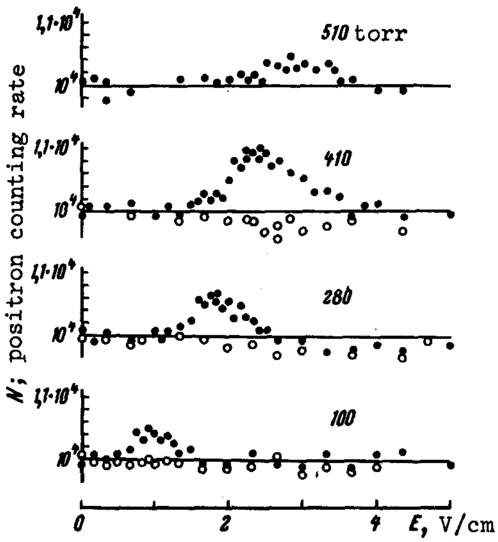

Dependence of the positron counting rate on the values of the accelerating (dark points) and decelerating (light points) electric fields at various helium pressures.

cross sections, further investigations are necessary. The influence of a weak electric field on the counting rate confirms also the hypothesis that the positrons are decelerated in helium to low energies.

The effect was not observed in other gases, such as H_2, O_2, N_2, Ne, and Ar at $E/P < 50$ V/cm-atm and Xe at $E/P < 10^3$ V/cm-atm.

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OBSERVATION OF HIGH-FREQUENCY OSCILLATIONS IN STRONG EXCITATION OF FERROMAGNETIC α-Fe_2O_3

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We report in this paper an experimental observation of high-frequency (HF, about 1 MHz) oscillations of magnetization and elastic oscillations in antiferromagnetic (AF) single-crystal hematite (α-Fe_2O_3), which occurred under the influence of a definite level of microwave pumping.

The experiments were performed at room temperature, at a frequency 9300 MHz, with longitudinal and transverse polarization of the microwave pumping field. The constant magnetizing field was applied in the basal plane of the crystal. The samples used were spheres and plates with a resonance curve (measured at an approximate freuqency 37 GHz) of width from 500 to 1000 Oe. The HF oscillations were displayed on the screen of an S4-8 spectrum analyzer following detection of the microwave signal reflected from a resonator containing the sample.

Figure 1 shows a plot of the excitation threshold of the HF magnetization oscillation for longitudinal polarization of the pumping field. We see that: 1) the HF oscillations are excited only in a definite region of the magnetizing fields, and 2) the threshold curve shows a clearly pronounced minimum.

In the case of a transversely polarized pumping field, the threshold curve retains approximately the same form, but its minimum shifts towards higher values of the magnetizing fields.

The spectral composition of the HF magnetization curves exhibits the following distinguishing features: at a slight excess above threshold, the spectrum consists of one component of frequency ∿ 1 MHz; when the pumping level is increased, the number of components increases, although their width does not; the component with the highest frequency corresponds to approximately 10 MHz. The frequency of the individual HF components increases smoothly with increasing constant field, and also with increasing pump level. These changes amount to several dozen kilohertz. At certain values of the constant field and of the pump level, abrupt "jumps" of the HF-component frequencies, amounting to several hundred kilohertz, are observed; these "jumps" have a hysteretic nature.

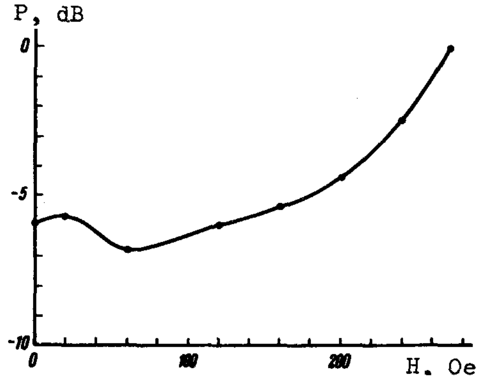

Fig. 1. Threshold curve of HF magnetization oscillations in the case of longitudinal pumping.

The threshold values of the pump fields are relatively small: they exceed only by a few times the values obtained for yttrium ferrites. The intensity of the HF magnetization oscillations increases rapidly with increasing pump level, reaching a maximum value which subsequently remains practically unchanged. In the case of transverse pumping the intensity is larger by about one order of magnitude than in the case of longitudinal pumping.

