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New constraints for QCD matter from improved Bayesian parameter estimation

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Transport properties of the matter created in heavy-ion collisions, the quark-gluon plasma (QGP), contain essential information about quantum chromodynamics (QCD). To deepen our understanding of QCD, it is crucial to estimate these transport properties (for instance, specific shear and bulk viscosity) in the light of experimental data as accurately as possible. In this talk, we present our latest study in inferring the transport properties of QGP by an improved Bayesian analysis using the CERN Large Hadron Collider Pb-Pb data at $\sqrt{s}_{NN} = 2.76$ and 5.02 TeV. To improve the uncertainties, we include new observables sensitive to specific shear and bulk viscosity, reflecting mostly nonlinear hydrodynamic responses. We show that the uncertainty of the transport coefficients is significantly reduced by including the latest flow harmonic measurements. The analysis also reveals that higher-order harmonic flows and their correlations have a higher sensitivity to the transport properties than the other observables. This observation shows the necessity of accurate measurements of these observables in the future.

Based on:
[1] J.E. Parkkila, A. Onnerstad, D.J. Kim, Phys.Rev.C 104 (2021) 5, 054904, arXiv: 2106.05019 [hep-ph]
[2] J.E. Parkkila, A. Onnerstad, S. F. Taghavi, C. Mordasini, A. Bilandzic, D.J. Kim, arXiv: 2111.08145 [hep-ph]

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