



Swift Gamma Ray Bursts

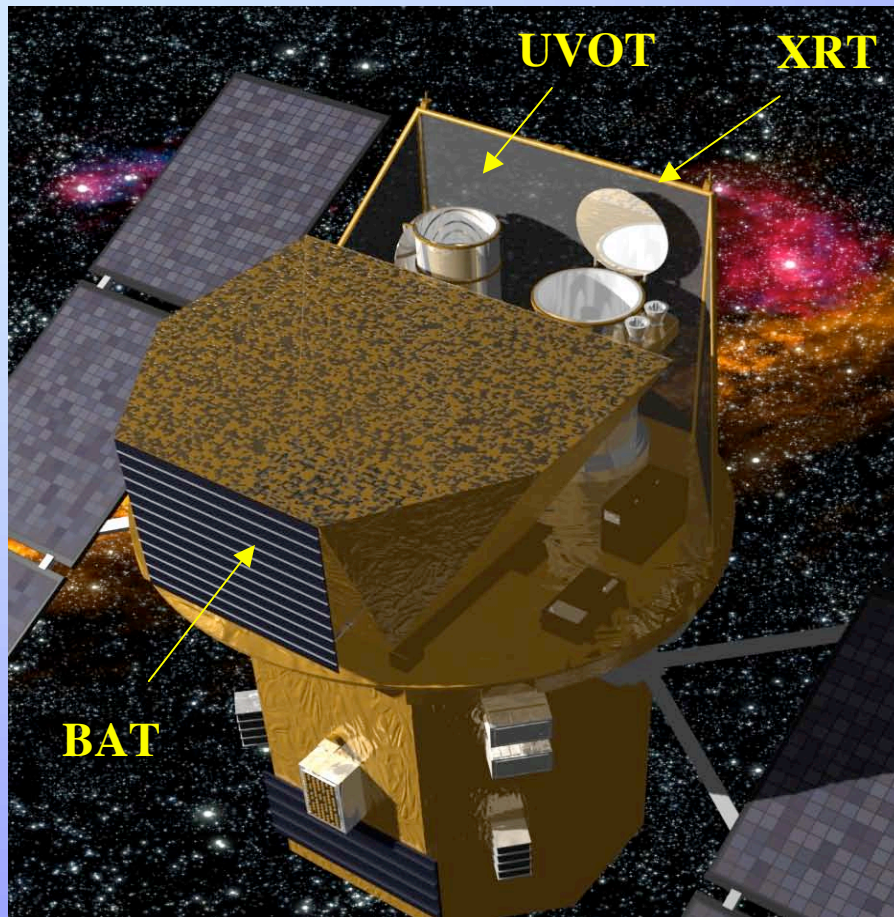
Neil Gehrels

NASA-GSFC

July 10, 2009

David Band Symposium

Swift Mission



3 instruments, each with:

