

Chou-Yang model and predictions for high-energy pion-deuteron scattering

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Abstract. Using fits to the available data on the pion and deuteron electromagnetic form factors and the Chou-Yang model, the computed values of differential cross-sections for high-energy pion-deuteron elastic scattering agree reasonably well with the available experimental data. Whereas only a shoulder is expected to appear up to energies of several hundreds of GeV, a dip and a secondary maximum are predicted to be conspicuous only for $P_{\text{lab}} \geq 400$ GeV/c. The position of the dip starts at a much lower value, $|t_d| \approx 0.5-0.6$ GeV², as compared to the corresponding position in the pp scattering. The positions of the first dip are plotted against total cross-section which can be verified by future high-energy experiments. Limitations of the model predictions for ultrahigh energies are pointed out.

Keywords. Chou-Yang model; hadron-nucleus scattering; pion-deuteron scattering.

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1. Introduction

Until about six years ago, the Chou-Yang model (Chou and Yang 1967, 1968, 1979; Durand and Lipes 1968; Clarke and Lo 1974; Kac 1973; Chan *et al* 1978) with the Hayot-Sukhatme modifications (Hayot and Sukhatme 1974) was considered to provide an excellent description of the elastic hadron-hadron scattering at high energies including the forward diffraction peak and the dip regions. Besides simplicity, another aesthetically appealing feature of the model is its proposed ability to provide total and differential cross-section values in terms of the interaction strength and the electromagnetic charge form factors of the colliding hadrons. However, critical analyses of the available experimental data at CERN ISR and $\bar{p}p$ collider energies have revealed several shortcomings of the model: For pp scattering with $P_{\text{lab}} \geq 400$ GeV/c, the proposed factorization hypothesis for the eikonal, as two separate functions of the impact parameter (b) and the centre of mass energy $[(s)^{1/2}]$, breaks down, and the inelastic overlap function differs significantly from the model prediction (Amaldi and Schubert 1980). Also the standard Chou-Yang model fails to account for the observed slope-break at $|t| \approx 0.1$ GeV². Similar deficiencies of the model have also been noted in the case of $\bar{p}p$ scattering and new forms of the eikonal have been suggested for

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