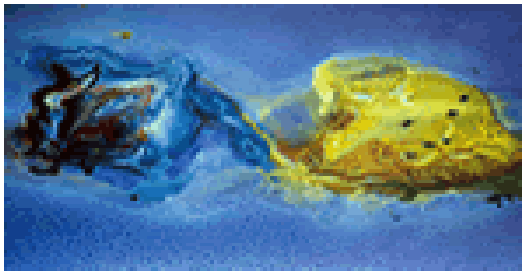

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Analytical generalization of 3+1 dimensional self-similar and Gubser flows to relativistic magnetohydrodynamics

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Due to absence of expansion transverse to the beam direction, Bjorken flow is unable to describe certain observables in heavy ion collisions such as transverse momentum spectra of final hadrons. This caveat has motivated introduction of analytical relativistic hydrodynamics(RH) solutions with transverse expansion, in particular 3+1 self-similar and Gubser flows. Inspired by recently found generalizations of Bjorken flow to the relativistic magnetohydrodynamics(RMHD), we present a procedure for generalization of RH solutions to RMHD using symmetry arguments. We find the relation between RH degrees of freedom and the magnetic field evolution in ideal limit, namely an infinitely conductive fluid. Using this procedure, we find the magnetic field evolution in aforementioned flows. In the case of self-similar flow a family of solutions are found, which are related through a certain differential equation. To find the magnetic field evolution in Gubser flow, we solve RMHD equations for a stationary fluid in the conformally flat $dS^3 \times E^1$ spacetime. The results are then Weyl transformed back to Minkowski spacetime. In this case the magnetic field temporal evolution exhibits a transmission between $1/t$ to $1/t^3$ near the center of collision. Longitudinal component of the magnetic field is found to be sensitive to transverse size of the fluid. We also find the radial evolution of magnetic field for both flows. The radial domain of validity in the case of self-similar flow is highly restricted, in contrast to Gubser flow. Comparison of the results suggest that Gubser RMHD may give a qualitative picture of magnetic field decay in the QGP.

Primary author: Mr SHOKRI, Masoud (Sharif University of Technology)

Co-author: SADOOGHI, Neda (Sharif University of Technology)

Presenter: Mr SHOKRI, Masoud (Sharif University of Technology)

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