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1) In addition, the electron-lattice interaction constant is renormalized.

2) Amirkhanov and Bashirov [4] indicate a position H_0^+, but in fact this should be H_0^-, since the g*-factor is negative.

3) The g*-factor determined from spin resonance can coincide with (6) only for pure samples.

SUPPRESSION OF LOW-FREQUENCY OSCILLATIONS IN TWO-STREAM INSTABILITY BY PRIOR MODULATION OF THE ELECTRON BEAM

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We have shown earlier [1] that development of two-stream instability is accompanied, besides high-frequency oscillations (1000 - 6000 Mcs), also by low-frequency oscillations (10 kcs - 30 Mcs), and by intense ion currents, comparable in magnitude with the electron current of the primary beam. The energy of the ions reaches several hundred electron volts. Apparently the acceleration and "heating" of the ions are due to the low-frequency oscillations. On the other hand, these oscillations, which arise upon development of two-stream instability, lead to anomalous diffusion of the plasma. Therefore a determination of the causes of the low-frequency oscillations and a development of methods for their suppression is of interest. It is also necessary to determine whether these oscillations are produced by the beam directly or are brought about by the high-frequency oscillations.

We report here the results of experimental investigations from which it follows that the low-frequency oscillations can be stopped by modulating the beam at a high frequency, $\omega_m = 2\omega_{He}$. The connection we investigated between the low- and high-frequency spectra indicates that the low-frequency oscillations are brought about by the high-frequency ones.

The experiments were made with a previously-described setup [1,2]. An electron beam with current up to 100 mA and particle energy 2 - 5 keV is injected in an interaction chamber situated in a longitudinal magnetic field of intensity up to 2000 Oe. At the entrance to the system is placed a resonator tuned to 3000 Mcs, with which the beam can be modulated. The attainable modulation depth α was equal to 0.15. The experimental conditions were chosen such that the modulation frequency ω_m was double the cyclotron frequency for the electrons. This condition corresponds to the first zone of instability excitation in the presence of external modulation [3].

The oscillations were received with probes placed in the plasma. The spectrum of the high-frequency oscillations was investigated with wave meters and with an IV-46 analyzer, while an S-4-8 analyzer was used for the low-frequency oscillations.

The main results are shown in Figs. 1 and 2.

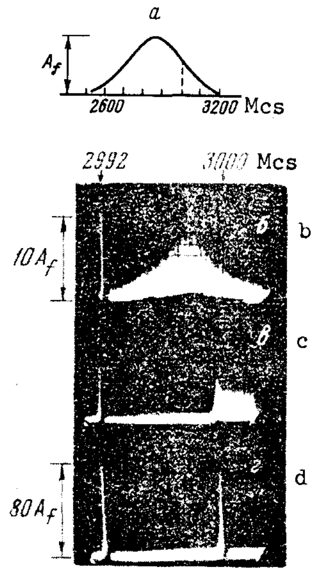

Fig. 1. Spectrum of high-frequency oscillations vs. depth of modulation of the electron beam (f = 2992 Mcs marks the start of the sweep; the total sweep is 10 Mcs).

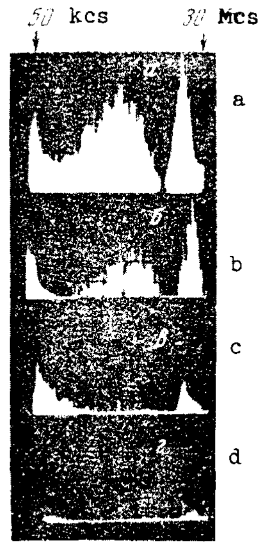

Fig. 2. Spectrum of low oscillations vs. electron-beam modulation.

Figure 1a shows the approximate spectrum of the high-frequency oscillations in the absence of beam modulation. The maximum of the amplitude lies in the frequency region 2900 Mcs. The spectrum extends over ~12%. The dashed line denotes the frequency at which the beam was modulated. Oscillograms b, c, and d of Figs. 1 and 2 are the spectra of the high- and low-frequency oscillations vs. the modulation depth. The total sweep of the high-frequency spectrum is 10 Mcs, and that of the low-frequency oscillations is from 50 kcs to 30 Mcs.

Even at the relatively low values $\alpha \approx 0.04 - 0.06$ one can see in the high-frequency spectrum suppression of the frequency with the maximum amplitude, and separation of a new frequency which is shifted 30 - 40 Mcs relative to the modulation frequency (the spectrum width is of approximately the same order as before). In the low-frequency spectrum one observes a decrease in the oscillation amplitude (Fig. 2b).

Further increase in the depth of modulation leads to a narrowing of the spectrum of the high-frequency oscillations and to a suppression of the low-frequency ones (Fig. 1b, $\alpha \approx 0.09$; Figs. 1c, d and Figs. 2c, d - $\alpha \approx 0.11$ and 0.15, respectively).

It is interesting to note that the width $\Delta\omega_{hf}$ of the high-frequency spectrum coincides approximately with the region of frequencies occupied by the low-frequency spectrum. One possible explanation is that the low-frequency oscillations are the result of nonlinear interaction of the high-frequency ones and therefore $\omega_{max\ lf} \simeq \omega_{hf}$.

Another interesting fact is that an increase in the depth of modulation is accompanied not only by a narrowing of the high-frequency spectrum, but also by a shift of the frequency of the maximum oscillation amplitude to the modulating frequency. When $\alpha \simeq 0.15$ the maxima of the oscillations coincide. As seen from Fig. 2d, the spectrum in the 50 kcs - 30 Mcs region is then fully suppressed. In the 0 - 50 kcs region the amplitude drops by a factor 2 - 3.

Simultaneously with the change that modulation produces in the spectrum, a 30% decrease is observed in the ion current (in individual cases up to 40%). The plasma column diameter decreases when the low-frequency oscillations are stopped. This decrease in diameter is apparently due to the decrease in the anomalous diffusion due to the low-frequency oscillations.

The experimental results indicate that prior modulation of the beam makes it possible to suppress not only the high-frequency oscillations over a wide range of frequencies, but also the low-frequency oscillations excited by the two-stream instability [4,5]. We have shown that the low-frequency oscillations are produced by the high-frequency ones.

For a conclusive answer to the question whether low-frequency oscillations are the result of nonlinear interaction between high-frequency waves or to static potential wells caused by the high-frequency fields additional research is necessary.

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A NEW RESONANCE CONNECTED WITH MUTUAL DRAGGING OF ELECTRONS AND PHONONS

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This paper is devoted to an investigation of the effect of the mutual dragging of electrons and phonons on the propagation of electromagnetic waves in semimetals and degenerate semiconductors situated in an external magnetic field.

Assuming the electric field to be weak and negelecting spatial dispersion, we seek the distribution functions f and N for the electrons in the form

$$f = [\exp(\frac{\epsilon(p) - \epsilon_0}{T}) + 1]^{-1} + (\vec{\chi}(p), \frac{\vec{p}}{p}), \quad N = [\exp(\frac{\hbar\omega(q)}{T} - 1]^{-1} + (\vec{\psi}(q), \frac{\vec{q}}{q}). \qquad (1)$$