ture gradient in the absence of an external field. The strong field in the paraelectric region on the boundary between the phases shifts the Curie point toward higher temperatures, as a result of which the boundary moves toward the heated end of the crystal a distance on the order of the screening length. After the space charges are redistributed, the screening layer should contain near the new boundary a section of ferroelectric phase at a temperature higher than the phase-transition temperature. This shifts the boundary in the opposite direction, and the process is then repeated. It is clear from the foregoing that the period of the oscillations should be determined by the Maxwell time constant τ_p, and the oscillation amplitude by the screening length and by the temperature gradient. The estimated values for SbSI are $\tau_p \simeq 1$ sec and $d_e \simeq 3 \times 10^{-1}$ cm, and agree with the frequency and amplitude of the observed oscillations. Illumination of the crystal, which causes photoconductivity, should increase the oscillation frequency. The redistribution of the charges in the volume of the crystal, which accompanies the oscillations of the boundary, leads to oscillations of the current in the external circuit (pyrocurrent).

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QUASILINEAR TRANSFORMATION OF WAVES IN AN INHOMOGENEOUS PLASMA AND NONLINEAR EFFECTS

K. Jungwirth and J. Vaclavic
Institute of Plasma Physics, Czechoslovak Academy of Sciences

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It was shown earlier [1] that wave transformation in an inhomogeneous plasma may be caused not only by nonlinear effects, but also by quasilinear ones. In such effects, the plateau produced as a result of quasilinear interaction of one group of waves with the particles can be unstable for another group of waves. The possibility of quasilinear transformation of high-frequency waves ($\omega_\alpha \approx \alpha_p$) in the low-frequency part of the spectrum ($\omega_\beta \ll \omega_\alpha$) was demonstrated by using as an example potential electron oscillations of a cylinder of cold homogeneous plasma of radius R, Excited by a longitudinal electron beam of radius a, moving along a homogeneous magnetic field $\vec{B} \parallel z$. The ratio of the beam and plasma densities was assumed small ($N/n_0 \ll 1$). However, the earlier discussion left quite open the question whether this effect predominates also when nonlinear wave interaction is taken into account.

It is easy to verify that the spectrum

$$k_\perp^2\{1 - [\omega_p^2/(\omega^2 - \omega_B^2)]\} + k_z^2[1 - (\omega_p^2/\omega^2)] = 0 \quad (1)$$

is of the decay type, so that the conservation laws allow processes in which two high-frequency waves with $\omega_\alpha \approx \omega_p$ and one low-frequency wave participate, or else processes with three low-frequency waves

$$\omega_\beta \approx \pm[\omega_p\omega_B(\omega_p^2 + \omega_B^2)^{-1/2}](k_z/k). \quad (2)$$

Assuming that high-frequency waves have been excited at the initial instant of time $t = t_0$ and that at that time the level of the low-frequency waves is negligibly small, we obtain from the kinetic equation for the low-frequency waves in the initial stage of the process the following estimate of their energy density:

$$W_\beta(t) \approx (k_{\beta z}/k_{\alpha z})W_\alpha(t_0)\{\Gamma(\exp[(2\gamma_\beta - \Gamma)(t - t_0)] - 1)/(2\gamma_\beta - \Gamma)\}, \quad (3)$$

where $W_\alpha(t_0)$ is the initial energy density of the high-frequency waves and γ_β is the linear increment. An estimate of the quantity Γ, which characterizes the nonlinear interaction, is given in the table. The same table lists also the values of γ_β [2], the ratios Γ/γ_β which determine the time variation of $W_\beta(t)$, the characteristic values of the low-frequency wave vectors as determined from the condition for the maximum of the increment [1], and the relations for the wave vectors of the low-frequency waves excited either by the nonlinear interaction or by the inhomogeneous beam. W_δ denotes the average energy density of the monoenergetic beam: $W_\delta = (Mv_z^2/2)(a^2N/R^2)$.

Thus, a Rayleigh-Jeans distribution is established in the density region $\omega_p^2 \lesssim \omega_B^2$ if the condition

$$[W_\alpha(t_0)/W_\delta] > (R/a)(N_z/a\omega_B) \quad (4)$$

is satisfied, so that no quasilinear transformation takes place. In the opposite case, or in the density region $\omega_p^2 \gg \omega_B^2$ we can neglect the nonlinear interaction during the initial stage of growth of the low-frequency oscillations. But since an inhomogeneous beam excites low-frequency oscillations only with $m/k_z < 0$ [2] (m is the azimuthal wave number), and waves with $m/k_z < 0$ are damped because of the sufficiently rapid nonlinear transformation of the growing waves into damped waves, the final energy density of the low-frequency oscillations can be much smaller than predicted by the quasilinear theory. From the kinetic equation for the low-frequency waves we find that if all conditions for quasilinear transformation of energy from high to low frequencies are satisfied, then energy can be drawn from the high-frequency oscillations only if

$$W_\alpha(t_0) \lesssim (R/a)(\omega_\beta/\omega_B)(N_z/a\omega_B)W_\delta \quad (5)$$

