Black Hole Plasma Astrophysics
(Danish Prospects with GLT)

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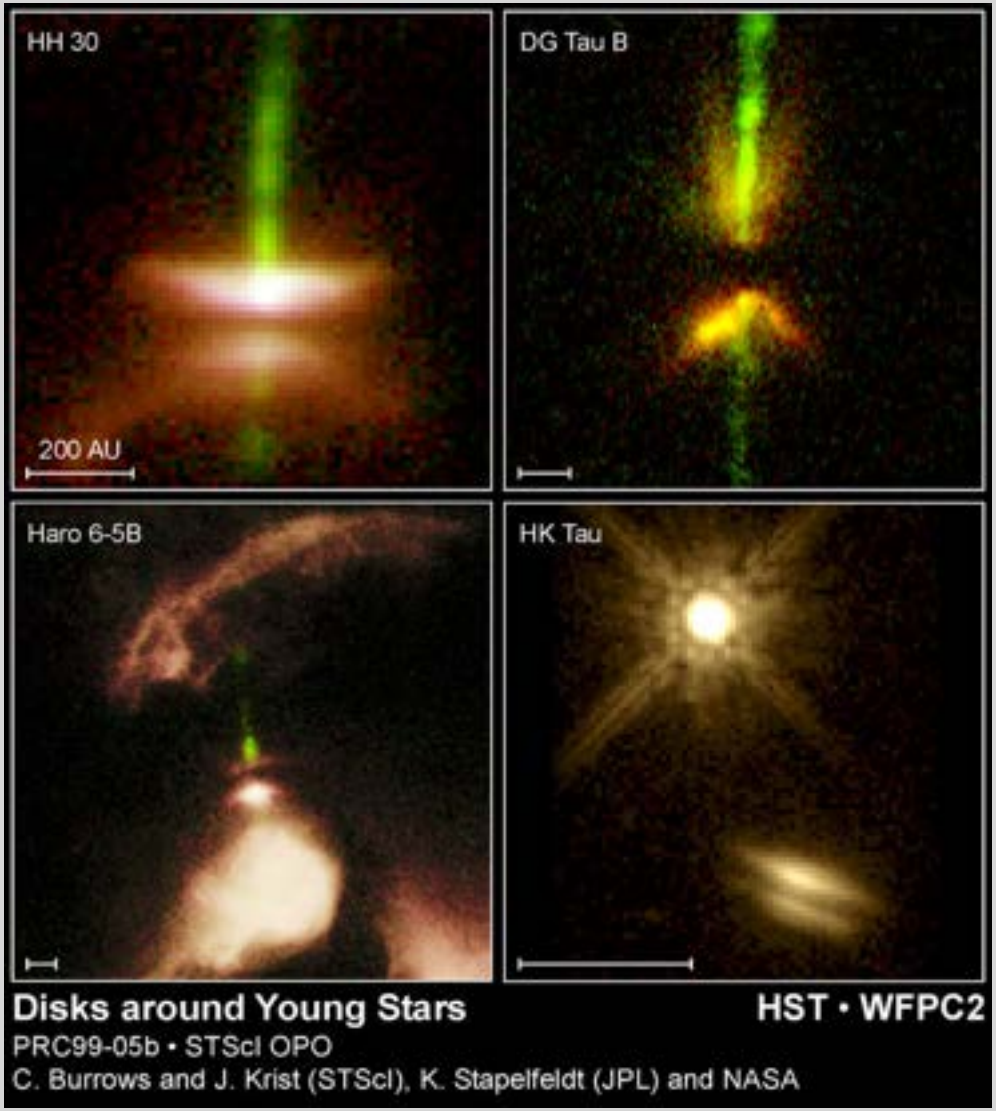
