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Helicity and vorticity in heavy-ion collisions and hyperon polarization

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Heavy-ion collisions at center-of-mass nucleon collision energies 2.3–11.5 GeV are analyzed within the parton-hadron-string dynamics (PHSD) transport model. After the separation of spectator nucleons, the momentum distributions of particles constituting a fireball are fluidized and the energy and baryon number densities, temperature, and velocity fields are obtained in the Landau frame. It is shown that the velocity field has dominantly Hubble-like transversal and longitudinal expansion and a small vortical component on top of it. The vorticity is concentrated in the form of two oppositely rotating vortex rings moving in opposite directions along the nuclear collision axis. Global polarization of various hyperons species induced by the local vorticity of the medium is calculated. The polarization of all anti-hyperon species is found to be significantly larger than that of hyperons. The observable global polarization of Lambda hyperons is strongly influenced by the feed-down from weak and electromagnetic decays of heavier hyperons. Strong suppression is found to be due to electromagnetic decays of Sigma0 hyperons, which multiplicities obtained in the transport are poorly constrained both from the microscopic input of the Sigma0 production reactions and from the experimental data. The results of the calculation are compared with the available measurements of hyperon polarization.
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