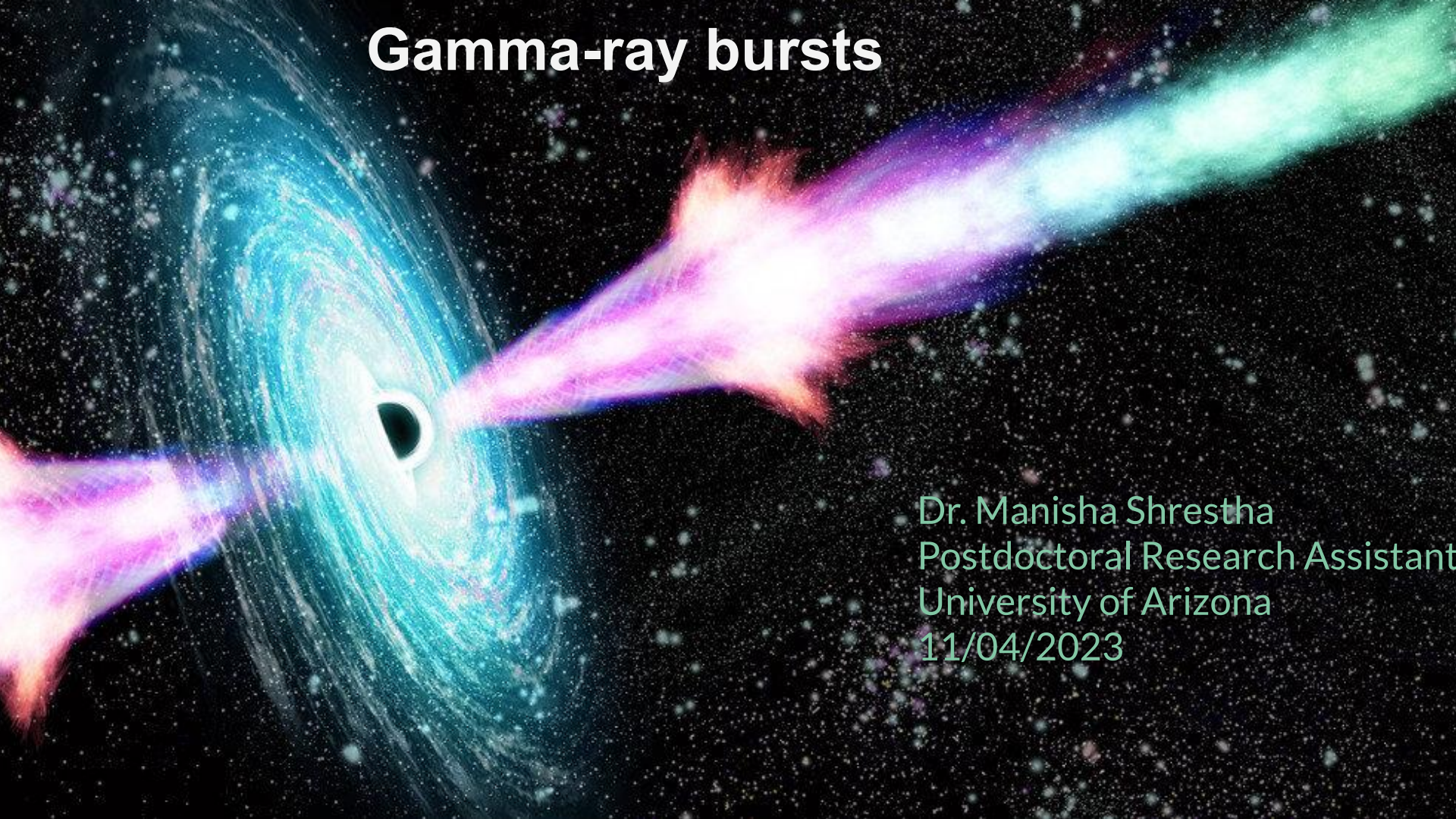
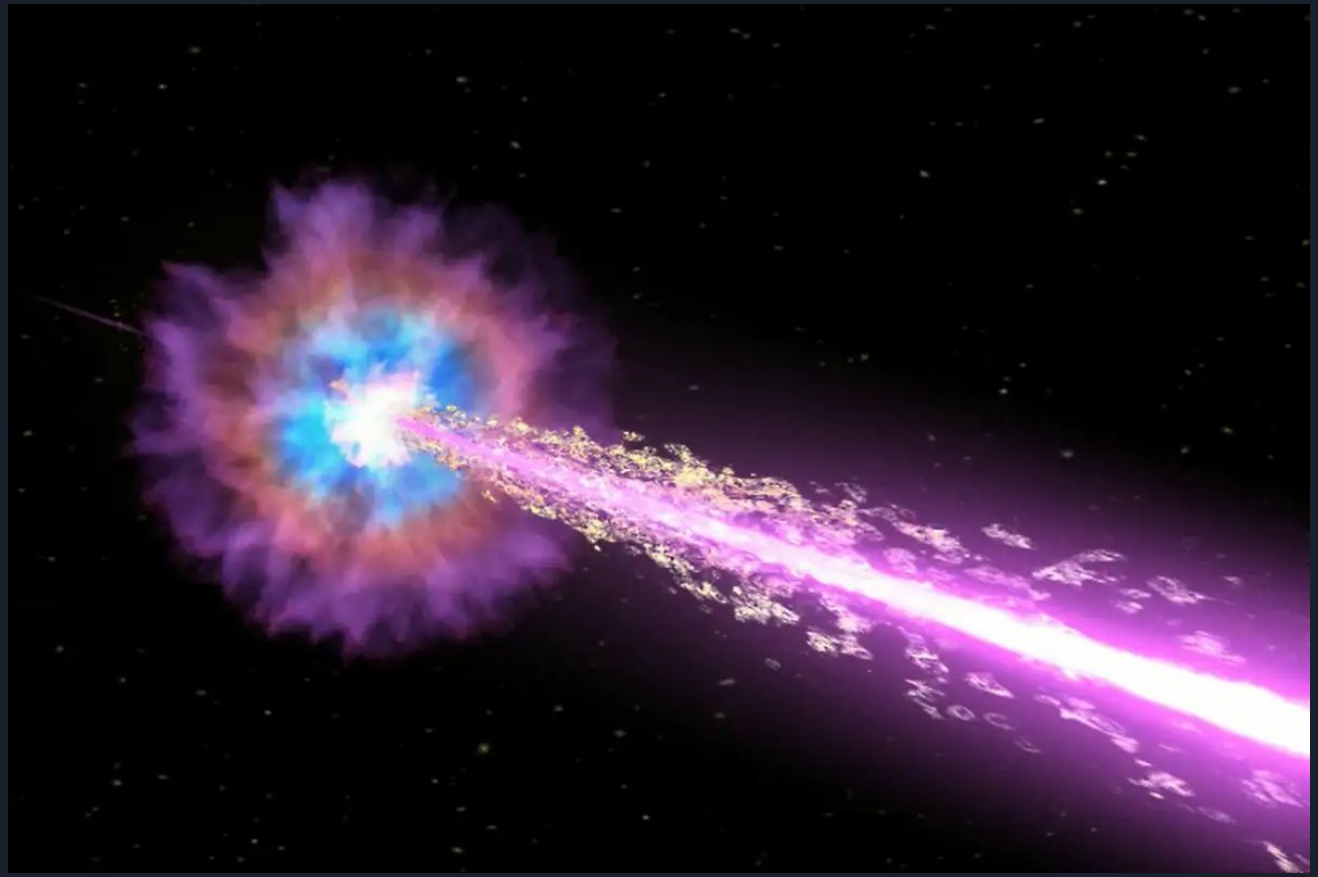
Gamma-ray bursts



