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Title: Neutron Star Mergers and Neutrino Driven Accretion Flows

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Neutron Star Mergers and Neutrino Driven Accretion Flows

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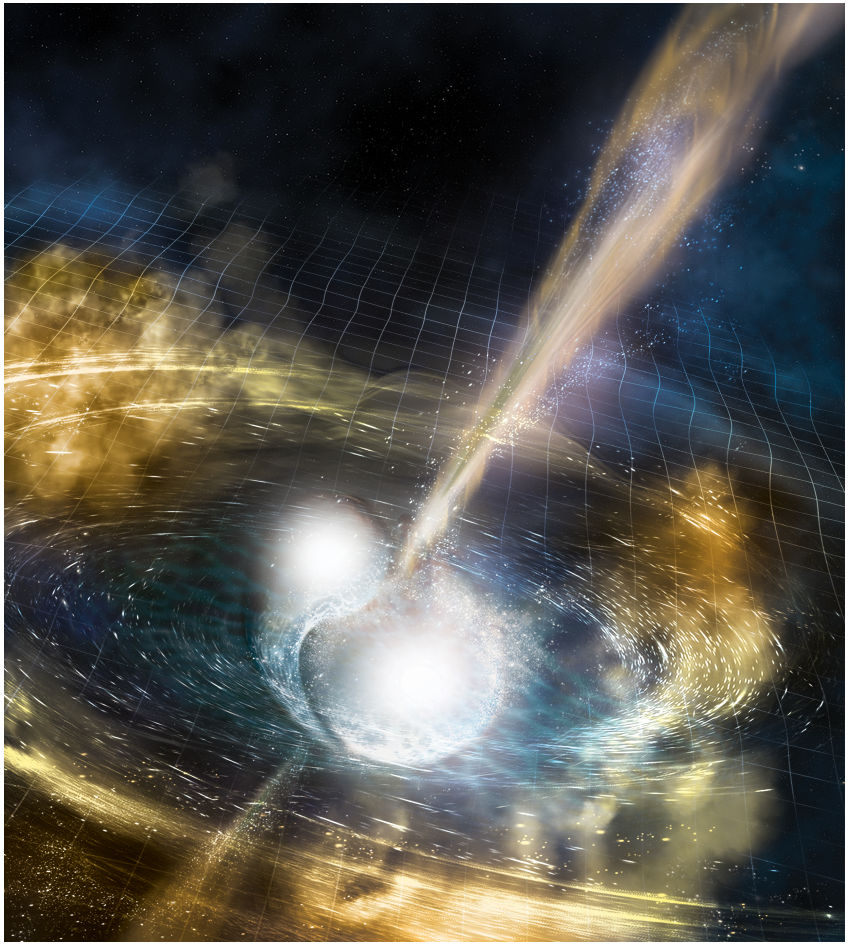
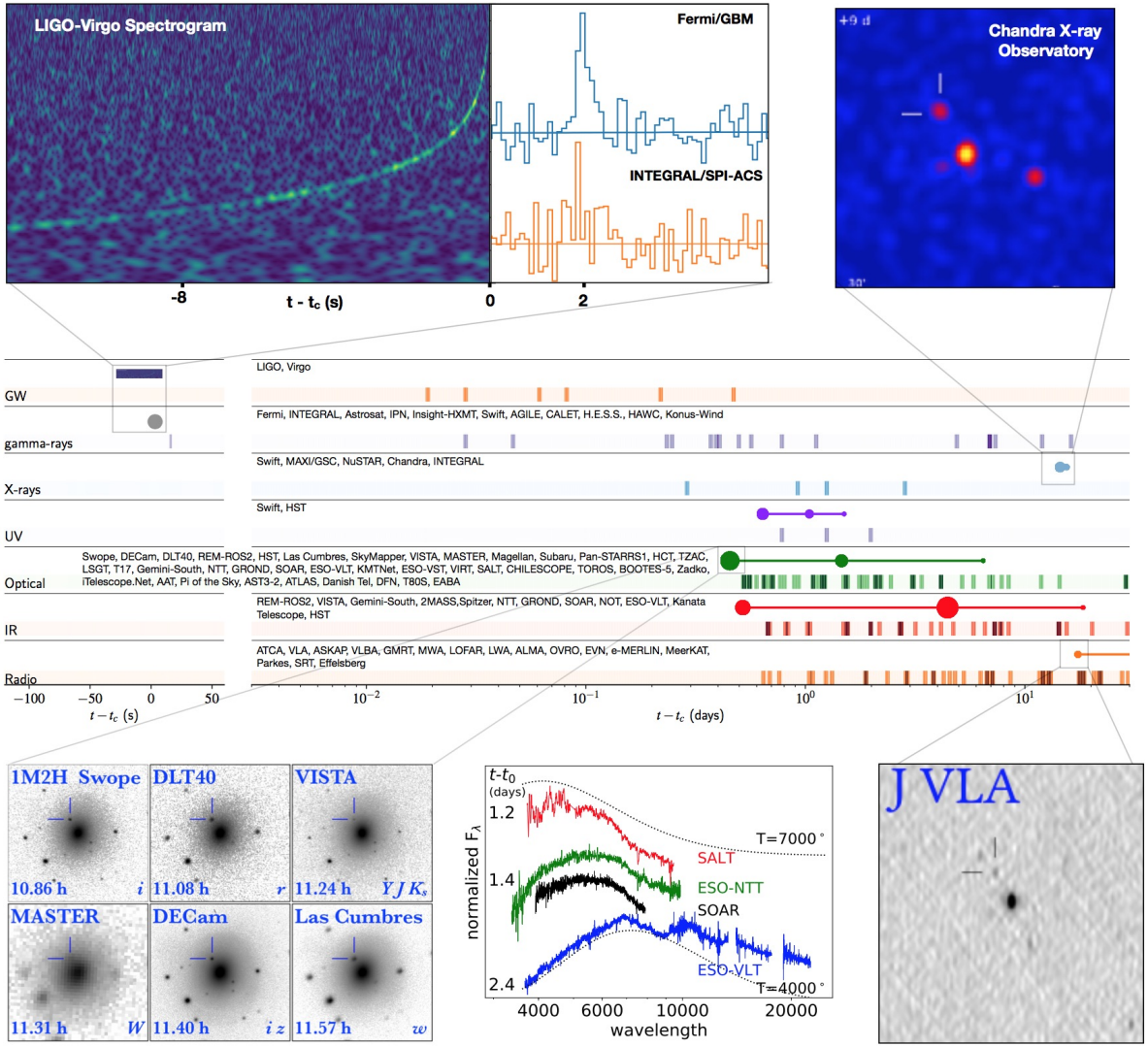
Astro Coffee at the IAS
LA-UR-18-26592

