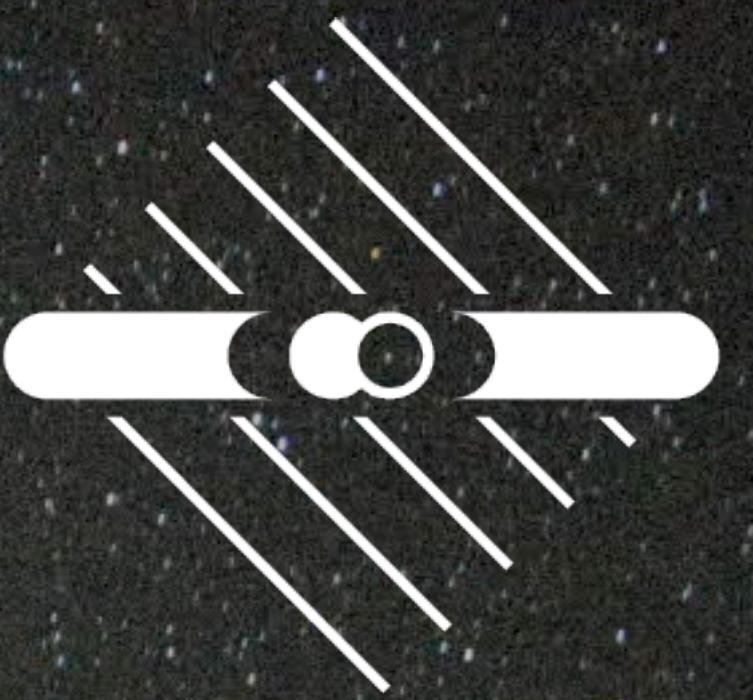


# VHE observations of GRB 190829A with H.E.S.S.

**16th Marcel Grossmann Meeting**

**Edna Ruiz-Velasco (Max Planck Institute for Nuclear Physics),  
C. Romoli, F. Schussler, A. Taylor, S. Zhu, D. Khangulyan, F.  
Aharonian, for the H.E.S.S. Collaboration.**



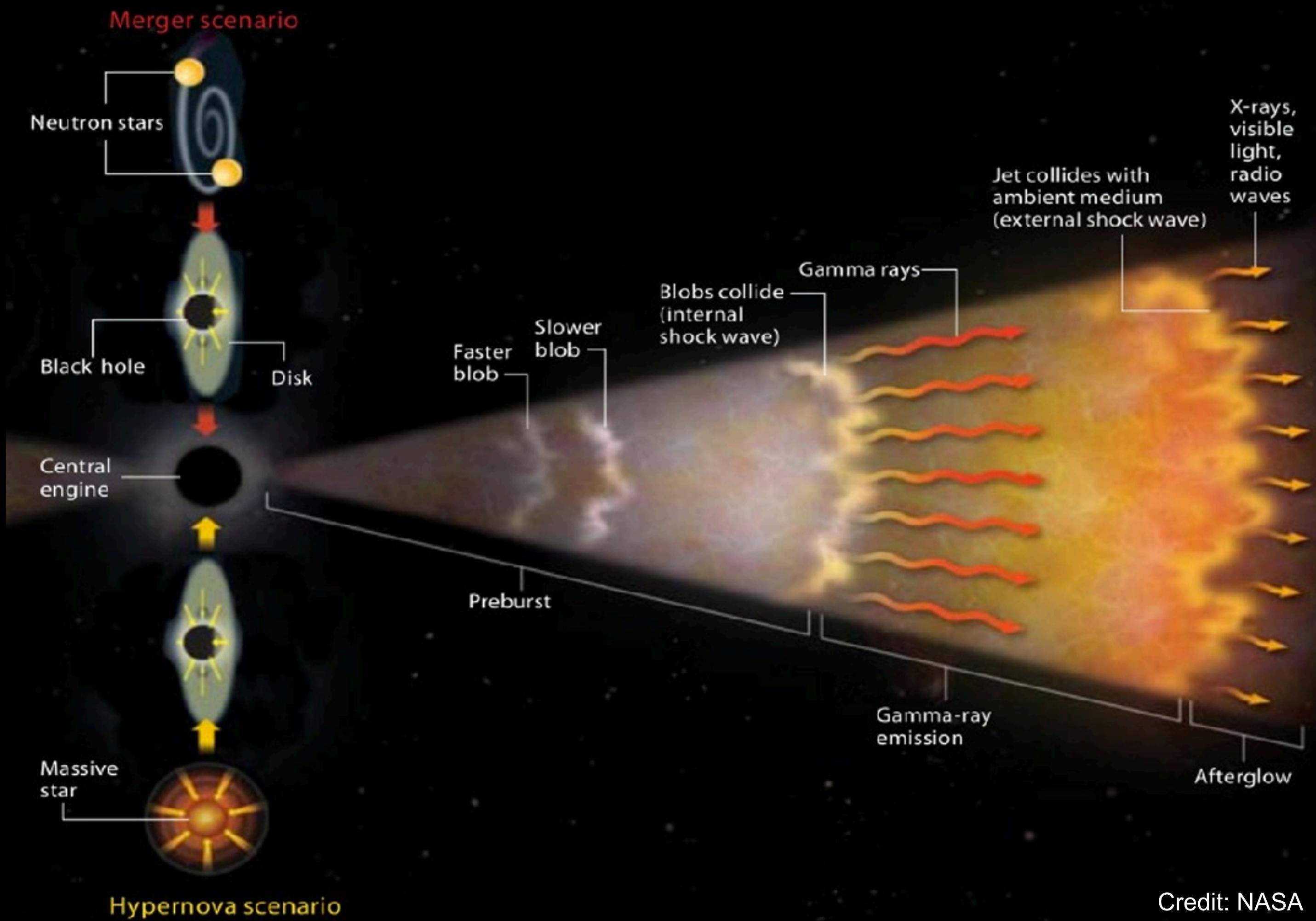
- GRBs at HE and VHE:
  - 1 GRB per day GBM-BAT
  - ~12 GRBs per year Fermi-LAT

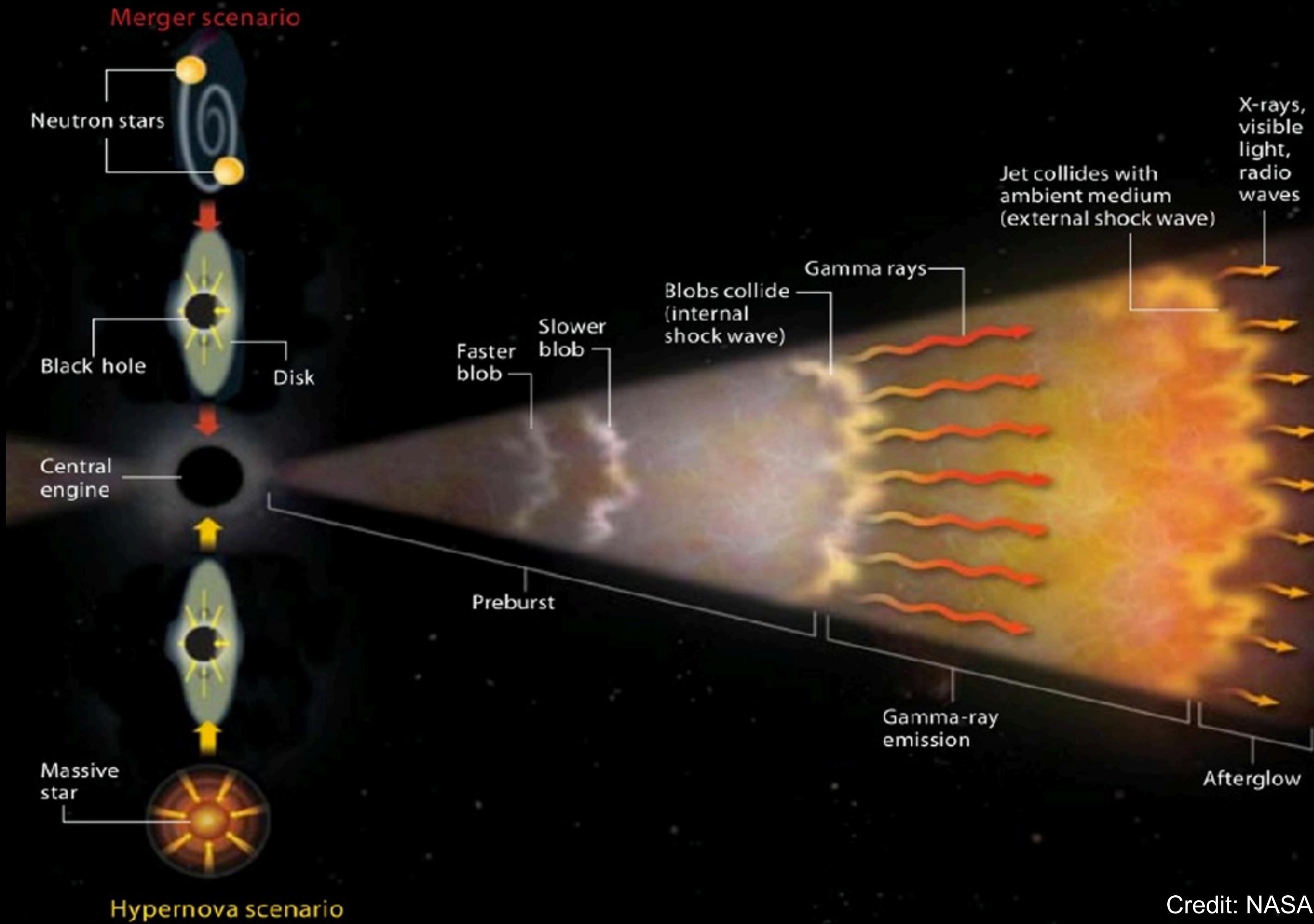
- GRB130427A: Extended HE emission, 94 GeV max energy photon.

**VHE emission was a decades-long mystery**

Now many detections!