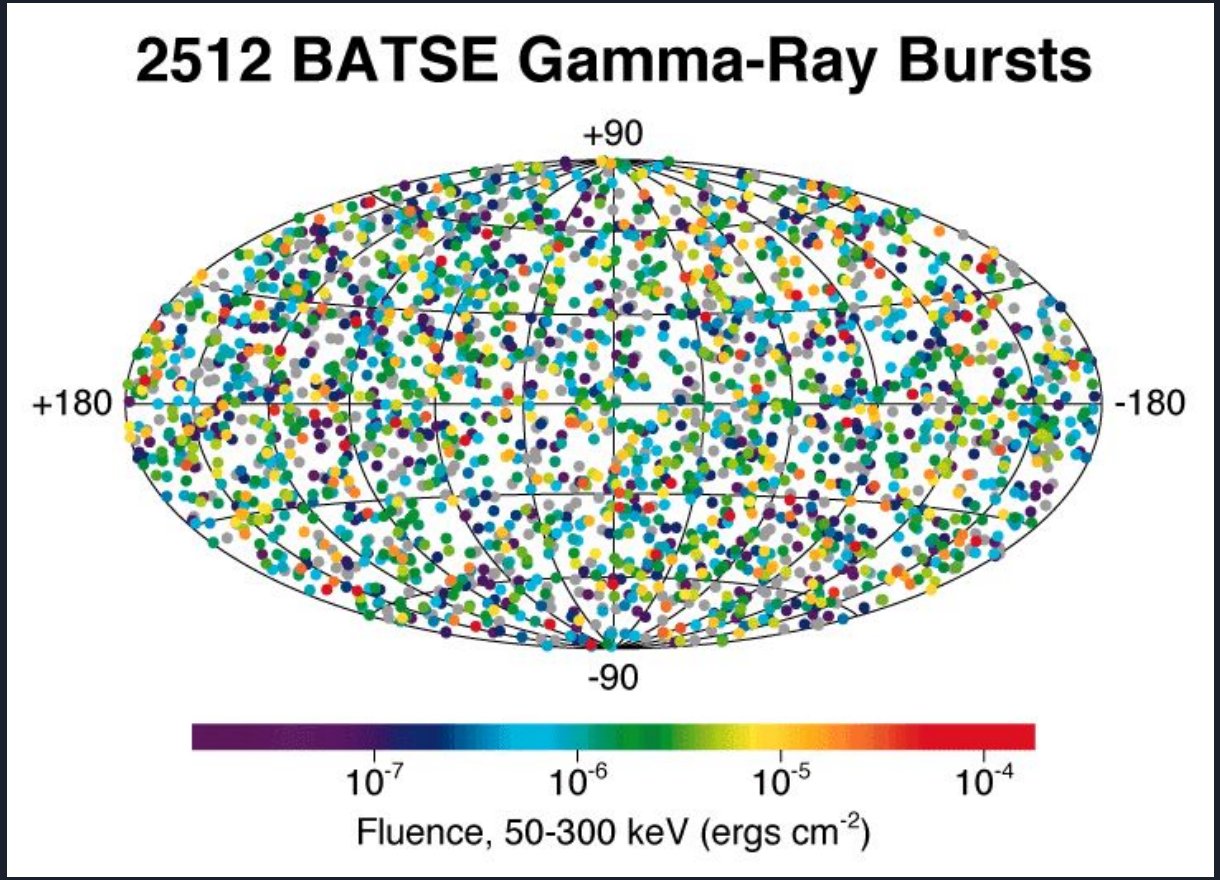
Dr. Manisha Shrestha
Postdoctoral Research Assistant
University of Arizona
11/04/2023

Gamma-ray bursts are very energetic

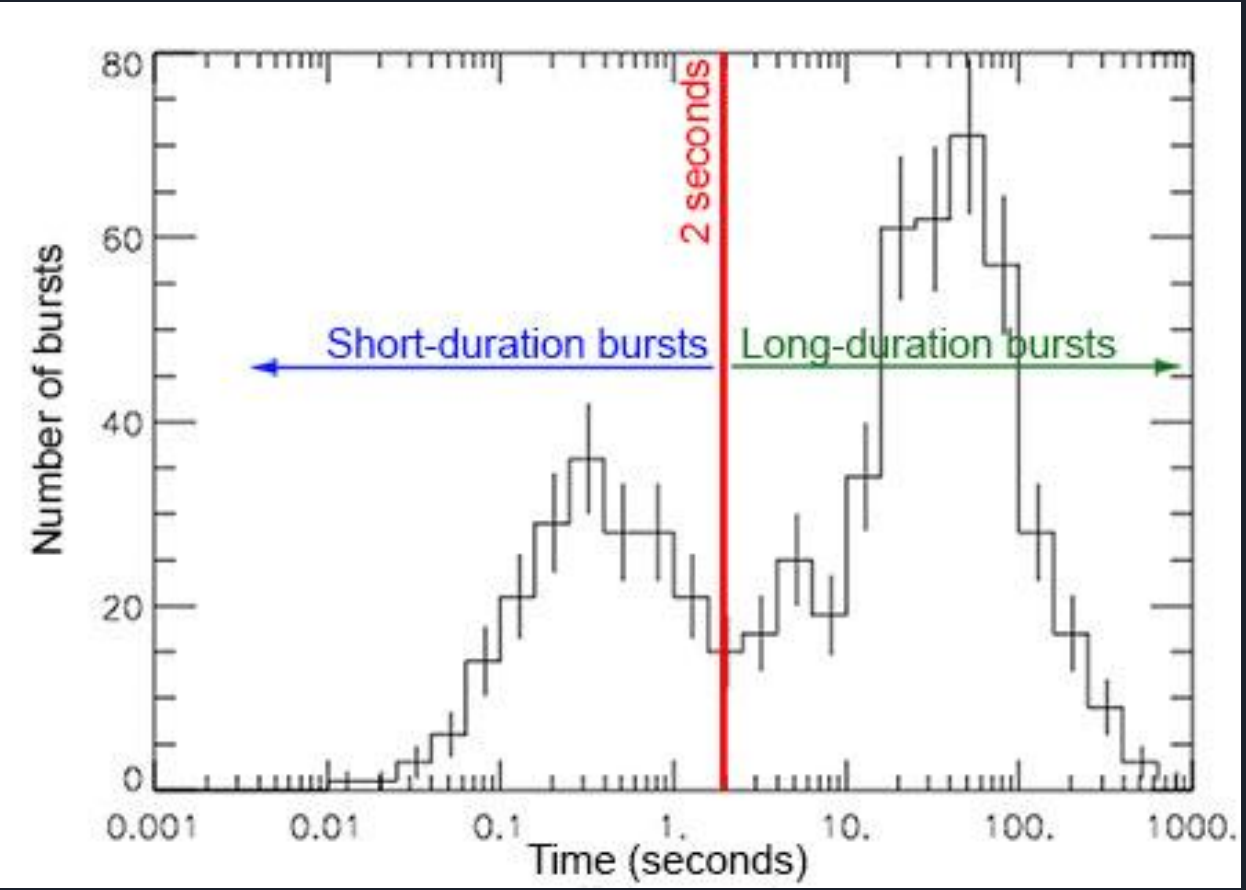


Gamma-ray bursts

Distant origin



Types of Gamma Ray Bursts



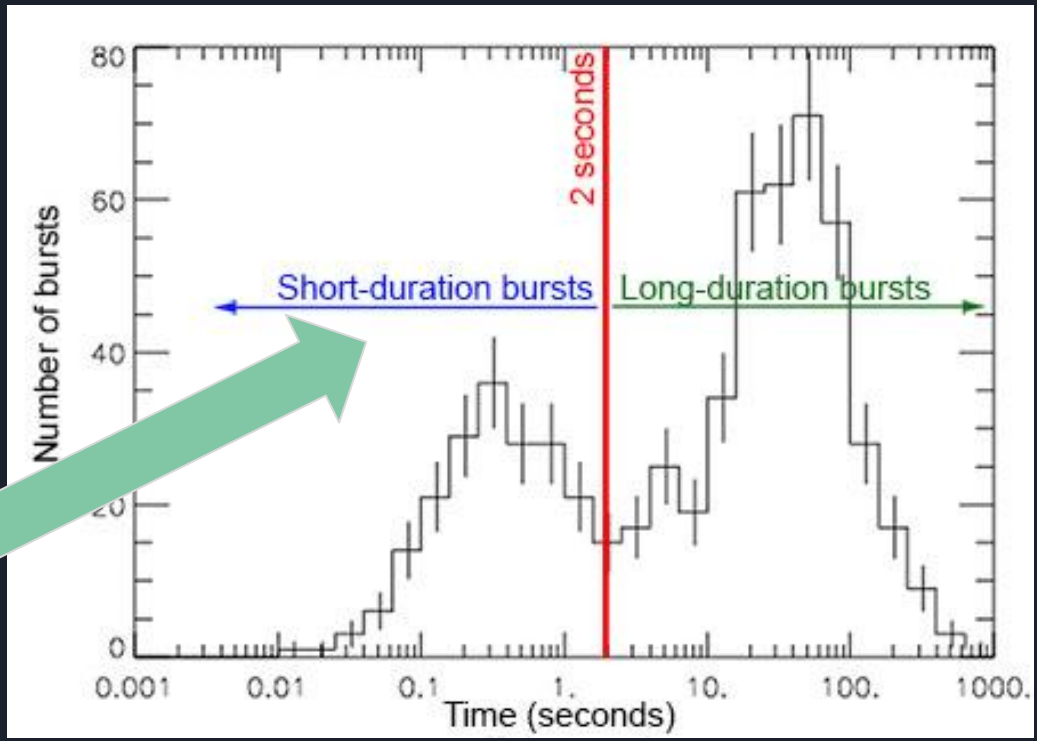
https://imagine.gsfc.nasa.gov/science/objects/bursts1.html

