Almost identical curves of absorption *vs* temperature are obtained for CdS and for KCl as shown in Fig. 1. The absorption is not spectrally sensitive and occurs also for other transparent solids such as glass plates. The intensity and form of the curves shown in Fig. 1 are dependent on the rate of heating, the vacuum in the crystal cryostat, and on previous treatment. Detailed investigation shows that the peaks in Fig. 1 are due to interference effects from condensed surface films on the crystals, the latter acting as efficient vapor traps as they lag behind their surroundings during warming. Using dry air in the cryostat at atmospheric pressure reduces the effect, presumably by reduction of the mean free path of vapor molecules. Deliberate introduction of known vapors produces peaks at temperatures specific to each vapor and related to its boiling point.

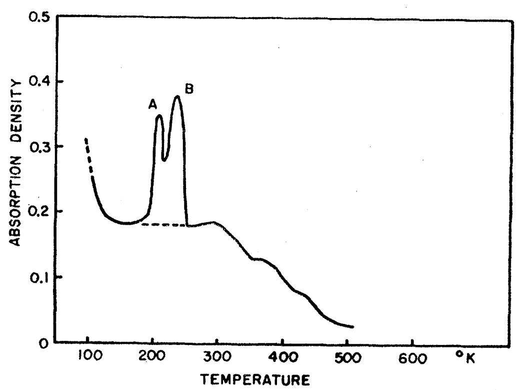

FIG. 2. Thermal bleaching curve for the F band of KCl colored by x-rays at 100°K.

Figure 2 shows the thermal bleaching curve for KCl colored by x-ray irradiation at low temperatures. Apart from the "interference" peaks, A and B, the form of the curve is as expected from previous knowledge of the thermal stability of F centers in KCl, true bleaching occurring above room temperature in the region of 400°K.

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Polarization in *n-p* Scattering at 100–200 Mev*

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THIS note reports some recent results obtained from the study of azimuthal asymmetries in the charge-exchange scattering of partially polarized neutrons by hydrogen and carbon. The experimental method and some preliminary data have already been briefly reported.[1,2] Additional runs have been made, including measurements at first-scattering angles $\theta_1 = 15°$ and 30°, and at a variety of neutron threshold energies.

Considerable work was done to obtain an accurate knowledge of the center line of the neutron beam, since the asymmetries that we observed were generally small while their sensitivity to angular error of the center line was of the order of 25 percent per degree for CH_2 second scatterers. In our procedure, an optical line-of-sight passed through the centers of targets located at three points in the cyclotron, defining first-scattering angles of $+\theta_1$, 0, and $-\theta_1$, respectively. The axis of two collimators in the second-scattering proton telescope was set to this optical line. The telescope could then be rotated to the left and right of the center line, and angles set within one minute of arc. The angular acceptance of the proton telescope was 2° at half-maximum. Inequality of left-right angular settings with respect to the actual neutron beam could be deduced from the second-scattering left-right asymmetry for neutrons produced at zero first angle; it could also be deduced from the *mean* left-right asymmetry produced by equal and opposite first angles.

In this way we have found apparent angular errors as large as nine minutes, without being able to locate their source. In such cases, however, the two methods of deducing the angular error were in good agreement and provided a consistent correction to the data.

The energy spectra of the neutron beams were found to be similar to those previously measured.[3] Lower limits to the acceptable neutron energy were set by means of copper absorbers in the proton telescope, and these limits were kept constant as the angles were changed, assuming free *n-p* collision kinematics.

Figures 1 and 2 present asymmetries observed in this way for a primary proton energy of 230 Mev, first angles of 15° and 30°, first targets of Be and C, a neutron threshold of 100 Mev, second scatterers of C and H, and second angles up to 55°. Asymmetries are given as $2e$, defined in the usual way,[1] and all angles are in the laboratory system. The asymmetries found at $\theta_1 = 30°$ are consistently larger than those found at $\theta_1 = 15°$. Results were also obtained at neutron thresholds of 125, 150, and 175 Mev, but no significant energy dependence was found.