IACTs (MAGIC, H.E.S.S., VERITAS)  
WFOV (HAWC, LAAHSO)  
all looking for GRBs.





See **Sylvia Zhu's** presentation  
on H.E.S.S.  
GRB programme

Now many detections!

IACTs (MAGIC, **H.E.S.S.**, VERITAS)  
WFOV (HAWC, LAAHSO)  
all looking for GRBs.

# In this talk...

REPORT

## Revealing x-ray and gamma ray temporal and spectral similarities in the GRB 190829A afterglow

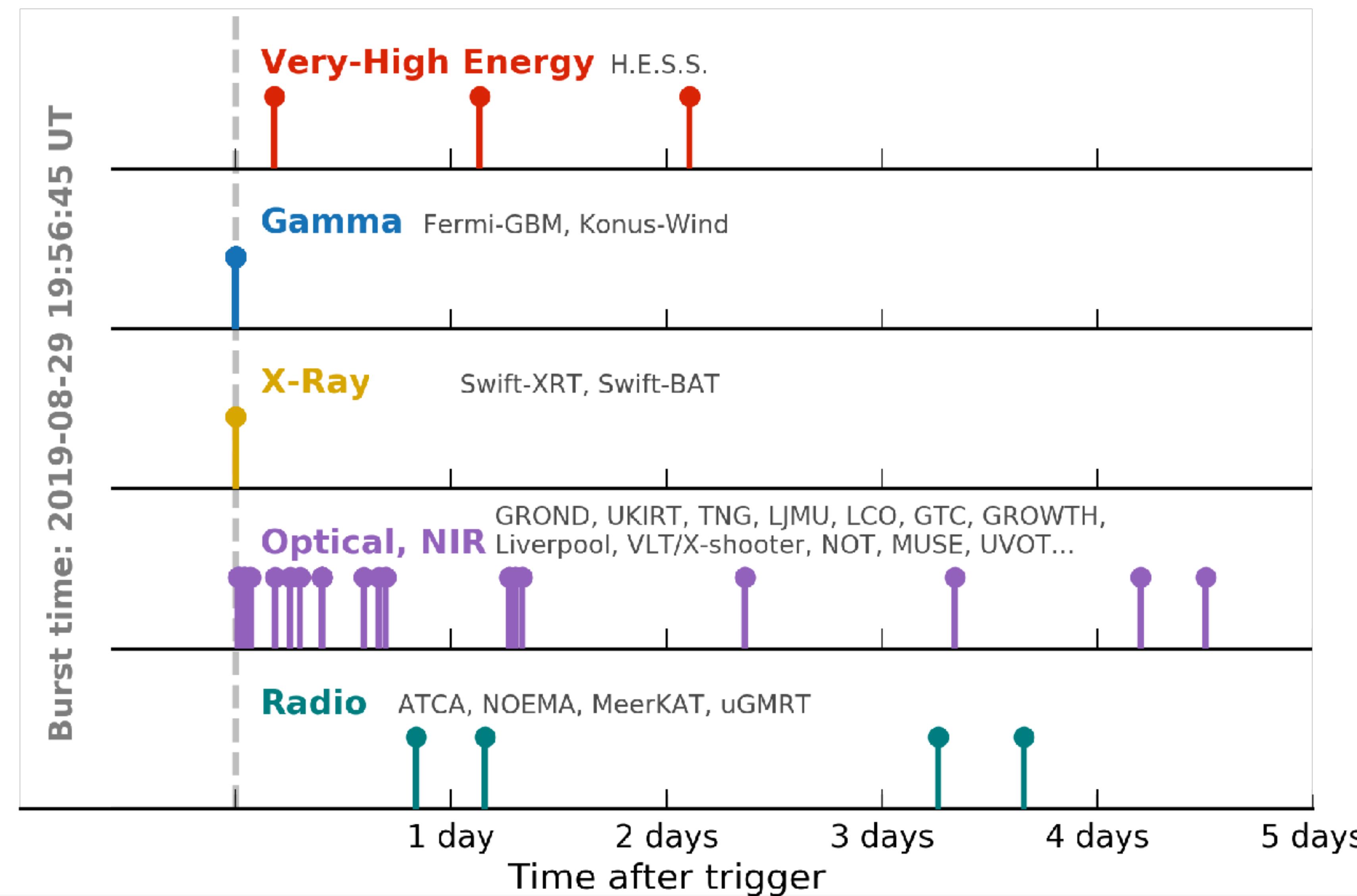
H.E.S.S. Collaboration<sup>†,\*</sup>, H. Abdalla<sup>1</sup>, F. Aharonian<sup>2,3,4</sup>, F. Ait Benkhali<sup>3</sup>, E. O. Angüner<sup>5</sup>, C. Arcaro<sup>6</sup>, C. Armand<sup>7</sup>, T. Armstrong...

\* See all authors and affiliations

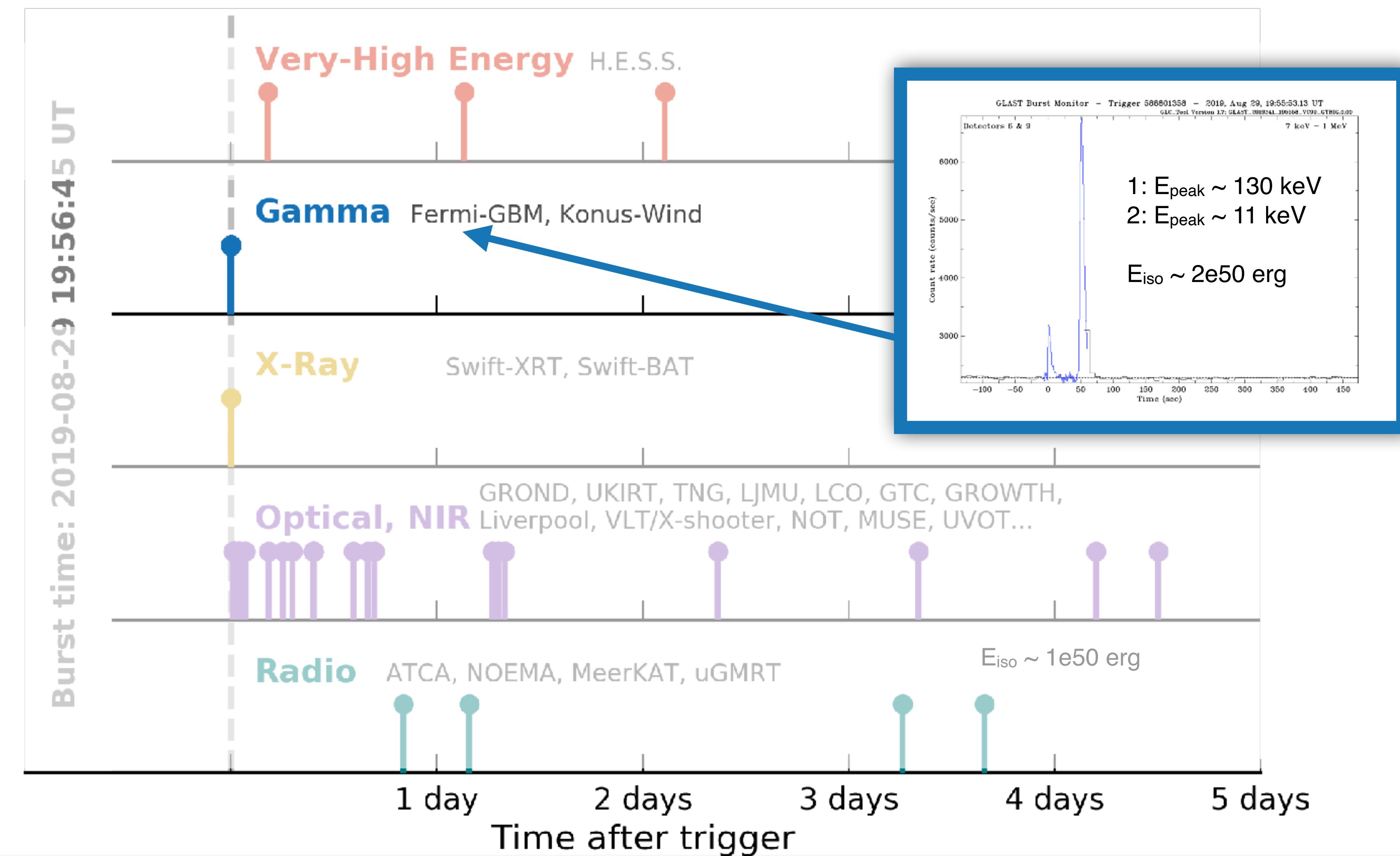
Science 04 Jun 2021:  
Vol. 372, Issue 6546, pp. 1081-1085  
DOI: 10.1126/science.abe8560



