



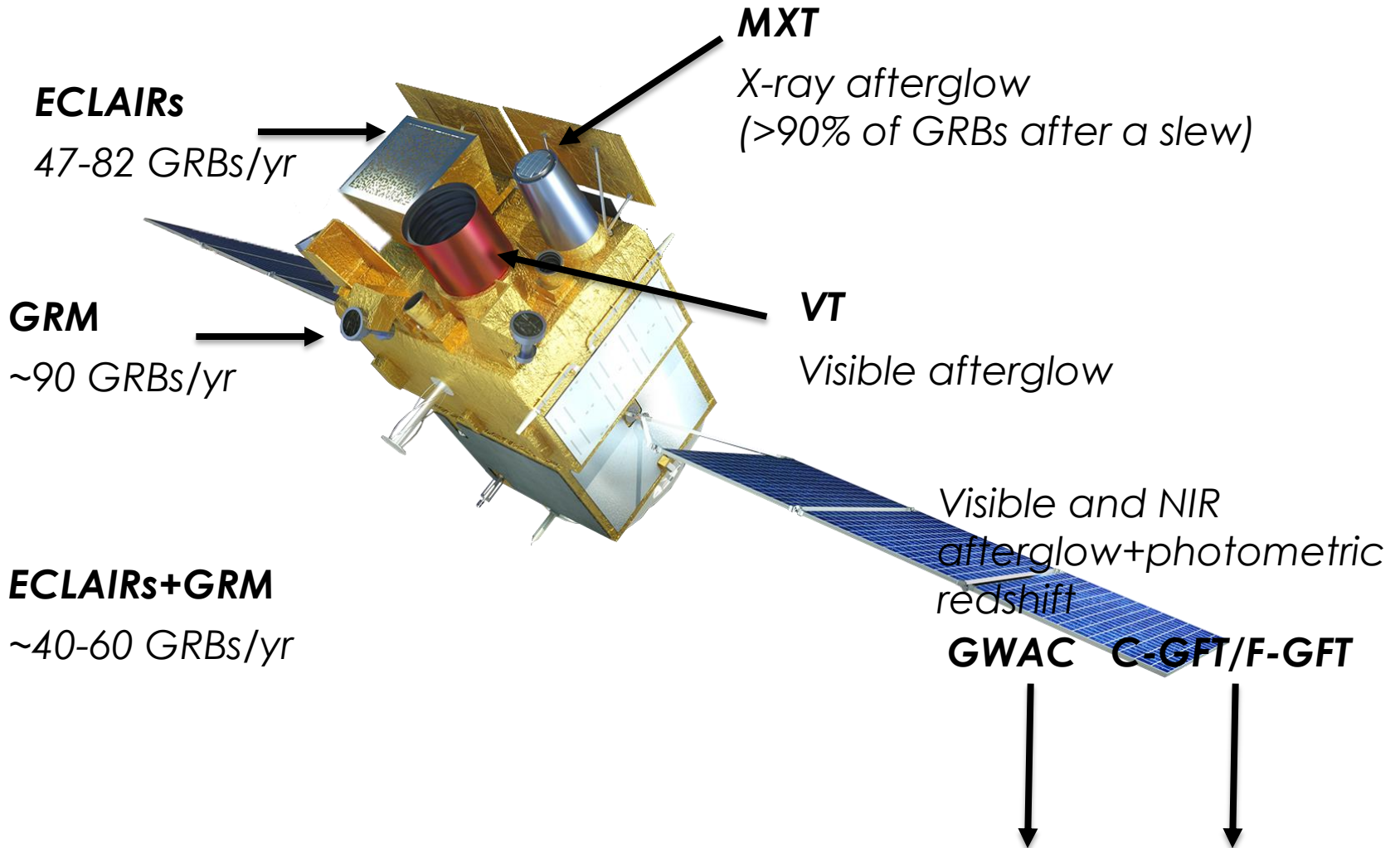
A SVOM Perspective of The GRB Science

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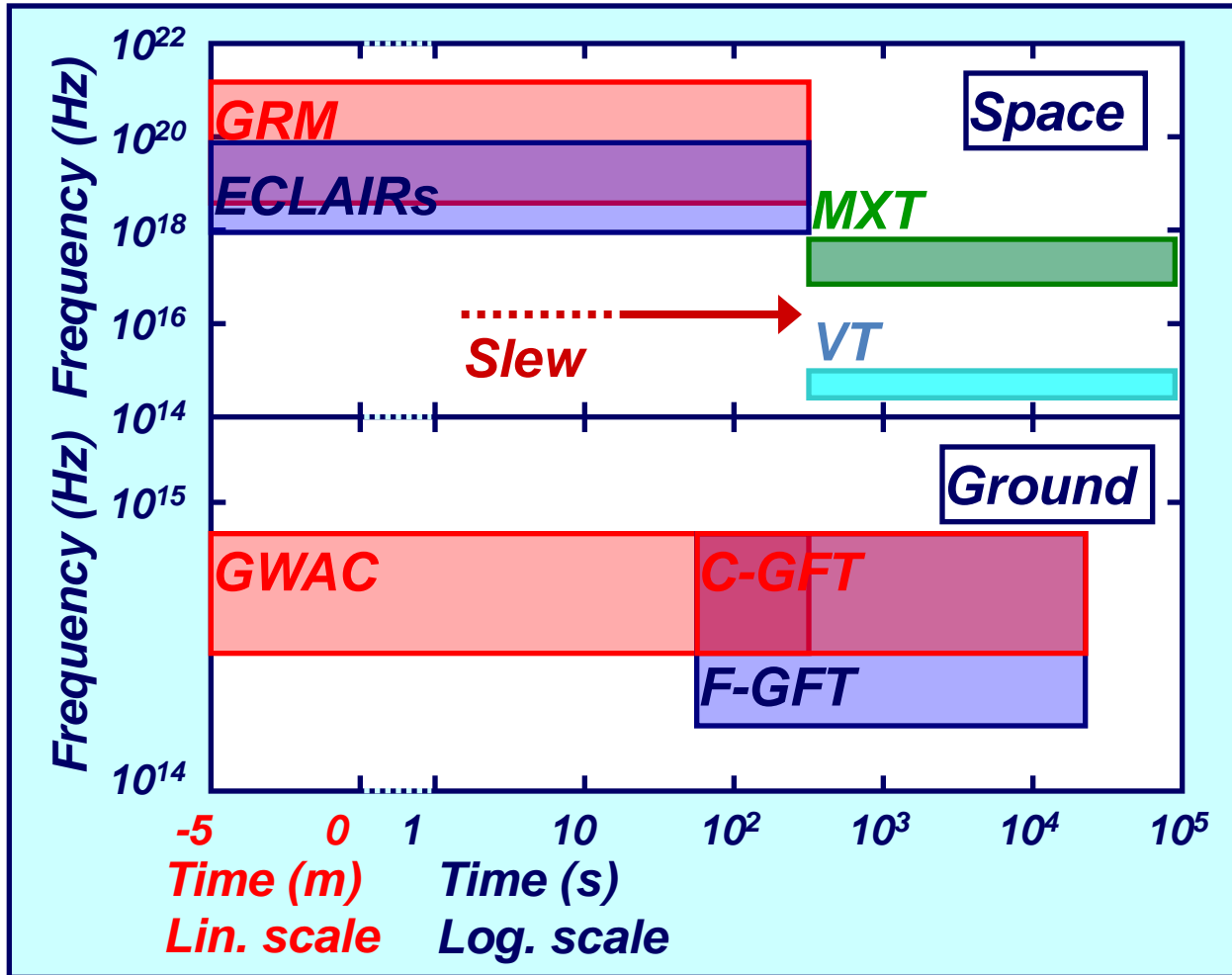
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2019 Nanjing GRB Conference, May 13-17, 2019, Nanjing, China

