChR and even appearance of new features of ChR linear polarization at planar channelling. The effects predicted strongly depend on the channelled particle energy and are closely connected to the normal and anomalous Doppler effects in emission from an oscillator moving in the medium [7-10].

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