GW170817



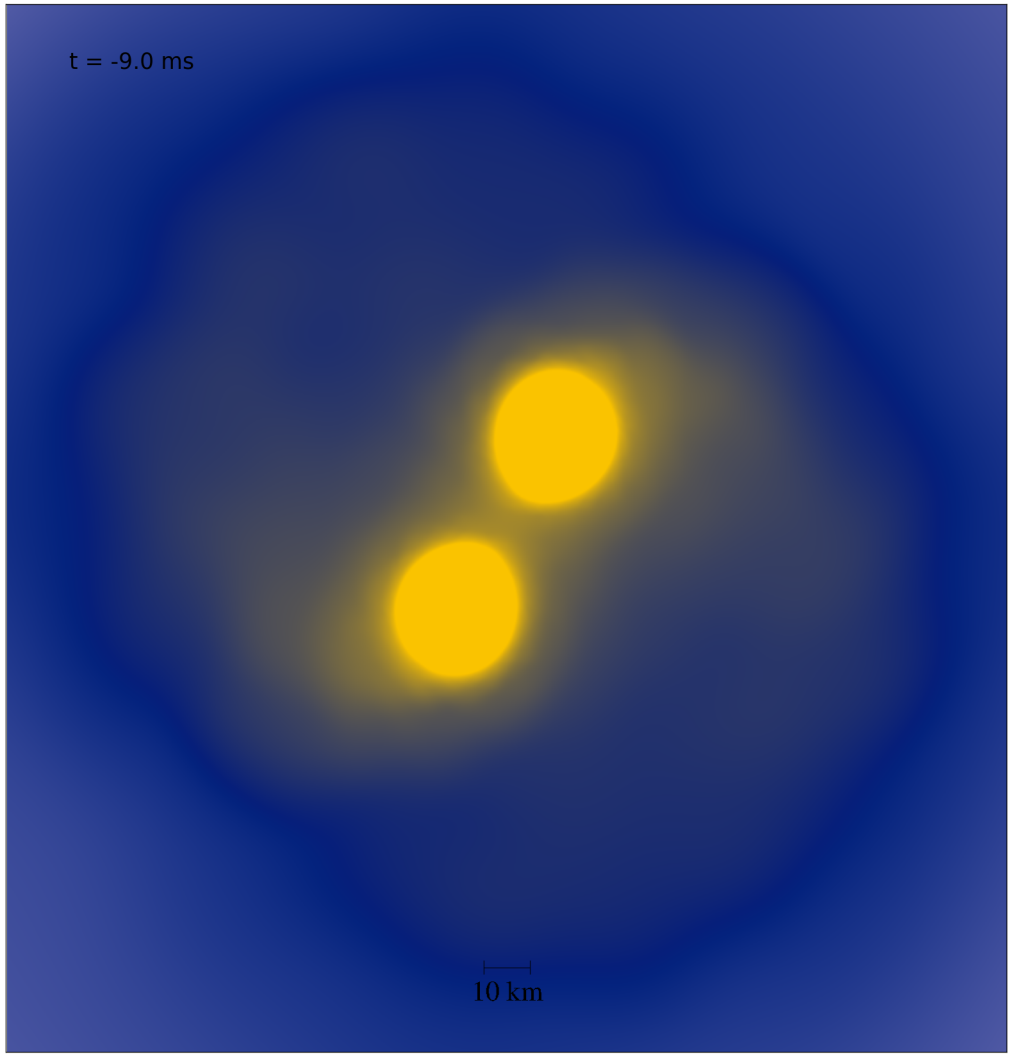
https://youtu.be/e7LcmWiclOs
NSF/LIGO/Sonoma State University/A. Simonnet
NASA's Goddard Space Flight Center/CI Lab

Observations Galore!



