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Production of hypernuclei from excited nuclear residues in relativistic ion collisions: New opportunities for FAIR.

Investigation of hypernuclei is a rapidly progressing field of nuclear physics, since they give opportunities both to improve methods of traditional nuclear studies and to open new horizons for studying particle physics and nuclear astrophysics. Within dynamical and statistical theories we study the main regularities in the production of hypernuclei emerging from the projectile and target residues in relativistic ion collisions. This process will also allow to understand the mechanisms of peripheral collisions and the properties of hyper-matter of low temperatures, including hyperon-hyperon interactions at low energies. We demonstrate that the yields of hypernuclei increase considerably at beam energies above the energy threshold for Lambda hyperons (~1.6 AGeV), followed by a saturation for yields of hypernuclei with increasing the beam energy up to few TeV [1]. These hypernuclei have a broad distribution in masses and isospin. They can even reach beyond the neutron and proton drip-lines since they are stable with respect to nucleon emission [2]. Weak decay of such hypernuclei may lead to formation of normal nuclei beyond the drip-lines also, thus providing a unique chance for reaching the islands of stability on the nuclear chart. The production of specific hypernuclei depend strongly on the isotopic composition of the projectile, therefore, it will be possible to obtain exotic hypernuclei that may be difficult to reach in traditional hypernuclear experiments [1]. We show also new calculations including DCM, UrQMD, and HSD transport models, the coalescence model, and the statistical model, with formation of light hypernuclei at all rapidities and large hyper-residues. The perspectives of hypernuclear studies involving these novel processes at the present accelerators are discussed.

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