- lightcurves
- images
- spectra

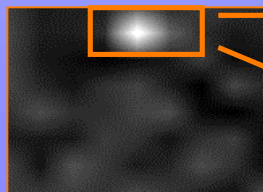
Rapid slewing spacecraft

Rapid telemetry to ground

100 GRBs per year

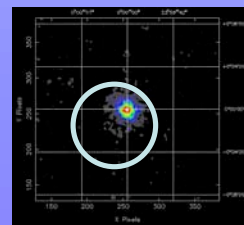


BAT Position - 2 arcmin



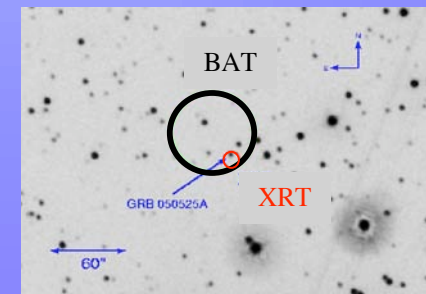
T < 10 sec

XRT Position - 5 arcsec



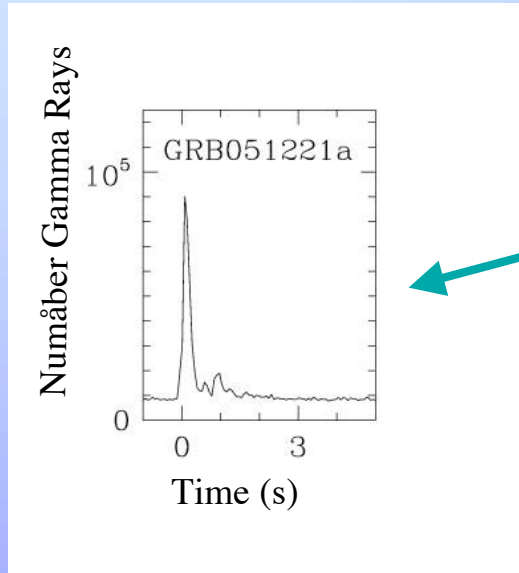
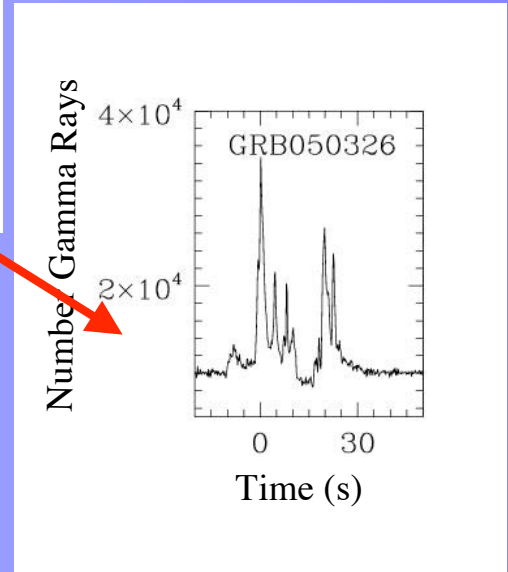
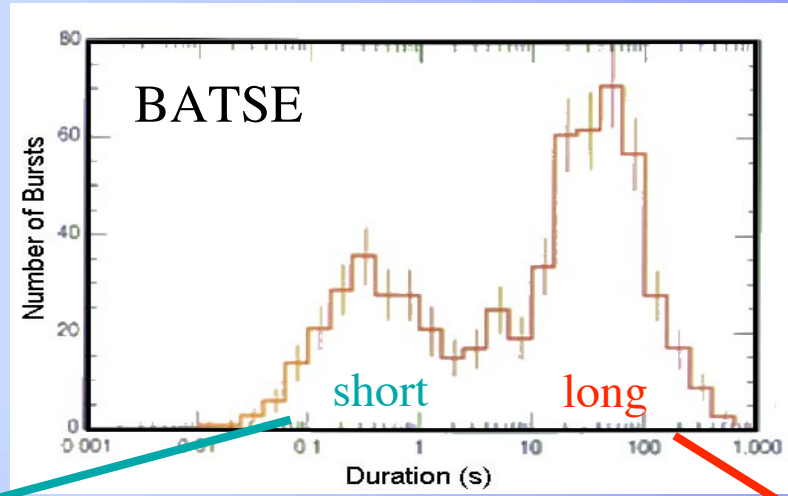
T < 90 sec

