

Tests of Fluidity of AdS/CFT Plasma Wakes

J. Noronha^{a,b}, G. Torrieri^b, M. Gyulassy^c

^a Frankfurt Institute for Advanced Studies, J.W. Goethe Universität
D-60438 Frankfurt am Main, Germany

^b Institute for Theoretical Physics, J.W. Goethe Universität
D-60438 Frankfurt am Main, Germany

^c Department of Physics, Columbia University, 538 West 120th Street, New York
NY 10027, USA

The AdS/CFT correspondence predicts [1] much stronger energy loss of heavy quarks at RHIC and LHC than pQCD. Additionally, it predicts [1-3] a striking Mach-cone plus diffusion jet-wake correlation pattern that resembles the near perfect fluid response of the sQGP. In this work we test the AdS energy-momentum tensor solutions in [3] for collective behavior by matching their form to the expected Navier-Stokes viscous fluid form, assuming the minimal AdS $\eta/s = 1/4\pi$ viscosity. We check to what extent the energy in the wake created by the heavy quark is thermalized and the degree of local isotropization in the plasma's local rest frame (Landau frame). We find that for a reasonably large N t'Hooft coupling $\lambda \sim 10$ and realistic T (~ 300 MeV), the system is well described by relativistic Navier-Stokes equations. This suggests that up to significant differences between strongly coupled QCD and SYM, the energy lost by heavy quarks in the medium created at RHIC should be mostly thermalized. We also perform a comparison between the energy-momentum tensor obtained in [2-3] with a full ideal 3D numerical hydrodynamic solution with the objective of disentangling the viscous and ideal contributions and of ascertaining the form of the energy-momentum source provided by the heavy quark. Unfortunately, contrary to first suggestions and RHIC data, the strong AdS diffusion wake fills the inside of the AdS Mach cone after a Cooper-Frye freeze-out of the sQGP [4]. We discuss how Mach cone like signatures differentiate between pQCD versus AdS/CFT jet energy-momentum loss mechanisms.

References

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