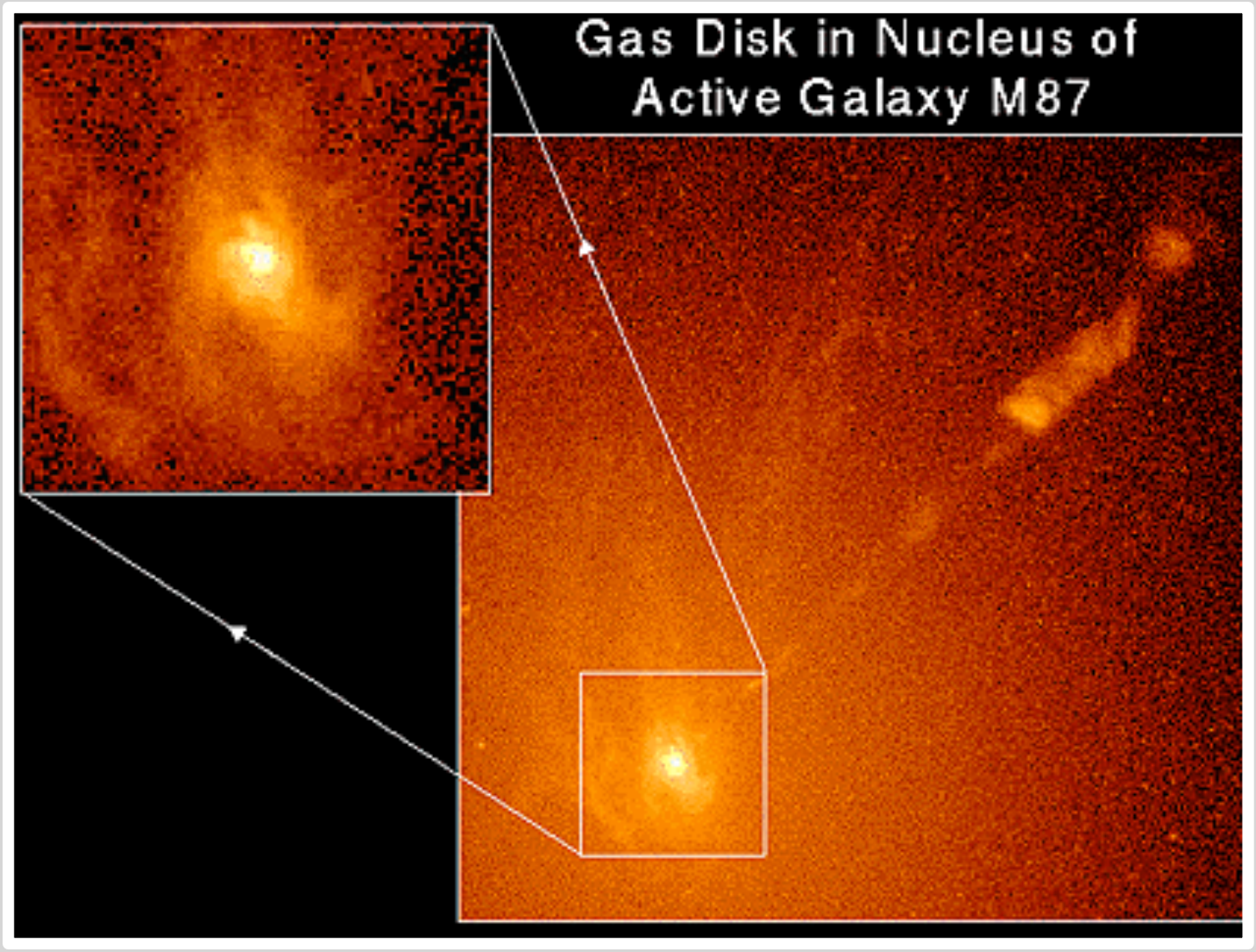
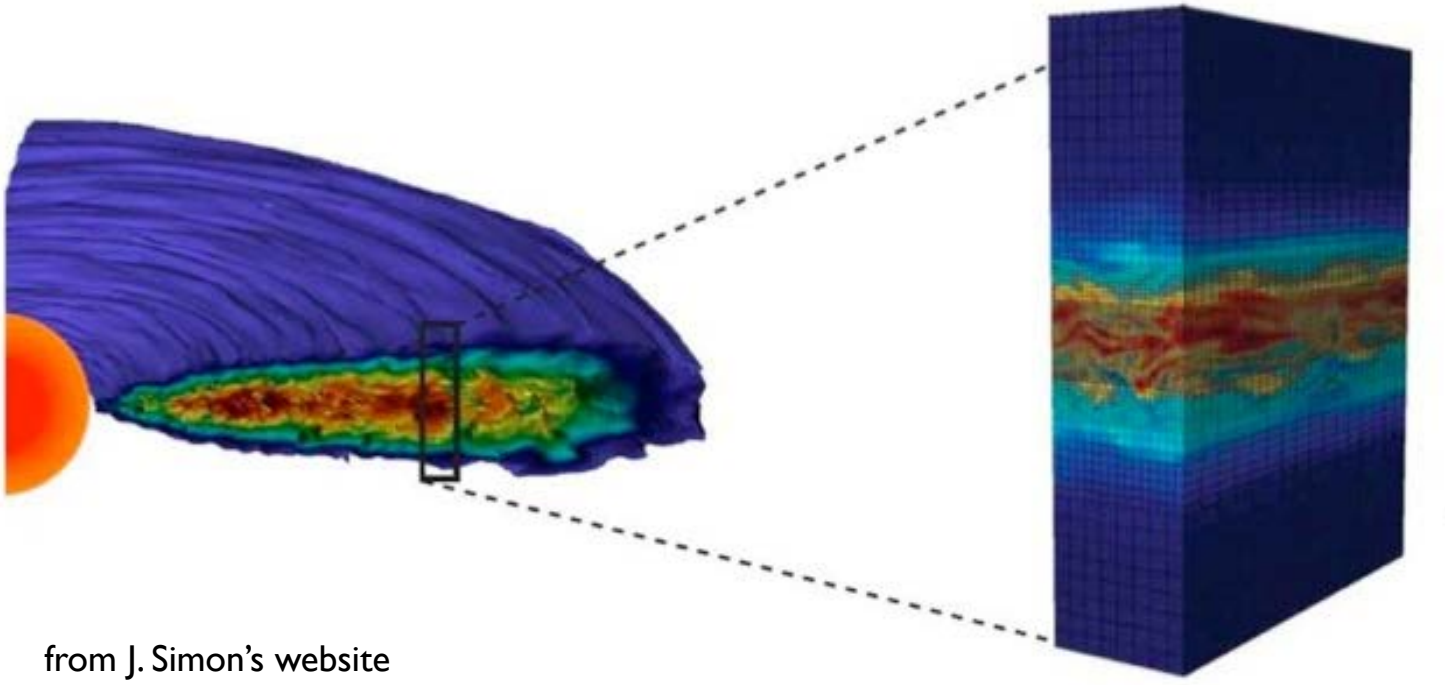
Protoplanetary Disks



