On the Pre-asymptotic Mode in Hadron Elastic Scattering.

S. M. Troshin, N. E. Tyurin and O. P. Yushchenko

Institute for High Energy Physics - Serpukhov, USSR

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Summary. — The pre-asymptotic behaviour of total and elastic cross-sections is considered on the basis of the quark model for the $U$-matrix.

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The analysis of the experimental data on hadron elastic scattering up to the energy $\sqrt{s} = 546$ GeV (1) shows that in the transition from the ISR to SPS$p\bar{p}$ energies the ratios $\sigma_{el}(s)/\sigma_t(s)$ and $B(s)/\sigma_t(s)$ vary with the energy:

<table>
<thead>
<tr>
<th>$\sqrt{s}$ (GeV)</th>
<th>$\sigma_{el}/\sigma_t$</th>
<th>$B/\sigma_t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>20÷60</td>
<td>0.175 ± 0.006</td>
<td>0.120 ± 0.003</td>
</tr>
<tr>
<td>546</td>
<td>0.215 ± 0.005</td>
<td>0.096 ± 0.002</td>
</tr>
</tbody>
</table>

This allows one to conclude that at accessible energies the rise of total and elastic cross-sections, as well as the slope parameter for $-t = 0$ is of pre-asymptotic nature.

Indeed, the majority of the dynamic models predict the asymptotic dependence $\sigma_t^{(\infty)}(s) \sim \ln^2 s$. But the use of this form for a total cross-section implies that $\sigma_{el}(s) \sim \ln^2 s$ and the ratios $\sigma_{el}/\sigma_t$ and $B/\sigma_t$ are energy independent. In fact, the new experimental data show these ratios to have an evident energy

dependence at the energies available. Consequently, at modern energies the scattering picture is pre-asymptotic. It seems important to study the interaction dynamics and analyse of the experimental data in the framework of various dynamic models.

In this paper we analyse the preasymptotic effects in elastic scattering on the basis of the quark model for the $U$-matrix (2).

We shall consider now the main experimental regularities of elastic scattering and the total cross-sections behaviour in hadron interaction. The most prominent fact about the cross-section is the rise of total cross-sections in the interactions of various hadrons. Assuming the cross-sections of $pp$ and $p\bar{p}$ interactions to coincide at the SPS$p\bar{p}$ energy and taking into account that $\sigma_t(p\bar{p}) = (61 \pm 3) \text{mb}$, one may conclude by analysing the data at $\sqrt{s} =$

![Graph](image)

Fig. 1. — The comparison of the dependence $\sigma_t(s) = \sigma_0(1 + a\sqrt{s})$ with the data on total cross-sections of $pp$ interactions.