

Variation of average charged particle multiplicity in p -nucleus interactions with energy and the two component description of particle production at high energies

G L KAUL, S K BADYAL, I K DAFTARI, V K GUPTA, B KOUR,
L K MANGOTRA, Y PRAKASH, N K RAO, S K SHARMA and
GIAN SINGH

Department of Physics, University of Jammu, Jammu Tawi 180 001, India

MS received 28 May 1980; revised 26 August 1980

Abstract. Experimental data on average shower particle multiplicity ($\langle N_s \rangle$) accumulated on p -nucleus interactions in the wide momentum region of 7.1–8000 GeV/c is investigated. It is observed that $\langle N_s \rangle$ is represented exceedingly well as a function of (νS) . There are two physical processes which represent the experimental data reasonably well in the two momentum regions viz 7.1–67.9 GeV/c and 67.9–8000 GeV/c. $\langle N_s \rangle = a(\nu S)^a + b$ fits the data in the low momentum region, whereas $\langle N_s \rangle = a + b \ln(\nu S)$ fits the experimental data in the high momentum region. The two physical processes are unified and represented by a single equation which is shown to be the consequence of two component theory and collective models.

Keywords. Proton-nucleus collisions; charged particle multiplicity; collective models; two component theory.

1. Introduction

Multiparticle production in hadron-nucleus interactions at high energies has been extensively studied in the recent past both at accelerator energies (upto ~ 400 GeV) and at cosmic ray energies. Following the calculations of Glauber (1967), the hadron-nucleus interactions can be regarded as superposition of successive independent hadron-nucleon interactions. This has been used by various authors to study the space-time development (Gottfried 1973) of particle production processes. It was hoped that hadron-nucleus studies would help in discriminating between various models of hadron-nucleon interactions (Fermi 1950, 1951; Belencki and Landau 1956; Satz 1965; Berger and Krizwicki 1971; Muller 1970). In addition, various models for hadron-nucleus interactions have also been proposed (Dar and Vary 1972; Berlad *et al* 1976; Gottfried 1973; Anderson and Otterlund 1975; Babecki 1976; Afekh *et al* 1976) which in general are extensions of the models of hadron-hadron interactions. A detailed comparison of the systematics of various multiparticle production parameters between hadron-hadron and hadron-nucleus interactions is, therefore, necessary to understand the physical picture of the interaction.

It is observed that the mean charged particle multiplicity, $\langle N_s \rangle$ or the normalised mean multiplicity $R_{em} (= \langle N_s \rangle / \langle N_{ch} \rangle$, where $\langle N_{ch} \rangle$ is the average charged particle multiplicity in p - p collisions) is one of the most extensively studied parameter in