

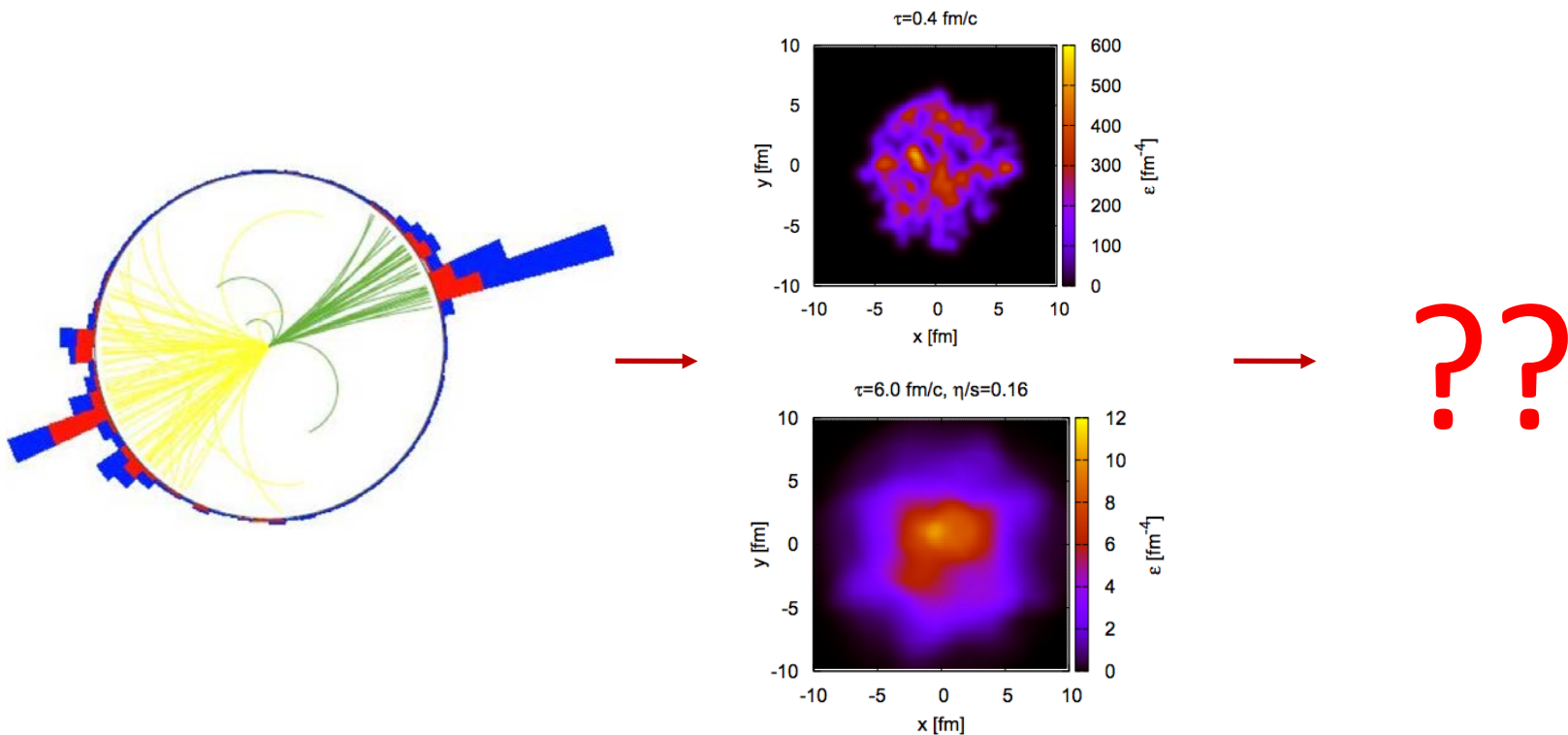
Dynamical medium effects on jet quenching in holography

Jasmine Brewer



Work done in collaboration with
Andrey Sadofyev and Wilke van der Schee

Want to use jets as a short-distance probe of the QGP



- complicated by the presence of many effects

Many approaches for understanding the modification of jets in medium

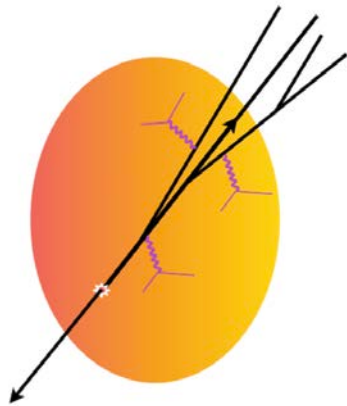
- Perturbative methods (weak coupling; quasi-particle picture of the QGP)
- Jets in holography (infinitely strong coupling, not QCD)

This talk: effects of a dynamical medium on jet energy loss in holography

- Usual assumptions: evolving temperature and zero velocity
- Goal: qualitative lessons to inform other calculations

