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## Extracting the shear viscosity of the QGP in the presence of bulk viscosity

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The interplay between shear and bulk viscosities on the flow harmonics,  $v_n$ 's, at RHIC is investigated using the 2+1 hydrodynamical code v-USPhydro [1] that includes bulk and shear viscosity effects (on an event by event basis) both in the hydrodynamic evolution and also at freeze-out. While shear viscosity is known to attenuate the flow harmonics, the inclusion of bulk viscosity decreases the shear viscosity-induced suppression of the flow harmonics at RHIC bringing them closer to their values in ideal hydrodynamical calculations [2].

In this talk, NeXuS initial conditions [3] are used to investigate not only how initial flow can alter the hydrodynamic evolution of the quark-gluon plasma but also how different models for bulk viscosity to entropy density ratio,  $\zeta/s$ , ranging from strong coupling holographic models to hadron gas+lattice calculations, can be used to determine the sensitivity of current hydrodynamic modelling to temperature dependent transport coefficients. We find that flow harmonic data at RHIC can only be adequately described with viscous hydrodynamics [4] if the shear viscosity to entropy density ratio,  $\eta/s$ , of the quark-gluon plasma is two to three times as large as the AdS/CFT viscosity bound.

[1] J. Noronha-Hostler, G. S. Denicol, J. Noronha, R. P. G. Andrade and F. Grassi, Phys. Rev. C88, 044916 (2013).

[2] J. Noronha-Hostler, J. Noronha and F. Grassi, Phys. Rev. C90, no. 3, 034907 (2014).

[3] H. J. Drescher, M. Hladik, S. Ostapchenko, T. Pierog and K. Werner, Phys. Rept. 350, 93 (2001).

[4] J. Noronha-Hostler, F. Gardim, M. Gyulassy, F. Grassi, M. Luzum, and J. Noronha, "Extracting the shear viscosity of the QGP in the presence of bulk viscosity", to appear.

### On behalf of collaboration:

NONE

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