

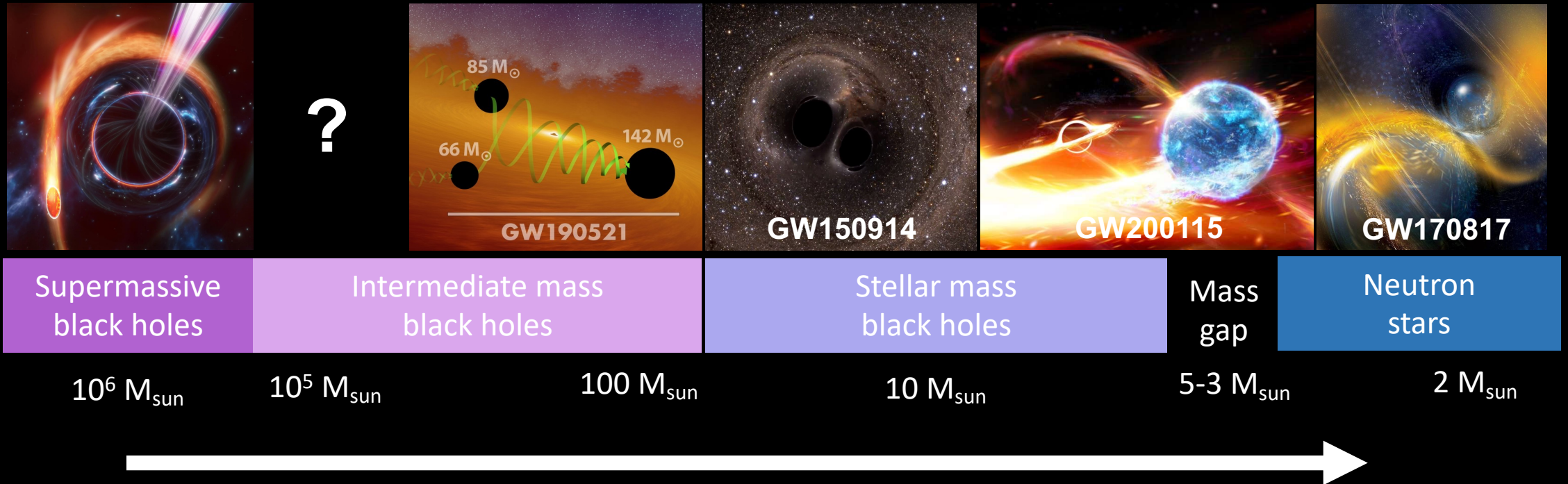
# A holistic view of compact binary mergers