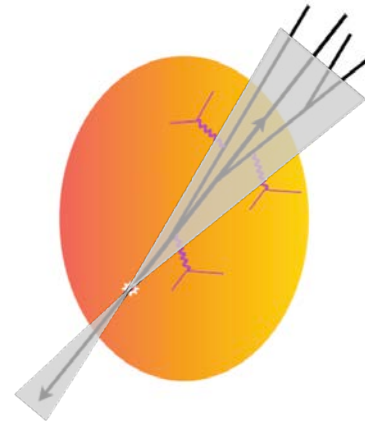
Holographic models of jet quenching

Hybrid model



local parton energy loss
from holography

This work

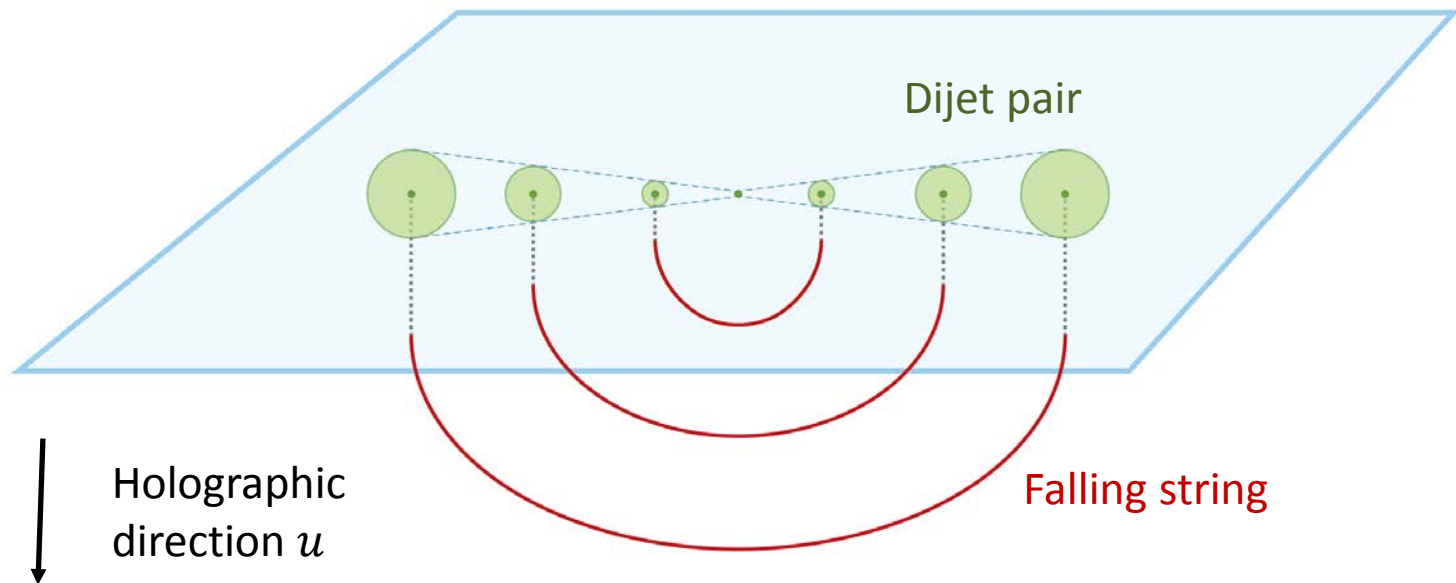


entire jet described
in holography

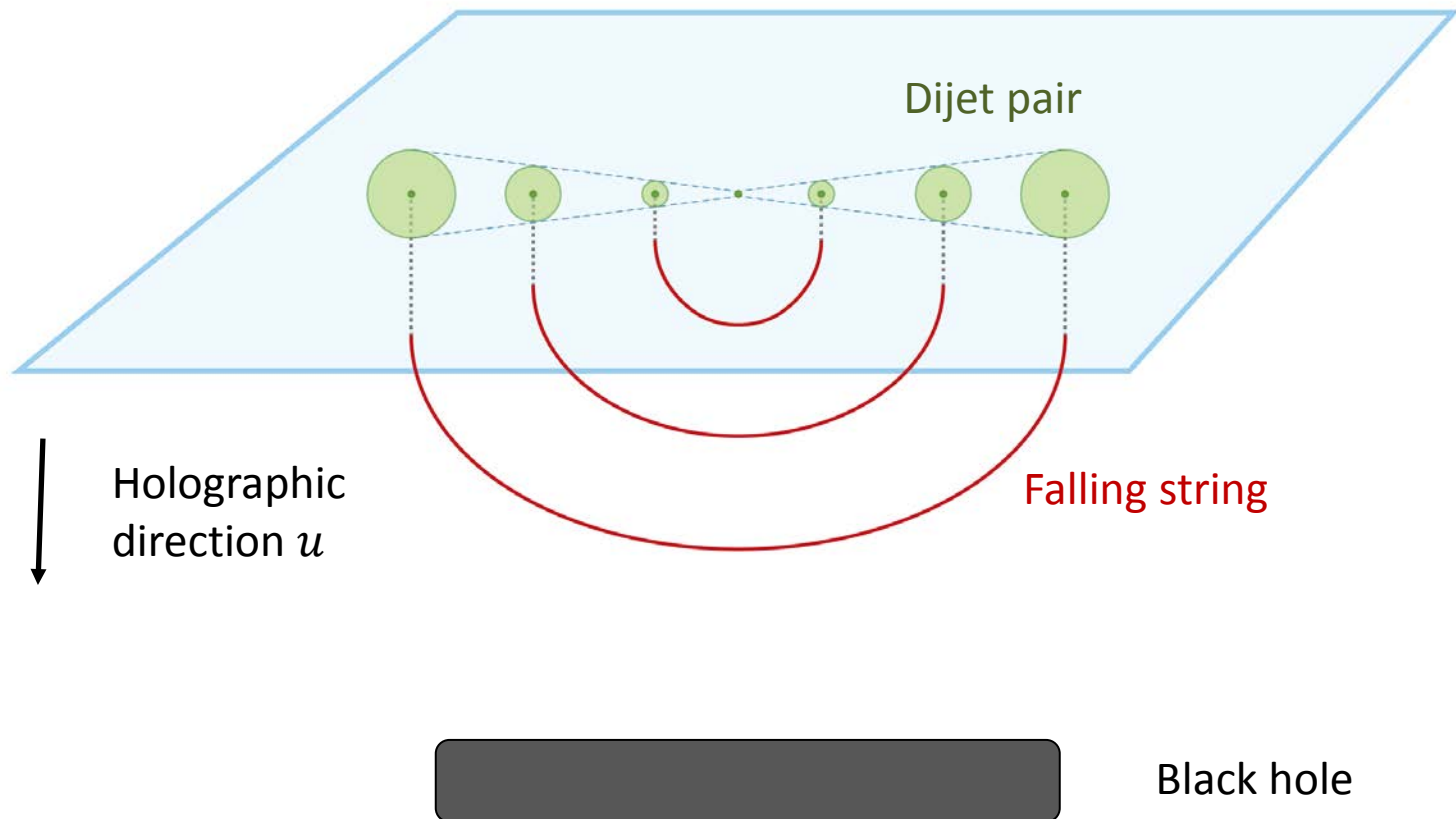