UVOT Position - < 1 arcsec

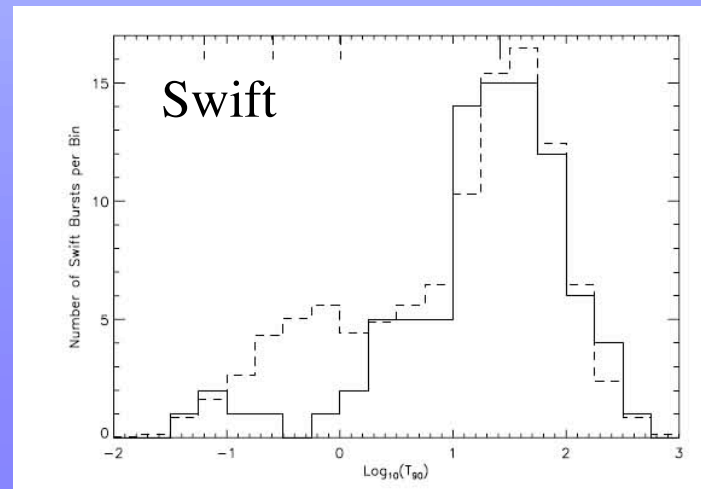


T < 2 min

Kouveliotou et al.
2003

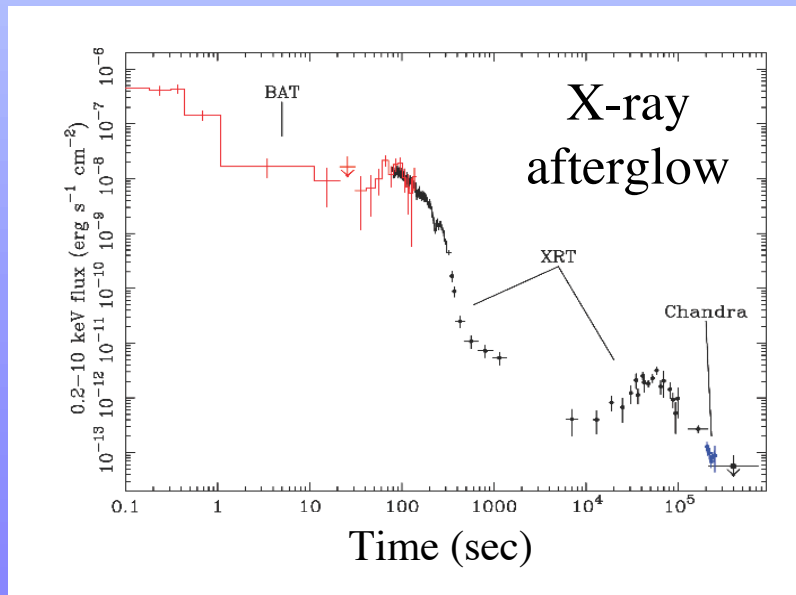
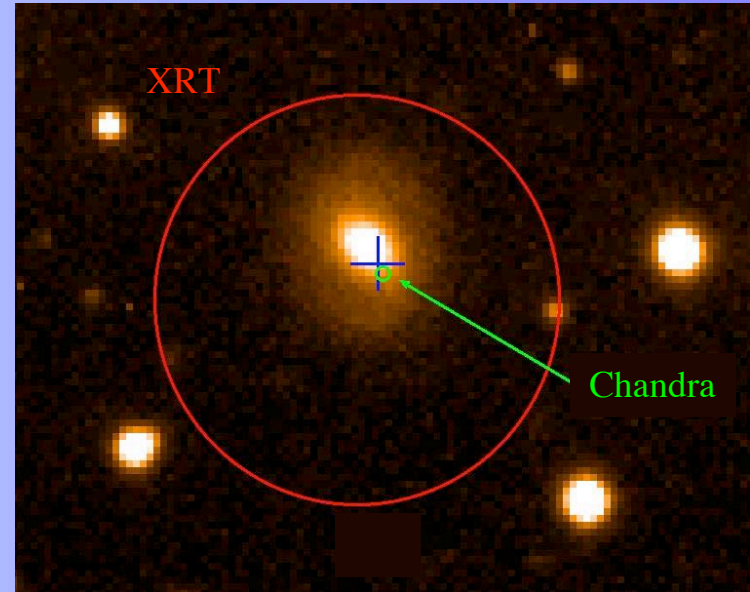
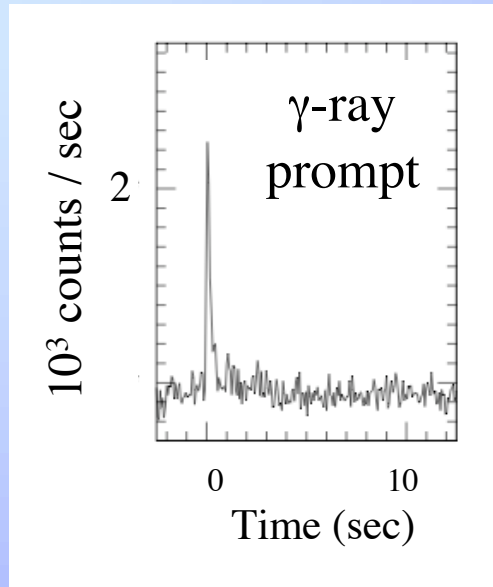


