

$\bar{\Lambda}$  HYPERON PRODUCTION BY 7-8 GeV NEGATIVE PIONS IN HYDROGEN

V. A. BELYAKOV, V. I. VEKSLER, N. M. VIRYASOV, I. VRANA, KIM HI IN, E. N. KLADNITSKAYA, A. A. KUZNETSOV, A. MIKHUL, NGUYEN DINH TU, M. I. SOLOV'EV, T. HOFMOKL, and CH'ENG LING-YEN

Joint Institute of Nuclear Research

Submitted to JETP editor March 13, 1963

J. Exptl. Theoret. Phys. (U.S.S.R.) 45, 88-89 (August, 1963)

Observations of the production and decay of  $\bar{\Lambda}$  hyperons are reported. The cross section for production of  $\bar{\Lambda}$  hyperons by 7-8 GeV negative pions in hydrogen is estimated to be  $\sim 3 \mu\text{b}$ .

IN the study of the production of  $\Lambda$  hyperons and  $K^0$  mesons in  $\pi^-$ -p interactions<sup>[1-4]</sup> by 7-8 GeV pions, we selected 42  $V^0$  events in which the momentum of the negative particle from the decay was greater than the momentum of the positive particle and the transverse momentum of the decay products was less than or equal to 100 MeV/c.

After application of criteria for the separation of  $\Lambda$  hyperons and  $K^0$  mesons, namely, kinematic criteria with the use of the  $\chi^2$  test, measurement of the ionization, and determination of the  $\delta$ -electron energy (if it occurred on the track of a negative particle), one  $\bar{\Lambda}$  hyperon was reliably identified and ten cases were found to be ambiguous.

	$\bar{\Lambda}$	$\bar{\Lambda}$ or $K^0$	$\bar{\Lambda}$ or $K^0$
$p_-, \text{ MeV}/c$	2355	3538	2546
$p_+, \text{ MeV}/c$	467	558	418
$\theta_-$	2°24'	1°36'	2°18'
$\theta_+$	12°21'	10°6'	13°18'
$p_{V^0}, \text{ MeV}/c$	2809	4087	2951
$\chi^2$ for $\bar{\Lambda}$	0.67	0.43	0.66
$\chi^2$ for $K^0$	10.2	0.31	1.37
$\bar{p}$ annihilation	yes, in wall	no	no
other particles recorded	$\Lambda, \chi^2=1.63$	no	no
missing mass, MeV	1024	2286	2678
$\theta_{\bar{\Lambda}}$	73°30'	7°24'	69°44'
$p_{\bar{\Lambda}}, \text{ MeV}/c$	530	770	540
$10^{10} \tau_{\bar{\Lambda}}, \text{ sec}$	0.90	0.94	1.40

The  $\Lambda$  hyperon found by us was produced in the reaction  $\pi^- + p \rightarrow \bar{\Lambda} + \Lambda + n$  together with a  $\Lambda$  hyperon which was also well identified.

The antiproton from the  $\bar{\Lambda}$  decay annihilated in the wall, while the  $\pi^\pm$  mesons from the annihilation, which were emitted backward, were recorded in the chamber. A photograph of this event is shown in the figure.

Among the nine ambiguous cases, two were consistent with the production of  $\bar{\Lambda}$  hyperons in the reaction

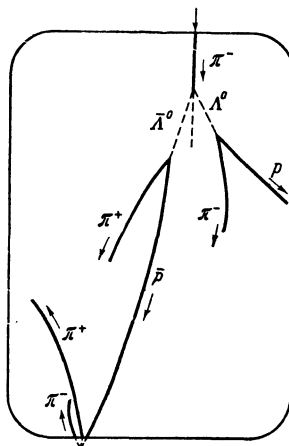
$$\pi^- + p \rightarrow \bar{\Lambda} + \Lambda + n + \dots$$

The remaining seven cases involve either the production of  $\bar{\Lambda}$  hyperons in  $\pi^-$ -C interactions or the production of  $K^0$  mesons in  $\pi^-$ -p interactions.

