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Making sense of Hydrodynamics with 50 particles

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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. This is in contrast to usual attempts to understand hydrodynamics as a "top-down" theory, in terms of models such as transport and holographic strongly coupled systems. We attempt to do this using basic statistical mechanics, and find the apparently counter-intuitive conclusion that in the small viscosity limit it might indeed be that smaller systems could thermalize faster.

Primary author(s) : Prof. TORRIERI, Giorgio (State University of Campinas (Unicamp),Brasil)

Presenter(s) : Prof. TORRIERI, Giorgio (State University of Campinas (Unicamp),Brasil)

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