2 - 28 Critical Behavior of Nuclear Phase Transition

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Nuclear multifragmentation known as a universal phenomenon occurring when a large amount of energy is deposited in a nucleus is a promising process for studying nuclear matter properties at the extreme conditions of high excitation energies, subsaturation densities, and at different isospins. In particular, one hopes to establish its connection to a nuclear liquid-gas phase transition[1]. As was shown in many experiments[2-4], an equilibrated source can be formed in the multifragmentation region. For this reasons statistical models have proved to be very successful in describing the fragment production.

The statistical multifragmentation model (SMM) was used in the study; for a review see Ref. [5]. The break-up density was chosen to be $\rho=\rho_0/6$[6]. A standard value of symmetry energy, 25 MeV, was used in the simulation. The sources with charge number 40 and mass number 80, 100 and 120 were studied, respectively. Fig. 1 shows the mass distribution of secondary cold fragments from an equilibrated source with charge number 40 and mass number 100. From top to bottom panel, the excitation energy increase from 5 to 7 MeV/u. The mass distributions display a power law and were fitted with a power law expression. The τ values of systems with different excitation energies were extracted.

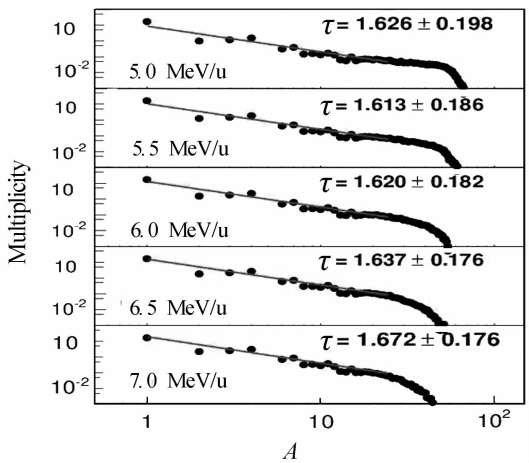

Fig. 1 Mass distribution of secondary cold fragments from an equilibrated source with charge number 40 and mass number 100. • SMM results, — power law fits.

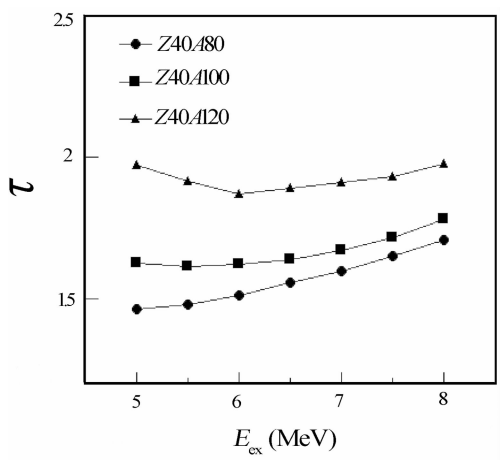

Fig. 2 Extracted τ values as a function of source excitation energy. The different symbols correspond to the equilibrated source with charge number 40 and mass number 80.

In Fig. 2, the Extracted τ values as a function of source excitation energy was plotted. The solid circles, solid squares and solid triangles correspond to the equilibrated source with charge number 40 and mass number 80, 100 and 120, respectively. From the figure, one can see the τ value differs from each other for three systems in the same excitation energy. This may come from the finite size effect. The minimum in the curve suggests the system is at or near the critical point. It shows the excitation energy for critical point increased as the system mass number increases, though the minimum was not included in the excitation energy range of system with charge number 40 and mass number 80.

References

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