Emergence of collectivity near a critical point

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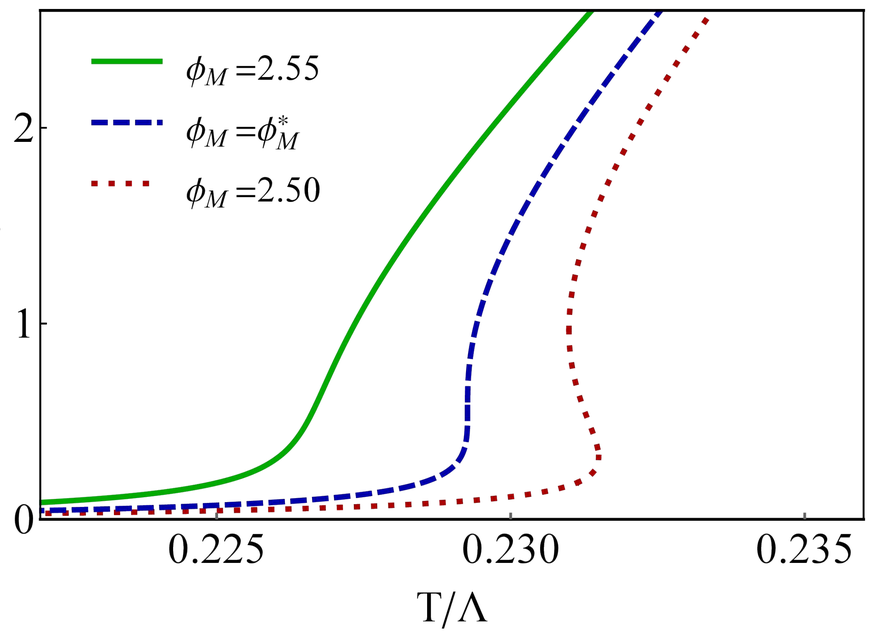
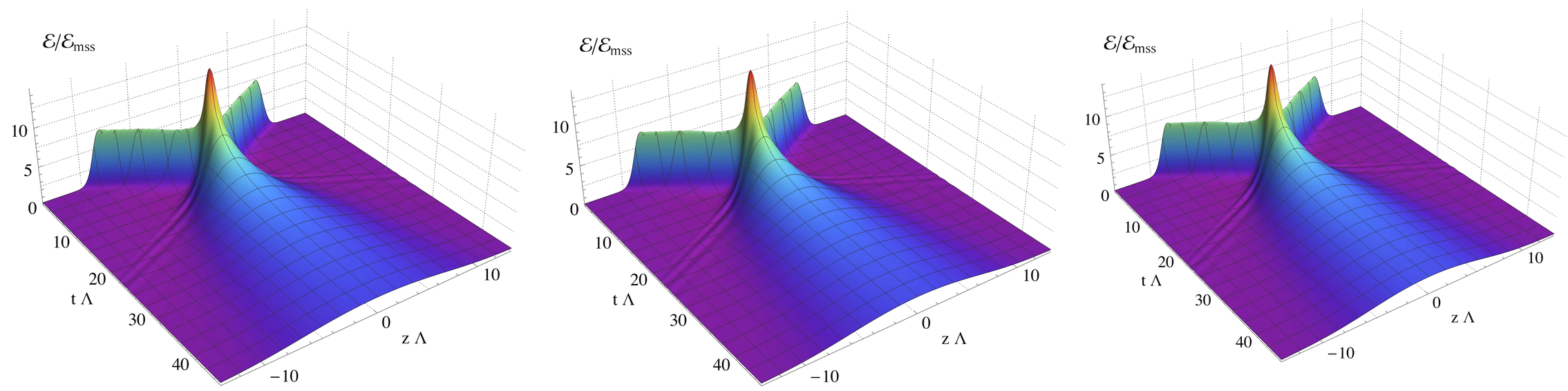
Introduction

The AdS/CFT correspondance relates quantum gauge theories with gravity.

