lized by using a magnetic field which increases sharply). The magnetic field is assumed to be of the form:

$$H(x) = H^* \exp(x^2/2a^2). \tag{2}$$

At a given time the density distribution is given by the expression:

$$N/N_0 = (1/\psi)\exp[-(\psi^{-2}-1)x^2/2a^2], \tag{3}$$

where $\psi(t)$ satisfies the equation:

$$\ddot{\psi} + (W_\perp/ma^2)(\psi - 2W_\parallel/W_\perp\psi) = 0,$$
$$\psi(0) = 1, \quad \dot{\psi}(0) = 0. \tag{4}$$

It follows from Eq. (4) that ψ is a periodic function of time (period T) which varies between the limits ψ_1 and 1. As an approximation we have:

$$T \approx \begin{cases}(W_\perp/ma^2)^{1/2} & \text{for } W_\perp/2W_\parallel \sim 1,\\ \pi(W_\perp/ma^2)^{1/2} & \text{for } W_\perp/2W_\parallel \gg 1;\end{cases} \tag{5}$$

$$\psi_1 \approx \begin{cases}(2W_\parallel/W_\perp)^{1/2} & \text{for } W_\perp/2W_\parallel \sim 1,\\ \exp(-W_\perp/4W_\parallel) & \text{for } W_\perp/2W_\parallel \gg 1.\end{cases} \tag{6}$$

According to Eqs. (3) to (6), the plasma undergoes periodic longitudinal compression at the point of minimum magnetic field and expands to a uniform distribution of density N_0.

(b) Adiabatic stratification when a magnetic gradient, which is periodic along the tube, is turned on quasi-statically. Let the magnetic field be of the form:

$$H(x, t) = H_1(t) - H_2(t)\cos(\pi x/a),$$
$$H_1(t) > H_2(t), \quad H_2(0) = 0. \tag{7}$$

We neglect the inertia term in Eq. (1) and introduce the adiabaticity equations:[1]

$$W_\perp/H = W_{\perp 0}/H_0, \quad W_\parallel/n^2 = W_{\parallel 0}/n_0^2. \tag{8}$$

The density is:

$$(n/n_0)^2 = A + B\cos(\pi x/a), \quad B = (W_{\perp 0}/3W_{\parallel 0})H_2(t)/H_0,$$
$$(2/\pi)(A+B)^{1/2}E(k) = 1, \quad k^2 = 2B/(A+B), \tag{9}$$

where $E(k)$ is a complete elliptic integral of the second kind. At a given time

$$\frac{n}{n_0} = \frac{\pi}{2}\left|\cos\frac{\pi x}{2a}\right|. \tag{10}$$

According to Eq. (9) the plasma is stratified along the magnetic field, forming bunches which are concentrated about the points of minimum magnetic field.

In conclusion we wish to thank Professor Ia. P. Terletskii for his interest in this work.

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Translated by H. Lashinsky
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THE RADIATION FROM A CHARGED PARTICLE PASSING THROUGH A PLATE

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LET a charged particle moving in vacuum along the positive z direction pass through a plate of thickness a made of a material with dielectric constant ϵ. We proceed as in reference 1, the only difference being that in the region $z < 0$ the radiation field will consist of reflected waves only, and the field in the region $z > a$ of waves moving in the positive z direction, while inside the plate there are both kinds of waves; we then get for the Fourier components of the radiation field in the spaces before and after the plate the formulas

$$\mathbf{E}'_{0t}(\mathbf{k}) = \frac{ei}{2\pi^2}\frac{\varkappa}{F}\left\{\left(\frac{\varepsilon}{\lambda}+\frac{1}{\lambda_0}\right)^2\alpha e^{-i\lambda a} + \left(\frac{\varepsilon}{\lambda}-\frac{1}{\lambda_0}\right)\beta e^{i\lambda a} + \frac{2\varepsilon}{\lambda}\gamma e^{ik_z a}\right\}, \tag{1}$$

$$\mathbf{E}'_{1t}(\mathbf{k}) = -\frac{ei}{2\pi^2}\frac{\varkappa}{F}\left\{\left(\frac{\varepsilon}{\lambda}-\frac{1}{\lambda_0}\right)\alpha e^{i\lambda a} + \left(\frac{\varepsilon}{\lambda}+\frac{1}{\lambda_0}\right)\beta e^{-i\lambda a} + \frac{2\varepsilon}{\lambda}\delta e^{-ik_z a}\right\}, \tag{2}$$

where

$$\lambda_0^2 = \frac{\omega^2}{c^2} - \varkappa^2; \quad \lambda^2 = \frac{\omega^2}{c^2}\varepsilon - \varkappa^2;$$
$$F = \left(\frac{\varepsilon}{\lambda}+\frac{1}{\lambda_0}\right)^2 e^{-i\lambda a} - \left(\frac{\varepsilon}{\lambda}-\frac{1}{\lambda_0}\right)^2 e^{i\lambda a}, \tag{3}$$

$$\left.\begin{matrix}\alpha\\ \beta\end{matrix}\right\} = \frac{\pm\varepsilon/\lambda - v/\omega}{k^2-\omega^2/c^2} + \frac{\mp 1/\lambda + v/\omega}{k^2-\omega^2\varepsilon/c^2};$$
$$\left.\begin{matrix}\gamma\\ \delta\end{matrix}\right\} = \frac{\mp 1/\lambda_0 + v/\omega}{k^2-\omega^2/c^2} + \frac{\pm 1/\lambda_0\varepsilon - v/\omega}{k^2-\omega^2\varepsilon/c^2}. \tag{4}$$

Taking $R \gg a$, where R is the distance from the place the particle enters the plate (or where it leaves the plate) to the point of observation, we can obtain for the radiation emitted (as has been done in reference 1) a formula agreeing with that obtained by Pafomov.[2*] We only remark that the formula given in reference 2 does not hold for $a \lesssim R$. In this case we can obtain (cf. reference 1) from Eqs. (1) and (2) a formula that has no zeroes in the denominator.

