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How is Hydrodynamics in pp and pA collisions possible?

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 via an "inverse attractor" mechanism.

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Author: TORRIERI, Giorgio

Presenter: TORRIERI, Giorgio