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Signatures of the spin Hall effect in hot and dense QCD matter

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The spin Hall effect (SHE) is a generation of spin polarization for moving spin carriers in materials under an external electric field and has been observed in semiconductors, metals, and insulators at or below room temperature. Recent theoretical analyses show that spin Hall current can be induced by the baryon chemical potential gradient which plays the role of the analogous electric field and which becomes sizable in the fireballs created in heavy-ion collisions at beam energy of O(10) GeV. In this talk, we focus on this important mechanism and predict the signature of the SHE using a (3+1) D viscous hydrodynamic model MUSIC with AMPT initial condition. We propose to use the second Fourier coefficients of the net spin polarization of Lambda hyperon as sensitive probes to search for the SHE. Those SHE observables show a qualitative difference in both the sign and beam energy dependence for the situations with and without the SHE. Future experimental observation of these distinct qualitative features would provide strong evidence for the existence of the SHE in the hot and dense QCD matter at trillions of degrees.

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Primary authors: FU, Baochi; SONG, Huichao; PANG, LongGang (Central China Normal University); YIN, Yi (Institute of modern physics, Chinese Academy of Sciencessti)

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