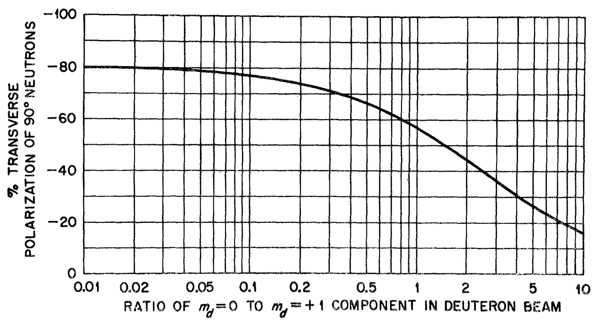

FIG. 2. Polarization of neutrons produced at 90° in the T(d,n)He^4 resonance reaction by a polarized deuteron beam. The direction of polarization is opposite to the beam direction in the scattering plane, hence transverse to the neutron direction.

detector efficiency = 20 %. The resulting count rate is ~300/sec.

Reference to the partial cross sections listed above shows that the 14-Mev neutrons produced in the d-T reaction are, in general, polarized. The $m_d = \pm 1$ deuterons produce equal and opposite neutron polarizations and the $m_d = 0$ deuterons no polarization. Figure 2 shows the polarization of the neutrons at 90° as a function of the contamination of an $m_d = +1$ beam by $m_d = 0$. The direction of polarization is opposite to the beam direction in the scattering plane, hence transverse to the neutron direction. It is, of course, essential to the use of the neutrons in a subsequent nuclear process that the neutron polarization be transverse. By examination of the neutron angular distribution and polarization, it therefore appears that the complete polarization state of the deuteron beam can be determined.

It should be pointed out that the analogous He$^3(d,p)$ reaction may be an even more convenient one for determining the polarization state of the deuteron. This reaction would, in addition, produce 14-Mev polarized protons.

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[7]Because this reaction picks out of the deuteron beam only the s-wave part, which has no preferred direction, the angular dependences of the partial cross sections are really referred to the alignment axis, chosen here to coincide with the beam axis. For a different alignment axis the results may be obtained by rotating the angular distributions presented above through the angle between the two axes. In this case the differential cross sections will depend on both the polar and azimuthal angles. If the polarization state of the deuteron beam is too complex to be described solely in terms of one alignment axis, then the calculation must be altered.

RESONANCES IN THE π-HYPERON SYSTEM

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The scattering matrix for the charge symmetric π-Σ-Λ interaction[1] has been investigated in the Chew-Low approximation. The Σ-Λ relative parity was assumed to be even. In the case of global symmetry ($g_{\Sigma\Sigma\pi} = \pm g_{\Sigma\Lambda\pi}$) we obtain the familiar Chew-Low equations for the π-nucleon system; the π-nucleon states of isotopic spin $T=\frac{3}{2}$ and $T=\frac{1}{2}$ corresponding now to the π-hyperon states $T=2$ and $T=0$, respectively. The scattering amplitude for the two $T=1$ states ($\Sigma\pi$ and $\Lambda\pi$) can be written as a linear combination of the amplitudes in the $T=2$ and $T=0$ states. The effective range in the $T=2$, $J=\frac{3}{2}$ state is positive, and if the coupling constant and cutoff energy are comparable to the π-nucleon values we get the analog of the famous π-nucleon $T=\frac{3}{2}$, $J=\frac{3}{2}$ resonance. In the limits $g_{\Sigma\Lambda\pi} \ll g_{\Sigma\Sigma\pi}$ and $g_{\Sigma\Lambda\pi} \gg g_{\Sigma\Sigma\pi}$, the effective range also turns out to be positive in the $T=2$, $J=\frac{3}{2}$ state. In addition the effective range is positive in the $T=0$, $J=\frac{1}{2}$ state for the case $g_{\Sigma\Lambda\pi} \ll g_{\Sigma\Sigma\pi}$ and in the $T=1$, $J=\frac{1}{2}$ ($\Sigma\pi$) and $T=1$, $J=\frac{3}{2}$ ($\Lambda\pi$) states in the case $g_{\Sigma\Lambda\pi} \gg g_{\Sigma\Sigma\pi}$.

