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Λ Polarization and Vortex Rings in Heavy-Ion Collisions at NICA Energies

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We review recent studies of vortical motion and the resulting polarization of Λ hyperons in heavy-ion collisions at NICA energies, in particular, within the model of three-fluid dynamics (3FD). This includes predictions of the global Λ polarization and ring structures that appear in Au+Au collisions. The global Λ polarization in Au+Au collisions is calculated, including its rapidity and centrality dependence. Contributions from the thermal vorticity and meson-field term (proposed by Csernai, Kapusta and Welle) to the global polarization are considered. The results are compared with data from recent STAR and HADES experiments. It is predicted that the polarization maximum is reached at $\sqrt{s_{NN}} \approx 3$ GeV, if the measurements are performed with the same acceptance. It is demonstrated that a pare of vortex rings are formed, one at forward and another at backward rapidities, in ultra-central Au+Au collisions at $\sqrt{s_{NN}} > 4$ GeV. The vortex rings carry information about early stage of the collision, in particular about the stopping of baryons. It is shown that these rings can be detected by measuring the ring observable R_Λ even in midrapidity region $\%0 < y < 0.5$ (or $-0.5 < y < 0$) on the level of 0.5–1.5\% at $\sqrt{s_{NN}} = 5 - 20$ GeV. At forward/backward rapidities, the R_Λ signal is expected to be stronger. Possibility of observation of the vortex-ring signal against background of non-collective transverse polarization is discussed.

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