Eleonora Troja

*University of Rome – Tor Vergata*

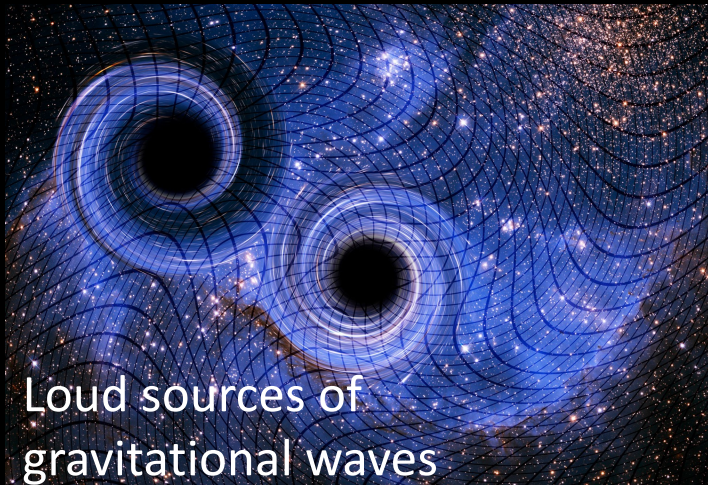


# Down the mass spectrum





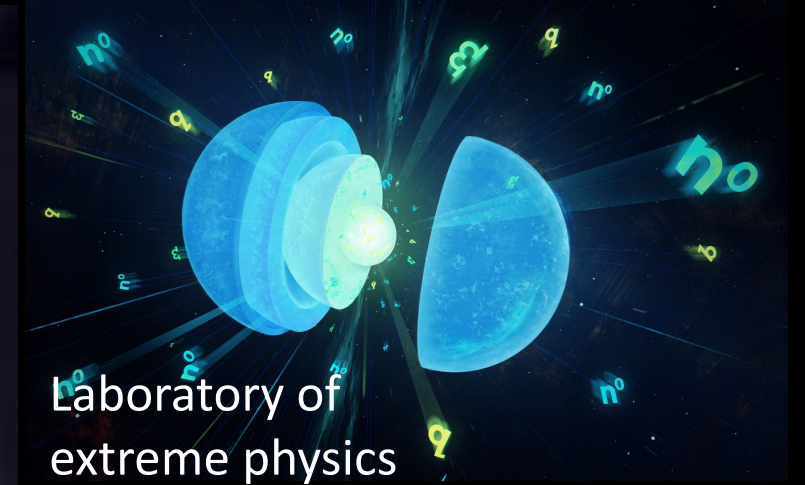
# Premier role in Astrophysics



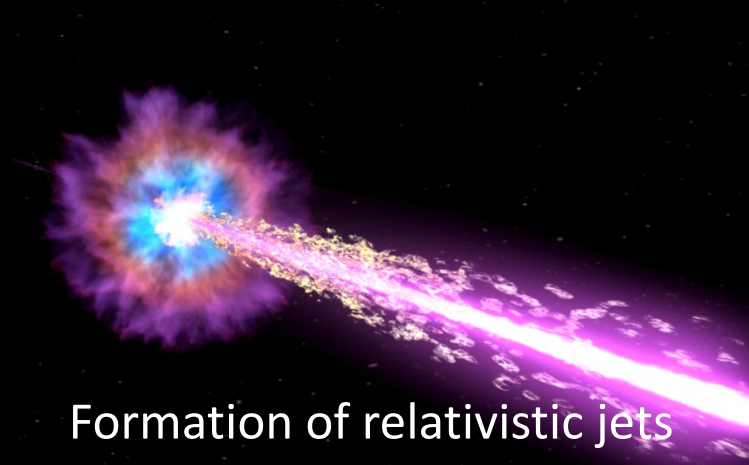
Loud sources of gravitational waves



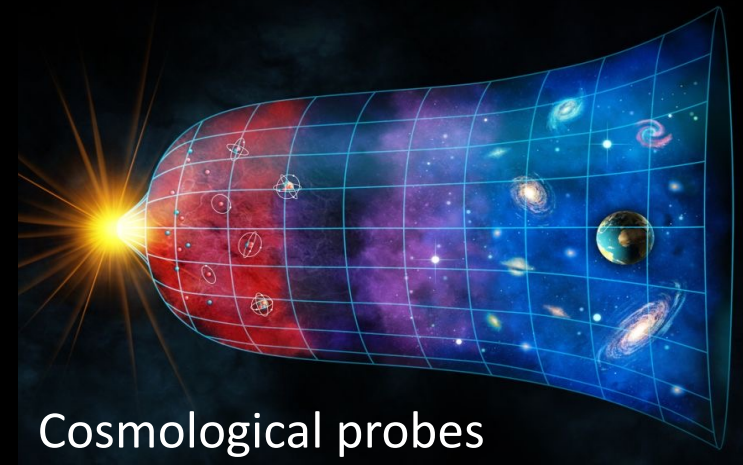
Origin of the heavy r-process elements



Laboratory of extreme physics

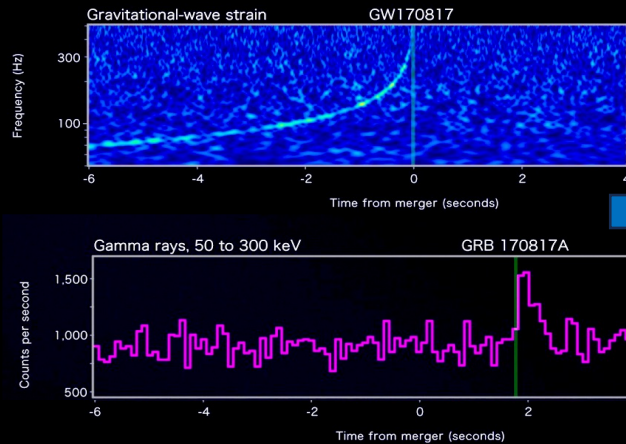


Formation of relativistic jets

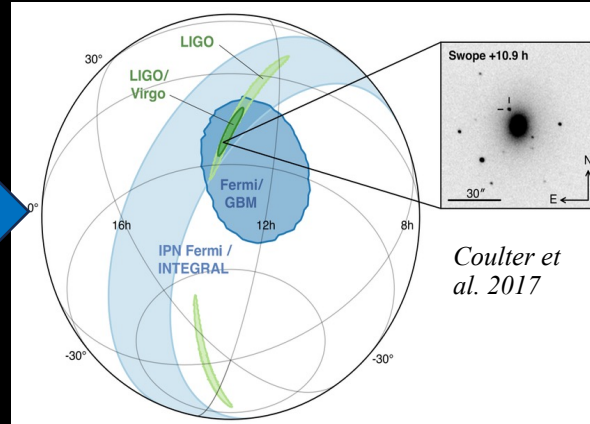


Cosmological probes

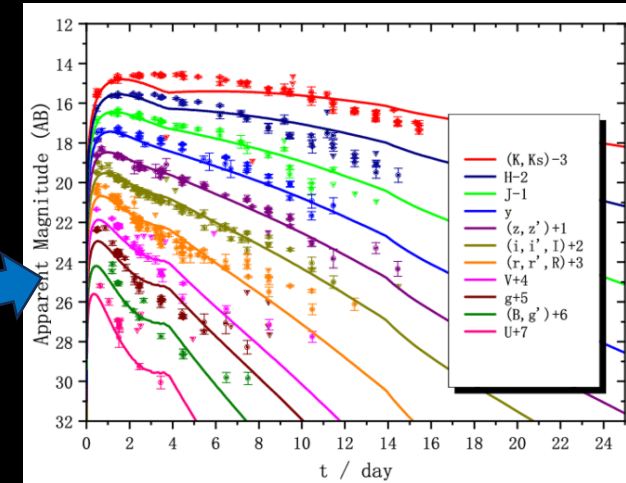
# GW170817: the first binary NS merger



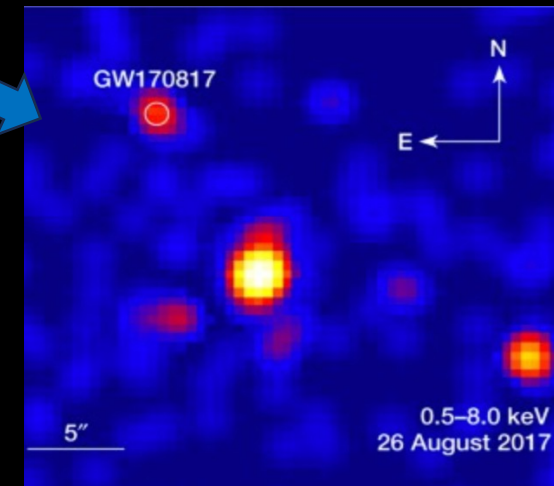
*Abbott et al. 2017*  
*Goldstein et al. 2017*  
*Savchenko et al. 2017*  
*Zhang et al. 2017*



*Coulter et al. 2017*



*Drout et al. 2017*  
*Pian et al. 2017*  
*Kasliwal et al. 2017*  
*and many others*

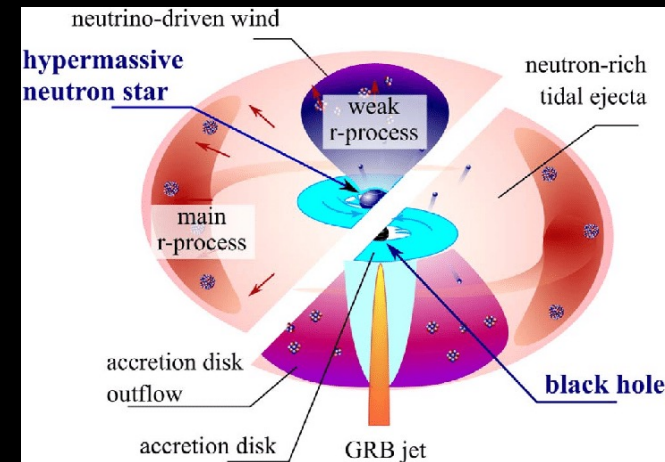
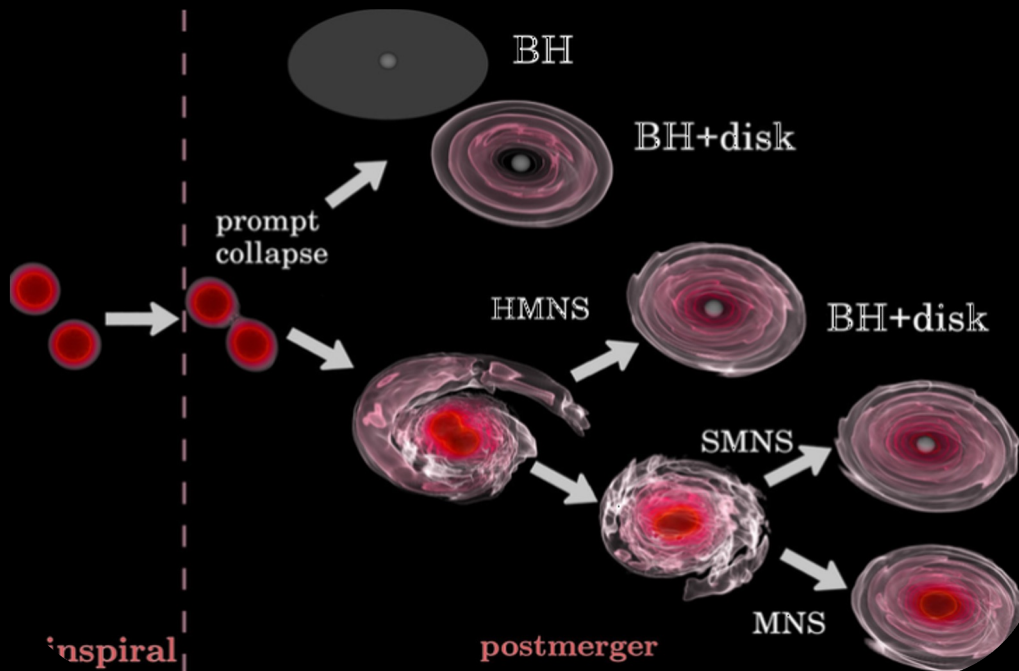


