boundary), and integrates the signal with respect to time. In order for the plasma to be stable against flute perturbations during the course of slow accumulation or decay, it is necessary to vary the gain in proportion to the concentration. Since $m\omega_{0i}^{2}(\omega_{Hi}\omega)^{-1}\phi_m = 4\pi e a \ell n_{em}$, where n_e is the perturbation of the electron density in the region $dn/dr \neq 0$, it follows that condition (2) will be realized if one "measures" directly n_e and $\psi(b) = 4\pi e a \ell \Delta n_e$. It can be stated that in a system responding to concentration oscillations, the role of that part of the high-frequency circuit which forms the required transfer function $\omega_{0i}^{1}\omega^{-1}$ is performed by the plasma itself.

Let us consider one more possibility of stabilizing flute oscillations, namely by introducing controlled sources of electrons inside the plasma [5, 6][2]. Let the source intensity be proportional to the perturbation of the electron density: $S = sn_e$. The dispersion equation is

$$1+[(\omega - is(\omega))^{-1} - (\omega + m\omega^*)^{-1}]\omega_{Hi} = 0 . \qquad (5)$$

Let $s = -i\omega\Delta_1$, where Δ_1 is a real constant in the region $|\omega| < \Omega$, i.e., $S = \Delta_1(\partial n_e/\partial t)$. When $|\Delta_1| \ll 1$, the sufficient condition for stability is

$$\Delta_1^2 > 4m\omega_{Hi}^{-1}\,\omega^*. \qquad (6)$$

We consider another example, $s = i\omega\Delta_2$ $(S = \Delta_2(\partial n_e/\partial\theta))$, where $\Delta_2 > 0$. The oscillations are stable if

$$\Delta_2 > \omega^* \quad . \qquad (7)$$

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KINETIC DIAMGNETISM AND PARAMAGNETISM

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A conducting medium in a non-equilibrium state, for example in the presence of a temperature gradient or an electric field, or else in the presence of convective motion, has special magnetic properties. Depending on the carrier-scattering mechanism and on the

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[2] This method can be used to suppress not only surface but also internal (upper radial) modes.

magnitude of the external field, the latter can either decrease within the medium, so that there exists a characteristic length playing the role of the depth of the penetration of the magnetic field, or conversely the magnetic field may be strong in the interior of the medium and become weaker closer to the surface.

In the presence of a temperature gradient ∇T perpendicular to the magnetic field H, a Nernst thermal emf is produced and can cause an electric current leading to kinetic diamagnetism or paramagnetism. In a celestial body with a radial temperature gradient, a magnetic field directed along the rotation axis produces azimuthal electric currents and the resultant magnetic field increases in the outward direction.

Let us consider a cylinder of radius R and of length L >> R in an external magnetic field $H = H_z$ parallel to the cylinder axis. Assume that in the direction of the cylindrical radius vector r there is an axially-symmetrical temperature gradient ∇T, which does not depend on r or z.

Then a current of density $\vec{j}$ is produced in the cylinder, and

$$\frac{c}{4\pi} \,\mathrm{rot}\, \mathbf{H} = \sigma \mathbf{E} + \sigma_1 [\mathbf{E} \times \mathbf{H}] - \beta \nabla T - \beta_1 [\nabla \mathbf{T} \times \mathbf{H}]. \tag{1}$$

Since $j_r = 0$, we get $E_r = (\beta/\sigma)\, \nabla T$ and an azimuthal current due to the Nernst and Hall effects

$$i_\phi = \frac{\sigma_1 \beta - \sigma \beta_1}{\sigma} [\nabla \mathbf{T} \times \mathbf{H}]_\phi .$$

Equation (1) has a solution in which $H_r = H_\phi = 0$, so that

$$\frac{\partial H_z}{\partial r} = \frac{4\pi}{c} \Lambda \nabla T H_z = \frac{H_z}{\delta}; \quad \Lambda = \frac{\sigma_1 \beta - \sigma \beta_1}{\sigma}; \quad \delta = \frac{c}{4\pi \Lambda \nabla T}.$$

in a weak magnetic field $\Omega\tau = H/H_c << 1$ (Ω and τ are the cyclotron frequency and the relaxation time of the electrons, $H_c = mc/e\tau$), Λ does not depend on the magnetic field, and

$$H_z = H_{z_0} \exp r/\delta . \tag{2}$$

If $\partial T/\partial \tau < 0$, then the magnetic field decreases in the inward direction when $\Lambda < 0$. The conductor has in this case a "kinetic diamagnetism" and exhibits a unique Meissner effect - expulsion of the magnetic field to the outside. When $\Lambda > 0$, "kinetic paramagnetism" is observed and the magnetic field becomes stronger in the interior of the conductor.

In the opposite limiting case of a strong magnetic field $H >> H_c$ we have

$$\frac{\partial H_z}{\partial r} \frac{1}{H_c} = \frac{H_c}{\delta H_z}; \qquad H_z^2 = H_c^2 [1 + \frac{2}{\delta}(r - r_c)]. \tag{3}$$

The magnetic field is strengthened or weakened not exponentially, but more slowly, in proportion to $\sim \sqrt{r - r_c}$. (The latter expression has only limited validity, since the strengthening of the magnetic field causes the latter to become quantizing and δ assumes different values. In a medium in which the magnetic field passes through the value H_c, it is necessary to join together the solutions (2) and (3).)