Short VS Long



Band 2006

GRB 050724



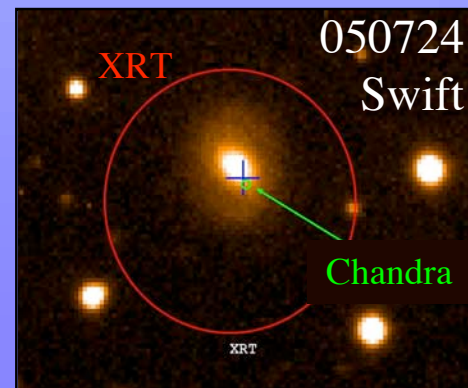
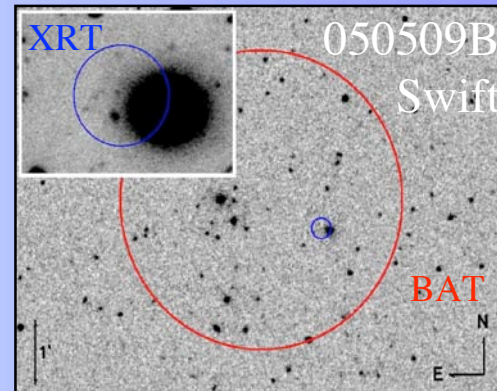
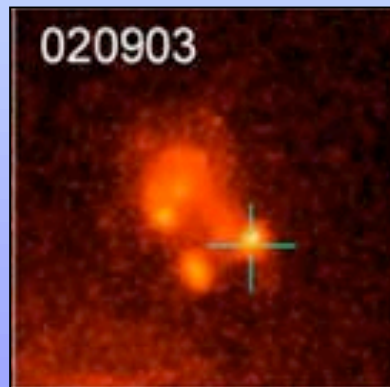
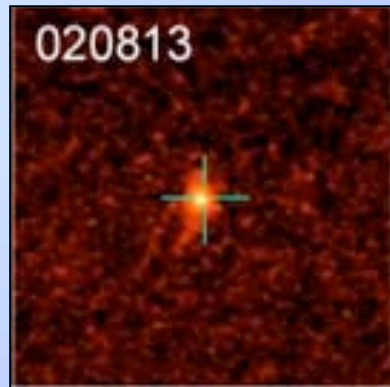
Host:

- Elliptical
- $z = 0.258$
- no coincident supernova
- $\text{SFR} < 0.02 M_{\odot} \text{yr}^{-1}$

