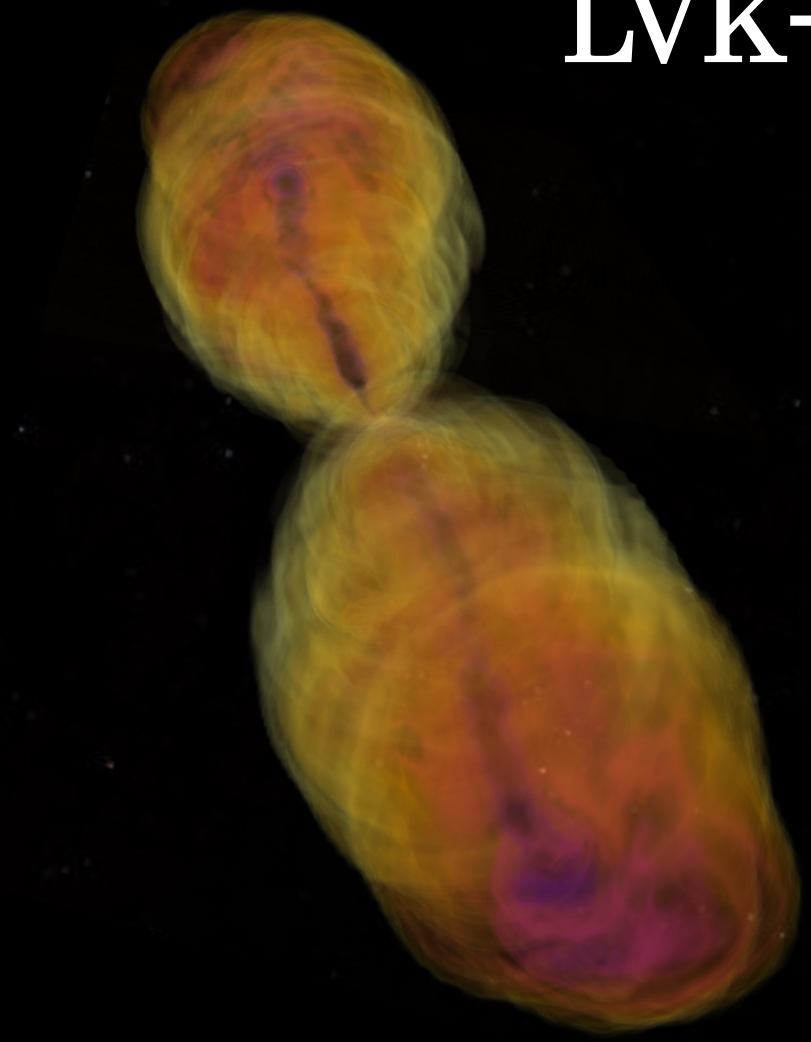
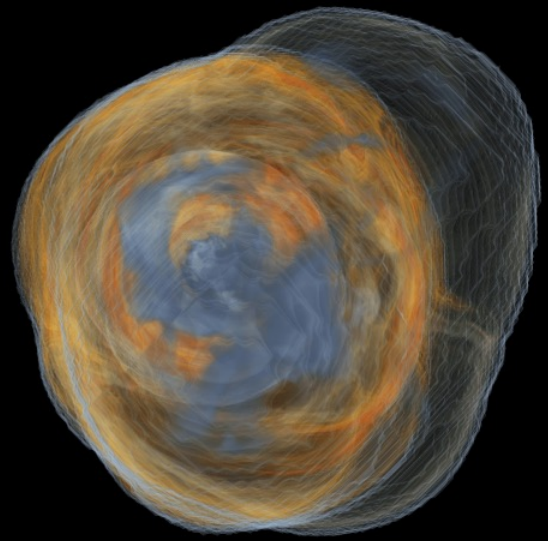