Different values of the density of a cold plasma

Quantity			Frequency intervals: $\omega_p^2 \ll \omega_B^2$	$\omega_p^2 \approx \omega_B^2$	$\omega_p^2 \gg \omega_B^2$
HF waves $\omega_\alpha \approx \omega_p$		$k_{\alpha\perp}$	$\approx (\omega_p/N_z)$	$\approx (\omega_p/N_z)$	$\approx (\omega_p/N_z)$
		$k_{\alpha z}$	$\approx (\omega_p/N_z)$	$\approx (\omega_p/N_z)$	$\approx (\omega_p/N_z)$
LF waves $\omega_\beta \ll \omega_B$	excited by nonlinear interaction	$k_{\beta\perp}$	$\approx k_{\alpha\perp}$	$\approx k_{\alpha\perp}$	$\approx k_{\alpha\perp}$
		$k_{\beta z}$	$\approx \frac{\omega_\beta}{\omega_p} k_\beta \ll k_{\beta\perp}$	$\approx \frac{\omega_\beta}{\omega_p} k_\beta \ll k_{\beta\perp}$	$\approx(\omega_\beta/\omega_B)k_\beta < (\omega_B/N_z)$ $\frac{\omega_\beta}{\omega_B} < \frac{\omega_B}{\omega_p} \ll k_{\beta\perp}$
	excited by beam	$k_{\beta\perp}$	$\approx (\omega_p/N_z)$	$\approx(\omega_p/N_z) \approx (\omega_B/N_z)$	$\approx (\omega_B/N_z)$
		$k_{\beta z}$	$\approx (\omega_\beta/N_z) \ll k_\beta$	$\approx (\omega_\beta/N_z) \ll k_\beta$	$\approx (\omega_\beta/N_z)$
ω_{drift} corresponding to maximum value			$\approx \frac{\omega_p}{\omega_B} \frac{N_z}{a}$	$\approx \frac{N_z}{a}$	$\approx \frac{N_z}{a}$
LF waves γ_β			$\approx \frac{N}{n_0} \frac{\omega_p}{\omega_B} \frac{N_z}{R}$	$\approx \frac{N}{n_0} \frac{N_z}{R}$	$\approx \frac{N}{n_0} \frac{N_z}{R}$
Γ			$\frac{\omega_p}{M n_0 N_z^2} W_\alpha(t_0)$	$\frac{\omega_p}{M n_0 N_z^2} W_\alpha(t_0)$	---
Γ/γ_β			$\frac{a\omega_B}{N_z} \frac{a}{R} \frac{W_\alpha(t_0)}{W_\delta}$	$\frac{a\omega_p}{N_z} \frac{a}{R} \frac{W_\alpha(t_0)}{W_\delta}$	---
Additional conditions			$\omega_p \gtrsim (N_z/a)$	$\omega_p \gtrsim (N_z/a)$	$\omega_B \gtrsim (N_z/a)$ $\omega_B \gtrsim \omega_\beta \gtrsim \omega_B(\omega_B^2/\omega_p^2)$
Remark			---	---	Beam and nonlinear interactions excite different groups of lf waves

in the high-density region $\omega_p^2 \gg \omega_B^2$, and when

$$W_\alpha(t_0) \lesssim (R/a)(\omega_\beta/\omega_p)(\omega_B/\omega_p)(N_z/a\omega_p)W_\delta \tag{6}$$

in the region $\omega_p^2 < \omega_B^2$, $\Gamma/\gamma_\beta \ll 1$.

A detailed corroboration of our deductions will be published later [3].

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USE OF RUBY TO OBTAIN INFRALOW TEMPERATURES BY ADIABATIC DEMAGNETIZATION

N. E. Alekseevskii
Institute of Physics Problems, USSR Academy of Sciences
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To obtain very low temperatures by adiabatic demagnetization, it is customary to use compounds containing ions of paramagnetic metals, such as iron and manganese alums, sulfates, nitrates, and others. It must be noted, however, that practically all the compounds presently used for demagnetization have many serious shortcomings: they decompose readily, they have relatively low thermal conductivity (especially when working with polycrystals), they are brittle, etc.

It is therefore natural to attempt to replace the presently-used salts with other magnetic systems. Suitable objects for this purpose are, for example, oxides with a small amount of paramagnetic ions added. These substances include, as is well known, ruby, which is an Al_2O_3 crystal in which chromium is dissolved in the form of Cr^{3+} ions.

The magnetic susceptibility of ruby single crystals was investigated in detail in [1,2]. Sevast'yanov and Baibakov [3] investigated the anisotropy of the magnetic susceptibility and its dependence on the concentration.

We used for the experiments a cylindrical ruby crystal whose axis was inclined $\approx 60°$ to the principal axis of the crystal. The chromium content was $\approx 0.5\%$. An electromagnet producing a field of ≈ 23 kOe was used in most measurements. The initial temperature when working with this apparatus was 1.4°K. A number of experiments were made also with apparatus in which the field was produced with a superconducting solenoid and amounted to 55 kOe at an inside diameter 37 mm.

We could not measure the magnetic temperature in the superconducting solenoid, because the residual field of the solenoid greatly influenced the measurement results. Therefore the internal Dewar was lifted together with the ampoule after the demagnetization in such a way that the ampoule was raised approximately 200 mm above the solenoid during the measurement. The measurements were made both with ampoules from which the heat-exchange helium was pumped out by a sorption pump, and with permanently filled ampoules, similar to those used by Alekseevskii and Migunov [4]. In the latter case the ampoule, whose volume was ≈ 15 cm^3,