Long GRBs

Short GRBs

star forming
irregulars

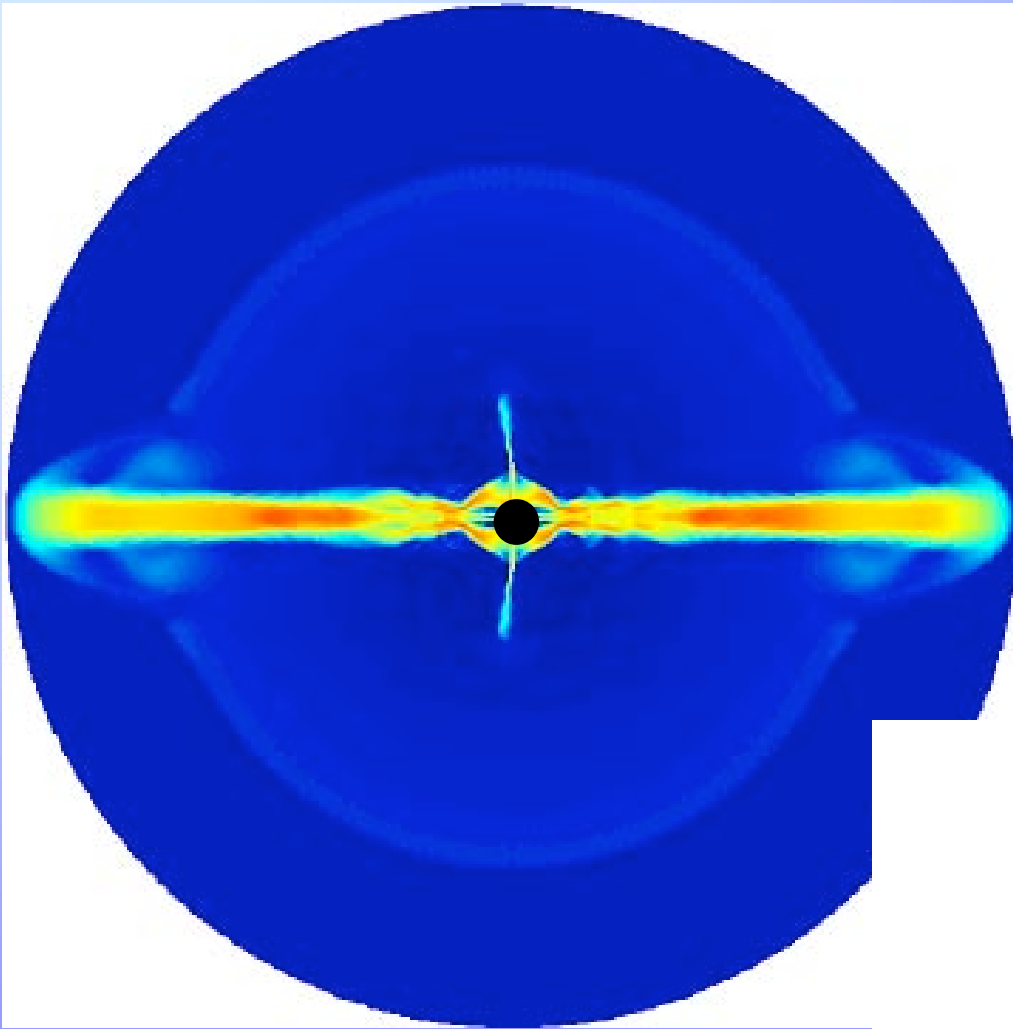


$z = 0.225$
cD elliptical
 $\text{SFR} < 0.2 M_{\odot} \text{ yr}^{-1}$

$z = 0.161$
