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## Initial-state-driven spin correlations in high-energy nuclear collisions

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In the study of spin-polarization phenomena in heavy-ion collisions, it is typically assumed that final-state particles are polarized through thermal vorticity and shear. In this sense, polarization is a final-state effect. Here, we propose a different mechanism. We postulate that the collision of spin-carrying nucleons generates an initial transverse spin density, inducing a net polarization of the QCD fireball along a random direction. If the net spin is conserved throughout the evolution of the fireball, the final-state particles should exhibit measurable polarization. Within a wounded nucleon picture, we estimate that initial-state fluctuations induce a net polarization of Lambda baryons which is around 1% in central collisions and 10% in noncentral collisions, exceeding the contributions from thermal vorticity and shear. We introduce a two-particle angular correlation observable designed to reveal initial net-spin fluctuations, and emphasize the main signatures to look for in experiments. We argue that the discovery of these phenomena would have profound implications for nuclear structure and our understanding of spin in relativistic hydrodynamics. In the study of spin-polarization phenomena in heavy-ion collisions, it is

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