ԵՐԵՎԱՆԻ ՖԻԶԻԿԱՅԻ ԻՆՍՏԻՏՈՒՏ
ЕРЕВАНСКИЙ ФИЗИЧЕСКИЙ ИНСТИТУТ

ԳԻՏԱԿԱՆ ՀԱՂՈՐԴՈՒՄ НАУЧНОЕ СООБЩЕНИЕ

Scientific Report ЕФИ-213(5)-77

L.A. GRIGORYAN, V.A.SHAKHBAZYAN

p ^{4}He AND $\bar{p}^4$He ELASTIC SCATTERINGS IN QUASIEIKONAL MODEL OF COMPLEX MOMENTA THEORY

АРУС

ԵՐԵՎԱՆ 1977 ЕРЕВАН

YEREVAN PHYSICS INSTITUTE

Scientific Report ЕФИ-213(5)-77

L.A. GRIGORYAN, V.A.SHAKHBAZYAN

$p\,^4He$ AND $\bar{p}\,^4He$ ELASTIC SCATTERINGS IN QUASIEIKONAL MODEL OF COMPLEX MOMENTA THEORY

Yerevan, 1977

In the preceding publications [1,2] the detailed explana - tion of the possibility to describe the inelastic screening phenomena in a ^4He nucleus by means of shower enhancement coefficients of the quasi-eikonal model [3] of the complex momenta theory was presented. The main idea is that in the Serpukhov energy range the showers are emitted mainly in the hadron-pomeron verticies [4]. This opens the possibility to construct the quasi-eikonal model for the ^4He nucleus, in which the shower enhancement and inelastic screening are treated in the unified manner [1,2]. Of course, such a procedure is applicable only for light nuclei, for which effects of "coalescense" of Reg - geon ladders [5] and effects of longitudional transfer momenta [6] may be neglected. As is shown in Ref. [7] both the first and the second ones may be neglected, when the condition $\frac{p}{m^2} \gg R$ takes place (p is the momentum of an incident particle and R is the radius of a nucleus). As the radius of ^4He is nearly between 6 and 7 $(GeV)^{-1}$, we can expect that at energies of incident particles already above 20 GeV the above mentioned condition begins to be fulfilled.

Now, if we want to describe the elastic scatterings of proton and antiproton on ^4He nucleus, we may take into account only P-, P' and ω -trajectories. We don't write down rather combersome formulae, which are analogious to the formulae of Refs [1,2], and immediately present and discuss results of the numerical calculations. In the fig. 1 are plotted the theoretical curves of differential cross-sections for the process $p + {}^4He \to p + {}^4He$ at energies of an incident proton equal to 24 GeV and 50 GeV. The shower enhancement coefficients obtained in refs [3, 8] are used. Both the solid line and the dashed line are obtained in the quasi-eikonal model. The difference between two curves is due to the procedure of the description of a shower arising when incident proton rescatters on <u>different</u> nucleons of the nucleus. The solid line corresponds to the case when the shower is produced only in the incident proton - pomeron vertex. The dashed line corresponds to the case when the shower is produced both in the incident proton-pomeron vertex and in the vertex of the interaction of a pomeron with the nucleon of the nucleus. It should be stressed that rescatterings on the same nucleon are taken into account so as in ref. 3. The both curves are plotted to demonstrate how the value of inelastic screening is changeable in the framework of the quasi eikonal model. In fig. 2 the theoretical curves for the process $\bar{p} + {}^4He \to \bar{p} + {}^4He$ are plotted at the same energies of an incident antiproton. The fig. 3 demonstrates the comparision of the calculated curves of differential cross-section for the proton-^4He elastic scattering at E_{lab} = 24GeV with the experimental

data of ref.[9]. In fig. 4 the total cross-sections of the proton-^4He and antiproton-^4He interactions are plotted. The solid and the dashed lines in figs 2-4 have the same meaning as those in fig. 1. The parameters of the nucleon distribution in the ^4He nucleus are taken from the ref.[10].

As is seen from fig. 3 the quasieikonal model is in a rather good accordance with the experimental data. It should be stressed that we have <u>not</u> introduced any additional parameters to fit the experimental data. Our consideration is valid in the transfer momenta interval nearly $0 \div 0,3(\frac{GeV}{c})^2$ because we have neglected the spin-flip amplitudes and effects connected with the nuclear structure. Both solid and dashed lines are normalized by the experimental value at $/t/ \equiv \tau = 0,27(\frac{GeV}{c})^2$. We can see, that the accordance between the quasi-eikonal model predictions with the experimental data in the case of the minimum value of inelastic screening (solid line) is better than that in the case of the maximum value of inelastic screening (dashed line).

Considering the results of this paper together with the results of Refs. [1, 2] we can say, that the quasi-eikonal model may be treated as "quasi-eikonal approximation" of the complex momenta theory, which is valid for the Serpukhov energy range not only for hadron-nucleon collisions, but also for collisions of hadrons with light nuclei.