We have also observed in these experiments HF elastic oscillations of the sample. They were picked off the sample with the aid of a piezoelectric plate secured to the outer wall of the resonator. The signal from usch a plate was fed to an S4-8 spectrum analyzer. It was established that the excitation threshold, the spectrum, and the intensity of the HF elastic oscillations correlate well with the values obtained in the study of the HF magnetization oscillations. When the sample was rigidly secured (pressed in polystyrene), the intensity of the elastic oscillations decreased by approximately 20 dB, whereas the intensity of the HF magnetization oscillations remained practically unchanged. It is interesting that the intensity of the HF elastic oscillations in antiferromagnetic α-Fe_2O_3 is larger by approximately one order of magnitude than the intensity of the HF elastic oscillations in single-crystal yttrium ferrite in the case of nonlinear ferromagnetic resonance [1].

Both types of HF oscillations could be completely suppressed by producing in the sample an alternating magnetic field. Such a field was produced either with the aid of a coil wound around the sample, or through magnetostriction by exciting elastic oscillations in the crystal (the latter were produced by using the aforementioned piezoelectric plates). Plots illustrating the suppression of the HF oscillations in the case of longitudinal polarization of the pumping field are shown in Figs. 2a and 2b. It is seen that the optimal frequency of suppression of the HF oscillations by either method is approximately 1.5 MHz.

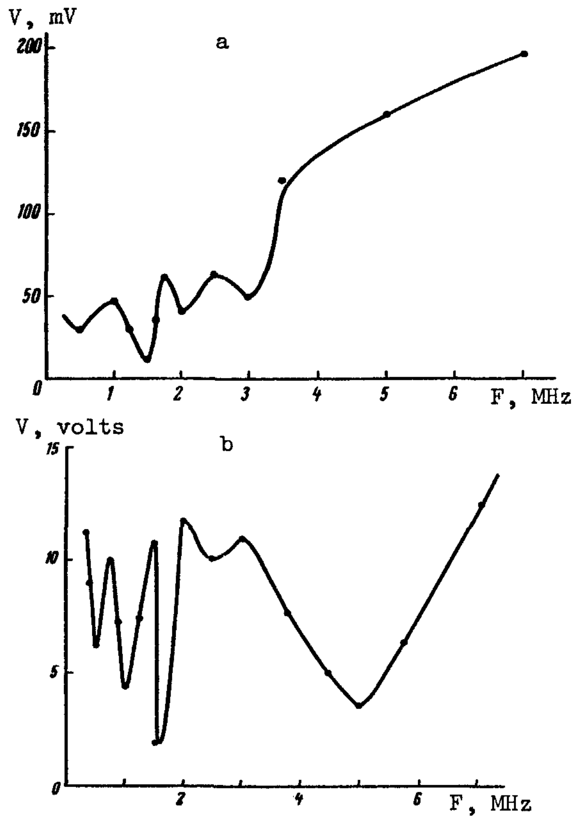

Fig. 2. Plots of voltages in coil (a) and on piezoelectric plate (b) vs. the frequency of additional modulating signal, at which total suppression of the HF oscillations occurs (longit. pumping)

The characteristics (including the suppression) of the HF oscillations observed in AF hematite crystals are analogous to the characteristics of automodulation of nonlinear ferromagnetic resonance [2]. The investigated AF crystals did not possess a ferrite base. This fact was established by simultaneously observing the HF oscillations in hematite and in yttrium ferrite and varying the temperature. It turned out that at a temperature close to 250°K (when the hematite goes over into the antiferromagnetic state), the HF oscillations in the AF crystal vanished abruptly, whereas in the yttrium ferrite they did not change noticeably. It can therefore be assumed that the HF oscillations in the AF hematite crystal are the consequence of parametric excitation of spin waves and of their instability. It is perfectly probable, however, that the domain structure of the antiferromagnet can also become manifest in the described phenomena, inasmuch as in the the constant fields in which they are observed the sample may not be completely saturated. In this connection, great interest attaches to analogous experiments in the region of shorter wavelengths.

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CORRELATION OF THE CRITICAL SUPERCONDUCTING-TRANSITION TEMPERATURE WITH THE CONDUCTION-ELECTRON CONCENTRATION IN V-Ga AND Nb-Ti ALLOYS

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We have investigated the superconducting and optical properties of alloys of vanadium with gallium and of niobium with titanium. The vanadium-gallium alloys were obtained by simultaneous evaporation of the vanadium and gallium from different evaporators. The method of producing such alloys has been described earlier [1]. The alloys of niobium with titanium were produced in an arc furnace in an atmosphere of purified argon. The method of producing these alloys is described in [2]. Samples of the following compositions were prepared: V-Ga