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MULTIQUARK RESONANT STATES

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The invariant mass spectra of forty nine hadronic systems with hypercharge, strangeness and baryon number, varied in the limits $0 \leqslant Y \leqslant 6$, $-2 \leqslant S \leqslant +1$, $0 \leqslant B \leqslant 6$, have been studied. Resonance-like peaks have been found in the invariant mass spectra of $Y \leqslant 1$ systems only. The same inequality holds for all established resonances. Thus, a hypercharge selection rule is suggested: " The hypercharge of hadronic resonances in weak gravitational fields cannot exceed one: $Y \leqslant 1$" This rule defines the conditions and selects the classes of interactions which make possible the formation of hadrons in weak gravitational fields, i.e., in terrestrial conditions. Thus one cannot exclude that it is based on a new symmetry principle, unknown up to now /1/. On the other hand, recently a number of theoretical investigations of multiquark states have appeared. The masses of peaks found in the effective mass spectra of $Y \leqslant 1$ exotic systems, studied in this work are in striking agreement with the predictions, made in papers /2/. Below this comparison for $Y \leqslant 1$ systems is presented, the results being obtained by means of 55 cm and 2 m JINR propare bubble chambers. The first one was exposed to the neutron of $\langle p_n \rangle = 7.0$ Gev/c and negative pion of $p_{\pi^-} = 4.0$ Gev/c momenta beams. The second one was exposed to relativistic ^{12}C ion beam of cp=4.2 Gev/n. Let us remind that the measured masses of baryons Λ, Σ°, $\Sigma^*(1385)$ and of K°-meson were very close to the tabular values. The Λp invariant mass resolution (r.m.s. deviation) is 3.00 MeV/c^2 in the initial part of the spectrum, 4.25 MeV/c^2 around the 2128 MeV/c^2 peak, 6.40 MeV/c^2 in the vicinity of 2256 MeV/c^2 peak. The $\Lambda\Lambda$ invariant mass resolution in the 2365 MeV/c^2 peak region is $M_{\Lambda\Lambda}=(10.0 \pm 2.4)$ MeV/c^2. V° - particles were possible to identify at $P_{V^\circ} \geqslant 0.150$ GeV/c, π^- and K^- at $p \geqslant 0.045$GeV/c, protons - in the range $0.150 \leqslant p \leqslant 1.0$ Gev/c, π^+ and K^+ at $p < 1.0$GeV/c. The inclusive production of possible multiquark hadrons on ^{12}C nuclei has been studied.

In order to establish the existence of presumed resonances, the following method was used in this work. It is customary to consider

the existence of a resonance to be established if one has succeeded in measuring the following four quantities: (i) The statistical significance of a peak, defined by the confidence level, corresponding to the so-called number of standard deviations, $N_{sd} \pm \Delta N_{sd}$. (ii) The mass of the hypothetical resonance, $M \pm \Delta M$. (iii) Its width, $\Gamma \pm \Delta\Gamma$. (iiii) Its production effective cross section, $\sigma \pm \Delta\sigma$. In order to solve this problem, today, because of the absence of the theory of strong interactions, one has to invent a physical model by means of which one would be able a) to imitate all final states observed in the experiment in question and to describe, that is to reproduce mathematically the invariant mass spectrum observed; b) to describe simultaneously the results of other experiments, if there are such ones. Naturally, the larger is the number of such auxiliary experiments, the higher is the plausibility of the model in question, and the information, thus obtained, should be considered to be closer to a model-independent, absolute one. The models used in this work for the analysis of the invariant mass spectra of di - and multibaryon systems were based on two fundamental hypotheses. The first one is the correctness of the impulse approximation for π^- and $n\,^{12}C$ interactions in the (4.0-7.0) GeV/c momentum range. According to the second hypothesis, any peak or enhancement observed in the invariant mass spectra in question is due to the intranuclear s-channel hyperon-nucleon interaction. The creation of exotic strange baryons, apart from this mechanism may be due to interactions of the incident particles with free or bound nucleons. There exists also a probability of their creation in intranuclear secondary particle - nucleon interactions. The validities of the proposed models were tested, making use of the well known methods of testing the hypotheses. The best-fit parameters thus obtained comprised the masses, widths and contributions of resonances as well as the contributions and parameters (if any) of all kinds of backgrounds. Any fitting used in this work was performed by means of the "Minuit" program. Only after the acception of the most plausible model and thus obtaining the most probable best-fit total background one became able to determine correctly the statistical significance of resonance-like peaks and the resonance production effective cross sections. The following criteria were used in this work.(1)Models of only C.L.> 1% were accepted.(ii) For an accepted model any resonance-like peak must satisfy the well-known condition $N_{sd} \geqslant 5$. Besides, an additional condition introduced, had to be fulfiled: $\Delta N_{sd}/N_{sd} \leqslant 0.25$. (iii) Any best-fit parameter $Z \pm \Delta Z$, must satisfy the condition $\Delta Z/Z \leqslant 0.3$.