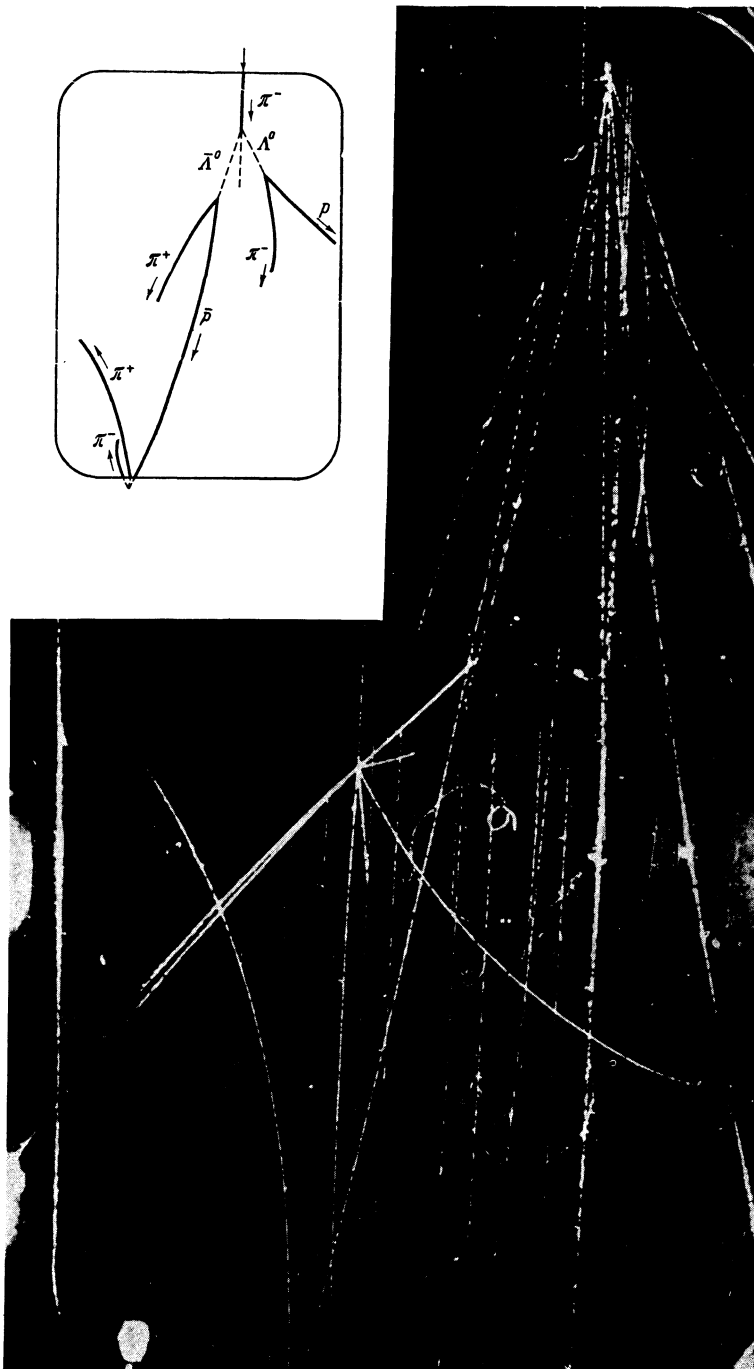
The characteristics of all three cases are shown in the table.

The cross section for the production of  $\bar{\Lambda}$  hyperons in hydrogen by  $\pi^-$  mesons at our energy was found to be  $\sim 3 \mu\text{b}$ .<sup>1)</sup> Apparently, the cross section for the production of  $\bar{\Lambda}$  hyperons by 7-8 GeV  $\pi^-$  mesons does not differ greatly from the cross section for  $N\bar{N}$  production (in our earlier work<sup>[5]</sup> we estimated the value for the production of slow antiprotons to be of the order of  $1 \mu\text{b}$  per nucleon).

<sup>1)</sup>A total of 60 000 photographs was used in this work with a mean intensity of ten  $\pi^-$  meson tracks per picture. The length of the  $\pi^-$  meson track in the fiducial region of the chamber was 38 cm.



Photograph of event depicting the production and decay of  $\bar{\Lambda} + \Lambda$  hyperons and the decay scheme.



<sup>1</sup> Wang, Wang, Veksler, Vrana, Ting, Ivanov, Kladnitskaya, Kuznetsov, Nguyen, Nikitin, Solov'ev, and Ch'eng, JETP 40, 464 (1961), Soviet Phys. JETP 13, 323 (1961).

<sup>2</sup> M. I. Solov'ev, Proc. of the 1960 Ann. Intern. Conf. on High Energy Physics at Rochester, Univ. of Rochester, 1961, p. 388.

<sup>3</sup> Belyakov, Wang, Veksler, Viryasov, Vrana, Tu, Kim, Kladnitskaya, Kuznetsov, Mikhul, Nguyen, Patera, Penev, Sokolova, Solov'ev, Hofmohl, Ch'eng, and Schneeberger, Proc. of the 1962 Ann. Intern. Conf. on High Energy Physics at CERN, Geneva, 1962, p. 252.

<sup>4</sup> Belyakov, Wang, Veksler, Viryasov, Vrana, Tu, Kim, Kladnitskaya, Kuznetsov, Mikhul, Nguyen, Patera, Penev, Sokolova, Solov'ev, Hofmohl, Ch'eng, and Mikhul, Joint Institute of Nuclear Research Preprint D-1105, 1962.

<sup>5</sup> Wang, Wang, Ting, Ivanov, Kladnitskaya, Kuznetsov, Nguyen, Nikitin, Otwinowski, and Solov'ev, JETP 38, 1010 (1960), Soviet Phys. JETP 11, 726 (1960).