*Troja et al. 2017*



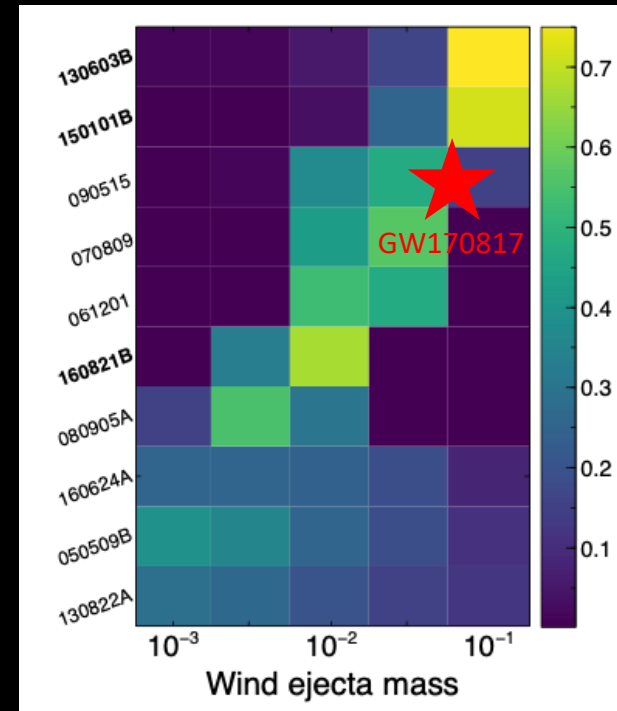
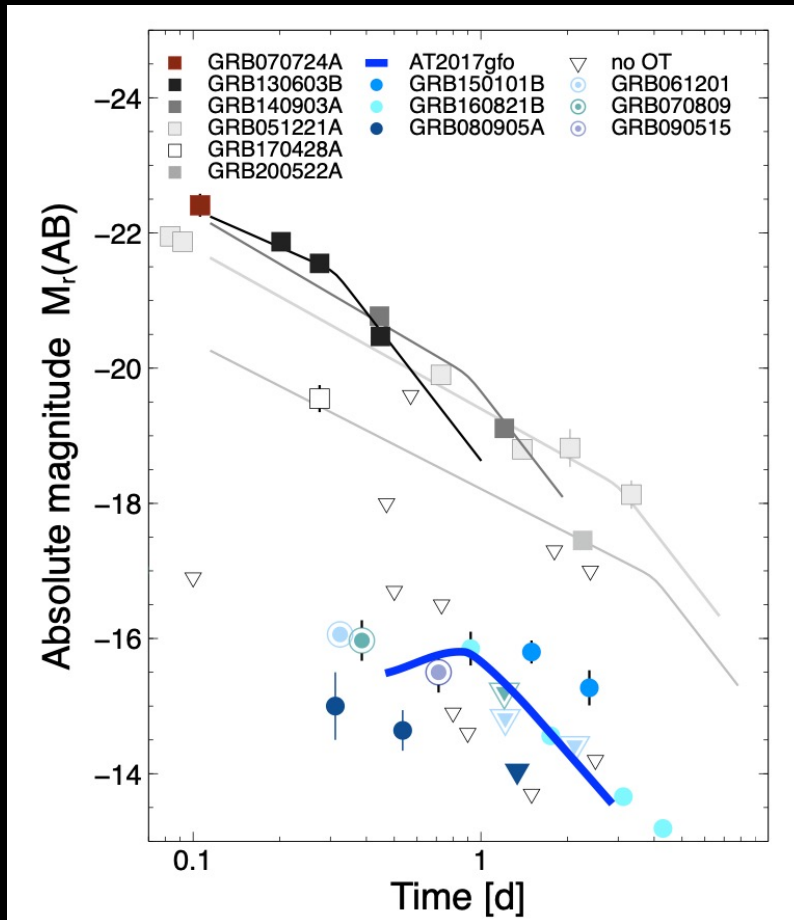
# Open questions

- Is AT2017gfo a typical kilonova?
- What is the merger remnant?
- How does the remnant nature affect the EM emission?
- Do all NS mergers launch relativistic jets?



*Korobkhin et al. 2021*

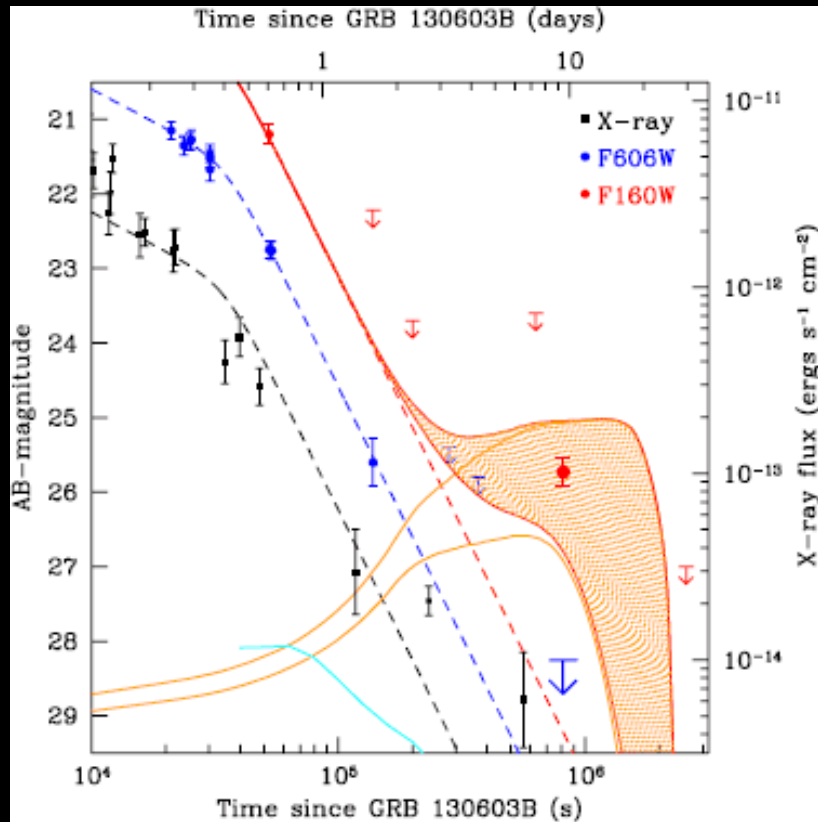
# Optical kilonovae are ubiquitous and diverse