SVOM



SVOM potential



SVOM ~ Swift + Fermi/GBM



Afterglow machine



Prompt emission machine

SVOM ~ Swift + Fermi/GBM

ECLAIRS ~ Swift/BAT

MXT \lesssim Swift/XRT

VT \gtrsim Swift/UVOT

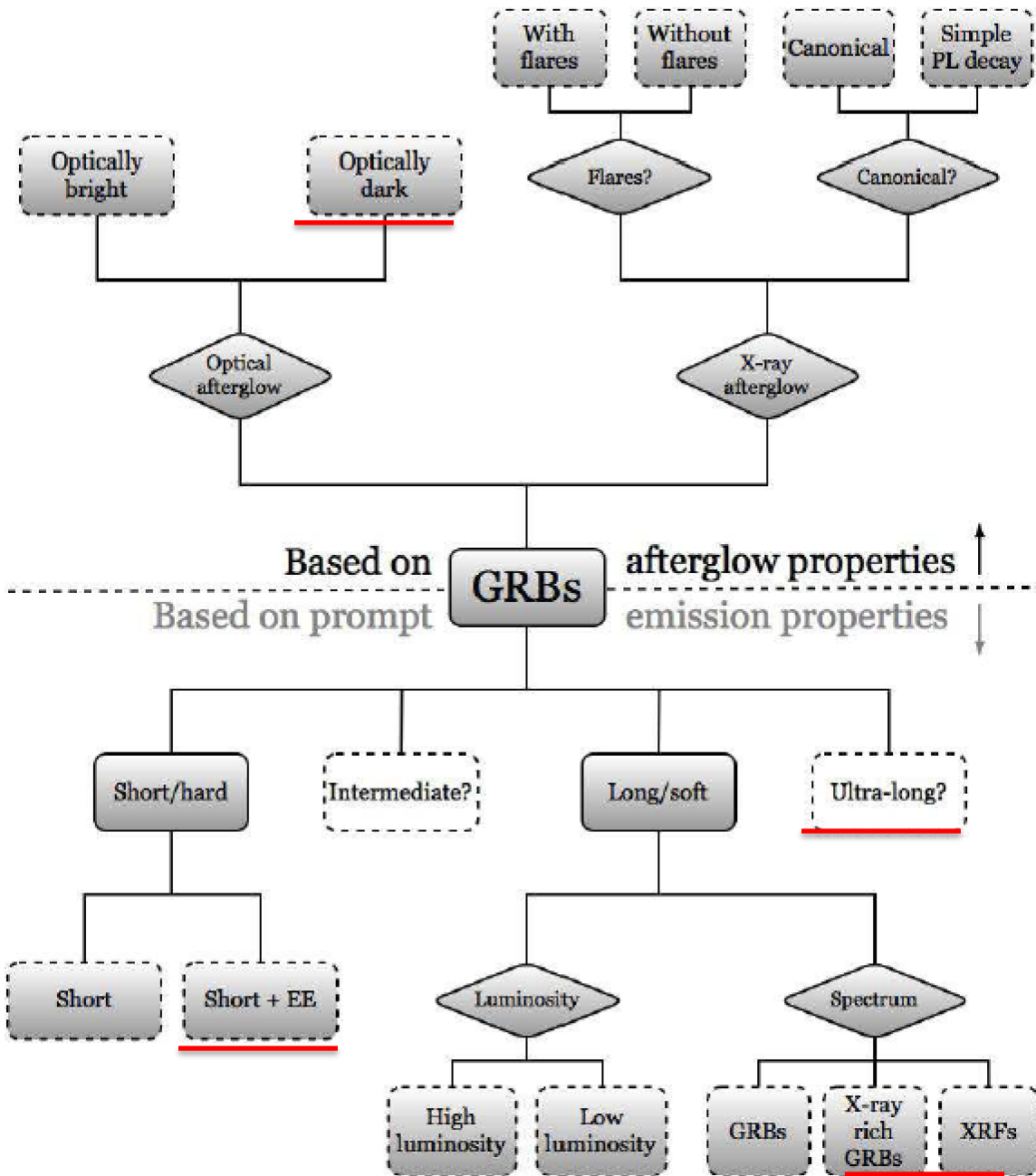
GRM \lesssim Fermi/GBM

GWAC ~ ??? (unmatched)