БИБЛИОТЕКА

The Λp-dibaryons (I=1/2, Y=1, B=2, S=-1)

The Λp-invariant mass spectrum (N=2347 combinations), due to $n^{12}C \to \Lambda(mp)X$; m=1,2 reactions **,is shown in fig.1.** The model, accepted for the analysis was based on two hypotheses: (i) the impulse approximation is valid; (ii) the formation of Λp - resonances takes place in S-channel, Λp elastic interactions exclusively,because in the relative momentum range, $0.0 < p_\Lambda \leq 2.0$ GeV/c, or in the equivalent effective mass one, $2053.8796 \leq M \leq 2553.8796$ MeV/c^2, one has $\sigma^{in}_{\Lambda p}(\Lambda p \to YN(m\pi);\ m=1,2,3,\ldots) \ll \sigma^{el}_{\Lambda p}(\Lambda p \to \Lambda p)$. In order to re-

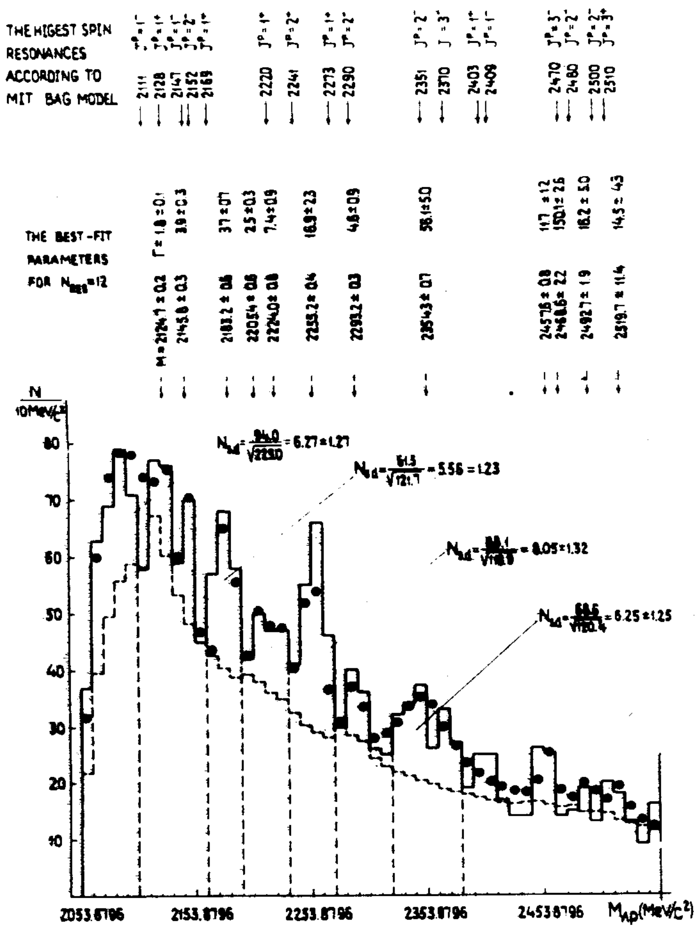

Fig.1

produce mathematically the Λ p mass spectrum one had to calculate the probabilities of all final states with Λ and p, provocated by a fast neutron, passing through a carbon nucleus. The theoretical cross section $\sigma^{el}_{\Lambda p}(p_\Lambda)$, which one needed for the probability $W^{el}(\Lambda p \to \Lambda p)$, was parametrized as a sum of three cross sections due to: (i) spin-independent ($a_s=a_t$, $r_s=r_t$) low energy scattering in effective range approximation; (ii) potential scattering; (iii) Breit-Wigner resonance elastic scattering, depending on resonance total spins and orbital momenta. The probabilities $W^{el}(\Lambda p \to \Lambda p)$, $W^{\Lambda\Sigma\Lambda}(\Lambda p \to \Sigma^0 p, \Sigma^0 \to \Lambda\gamma)$, $W^{\Sigma\Lambda}(\Sigma^{\pm}N \to \Lambda p)$ were computed using (i) the Λ- and Σ^0-hyperons from interactions of fast neutrons with quasi-free neutrons and free- and quasi-free protons without seen protons of $p_p < 1.0$ GeV/c momenta; (ii) the known momentum distribution of protons, bound in ^{12}C nucleus; (iii) the measured cms angular distributions for $\Lambda p \to \Lambda p$, $\Lambda p \to \Sigma^0 p$ processes and the measured cross section $\sigma^{\Lambda\Sigma}(p_\Lambda)$ /3/. The detection efficiency, with geometrical and measurement restrictions imposed, was taken into account. Accoding to the model, the Λp invariant mass spectrum and the measured Λp elastic scattering cross sections /3/ in the p_Λ =(0.1-2.0) GeV/c range, were simultaneously fitted using a common $\chi^2_{n_D}$ functional. Using the measured effective mass resolutions, Gaussian convolutions were performed, what permitted one to choose the bin-size, proceeding only from the statistical provision. Λp -effective mass spectrum formed of chance combinations of Λ - hyperons, mentioned in (i) with protons from $n^{12}C \to \Lambda(mp)X$; m=1,2 reactions, normalized to one, imitated the background due to Λ and p from different stages of intranuclear cascade processes. The first hypothesis, assuming the observed Λp mass spectrum to be due exclusively to the background of the last type was rejected, because of χ^2_{44}=1088.37. Further,hypotheses on resonance number