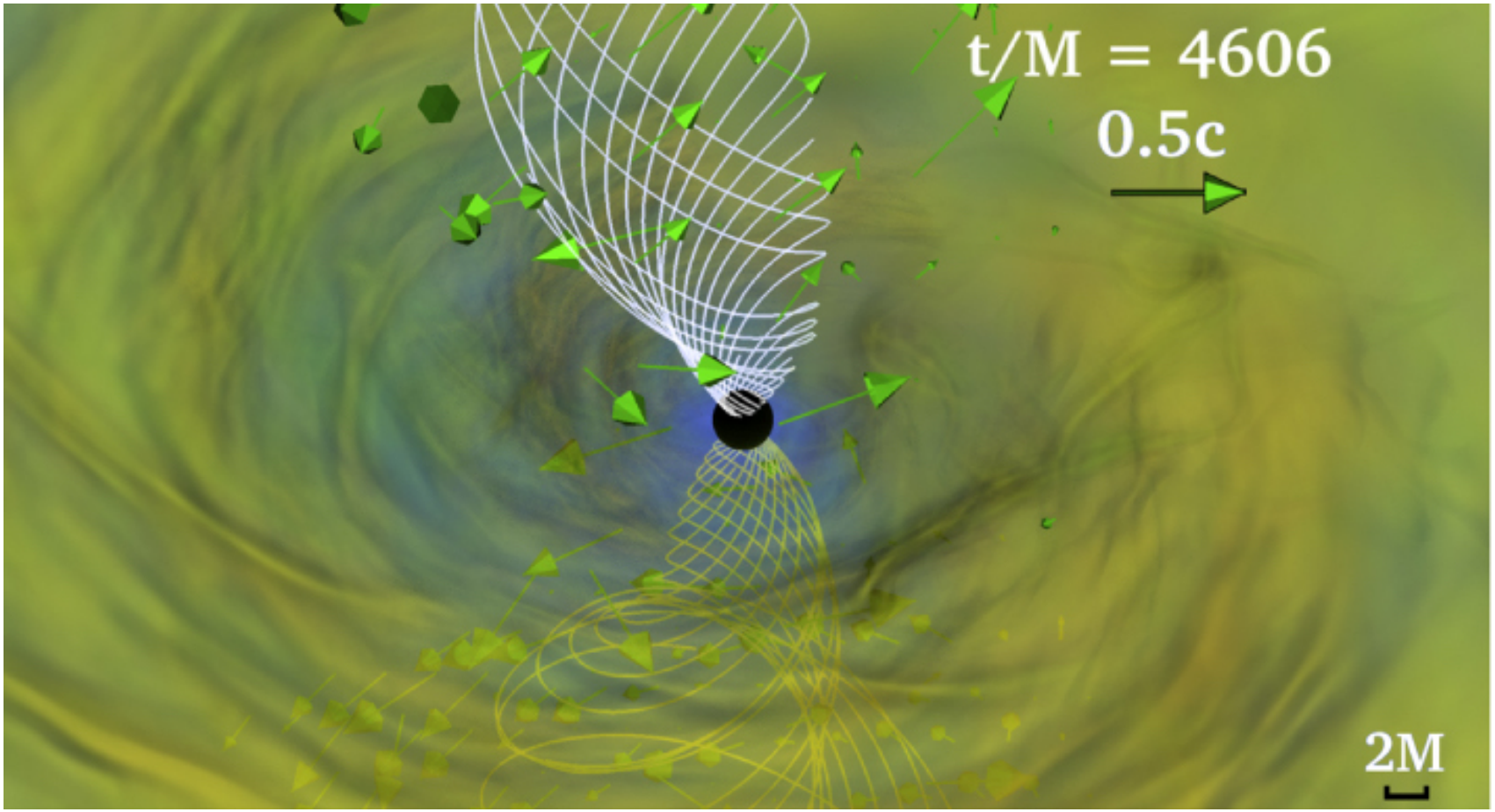
Abbot+, 2017

Merger Dynamics in Short



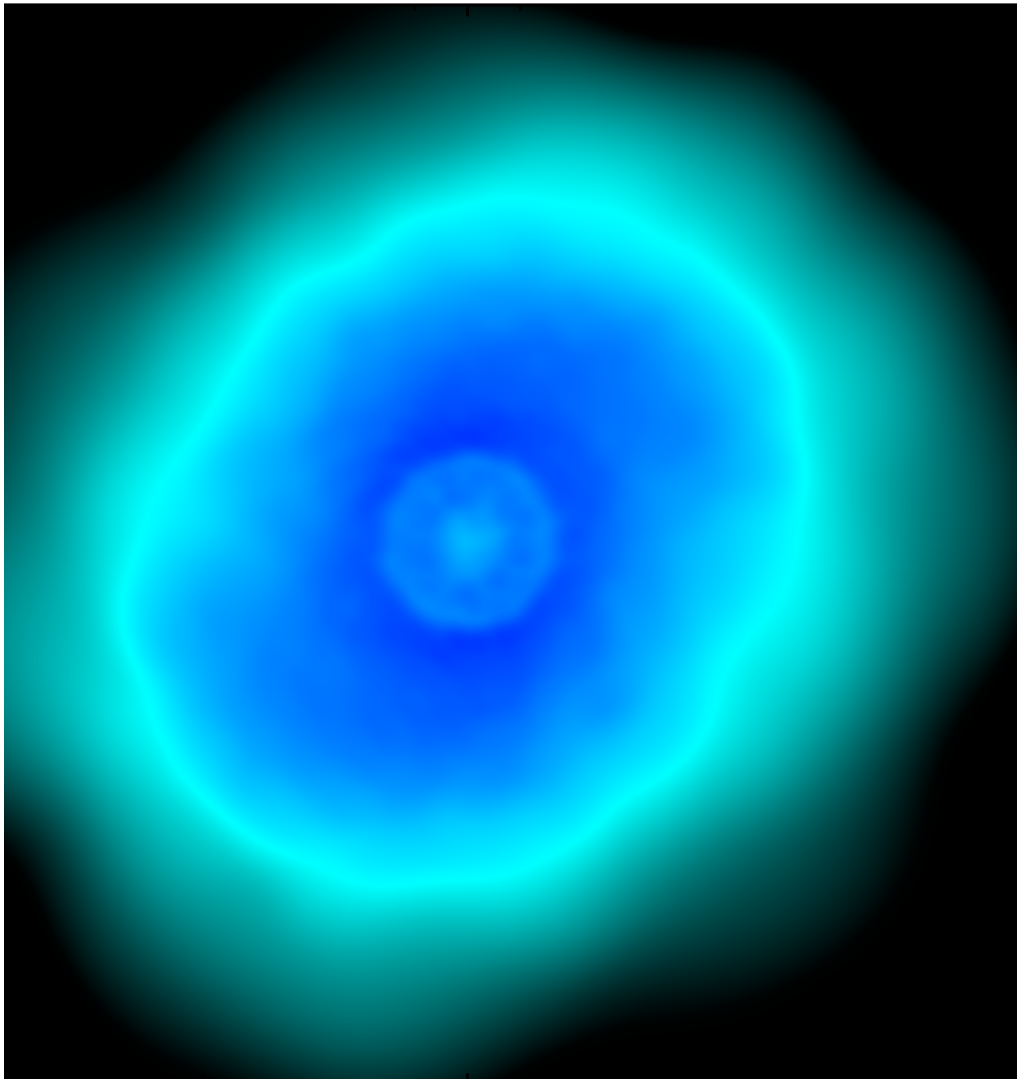
JMM+, 2016