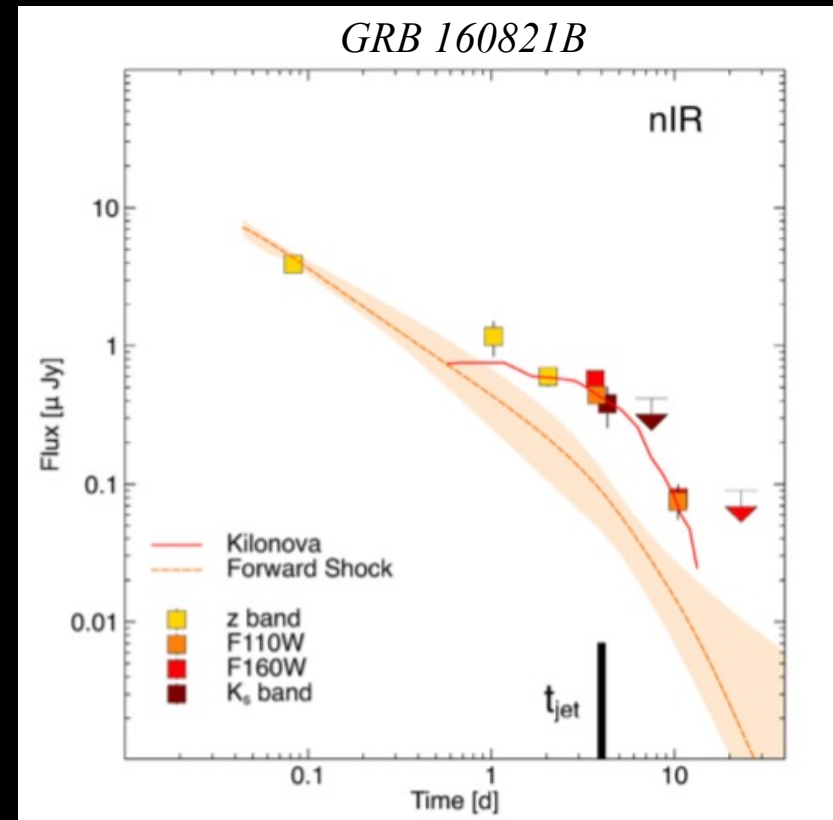
*Troja et al. 2023*

..but not ultra-luminous

# Infrared is hard to get

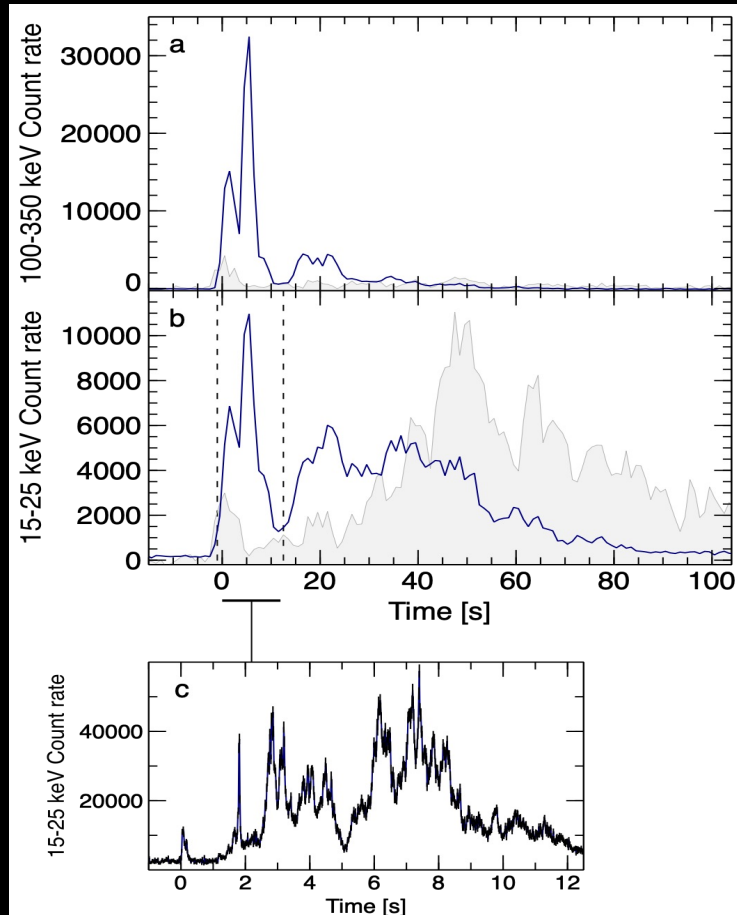


*Tanvir et al. 2013*



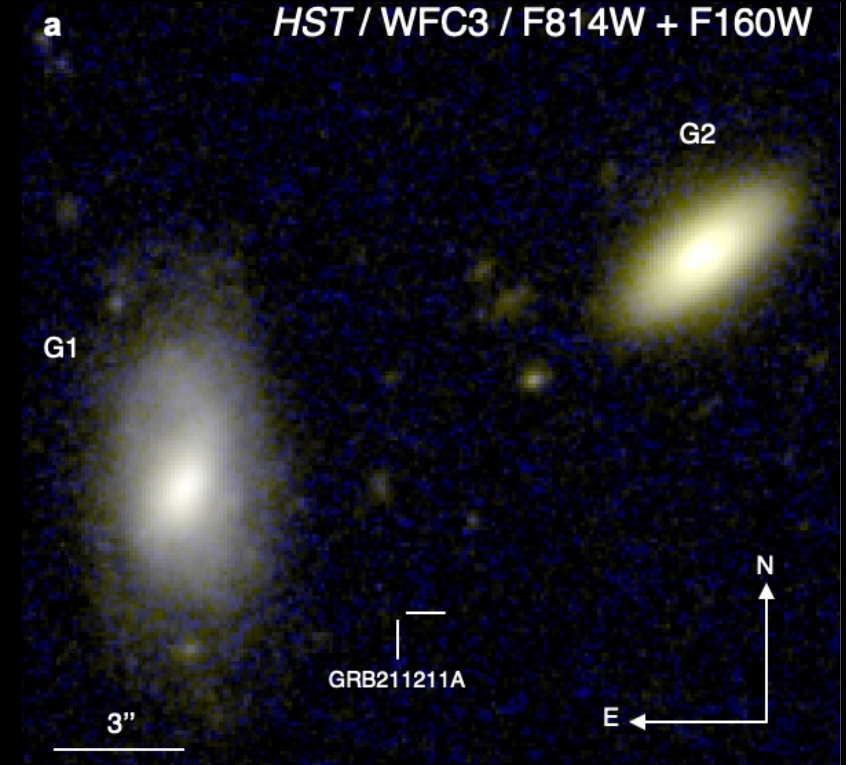
*Troja et al. 2019*

# The unexpected GRB211211A



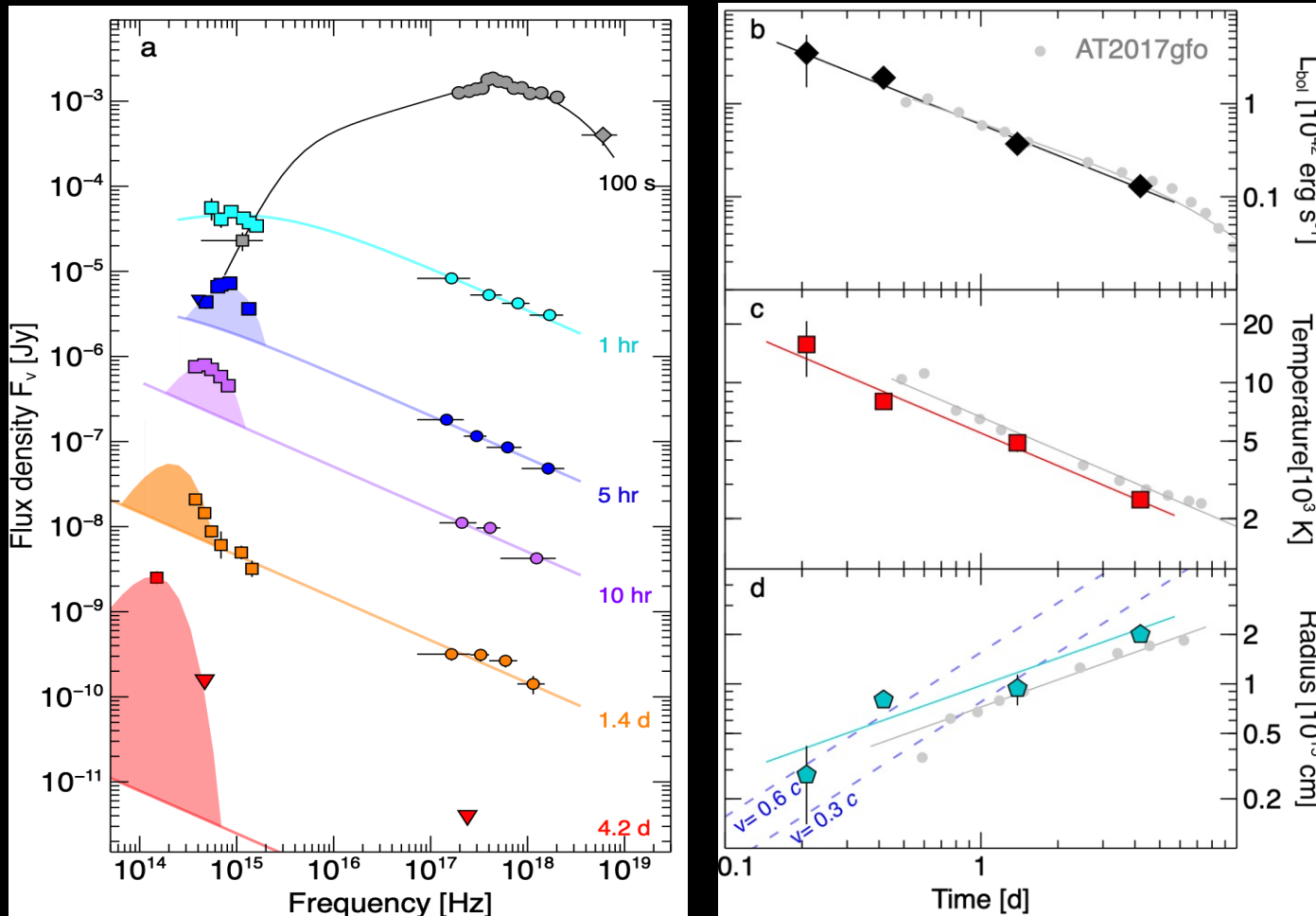
Similar to GRB060614 /Gehrels et al. 2006)