Let us consider the dependence of Λ on the scattering mechanism. Let $\tau \sim v^k$.

a) For degenerate electrons with $k = 2n$ and $k = 2n + 1$ we get the values of Λ for a weak magnetic field

$$\Lambda = -\frac{2^n n(4n+3)!!}{(2n+3)!!}\frac{\sigma\tau}{mc}\ ;\quad \Lambda = -\frac{(2n+1)(4n+5)!!\sqrt{\pi}\,\sigma\tau}{8(n+2)!\,mc}$$

and in the case of a strong magnetic field

$$\Lambda = 2^{\frac{-3n}{n-1}}(3-2n)!!\frac{\sigma\tau}{mc}\ ;\quad \Lambda = -\frac{3(2n+1)\sigma\tau}{4(1-n)mc}\ .$$

b) For degenerate electrons in a weak magnetic field $\Lambda = - k(\pi^2/3)(T/\zeta)(\sigma\tau/mc)$, and in a strong magnetic field $\Lambda = - k(\pi^2/6)(T/\zeta)(\sigma\tau/mc)$. The signs of k and Λ are opposite.

For degenerate electrons in a weak field we have

$$\delta = -\frac{ne^2c^2}{4\pi\sigma^2}\frac{\zeta}{T}\frac{1}{\nabla T}\ .$$

In the presence of strong dragging of the electrons by phonons, the coefficients β and β_1 may increase strongly. This is the situation, for example, in the case of semimetals. In antimony [1], the Nernst coefficient at helium temperatures is increased approximately 400 times by the dragging. If we take a 100-fold increase and put $T \approx 4^{\circ}K$ and $\nabla T \approx 0.1^{\circ}K$ ($\sigma \approx 4.5 \times 10^{19}\ sec^{-1}$[2]), then $\delta \approx 10^{-2}$ cm. In a cylinder of radius 0.6 cm, the magnetic field can increase by a factor of 4. This increase takes place so long as $H < H_c \approx 30$ Oe. Since scattering by acoustic phonons predominates at helium temperatures [1], the field increases in the outward direction when $\partial T/\partial r > 0$. A similar effect is possible also in other semimetals.

In the interior regions of the sun, $T \approx 10^{-11}$ erg and $n \approx 10^{18}\ cm^{-3}$, we have the ratio $\delta \approx 1$, where $L \approx |T/\nabla T|$ is the inhomogeneity length.

If in place of ∇T we apply along the radius an electric field E_r, then $E_r = E_0(r_0/r)$ ($E_0 = E_r$ at $r = r_0$, r_0 is the inside radius of the cylinder), and

$$\frac{\partial H_z}{\partial r} = \frac{4\pi\sigma_1}{c}\frac{E_0 r_0}{r}H_z\ .$$

(It can be shown that $H_r, H_\phi \ll H_z$). Then

$$H_z(r) = H_0\left(\frac{r}{r_0}\right)^a\ ;\qquad a = \frac{4\pi}{c}\sigma_1 E_0 r_0\ .$$

Putting $\sigma_1 = \sigma_0 e\tau/mc$, where $2\pi r_0\sigma_0 E_0 = I_0$ is the radial current per unit length, we get $a = 2I_0/cH_c$. In indium antimonide $H_c \approx 300$ Oe, and in metals it is larger by one order of magnitude; under pulsed condition, current is possible with $a \geq 2$ and with

$$\frac{R}{r_0} \approx 3\ ;\qquad \frac{H}{H_0} \gtrsim 10\ .$$

When $H > H_c$ and in the case of carriers of the same sign,

$$\sigma_1 = \frac{nec}{H}; \quad H = \sqrt{H_o^2 + b\ln\frac{r}{r_o}}; \quad b = 8\pi neE_o r_o^2 .$$

The sign of the change of the magnetic field in the presence of a radial current is determined by the sign of the Hall constant, i.e., by the sign of the charge of the majority carriers.

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CORRESPONDENCE OF THE EQUATIONS OF THE MULTIPERIPHERAL AND MULTIREGGEON THEORIES OF INELASTIC PROCESSES

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The multiperipheral (MP) theory of inelastic processes, in which single-pion diagrams are considered (see Fig. 1), is formulated [1, 2] within the framework of the Bethe-Salpeter (BS) equation. In the multireggeon (MR) theory [3], which considers diagrams with exchange of one vacuum reggeon (see Fig. 2), its analog is the equation of Chew, Goldberger, and Low (CGL) [4].

These theories describe inelastic processes that are different from each other, i.e., they are valid in different regions of the phase volume [5, 6]. For most processes, the criteria of applicability of the MR theory are satisfied [5]. Recent papers (see [7, 8]), however, contain phenomenological attempts to extend the applicability of the MR theory to the entire phase volume by introducing "clusters" and exchange of "meson" reggeons (i.e., by replacing Fig. 2a with the diagram of Fig. 2b with $R \neq P$).

We write down a single equation for the inelastic processes, which reduces to the BS equation in most of the phase volume, reduces to an equation of the CGL type in the region of applicability of the MR theory. Such an equation was considered in [9], but only for particular cases - the model of Amati et al. [10] and the completely reggeized model [4] (Fig. 2a), which cannot pretend to describe the majority of the inelastic processes.

We denote by $A_1(p_a, p_b)$ the imaginary part of the amplitude of 0° elastic scattering of particles with momenta p_a and p_b in the s-channel. We define [4] the function B as follows:

$$A_1(p_a, p_b) = \frac{1}{4\pi^4}\int d^4k_1 \bar{A}_1(p_a, k_1)\, D^2(k_1^2)\, B(k_1, p_a, p_b) . \qquad (1)$$

This relation is valid both in the MP and in the MR, but in the former case $\bar{A}_1$ and D^2 are interpreted as the imaginary part of the irreducible block of the amplitude of the elastic scattering and the square of the pion propagator, and in the MR as the squares of the vertex