Disk Drives a Jet



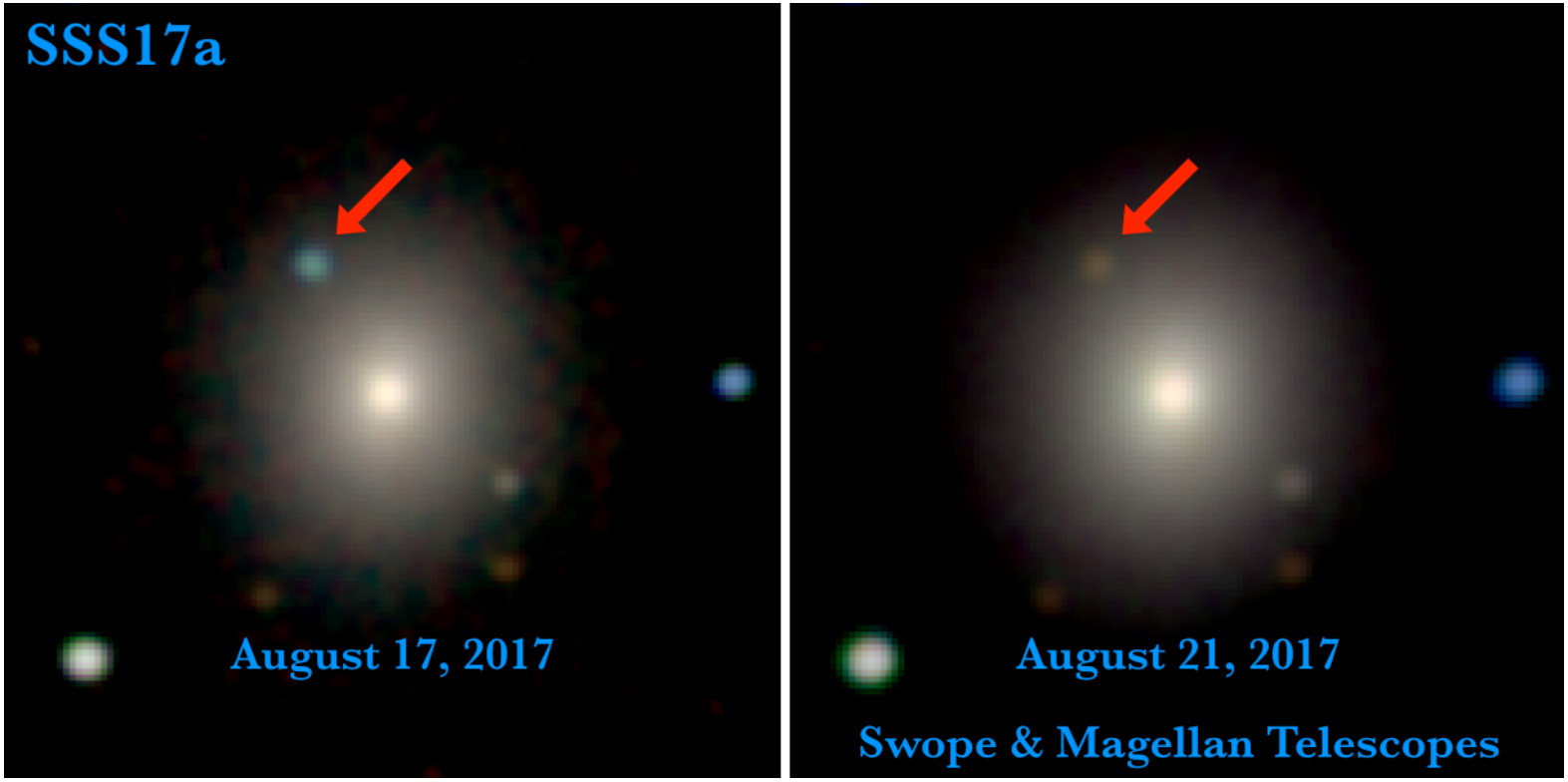
Ruiz+, 2016

The Radioactive Cloud



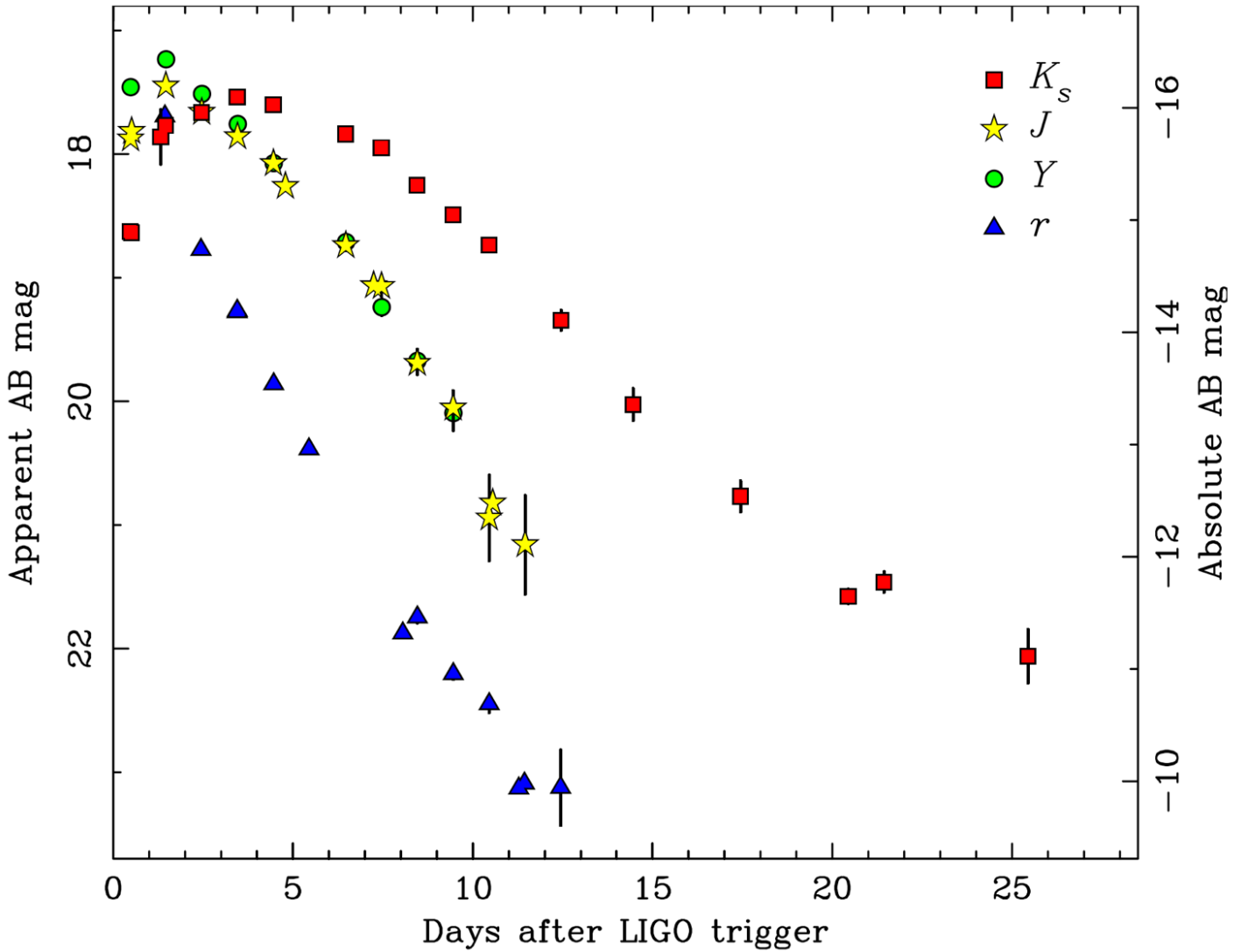
