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A POSSIBLE MODEL OF Λ-PARTICLE PRODUCTION IN HIGH ENERGY πN COLLISIONS

WANG JUNG and HU SHIH-KO

Joint Institute for Nuclear Research

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A possible model of Λ-particle production in high energy πN-collisions, suggested by D. I. Blokhintsev and Wang Jung, is considered. The polarization and the distribution of transverse momentum of the Λ particles, and also the percentage of particles emitted in the forward direction in the center-of-mass system are calculated. It is shown that the model is in agreement with the available experimental data.

SOLOV'EV and Wang Kang-ch'ang et al.[1-3] have recently measured the transverse momentum and angular distribution of Λ particles produced in high-energy πN-collisions (momentum of the incident π meson ≈ 7 Bev/c), and have observed longitudinal polarization of the Λ-particle. In this article we shall show that all characteristic features of Λ-particle production in high-energy πN collisions are in agreement with the model proposed by Blokhintsev and Wang Jung.[4] This model has two essential features: 1) the pole term corresponding to the diagram shown in the accompanying figure gives the dominant contribution; 2) the (ΛNK) vertex part takes the form $1 \pm \gamma_5$ (this model does not assume parity conservation in strong interactions[5]).

Aside from conservation of energy-momentum and strangeness, there are no other restrictions on the multiplicity of particles which may be produced jointly with the Λ. The theoretical results discussed here, as well as the corresponding experimental results, are almost independent of this multiplicity.

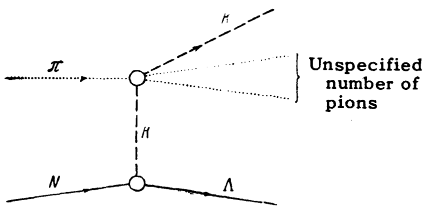
The following results were obtained from this model:

1) The optimum transverse momentum of the Λ particle (≈ 400 Mev/c) is almost independent of the energy of the incident π meson.

2) In the center-of-mass system, approximately 13.7% of the Λ particles are emitted in the forward direction.

These are precisely the characteristic kinematical features of Λ-particle production experiments ([2] and also private communication from M. I. Solov'ev). Furthermore, according to this model it is possible to predict the following:

3) The Λ particles are polarized in the laboratory system; the direction of the polarization



vector coincides with the direction of the momentum of the Λ, i.e., they are longitudinally polarized. Furthermore, the degree of polarization is

$$\overline{P} = \begin{cases} +v/c & \text{for } 1-\gamma_5 \\ -v/c & \text{for } 1-\gamma_5 \end{cases},$$

where v denotes the velocity of the Λ particle in the laboratory system.

For Λ decay the asymmetry parameter is $\alpha \approx -0.85$.[6]

Theoretical values of $\alpha\overline{P}$ are given in the table. We see that this model agrees with the experimental results[3] in so far as the cases with $p_\Lambda \leq 1200$ Mev/c are concerned, if the vertex part takes the form $1 + \gamma_5$.

As far as cases with $p_\Lambda > 1200$ Mev/c are concerned, no experimental data have been obtained because certain difficulties of a kinematical nature arise in connection with the identification of the Λ particle.[3] But momenta in the range $p_\Lambda > 1200$ Mev/c in the laboratory system correspond to larger angles (with respect to the backward direction) and smaller momenta of the Λ particle

p_Λ in Mev/c (lab system)	$\alpha\overline{P}$ (for $1+\gamma_5$)	$\alpha\overline{P}$ (for $1-\gamma_5$)
~200	−0.15	+0.15
~600	−0.40	+0.40
~1000	−0.57	+0.57
~1300	−0.65	+0.65

in the center-of-mass system, and in accordance with the proposed model the relative number of cases in this range is considerably smaller than for $p_\Lambda < 1200$ Mev/c, i.e., it is probable that only a few of the 29 unidentified cases can be Λ particles. Thus the model with vertex part $1 + \gamma_5$ is probably still in agreement with the polarization experiments, even in the region $p_\Lambda > 1200$ Mev/c.

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