SVOM can well study both **afterglow** and **prompt emission** in a large sample of GRBs!

Diversity of GRBs

Phenomenological Classification Schemes



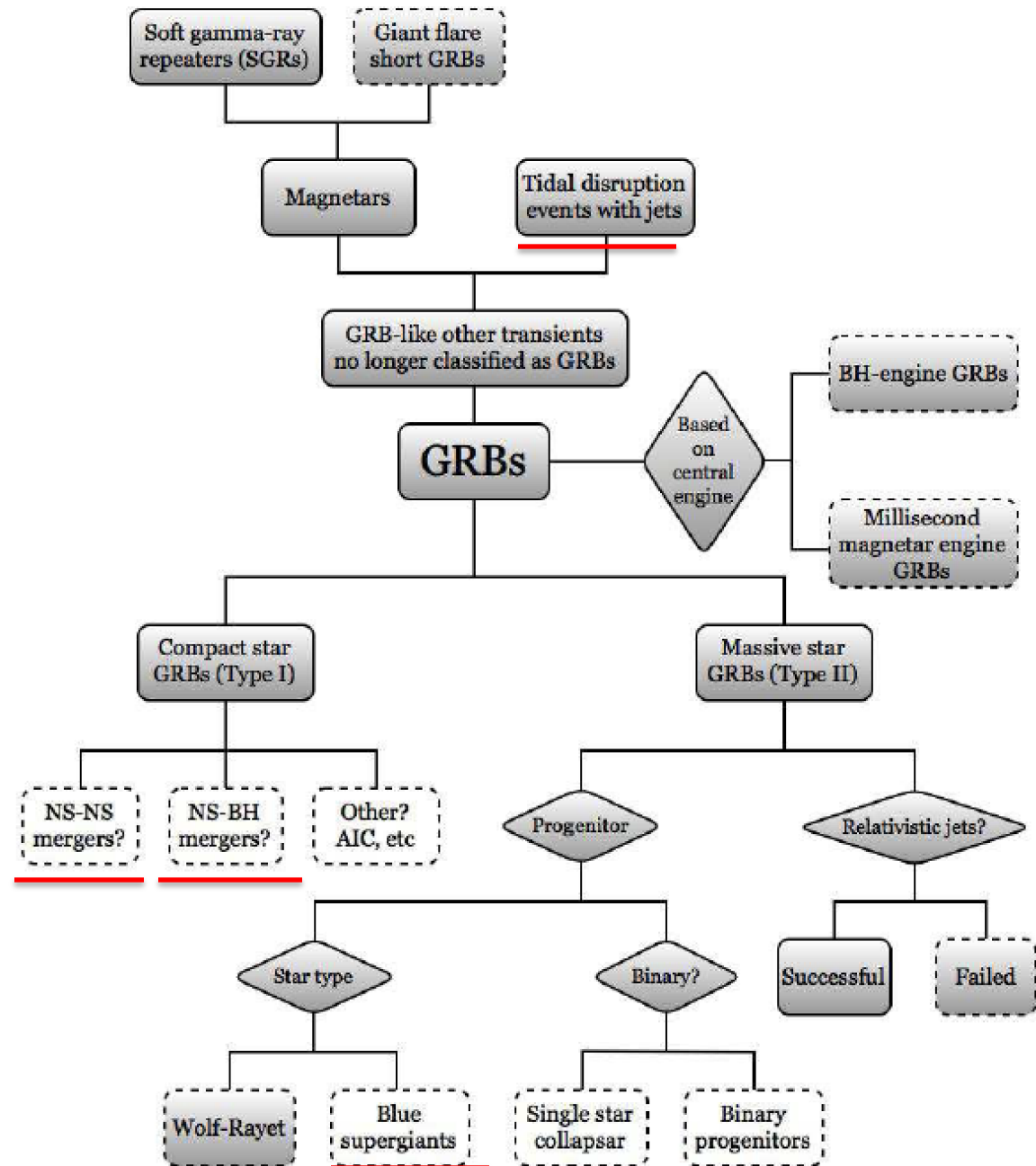
SVOM can lead to a better study of GRBs of all phenomenological types:

