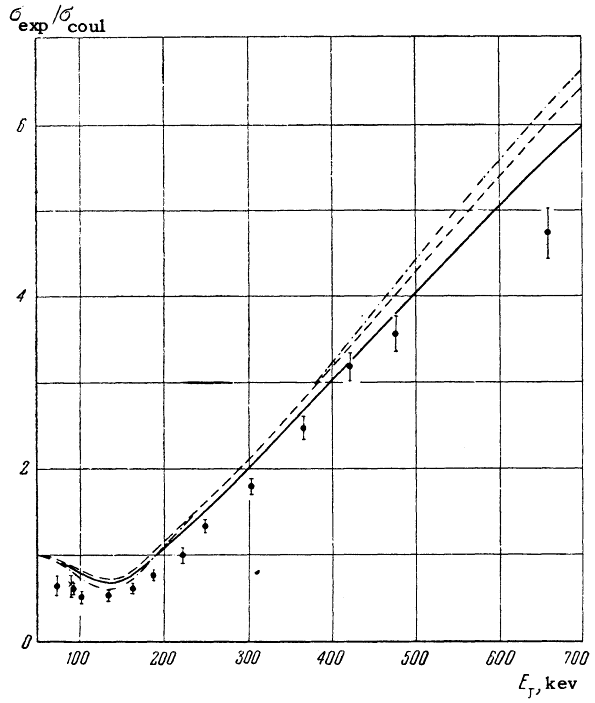

FIG. 2. a – radius of channel, γ_1 – reduced partial width of scattering, γ_2 – reduced partial width of reaction, E_0 – formal resonance energy. Continuous curve: $a = 0.5 \times 10^{-12}$ cm, $\gamma_2 = 2.16 \times 10^{-11}$ kev cm; $E_0 = -444$ kev; dashed curve: $a = 0.7 \times 10^{-12}$ cm, $\gamma_1 = 0.51 \times 10^{-9}$; $\gamma_2 = 1.27 \times 10^{-11}$ kev cm, $E_0 = -130$ kev; dash-dotted curve: $a = 0.7 \times 10^{-12}$ cm, $\gamma_1 = 0.34 \times 10^{-9}$ $\gamma_2 = 1.18 \times 10^{-11}$ kev cm; $E_0 = -55$ kev.

spond to a scattering from an ideally reflecting sphere, surrounded by a Coulomb field, with a spherical radius of 4×10^{-13} cm. The curve is drawn in Fig. 1 for the effective cross section, computed under this assumption. The potential scattering in the quintuplet state is natural, inasmuch as the spins of all the nucleons are parallel in this state.

The character of the dependence of the D – T scattering on the energy in the region of small energies (see Fig. 2) points to the presence of resonance scattering. Computed curves are drawn in the Figure for several values of the resonance parameters, determined from analysis of the reaction. In the computation, potential scattering was also taken into consideration. The experimental values for the cross section of scattering is close to the computed curve; however, it is lower by about 20%.

For energies below 100 kev, the gap between the experimental points and the computed curve is possibly connected with a systematic error in the determination of the energy of the scattered particles. In subsequent research, it is proposed to improve the accuracy of measurements in this region* and to carry out a more detailed analysis of the results with the aim of clarifying the possibility of choice of parameters which would have described equally well both the reaction and the scattering.

*Note added in proof (March 22, 1958). As a result of improving the accuracy of energy measurement of the particles under consideration, we obtained values of 0.98 ± 0.13; 0.79 ± 0.08; 0.63 ± 0.04 corresponding to energies 76, 96 and 140 kev. For high energies, the curve, which we can obtain by means of the experimental points, is not changed.

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OSCILLATION OF THE ELECTRICAL RESISTANCE OF n-TYPE GERMANIUM IN STRONG PULSED MAGNETIC FIELDS

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WE have investigated the change in the electrical resistance of three monocrystalline specimens of n-type germanium in a transverse pulsed magnetic field with magnetization up to 120 kG at temperatures of 300, 77 and 20°K.