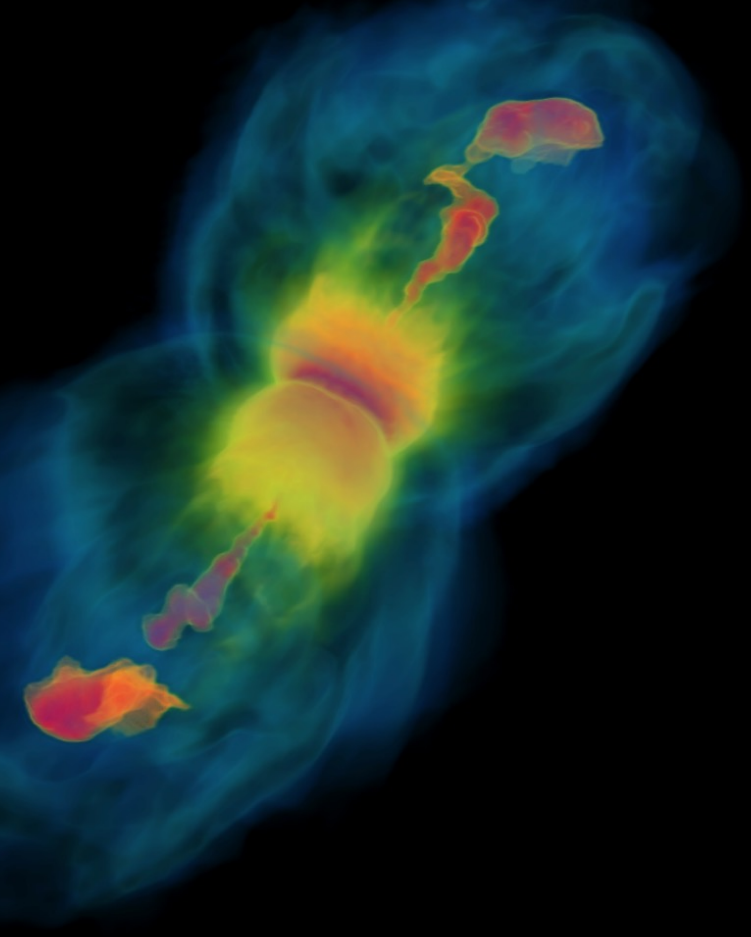
Multi-messenger Cocoons: New LVK-Detectable GW sources







