JOINT TUFTS/MIT COSMOLOGY SEMINAR

Towards Classification of Hydrodynamics: From Effective Field Theory to AdS/CFT

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Complete classification of hydrodynamics through a detailed derivation from microscopic quantum field theory is an important unsolved problem, which could shed light on physical phenomena from fluid dynamics to particle physics and cosmology. By the use of effective field theory techniques, it was recently shown that phenomenological derivative expansion can arise from low-energy physics of Goldstone modes. The action principle of standard quantum field theory is, however, unable to describe dissipative effects required for the description of viscous fluids. To account for dissipation, we can re-formulate the effective field theory in the Closed-Time-Path (CTP) formalism of Schwinger and Keldysh. I will present the CTP construction of hydrodynamics and discuss how it enables us to derive the viscous stress-energy tensor and the Navier-Stokes equations. I will then move on to discuss the study of different classes of hydrodynamical theories through the use of AdS/CFT correspondence. First, I will introduce the connection between hydrodynamics and string theory. I will then address the question of whether theories with (nearly)-vanishing viscosity and non-vanishing higher-order hydrodynamic coefficients exist by analysing the four-derivative Gauss-Bonnet-Maxwell theory. Finally, I will discuss the validity of hydrodynamic approximation to low-energy physics.

Tuesday, October 1, 2013, 2:45 pm
Cosman Seminar Room
Center for Theoretical Physics
Building 6C, Room 6C-442
Massachusetts Institute of Technology

Refreshments at 2:30 in the same room