KNO Type Scaling of Secondary Charged Particles Produced in 4.5 a GeV ^{12}C-nucleus collisions

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Introduction

Study of the secondary charged particles produced in heavy ion collisions is attracting a great deal of attention during the recent years[1].it is reported that the multiplicity distribution of secondary charged particles produced in high energy hadron-hadron and hadron-nucleus collisions Obey Koba, Nielson and Olesen(KNO) scaling[2].However, no attention has been paid to study the nature of the multiplicity distribution of secondary charged particles produced in relativistic heavy ions reactions.Thus,an attempt has been made to study the multiplicity distribution of secondary charged particles produced in 4.5 A GeV ^{12}C-nucleus interactions.

Experimental Result and Discussion

The integral multiplicity distribution of different charged secondaries produced in ^{12}C-nucleus interactions at 4.5 A GeV is exhibited in Figs 1-4, as is evident from the figure, the data points are represented extremely well by the expression

$$dn/dN_h = \beta \exp(-\alpha N_h) \qquad (1)$$

It is evidently clear from the figure that the integral multiplicity distributions of secondary charged particles exhibit a KNO type scaling behavior. The values of the parameter α occurring in eq. (1) are found to be 0.02 ± 0.02, 0.20 ± 0.06, 0.078 ± 0.02 and 0.133 ± 0.03 respectively for grey,Ng,black,Nb, relativistic charged particle, Ns and heavily ionizing particles,Nh multiplicity distributions. The respective values of parameter β are 12.17 ± 0.23, 18.43 ± 0.16, 7.91 ± 0.11 and 13.39 ± .38 .Figure 5 shows the integral frequency distribution of heavily ionizing tracks, Nh produced in 4.5 A GeV C-nucleus interactions.In this figure, five distinct straight lines denote the integral multiplicity for all the events (in general). The first line (Nh=0-1) includes all interactions with hydrogen nuclei (H), while the second line corresponds to interaction with CNO nuclei in addition with peripheral collisions with AgBr nuclei. The third and fourth line represents certain phenomenon as a superposition between central collisions with Br nuclei and peripheral interactions with Ag nuclei. However, the fifth line is due to the central collisions of carbon projectile with Ag nuclei. It is found that for ^{12}C-nucleus interactions the collisions with the CNO groups of nuclei are contained in the range Nh < 7 and beyond this range the interactions occur solely with heavy group of emulsion nuclei (AgBr). Similar results is also obtained by Jilany et al [3] in 4.5 A GeV ^{24}Mg-emulsion interactions.

Conclusion

The problem of separating the interactions with H, CNO and AgBr group is difficult [4]. Thus, the number of heavily ionizing particles, Nh emitted from the target nucleus may be an important parameter for separating the events caused by the projectile in different target nuclei. It is also easy to obtain experimentally.

References

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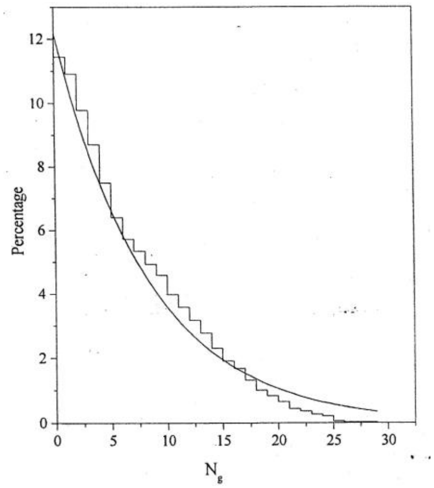

Fig 1.Integral multiplicity distribution of Ns

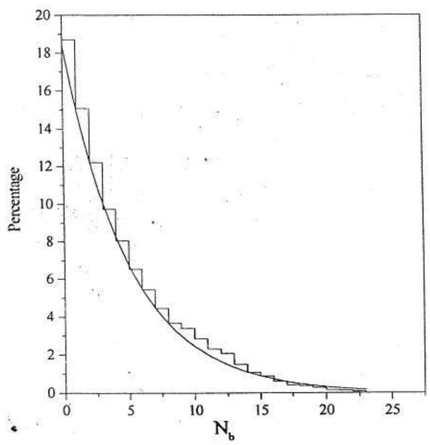

Fig 2.Integral multiplicity distribution of Nb

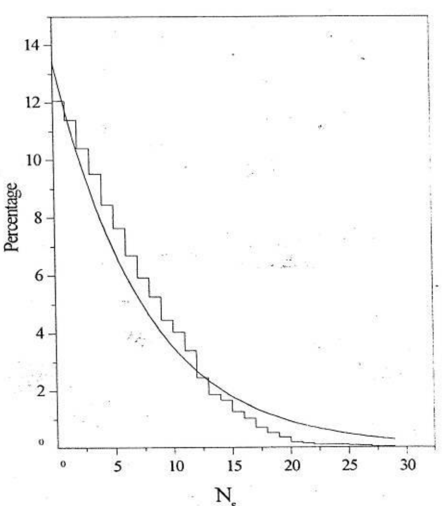

Fig 3.Integral multiplicity distribution of Ng

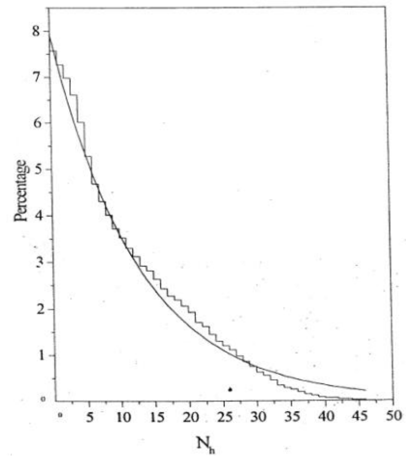

Fig 4.Integral multiplicity distribution of Nh

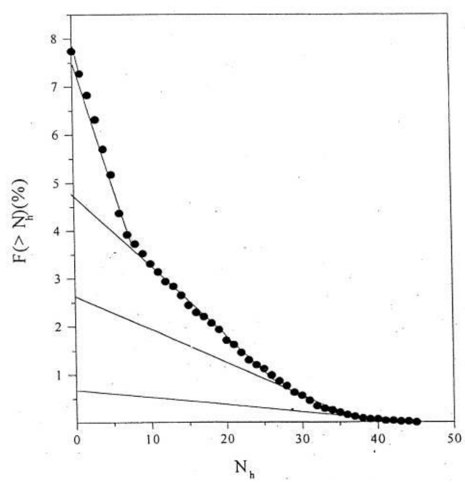

Fig 5.Integral frequency distribution of Nh