structure of Ga is complicated and its dispersion differs from quadratic.

Notice should be taken, in conclusion, of the slight variation of $\Delta S/S$ in a rather wide range of angles ϕ, whereas according to [1] a sharp decrease of $\Delta S/S$ should occur already when ϕ is several times larger than S/v_F, i.e., at angles close to 1°. The experimentally obtained dependence of $\Delta S/S$ on ϕ at $qr_H \ll 1$ is shown in Fig. 3. We see that when $\omega\tau = 10.4$ the value of $\Delta S/S$ not only fails to decrease, but even increases in the region of angles ϕ up to 4°, and experiences a number of extrema. Additional experiments are being planned for the purpose of explaining the observed relations.

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INVESTIGATION OF THE DOMAIN STRUCTURE OF SILICON IRON WITH THE AID OF POLARIZED NEUTRONS

G. M. Drabkin, V. A. Trunov, and A. F. Shchebetov
A. F. Ioffe Physico-technical Institute, USSR Academy of Sciences
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Various authors have considered, with varying degrees of approximation, the connection between neutron depolarization in a transmitted beam, the domain dimensions, and the saturation induction [1 - 3]. These investigations have made it possible to estimate the average domain parameters, but no account was taken of the influence of the domain structure as a whole on the character of the passage of the polarized neutrons. With an aim at a more thorough study of the domain structure, we set up experiments on the influence of the magnetic field and temperature on the neutron depolarization. The investigation objects were iron single crystals measuring 1.1 x 1.8 x 0.047 cm. Three types of plates were investigated, with the [100] direction along the largest side and at angles 45° and 90° to it. The plane of the plate coincides with the (110) plane within 1 - 2 degrees. The sample was made up of 11 plates. The sample was annealed in vacuum at 1100°C for 24 hours. The measurements were made with the polarized-neutron spectrometer described earlier in [4]. The beam parameters were $\lambda = 1.13$ Å and $P_1P_2 = 0.952$, where λ is the neutron wavelength and P_1 and P_2 the polarization efficiencies of the analyzer and polarizer crystals, respectively. We determined the dependence of the polarization ratio R on the applied magnetic field and temperature. R was defined as the ratio of the neutron-beam intensity without turning on the non-adiabatic neutron spin flip to the intensity with the spin-flip turned on. The plates were oriented with the largest side parallel to the field. The measurement results are shown in Figs. 1 and 2. It must be noted that the character of the depolarization depends on the angle between the [100] direction and the magnetic-field direction, and on the temperature, and also that it has a resonant dependence on the magnitude of the magnetic field. No such resonances were observed in samples made of polycrystalline iron plates. To determine the nature of the observed resonances, we

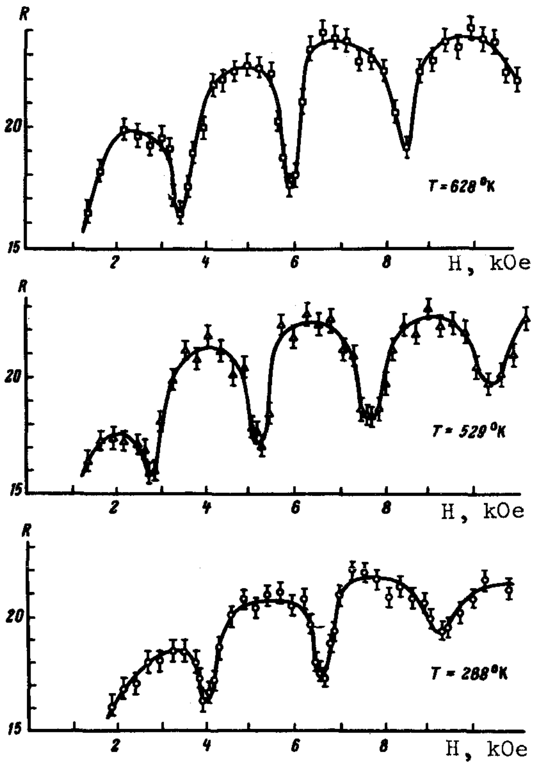

Fig. 1. R as a function of the external field in which the sample is placed. The [100] direction makes an angle of 45° with the largest side of the plate. The beam is perpendicular to the plane of the plate.

experimented with the influence of the neutron velocity on the location of the resonances. (Similar measurements were made on the neutron resonant spin flip in a spatially-periodic constant field [4].)

The results of these measurements are shown in Fig. 3. Different sections of the energy spectrum of the incident neturons were selected by rotating the analyzer crystal. It follows from Fig. 3 that for the longer-wavelength neutrons the resonance sets in at lower values of the applied field.

To determine the influence of the domain geometry, we rotated the sample in our measurements through ±25° relative to the field. In such rotations, the resonance also sets in at lower values of the magnetic field.