*Troja et al. 2022*  
*Yang et al. 2022*  
*Rastinejad et al. 2022*





# A kilonova similar to AT2017gfo



*Troja et al. 2022*

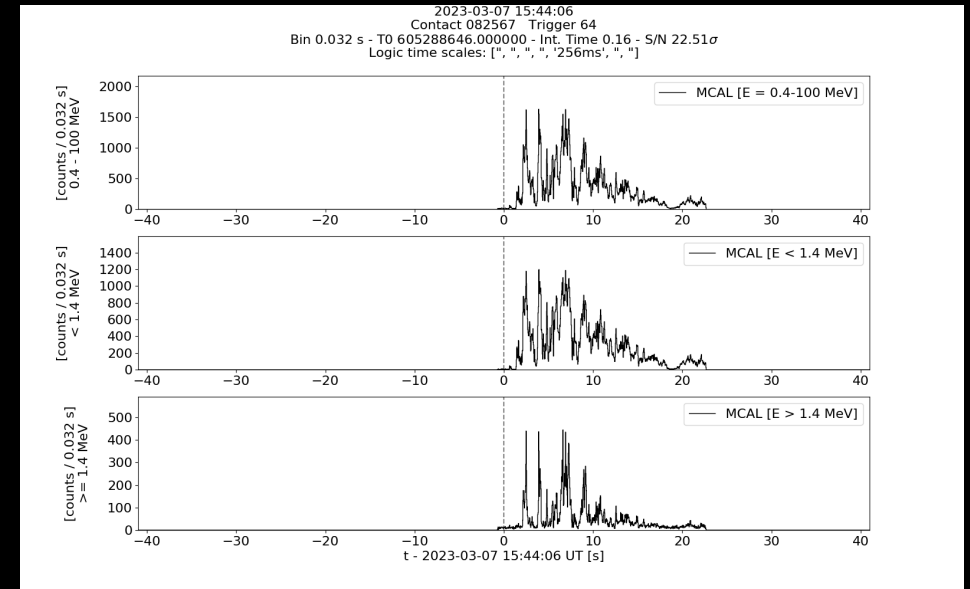
# Even more unexpected: GRB230307A



*Levan et al. 2023*

*Yang et al. 2023*

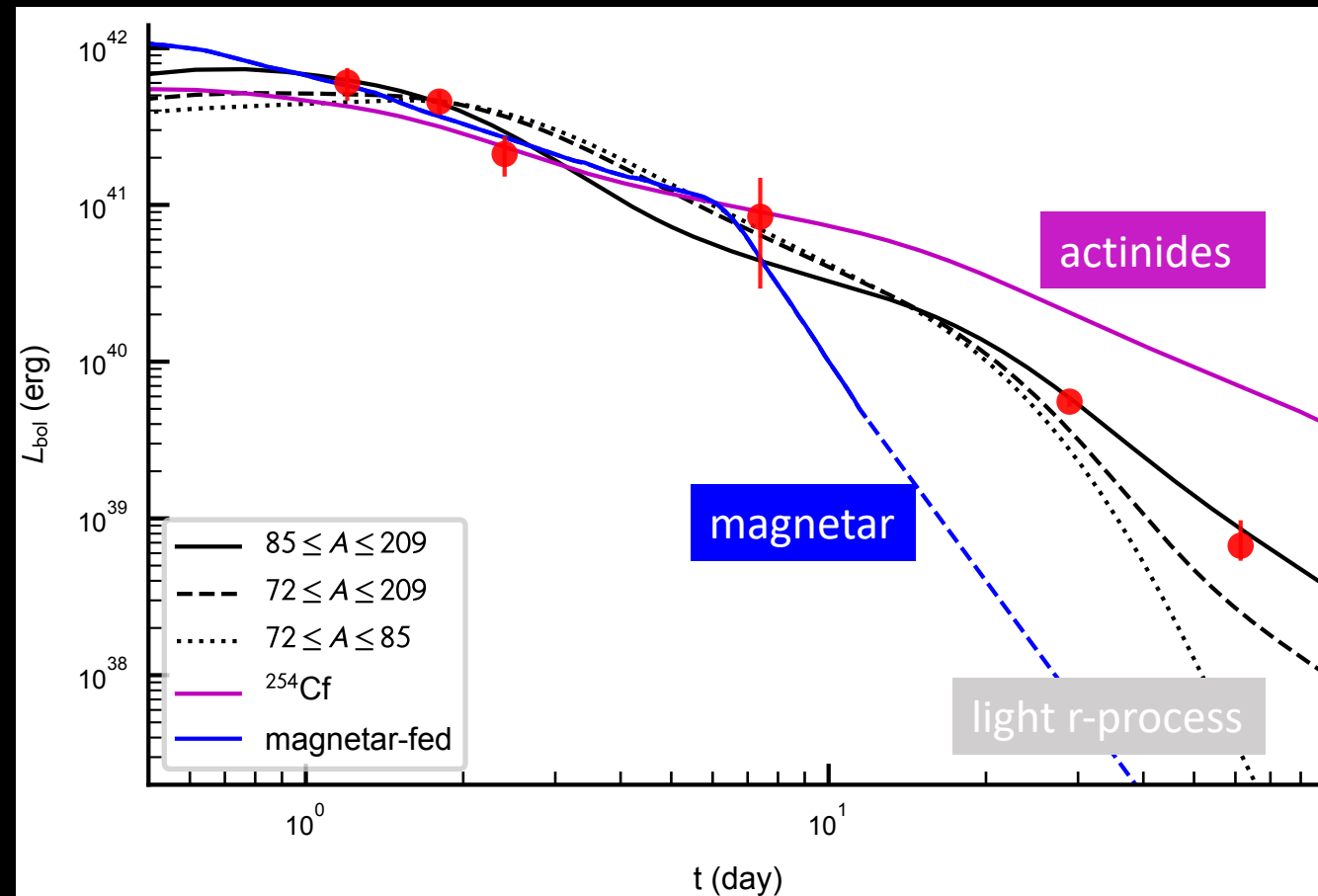
*Sun et al. 2023*



# Evidence for heavy elements nucleosynthesis

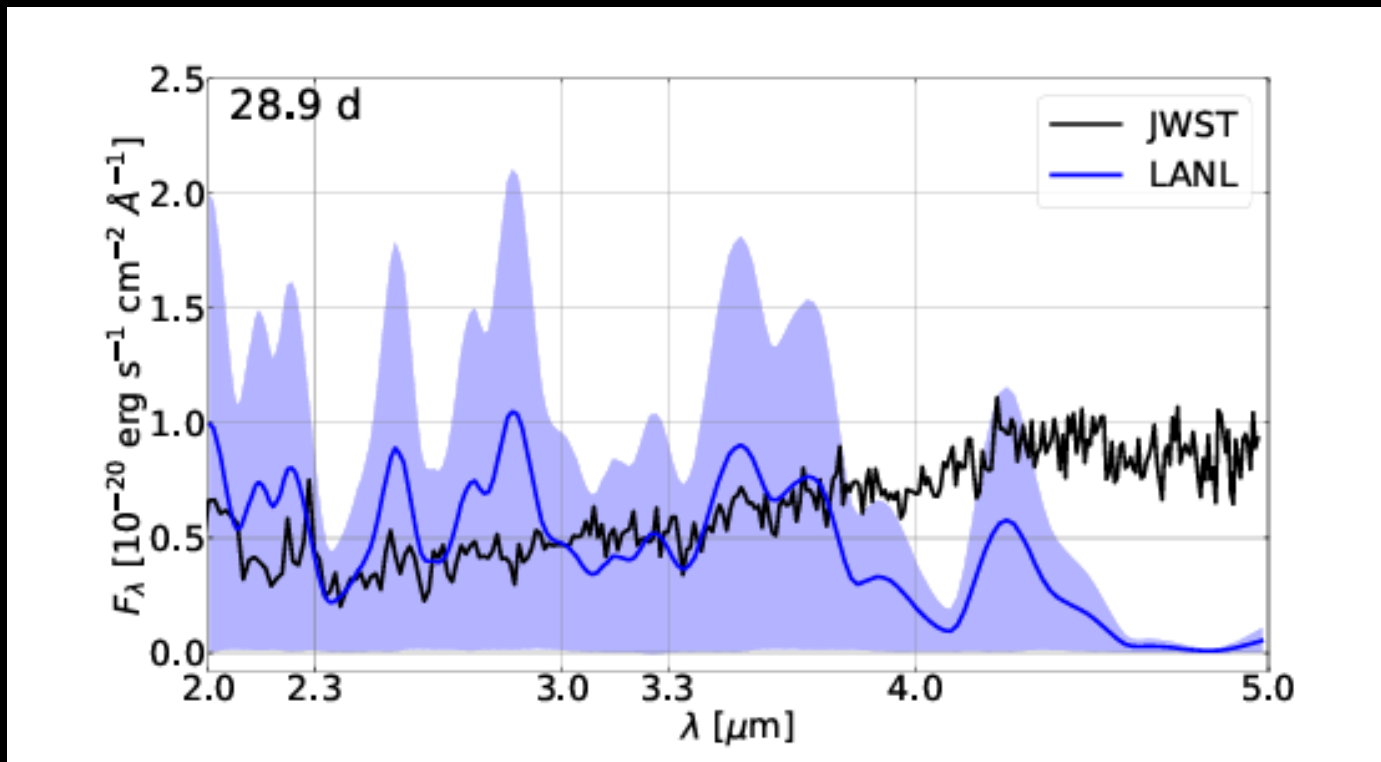