Progenitors of Short GRBS

https://www.youtube.com/watch?v=x_Akn8fUBeQ

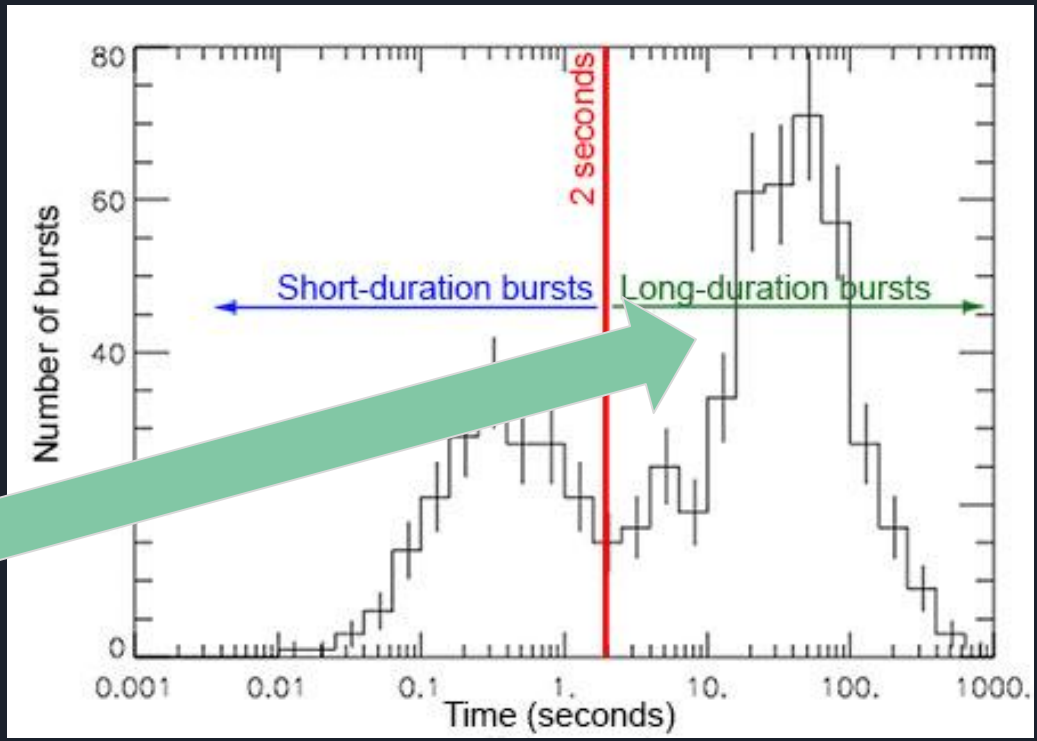
Neutron star + Neutron star GW170817

National Science Foundation/LIGO/Sonoma State University/A. Simonnet

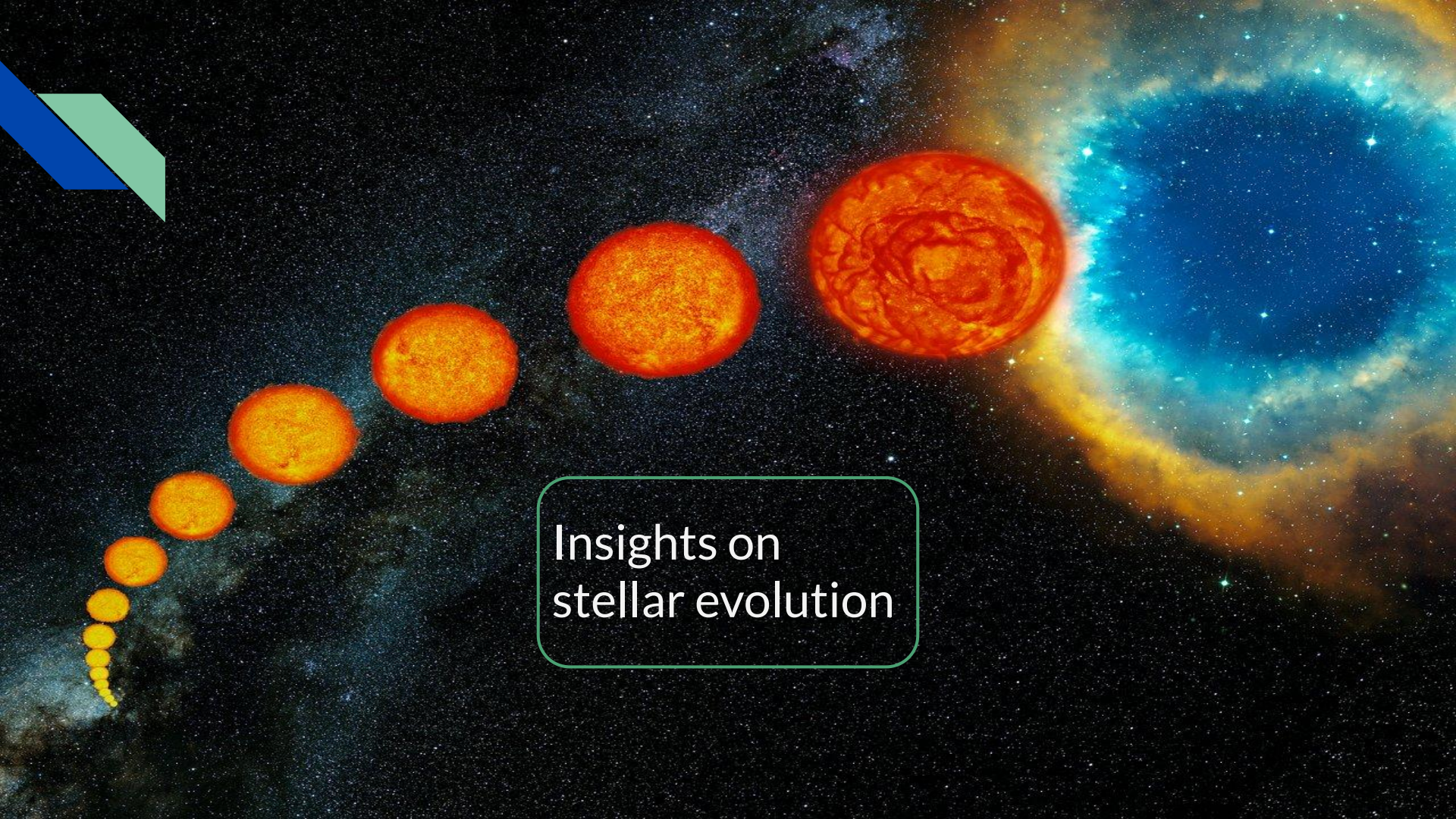


Progenitors of Long GRBS

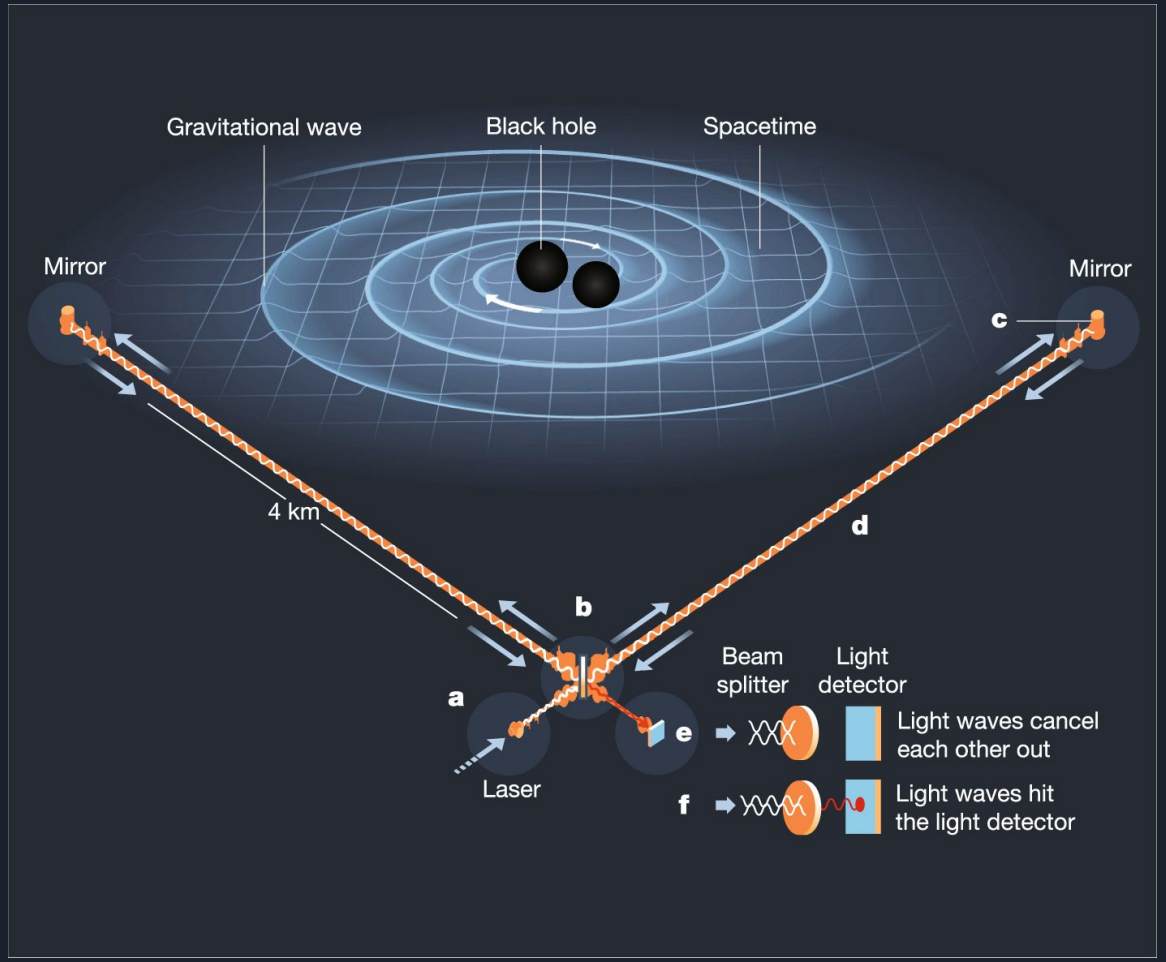
Death of massive stars (Supernovae)



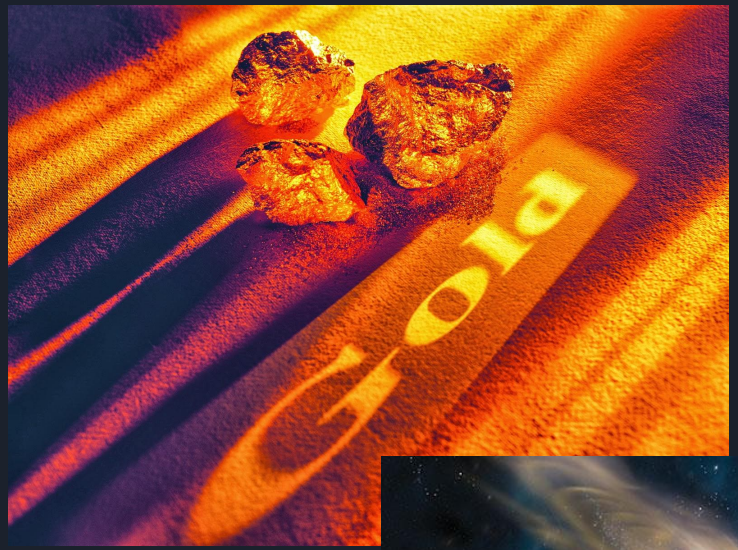
Why do we care?

