
Trento Institute for Fundamental Physics and Applications



Graziano Fortuna meeting room

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The hidden gauge theory of relativistic hydrodynamics, and what is a "fluid" of 50 particles?

Abstract

The observation, in hadronic collisions, of "ideal fluid" type behavior in systems of a comparatively small number of particles, presents a conceptual puzzle, since the way we usually derive hydrodynamics is via approximating "many" particles as a continuum. I will argue that making sense of this requires re-deriving relativistic hydrodynamics as a "bottom-up" theory, with no reference to microscopic physics except the local emergence of a thermalized system. We attempt to do this using basic statistical mechanics, and find the appearance of a gauge-like redundancy hidden within relativistic dissipative hydrodynamics, arising from the fluctuation-dissipation theorem. This might lead to the apparently counter-intuitive conclusion that in the small viscosity limit it might indeed be that smaller systems could thermalize faster.