If the thermal emission  
is a kilonova

Yang, Troja et al. 2023  
*Nature*, in press

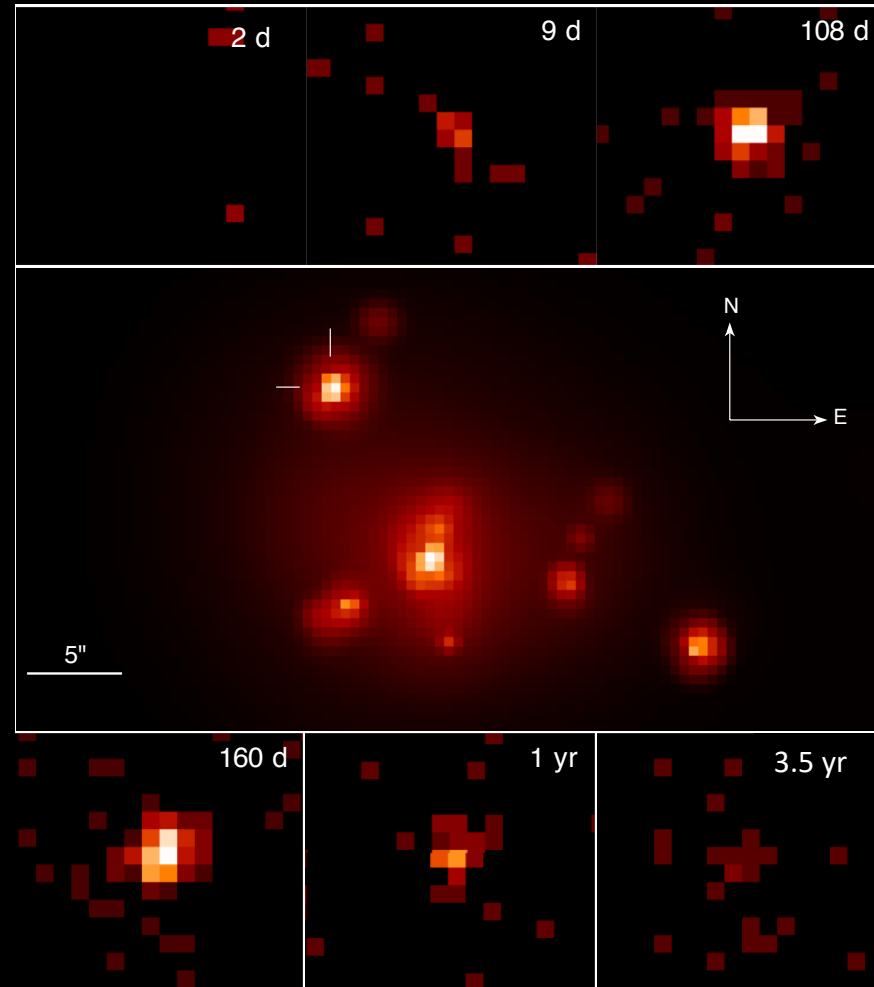




# Challenging for theoretical models

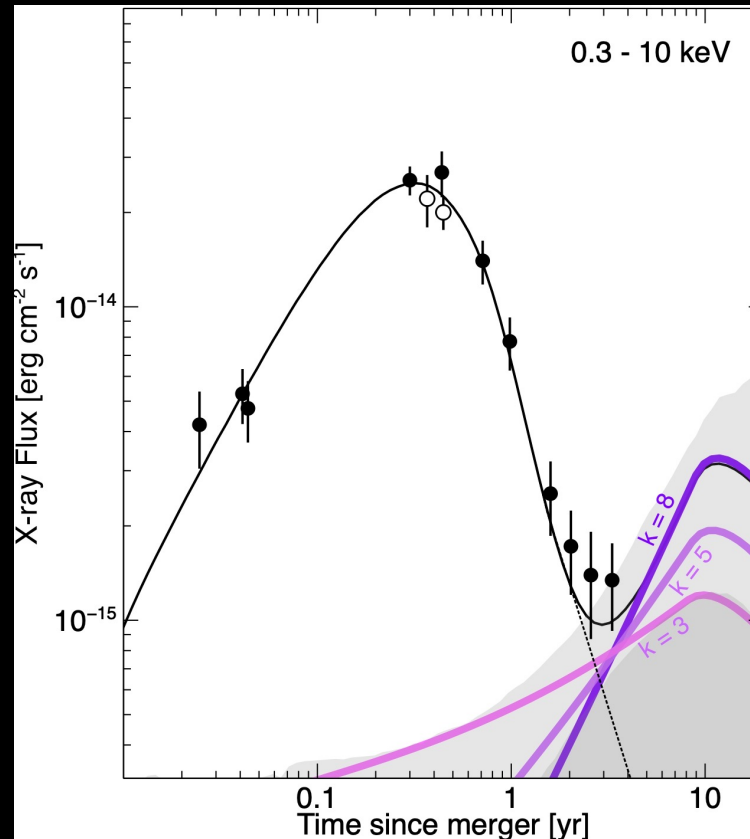


# News from GW170817



*Troja+17*  
*Troja+18*  
*Piro+19*  
*Troja+19*  
*Ryan+20*  
*Troja+20*  
*Troja+22*  
*Ryan+23*