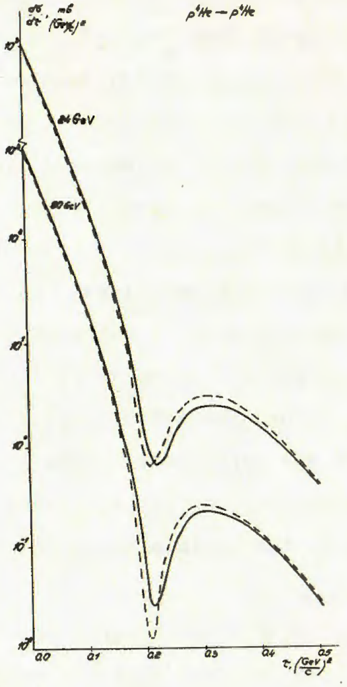

Fig. 1

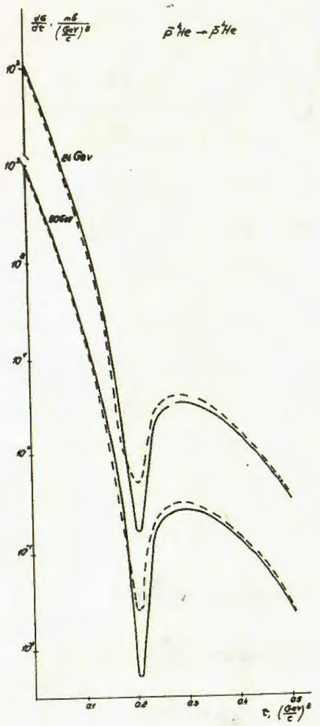

Fig. 2

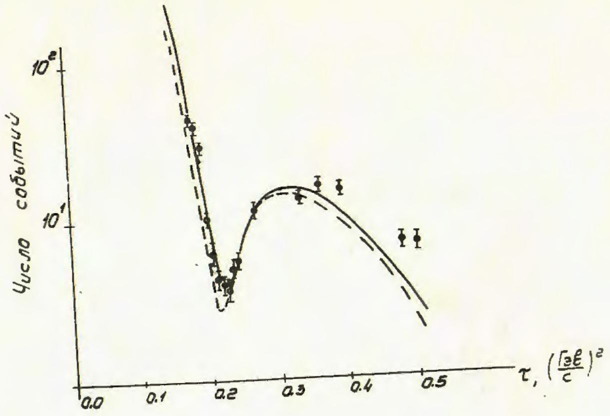

Fig. 3

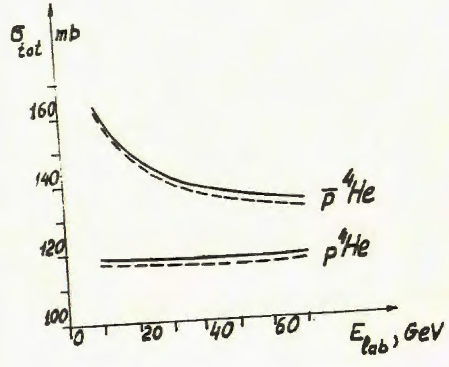

Fig. 4

References

1. L.A.Grigoryan, V.A.Shakhbazyan, Scientific Report EFI-182(28)76, Sov. J. Nucl. Physics, in press.
2. L.A.Grigoryan, V.A.Shakhbazyan, Scientific Report EFI-183(29) 76
3. K.G.Boreskov, A.M.Lapidus, S.T.Sukhorukov, K.A.Ter-Martirosyan, Yader. Fiz., 14, 814 (1971).
4. V.N.Gribov, JETP, 56, 892 (1969).
5. O.V.Cancheli, Pisma v JETP, 18, 465 (1973)
6. V.N.Gribov, JETP, 57, 1306 (1969).
7. J.Koplik and A.H.Mueller, Phys.Rev. 12D, 3638 (1975)
8. A.B.Kaidalov, Sov. J.Nucl.Phys., 13, 401 (1971).
9. Clermond-Ferran-Lyon-Strasbourg Collabor. Submitted to the Second Intern. Conf. on Elementary Particles, Aix-en-Provance, France, Sept. 6-12 (1973).
10. G.I.Lykasov, A.V.Tarasov, Sov. J.Nucl.Phys. 17, 301(1973).

The manuscript was received
December 13, 1976

Л.А.ГРИГОРЯН, В.А.ШАХБАЗЯН

УПРУГОЕ РАССЕЯНИЕ p^4He И $\bar{p}^4He$ В КВАЗИЭЙК
НАЛЬНОЙ МОДЕЛИ ТЕОРИИ КОМПЛЕКСНЫХ
МОМЕНТОВ

(на английском языке)

Ереванский физический институт

Тех.редактор А.С.Абрамян

Заказ 812 ВФ-03121 Тираж 29

Подписано к печати 7/П-77г. Формат издания 30х4
0,7 уч.изд.л.Ц 5 к.

Издано отделом научно-технической информации
Ереванского физического института ,Ерева 36,пер.М
каряна 2.