star forming galaxy
with offset

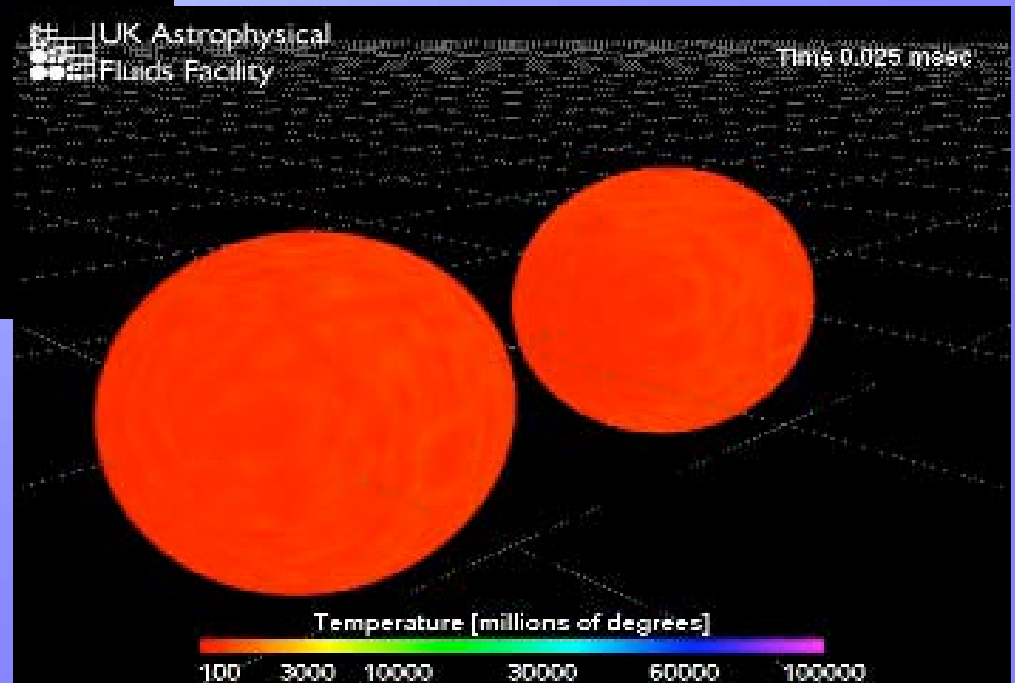
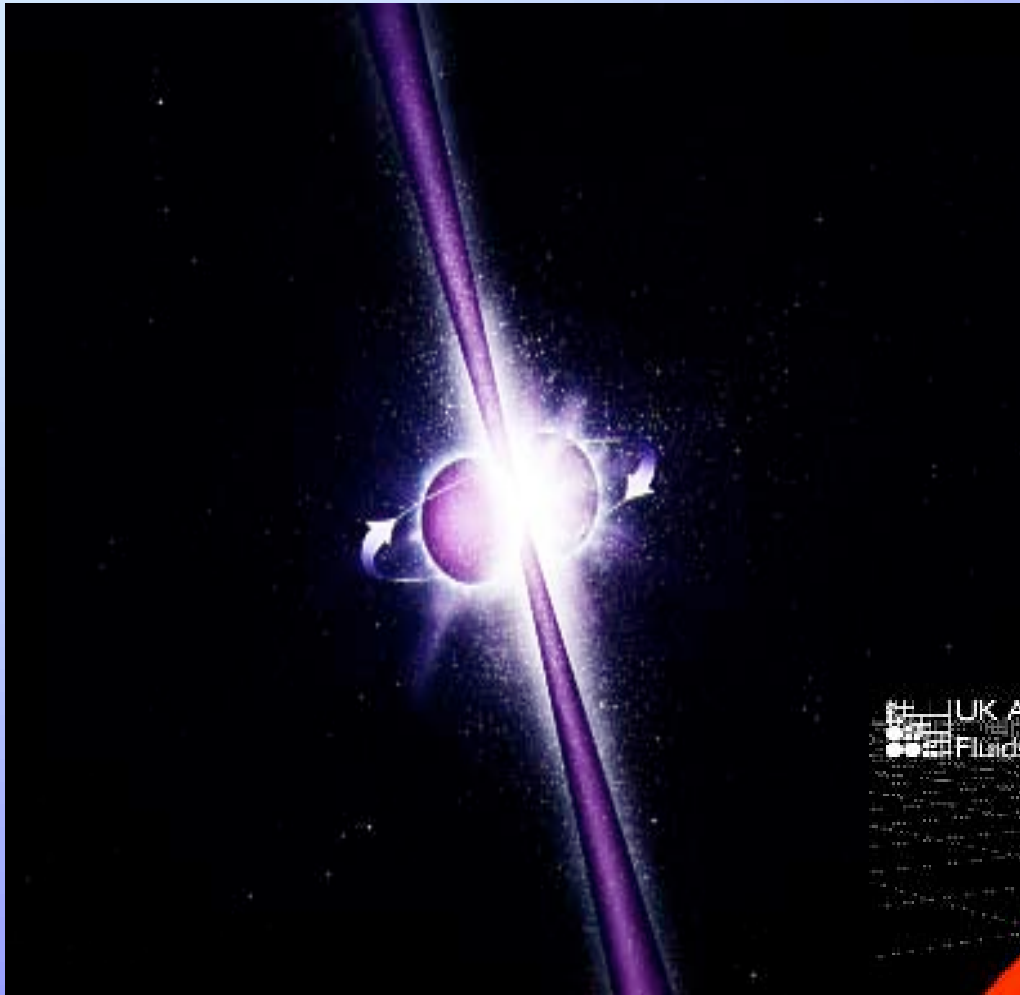
$z = 0.258$
elliptical
 $\text{SFR} < 0.02 M_{\odot} \text{ yr}^{-1}$