# Long-term monitoring to search for a KN afterglow

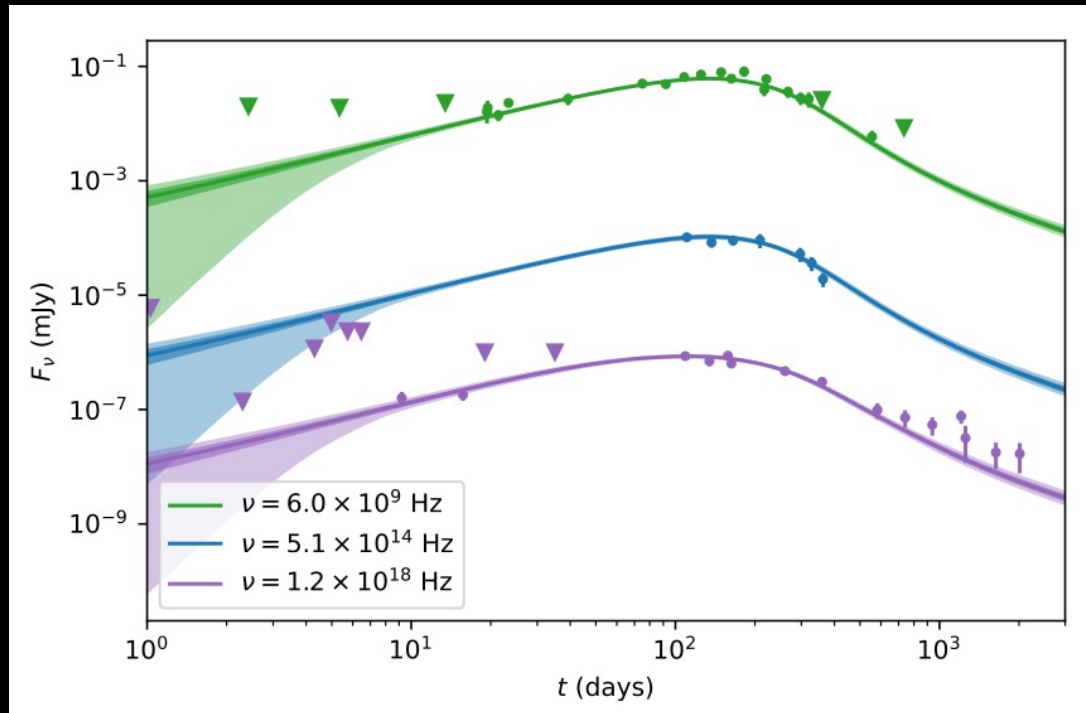


*Troja et al., 2020, MNRAS, 498, 564*

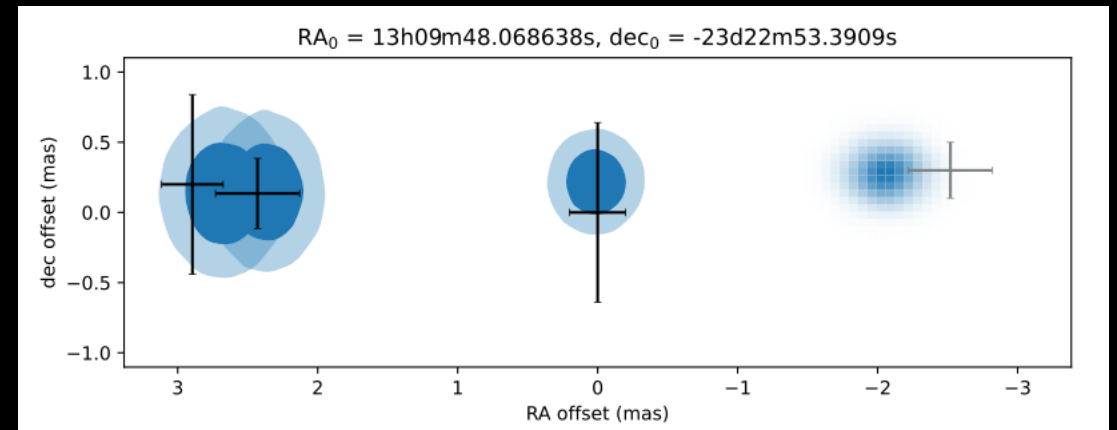




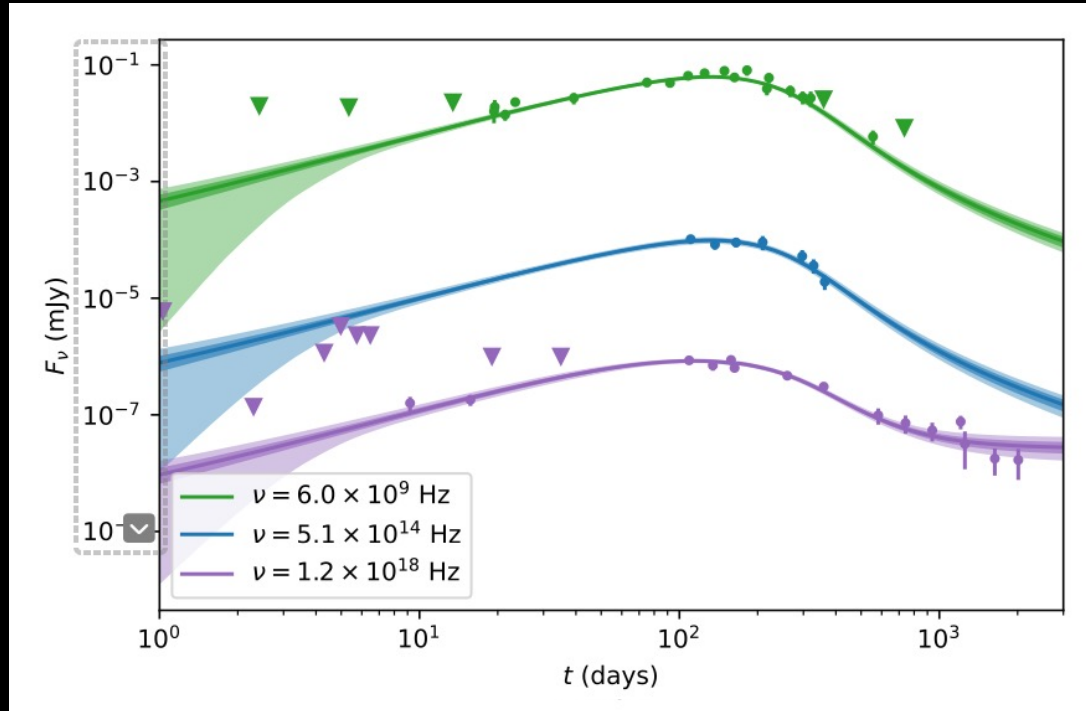
# Evidence for a new component in X-rays?



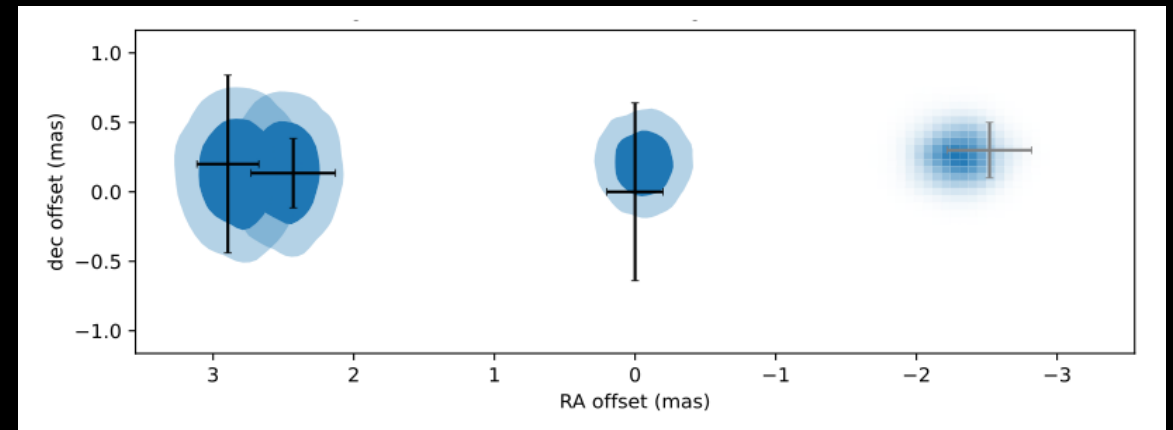
*Ryan et al. 2023*



# Evidence for a new component?



*Ryan et al. 2023*



<2 sigma

# Summary and open questions

Kilonovae similar to AT2017gfo are common.