Roadmap

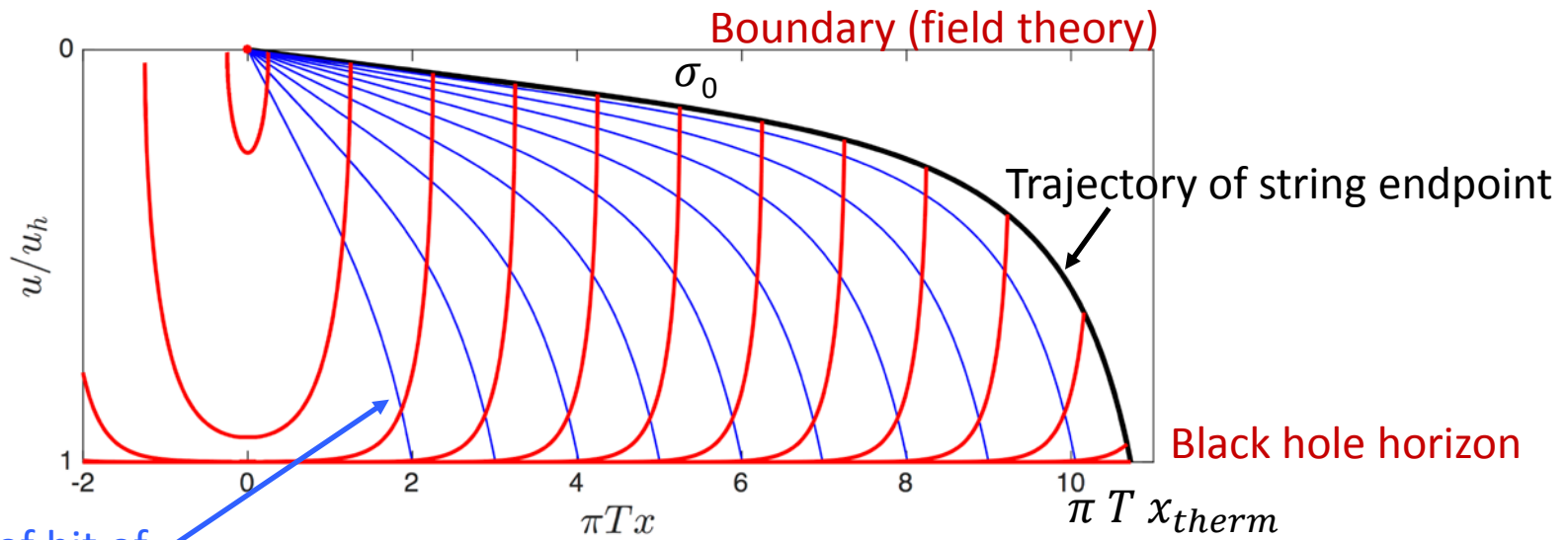
- Introduction to jets in holography
- Jets in a flowing plasma
 - Simple formula for string evolution in ideal hydrodynamics
- Phenomenological effects in Gubser flow
 - Energy loss generically decreased by flow effects

