$-t = 0.5$ the polarization at all energies and t values measured is consistent with 0.7. Both polarization and angular distribution therefore point to some general nonresonant mechanism with sizable flip and nonflip terms as the dominant mechanism in this large-t region.

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POLARIZATION IN K^+-p ELASTIC SCATTERING AT 3.75 AND 4.40 GeV/c *

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The polarization parameter in K^+-p elastic scattering has been measured at 3.75 and 4.40 GeV/c in the range of squared momentum transfer $0.2 \lesssim -t \lesssim 1.0$ (GeV/c)^2. The data are compared with the predictions of recent Regge-pole models.

We report here the final results of measurements of the polarization $P(t)$ in K^+-p elastic scattering at 3.75 and 4.40 GeV/c for squared momentum transfers in the interval $0.2 \lesssim -t \lesssim 1.0$ (GeV/c)^2. Earlier results on polarization in K^+-p elastic scattering above 1 GeV/c have been obtained at 1.22 and 2.48 GeV/c [1] and at 14 GeV/c.[2]

The data were obtained in a polarized-target experiment set up to measure polarization in $\pi^\pm$-p, K^+-p, and p-p elastic scattering in the momentum region between 2.5 and 5.0 GeV/c. Preliminary results on polarization in $\pi^\pm$-p and p-p scatterings have already been reported.[3,4]

The measurements were carried out in an unseparated 0° secondary beam in the external proton beam area of the zero-gradient synchrotron at Argonne National Laboratory. The beam had a momentum acceptance of ±3.5% and an intensity of about 10^6 particles per pulse. For momenta around 4 GeV/c, it contained pions and protons in the ratio 1:2 and about 1% positive kaons. Two gas threshold Cherenkov counters in the beam were used to veto positrons and to identify pions, and a gas differential Cherenkov counter,[5] placed about three meters upstream of the polarized target, selected kaons. The K^+-p polarization data were taken simultaneously with π^+-p and p-p data. Particles identified as kaons had a pion and proton contamination of less than 1%.

Information about incoming beam particles was obtained from scintillation-counter hodoscopes placed in the beam upstream of the polarized target. Other arrays of counters detected particles scattered in the vertical plane. Whenever a beam particle and two particles coming from the target (one above and one below the beam line) were detected in coincidence, the information on which counters had been triggered was sent to an on-line computer which computed the azimuthal and polar angles of the two outgoing particles. The information was also written on magnetic tape to permit a more detailed off-line analysis. Events from elastic scattering by the free protons of the target were selected on the basis of coplanarity and angular correlation in the scattering plane.

The free protons contained in the lanthanum magnesuim nitrate polarized target used in the experiment had an average polarization of about 0.55. The sign of the polarization was reversed approximately every six hours.

The results are presented in Table I and in Fig. 1. The errors are statistical and include the contribution due to background subtraction. The uncertainty in the target polarization contributes an additional normalization error of

Table I. Polarization in K^+-p elastic scattering at two incident momenta.

Polarization			
Incident momentum 3.75 GeV/c		Incident momentum 4.40 GeV/c	
$-t$ (GeV/c)^2	$P(t)$	$-t$ (GeV/c)^2	$P(t)$
0.22	0.46 ± 0.22	0.23	0.34 ± 0.12
0.25	0.18 ± 0.11	0.27	0.39 ± 0.12
0.30	0.25 ± 0.09	0.33	0.16 ± 0.10
0.36	0.40 ± 0.09	0.40	0.21 ± 0.10
0.43	0.42 ± 0.10	0.49	0.31 ± 0.12
0.50	0.32 ± 0.12	0.58	0.21 ± 0.13
0.58	0.35 ± 0.13	0.68	0.27 ± 0.14
0.66	0.24 ± 0.13	0.78	-0.02 ± 0.25
0.74	0.44 ± 0.17	0.88	0.03 ± 0.22
0.83	0.40 ± 0.18	1.00	0.40 ± 0.37

about ±10 %. The horizontal bars indicate that several counter bins were combined to provide the data points. The sign of the polarization is defined in the standard way as positive in the direction $\vec{p}_i \times \vec{p}_f$, where $\vec{p}_i$ and $\vec{p}_f$ are, respectively, the incoming and outgoing kaon momenta.[6] At both momenta $P(t)$ is positive throughout the range of t investigated except possibly beyond $-t \approx 0.8$. This behavior is consistent with that observed both at lower[1] and higher[2] momenta. The magnitude of $P(t)$ appears to decrease monotonically with increasing momentum.

