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Production of nuclei via correlated decay of nuclear sources in local equilibrium

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The statistical approaches were previously successfully applied for the description of the disintegration of excited nuclear sources. Such single sources in equilibrium with the temperature around 6-8 MeV (also with smaller temperatures) can be produced both from spectator residues in peripheral collisions of nuclei and after the fusion of nuclei in central collisions at Fermi energy. We generalize this approach [1,2] and demonstrate that the new conception of local equilibrium can be used to explain the fragment formation in quickly expanding nuclear matter under very high excitation energy. In this case we consider the matter subdivided into several excited clusters. For the first time our approach is able to describe consistently the FOPI experimental data measured in central collisions, in particular, yields and kinetic energies of nuclei, and the modification of the nuclear isotope yields with increasing the beam energy. In peripheral collisions of Fermi energy we are able to explain [3] the projectile-like and neck-like fragment emission (in FAZIA experiment) by separating two local sources in the reaction. Relation to the symmetry energy during the statistical fragment formation is discussed. We have obtained the limitation on the temperature of such local sources which determines the statistical nucleation process.

[1] A.S. Botvina, et al., Phys. Rev. C103, 064602 (2021).

[2] A.S. Botvina, et al., Phys. Rev. C106, 014607 (2022).

[3] R. Ogul, et al., Phys. Rev. C107, 054606 (2023).

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