were tested within N_{Res} =0-17. During the fit the contribution of the $\Sigma\Lambda$ conversion tended to zero at any N_{Res} . This phenomenon, most probably, is due to the negligible detection efficiency of very slow Σ^0- hyperons. This makes the Σ^0 sample scanty of them and distorts the Σ^0-momentum spectrum, making the sample unadequate. For these reasons $\Sigma\Lambda$ conversion process was excluded, fixing its contribution at zero. The contribution of the potential Λp scattering gradually decreased with the increasing N_{Res} . Therefore it was excluded for all hypotheses with $N_R \geq 7$. The upper part of fig.2 shows the C.L. vs. N_{Res} . The model becomes significant, C.L.=2.29%, at N_{Res} =5. The confidence level rises up to N_{Res} =10,because the number of enhancements in the spectrum exceeds the number of resonance,inserted in $\sigma^{el}_{\Lambda p}(p_\Lambda)$. The optimal hypotheses correspond to N_{Res}=12 and 13 with C.L.=39.05% and

39.08%. At $N_{Res} > 13$, it exceeds the number of enhancements and C.L. gradually decreases to 12.09% at N_{Res} =17. Thus an appropriate description of the Λp mass spectrum, observed in the neutron experiment requires to take into account (i) the low energy Λp scattering; (ii) the $\Lambda p \to \Sigma^o p$ conversion process; (iii) the background due to the intranuclear cascade processes; (iiii) the resonance Λp scattering, the number of Breit-Wigner resonance being $N_{Res} \geq 5$. Neverthless, only four peaks, at 2092, 2183, 2256 and 2353 MeV/c^2 turned out to be **significant**, One has: (i) $6.03 \leq N_{sd}(2092) \leq 6.59$ in the range $7 \leq N_{Res}(2092) \leq 17$; (ii) $5.09 \leq N_{sd}(2183) \leq 5.56$, $6 \leq N_{Res}(2183) \leq 17$; (iii) $5.30 \leq N_{sd}(2256) \leq 8.09$, $4 \leq N_{Res}(2256) \leq 17$; (iiii) $5.22 \leq N_{sd}(2353) \leq 6.25$, $6 \leq N_{Res}(2353) \leq 12$. As an example the results of the fit at N_{Res} =12 are shown in fig.1, with χ^2_{57}=59.36 and C.L.=39.05%. The best-fit resonance parameters are shown below the predicted ones. The agreement is satisfactory. The blackened circles represent the fitted, i.e. the reproduced histogram. The best-fit contributions of processes are also very realistic: A($\Lambda p \to \Lambda p$)=0.260±0.003; B($\Lambda p \to \Sigma^o p$)=0.135±0.001; C(I.C.B.)=0.605±0.001. The well known peak at 2128 MeV/c^2 in the neutron experiment is unsignificant, whereas in the pion experiment it is of high significance /1/. This fact can be due to interplay of a number of causes: (i) the softer hyperon, especially the Σ^o-hyperon momentum spectrum due to the lower incident pion momentum and to the difference of Λ and Σ -hyperon angular distributions in πN and nN cms; (ii) the larger hyperon, especially the Σ^o hyperon production c.s. in πN at 4.0 GeV/c as compared to the nN **collisions** at 7.0 GeV/c; (iii) **different** forms of backgrounds, etc. Equally successfull was the fit to

