OBSERVATION OF ULTRASONIC OSCILLATIONS IN NONLINEAR FERROMAGNETIC RESONANCE

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It is known [1, 2] that nonlinear ferromagnetic resonance (NFMR) is unstable. The instability of NMFR is manifest in the form of high-frequency (about 1 MHz) oscillations of the magnetization - NFMR auto-modulation.

It was shown in [1] that, owing to magnetostriction, the NFMR auto-modulation should excite crystal lattice vibrations. Experimental observation of such acoustic oscillations was reported briefly in [2]. In that investigation, the acoustic oscillations were picked off a ferrite sample by a mechanical concentrator with a narrow transmission band, making it possible to observe acoustic oscillations only at discrete points of the spectrum.

In our present study we picked off the acoustic oscillations from the sample with the aid of two broadband piezoelectric plates having different resonant frequencies (∿ 500 kHz and ∿ 1 MHz, respectively).

The method used to secure the ferrite and the piezoelectric plate is shown in Fig. 1. The experiments were performed at a pump frequency 9300 MHz, in a magnetizing-field range approximately from 500 to 2500 Oe, at transverse and longitudinal polarizations of the pump field, using samples cut in the form of a parallelepiped from single-crystal yttrium ferrite.

NFMR auto-modulation was observed when the pump level exceeded the NFMR threshold by approximately 1.4 times, and acoutic oscillations could be observed when the ratio was increased to about 1.7.

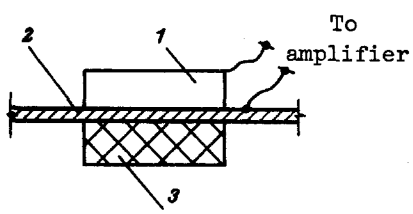

Fig. 1. Mounting of ferrite sample and ferroelectric plate: 1 - piezoelectric plate, 2 - waveguide wall, 3 - ferrite sample.

Figures 2a and 2b show plots of the spectral composition and of the intensities of the NFMR auto-modulation and acoustic oscillations obtained by transverse pumping. It is seen from the figure that the spectral composition and the acoustic-oscillation intensity correlate well with that of the NFMR auto-modulation. However, the spectrum of the acoustic oscillations is still much narrower than that of the NFMR auto-modulation oscillations. This may be due to the selective properties of the plates.

Similar relations were obtained also by longitudinal pumping. The difference from the case of transverse pumping lies here in the fact that the intensity of the acoustic oscillations is lower by about one order of magnitude, as is, incidently, the intensity of the NFMR auto-modulation [4]. This is probably why they are observed in a relatively narrow range of magnetizing fields in the vicinity of the field corresponding to the minimum of the excitationthreshold of the NFMR auto-modulation.

Thus, the experimental results allow us to draw the definite conclusion that NFMR auto-

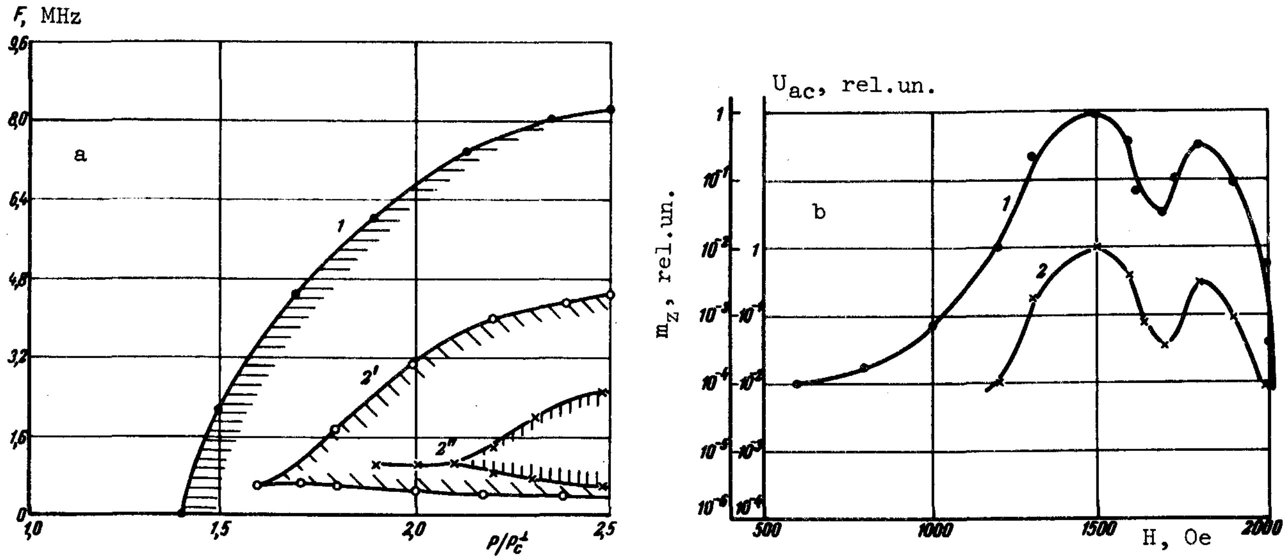

Fig. 2. a) Spectral composition of NFMR auto-modulation oscillations (1) and of acoustic oscillations (2) (2', 2" - piezoelectric plates with resonant frequencies ∿500 kHz and ∿1 MHz respectively, P_c - minimum NFMR excitation threshold for transverse pumping). b) Intensity curves of NRMR auto-modulation (1) and of the acoustic oscillations (2).

modulation is accompanied by excitation of ultrasonic acoustic oscillations were observed also in hematite (α-Fe_2O_3) at room temperature. In this case the intensity of the acoustic oscillations is higher by more than one order of magnitude than the intensity in the yttrium ferrite.

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YIELD OF DEUTERONS KNOCKED OUT FROM THE C^{12} NUCLEUS BY 730 AND 1260 MeV PROTONS

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The yield of deuterons from the C^{12} nucleus near the maximum of backward elastic p-d scattering was investigated on the internal target of proton synchrotron of the Institute of Theoretical and Experimental Physics. The experimental setup is shown in Fig. 1. The particles emitted at an angle of 13° to the direction of the primary beam were momentum-analyzed by an SP-12 magnet and were incident on a scintillation-counter hodoscope C_1 - C_6 with a flight base 16.6 m, where the deuterons were separated from the other particles by their time of flight. The setup and the experimental procedure are described in detail in [1]. We used a carbon target 0.5 mm thick. The measurements were made at two kinetic ener-