Ore Gottlieb

CIERA, Northwestern University

ore@northwestern.edu

AAS 242 Press Conference

With: H. Nagakura, A. Tchekhovskoy, P. Natarajan, E. Ramirez-Ruiz, S. Banagiri, J. Jacquemin-Ide, N. Kaaz, V. Kalogera

Detectable GW in LVK

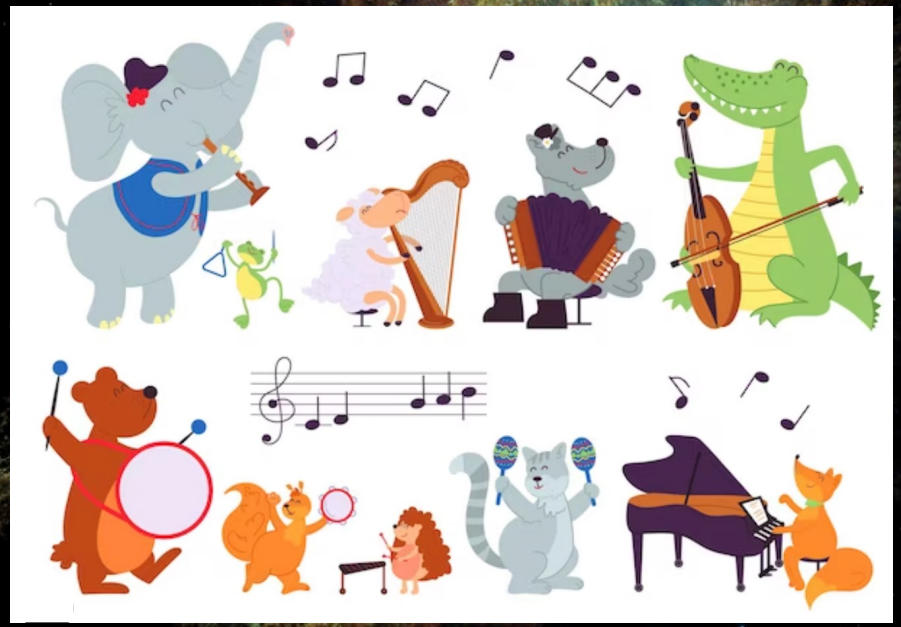
Inspiral GWs

Binary black holes

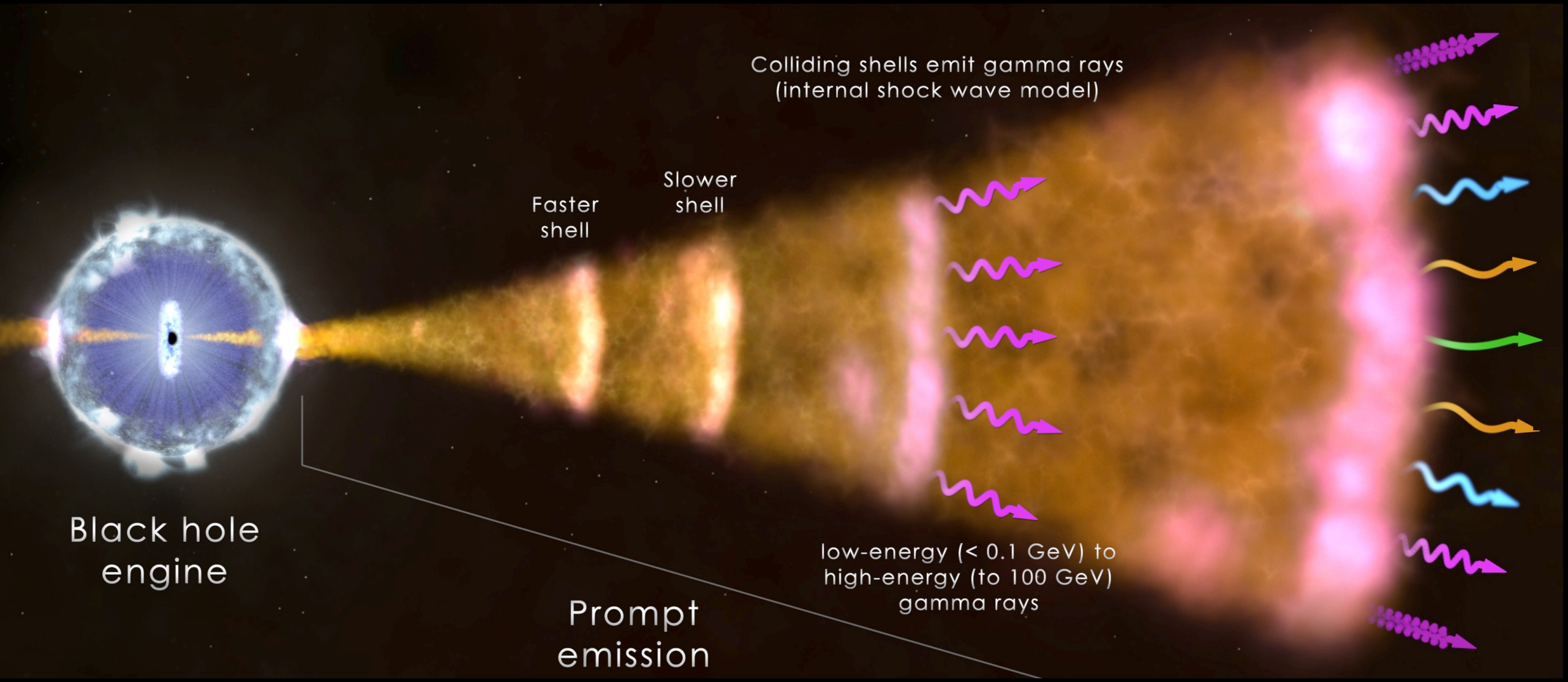
Black hole-neutron star

Stochastic GWs

Supernovae?