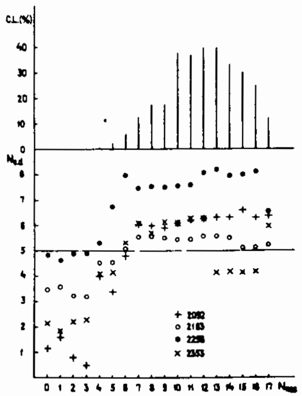

Fig.2.

the measured in /3/ cross sections $\sigma^{el\,exp}_{\Lambda p}(P_\Lambda)$ (fig.3), presented by crosses. The continious curves represent the Λp elastic scattering effective cross section $\sigma^{el\,Th}_{\Lambda p}(p_\Lambda)$, computed in the frame of the model at N_{Res} =12. The open circles represent the best-fit $\langle \sigma^{el\,Th}_{\Lambda p}(p_\Lambda) \rangle$, the averaging performed just over the same momentum ranges as in /3/ (the horisontal bars of crosses). These ranges of 100 and 200 MeV/c are enough to smear out narrow resonance peaks, such as the 2128 and 2183 MeV/c^2 of Γ = 8.5 and 14.2 MeV/c respectively, in momentum units, though their formation resonance cross sections attain several tens of **millibarns.** Instead, the full

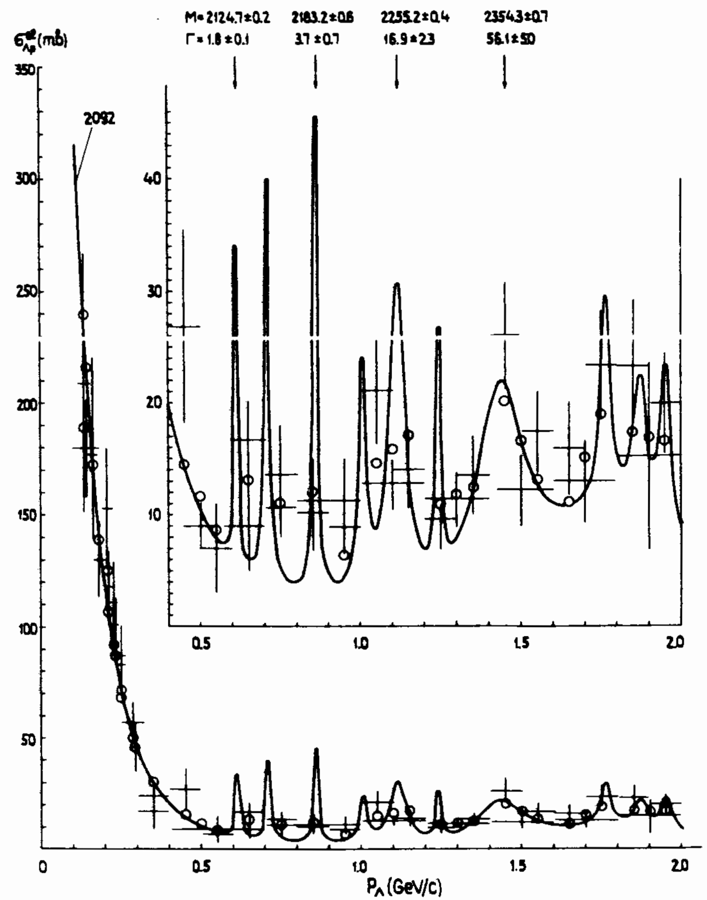

Fig.3.