Supermassive Black Hole



Modeling Astrophysical Disks



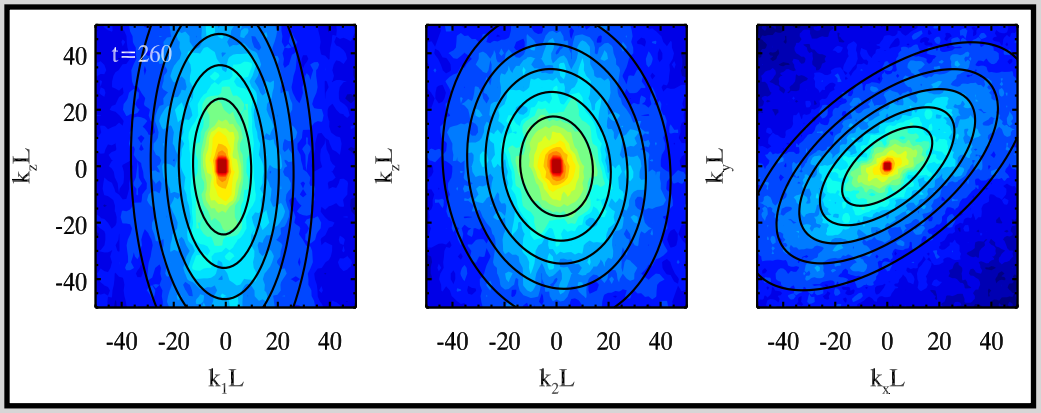
from J. Simon's website

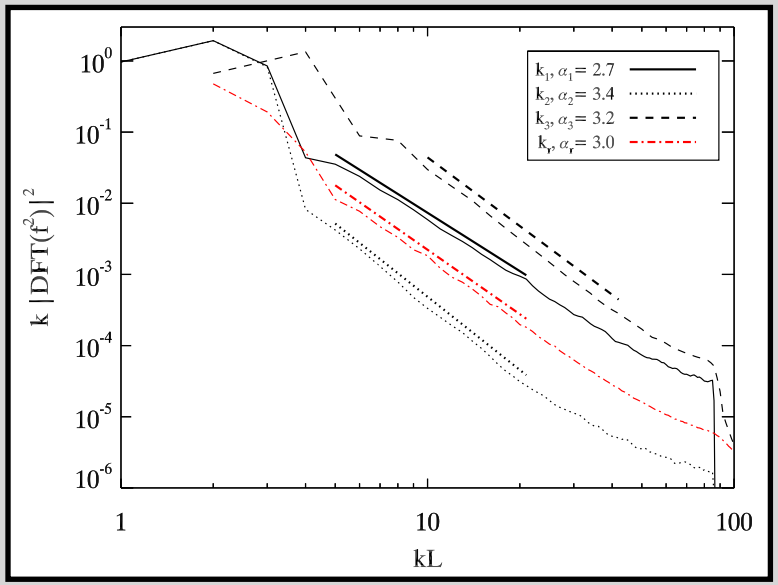
Magnetic fields render the flow turbulent making this a difficult problem

Gas is fully ionized we can model disks using magnetohydrodynamics

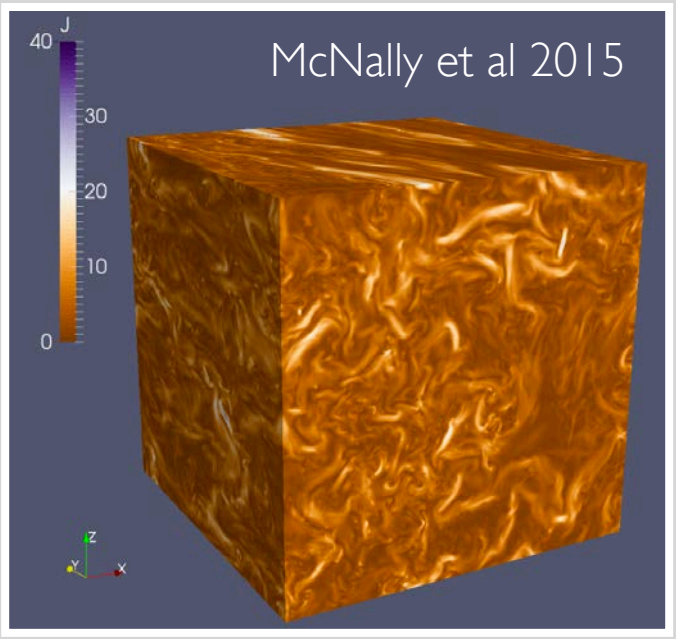
Turbulence in Disks

Understanding disk turbulence is key for developing realistic disk models and shedding light into fundamental questions