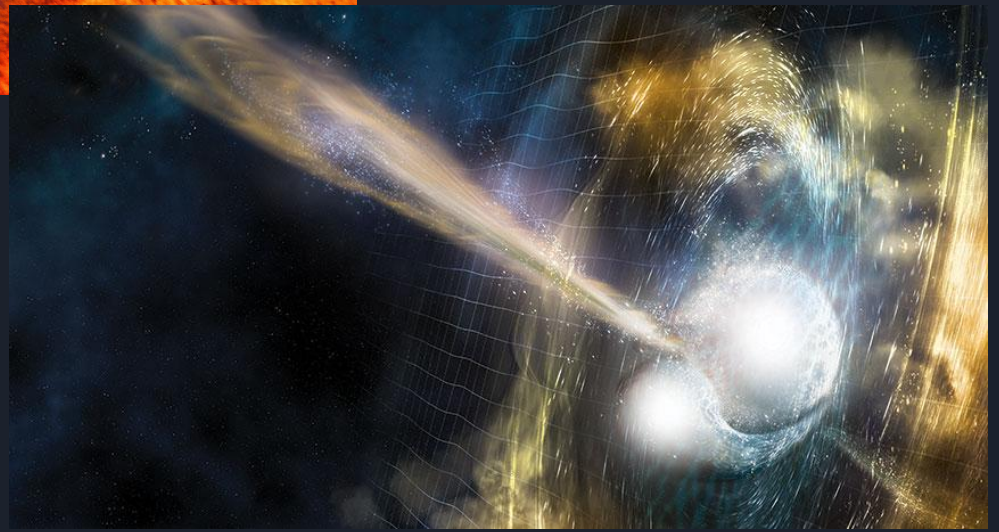

Insights on
stellar evolution

Sources of Gravitational Wave

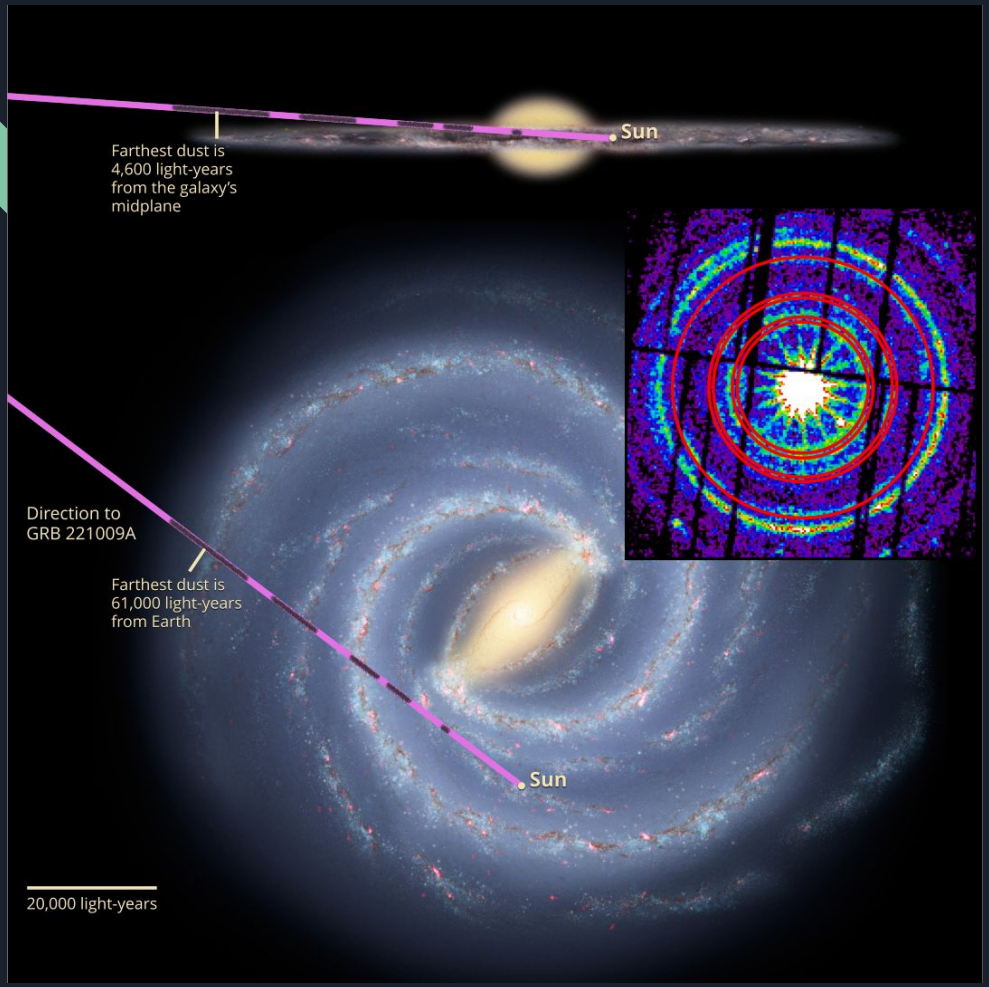


credit: ©Johan Jarnestad/The Royal Swedish Academy of Sciences.