JMM+, 2016

The Kilonova



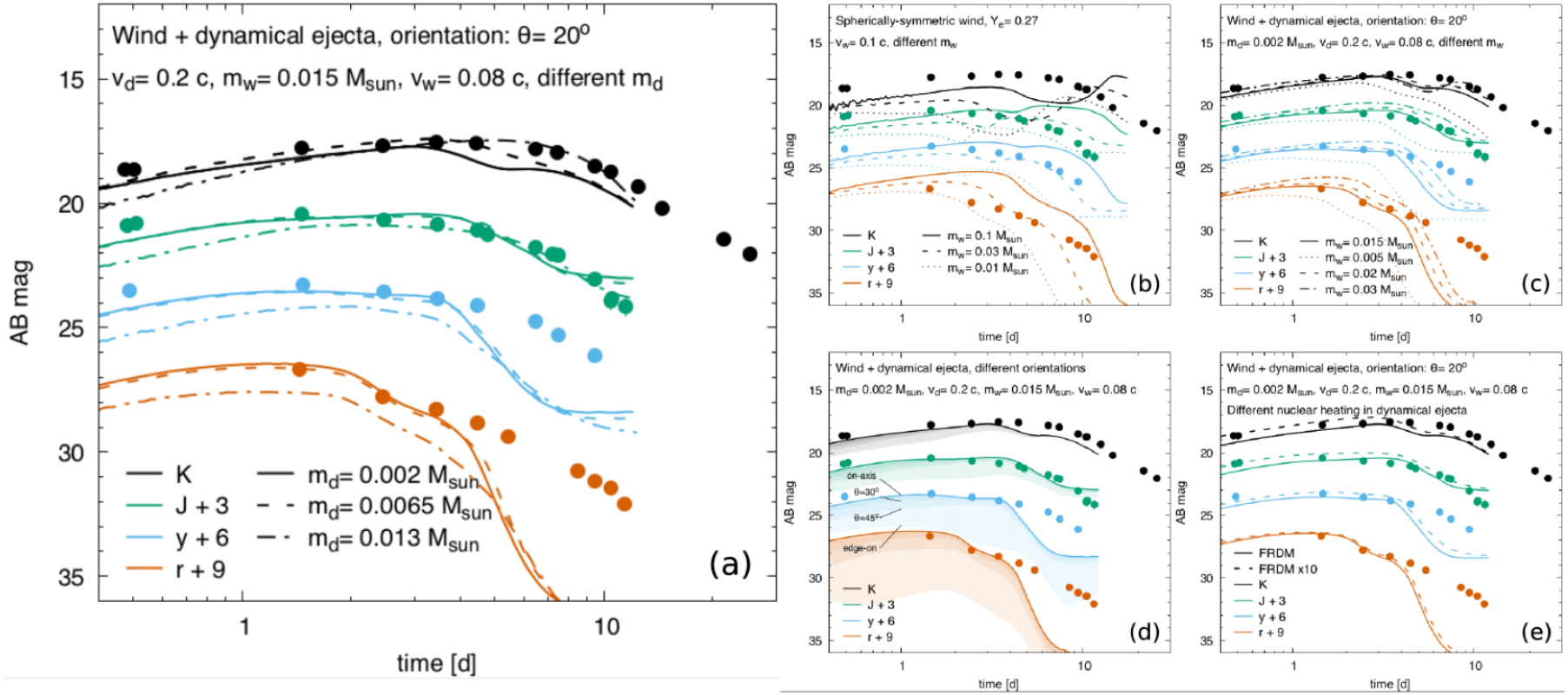
M2H/UC Santa Cruz and Carnegie Observatories/Ryan Foley