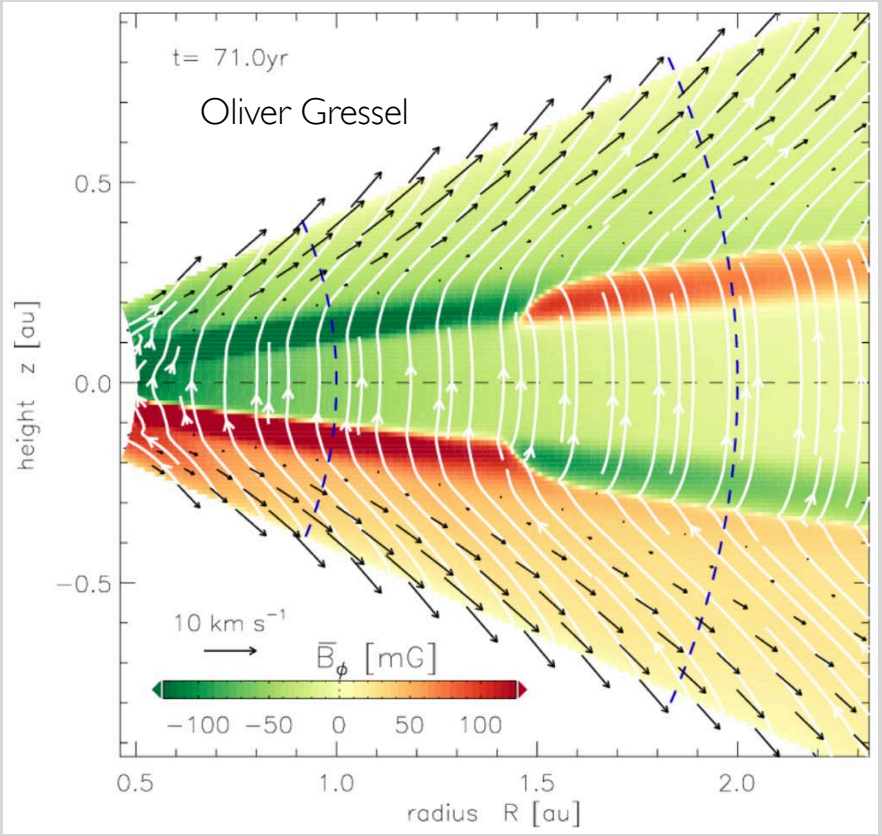
Murphy & Pessah, 2014



Protoplanetary Disks Dynamics

Global models are key to study outflows that arise as a consequence of disk accretion

Modeling protoplanetary disks is difficult because magnetic fields are not well coupled to the gas



Gressel et al. 2015

What Is Different in Black Holes?

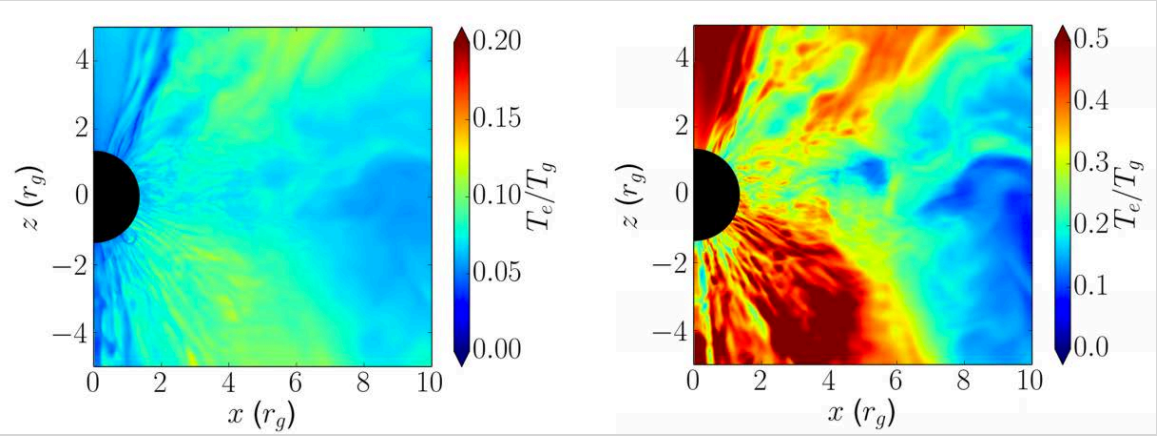
- general relativity important

- non-ideal effects are not important, but

- magnetohydrodynamics breaks down

- hot plasma - kinetic effects important

Electron thermodynamics key to emissivity



Ressler at al. 2015

What Does it Take to Image the Flow?

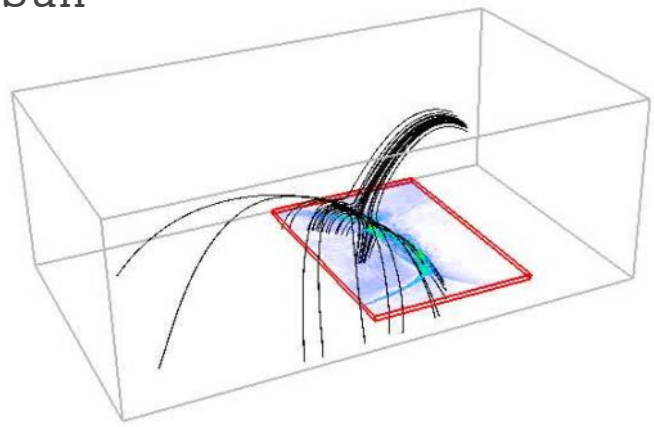
- general relativity
- hybrid approach to mhd + plasma physics
- plasma emissivity
- ray tracing