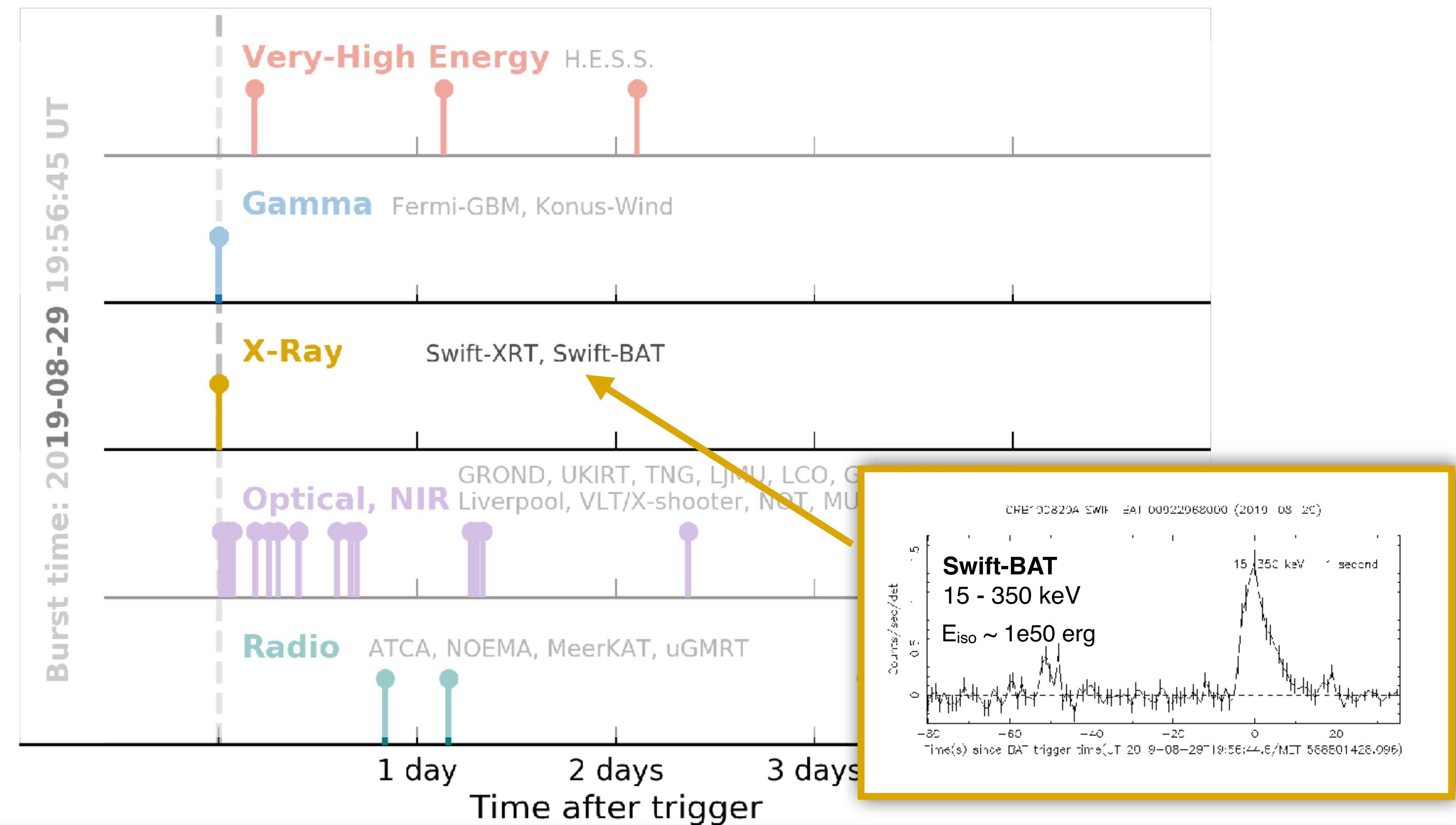
# Timeline



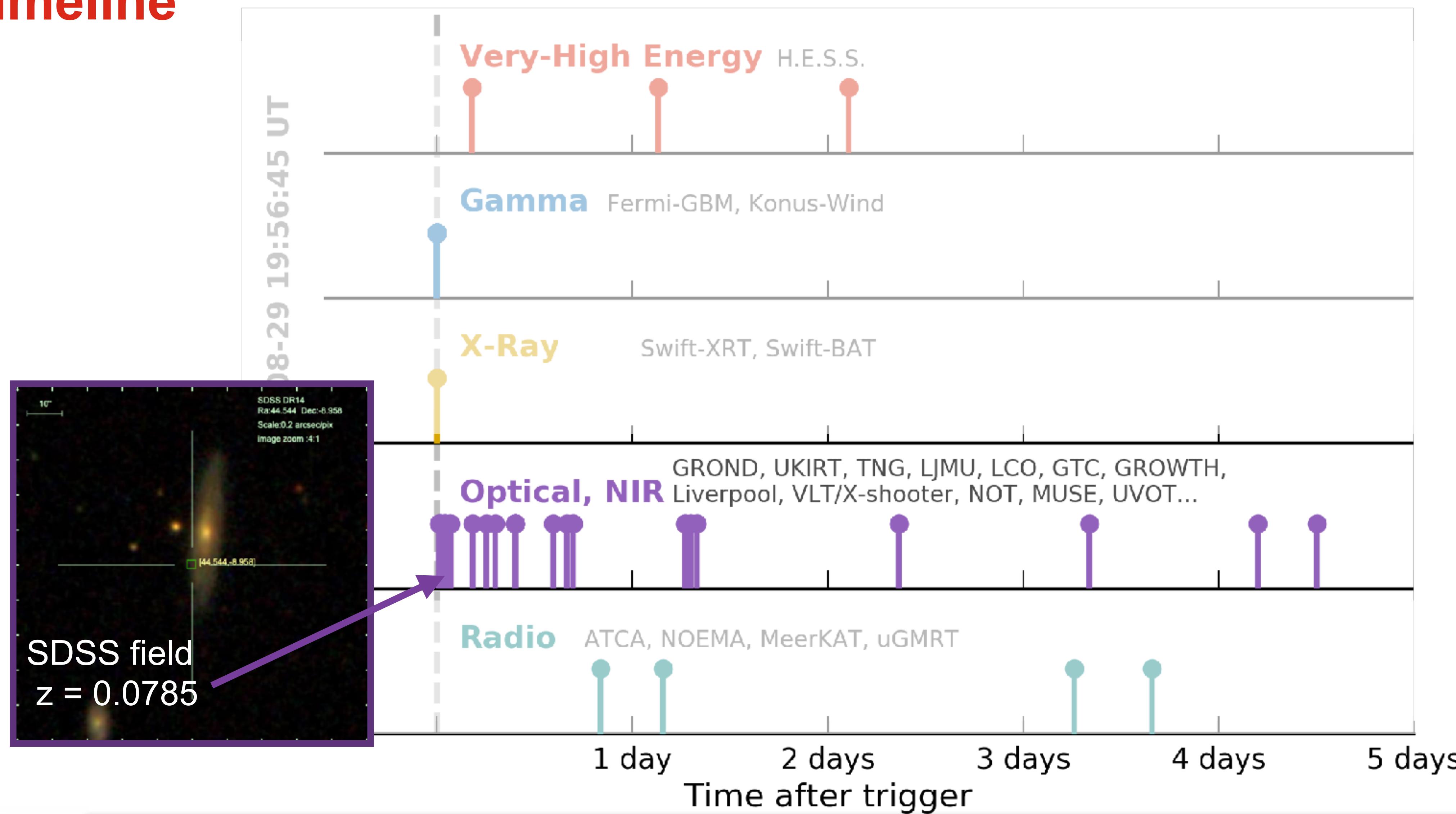
# Timeline



# Timeline

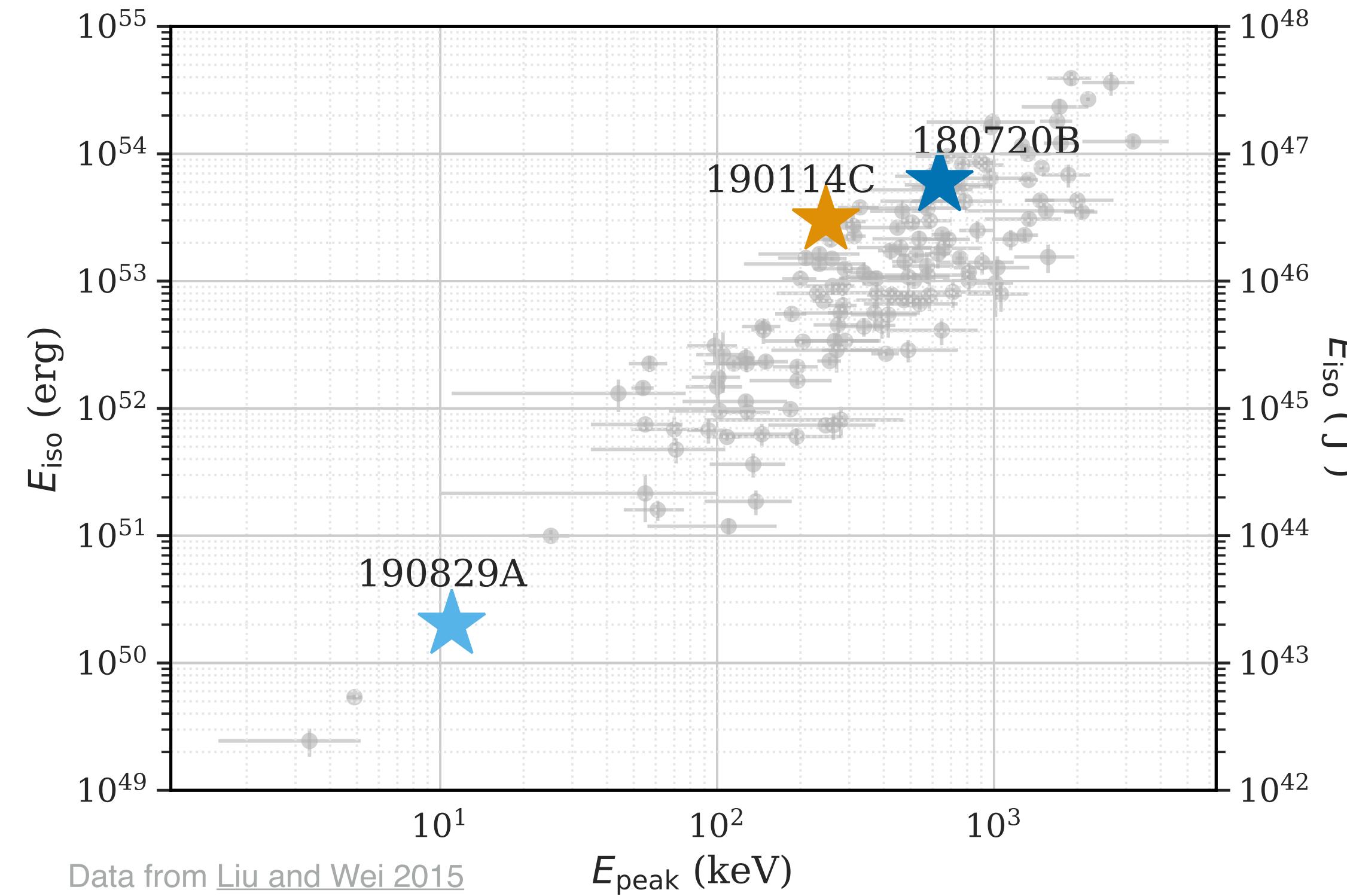


