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ON THE LOW ENERGY Λ_p SCATTERING

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ON THE LOW ENERGY Λp SCATTERING

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К вопросу о Λp -рассеянии при низких энергиях

Показано, что особенности, наблюдавшиеся в спектрах эффективных масс Λp, могут быть обусловлены особенностями в сечениях упругого рассеяния Λp при низких энергиях.

Препринт Объединенного института ядерных исследований.
Дубна, 1974

Shahbazian B.A., Timonina A.A., Kalinina N.A. **E1 - 7669**

On the Low Energy Λp Scattering

It is shown that the enhancements observed in the Λp effective mass spectra [1] may be due to those in Λp elastic scattering cross sections.

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In recent experiments it was shown [1] that the Λp effective mass spectra obtained in neutron- ^{12}C and $\pi^- - ^{12}C$ collisions at 7.0 GeV/c and 4.0 GeV/c moments, respectively, revealed narrow peaks at 2058 MeV/c^2, 2127 MeV/c^2 and 2251 MeV/c^2.

The first peak is due to negative Λp scattering length.

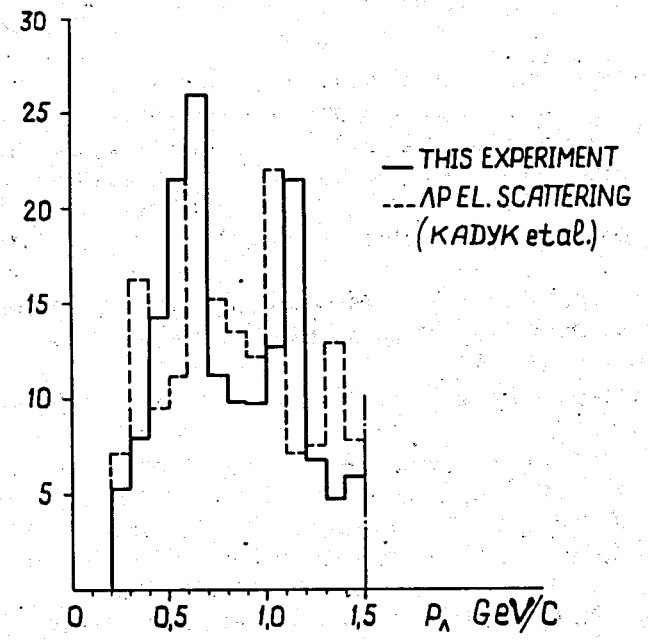
The second one was ascribed either to Λp resonance or to a negative scattering length of Σp with subsequent conversion $\Sigma N \to \Lambda p$.

The third peak was treated as a Λp resonance at 2251 MeV/c^2.

The fact of observing the Λp effective mass spectra of similar forms with peaks of the same masses irrespective of the nature and energy of incident particles bombarding the carbon nucleus, suggests a mechanism of their formation which is due to the immediate Λp interaction. Namely, due to a high density of the nuclear matter a Λ-hyperon created in a nucleus can interact with a bound proton of the same nucleus, and both particles can leave it without subsequent collisions.

As far as our experiments cover the low mass part of the total Λp effective mass spectrum, it means that according to the adopted mechanism the experiments select the low energy Λp interaction which is predominantly Λp - elastic scattering. Then the observed enhancements should reveal themselves in the Λp elastic scattering cross section.

In order to compare our results with the existing low energy Λp elastic scattering data, i) we have subtracted the estimated background [1] from the experimental Λp effective mass spectrum (the $n\,^{12}C$ experiment, P_n = 7.0 GeV/c); ii) the residual Λp effective mass spectrum was transformed into the incident momentum distribution in the rest system of the target proton; iii) the resulting histogram was then compared to the histogram of incident Λ-hyperons undergone elastic scattering on protons [2] (the area under histogram was normalized). The result is shown in the figure.



The solid line presents our result, the dashed-line histogram corresponds to the Λp elastic scattering.

Although the statistics in the Λp elastic scattering experiment [2] is insufficient (175 events) and the lower bound on Λ-momentum is rather high (200 MeV/c), which forced us to omit the corresponding part of our Λp effective mass spectrum, the second and third enhancements

on both histograms are clearly seen at nearly the same corresponding momenta.

We have drawn the following conclusions.

1. These preliminary results show that the enhancements in the Λp effective mass spectra at 2127 MeV/c^2 and 2251 MeV/c^2 may be formed in the Λp elastic scattering channel, i.e., the cross section of the Λp elastic scattering at $P_\Lambda \approx 650$ MeV/c and $P_\Lambda \approx (1000 \div 1200)$ MeV/c reveals resonances.

2. Besides, our results indicate that in some cases the nucleus can be used as an effective high density proton target in difficult experiments on low energy unstable particle scattering on protons.

References

1. B.A.Shahbazian, A.A.Timonina, N.A.Kalinina. Lett. Nuovo Cim., 2, 63 (1973).
2. J.A.Kadyk et al. Nucl.Phys., B27, 13 (1971).

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