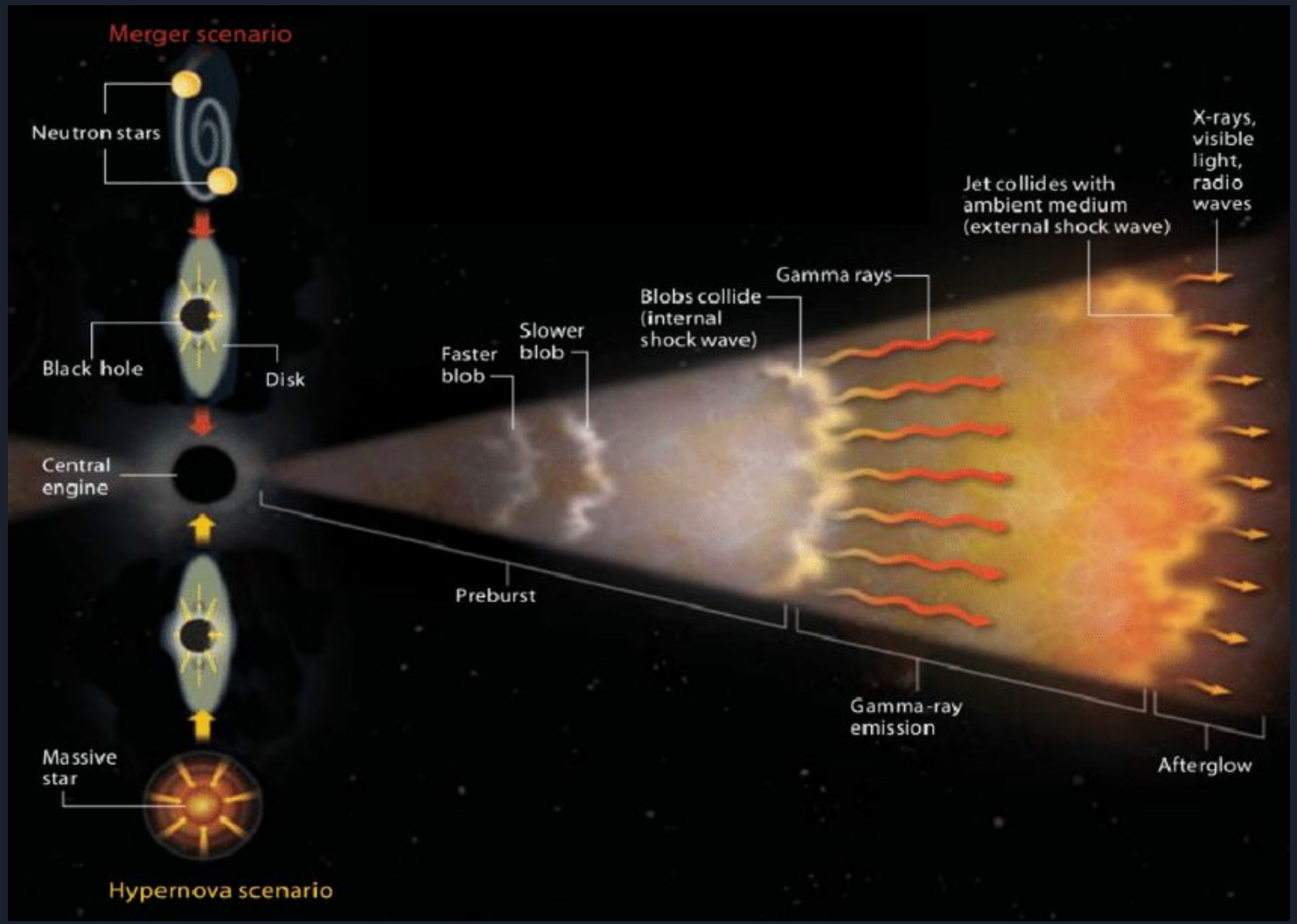


Origin of heavy elements like Gold

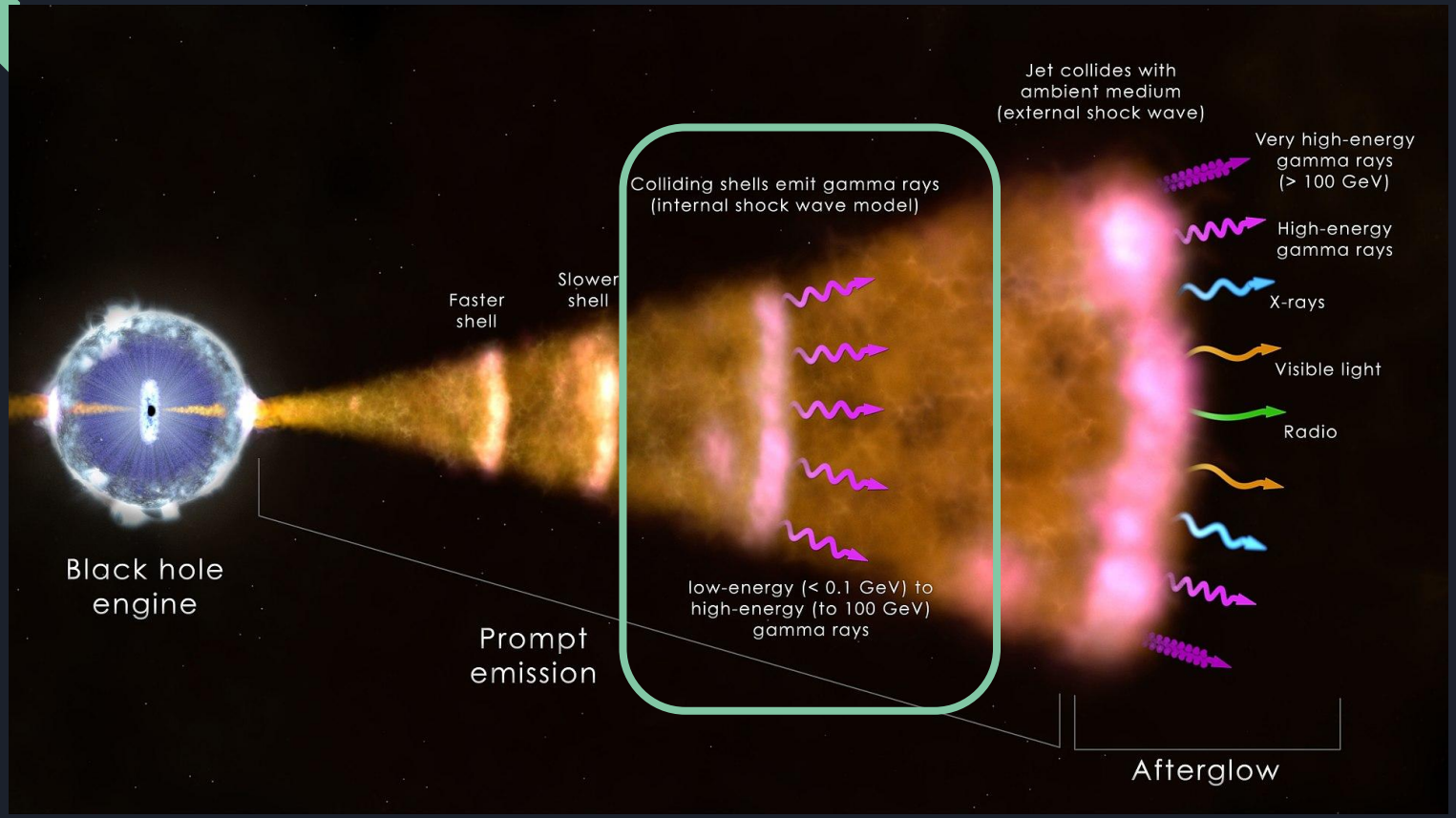


Can map distant Universe

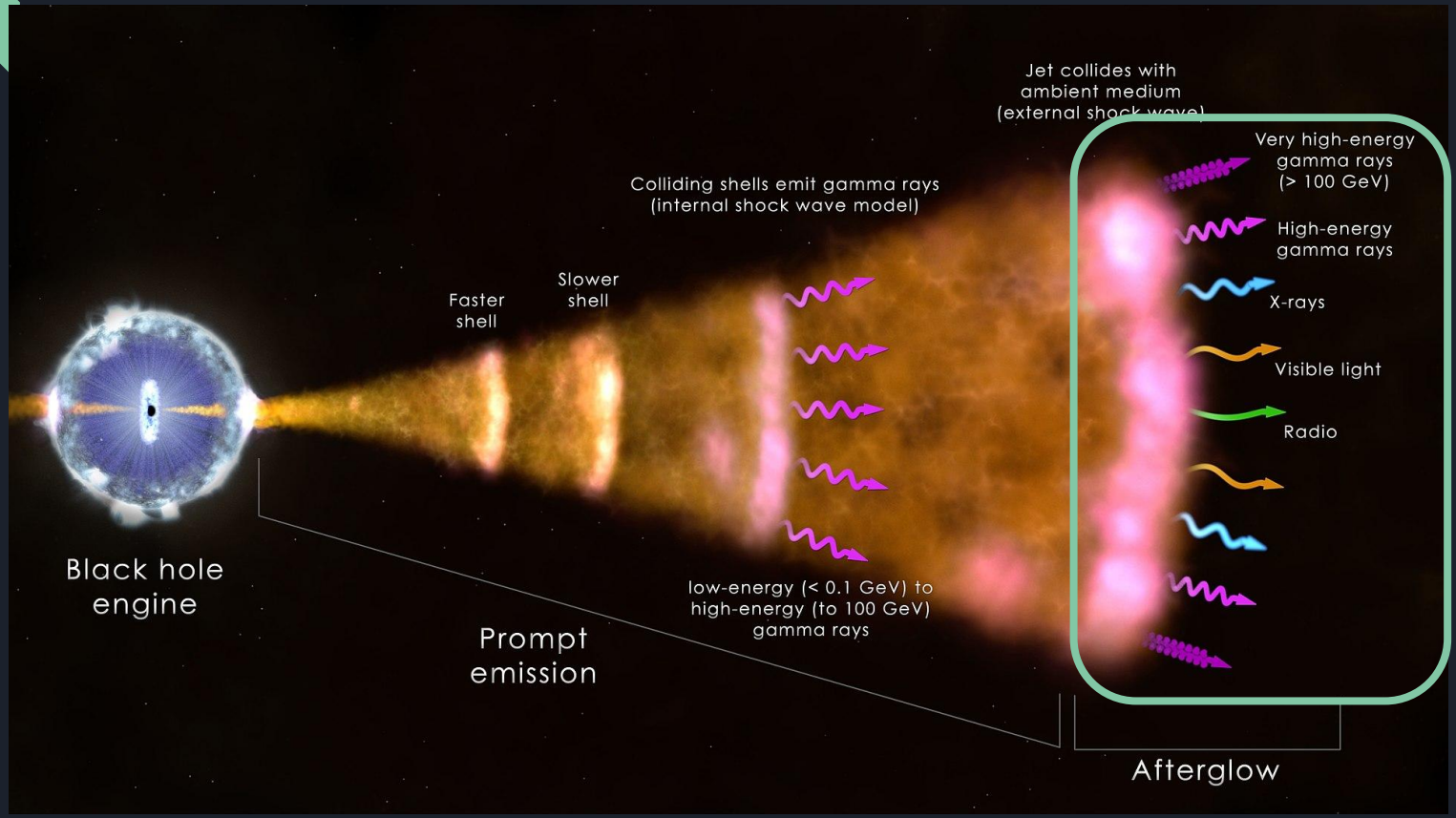
What do we know?