From the results shown, an estimate can be made of the polarization, P, for the exchange scattering of neutrons by C and H, and of protons by Be and C. Assuming charge symmetry and ignoring the energy change between the two events, we obtain $P(p\text{-C-}n, 30°) = P(n\text{-C-}p, 30°) = +0.19 \pm 0.02$. Then $P(p\text{-Be-}n, 30°) = +0.13 \pm 0.03$; $P(n\text{-}H\text{-}p, 30°) = +0.15 \pm 0.05$; and

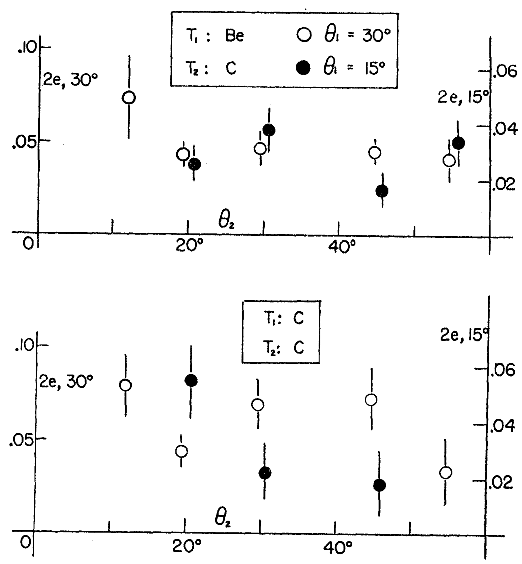

FIG. 1. Upper part: asymmetries observed with first target beryllium, second target carbon. Lower part: both targets carbon.

$P(n\text{-H-}p,\ 55°) = -0.55 \pm 0.15$. Errors given are purely statistical standard deviations.

As previously reported, it appears that polarization in n-p exchange scattering is small up to 45°, and that its angular dependence is strikingly different from that observed in exchange scattering from carbon. The n-p data are inconsistent with a Serber potential,[4] which predicts a polarization $P(\theta)$ that is antisymmetric about 45°.

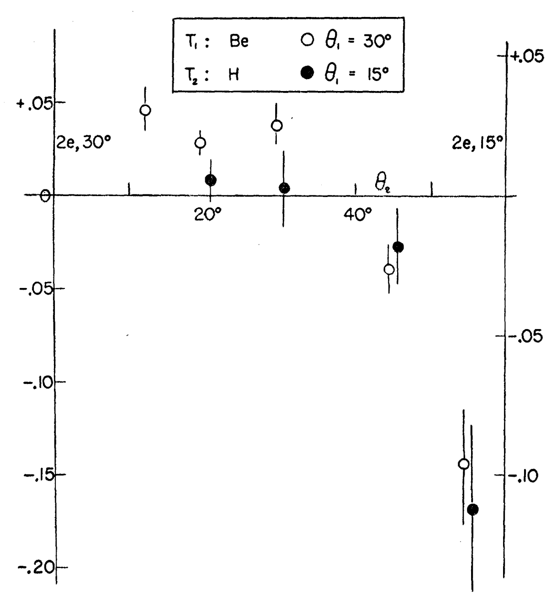

FIG. 2. Asymmetries observed with first target beryllium, second target hydrogen (from CH_2–C subtraction).

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Meson-Proton Scattering Phase Shift Analysis

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WE have re-analyzed the experimental information available to date concerning direct π^+ and π^- scattering and π^- charge exchange scattering from hydrogen between zero and 217 Mev. The experimental data and the analysis of these data, as well as references to the original literature, between 120 and 217 Mev, may be found in our paper on the subject.[1] For low energies, the same information may be found in our forthcoming book.[2] References to the experimental work are also given in the paper by Orear.[3]

In references 1 and 2 it is shown that at low energy, arguments of continuity can be given to select the Fermi type phase shifts, as opposed to those usually denoted as Steinberger-type phase shifts.[4] Furthermore, analysis in the high-energy region[1] leads one to prefer the Fermi type solution over the Yang type. Hence, all phase shifts presented below are of the Fermi type.

Figure 1 shows the variation of the principal phase shift δ_{33} (i.e., $T=3/2$, $j=3/2$). The dotted curve indicates an η^3 dependence, where η is the meson momentum in the center-of-mass system in units of μc. Up to 80 Mev, $\delta_{33}=13.4\eta^3$ degrees, but after that it rises faster towards the resonance at about 195 Mev.

Figure 2 shows the two S-state phase shifts for $T=3/2$ and $T=1/2$, that is, δ_3 and δ_1. The numerals next to the points indicate the energy in Mev. Note that δ_3 follows a rather good straight line of the form $\delta_3=9.6-17.1\eta$ degrees from high energies down to around 60 Mev, but does *not* head for zero. On the contrary, the points at 40 and 26 Mev seem to indicate a break in slope. Previous analysis by the Rochester group[5] had placed δ_3 at 40 Mev much closer to the axis, with a simultaneous upward shift in δ_1 at 40 Mev. We do not believe that the present data bear out this conclusion. However, we must admit that our values lead to a