In the extreme relativistic case, setting $\lambdabar\epsilon^{-1/2} \ll a \ll R$, we get for the radiation emitted backward the expression

$$W''_{\text{Cer}} = 2\frac{e^2}{\pi c}\left(\ln\frac{2}{1-v/c}-1\right)(\omega_2-\omega_1)\left(\frac{\sqrt{\varepsilon}-1}{\sqrt{\varepsilon}+1}\right)^2, \tag{5}$$

if $\epsilon(\omega)$ is constant in the frequency interval (ω_1, ω_2) In this same case we get for the radiation emitted forward the formula (5), but without the last factor, on the assumption $\lambdabar/|\epsilon^{1/2}-1| \ll a \ll R$ ($\lambdabar$ is the wavelength of the radiation divided by 2π.

It can be seen from the formulas (1) and (2) that there will be no Cerenkov radiation if $a \ll \lambdabar$. If, on the other hand, $\lambdabar < a \lesssim R$, then in finding the paths of steepest descent one must take into account the exponents appearing in Eqs. (1) and (2), and the result is that at a given point in the field we shall have bands of Cerenkov frequencies given by the relations

$$\frac{v}{c}\sin\theta\left(1-\frac{a}{R}\frac{s\cos^2\theta}{\sqrt{\varepsilon(\omega)-\sin^2\theta}}\right)\leqslant\sqrt{(v/c)^2\varepsilon(\omega)-1} \leqslant\frac{v}{c}\sin\theta\left(1-\frac{a}{R}\frac{t\cos^2\theta}{\sqrt{\varepsilon(\omega)-\sin^2\theta}}\right), \tag{6}$$

where θ is the angle between R and the perpendicular to the plate, while $s = 2n + 2$, $t = 2n + 1$ for the Cerenkov radiation emitted backward, and $s = 2n + 1$, $t = 2n$ for the radiation emitted forward (n is a nonnegative whole number). The backward flux of Cerenkov radiation through the area between ρ and $\rho + d\rho$ will be given by

$$\frac{dW''_{\text{Cer}}}{d\rho} = \frac{4e^2}{v^2}\sum_{n=0}^{\infty}\int_{\Delta\omega_n''}\frac{[1-\varepsilon\sqrt{1+(v/c)^2(1-\varepsilon)}]^{4n}}{[1+\varepsilon\sqrt{1+(v/c)^2(1-\varepsilon)}]^{4n+4}} \times\sqrt{\left(\frac{v^2}{c^2}\varepsilon-1\right)\left(1+\frac{v^2}{c^2}(1-\varepsilon)\right)} \times\left(\sqrt{1+\frac{v^2}{c^2}(1-\varepsilon)}-1\right)^2\omega d\omega, \tag{7}$$

and for the forward radiation we have

$$\frac{dW'_{\text{Cer}}}{d\rho} = \frac{4e^2}{v^2}\sum_{n=0}^{\infty}\int_{\Delta\omega_n'}\frac{[1-\varepsilon\sqrt{1+(v/c)^2(1-\varepsilon)}]^{4n}}{[1+\varepsilon\sqrt{1+(v/c)^2(1-\varepsilon)}]^{4n+2}} \times\sqrt{\left(\frac{v^2}{c^2}\varepsilon-1\right)\left(1+\frac{v^2}{c^2}(1-\varepsilon)\right)}\,\omega d\omega. \tag{8}$$

For $a \ll R$ the intensity of the Cerenkov radiation goes to zero.

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*V. E. Pafomov has informed us that there are misprints in Eq. (2) of reference 2: the exponent of the second term in square brackets should have the plus sign, and the exponent of the third term the minus sign.

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[2] V. E. Pafomov, J. Exptl. Theoret. Phys. (U.S.S.R.) **33**, 1074 (1957), Soviet Phys. JETP **6**, 829 (1958).

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RADIATIVE DECAY OF $\pi^\pm$ MESONS AND EFFECTS OF PARITY NON-CONSERVATION

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LONGITUDINAL polarization of particles is a consequence of the nonconservation of parity in weak interactions. A study of the radiative decay $\pi^\pm \to \mu^\pm + \nu + \gamma$ shows that parity is not conserved also in mixed interactions.

In the four-component-neutrino theory the equation for the decay has the form

$$D\psi_\nu = (eg/hc)\,\psi_\pi D^{-1}(\gamma_\mu A_\mu^+)\,\psi_\mu. \tag{1}$$

Here ψ_μ, ψ_ν, ψ_π, A_μ are the respective wave functions of the μ meson, the neutrino, the π meson, and the γ-ray quantum, and D is the Dirac operator. The longitudinal polarization of the μ meson and the neutrino is taken into account by means of the projection operator $\hat{\sigma\mathbf{p}}/\mathbf{p}$; its characteristic values (s_μ or s_ν) describe the longitudinal polarizations. $s_\mu = 1$ ($s_\nu = 1$) corresponds to spin in the direction of motion of the μ meson (neutrino), and $s_\mu = -1$ ($s_\nu = -1$) to the opposite spin direction. The circular polarization of the γ-ray quantum is described by means of the polarization vector

$$\mathbf{a}_l = \{\boldsymbol{\beta} + il\,[\mathbf{n}\times\boldsymbol{\beta}]\}/\sqrt{2},$$

where β is a unit vector perpendicular to $\mathbf{n} = \boldsymbol{\kappa}/\kappa$;