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The new microscopic Vavilov-Cherenkov radiation theory

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It is proposed the new microscopic theory of Vavilov-Cherenkov radiation (VCR), emitted directly by medium in non-equilibrium state, arising due to the interaction of medium with a sufficiently fast charged particle. Contrary to the macroscopic VCR theory of Tamm-Frank and quantum VCR theory of Ginzburg, we establish the new VCR parametric resonance mechanism and the new threshold of VCR effect, which is better corresponding to the VCR observations. We show that counting of the, known from Abraham's electrodynamics, force density F_A=0.5rot[PE] (P is the polarization vector of the medium in locally non-equilibrium anisotropic state, arising due to the non-stationary electric field E of particle, moving with the constant speed v) defines the possibility of parametric resonance excitation of the transversal to E polarization waves P. We get that the condition of exponential growth with time of the amplitude of the wave P, providing the realization of VCR effect, is |v|>v_th=c/n_*, where c is the light speed in vacuum, (n_*)>n>1, and n_* is the refraction index of the isotropic medium in the equilibrium state.

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