- Is there a separate “ultra-long” population?
- Trigger short GRBs with both hard spike (GRM) and extended emission (ECLAIRS)
- Accumulate more nearby low-luminosity GRBs with SN associations
- Better study of X-ray flashes and X-ray rich GRBs
- Better understanding of optically dark GRBs (VT)

Physical Classification Schemes

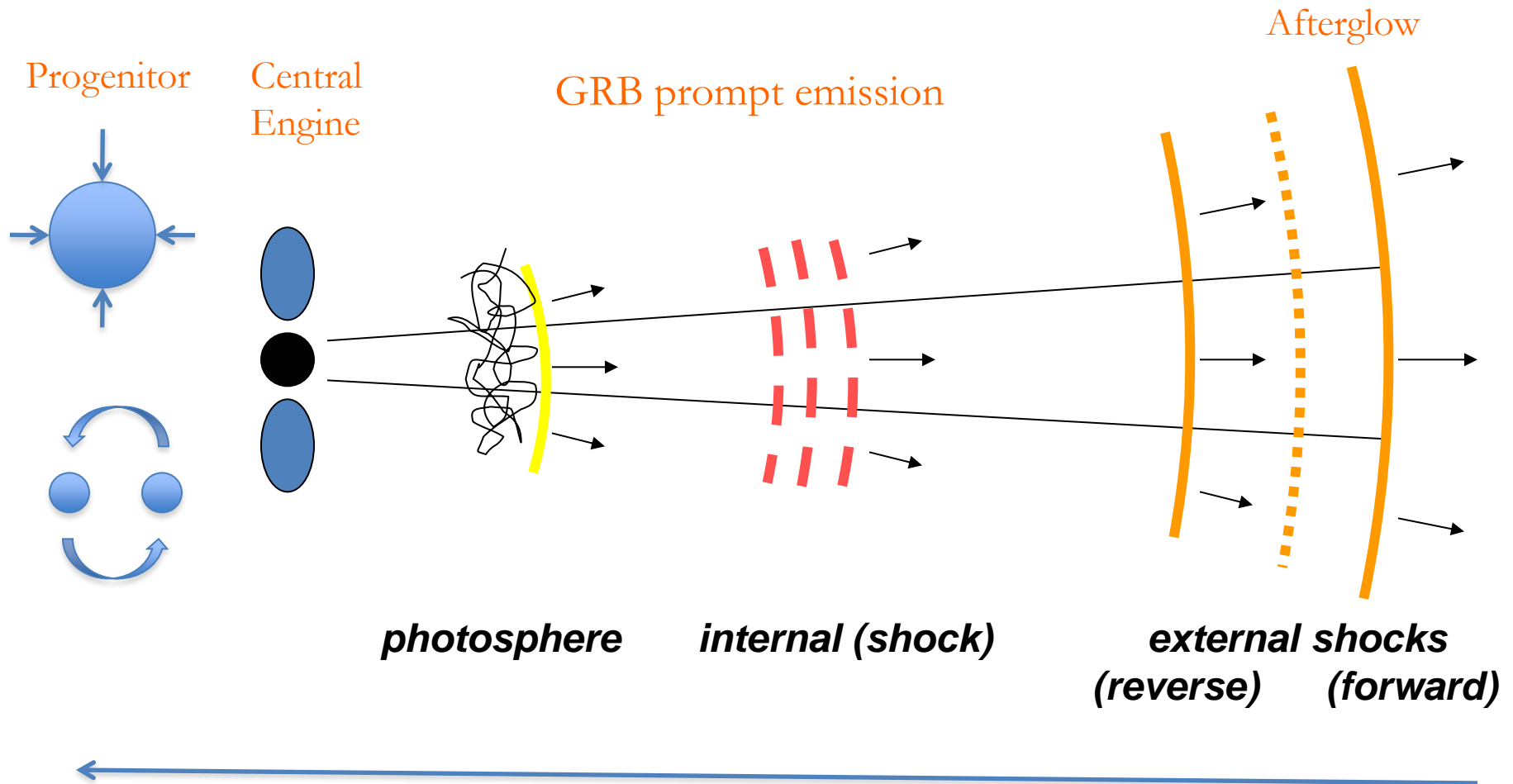
SVOM can help to understand the physical categories of GRBs:

- Can blue-supergiants make GRBs ?
- Can both NS-NS mergers and BH-NS mergers make short GRBs?
- Do some NS-NS mergers make long soft gamma-ray (X-ray) bursts?
- How common are TDE jets?
- Do pop III stars make GRBs?