widths of the 2256 and 2353 MeV/c^2 peaks, Γ =57.6 and 178.2 MeV/c respectively, are comparable with the mentioned ranges. Therfore these two peaks can be seen, as is the case (fig.3). These considerations are confirmed by a good coincidence, within the errors, of circles and crosses. The peak of 2092 MeV/c^2 mass is due to the effect of negative sign Λp scattering length and stipulates together with the measured points, the decreasing part of the cross section. The best-fit low energy scattering parameters, a=-(2.33$\pm$0.01)fm, r=(4.67$\pm$ 0.03)fm agree with the directly measured ones. The 2183,2256,2353 MeV/c^2 peaks are far from thresholds and can be considered as good candidates for six-quark resonant states of negative strangeness. Let us note that at least three more enhancements at 2145,2293,2453 MeV/c^2, seen in the mass spectrum of fig.1 (not significant) are waiting for higher statistics and better mass resolutions. It seems important to compare the spectrum of fig.1 with the spectra of highest momenta K^-D and π^+D experiments. Only the 2128 MeV/c^2 peak is seen in the Λp mass spectrum from three-particle final states, $K^-D \to \Lambda p \pi^-$, p_{K^-}=(1.45-1.65) GeV/c, deuterium bubble chamber /4/. Peaks at 2128, 2183,2256 appear in the Λp mass spectra from five-particle final states, $K^-D \to \Lambda p \pi^- \pi^+ \pi^-$, the same experiment (figs. 4,5,8, ref./5/). Fig.5 of ref./5/ represents the Λp mass spectrum in 15 MeV/c^2 bins for events with the lower limit of proton momentum imposed, 0.150GeV/c, coinciding with the one in this experiment. Fig.4 of this paper shows the same spectrum, reconstructed in 10 MeV/c^2 bins. The extreme peaks, 2092 and 2353 MeV/c^2 peaks are not seen because of the proton momentum restriction and the lack of energy, respectively. But the peaks

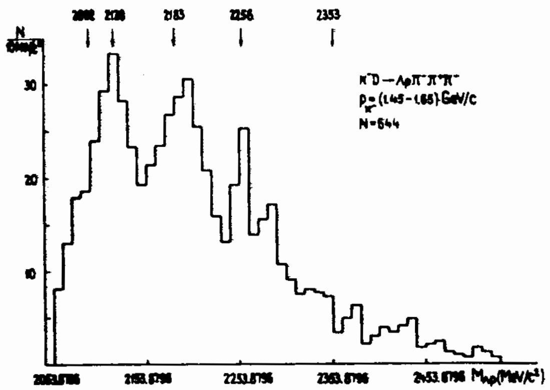

Fig.4

2128,2183 and 2256 MeV/c^2 are clearly seen as in the 15 MeV/c^2 plot (fig.5,ref./5/). The situation may be clarified if one reminds that the laboratory momentum spectrum of Λ from the reaction $K^-n \to \Lambda\pi^-\pi^+\pi^-$ has a wider maximum, spread to higher momenta, than the one from $K^-n \to \Lambda\pi^-$ reactions. According to the above mentioned hypothesis Λ -hyperons from the first channel should be able to excite higher mass Λ resonances then the ones from the second channel, when colliding the remnant proton. The stronger are forwardly collimated the negative pions from $\Lambda p \pi^-$-final states, the sharper becomes the Λp 2128 peak /4/. Three-particle final states with π^- and K^+-mesons, forwardly emitted in reactions $K^-D \to \Lambda p \pi^-$ and $\pi^+D \to K^+\Lambda p$ respectively, were studied by means of a missing mass spectrometer /6/. In view of results of experiments /4/ and /5/, no wonder that only the Λp 2128 peak has been observed. Finally, let us turn to Λp invariant mass spectrum from interactions of ^{12}C with propane at cp=4.2 GeV/n in the 2 m bubble chamber. Λp combinations from interactions of both primary ^{12}C ions and the whole variety of secondaries-hadrons ($h^\pm$) and nuclear fragments ($F^{(1-5)+}$) were lumped together. In spite of the variety of projectiles, their energies and targets, the summary Λp mass spectrum (fig.5) reveals 2128,2183 and 2256 MeV/c^2 peaks. Again the extreme peaks, at 2092 and 2353 MeV/c^2 are not seen because of a restriction imposed on slow proton length and the lack of energy, respectively. Thus at high energies of incident particles the Λp invariant mass spectra reveal five enhancements: at 2092 MeV/c^2, due to the negative sigh low energy scattering length effect, at 2128 MeV/c^2, due to two-body Λp resonance /2/ and at 2183,2256,2353MeV/c^2, which are far from thresholds and can be considered as good candida-

