

Measurements of hyperon polarization in heavy-ion collisions at $\sqrt{s_{NN}} = 3 - 200$ GeV with the STAR detector

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In heavy-ion collisions, the observation of the global hyperon polarization, \overline{P}_H , ranging from $\sqrt{s_{NN}} = 7.7$ GeV to 5.02 TeV has revealed the existence of large vorticities perpendicular to the reaction plane due to system's orbital angular momentum. We present recent results on \overline{P}_H , and differential measurements thereof, extended to the low energies of 3 and 7.2 GeV [1]. A notable advantage of the STAR acceptance at low $\sqrt{s_{NN}}$ is the ability to measure the dependence of \overline{P}_H on y across the full range of hyperon production in y which can test the predictions of numerous model calculations. Further studies of differential measurements of \overline{P}_H are presented as well using Au+Au collisions at $\sqrt{s_{NN}} = 19.6$ and 27 GeV which allow for comparisons to the low- $\sqrt{s_{NN}}$ measurements presented here and to the high-energy measurements studied in Ref. [2]. Studies of the vortical flow structure's dependence on system size are also possible using Ru+Ru and Zr+Zr collisions at $\sqrt{s_{NN}} = 200$ GeV which are presented here as well. Furthermore, while \overline{P}_H reveals information about the vorticity driven by angular momentum, a recent study [3] measuring local polarization along the beam direction, \overline{P}_Z , revealed vorticity in the QGP arising from collective flow. The measurement stands in disagreement with a number of model calculations and, to shed light on the matter, measurements of \overline{P}_Z can be conducted in smaller systems than Au+Au or relative to higher-order event-plane angles. These measurements of \overline{P}_Z in Ru+Ru and Zr+Zr at $\sqrt{s_{NN}} = 200$ GeV presented here will provide valuable insight into the mechanisms of flow-driven vorticity.

[1] M. S. Abdallah et al. Global Λ -hyperon polarization in Au+Au collisions at $\sqrt{s_{NN}}=3$ GeV. *Phys. Rev. C*, 104(6):L061901, 2021.

[2] J. Adam et al. Global polarization of Λ hyperons in

Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. *Phys. Rev. C*, 98:014910, 2018.

[3] J. Adam et al. Polarization of Λ ($\overline{\Lambda}$) hyperons along the beam direction in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. *Phys. Rev. Lett.*, 123(13):132301, 2019.