Merger scenario
Neutron stars
Black hole
Disk
Central engine
Massive star
Hypernova scenario
Faster blob
Slower blob
Blobs collide (internal shock wave)
Gamma rays
Jet collides with ambient medium (external shock wave)
X-rays, visible light, radio waves
Preburst
Gamma-ray emission
Afterglow

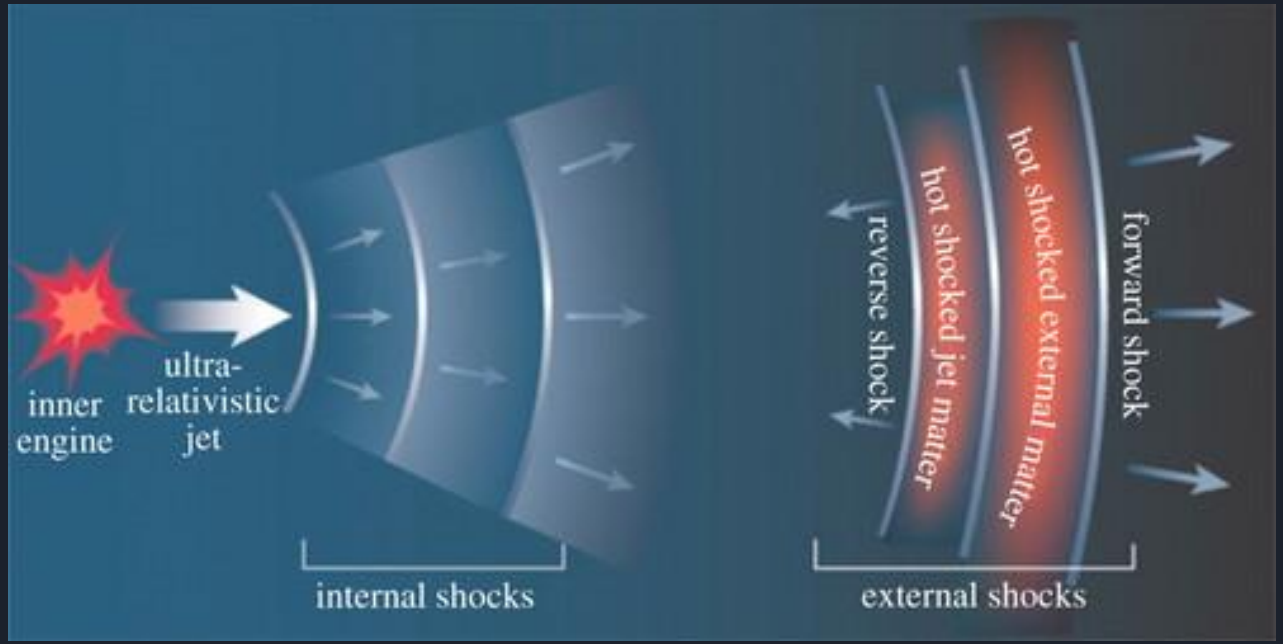
Gamma ray emission mechanism



X-ray to radio emissions

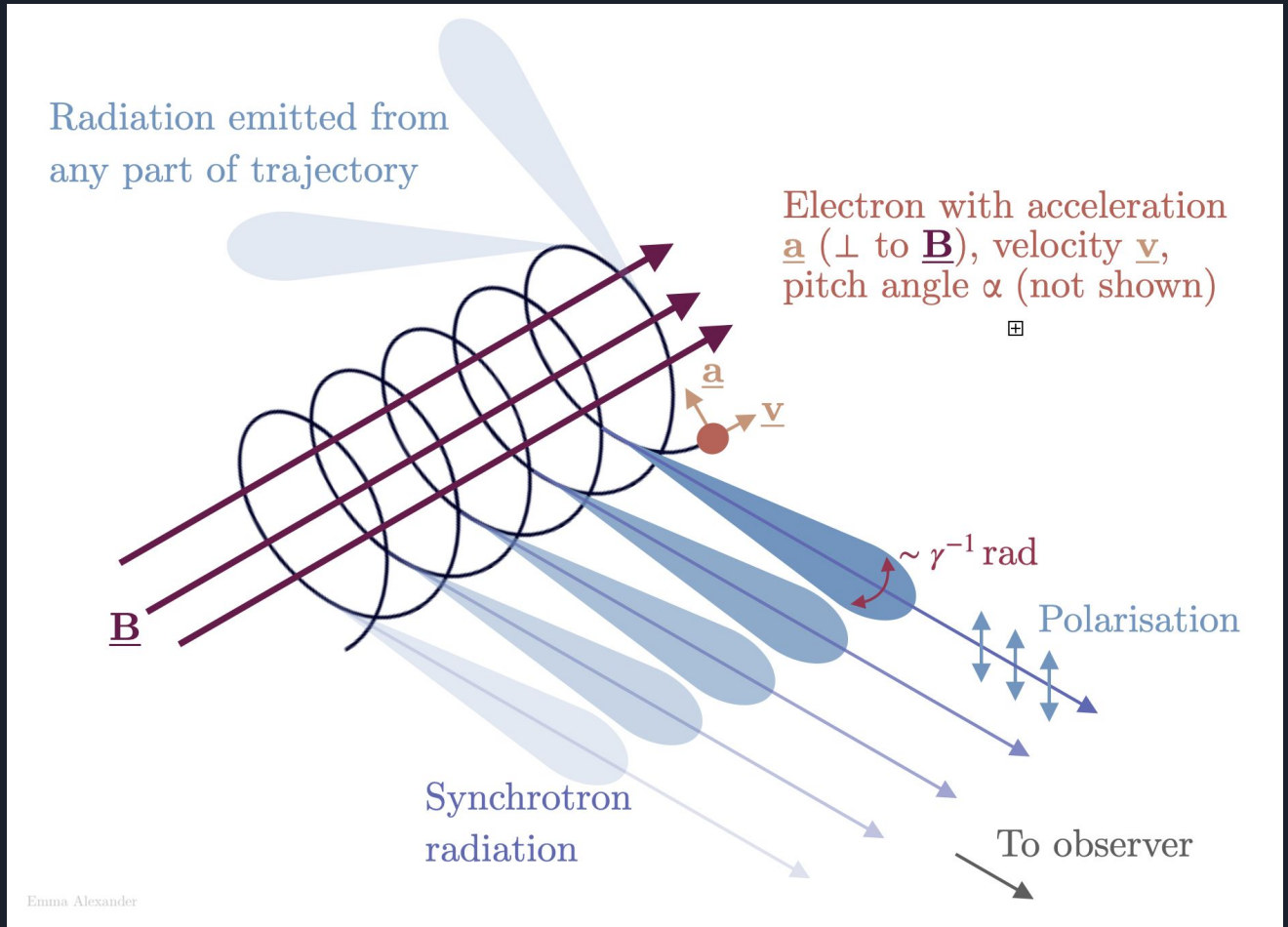


Reverse and forward shock