Infrared Light Curves



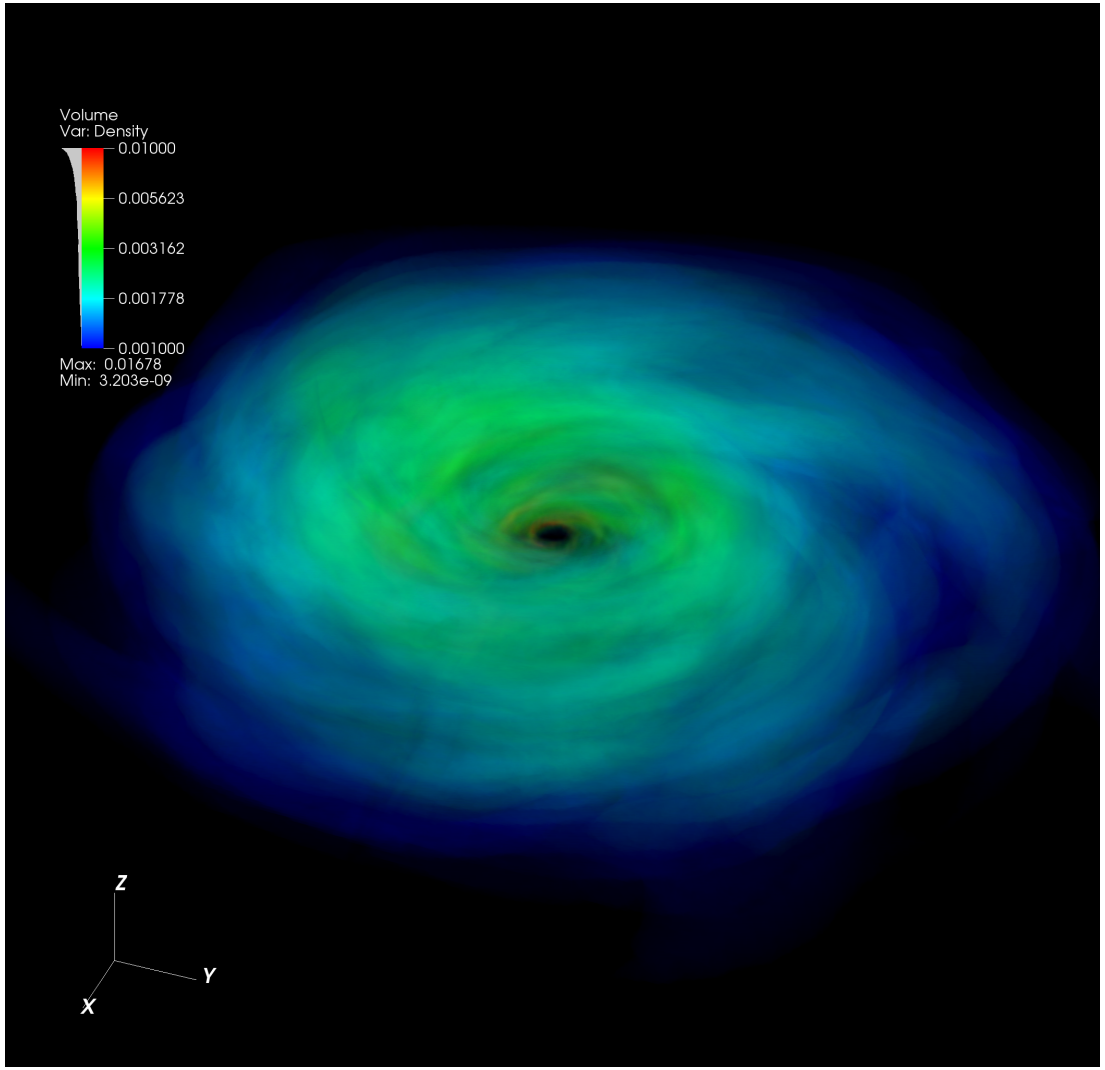
Tanvir et al., 2017/HST

Infrared Light Curves



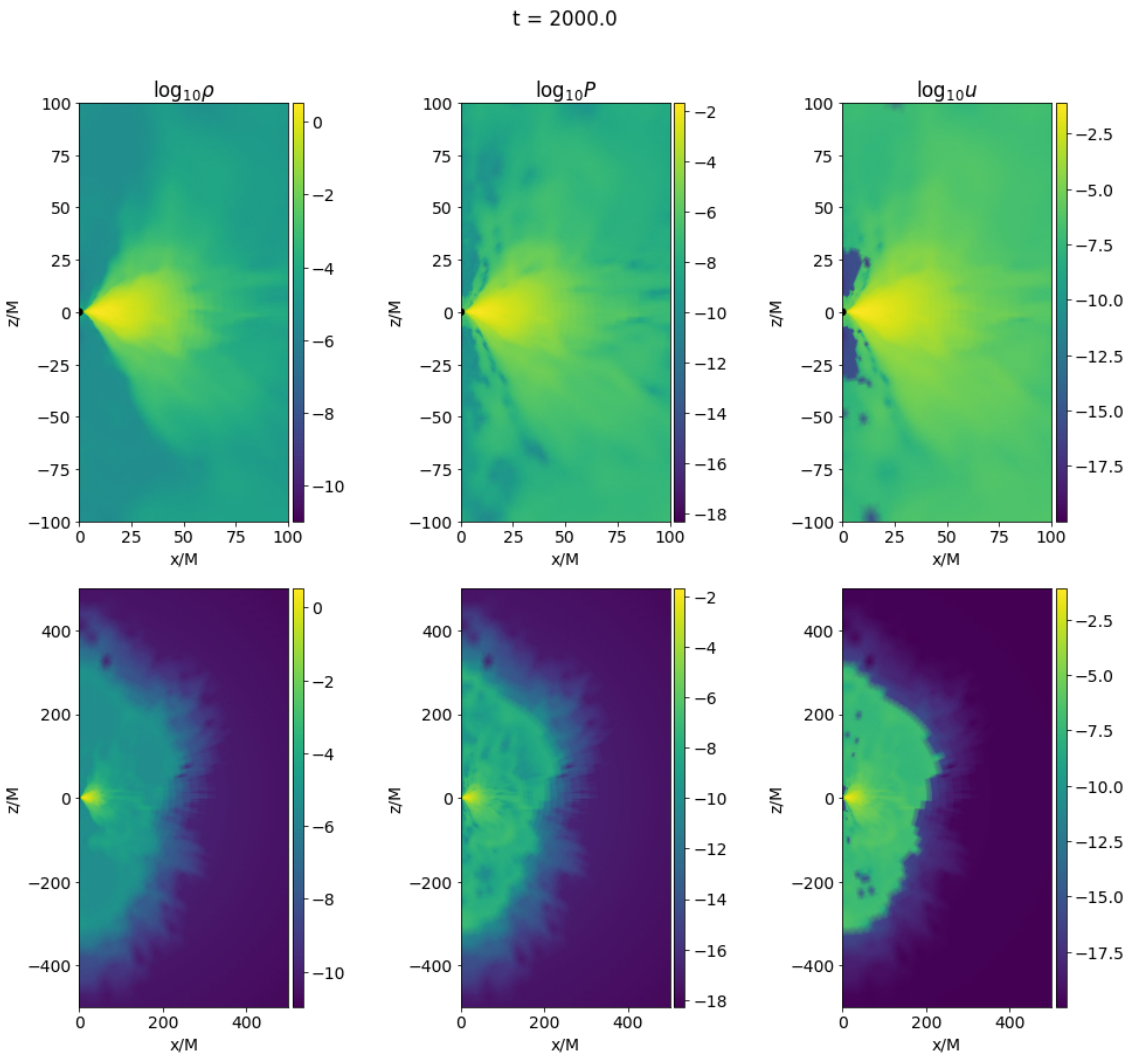
Tanvir et al., 2017/HST

Blue Kilonova Comes from the Disk?