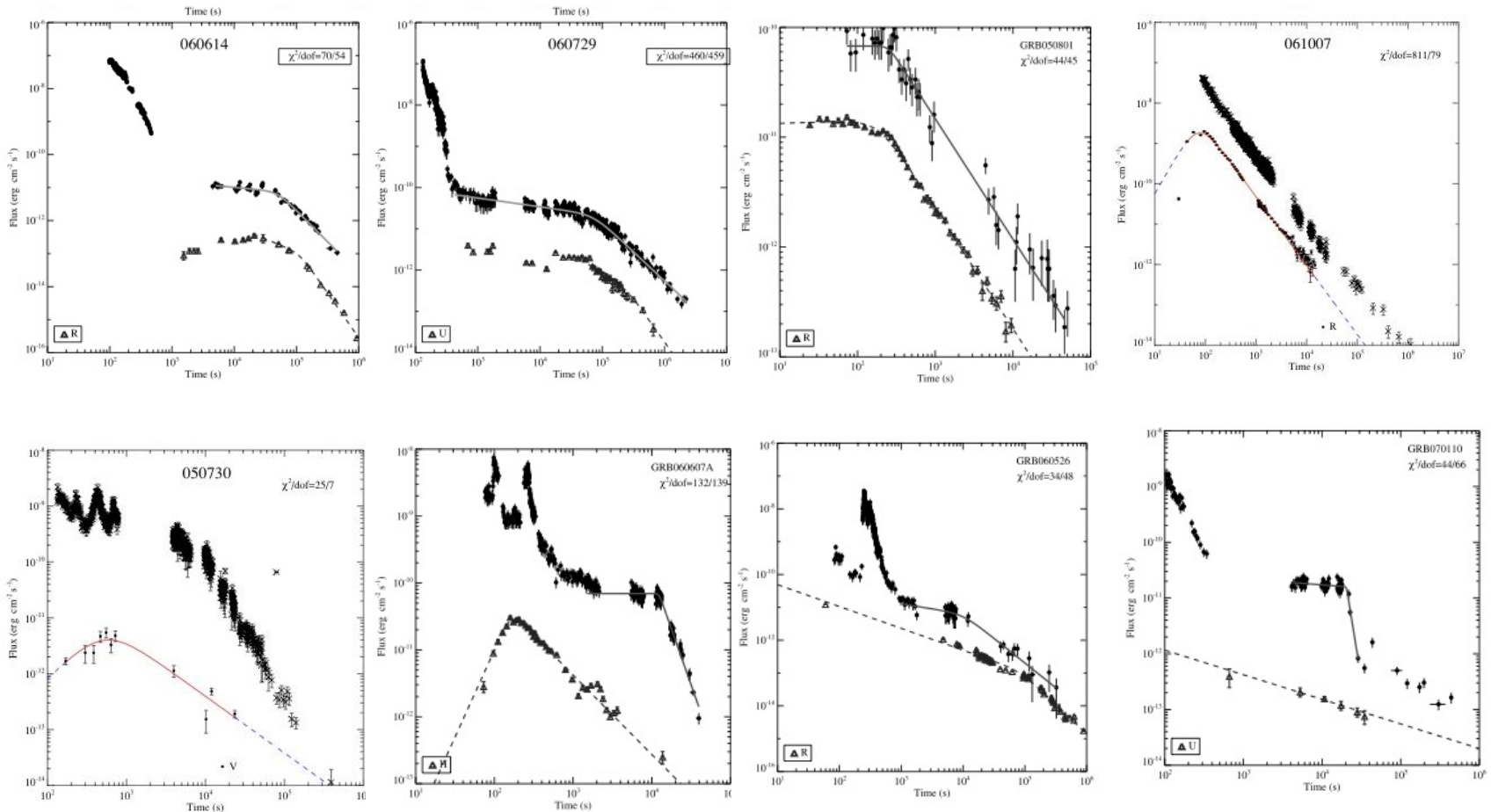


GRB physics

Physical Picture: A Sketch



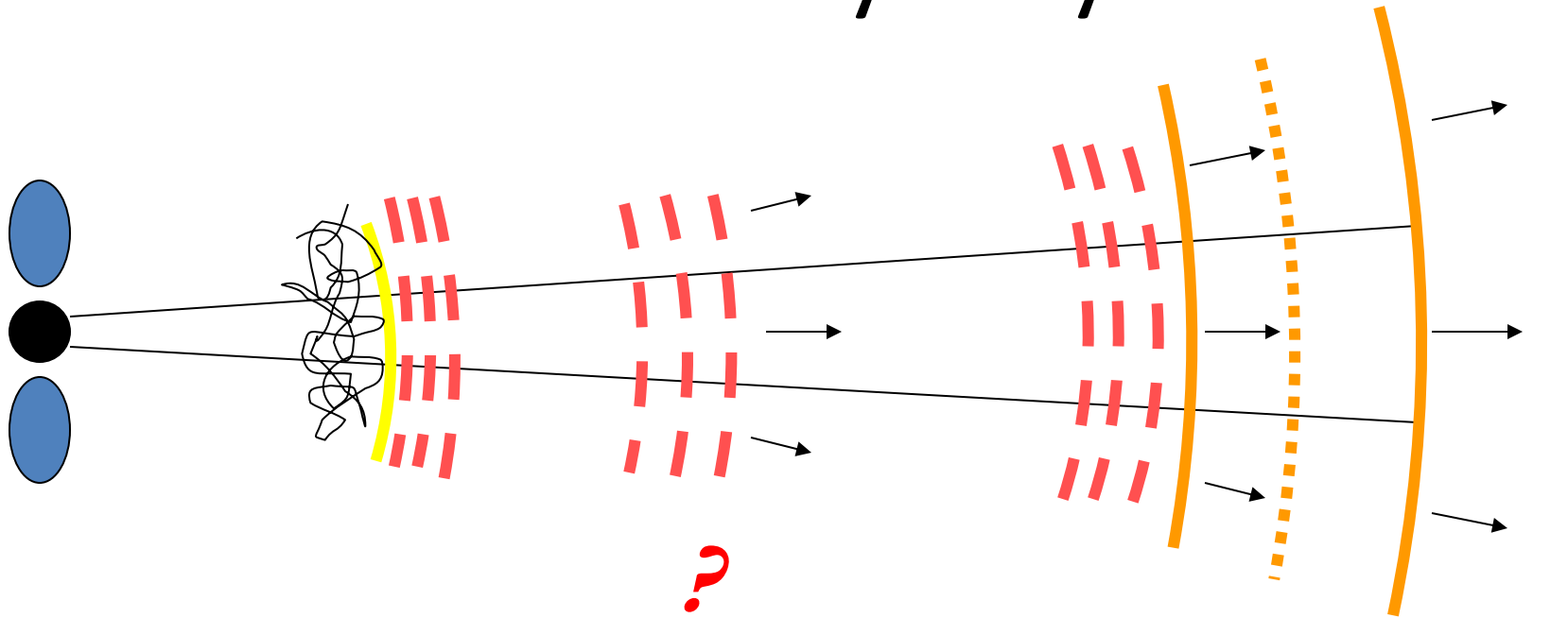
Big picture from Swift observations: achromatic vs. chromatic multi-wavelength lightcurves



O'Brien et al. 2006; Liang et al. 2007, 2008, 2009; Evans et al. 2009

SVOM will provide a large, uniform sample of multi-wavelength GRB afterglows

Prompt GRB Emission: Still a Mystery