# Timeline

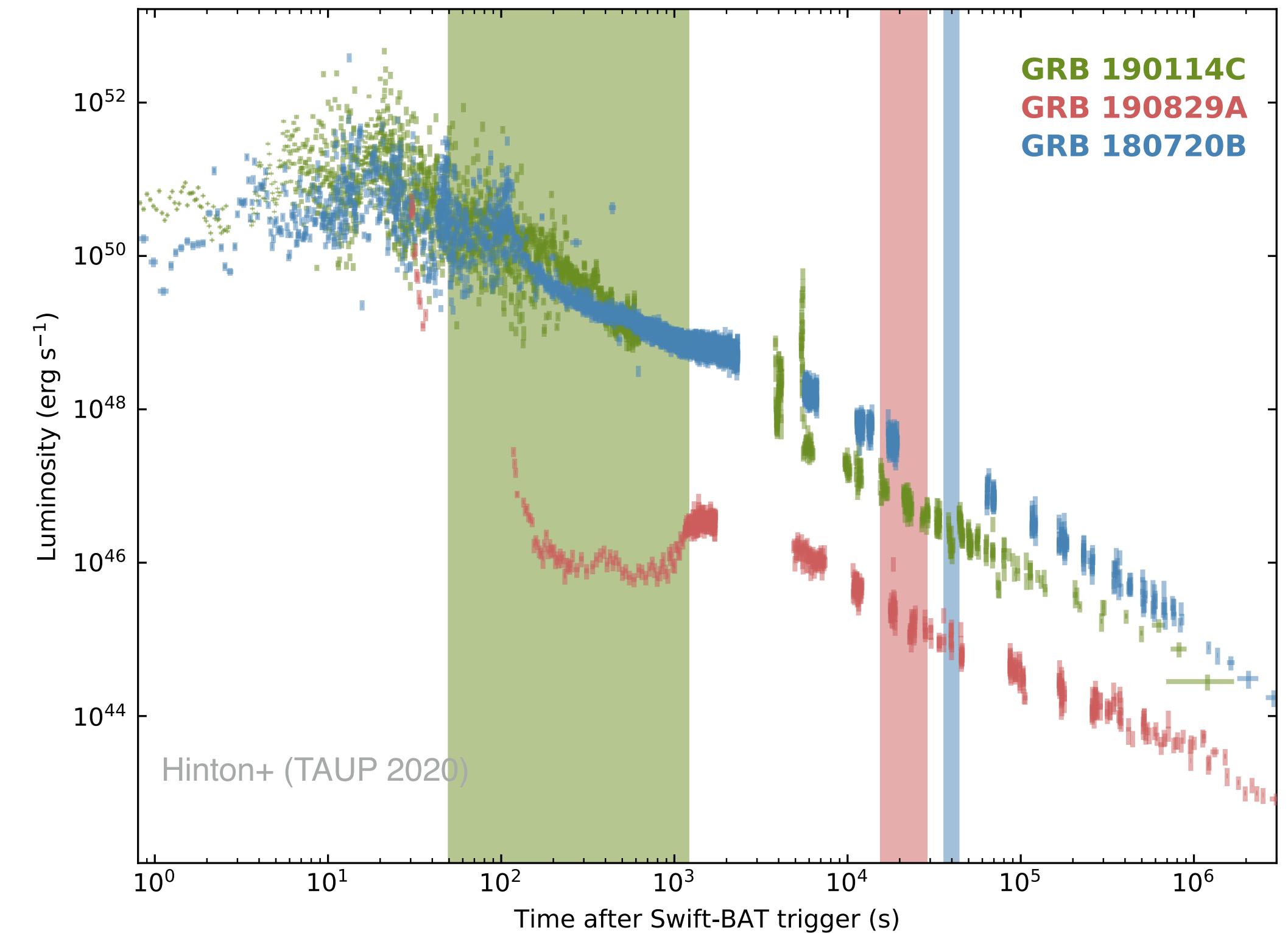


# In context...

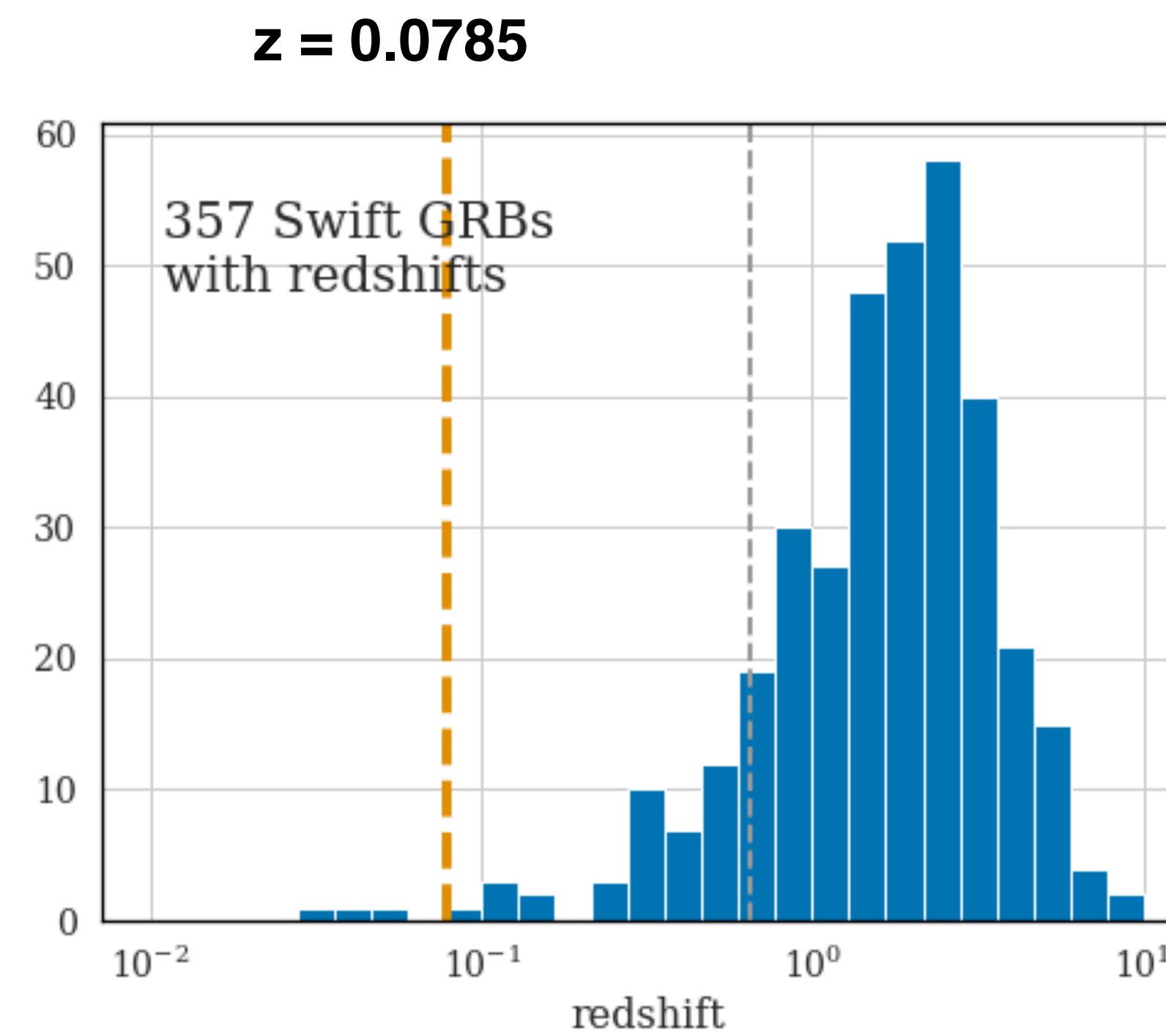