“Jets” in holography

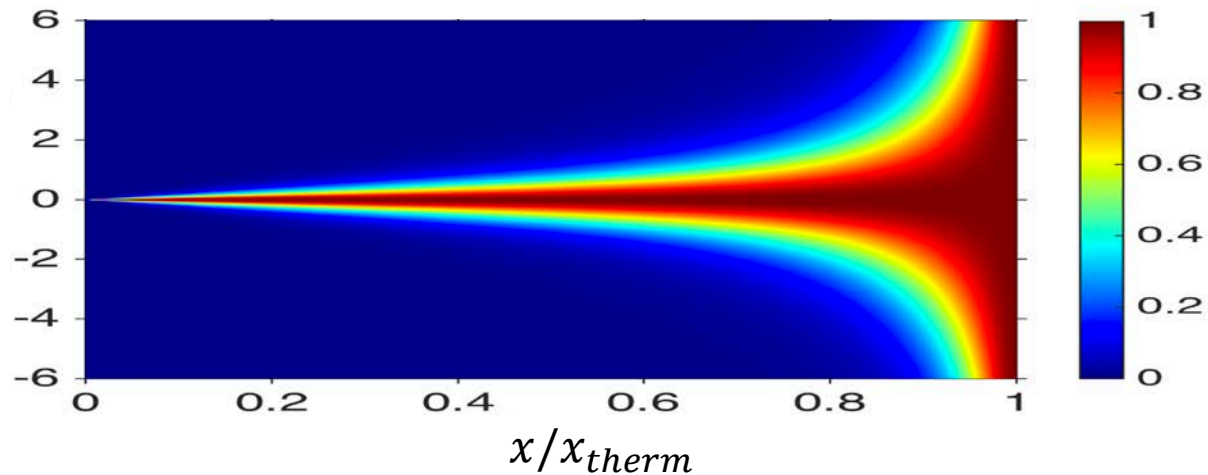


“Jets” in holography

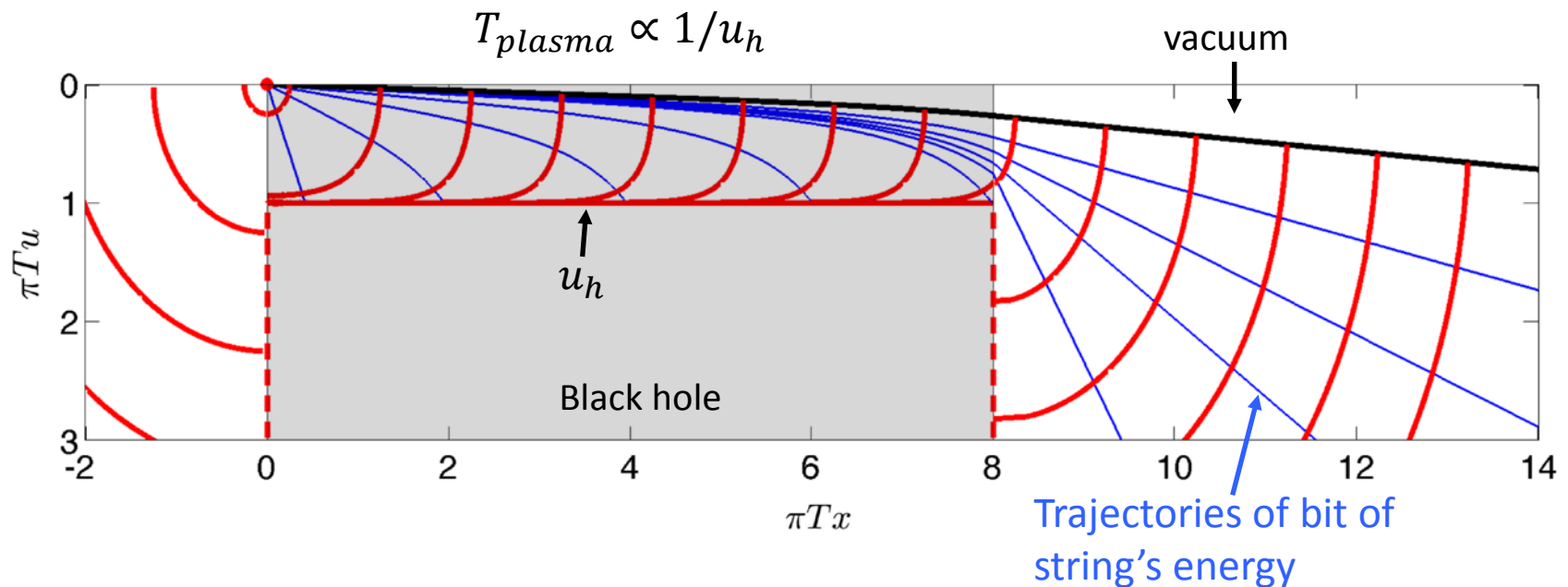




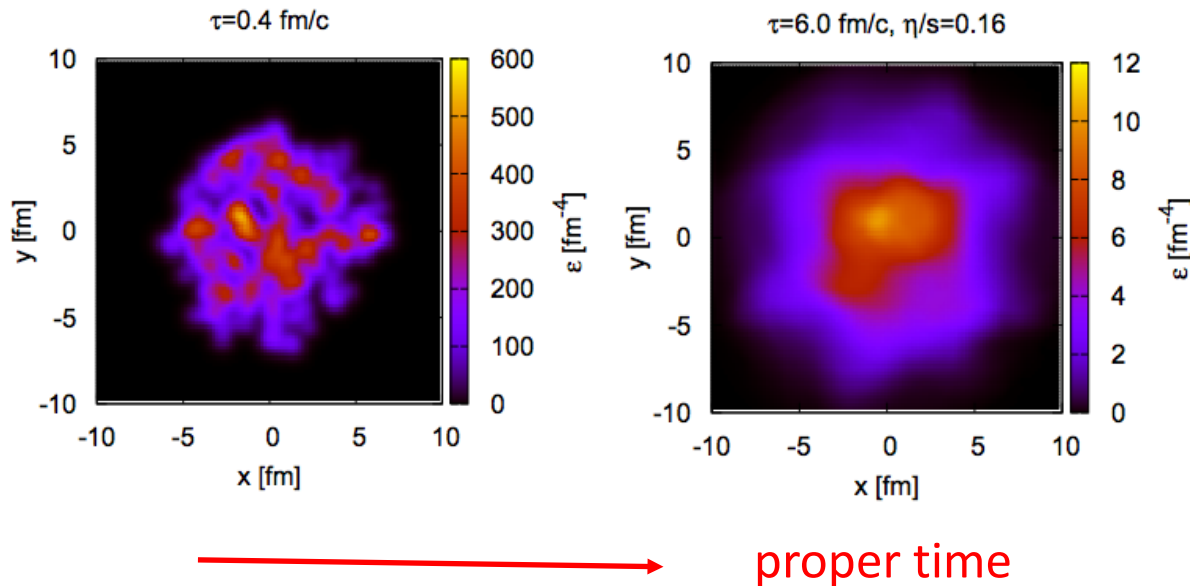
Trajectories of bit of string's energy



- For a finite-sized plasma, some energy lost, some escapes



QGP is not a static slab of plasma at all