**central
engine**

photosphere

internal

**external shocks
(reverse) (forward)**

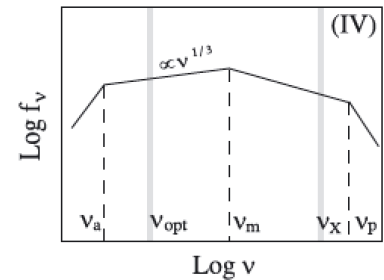
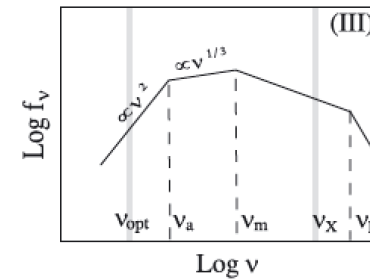
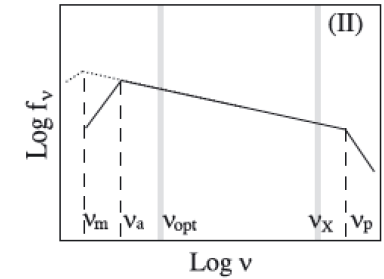
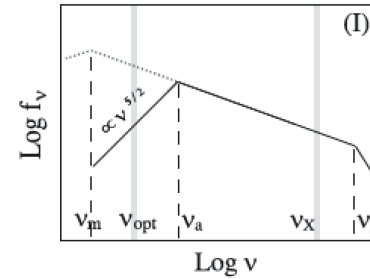
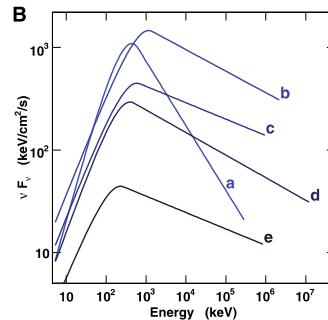
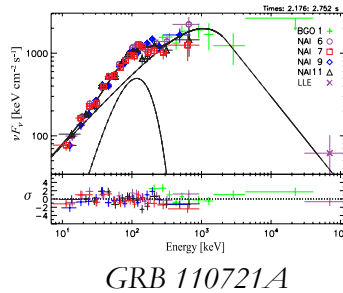
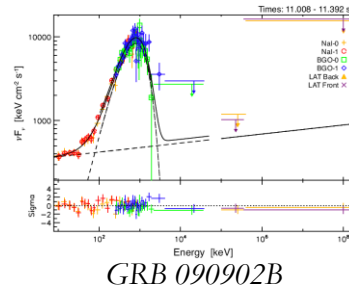
What is the jet composition (baryonic vs. Poynting flux)?