*How does a NS-BH merger look like?*

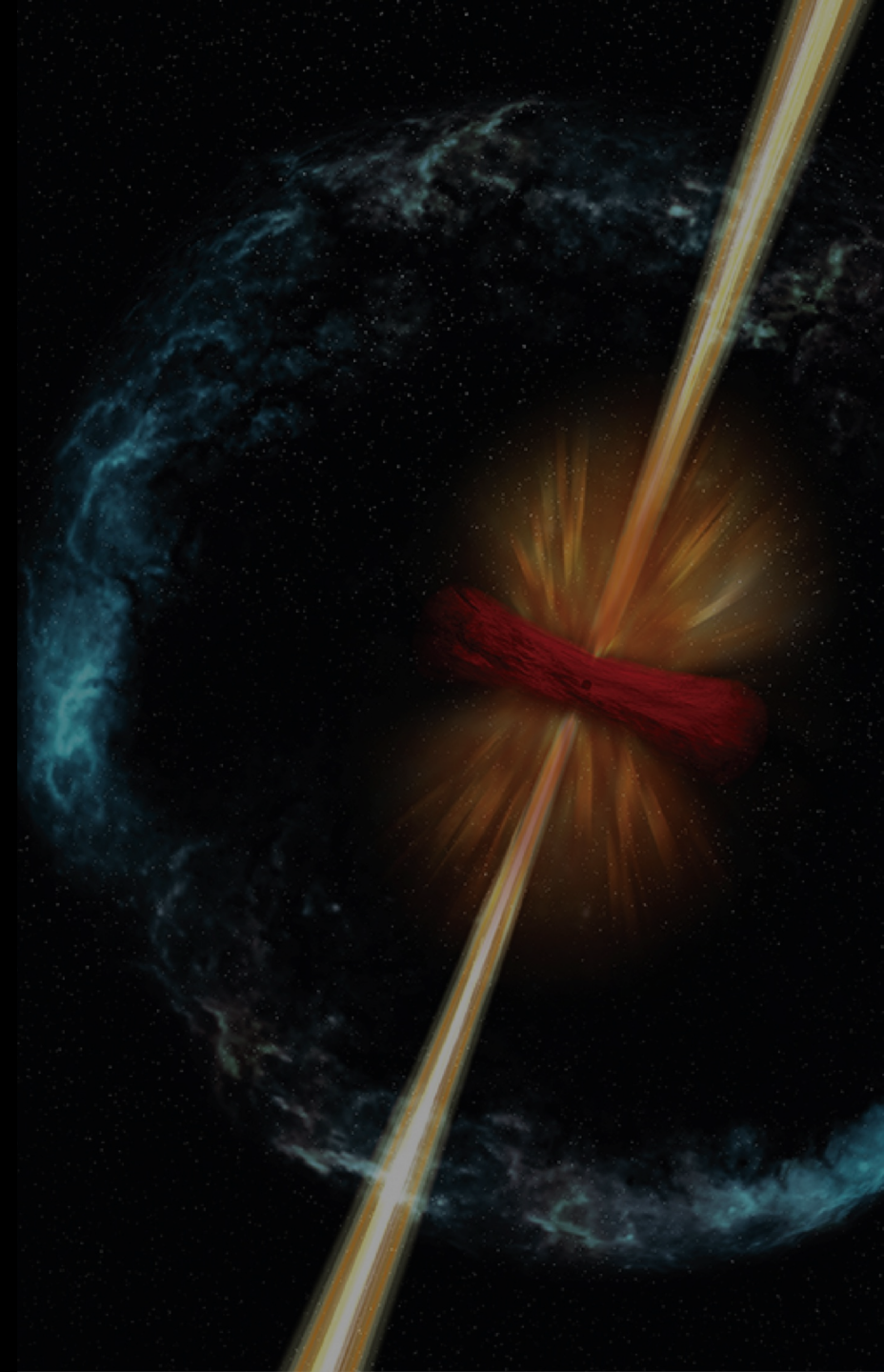
*How does a magnetar affect the emission?*

Some long GRBs are followed by a kilonova.

*What are their progenitors?*

The afterglow of GW170817 continues to shine in X-rays.

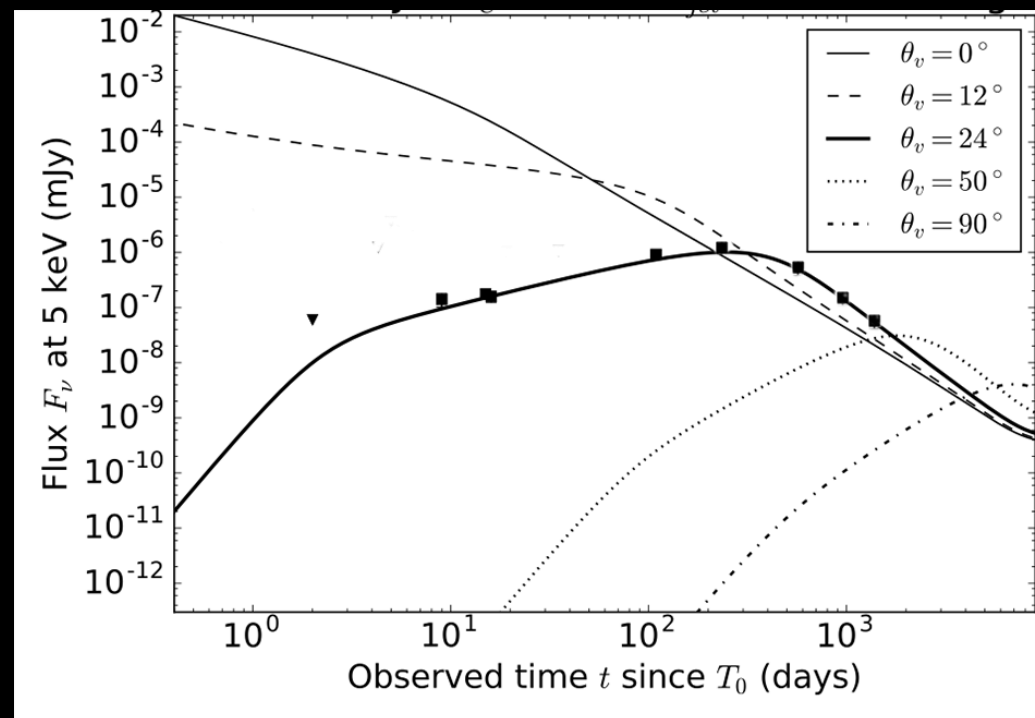
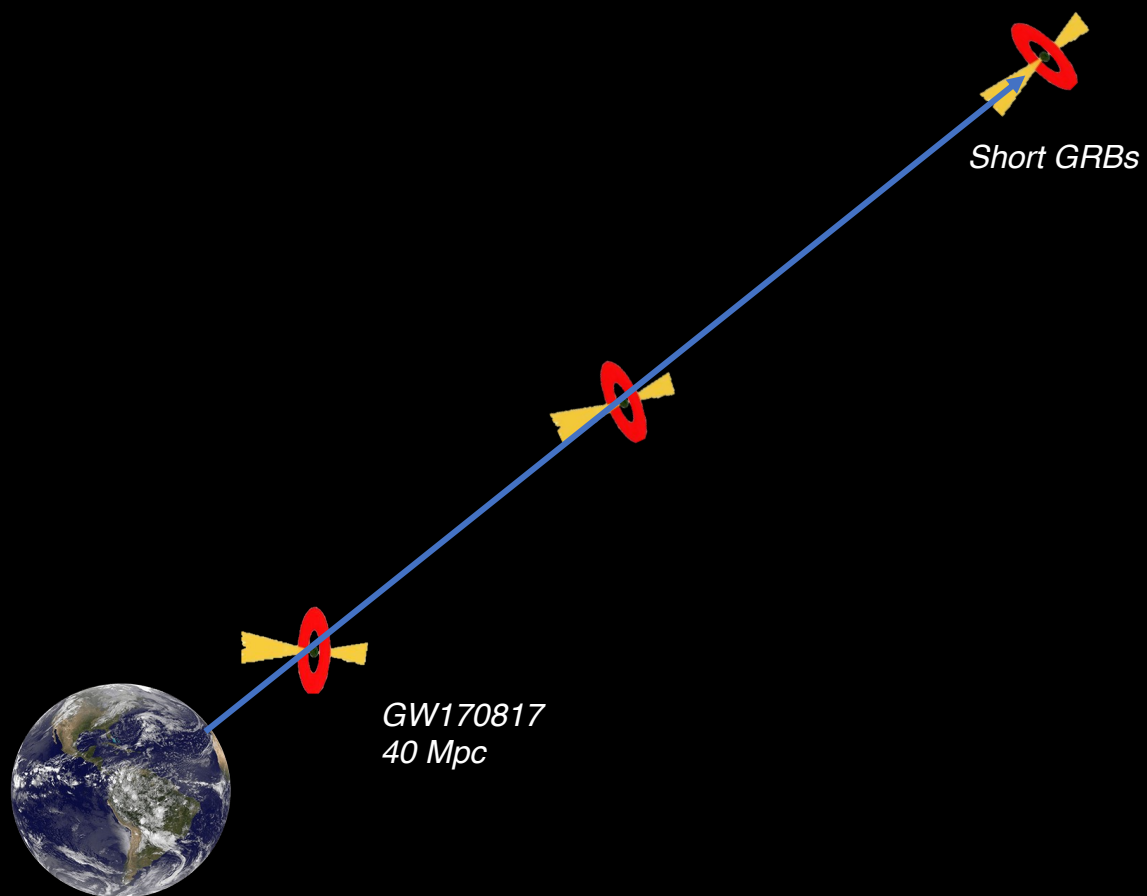
*Is it the onset of a new component?*





Thanks!

# The effects of viewing angle



# No kilonovae from O3a

