EVOLUTION OF CHARGE YIELD DISTRIBUTION WITH THE VIOLENCE OF COLLISIONS IN THE Pb MULTIFRAGMENTATION

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The reaction mechanism which produces multifragmentation of heavy nuclei is still an unsolved problem in despite of much theoretical and experimental work dedicated to it in the last few years. One of the main reasons for this is that the bulk of the available data originates from the one - particle inclusive measurements. In our experiment we examined the multifragmentation reaction channel in the 8.8 GeV $^{4}He+^{208}Pb$ interaction. We used CR-39 plastic track detector for this purpose. In this measurement it was possible to record all fragments, with charge numbers $Z\geq 2$, produced in a single interaction and to determine their charge numbers. We separated and analyzed the events having at least three fragments with $Z>2$. Our study included 803 such events. It has been found that about 86.4% of these events have three fragments with $Z>2$, about 7.7% of events have four $Z>2$ fragments and only 1.25% of events have five $Z>2$ fragments.

The sum (Ze) of the charge numbers of emitted light particles ($Z = 1$, $Z = 2$) was deduced by charge conservation for each event. The Ze should increase with the violence of the collision or the excitation of emitting source. In Fig.1. are presented, for events with three $Z>2$ fragents, the charge yields of fragments for various values of Ze. It can bee seen that the yields for small and for large Ze are qualitatively different. In the case of small Ze (gentle collisions) the charge yield has U-shaped form. The ternary events corresponding to the small Ze have one heavy ($Z\simeq 60$) fragment and two light ($Z<30$) fragments. The mechanism of their production could be evaporation or such collision in which only a part of the target is heated to the breaking excitation leaving a region of low excitation in the form of heavy fragment. For larger Ze (more violent collisions) the charge yields do not have U-shaped form. These charge yields are moving towards lower charges with increase of Ze. This shows that it is not correct to explain the mass yield curve by a single reaction mechanism as it has been done in the some analysis of the results of inclusive measurements. The similar conclusion was reached by Aichelin et al[1] in their study of charge yields of projectile fragments from the interaction of 990 MeV/nucleon gold with emulsion nuclei[2].

In Table I are presented the average values of Ze, the average charge (Z_L) of the lightest and the average charge (Z_H) of the heaviest fragment for events with various multiplicity of fragments with $Z>2$.

Table I Average values of Ze, Z_L and Z_H for various $M_{Z>2}$

$M_{Z>2}$	Z_e	Z_L	Z_H
3	48.7	5.4	18.2
4	37.1	4.2	20.9
5	32.4	3.8	21.4

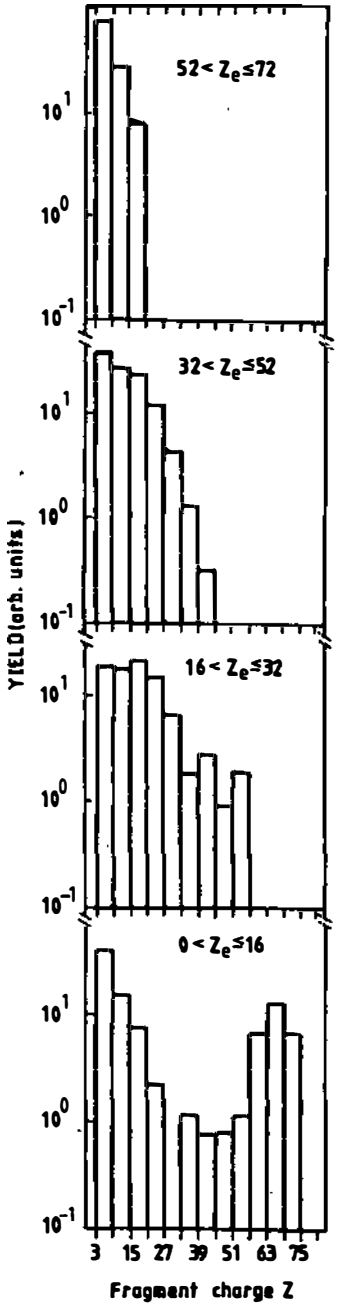

Fig.1. Charge yields of fragments for various values of Z_e for events with three Z>2 fragments.

The peripheral reactions were omitted by the requirement that the largest fragment has Z_H<60. It can be seen that starting from $M_{Z>2}$ = 3 the multiplicity of light particles (Z = 1, Z = 2) decreases with the increase of the multiplicity of fragments with Z > 2.

1. J.Aichelin, X.Campi, Phys. Rev. C34 (1986) 1643
2. C.J.Waddingtan, P.S.Freier, Phys.Rev. C31 (1985) 888.