## Amati relation



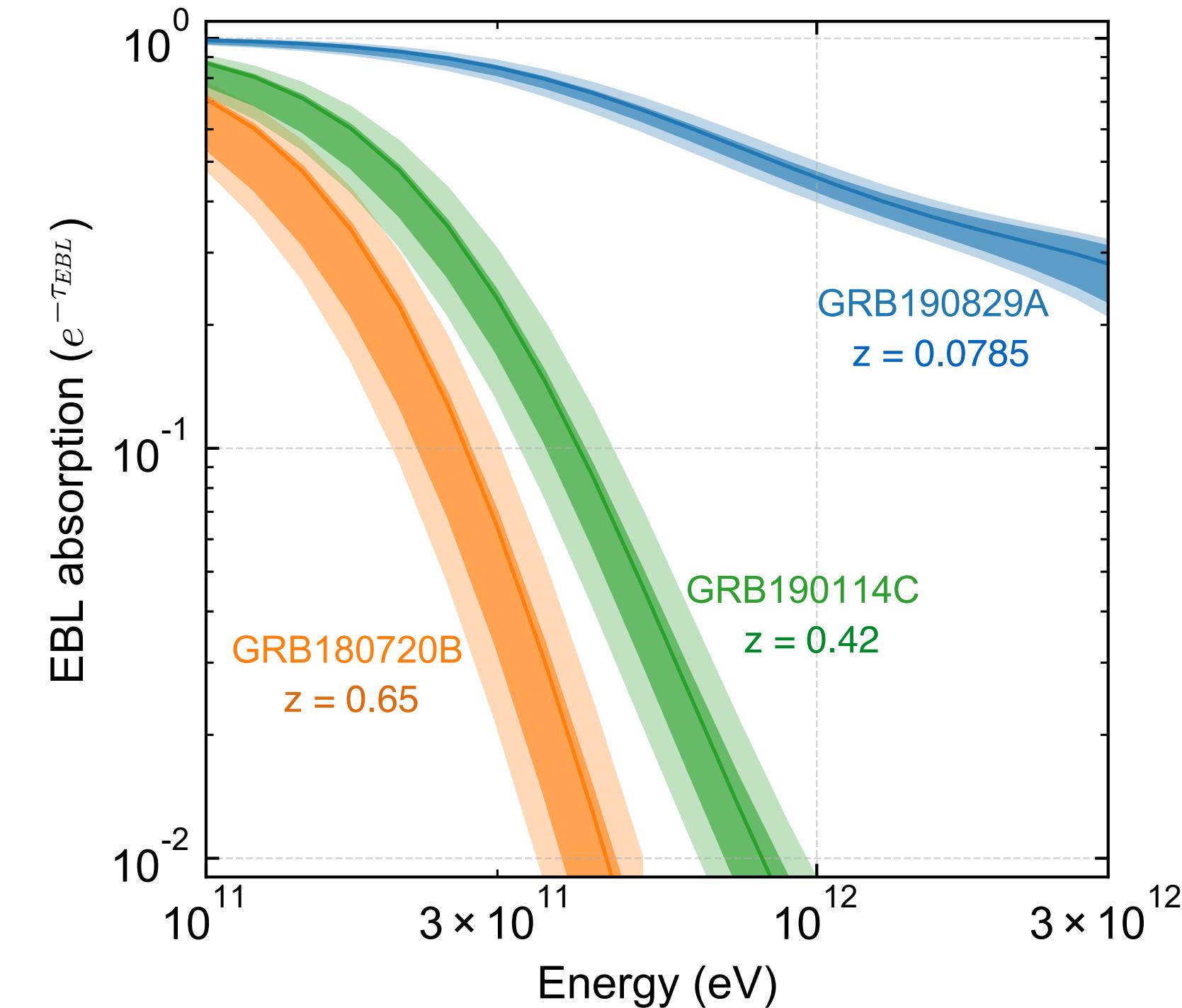
## Swift-BAT/XRT light curve



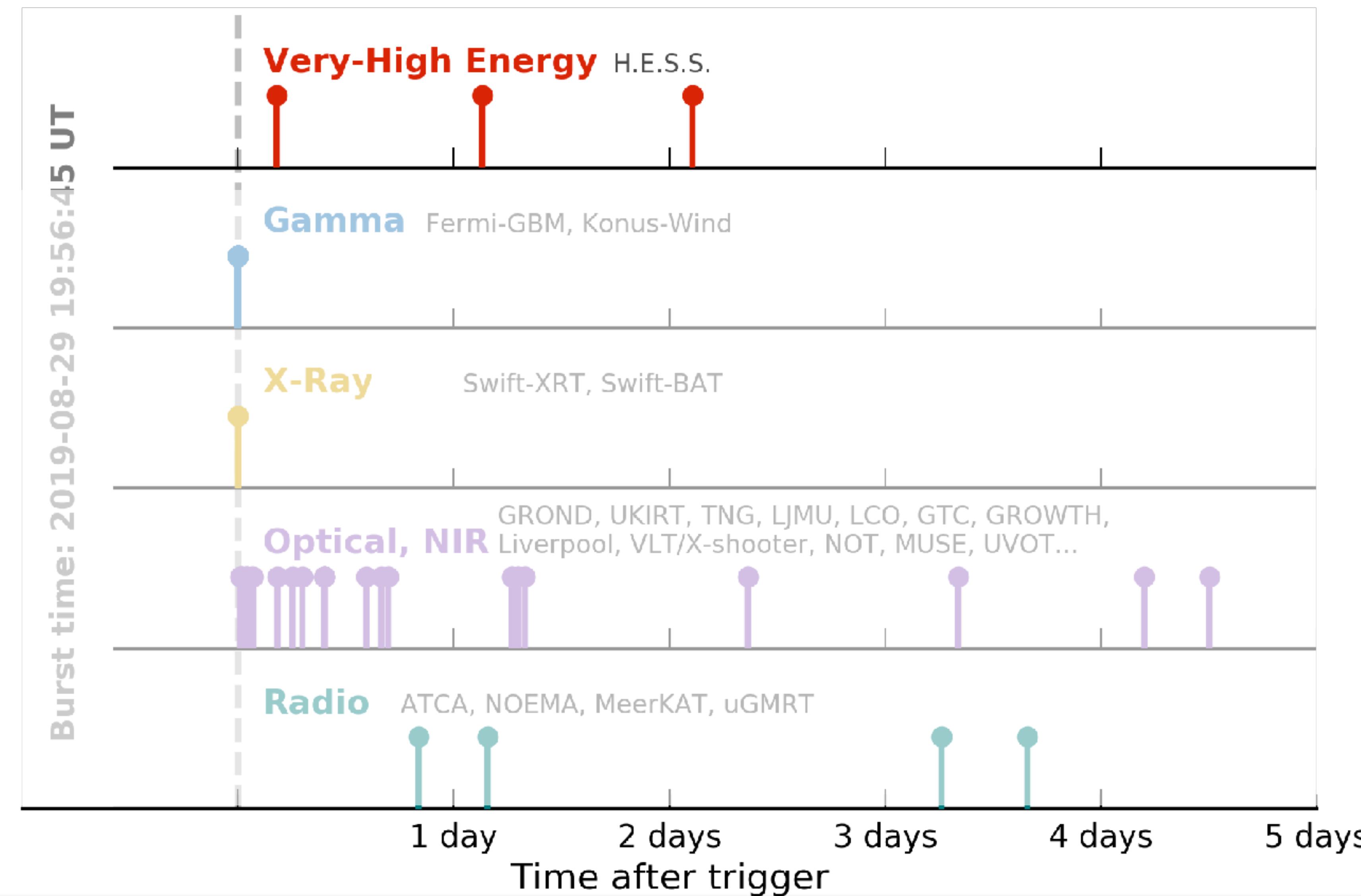
# In context...



