tion layers between domains in ferromagnets can affect in most significantly many of the physical properties of magnetic crystals, and can lead to a number of new effects. In this connection, the author considers the energy spectrum of a ferromagnet with one domain boundary and with a periodic domain structure. A theory of nuclear magnetic resonance of nuclei in domain boundaries is developed, with allowance for the influence of the "two-dimensional" magnetic-moment oscillations that are typical of them.

The discussion concerns the electric resistivity of ferromagnetic metals at low temperatures, and the giant change in the resistance under the influence of weak external magnetic fields and of the magnetic field produced by the measuring current itself. The idea is advanced that the creation of superpure ferromagnetic metals can uncover new prospects for their applications in technology, in connection with the possibility of controlling strong internal magnetic fields in such metals with the aid of weak currents and fields.

[1] E. A. Turov and M. P. Petrov, Yadernyĭ magnitnyĭ rezonans v ferro- i antiferromagnetikakh (Nuclear Magnetic Resonance in Ferro- and Antiferromagnetics), Nauka, 1969.

[2] E. A. Turov and M. I. Kurkin, Fiz. Tverd. Tela 10, 322 (1968) [Sov. Fiz.-Solid State 10, 2551 (169)].

[3] E. A. Turov, A. P. Tankeev, and M. I. Kurkin, FMM 28, 385 (1969) and 29, 747 (1970).

[4] E. A. Turov, Izv. AN SSSR, ser. fiz. 19, 474 (1965); FMM 6, 203 (1958).

[5] E. A. Turov and A. N. Voloshinskiĭ, Proc. Tenth International Conference on Low-temperature Physics (in Russian), IV, p. 105, VINITI, 1968.

[6] A. N. Voloshinskiĭ, E. A. Turov, and L. F. Savitskaya, Fiz. Tverd. Tela (1970).

S. A. Al'tshuler, Electron-nucleon Magnetic Resonance (ENMR)

Ions of elements of the intermediate groups, having an even number of electrons, in solids under the influence of the crystalline field, the ground energy level frequently splits in such a way that the lower sublevel is a singlet. If such ions have a nuclear spin $I \neq 0$, then it is possible to observe magnetic resonance, with the resonant frequencies, intensities, absorption line widths and paramagnetic-relaxation times that are intermediate between those in electron paramagnetic resonance and in nuclear magnetic resonance. This is due to the fact that the electronic magnetic moment, which is zero in the first approximation of perturbation theory, produces in the second approximation an increment to the nuclear magnetic moment μ_N, of the order of $\mu_e = a\beta/\Delta$, where a is the hyperfine-interaction constant, Δ the interval between the lower electronic sublevels, and β the Bohr magneton. An estimate shows that in many cases

An experimental study was made of the ENMR spectra in ionic crystals, viz., on V^{51} in corundum, Pr^{41} in sulfate, Tm^{169} in ethyl sulfate and gallium and aluminum garnets and on Pr^{141} and Tm^{169} in the intermetallic compounds PrP, PrAs, PrBi, TmP, TmAs, and TmSb, and in Pr metal. The measured values of the gyromagnetic factors γ and of the quadrupole-coupling constants turn out to be much larger than the corresponding values for the nuclear spins. In low-symmetry crystals, on going over from one crystal axis to another, the components of the tensor γ change very strongly; in thulium ethyl sulfate, for example, $(\gamma_\perp/\gamma_\parallel) \simeq 75$.

It is shown theoretically and experimentally that in ionic crystals, if the number of paramagnetic impurities is sufficiently small, the most effective mechanism of spin-lattice relaxation is as follows: the lattice vibrations, modulating the electric field of the crystal, act on the orbital motion of the electrons, and thus change the orientation of the nuclear spins. Measurements of the temperature dependence of the spin-lattice relaxation time have shown that, unlike the ordinary nuclear resonance, an important role is played not only by the processes of Raman scattering of the phonons, but also by transitions via the intermediate Stark level. In metals and in intermetallic compounds, if account is taken of the exchange interactions between the conduction electrons and the atoms of the intermediate groups, calculation in accordance with the experimental data leads to very short relaxation times.

Substances containing rare-earth ions with lower singlet electron levels, as shown by an evaluation of the results, can be used to obtain very low temperatures, $\sim 10^{-4}$°K, by adiabatic demagnetization. The first experiment with PrBi has made it possible to decrease the temperature from 26 to 10 millidegrees.

[1] M. M. Zaripov, Izv. AN SSSR ser. fiz. 22, 1220 (1956).

[2] R. M. Mineeva, Fiz. Tverd. Tela 5, 1403 (1963) [Sov. Phys.-Solid State 5, 1020 (1963)].

[3] S. A. Al'tshuler and V. N. Yastrebov, Zh. Eksp. Teor. Fiz. 47, 382 (1964) [Sov. Phys.-JETP 20, 254 (1965)].

[4] S. A. Al'tshuler and M. A. Teplov, ZhETF Pis. Red. 5, 209 (1967) [JETP Lett. 5, 167 (1967)].

[5] M. A. Teplov, Zh. Eksp. Teor. Fiz. 53, 1510 (1967); 55, 2145 (1968) [Sov. Phys.-JETP 26, 872 (1968); 28, 1136 (1969)]; FTT 10, 2548 (1968) [Sov. Phys.-Solid State 10, 2009 (1969)].

[6] E. D. Jones, Phys. Rev. Lett. 19, 432 (1967); Phys. Chem. Solids 29, 1305 (1968); Phys. Rev. 180, 450 (1969).

[7] S. A. Al'tshuler, ZhETF Pis. Red. 3, 177 (1966) [JETP Lett. 3, 112 (1966)].

[8] K. Andres and E. Bucher, Phys. Rev. Lett. 21, 1221 (1968).

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