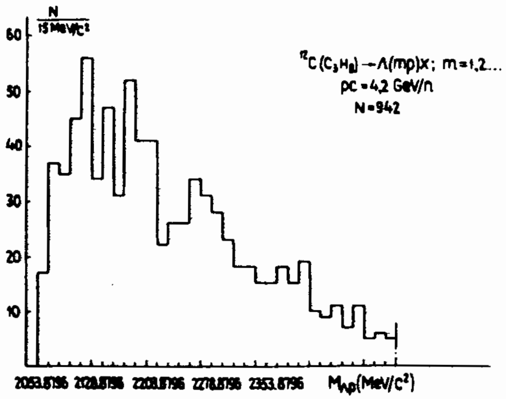

Fig.5.

tes for strange, six-quark resonant states. According to the second fundamental hypothesis, the intensity of resonance peak must depend on the momentum corresponding to the maximum of the Λ-hyperon momentum spectrum. If such a mechanism is true, one can **easily** see that with increasing the incident particle momentum, the maximum of this spectrum has to tend to higher momenta. In turn, in the invariant mass spectra, it has to reduce the intensity of smaller mass resonances and to increase the intensity of higher mass ones. The facts set here seem to demonstrate the correctness of these ideas. It is noteworthy an old suggestion of a Λp(2360) resonance /7/, close to Λp(2354) of this paper. This information, issued from A.Wetherell, attained the author through the mediation of P.Sonderegger. Thanks are due to them.

The $\Lambda p\pi$-dibaryons (I=3/2,1/2, Y=1,B=2,S=-1)

The simplest dibaryon resonance of hypercharge Y=1, undergoing three-particle decay has been searched for in the $\Lambda p\pi^{\pm}$ invariant mass spectrum from interactions of incident neutrons with quasi-free neutrons and free- and quasi-free protons (total electric charge Q=0 and Q=1, respectively,"nucleon-like" events). The final states of both Q=0 and Q=1 total charges contained protons of $p_p \leq 1.0$ GeV/c momenta. Fig. 6a represents the $\Lambda p\pi^{\pm}$ mass spectrum due to all combinations $\Lambda p\pi^{\pm}$ + $\Lambda p+$, with positive unidentified particles of $p_+ > 1.0$ GeV/c assumed to be π^+-mesons. This is a plausible assumpion, because it can be shown that only a small admixture of K^+ with momenta p>1.0 GeV/c should be expected in this sample. A **prominent** peak near 2500 MeV/c^2 is clearly seen. Fig.6b represents $\Lambda p\pi^{\pm}$ mass spectrum with no more than one doubly positive or neutral $\Lambda p\pi$ combinations. The rejection of extra combinations rather evenly lowers the spectrum and the peak survives /1/. The $\Lambda p\pi^{\pm}$ mass spectrum of fig.6c is contributed to by $\Lambda p\pi^{\pm}$ combinations with identified positive pions, **i.e.**, with momenta $p_{\pi+} \leq 1.0$ GeV/c. Finally, the spectrum of fig.6d is made up of $\Lambda p\pi^{\pm}$ combinations with both positive and negative pion momenta restricted to 1.0 GeV/c. The peak survives in both later cases. Three kinds of background were considered. 1) The background due to combinations of Λ, p, $\pi^{\pm}$ from various stages of intranuclear cascade processes. It was imitated by the invariant mass spectrum of chance combinations of Λ, π^+ and π^- from another sample of nucleon-like events, without seen protons, with the protons of the fundamental sampleof nucleon-like events.2)The phase space volume distributions

