pulses. As to the echo signal, it is not accompanied by any hypersonic oscillations.

We can draw the following conclusions from these experiments: 1) It follows apparently from the absence of the polarization-echo signal in quartz that the polarization echo is connected not with the piezo-effect, but with the ferroelectric state of the material. 2) The absence of a signal in lithium niobate can be attributed to the fact that this substance has a very high phase-transition temperature. At the temperatures of the experiment, the domain boundaries and the domains themselves have low mobility. It is therefore possible that the polarization echo signal is due to some degree to the mobility of the domain boundaries, or to the rotation of the domains themselves. 3) The absence of a signal in Rochelle salt may be due to the fact that the crystal goes over into the paraelectric state at helium temperatures.

The following can be stated concerning the nature of the echo signals: 1) The phenomenon is due to polarization (phasing) of the electric dipoles of the material. 2) When the excitation frequency changes from 8.9 to 9.6 GHz, the intensity of the echo does not change, i.e., the excitation does not have a resonant character. 3) With increasing excitation intensity, the echo signal increases monotonically and reveals symptoms of saturation at a power $\sim$1 kW. The symptoms in items (2) and (3) are characteristics of the macroscopic echo [4 - 6]. The short relaxation time at helium temperatures and the signal intensity, which exceeds the signals of electronic spin echo on paramagnetic impurities, indicate that we are dealing with electric dipoles. Polarization echo was observed also at 4.2°K in the ferroelectric single crystals KD_2PO_4, CsD_2AsO_4, CsH_2AsO_4, RbH_2AsO_4, and RH_2PO_4. We see therefore that the polarization echo is a characteristic phenomenon for ferroelectrics. One can hope that it can become a new method for investigating these substances.

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TEMPERATURE DEPENDENCE OF THE INTENSITY OF NMR OF HEXAGONAL COBALT

A.N. Pogorelyi and V.V. Kotov
Institute of Metal Physics, Ukrainian Academy of Sciences

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The hyperfine interaction in ferromagnets leads to occurrence at the nuclei of an effective alternating field (H) connected with the applied field (h) by the relation [1]:

$$H = \eta h, \tag{1}$$

where η is the gain of the radio-frequency field at the nucleus, and is determined by the character of the magnetization of the ferromagnet. In the general case, one should speak of two gains, one pertaining to nuclei located in the domain boundaries and expressed in terms of the displacement susceptibility

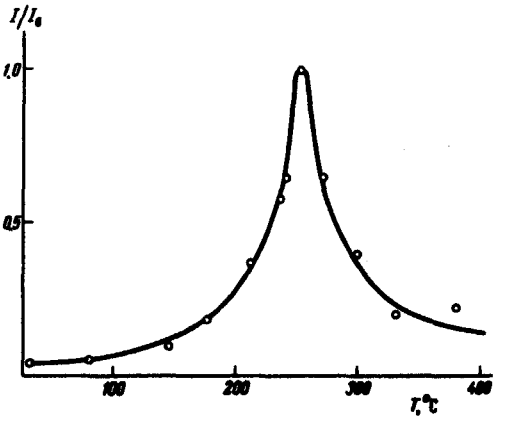
χ_{dis}

$$\eta_{dis} = - A_0 \chi_{dis}, \qquad (2)$$

where A_0 is a coefficient that depends on the hyperfine interaction constant, and the other pertaining to nuclei located in the domains and dependent on the rotation of the vectors of the magnetization inside the domains:

$$\eta_{rot} = - A_0 \chi_{rot}, \qquad (3)$$

where χ_{rot} is the rotation susceptibility. The participation of any particular group of nuclei in the resonance depends on the ratio of the gains for the nuclei inside the domain walls and the nuclei in the domains.



A good illustration of the foregoing is NMR in hexagonal cobalt. It is known [2] that the uniaxial magnetic crystalline anisotropy on the hexagonal cobalt decreases with increase in temperature, and reverses sign on going through zero in the temperature region 200 - 250°C. On the other hand, relation (3) can be written (in the absence of an external constant magnetic field):

$$\eta_{rot} = H_{loc}/H_A; \quad H_A = 2K_1/M, \qquad (4)$$

where H_{loc} is the longitudinal component of the local field at the nuclei, H_A is the effective anisotropy field, K_1 is the magnetocrystalline anisotropy constant, and M is the magnetization.