This note was prompted by the recent analysis of the K^--p scattering experiments by Matthews and Salam.[2] They suggest that near $T_K \approx 25$ Mev the interaction takes place through a $J=\frac{1}{2}$ resonance. The experiments do not suffice to determine the isotopic spin at resonance. We wish to point out that, while a $J=\frac{1}{2}$ resonance at these energies is not consistent with global symmetry, it can be explained by assuming either $g_{\Sigma\Lambda\pi} \ll g_{\Sigma\Sigma\pi}$ if $T=0$ or $g_{\Sigma\Lambda\pi} \gg g_{\Sigma\Sigma\pi}$ if $T=1$. The limit $g_{\Sigma\Lambda\pi} \ll g_{\Sigma\Sigma\pi}$ is very hard to reconcile with the near equality of the Λ-nucleon and nucleon-nucleon forces, and with the K^- capture experiments in deuterium which indicate that there exists a large Σ-Λ exchange. The possibility $g_{\Sigma\Lambda\pi} \gg g_{\Sigma\Sigma\pi}$ is compatible with these results. These remarks are strictly valid only if the K-nucleon-hyperon interaction is small compared to the π-hyperon interaction. A more detailed investigation including the K interaction is in progress.

I wish to thank Dr. R. Capps and Professor T. Kinoshita for several enlightening discussions and Professor H. Bethe for his constant encouragement and advice.

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EVIDENCE FROM PHOTOPRODUCTION FOR A PSEUDOSCALAR K^+ MESON*

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It has been suggested recently by Taylor[1] that the extrapolation procedure used[2] to determine the pion-nucleon coupling constant from pion photoproduction angular distributions could be applied to K-meson photoproduction data to obtain the parity of the K^+ meson. This suggestion is based on the fact that the sign of the residue of the meson current pole is positive for pseudoscalar K mesons and negative for scalar K mesons.

It is easy to see[3,4] that even if the mass difference between the nucleon and the hyperon is taken into account, the above qualitative statement continues to hold. Furthermore, one can add the quantitative statement that for the same value of the coupling constant the absolute value of the residue for the scalar case is larger than for the pseudoscalar case by a huge factor which, for the associated production of K^+ and Λ^0, turns out to be about 18.5.

The above statements are partially equivalent to the well-known fact that under usual circumstances scalar photoproduction is dominated by the direct-interaction term, while in pseudoscalar photoproduction at low energies the direct-interaction term plays a relatively small role. It has been shown,[3] however, that if one takes into account the anomalous magnetic moments of the fermions involved in the reaction, the distinction between the general features of the angular distribution of scalar and pseudoscalar photoproduction becomes much less pronounced. In fact, it seems impossible to decide from the qualitative features of the angular distribution whether the particle produced is scalar or pseudoscalar. The extrapolation procedure used in this note quantitatively separates out the direct-interaction (meson current) term, and hence the ambiguity due to the anomalous magnetic moments and other uncertainties, which are contained only in the nucleon current terms, disappear.

Experimental data on K-meson photoproduction angular distributions are still scarce. In the energy interval of 1000-1010 Mev, however, there are now about ten measurements of differential cross section for the associated production of K^+ and Λ^0. The data are shown in Table I. Since these data were taken at such low energies, the distance of extrapolation[2] is quite large, the pole being at $\cos\theta = 2.70$. At the same time, however, on account of the low energies, one can attempt to use low-order polynomials for the extrapolation, since it might be assumed that only S (and perhaps P) states play a significant role beside the meson current term. This assumption, which is made in the analysis to follow, is perhaps on less secure grounds here than it would be in the case of pion photoproduction,