- Usual assumptions: evolving temperature and zero velocity
- What are the effects of a dynamical medium on jet energy loss in holography?

Hydrodynamic equations:

$$T^{\mu\nu} = -pg^{\mu\nu} + (\epsilon + p)u^\mu u^\nu + \Pi^{\mu\nu}$$

“u=0”

“ideal”

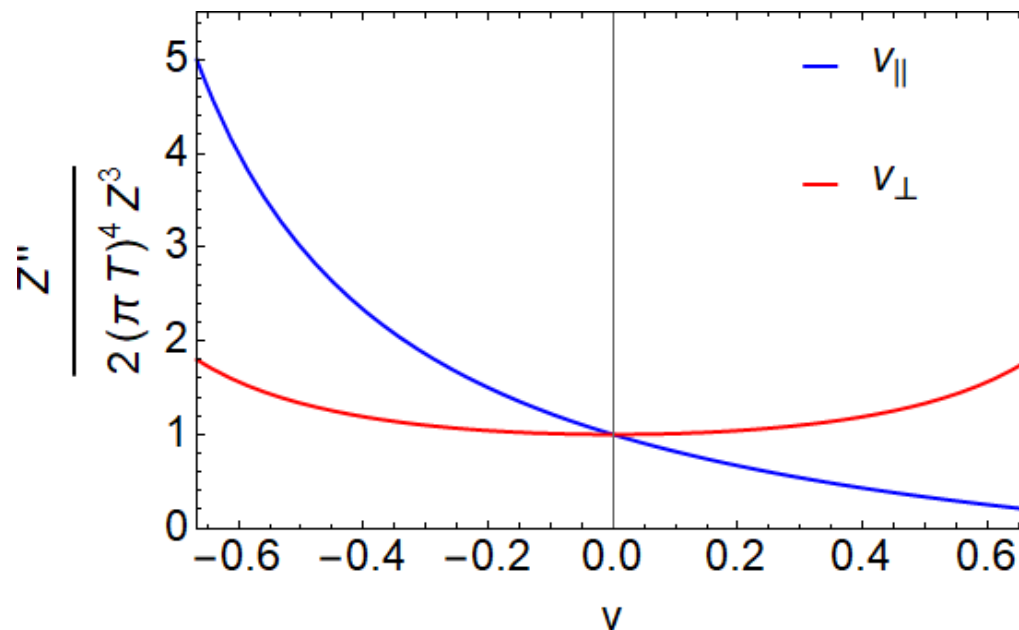
“viscous”