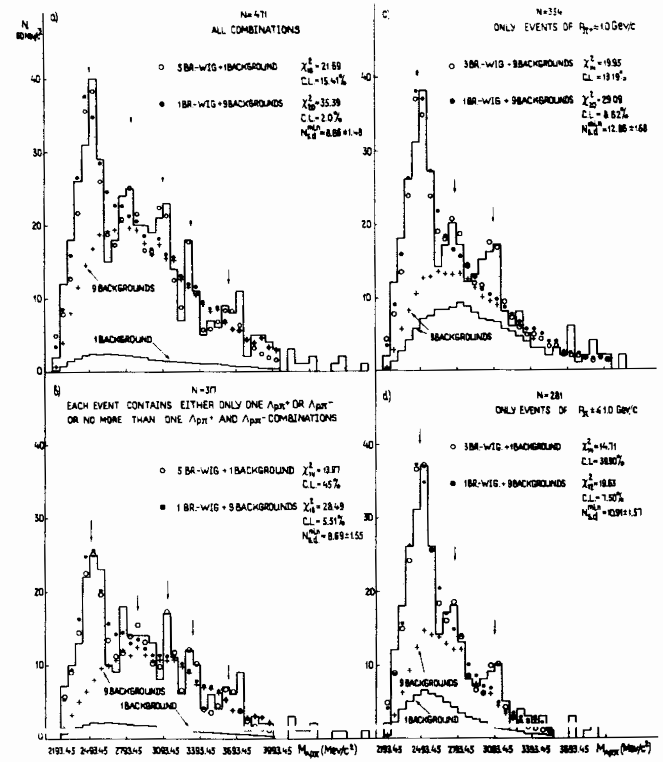

Fig.6.

for $\Lambda N \rightarrow \Lambda p(m\pi)$; m=1,2,3,4 reaction channels, proceeding on bound nucleons. 3) The phase space volume distributions for nN $\rightarrow \Lambda pK(m\pi)$; m=1,2,3,4 reaction channels, proceeding on bound nucleons. All restrictions, imposed on particle momenta in the real experiment were taken into account both in 2) and 3) backgrounds. Let us stress that the maxima of both 2) and 3)backgrounds are more shifted towards the peak observed, than it would be in the case of the OBE model background. Thus the use of phase space volume distributions lowers the significance of possible resonance peaks. The analysis included the description of the $\Lambda p\pi^{\pm}$ mass spectrum by the combinations of various numbers of Breit-Wigner resonances and the background channels /1/. Each component of the combination entered the $\chi^2_{n_D}$-functional with its own weight, which had to be determined together with the resonance parameters, masses and widths. Five hypotheses were tested for each of histograms of fig.6.

1) Nine-component background, no resonances - not significant.
2) Only resonances, no background at all - significant.
3) Only one resonance, no background - not significant.
4) Several resonances, not all kinds of background - significant.
5) Only one resonance and nine-component background - significant.

The significance of the last hypothesis is the lowest among the three significant ones. The best-fit parameters for the Bret-Wigner resonance of fig.6c are $M=(2495.2\pm8.7)MeV/c^2$, $\Gamma=(204.7\pm5.6)$ MeV/c^2 its significance defined by $N_{sd}=12.86\pm1.68$ and production cross section per carbon nucleons is $\sigma=(70.5\pm15.0)$ μb . This peak can be considered as a good candidate for a six-quark $\Lambda p\pi$ -dibaryon. The course of analysis of $\Lambda p\pi$ mass spectra differed from that of Λp mass spectrum, first because here there is only one peak, deserving this name and, secondly, there are not yet available auxiliary experiments, as were the ones on Λp elastic scattering cross section measurement, with respect to the fundamental experiment - the Λp invariant mass spectrum.

$\Lambda\pi^+\pi^+$-baryons (I=2, Y=0, B=1, S=-1)

A search for $\bar{q}q^4$ baryons of strangeness S=-1 has been undertaken in a sample of nucleon-like events without seen protons. All positively charged particles of $p_+ > 1.0$ GeV/c were assumed to be π^+-mesons. The $\Lambda\pi^+\pi^+$ invariant mass spectrum (fig.7) was fitted by a combination of seven Breit-Wigner resonances and 1) a background due to the phase space volume distributions for reaction channels $nN \to NK(m\ )$; m=1,2,3,4 and 2) a background due to hyperons and pions from

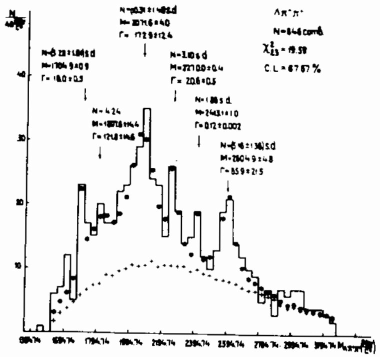

Fig.7.

different stages of intranuclear cascade processes. The best-fit parameters of resonances the numbers of standard deviations and resonance production effective cross sections per carbon nucleus are shown in the table. In the $\Lambda\pi^-\pi^-$-invariant mass spectra there are also enhancements (not significant) close to the bag model masses.