For K^+-p scattering, momenta near 4 GeV/c are sufficiently high that comparison with Regge-pole models may be made realistically.[7] Recently several phenomenological models of K-N scattering have appeared in the literature based either on a combined optical–Regge-pole model[8] or on the Regge-pole model alone.[9-11]

In Fig. 1 we compare the predictions of some of these models with the experimental data. In the following, we briefly discuss the models and how their predictions compare with the data:

(1) Model of Blackmon and Goldstein.[8]—This is a hybrid model where Regge-pole exchanges are combined with an optical model. The relative sign of the helicity-flip amplitudes for $I=1$ exchanges (ρ and A_2) is not determined and there are therefore two predictions. For a positive relative sign in K^+-p scattering, $P(t)$ has zeros at $t \approx -0.2$ and -1.0 (GeV/c)^2 and is positive only in this interval. This behavior is in poor agreement with the data.[12] The predictions corresponding to a negative relative sign are shown as curves I in Fig. 1 and are consistent with the data.

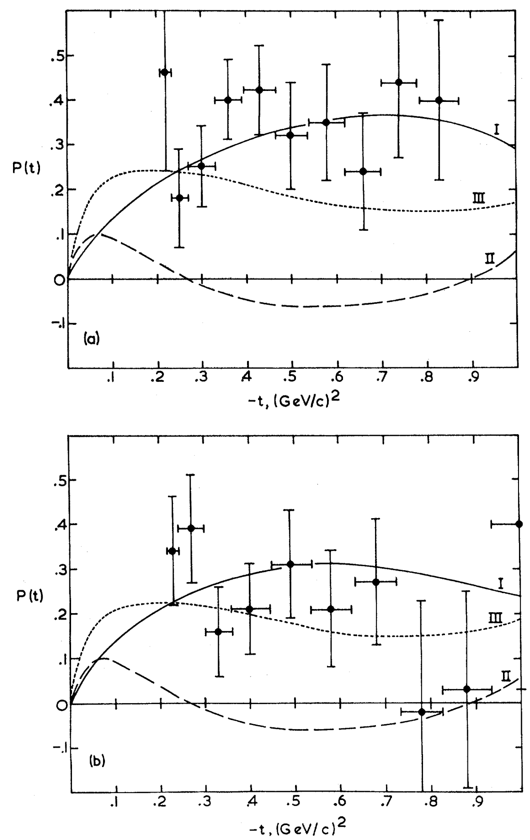

FIG. 1. Polarization in K^+–p elastic scattering at (a) 3.75 GeV/c and (b) 4.40 GeV/c. Solid lines (I) are the predictions of Ref. 8 for a negative relative sign (in K^+–p scattering) of the ρ and A_2 helicity-flip amplitudes. Dashed lines (II) are the predictions of Ref. 10 (solution 2); dotted lines (III) those of Ref. 11 (solution 3).

(2) Model of Chen-Cheung and Roth.[9]—This is a phenomenological Regge-pole model with two solutions which differ only in the parameters of the ω trajectory. Both solutions predict positive $P(t)$ at small $-t$ but a sign change at $t \sim -0.5$ in disagreement with the data.

(3) Model of Plaut.[10]—This again is a Regge model with two solutions coming from two sets of assumptions for the ghost-killing mechanism of the even-signature trajectories P, P', and A_2. The parameters were adjusted to fit K^--p polarization data at rather low energies. For K^+-p scattering solution 1 predicts large negative polarizations between $t=0$ and $t=-0.9$. Predictions of solution 2 are shown in Fig. 1 as the curves labeled II. Neither solution is compatible with the data.

(4) Model of Dass, Michael, and Phillips.[11]—This Regge model incorporates information ex-

tracted from the low-energy amplitudes by means of finite-energy sum rules. This information fixes the relative sign of the ρ and A_2 helicity-flip amplitudes. Corresponding to four sets of assumptions on the behavior of the ω and ω' trajectories four solutions are obtained. Solutions 1-3 give almost identical predictions for the polarization. The predictions of solution 3 are shown as curves III in Fig. 1 and are in reasonable agreement with the data. Solution 4 predicts much smaller polarizations which are inconsistent with the data.

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MEASUREMENT OF POLARIZATION IN K^+p ELASTIC SCATTERING AT 1.37, 1.45, 1.71, AND 1.89 GeV/c AND PHASE-SHIFT ANALYSIS*

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Measurements are reported of polarization in K^+p elastic scattering at 1.37, 1.45, 1.71, and 1.89 GeV/c. A phase-shift analysis including these new data has been performed. Resonancelike behavior is observed in the $P_{3/2}$ partial-wave amplitude.

We report here measurements of K^+p polarization over a range of c.m.-system angles from 20° to 160° at kaon momenta from 1.37 to 1.89 GeV/c from an experiment still in progress at the Argonne National Laboratory zero-gradient synchrotron (ZGS).

Until recently, our knowledge of the K^+p partial-wave amplitudes above 1 GeV/c came from a phase-shift analysis of total, total inelastic, and differential cross-section data performed by Lea, Martin, and Oades[1] at momenta up to 1.5 GeV/c and later extended to 2.0 GeV/c by Martin.[2] While the bump at 1.25 GeV/c in the K^+p total cross section observed by Cool et al.[3] and