$$\partial_\mu T^{\mu\nu} = 0$$

- To study jets: couple null geodesics to hydrodynamic evolution
- Small, higher-order gradients must be consistently neglected in the hydrodynamic evolution, since geodesics are very sensitive to these

Velocity effects in ideal hydrodynamics

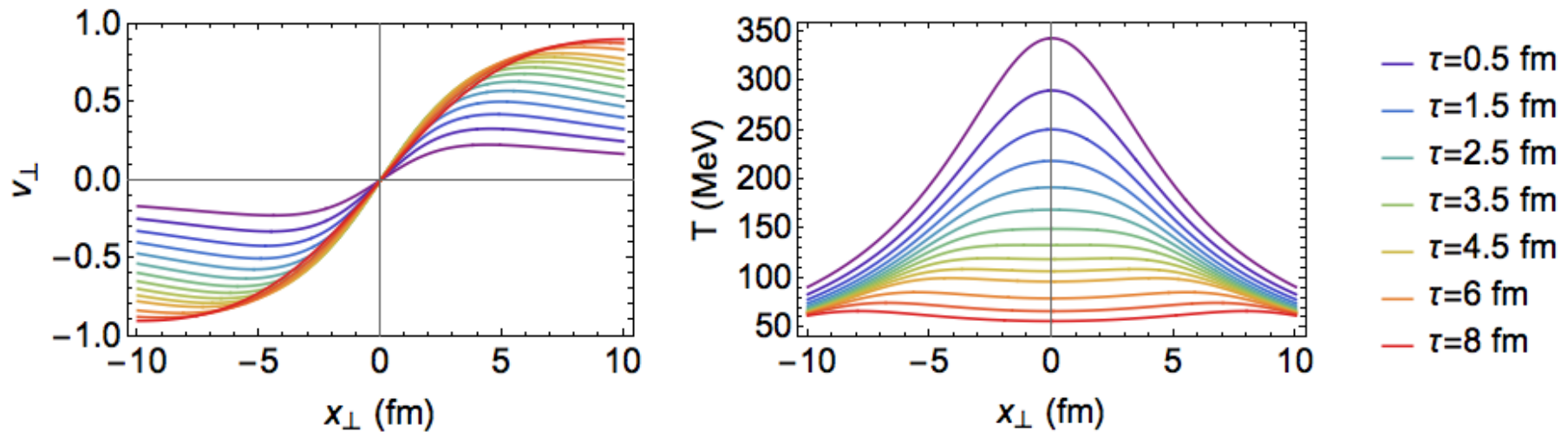
$$Z''(t) = -2\pi^4 T^4 (1 - v_{\parallel}) Z(t)^3 \left(\frac{1 - v_{\parallel}}{v_{\parallel}^2 + v_{\perp}^2 - 1} \right)$$



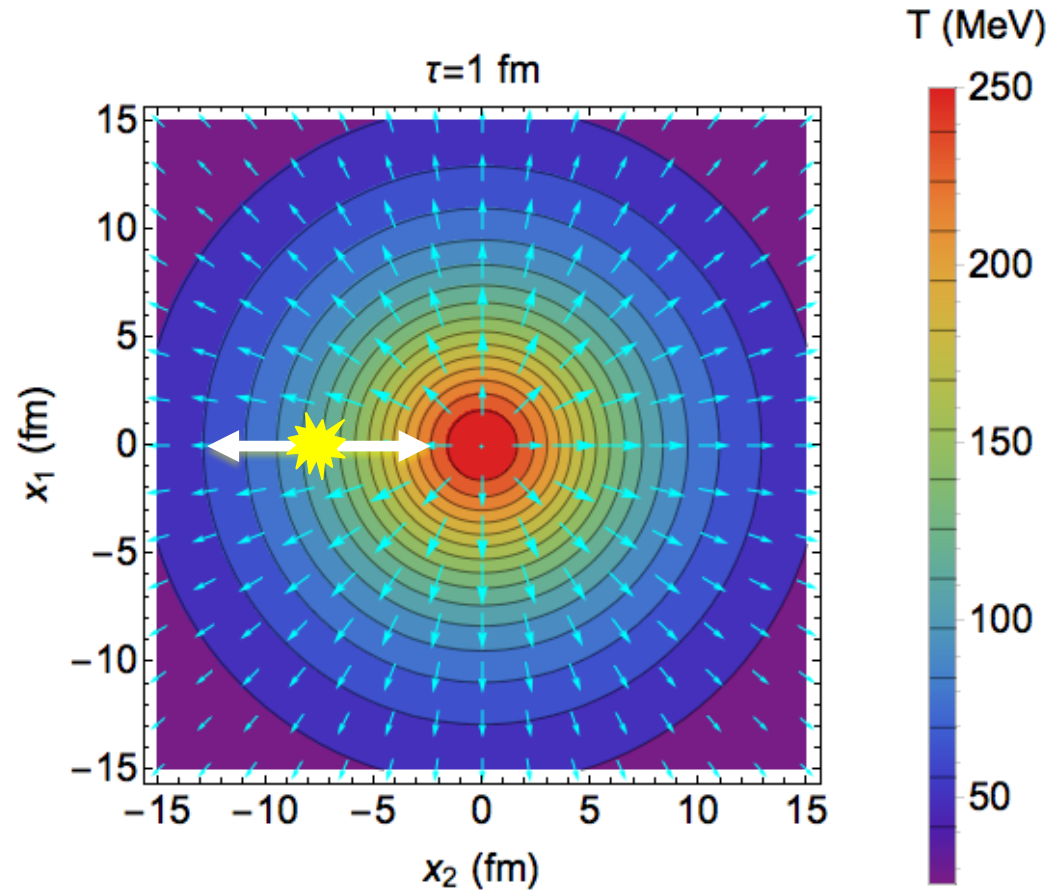
Viscous formula more complicated, but effects are subleading