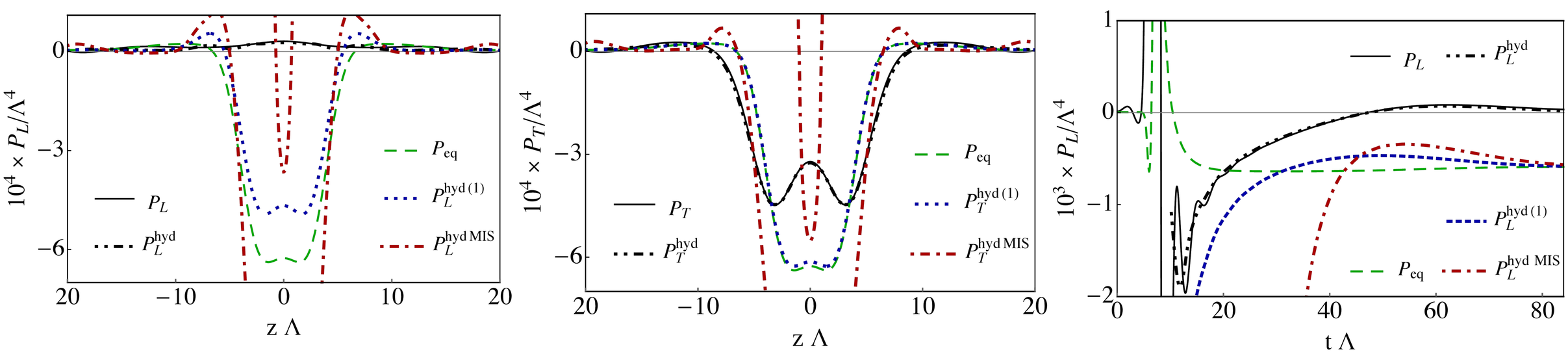
Holography allows to explore far from equilibrium dynamics:
- at strong coupling
- non-perturbatively
- in out-of-equilibrium
- for almost perfect fluids
- with fast hydrodynamization time
- as initial condition for hydrodynamics.

Now we explore dynamics near a critial point:
We discuss possible implications for searches of the QCD critical point.

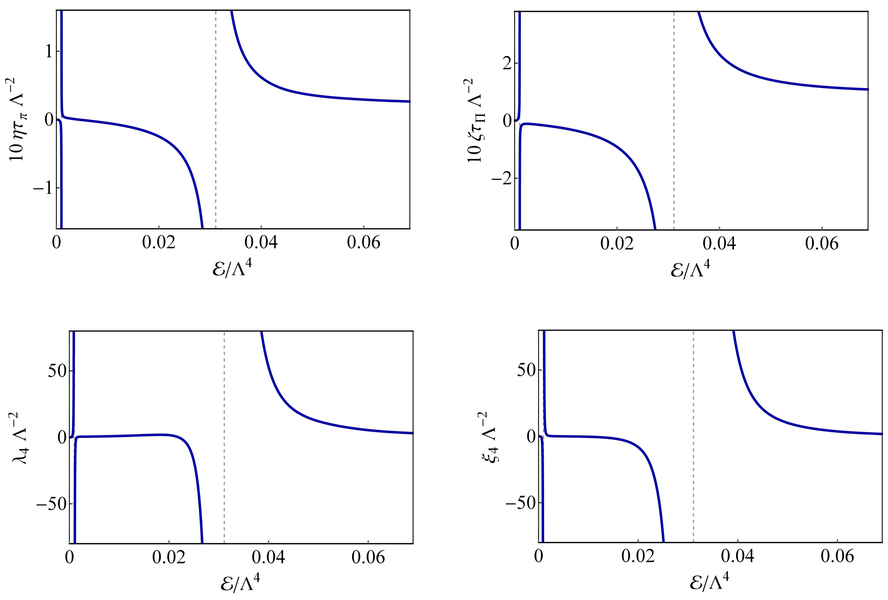




Energy density of colliding shockwaves dual to colliding nuclei across a cross-over, 2nd and 1st order phase transition



Longitudinal and transverse pressure at late time and the time evolution of the longitudinal pressure at mid-rapidity



MIS-type 2nd order transport coefficients

Summary - holographic collisions across a phase transition

We observe a long-lived, quasi-static blob of energy at mid-rapidity.

This configuration is well described by the constitutive relations of second-order hydrodynamics with 2nd order non-conformal transport coefficients and purely spatial 2nd order derivatives.

In contrast, a Müller-Israel-Stewart-type formulation of hydrodynamics fails to provide a good description.

1) Holographic Collisions across a Phase Transition By Maximilian Attems, Yago Bea, Jorge Casalderrey-Solana, David Mateos, Miquel Triana, Miguel Zilhao, arXiv:1807.05175 [hep-th], Phys.Rev.Lett. 121 (2018) no.26, 261601.

2) Dynamics of Phase Separation from Holography By Maximilian Attems, Yago Bea, Jorge Casalderrey-Solana, David Mateos, Miguel Zilhao, arXiv:1905.12544 [hep-th].