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Supervisor's review of Master Thesis of Bc. Ondřej Lomický Global polarization of hyperons in STAR Beam Energy Scan

The thesis titled “Global polarization of hyperons in STAR Beam Energy Scan” of Bc. Ondřej Lomický presents experimental analysis of the global polarization of lambda hyperons in gold-gold collisions at the center-of-mass energy of 27 GeV from the STAR experiment at RHIC. The presented results are complemented with simulated lambda global polarization at the same energy using a hydrodynamic model of heavy-ion collisions.

The thesis is divided into seven chapters, an introduction and conclusions. The structure of the thesis is clear and the presented topics are well separated into different sections. The overall flow of the thesis and the language are good and the thesis reads well. The bibliography is wide and well chosen.

The first two chapters focus on introduction to the heavy-ion collisions and the STAR experiment. They provide to the reader basic information needed to understand the theoretical and experimental details of the analysis presented in this thesis. Chapter 3, Global polarization of hyperons in heavy-ion collisions, presents details of the global polarization phenomenon in heavy-ion collisions: its relation to the medium vorticity, methods of the polarization measurement and experimental reconstruction of the event plane, as well as the recent experimental results on global hyperon polarization in heavy-ion collisions. Basics of hydrodynamic modeling of heavy-ion collisions, a 3+1D viscous hydrodynamic model vHLLE and hyperon polarization within this model are described in Chapter 4. Both chapters show that Ondřej obtained a good theoretical and experimental knowledge of the topic of the global hyperon polarization.

Chapters 5 and 6 present the main results of this thesis. It is described how the Lambda hyperons and their daughter baryon angular distributions are experimentally reconstructed. The global polarization of Lambda and anti-Lambda particles is obtained in Au+Au collisions at the center-of-mass of 27 GeV from the BES-II dataset of the STAR experiment. Two methods are used to extract the polarization and the results are corrected for acceptance efficiency, a few sources of systematic uncertainties are also considered. At the end, the obtained results are compared to hydrodynamic simulations with different initial conditions assumed. The results are discussed in Chapter 7. Ondřej looked critically on the output of his analysis, identified issues and discussed

their potential sources and improvements. This shows his in-depth knowledge of the topic and maturity as a researcher.

I have following following questions to Ondřej, related to the interpretation of the results.

1) In the discussion, a difference of the obtained results with respect to the STAR published results is mentioned and one of the given reasons is a different value of the alpha parameter that is currently used. How the results from Fig. 6.15 would look like if one considers the CP conservation and the alpha parameter 0.732 for both Lambda and anti-Lambda ?

2) And how these results compare to the recently shown at the Quark Matter 2022 conference preliminary results of the STAR Collaboration at the same energy ?

3) In the statistical-thermodynamic approach, the polarization is independent of the charge of the particles for a charge-neutral fluid, which corresponds to the same polarization for Lambda and anti-Lambda particles. Indeed, the experimental results do not show much difference between the Lambda and anti-Lambda global polarization, there is however a hint of splitting. What effect(s) could cause the difference between the Lambda and anti-Lambda global polarization ?

In my opinion the thesis of Bc. Ondřej Lomický is well written and shows Ondřej's good understanding of the studied topic and of the experimental methods. Ondřej worked very systematically and independently on his analysis. He obtained not only experimental results on the global Lambda and anti-Lambda polarization but he complemented them with hydrodynamical predictions. It was a pleasure to work with Ondřej and to see his development as a researcher over the course of his master studies. Therefore, I grade Ondřej Lomický **A(excellent)** note for his hard work.

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