- What are the effects of a dynamical QGP-like medium on jet energy loss in holography?

Example: Gubser flow

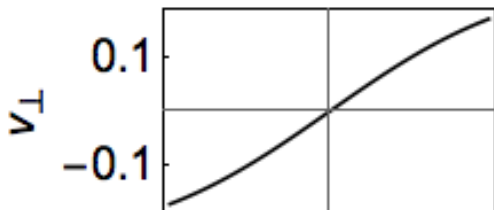
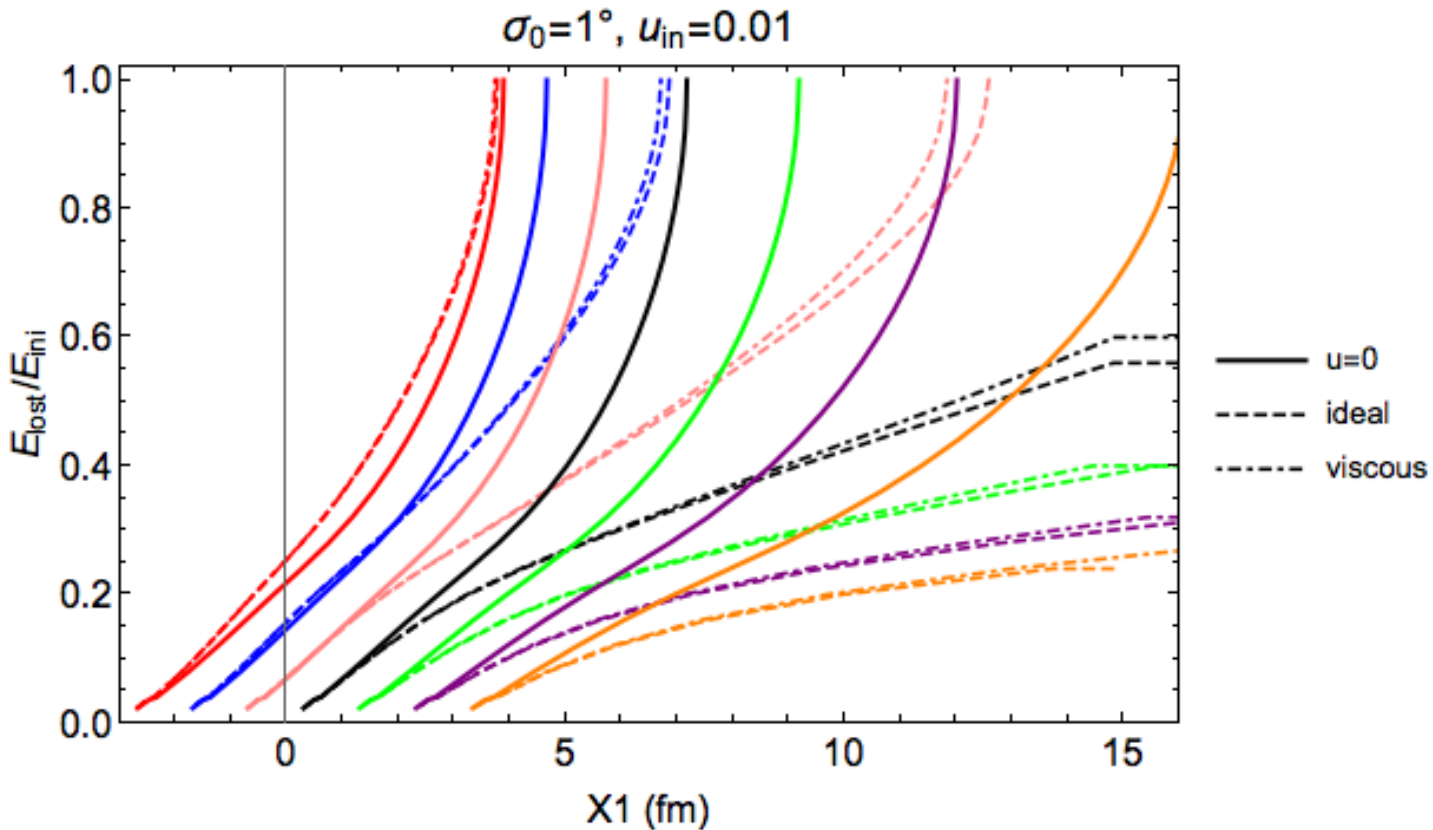


