$$\frac{\delta\sigma_b}{\sigma_a} = 1.7 \times 10^{-4} \frac{\epsilon^2}{\ln 4\epsilon} \left(\frac{\delta\omega}{\omega}\right)^2 \quad (6)$$

(the energy is in MeV).

If the photon detectors have a reasonable energy resolution, these cross sections become equal at energies on the order of 1 BeV.

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EFFECT OF MICROWAVE RADIATION ON THE ELECTRIC CONDUCTIVITY OF p-TYPE INDIUM ANTIMONIDE

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The effect of microwave radiation on the electric conductivity of indium antimonide was investigated by many authors, both in the USSR and abroad [1-4]. The authors of [1,2] investigated the variation of the electric conductivity of n-type indium antimonide in a constant magnetic field or in the absence of a field, at helium temperatures, under the influence of radiation in the millimeter radio band.

We observed a decrease in the dc electric conductivity under the influence of microwave radiation with density $P \sim 10^{-6} - 10^{-7}$ W/mm^2 in samples of single-crystal p-type indium antimonide with Hall carrier density from 7×10^{12} to 4×10^{14} cm^{-3}, Hall mobility $\mu = 2 \times 10^3 - 1 \times 10^4$ cm^2 V^{-1} sec^{-1}, and electric resistivity $\rho = 4 - 100$ ohm-cm in the microwave range $\lambda = 2 - 30$ mm at temperatures 77 - 150°K. The relative change in the electric conductivity was $\sim 10^{-5} - 10^{-6}$. We used samples of different dimensions: length 1 - 8 mm, width 1 - 4 mm, thickness 0.5 - 0.01 mm.

We measured the alternating voltage produced across the sample under the influence of microwave radiation modulated at audio frequency. The sample was mounted on a foamed-plastic plate in the center of the waveguide. The current was fed to the sample through leads insulated from the waveguide walls.

The sample was connected to a battery through the primary winding of the input transformer of the U2-1A measuring amplifier.

We used also an ordinary circuit for connecting photoresistances for maximum sensitivity. The signal from the amplifier was recorded with a two-beam electronic oscilloscope, the second channel of which was fed, through an analogous U2-1A amplifier, from the wavemeter detector (Fig. 1).

The microwave power flowed from a klystron generator (1) to the waveguide channel through a precision polarization attenuator (2) with controlled attenuation. Part of the power was diverted by a coupler (3) to the input of the wavemeter (4).

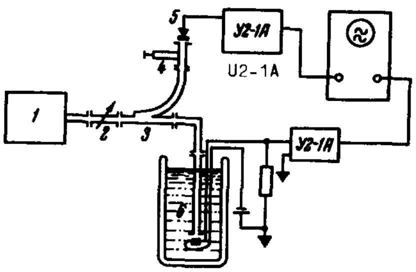

Fig. 1. Block diagram of the measuring setup.

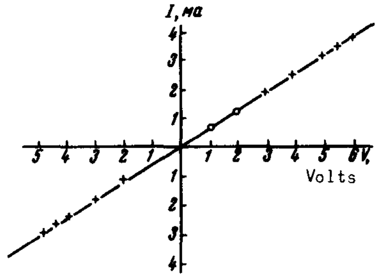

Fig. 2. Voltage-current characteristic.

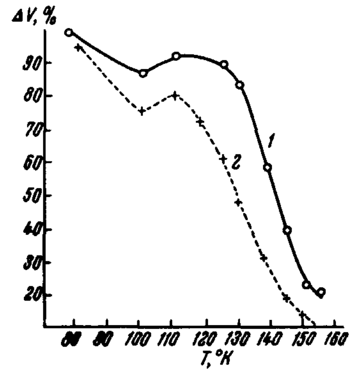

Fig. 3. Temperature dependence of the response.

Measurement results. Figure 2 shows the static voltage-current characteristic of the sample, plotted at 77°K in the operating-current region. It is a straight line with a slope independent of the current direction.

The temperature dependence obtained at a power of 10^{-6} W is shown in Fig. 3. Curve 1 pertains to a sample with the following parameters (at 77°K): resistivity 100 ohm-cm, Hall density 7×10^{12} cm^{-3}, and mobility 2000 cm^2/V-sec. Curve 2 was obtained with a sample with resistivity 4 ohm-cm, density 1×10^{14} cm^{-3}, and mobility 8×10^3 cm^2/V-sec.

The upper temperature limit (130 - 140°K) at which the signal becomes indistinguishable against the noise background coincides with the region where the semiconductor goes over from a state with hole conductivity to the state with electronic conductivity.

The inertia of the effect was investigated by varying the microwave modulation frequency over a wide range, maintaining the power level and the depth of modulation constant. A decrease in the signal was observed at 77°K at frequencies 0.5 - 0.7 Mc. Illumination of the sample with white light exerted no noticeable influence on the magnitude of the signal.

Our experiments allow us to assume that the observed effect is neither bolometric or photovoltaic, and that we are dealing with the direct influence of a microwave field on the sample conductivity. (We note that the resistivity of our samples is large enough to ensure penetration of the field into the volume of the sample). The small value of the microwave quantum does not make it possible to assume photoionization of any of the levels in the forbidden band. Furthermore, the sign of the effect should in this case be the opposite of that observed. Therefore, from our point of view, we are dealing here with the heating of the holes by the field and with the associated change in the relaxation time and in the mobility. To explain the decrease in the conductivity under the influence of the microwaves we must assume that the scattering of the holes by the acoustical phonons is one of the essential mechanisms of scattering in the temperature region investigated by us. We can visualize the following temperature dependence of the effect. At room temperature, as is well known, polar scattering predominates [5], wherein the relaxation is independent of the energy and consequently there is no influence of heating; with decreasing temperature, the contribution of the polar scattering decreases exponentially, whereas the contribution of the acoustic scattering decreases more slowly, in power-law fashion. At some temperature the effect reaches a maximum, followed by a decrease connected with the reduced role of the acoustic scattering and the dominating scattering by the impurities or by the carriers, wherein there is either no energy dependence of the relaxation time (neutral impurities) or a dependence that increases like $\tau \sim E^{3/2}$.

Thus, the effect observed by us can be interpreted as the consequence of the existence of hole scattering by acoustic phonons over a rather broad range of temperatures.

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EXCHANGE EFFECT IN ELASTIC SCATTERING OF POLARIZED IDENTICAL NUCLEI

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Polarization investigations are among the most important tasks of nuclear physics and are carried out on an ever increasing scale. Along with the scattering of polarized nucleons by polarized targets, increasing significance is being attached to experiments on the polarization of the products of direct nuclear reactions, for the purpose of explaining their concrete mechanism of determining the spectroscopic characteristics of the nuclei. Most experimental and theoretical studies of polarization phenomena have hitherto pertained, however, to fast particles, for which the nuclear interaction is decisive. At the same time, definite interest attaches to the problem discussed in the present note, that of elastic scattering of Coulomb-interacting polarized identical particles.

The elastic Coulomb scattering amplitude of two identical particles with spin I is obviously equal to

$$A^{M_1M_2}_{M_1'M_2'}(\theta) = \delta_{M_1M_1'}\delta_{M_2M_2'}f(\theta) + (-1)^{2I}\delta_{M_2M_1'}\delta_{M_1M_2'}f(\pi - \theta) \qquad (1)$$

where M_1 and M_2 are the projections of the spins of the beam and target nuclei in the initial state, M_1' and M_2' are the projections of the spins in the final state, $\delta_{M_1M_2}$ is the Kronecker symbol, and