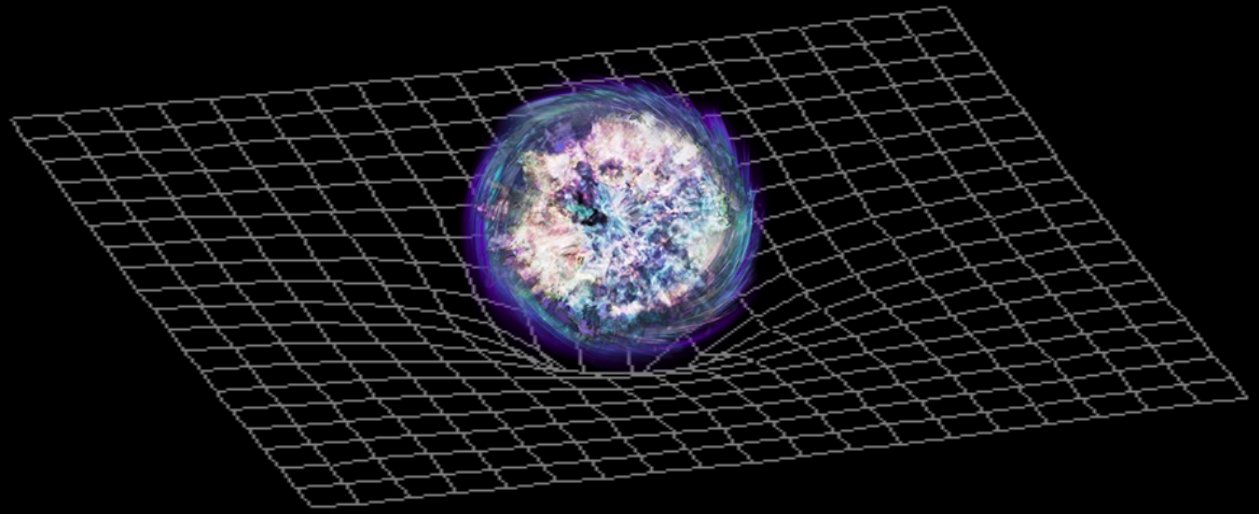


Collapsars

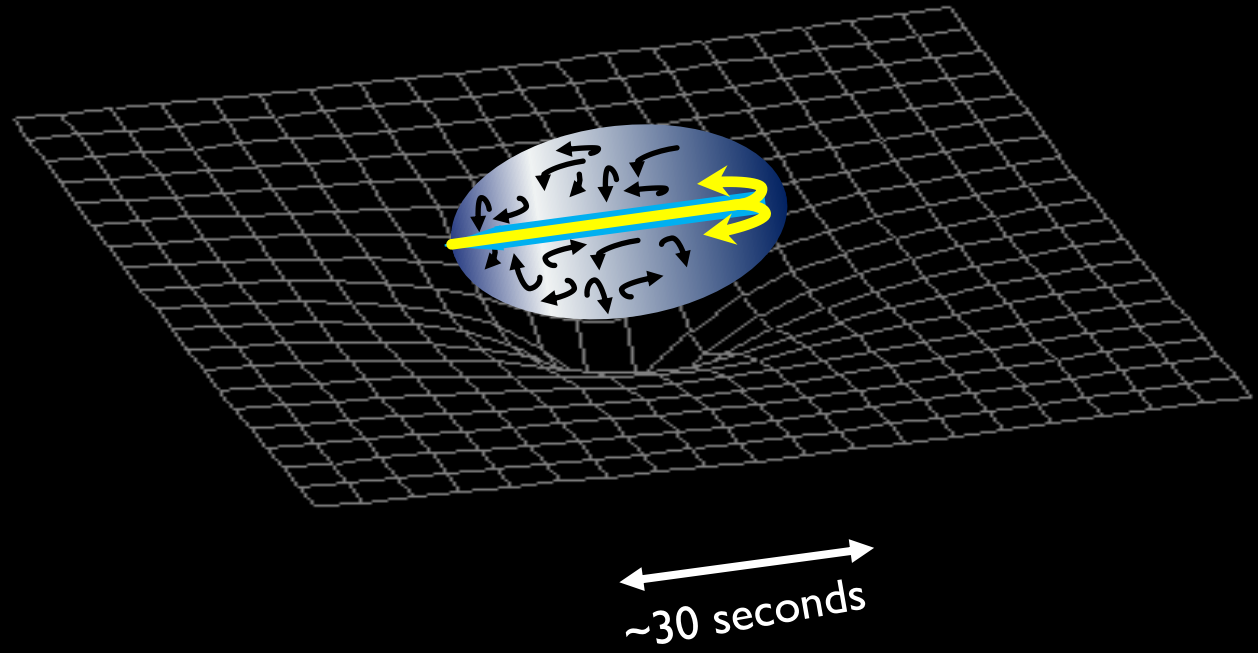

Colliding shells emit gamma rays
(internal shock wave model)
Faster shell
Slower shell
Black hole engine
Prompt emission
low-energy (< 0.1 GeV) to high-energy (to 100 GeV) gamma rays