Jets starting at different points in the transverse plane experience different velocity field

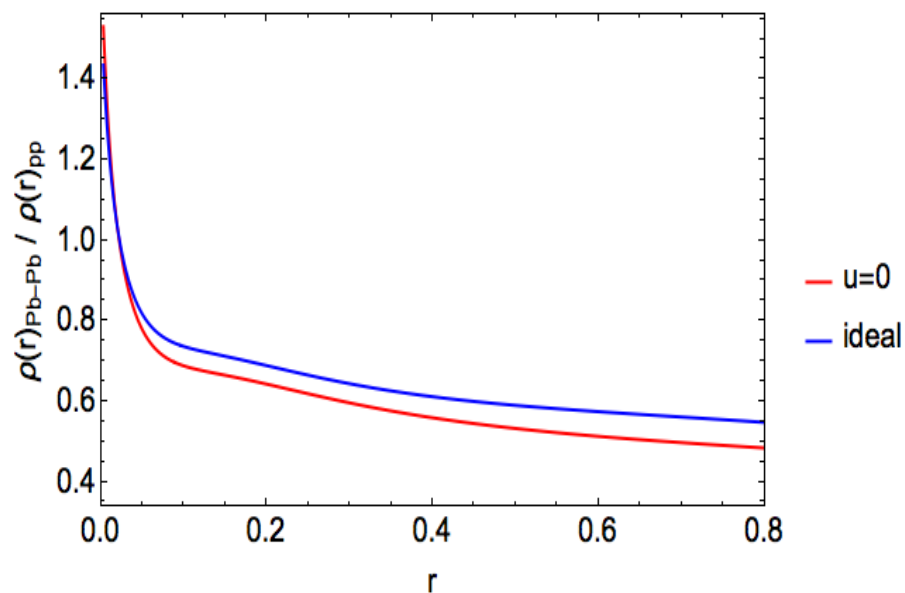
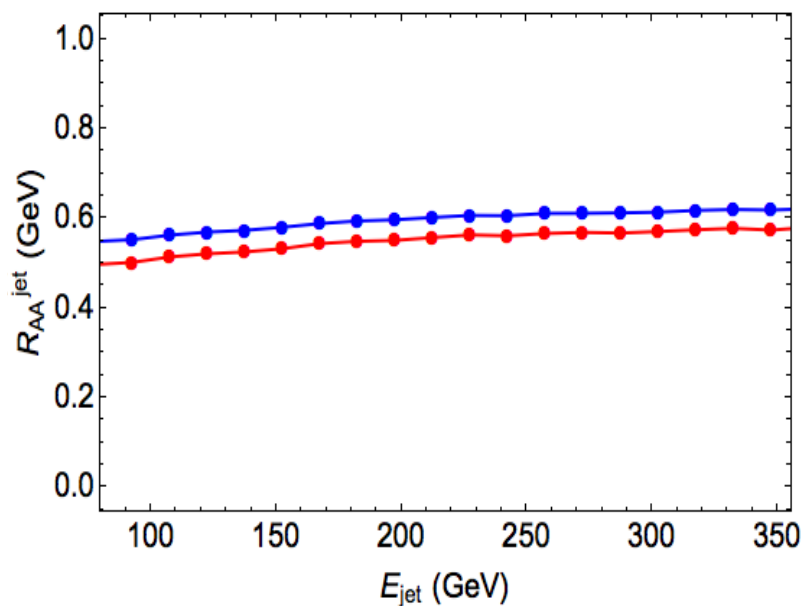


Gubser flow

- Velocity gradients in a holographic picture have a significant effect on energy loss



- Fluid effects generically decrease energy loss (due to the radially-flowing geometry)



Wrap-up

- Velocity gradients in the fluid can have a significant effect on the quenching of holographic jets
- For Gubser flow, including the effects of velocity gradients decreases energy loss
- Outlook: can this kind of effect be seen in other models?