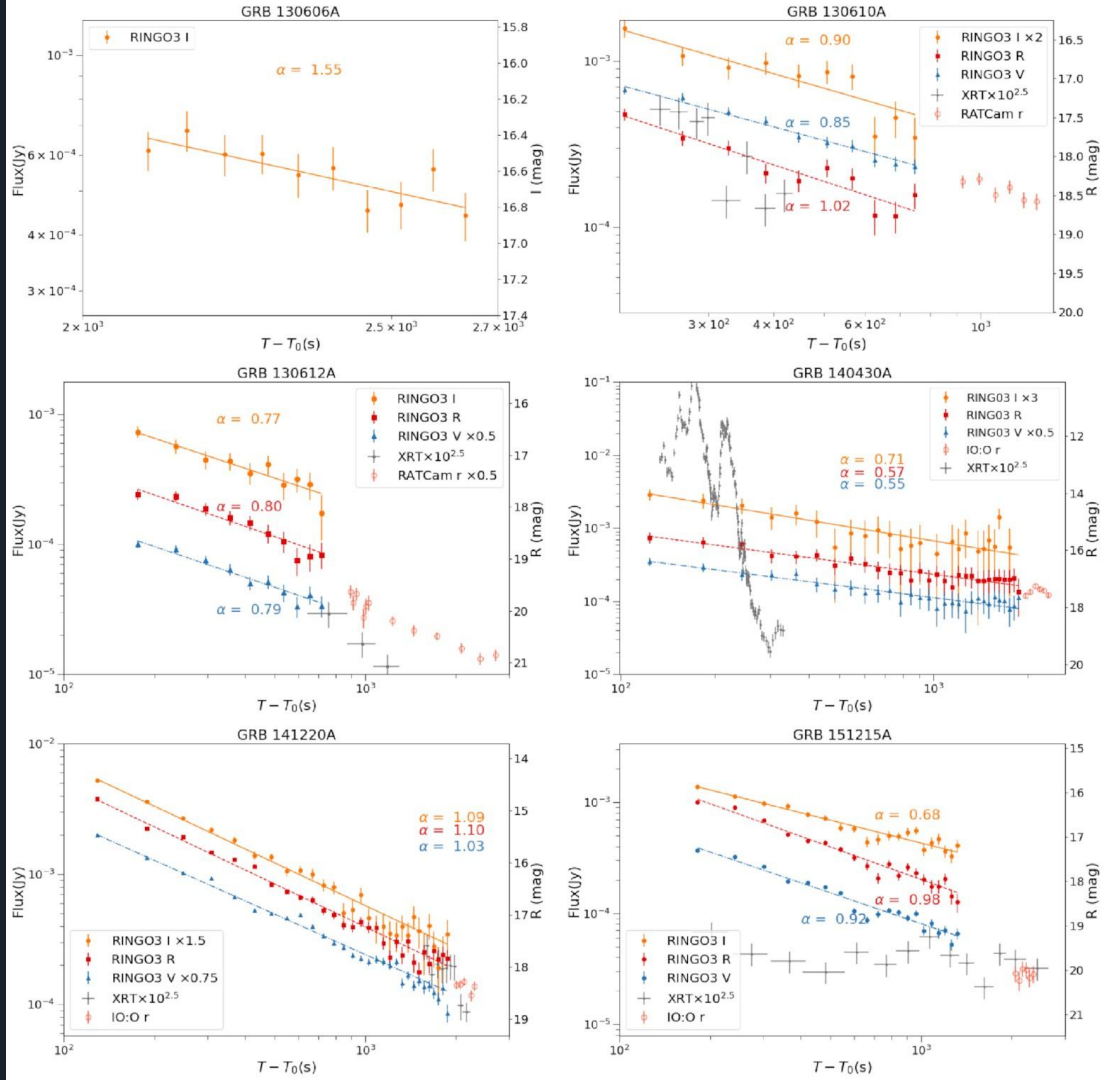


https://royalsocietypublishing.org/doi/10.1098/rsta.2011.0351

Synchrotron radiation

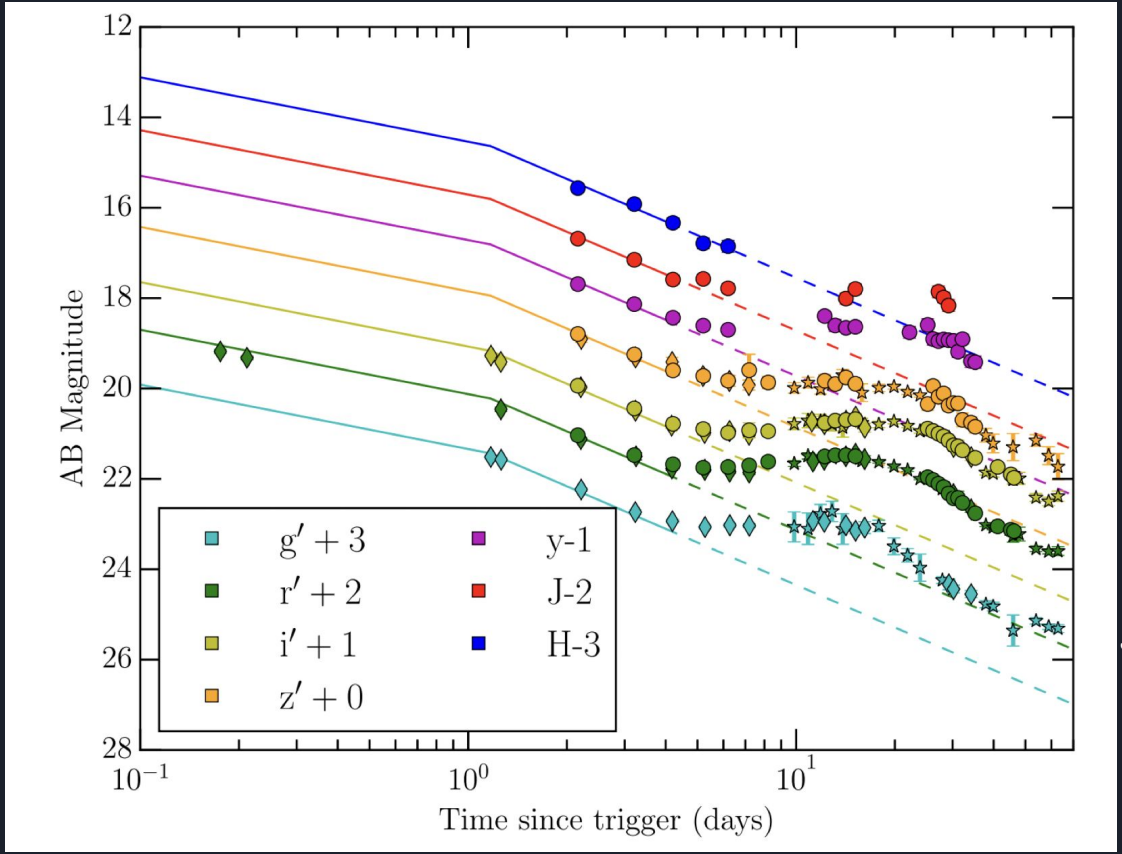


GRB afterglow



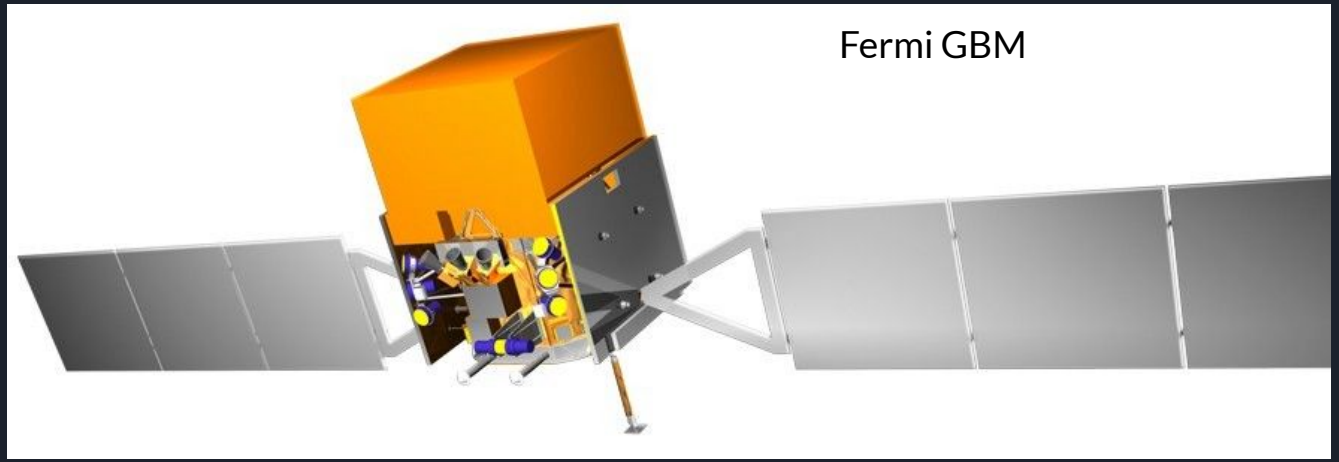
Shrestha et al. 2022

Supernova bump



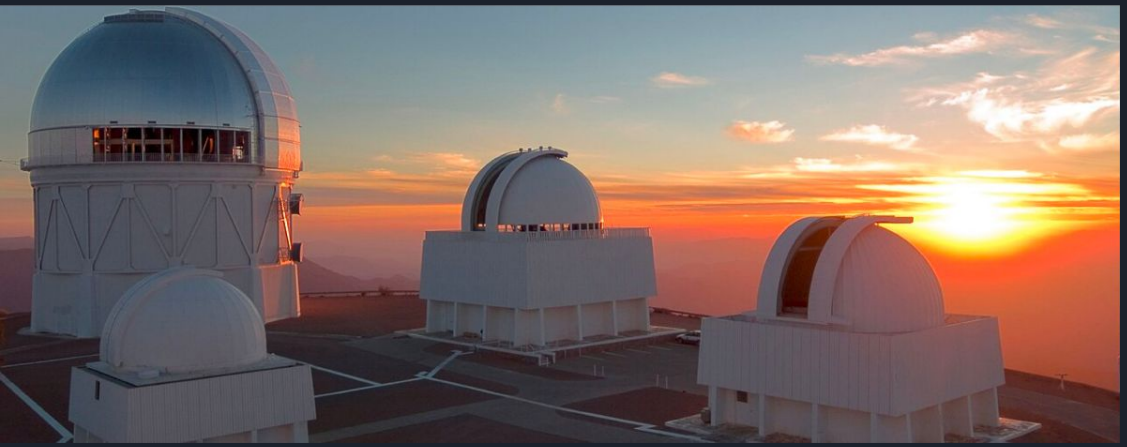
Toy et al. 2016

Gamma ray observations from space

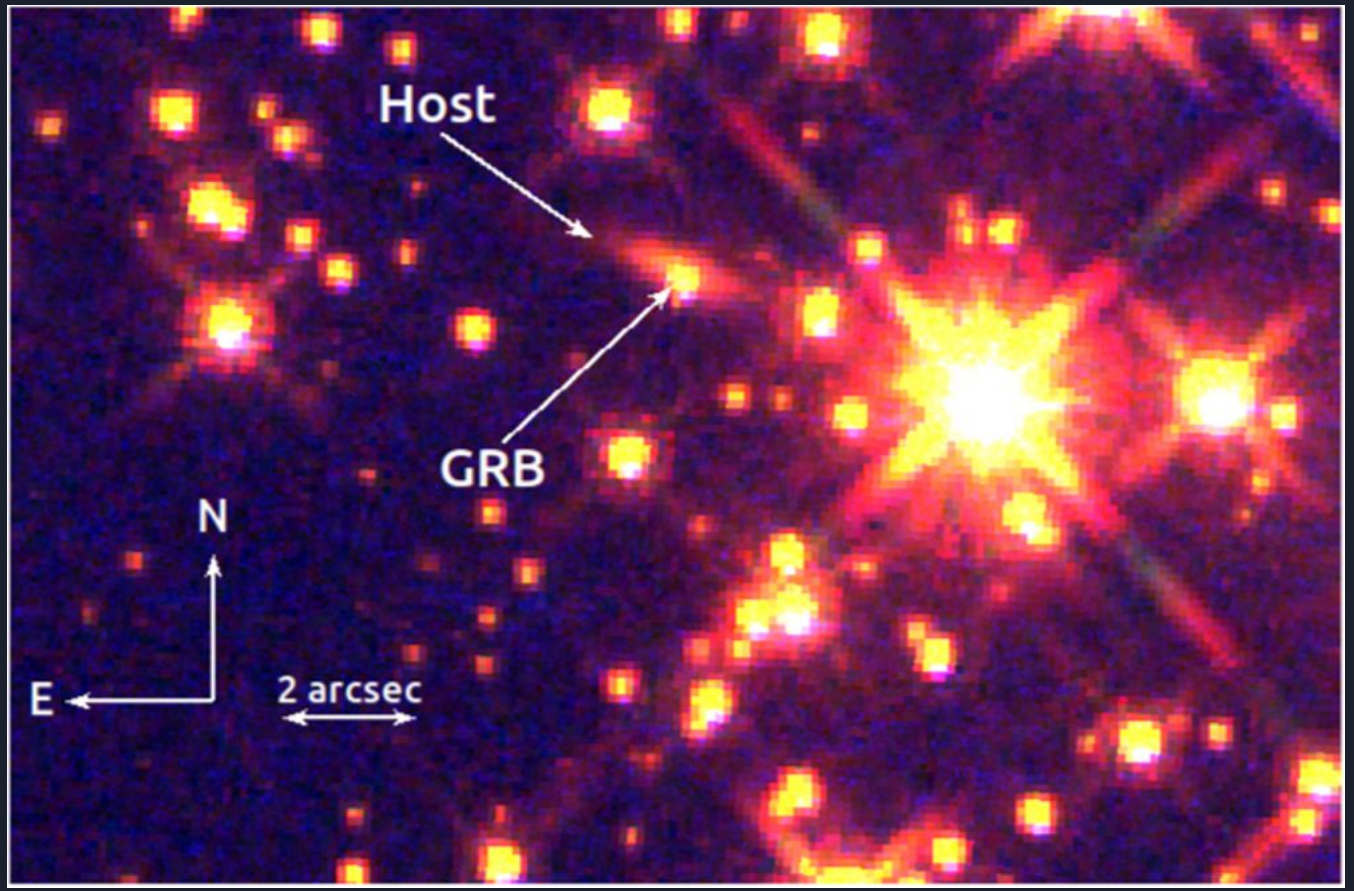


Fermi GBM

Gamma ray observations from ground



