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Introduction to Holography and its Application to Heavy-Ion Physics

Friday 4 December 2020 10:00 (30 minutes)

Holography, also known as AdS/CFT correspondence, lies at the intersection of gravitational physics and quantum field theory. It is a duality which maps the physics of a strongly coupled quantum field configuration onto the physics of a weakly curved model spacetime. It has been successfully applied to describe a variety of systems in gravitational terms–from condensed matter to quantum information theory. In the context of heavy-ion collisions, holography contributes to the understanding of jet quenching, quarkonium yields, and elliptic flow.
After an introduction to holography, this talk focuses on the calculation of hydrodynamic transport coefficients of the quark-gluon plasma. We will show how the specific shear viscosity, η/s, in the near-equilibrium regime can be derived from a nearly static black hole configuration. Next, the definitions of entropy density and shear viscosity will be properly generalized to the far-from equilibrium regime. We will construct a strongly time-dependent spacetime and find that the specific shear viscosity is decreased by more than 60% in the initial phase of a heavy-ion collision. These corrections impact the simulation of heavy-ion collisions and the extraction of viscosity from experimental data. Such a sharpened analysis paves the way towards a deeper understanding of the quark-gluon plasma.

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