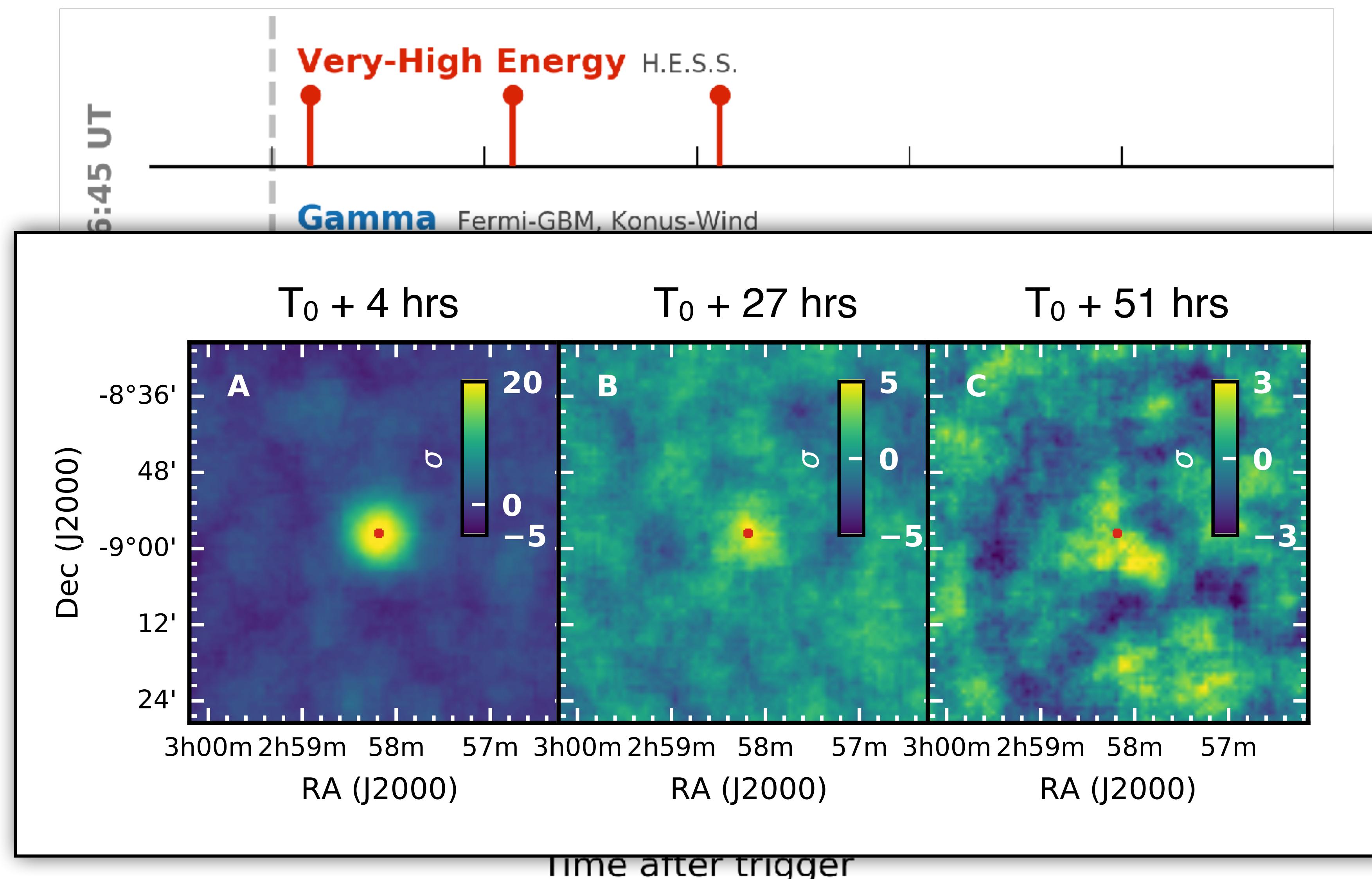
Credits: S. Zhu



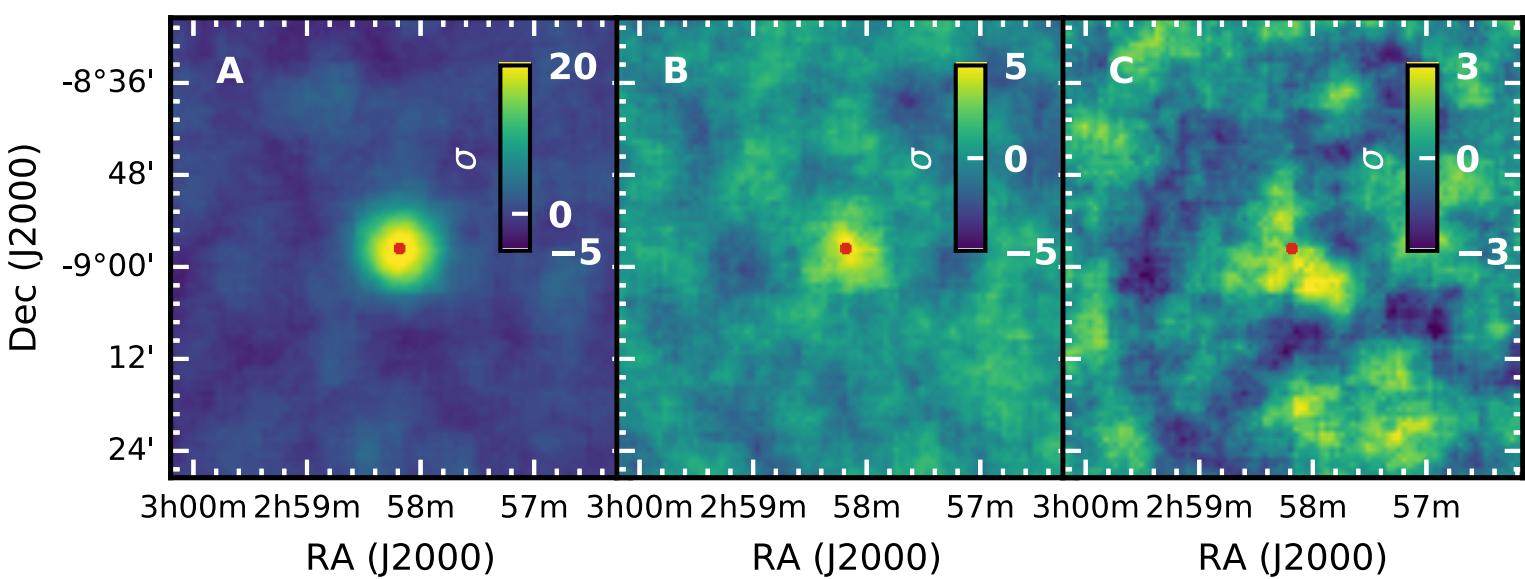
# Timeline



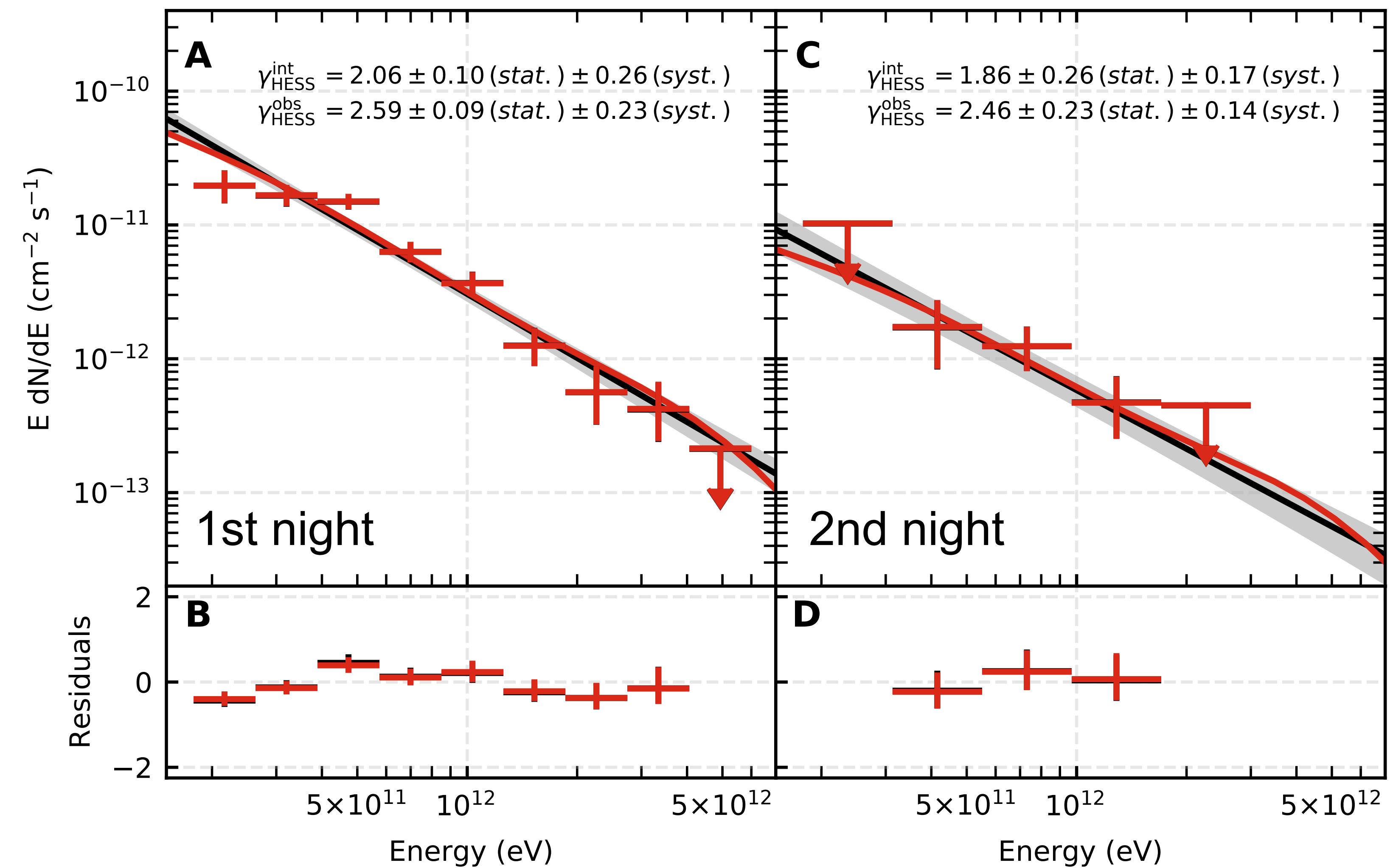
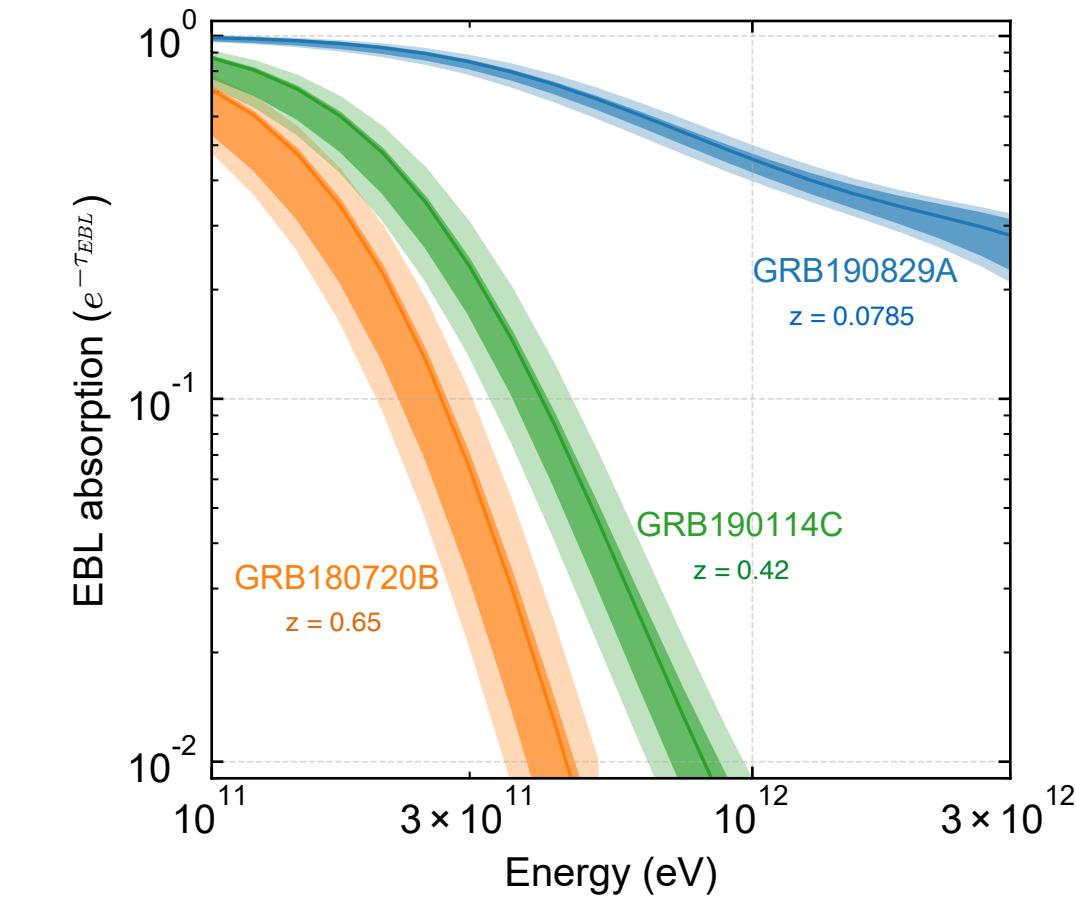
# Timeline