Where is (are) the dissipation radius (radii)?

How is the radiation generated (synchrotron, Compton scattering, thermal)?

Big Picture from Fermi observations: GRB jet composition

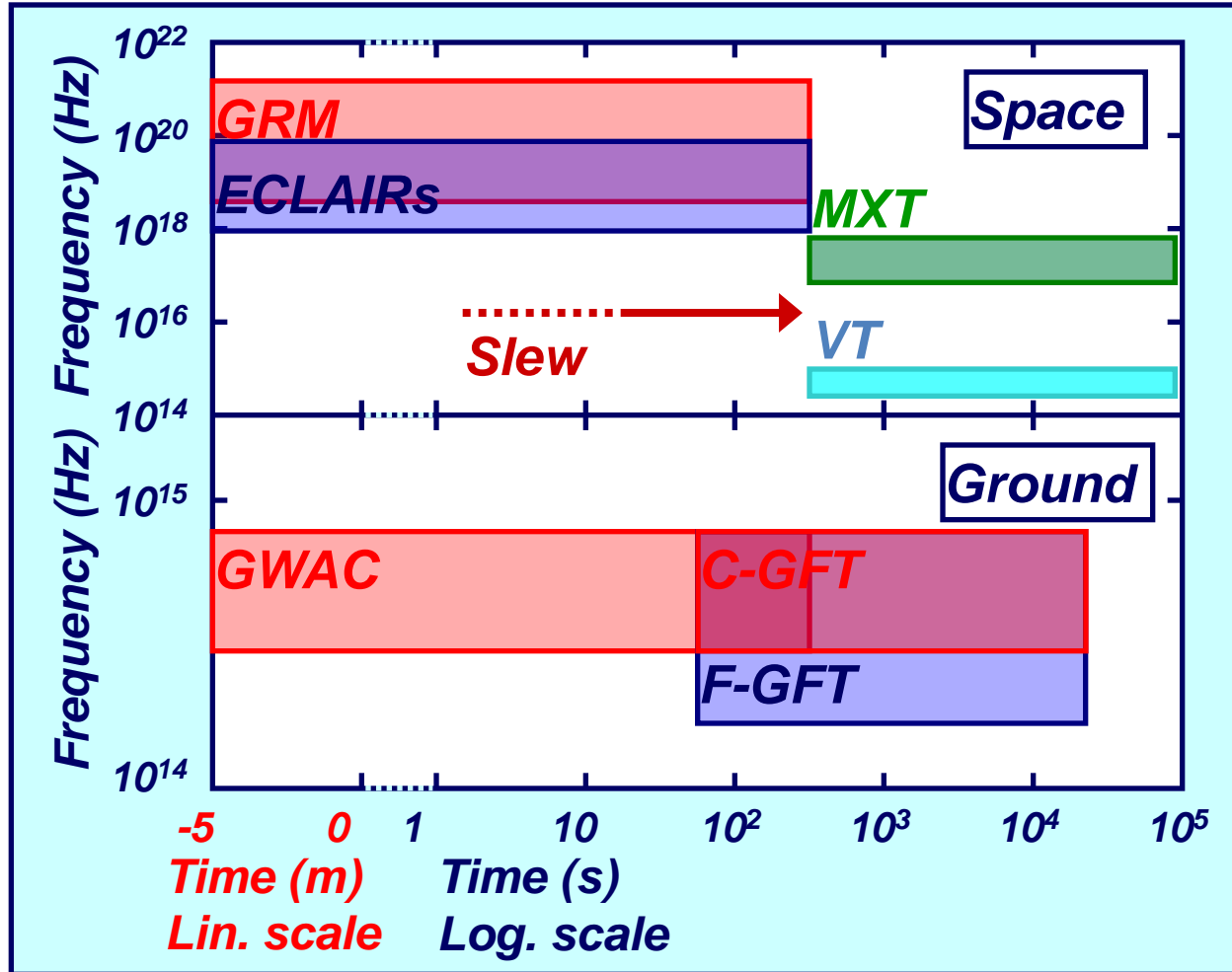
- GRB jets have diverse compositions:
 - Photosphere dominated (GRB 090902B), rare
 - Intermediate bursts (weak but not fully suppressed photosphere, GRB 100724B, GRB 110721A ...)
 - Photosphere suppressed, Poynting flux dominated (GRB 080916C)



Shen & Zhang (2009)

SVOM will provide a large, uniform sample of broad-band prompt emission spectra

SVOM potential



SVOM will cover 6 decades in energy (1-1e6 eV) during the prompt phase and cover pre-trigger phase as well: prior emission??