Consequently, whereas at room temperature we observe resonance from nuclei in the domain walls (since the anisotropy is large and $\eta_{dis} >> \eta_{rot}$), at a temperature close to 250°C all the nuclei should take part in the resonance, since η_{rot} reaches very large values at this temperature. The predicted effect can be revealed by the sharp decrease of the NMR resonance in the indicated temperature region, since the magnitude of the NMR signal (in the spin-echo method) is proportional to the gain and to the number of nuclei participating in the resonance. The increase of the NMR intensity at this point will be limited principally by a certain uncertainty in the temperature at which the anisotropy vanishes (owing to the possibly existing temperature gradient through the sample at the scatter of the values H_A in individual sections of the sample), and also the NMR saturation.

We have investigated the temperature dependence of NMR in hexagonal powdered polydomain cobalt by the spin-echo method. The figure shows a plot of the integral NMR intensity against the temperature. As seen from the figure, a sharp maximum is indeed observed on the temperature in the vicinity of 250°C. Thus, the experimentally observed "anomalous" increase of the NMR signal at 250°C is due to the increased value of the gain of the radiofrequency field (η_{rot}), and also to the increased number of working nuclei (practically all the nuclei take part in the resonance, and not only those in the domain walls, as is the case at room temperature). It should be noted that the point of vanishing of the anisotropy constant of hexagonal cobalt is indeed a "singular" point of sorts, since in addition to the described phenomenon, one observes in it also a minimum of the FMR line width on the temperature dependence [3], a maximum of the ultrasound damping [4], etc.

The observed effect may be useful in the investigation of the nature of local fields and the differences between them in the domain boundary and in the domain, and also in the development of a number of technical devices. The authors are grateful to A.G. Lesnik and V.F. Taborov for a useful discussion of the experimental data.

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ELECTROMAGNETIC GENERATION OF SOUND IN Bi

G.I. Babkin, V.T. Dolgopolov, and V.Ya. Kravchenko
Institute of Solid State Physics, USSR Academy of Sciences
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In experiments on electromagnetic excitation of sound in Bi single crystals placed in a constant magnetic field $H_0 < 100$ Oe, there was observed a significant temperature dependence of the amplitude of the acoustic resonances at helium temperatures [1, 2]. Since no excitation of sound was observed at all in ordinary metals under these conditions, it can be assumed that the effect is due to the specific features of the electronic spectrum of bismuth. The sound generation can be described by the action of the ponderomotive force $\vec{F}_n = c^{-1}\vec{j} \times \vec{H}_0$. However, the distinguishing features of the structure of the Fermi surface do not come into play in this case, since the effectiveness of this mechanism in the case of a skin layer that is thin compared with the length of the acoustic wave depends only on H_0 and on the total skin current, i.e., the amplitude H(0) of the electromagnetic wave incident on the sample. We analyze below another mechanism, which is sensitive to the electronic spectrum of the system.

The Fermi surface of semimetals consists of electronic and hole "valleys," the distance between which in p-space greatly exceeds their dimensions. The electromagnetic field disturbs the equilibrium in the system - both inside each valley and between the valleys. The latter means that the concentrations of electrons belonging to different valleys can vary (with the entire system remaining electrically neutral). This non-equilibrium behavior, peculiar to semimetals, is connected with the occurrence of carrier-density gradients and gives rise to a number of essential singularities in the electric conductivity and in the skin effect [3, 4]. Owing to the thermodynamic non-equilibrium of the system, there should arise also volume forces that deform the lattice. These in fact are the well-known deformation forces

$$\mathbf{F}_g = \sum_{\alpha=1}^{N} \vec{\nabla} \int d\tau_p \hat{\lambda}^\alpha f^\alpha$$

($\hat{\lambda}^\alpha$ is the deformation potential of the α-th valley, f^α is its distribution function, and $d\tau_p = (2/h^3)d^3p$); these forces were obtained by Kontorovich [5].

In ordinary metals with a singly-connected Fermi surface (H = 1), F_g is determined only by the p-dependent part $\lambda = \lambda_1(p)$, since $\vec{\nabla}^g \int d\tau_p f = \vec{\nabla} n = \vec{\nabla} n_1 = 0$ by virtue of the electroneutrality ($n = n_0 + n_1$, where n_1 is the deviation of the electron density from the equilibrium value n_0). The distinguishing feature of semimetals is expressed in the fact that, owing to the occurrence of