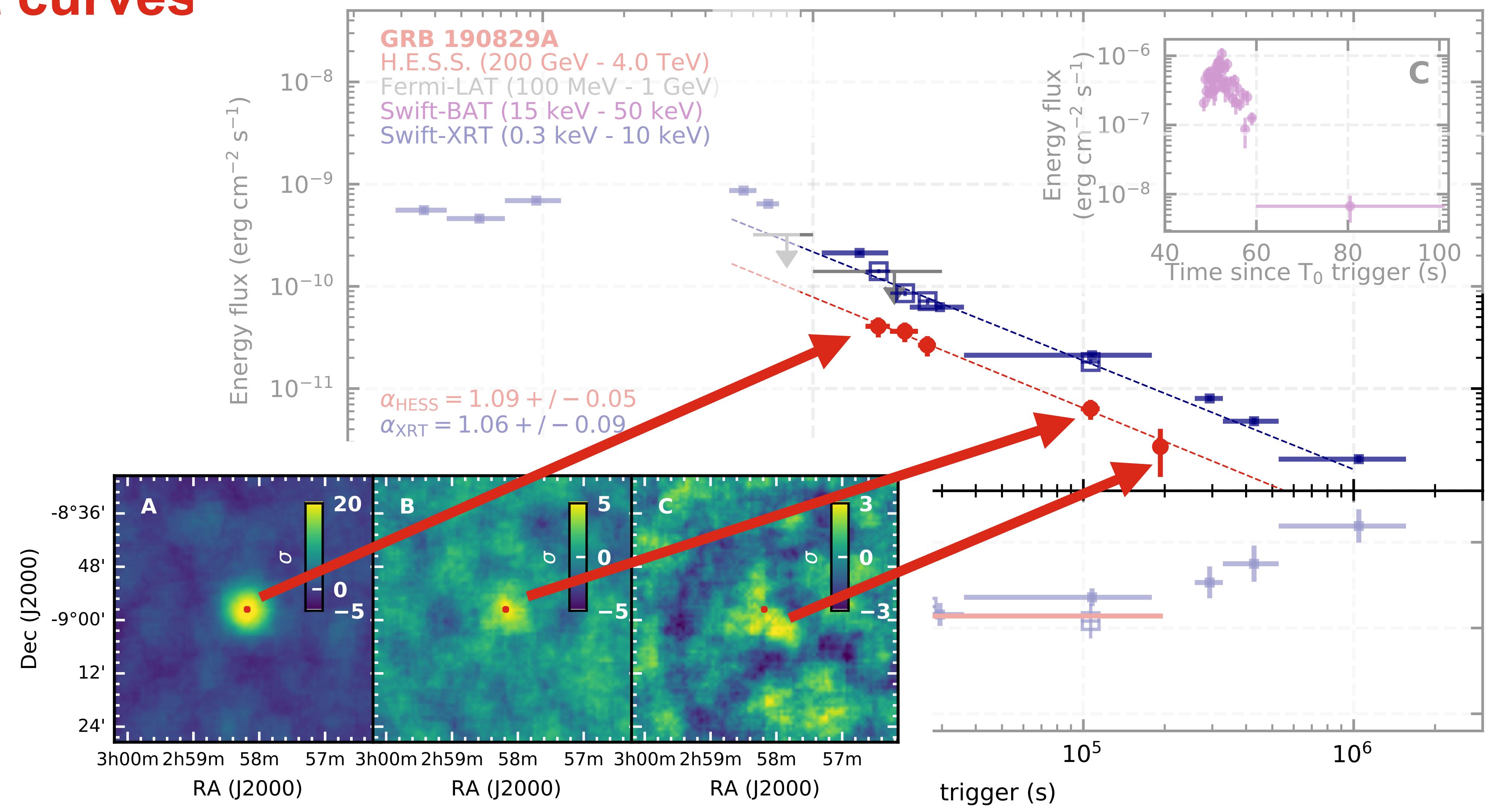
# H.E.S.S. spectra



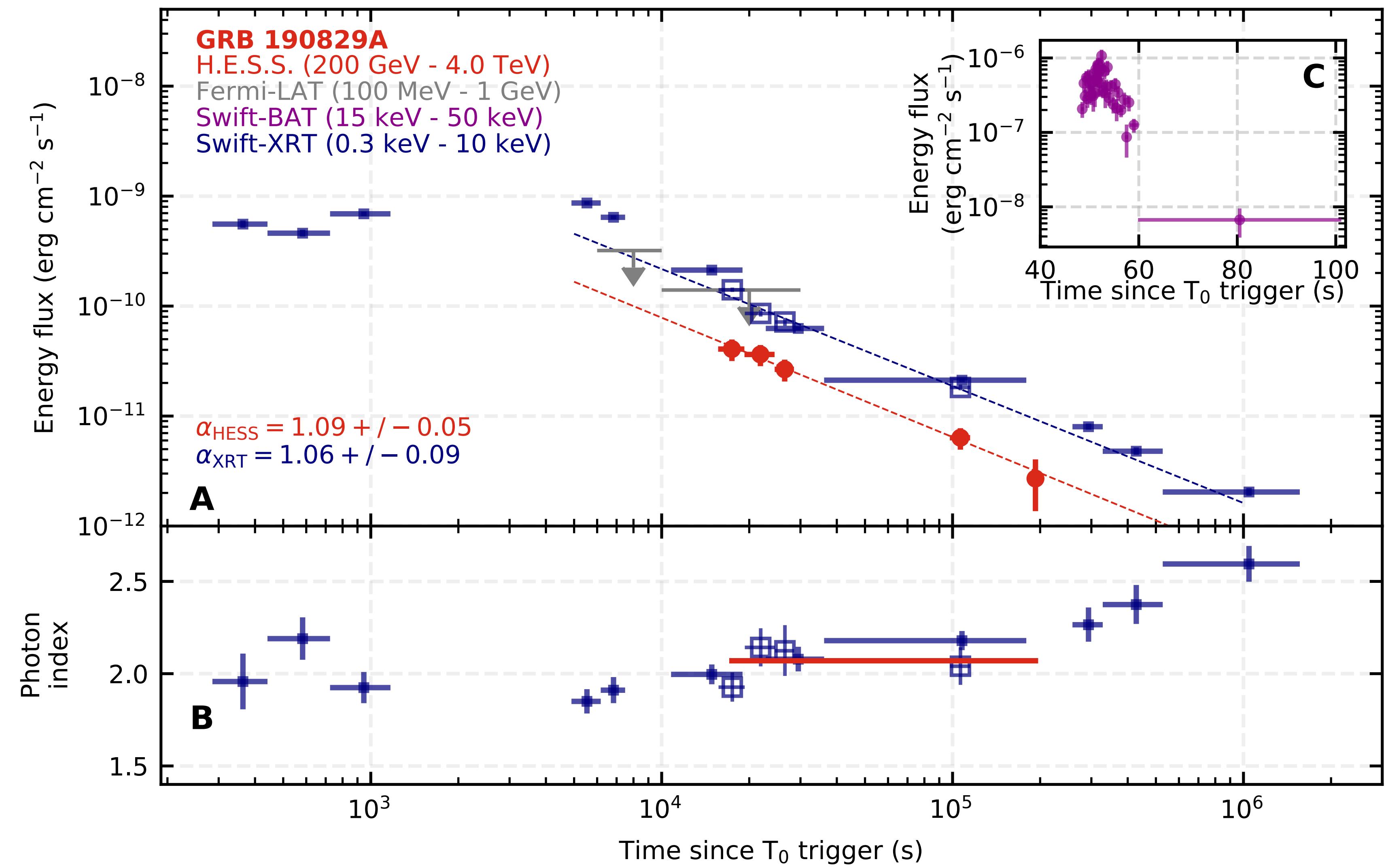
$$\frac{dN}{dE} \propto E^{-\Gamma} e^{-\tau(E,z)}$$