Stochastic gravitational waves

- Supernova - too weak



- GRB jets - $f_{GW} \approx 0.03$ Hz – too low for LVK

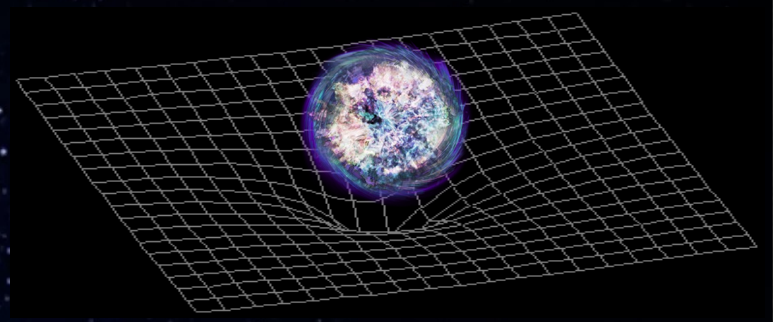


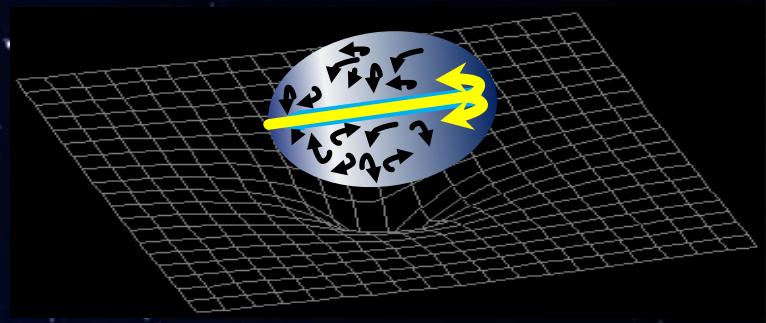
Dancing jets

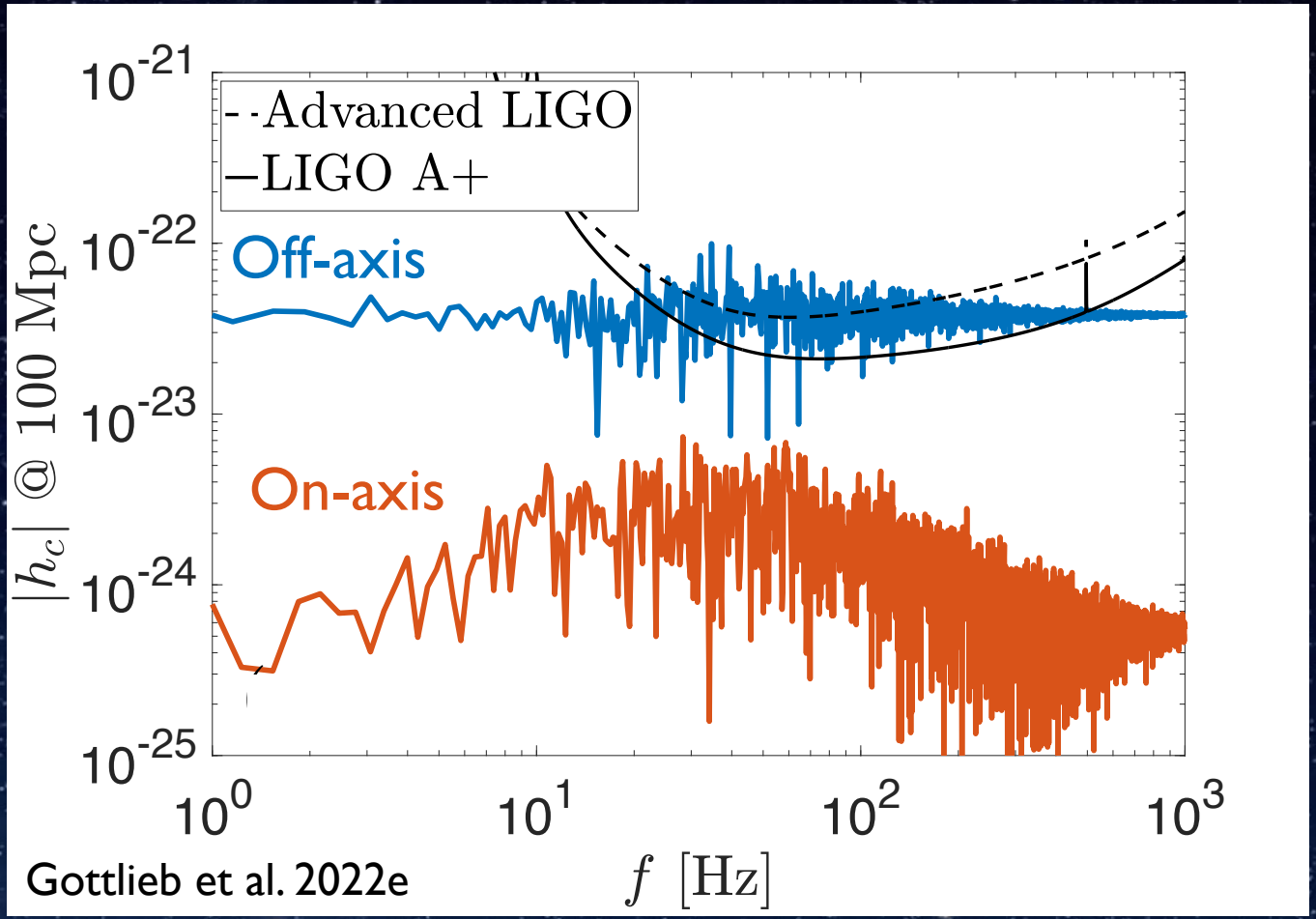
Gottlieb et al. 2022c

Multi-messenger cocoons

- ✓ Shape: hourglass
- ✓ Frequency: fast evolution
- ✓ Energy: comparable with jets and SNe
