the strong line broadening produced by impurities.

The shape of the absorption line, which has been studied very thoroughly by other authors,[5] is not understood. It was shown for the alkali metals that the positive part of the derivative dR/dH is considerably larger than the negative.

Examination of the shape of the absorption curve shows that for aluminum and copper the negative part of the derivative is considerably greater than the positive. This can be explained formally by particles with opposite sign of spin taking part in the paramagnetic resonance. It seems likely that Dyson's theory[6] is not fully applicable to our case, since $\mu H \lesssim kT$ and τ_{sp} is of the same order of magnitude as the collision time.

Since the electron mean free path is greater than the radius of the electron orbit in the magnetic field, a dependence of the signal strength on the inclination of the magnetic field relative to the specimen surface is observed in the experiments. The change in signal amplitude is in qualitative agreement with the theory of Azbel', Gerasimenko, and Lifshitz.[7]

*We are grateful to B. I. Aleksandrov for providing the initial specimen, prepared in his laboratory.

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SMALL-ANGLE SCATTERING OF 0.8- AND 2.8-Mev NEUTRONS

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WHEN studying the scattering of neutrons with an average energy of about 2 Mev in the region of angles smaller than 8 — 10°, we discovered, besides Schwinger scattering,[1] an additional contribution to the scattering cross section of U and Pu nuclei.[2,3] In this work we have tried to establish the energy dependence of the indicated effect in the angle interval of 3 to 25°. The work was carried out with a fast-neutron reactor. Measurements were made in two energy intervals with average energies of 0.8 and 2.8 Mev. The neutrons, with an average energy of 0.8 Mev, were separated out of a broad spectrum of reactor neutrons by radiotechnical collimation of the recoil protons.[4] The measurements at an average energy of 2.8 Mev were made with a threshold detector (as was done in references 2 and 3). The performance of the collimation system used for the measurements is presented in Fig. 1.

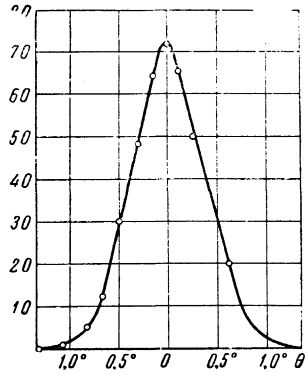

FIG. 1

Measurements were made in the 3 — 8° interval both to the left and to the right of the neutron beam; agreement of the two measurement results was observed. Figures 2 and 3 present the results of the measurements. The quantity $\gamma^2 \cot^2(\theta/2)$, which is the cross section for Schwinger scattering, was computed from the experimental points; $\gamma = \frac{1}{2}\mu_n(\hbar/mc)(ze^2/\hbar c)$, $\mu_n = 1.91$. As is evident from the graphs, the results of the measurements for neutrons of about 0.8 Mev agree with the theory of Schwinger scattering within the limits of error. At an energy of ~ 2.8 Mev, as was also reported in

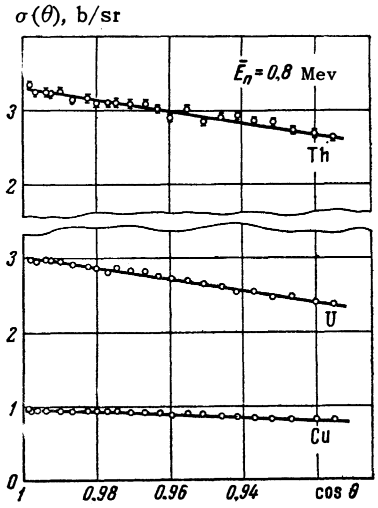

FIG. 2

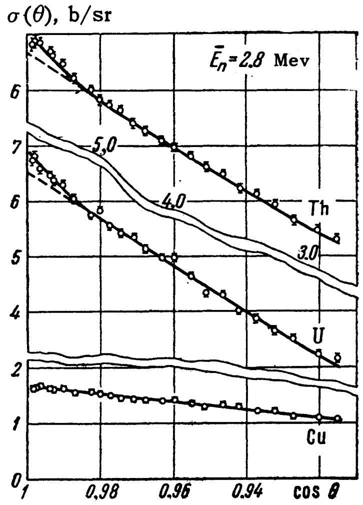

FIG. 3

references 2 and 3, a sharp increase in the scattering cross section of U and Th nuclei is observed in the region of angles smaller than 10°, in spite of allowances made for Schwinger scattering.

It must be observed that the detected phenomenon has not yet been satisfactorily explained.[5]

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PRODUCTION OF NEGATIVE-TEMPERATURE STATES IN P-N JUNCTIONS OF DEGENERATE SEMICONDUCTORS

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If a p-n junction in a semiconductor is biased in the forward direction, then there will be a decrease in the potential barrier due to space charge in the p-n junction, and the concentration of minority carriers near the junction will increase. The concentration of these carriers reaches a maximum once the potential barrier is completely removed by the applied field. This maximum value is about equal to the concentration of the carriers in a region of the crystal where they are the majority carriers (we assume the p-n junction to be abrupt). A negative temperature can arise in a junction only when the Fermi quasi-levels corresponding to the non-equilibrium concentrations of electrons and holes satisfy the relation[1]

$$\mu_e + \mu_p > \Delta, \qquad (1)$$

where μ_e and μ_p are the Fermi quasi-levels for electrons and holes, and Δ is the width of the forbidden band. If the p-n junction is now biased in the forward direction, the Fermi quasi-level of the minority carriers near the junction will be close to the Fermi level in that part of the crystal where these carriers are the majority ones. From equation (1) it then follows that in this case in at least some part of the p-n junction the carriers must be degenerate.