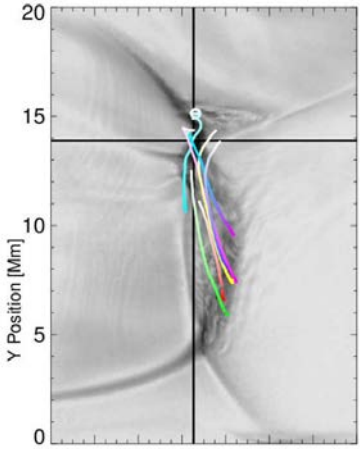
A. Broderik

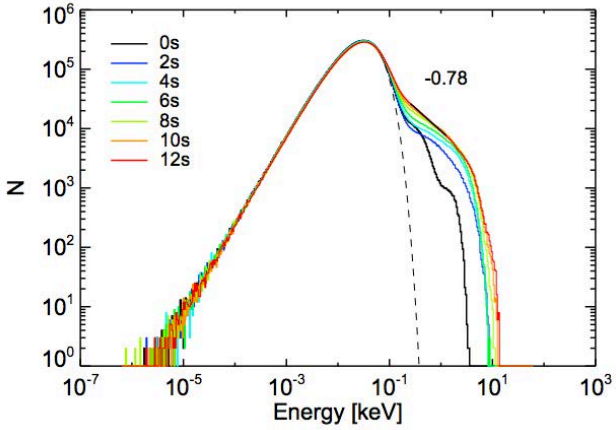
Hybrid Approach to Collisionless Plasmas

Sun

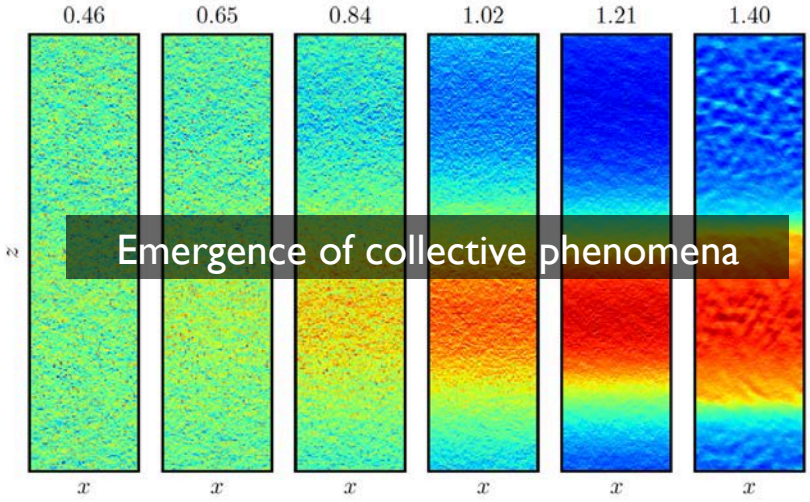
G. Bauman, T. Haugbølle, & Å. Nordlund, 2013



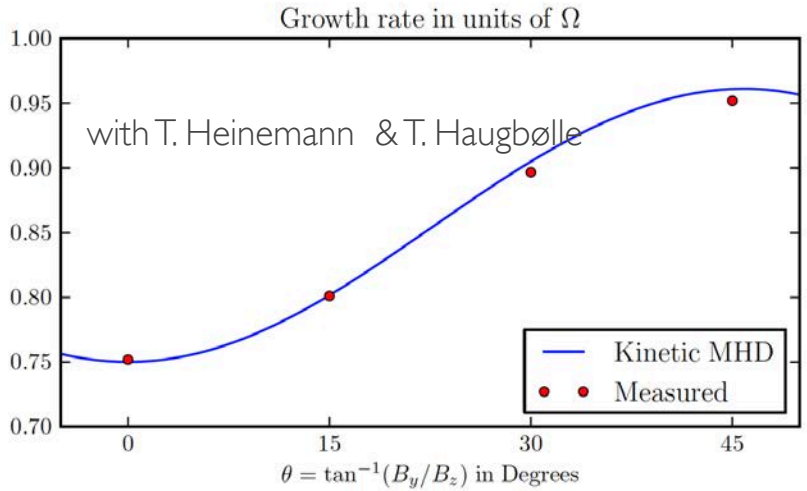




Accretion disks



Emergence of collective phenomena



What Do We Have?

- expertise in accretion processes
- expertise in magnetohydrodynamics
- expertise in plasma physics
- expertise in high-performance computing
- access to state-of-the art hardware
- expertise in general relativity