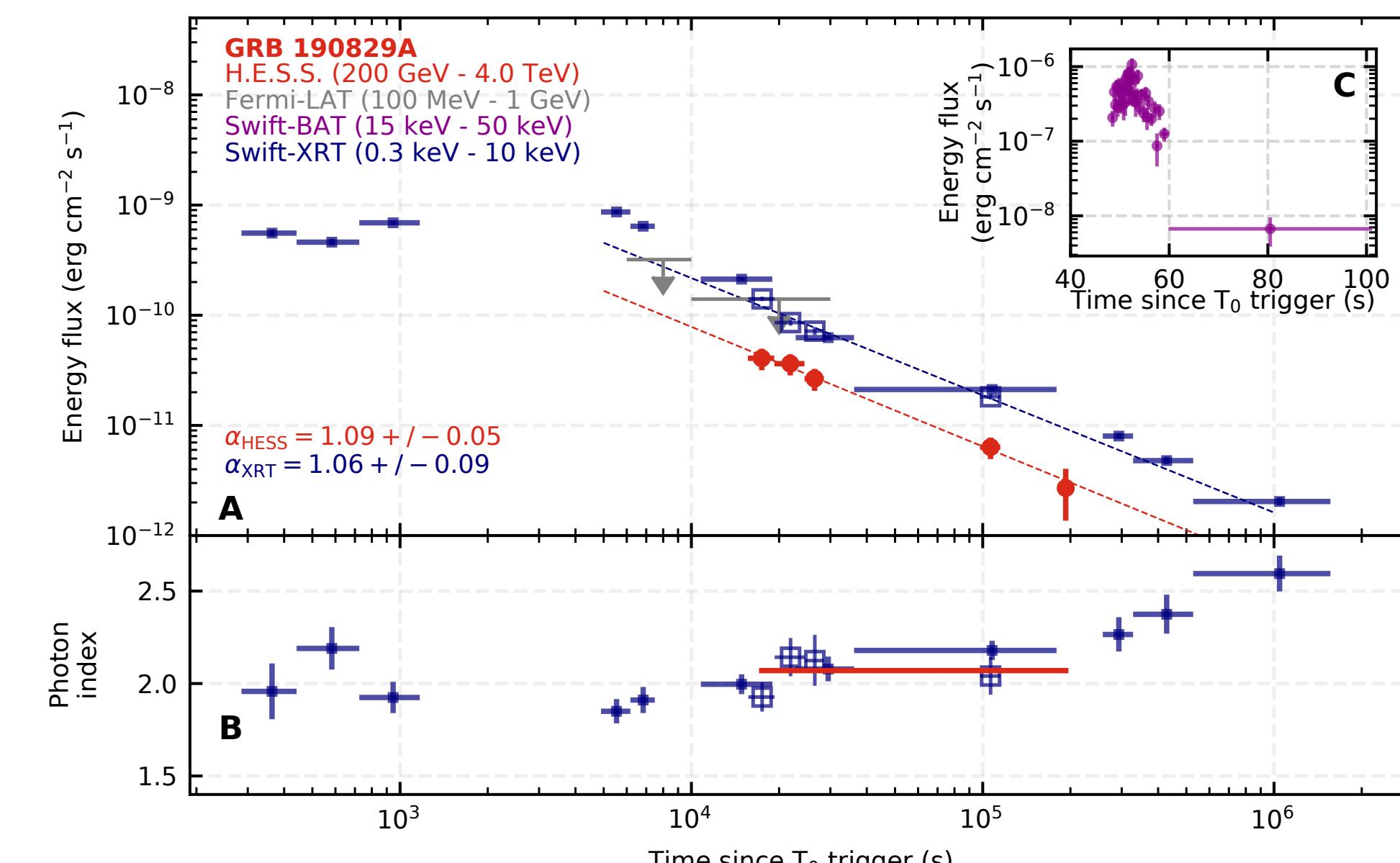
# MWL Light curves



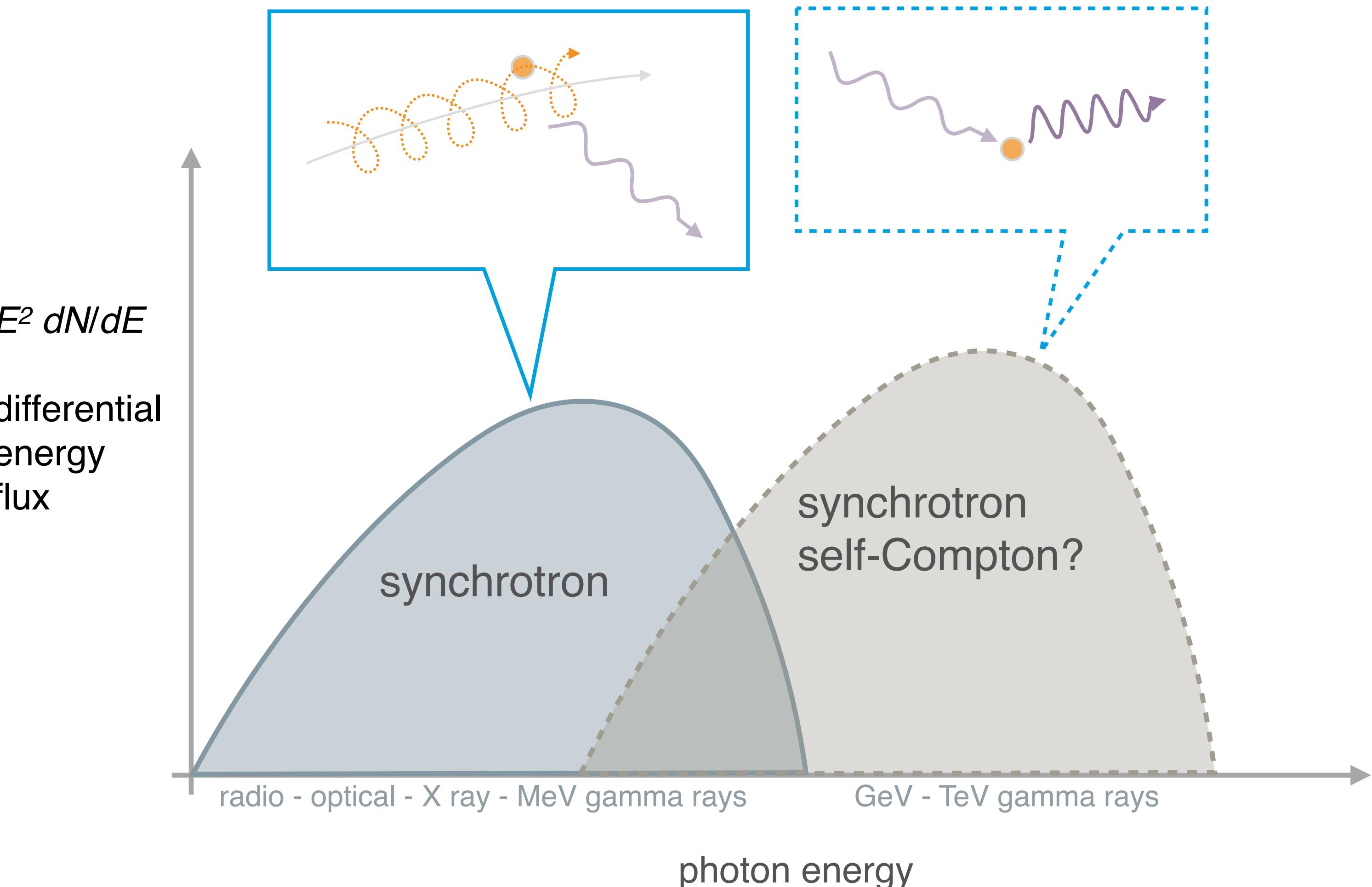
# MWL Light curves



# Emission mechanisms



Credits: S. Zhu

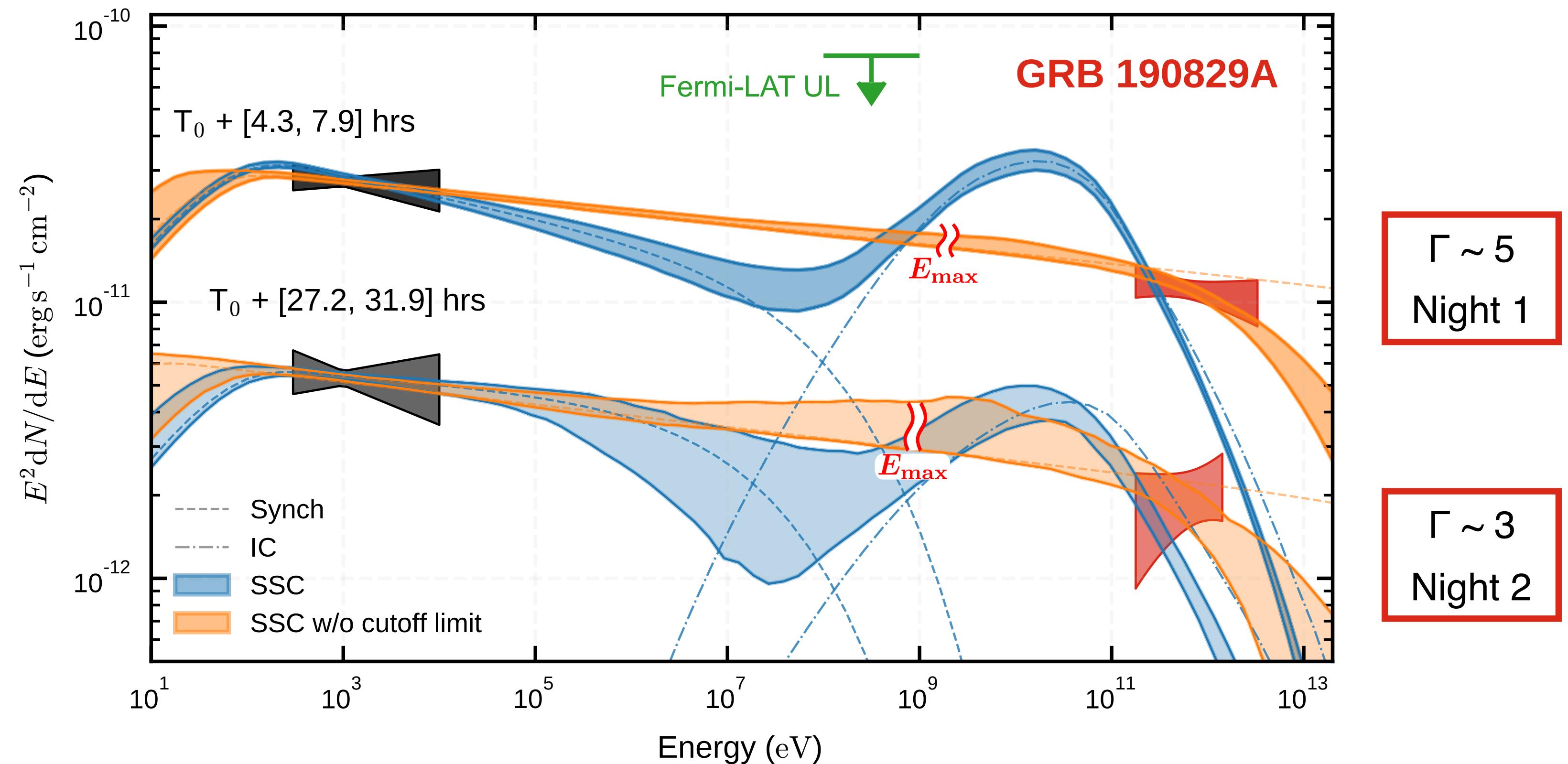


# Modelling of the MWL SED

- Emission from the GRB forward shock.
- One-zone dynamical model.

**No max photon energy for Synch:**  
 >5  $\sigma$  preference  
harder to realise than SSC  
(burnoff limit)

**SSC possible if:**  
 Higher  $\Gamma$  ( $\sim 10^2$ )  
 Hard electron distribution at HEs



# Conclusions

- GRB 190829A, very special: nearby and bright.
- VHE detection from 4 hrs to 51 hrs after onset.
- Very precise measurement of spectrum and temporal decay. Beyond what Fermi-LAT can provide.
- Similarities between x-ray and VHE (spectrum and light curve).
- Modelling stresses difficulties for SSC and Synch. Synch is preferred.