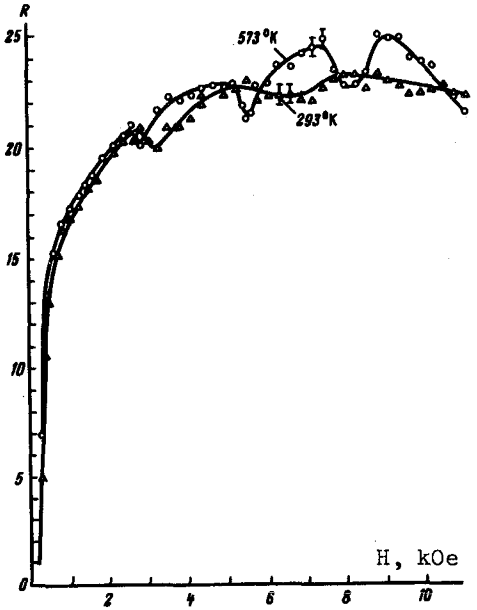

Fig. 2. R as a function of the external magnetic field. The [100] direction is parallel to the largest side of the single-crystal plate.

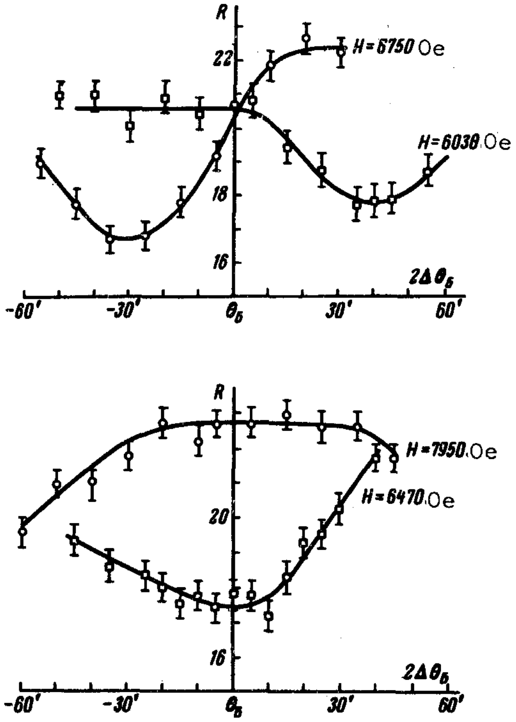

Fig. 3. Resonance on the θ-2θ curve vs. the external magnetic field. Abscissas - angular deviation of detector from Bragg position, with the analyzer crystal rotated through half this angle. The second resonance of the curve of Fig. 1 was investigated at room temperature.

These experiments point to the presence of a spatially-periodic field due to the domains (for details see [5]). The component elements of this structure are domains with magnetization direction along the field, residual domains of much smaller size with magnetization direction opposite to the field, and Bloch walls with magnetization direction perpendicular to the field. This situation is analogous to the case of spatial periodicity of the fields of a magnetic neutron resonator [4]. From the difference between the values of the induction of a sample, corresponding to neighboring resonances, we can determine the period of the residual domain structure $2d = (3.9 \pm 0.9) \times 10^{-2}$ cm. An estimate of the domain dimension for a sample in an unmagnetized state yields $d = 1.5 \times 10^{-2}$ cm [6]. The depth of the resonances depends strongly on the thickness of the Bloch walls. In turn, the thickness of the Bloch walls is determined by the magnetic anisotropy, and consequently also by the temperature. This can explain the influence of the temperature on the depth of the depolarization resonances.

Our experiments thus indicate that the domains have a periodic structure in the case of almost total magnetization of the sample. The experiments show that the presence of periodically disposed Bloch boundaries can lead to resonant depolarization of the neutron beam and yield information needed to determine the period of such a structure.

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ANGULAR DISTRIBUTION OF ELECTRONS RELEASED IN ATOMIC COLLISIONS

G. N. Ogurtsov, I. P. Flaks, and S. V. Avakyan
A. F. Ioffe Physico-technical Institute, USSR Academy of Sciences
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The instrument ensuring the best conditions for obtaining large transmission and high resolution in investigations of the energy distribution of electrons released as a result of ionization collisions is the cylindrical electrostatic analyzer. Such an analyzer was used recently by Melhorn [1 - 3] and by us [4, 5]. A detailed description of the instrument and of the experimental procedure is contained in [6]. As noted there, a major shortcoming of the cylindrical analyzer is the impossibility of analyzing the electrons at scattering angles differing from a fixed angle θ, which is determined by the focusing conditions and equals 54.5°.

To broaden the range of angles θ, we have proposed a method for prior deflection of the electrons with an electric field before they enter the analyzer [6]. We used this method in the present study to investigate the angular distribution of electrons released in collisions