JMM+, in prep.

Wind Dynamics? Nucleosynthetic Yield? Jet Physics?



JMM+, in prep.

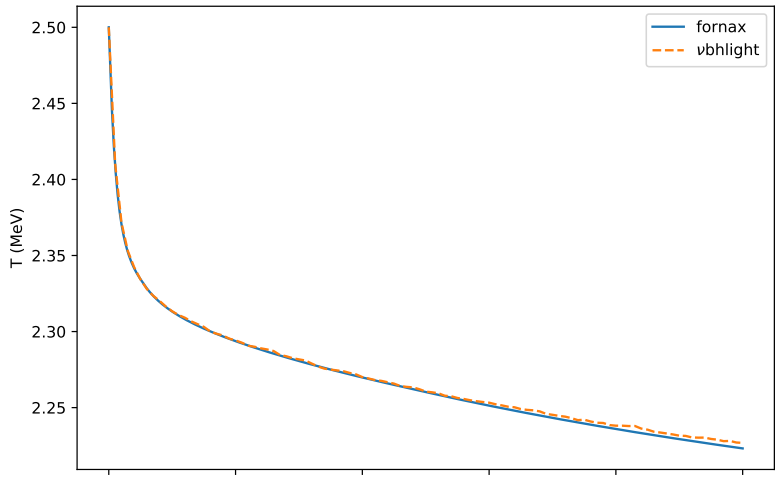
Presenting νbhlight!

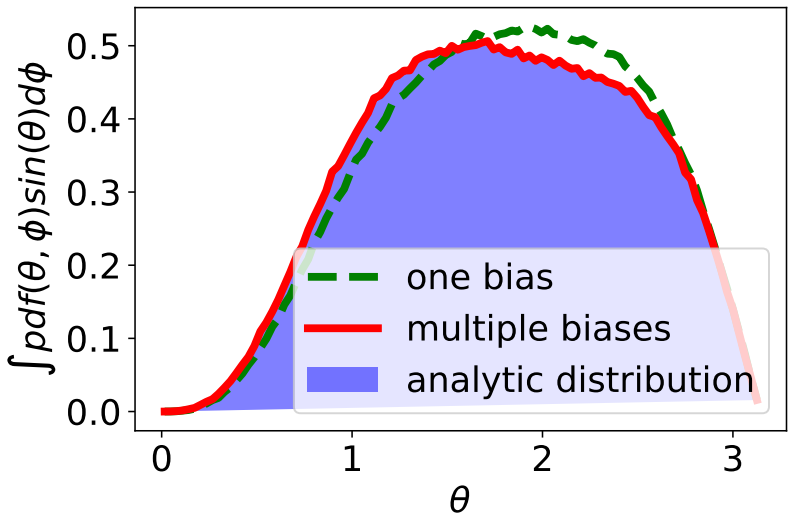
- νbhlight is a radiation GRMHD code.

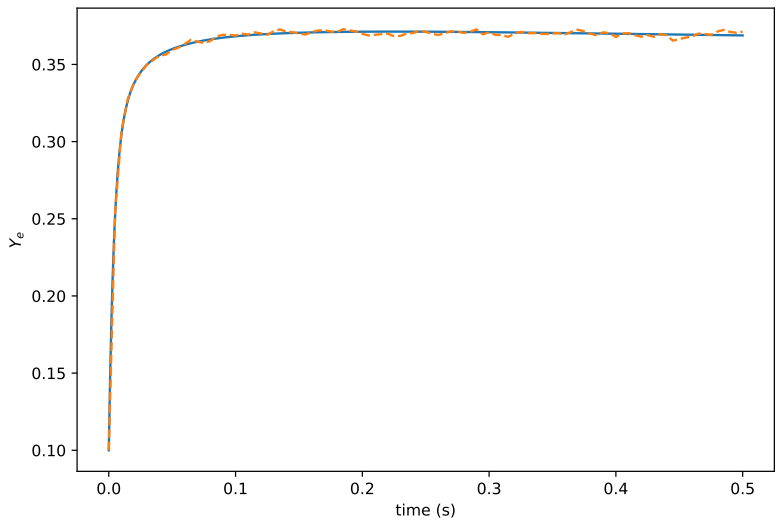
- Physics:
  - General relativity (static spacetimes)
  - Magnetic fields
  - Fluid dynamics
  - Realistic nuclear equations of state
  - Neutrino transport and weak interactions

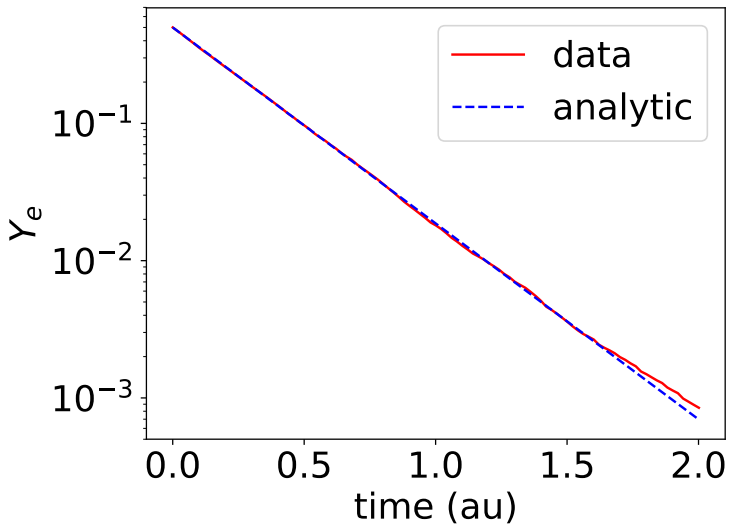
- Implementation:
  - Finite volume scheme for the fluid
  - Constrained transport for the B-field
  - Monte Carlo for ν
  - Tabulated microphysics
  - Built on Gammie+ (2003), Dolence+ (2009), and Ryan+ (2015)