Conclusions

Below are shown results on candidates for possible multiquark resonant states. Good agreement with the MIT Bag Model predictions on resonance masses should be stressed.

I. Strange dibaryons-candidates for q^6-states

1. Λp(I=1/2, Y=1, B=2, S=-1)

M (MeV/c^2)	Γ (MeV/c^2)	Significance ($N_{st.dev.}$)	σ prod. (μb)	Bag model predictions M (MeV/c^2)	JP
2255.2±0.4	16.9±2.3	8.05±1.32	85.3±20.0	2241	2^+
2354.3±0.7	56.1±5.0	6.25±1.25	65.0±17.0	2353	2^-
2183.2±0.6	3.7±0.7	5.56±1.23	60.0±15.0	2169	1^+

2. $\Lambda p\pi$ (I=3/2, 1/2, Y=1, B=2, S=-1)

M (MeV/c^2)	Γ (MeV/c^2)	Significance ($N_{st.dev.}$)	σ prod. (μb)	Bag model predictions M (MeV/c^2)	JP
2495.2±8.7	204.7±5.6	12.86±1.68	70.5±15.0	2500	$0^-,1^-,2^-$

II. Strange exotic baryons-candidates for $\bar{q}q^4$-states - $\Lambda\pi^+\pi^+$

M (MeV/c^2)	Γ (MeV/c^2)	Significance ($N_{st.dev.}$)	σ prod. (μb)	Bag model predictions M (MeV/c^2)	JP
1704.9±0.9	18.0±0.5	5.3±1.6	19.0±0.6	1710	$1/2^-$
2071.6±4.0	172.9±12.4	10.3±1.5	88.0±27.0	2120	$1/2^-$
2604.9±4.8	85.9±21.5	5.2±1.4	31.9±9.0	2615	$3/2^-$

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Шахбазян Б.А. Мультикварковые резонансные состояния   Е1-82-446

Исследованы инвариантные спектры масс сорока девяти систем в широком диапазоне гиперзаряда, странности и барионного числа. Резонансные пики обнаружены только в спектрах инвариантных масс систем с $Y \leq 1$. Кандидатами в шестикварковые дибарионы следует считать резонансные состояния Λp 2183, 2255, 2354 МэВ/c^2 и $\Lambda p\pi$ 2495 МэВ/c^2. Было найдено еще три кандидата в $\bar{q}q^4$ состояния $\Lambda\pi^+\pi^+$ 1705, 2072, 2605 МэВ/c^2. Массы всех этих кандидатов находятся в хорошем согласии с предсказаниями модели мешков МИТ. Напрашивается правило отбора по гиперзаряду: "Гиперзаряд адронных резонансов в слабых гравитационных полях не может превышать единицы: $Y \leq 1$".

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Shahbazian B.A. Multiquark Resonant States   E1-82-446

The invariant mass spectra of forty nine hadronic systems with hypercharge, strangeness and baryon number, varied in wide limits have been studied. Resonance - like peaks have been found in the invariant mass spectra of $Y \leq 1$ systems only. Candidates for six-quark dibaryons should be considered Λp 2183, 2255, 2354 MeV/c^2 and $\Lambda p\pi$ 2495 MeV/c^2 resonant states. Three more candidates for $\bar{q}q^4$ states were found $\Lambda\pi^+\pi^+$: 1705, 2072, 2605 MeV/c^2. The masses of all these candidates are in good agreement with MIT Bag Model predictions. A hypercharge selection rule is suggested: "The hypercharge of hadronic resonances in weak gravitational fields cannot exceed one $Y \leq 1$".

The investigation has been performed at the Laboratory of High Energy Physics, JINR.

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