The magnetic field was produced by the discharge of a condenser stack through a solenoid, in the opening of which a Dewar was inserted bearing the specimen.

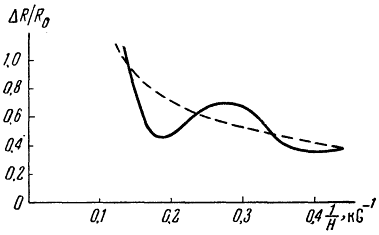
The germanium samples were of different purity and at room temperature (300°K) possessed the following specific resistances: $\rho = 54\,\Omega$ cm (sample No. 1), $\rho = 20\,\Omega$ cm (sample No. 2), and $\rho = 7\,\Omega$ cm (sample No. 3).

In the range of the magnetic field of 25 — 120 kG and at $T = 300$°K, the dependence of $\Delta R/R_0$ on the field was linear for all three specimens, with a slope of $34 \times 10^{-2}\mathrm{kG}^{-1}$ (No. 1), $1.65 \times 10^{-2}\mathrm{kG}^{-1}$ (sample No. 2) and $1.07 \times 10^{-2}\mathrm{kG}^{-1}$ (sample No. 3). At 77°K, in this same range of fields, the linear dependence of $\Delta R/R_0$ was maintained only for samples 2 and 3; however, the angle of slope of the lines increased in this case. So far as sample No. 1 is concerned, at 77°K, the dependence of $\Delta R/R_0$ on the field, beginning at 25 kG, bore a curvilinear character with a tendency toward saturation; this is seen from the fact that at fields with intensities of 25, 50, 75 and 100 kG, $\Delta R/R_0$ is equal to 2.4; 3.3; 4.6; 5.9, respectively.

The change of the resistance in a magnetic fields $\Delta R/R_0$ of sample No. 1 ($\rho = 54\,\Omega$ cm) was also studied at 20°K in fields up to 110 kG. These measurements gave very interesting results.

When sample No. 1 was at the temperature of liquid hydrogen and the magnetic field was turned on ($H = 110$ kG), then the resistance of the sample decreased, instead of increasing as it does ordinarily. The magnitude of the decrease in the specific resistance ρ (20°K, $H = 0$) $- \rho$ (20°K, $H = 110$) $= 670 - 390 = 280\,\Omega$ cm. However, the resistance of the sample was reduced in proportion to the decrease in the amplitude of the magnetid field from 110 kG to zero, up to its initial value of ρ (20°K, $H = 0$).

Moreover, for this sample of n-type germanium ($\rho = 54\,\Omega$ cm), we observed the phenomenon of the oscillation of the electric resistance in the field range from 25 to 110 kG. The period of these oscillations amounted to $0.18\ \mathrm{kG}^{-1}$, while its maximum amplitude was found at a field of $H = 55$ kG. In the Figure, the dependence of $\Delta R/R_0$ on the reciprocal of the magnetic field intensity is shown for 20°K.



L. Shubnikov and de Haas[1] first discovered the oscillation of the electrical resistance in a transverse static magnetic field, while studying bismuth at low temperatures,[1] and then Frederikse and Hosler,[2] Kanai and Sasaki,[3] and also Busch, Kern and Lüthi,[4] observed this same effect on a specimen of InSb. The latter authors carried out their measurements (as did we) with pulsed magnetic fields.

The theory of the oscillations of galvanometric effects is set forth in the researches of G. E. Zil'berman.[5]

So far as we know, the Shubnikov-de Haas effect has never been observed for germanium up to the present time.

Information on the experimental details and the arrangements for strong magnetic fields will be published in a subsequent paper.

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ON A FUNCTIONAL RELATION IN QUANTUM MECHANICS

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WE consider a system of non-interacting particles in a stationary state in some external field with potential $V(\mathbf{r})$.* The density of the number of particles in such a distribution will, generally speaking, be a very complicated function of V and all its derivatives

$$\rho(\mathbf{r}) = \rho(V, \nabla_i V, \nabla_i \nabla_k V \ldots), \qquad (1)$$