Code Tests



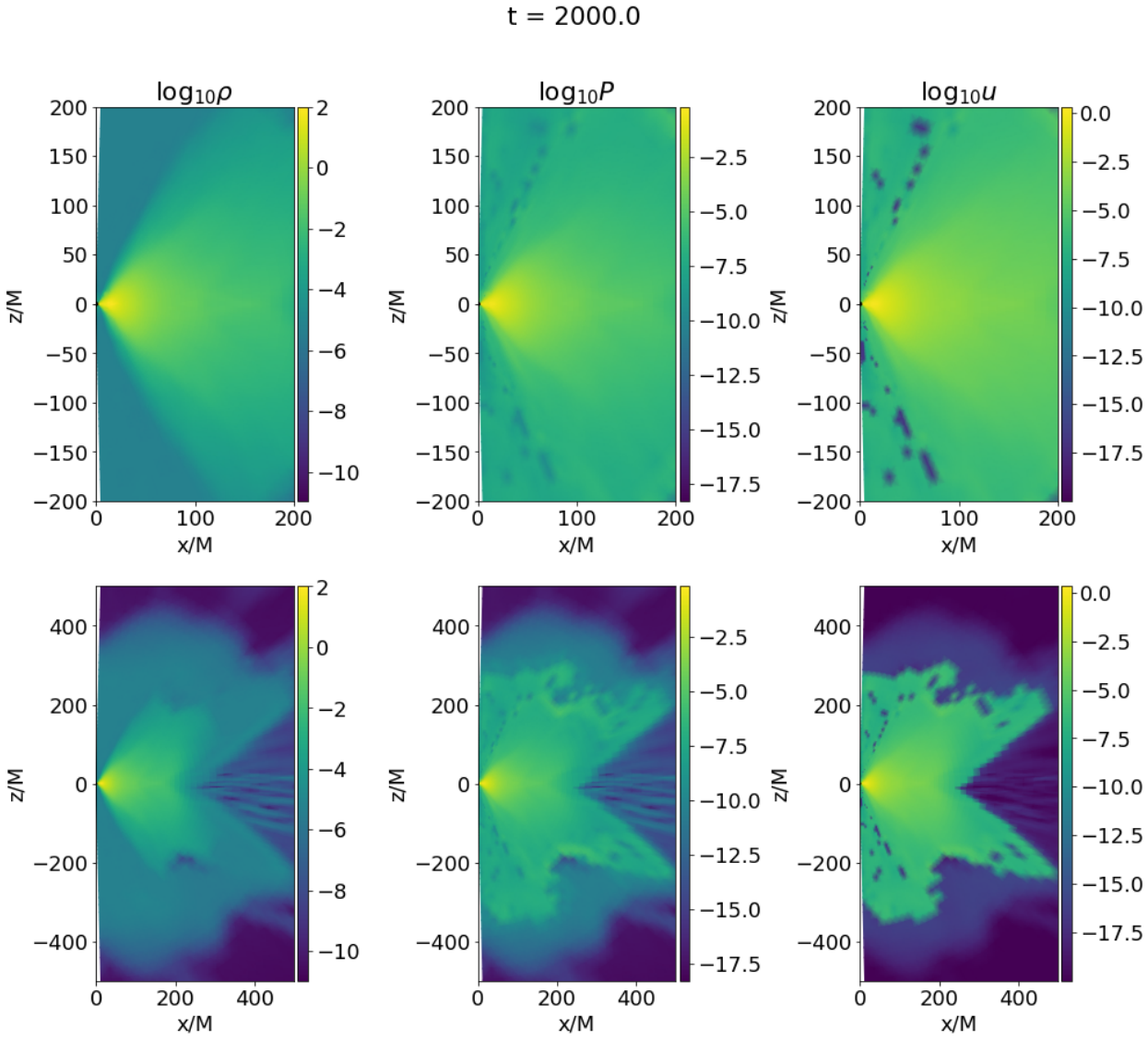


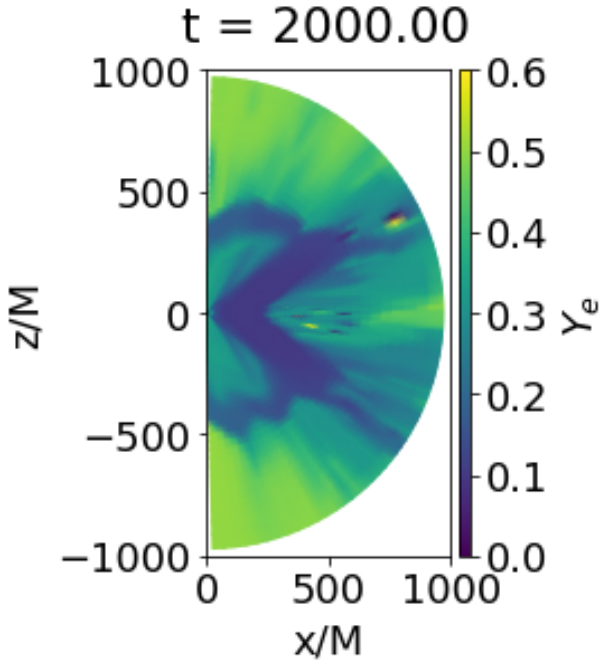




JMM+, in prep.

(Very!) Preliminary Results





- **JMM+**, in prep.

Conclusion

- The detection of a binary neutron star is very exciting!
- There are open questions about the central engine:
  - How important is the disk wind for nucleosynthesis and the kilonova?
  - What drives the wind? MHD? Neutrinos?
  - What drives the jet physics?
- Requires detailed radiation GRMHD and nucleosynthesis calculations
- We present νbhlight as a tool for modeling the central engine