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- ²⁰It is interesting to compare this ratio (5.34) with that (1.45) from (12) based on SU(6) symmetry [$(f_\omega/f_\rho) = 3$]. The discrepancy may be attributed to the failure of the VDM in the scaling region.
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Consistency of New Meson-Nucleon Elastic Scattering Data with a Previously Conjectured Universal Curve*

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We show that important new large- t π^+p data at $p_L = 13.8$ and 22.6 GeV/ c are in good agreement with a universal curve suggested last year.

Recently a detailed experimental study¹ of elastic pion-proton scattering was made at large energies ($p_L = 13.8$ and 22.6 GeV/ c) over a substantial part of the forward scattering region [$|t| \lesssim 5$ (GeV/ c)²] in order "to determine if the shapes and magnitudes of the cross sections are approaching limiting values as the momentum increases."¹ In this note we will show that these new data are in close agreement with an apparently universal curve for meson-nucleon scattering which was found last year in a study² of the high-energy ($p_L \gtrsim 5$ GeV/ c) elastic data then available. At that time it was shown that existing forward and backward data fell on a simple curve if cross sections normalized to unity at $t=0$,

$$f = \frac{d\sigma}{dt} / \left(\frac{d\sigma}{dt} \right)_{t=0}, \quad (1)$$

were plotted versus the dimensionless variable

$$\tau = -bt(s+t)/s, \quad (2)$$

where $b(s)$ is the slope of the forward peak [$|t| \lesssim 0.5$ (GeV/ c)²] appropriate to the reaction and energy. The angular regions which fell on the universal curve were defined by $|t| \lesssim 3$ (GeV/ c)² in the forward region and $|u| \lesssim 1$ (GeV/ c)² in the backward region. The quadratic character of the variable τ reflects the backward peak onto the forward peak. The universal character of the curve was expected to become even more evident at higher energies. If this curve is valid, a large body of existing data has been reduced to a determination of two quantities of obvious geometrical (optical) significance, b and σ_t (which fixes $d\sigma/dt|_{t=0}$ via the optical theorem, assuming the real part of the forward amplitude is small).

The recent high-energy forward-region data of Cornillon *et al.*¹ give strong additional support to

the universality of the curve. Figure 1 shows a plot of their π^-p data at $p_L = 13.8$ and 22.6 GeV/c in the manner described above compared with the conjectured curve of Fig. 1 in Ref. 2. The agreement for values of $|t| \lesssim 3$ (GeV/c)² over six decades is striking. The points not on the curve at large τ are beyond the boundary of the curve's validity at $t \cong 3$ (GeV/c)².

In order to plot the data in Fig. 1 we used³ $\sigma_T = 26$ mb at $p_L = 13.8$ GeV/c and $\sigma_T = 25$ mb at $p_L = 22.6$ GeV/c. In both cases the slope parameter was taken to be 7.5 (GeV/c)⁻², consistent with the data.

The disappearance of the dip at $t \approx -0.8$ (GeV/c)² and the appearance of a marked change in slope are in good agreement with the piecewise exponential character of the universal curve which has a break at $\tau \approx 5$.

In addition Cornillon *et al.* noted that the data between $1 < -t < 3$ (GeV/c)² cannot be simply fitted with a Regge parametrization. The conjectured curve of Ref. 2 provides a simple parametrization of meson-nucleon data and is apparently applicable where naive Regge theory is not. The authors feel that the data are displaying a geometrical character which (considering that the regularity is only observed in the forward and backward regions) may be understood within the framework of an optical model.

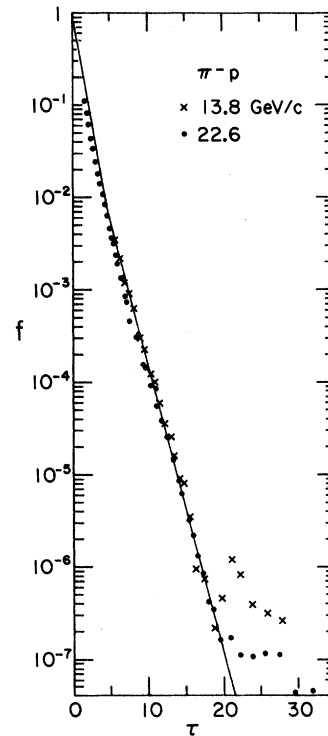


FIG. 1. A plot of new π^-p data taken from Ref. 1. The solid line is a reproduction of the previously conjectured universal curve shown in Fig. 1 of Ref. 2.

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