ОБЪЕДИНЕННЫЙ ИНСТИТУТ ЯДЕРНЫХ ИССЛЕДОВАНИЙ

Лаборатория теоретической физики

Hu Shih-ko, Wang Yung

Д-742

A PLAUSIBLE MODEL OF Λ -PARTICLE PRODUCTION IN HIGH ENERGY πN COLLISION

ЖЭТФ, 1961, т41, вып6, с1868-1869.

Дубна 1961

Hu Shih-ko, Wang Yung

Д-742

1120/5 *нр*

A PLAUSIBLE MODEL OF Λ-PARTICLE PRODUCTION IN HIGH ENERGY πN COLLISION

In a recent work of Wang Kan-chang, M.I. Soloviev and others [1,2,3], the transversal momentum and angular distribution of Λ -particle produced in high energy πN collision (momentum of incident pion $\sim$ 7 BeV/c) have been measured, and longitudinal polarization of Λ -particle was observed. Here in this note we will show that all the characteristic features of Λ -particle produced in high energy πN collision are in good agreement with the model suggested by D.I. Blokhiotsev and one of the authors (Wang Yung)[4]. This model consists of two essential points:

1. The pole term corresponding to diagram of Fig. 1 gives predominant contribution.

2. The vertex (Λ NK) takes the form $1 \pm \gamma_5$. (This model does not claim the conservation of parity in strong interaction[5]).

Other than energy-momentum and strangeness conservation laws, there are no other restrictions to the multiplicity of particles produced together with Λ . The theoretical results here discussed, just alike the corresponding experimental results, are almost independent of this multiplicity.

From this model, following results were obtained:

1. Optimal transversal momentum of Λ -particle $\sim$ 400 MeV/c (almost independent of incident pion energy).

2. In center of mass system, about 14% of Λ -particles are flying forward.

These are just the characteristic kinematic features in the Λ production experiments [2,7]. Furthermore, one can also predict from this model:

3. Λ -particles are polarized in laboratory system, the direction of polarization vector coincides with direction of momentum of Λ , i.e. polarization is purely longitudinal. Moreover, the degree of polarization is

$$\bar{P} = \zeta_{\parallel} = \begin{cases} +\frac{v}{c}, & \text{for } 1+\gamma_5 , \\ -\frac{v}{c}, & \text{for } 1-\gamma_5 , \end{cases}$$

where v — velocity of Λ in laboratory system.

The coefficient of asymmetry of Λ decay is:

$$\alpha \cong -0.89 \ [6].$$

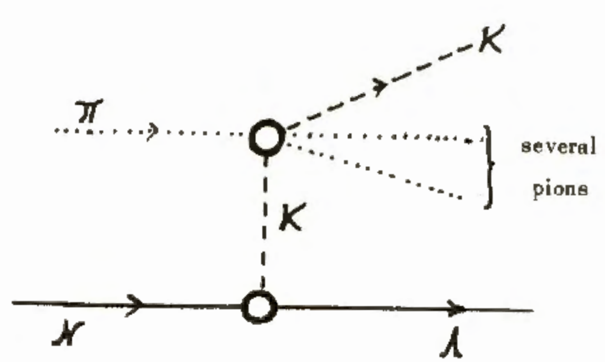
hence we have the following table of theoretical values of $\alpha\bar{P}$:

P_Λ ($\frac{MeV}{c}$) lab.syst.	$\alpha\bar{P}$ (from $1+\gamma_5$)	$\alpha\bar{P}$ (from $1-\gamma_5$)
~ 200	–0.16	0.16
~ 600	–0.42	0.42
~ 1000	–0.59	0.59
~ 1300	–0.67	0.67

We see that, so far as casea of $P_\Lambda \leq 1200 \frac{MeV}{c}$ are concerned, this model again gives agreement with experimental results related to the polarization of Λ produced in high energy πN collision,[3] if $1+\gamma_5$ is taken.

As for the cases with $P_\Lambda > 1200$ MeV/c, no definite experimental data have been given, because in identifying the Λ -particles, some difficulties of kinematical criterion arose.[3] But $P_\Lambda > 1200$ MeV/c in laboratory system corresponds to large angle (relative to backward direction) and smaller momentum of Λ — particle in center of mass system, and according to the suggested model, the relative number of cases in this region ($P_\Lambda > 1200$ MeV/c in laboratory system) is much smaller than that of $P_\Lambda < 1200$ MeV/c region, i.e. it is probable that only a few in the 29 [3] not identified cases could be cases of Λ , henceforth, the model with $1+\gamma_5$ is still probable to agree with polarization experiment even in the region $P_\Lambda > 1200$ MeV/c.

The authors wish to thank D.I. Blokhintsev for valuable suggestions and V.S. Barashenkov, M.I. Soloviev for interesting discussions.



F i g. 1.

References

1. M.I. Soloviev. Proceeding of the 1960 Annual International Conference on High Energy Physics at Rochester., 388.
2. Ван Ган-чан et al., ЖЭТФ, 40 (1961) 464-473.
3. Ван Ган-чан et al., ЖЭТФ, 39 (1960) 1854-1958.
4. D.I. Blokhintsev, Wang Yung. Nuclear Physics 22 (1961) 410-425.
5. В.Г. Соловьев. ЖЭТФ, 36 (1959) 628-629.
6. D.A. Glaser. 1958 Annual International Conference on High Energy Physics at CERN, 265.
7. M.I. Soloviev. Private Communication, will be published.