- ➢ Promising multi-messenger source







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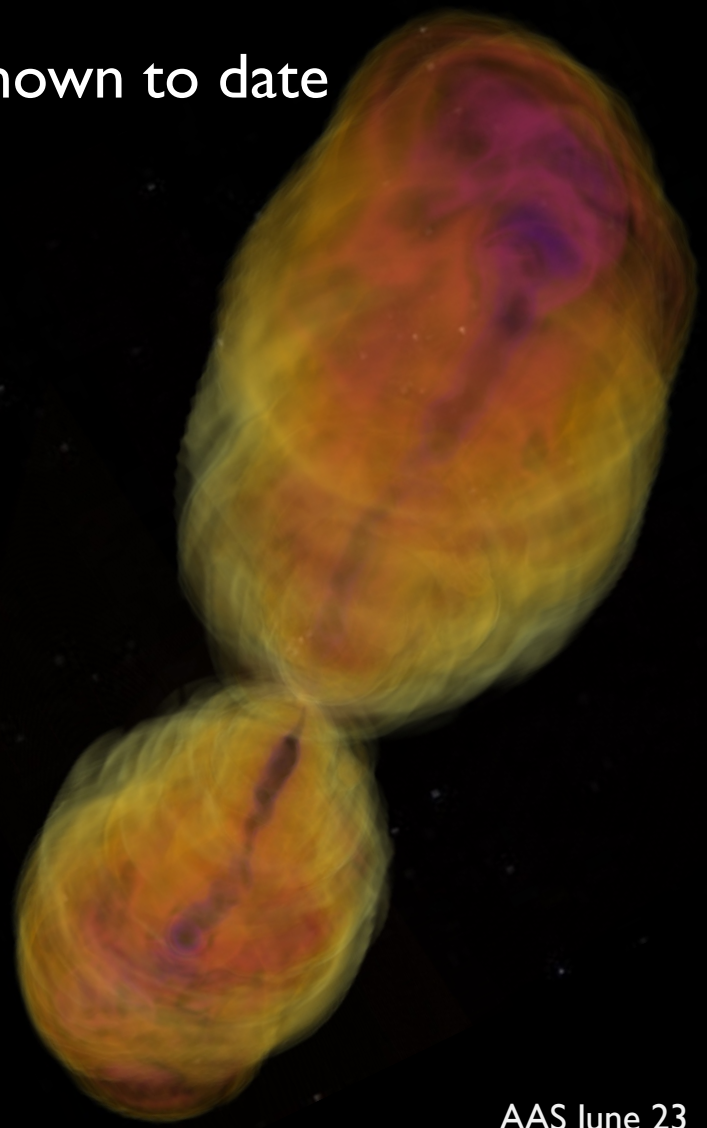
Summary

- Cocoons are the most promising stochastic GW sources in LVK known to date
- Cocoons are promising multi-messenger sources
- EM detection from cocoons will aid the GW detection prospects
- Numerical and analytic works are needed to constrain the physics



Questions? ore@northwestern.edu