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Global Lambda polarization in intermediate & high energy heavy ion collisions

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Relativistic thermodynamics with spin provided the polarization 4-vector to characterize the spin alignment in rotating systems. Based on a Yang-Mills flux-tube initial state and a high-resolution, (3+1)D particle-in-cell relativistic (PICR) hydrodynamics simulation, we numerically obtain the polarization vector for Λ hyperons at NICA and FAIR energies, and find that the y component of the polarization vector is dominant, while x and z components are anti-symmetric in the transverse momentum space, implying a vanishing contribution to the global polarization (at collider frame). Besides, we analyze the dependence of Λ polarization effect on centrality, energy and freeze-out time, in our model. The linear dependence of Λ polarization on impact parameter reveals that the polarization stems from the initial orbital angular momentum; the polarization effect is found to decrease with increasing energy, which is in line with the recent results from RHIC BES program, and is attributed to the more intensive thermal motion of particles at higher energies. The time evolution of the Λ polarization in our calculation agrees with the time evolution of vorticity predicted previously, and indicates the limit of applicability of hydrodynamic model at late stages of the expansion.
[1] Y.L. Xie, D.J. Wang, and L. P. Csernai, Phys. Rev. C 95, 031901(R) (2017).
[2] Y. L. Xie, M. Bleicher, H. Stöcker, D. J. Wang, and L. P. Csernai, Phys. Rev. C 94, 054907 (2016).

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Authors: Mr XIE, Yilong (University of Bergen); WANG, Dujuan (Wuhan University of Technology); Prof. CSERNAI, Laszlo Pal (University of Bergen); BLEICHER, Marcus (Uni Frankfurt); Prof. STOCKER, Horst (Frankfurt Institute of Advanced Studies)

Presenter: Mr XIE, Yilong (University of Bergen)

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