GRB 221009A: The brightest GRB of all time



Shrestha et al. 2023

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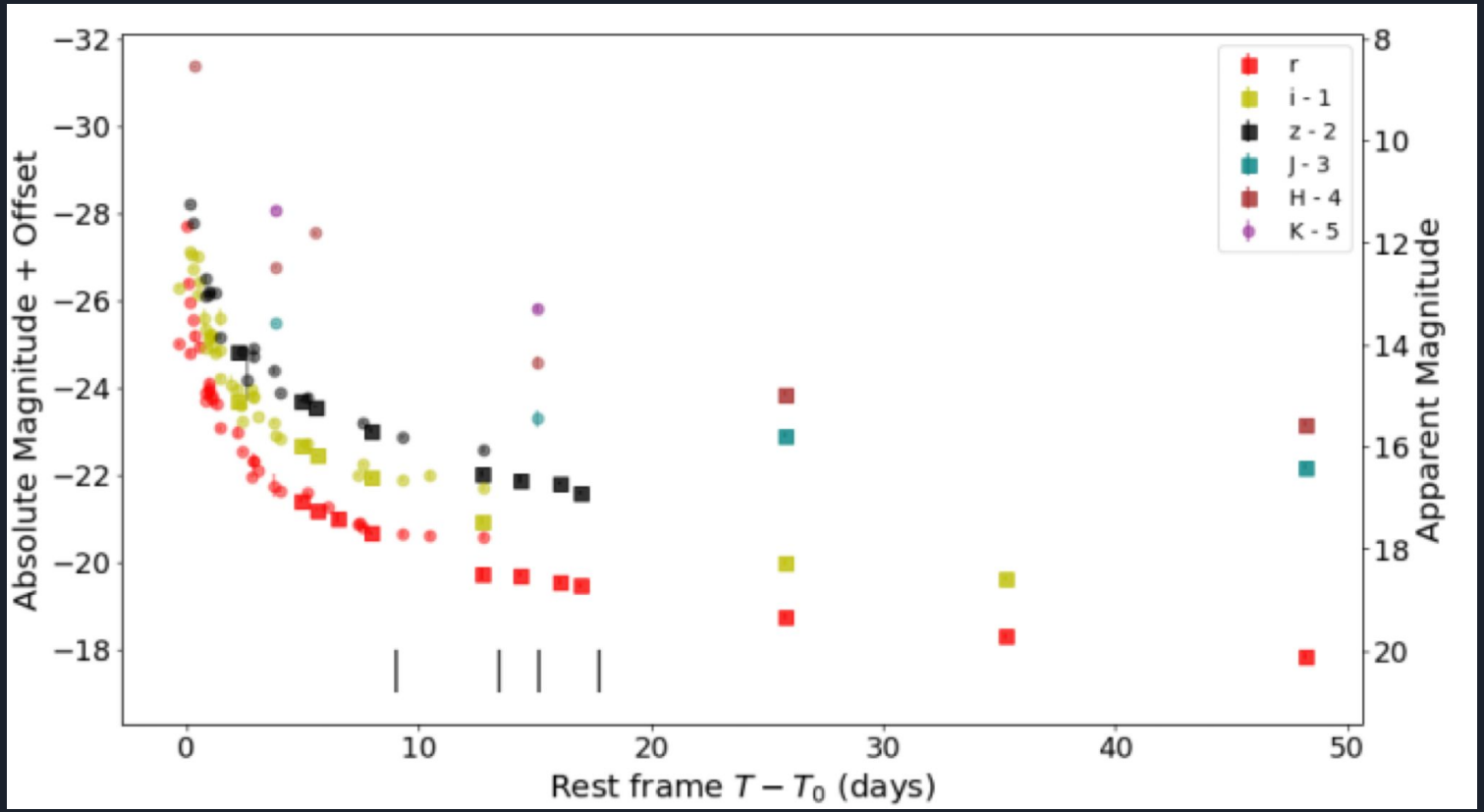
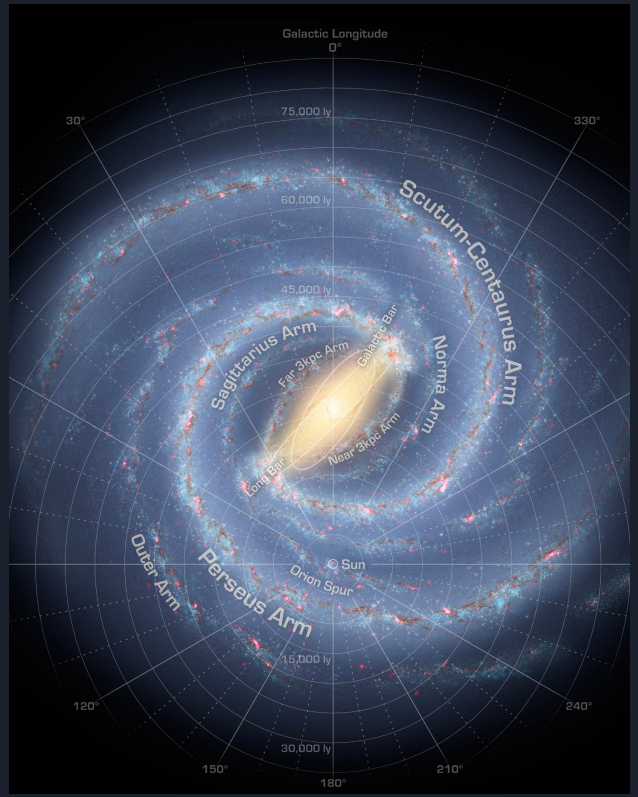


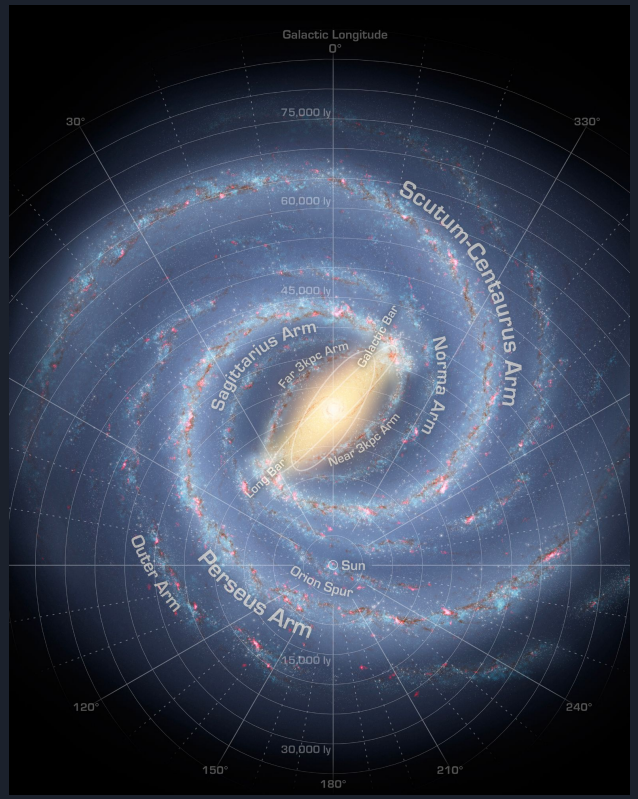
Shrestha et al. 2023

GRB in our own galaxy??



GRB in our own galaxy??

- 1 event every 100,000 - 1 million years
- Only <10% would point towards the Earth



GRB in our own galaxy??

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