Nucleation of Rapidly Expanding Nuclear Matter in Intermediate Energy Nuclear Reactions

A.S. Botvina

Institute for Theoretical Physics, J. W. Goethe University,
D-60438 Frankfurt am Main, Germany

The formation of light nuclei and hypernuclei in the rapidly expanding nuclear matter after intermediate energy nucleus-nucleus collisions is investigated. It is demonstrated that this phenomenon can be explained within the statistical approach by applying the local equilibrium concept. We subdivide the expanding nuclear system into several parts (primary clusters) consisting of nucleons which are close in phase space. The nucleation process takes place inside these clusters, and it can be described as their statistical decay in the coexistence region of the nuclear liquid-gas phase transition [1,2]. This approach is a natural generalization of the well-known compound nucleus concept, and the freeze-out volume concept developed for multifragmentation reactions. The local equilibrium concept allows to explain consistently many experimental data, that was not possible with the statistical models under assumption of global chemical equilibrium. We extend this approach by including the dynamical and statistical stages for the description of the nucleosynthesis in central collisions of relativistic ions. This hybrid model was successfully applied to describe experimental data on both normal nuclei and strange hypernuclei production in the GSI and RHIC-BES energy range [3]. Also the production of double strange hypernuclei and exotic unstable nuclei is predicted [4]. These new nuclei can be identified by the measurement of the correlated particles coming after their decay.

References

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