GRB cosmography

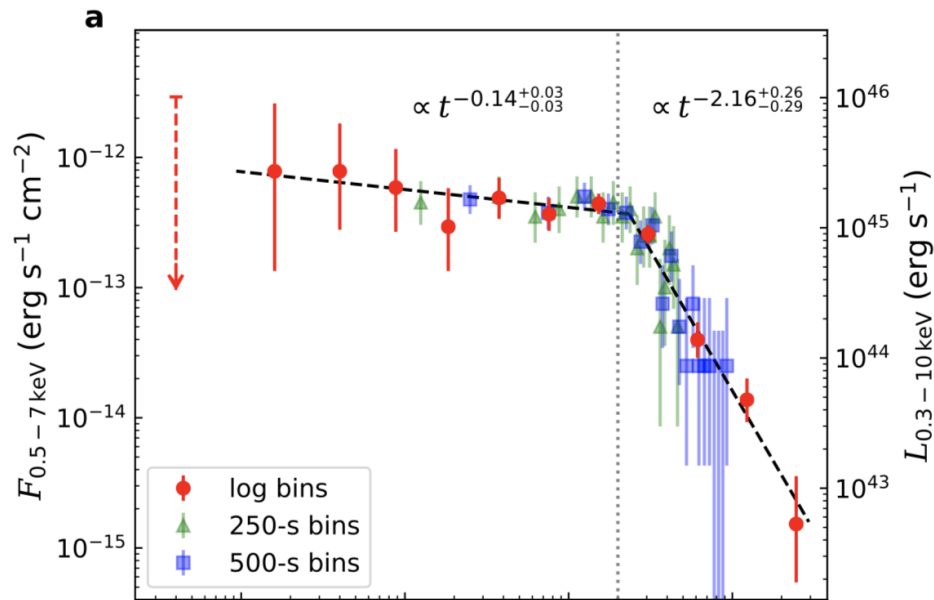
- Are GRBs standard candles?
 - Amati, Ghirlanda, Yonetoku, Liang-Zhang ...
- Parameters need to be measured:
 - $E_{\text{iso}}, L_{\text{iso}}$: measured by combining ECLAIRS/GRM/VT/GFTs
 - E_p : measured by ECLAIRS+GRM
 - t_b (in X-rays & optical): measured by MXT, VT, GFTs

SVOM will provide a uniform, large sample of GRBs with desired parameters to further test the prospects of GRB cosmography

Multi-messenger aspect

Frederic Daigne's talk

NS-NS merger product: BH vs. magnetar



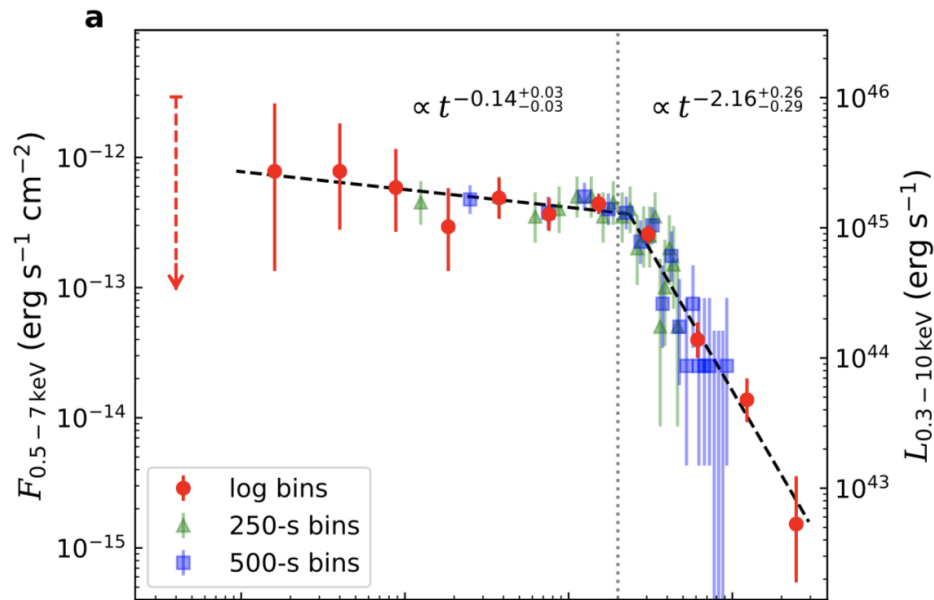
Xue et al. (2019)

SVOM may have the opportunity to detect GW-associated early X-ray/soft gamma-ray emission

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Summary

- SVOM will detect all **phenomenological** types of GRBs and potentially identify new **physical** types of GRBs.
- SVOM will further advance our understanding of GRB **physics** in a systematic manner.
- SVOM will play an important role in **multi-messenger** astrophysics
- As history repeatedly suggested, SVOM will have the potential to make **unpredicted** new discoveries