Long GRBs Collapsar Model



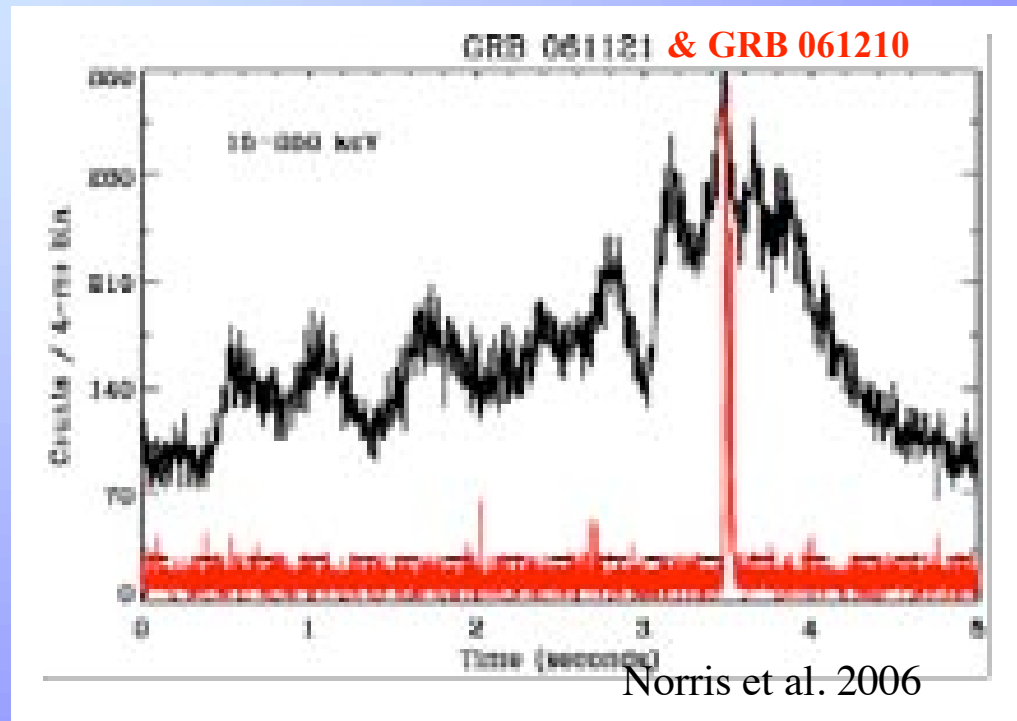
Barkov & Komissarov

Short GRBs Merger Model



Roswog et al.

Variability Comparing Short & Long

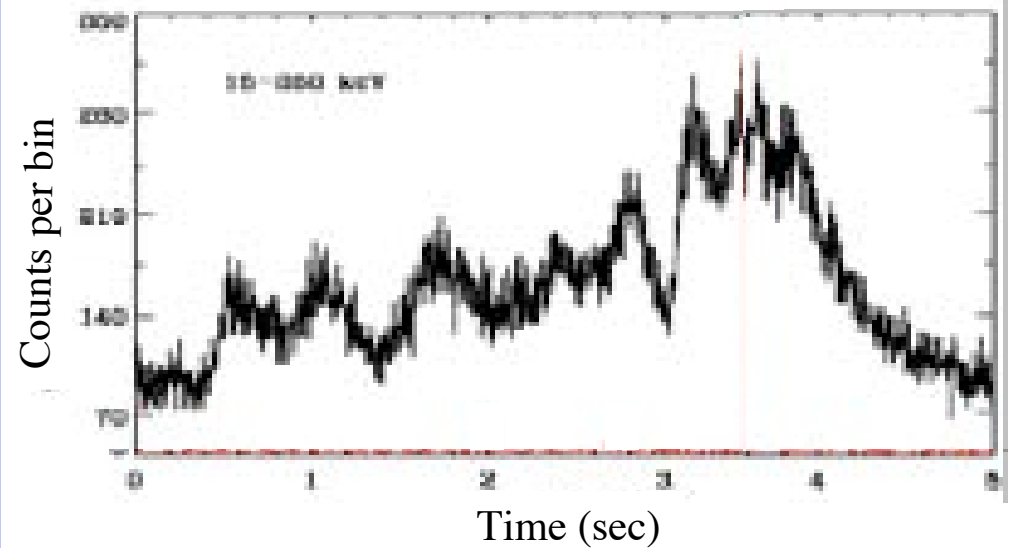


GRB 061121 = brightest long GRB
GRB 061210 = brightest short GRB

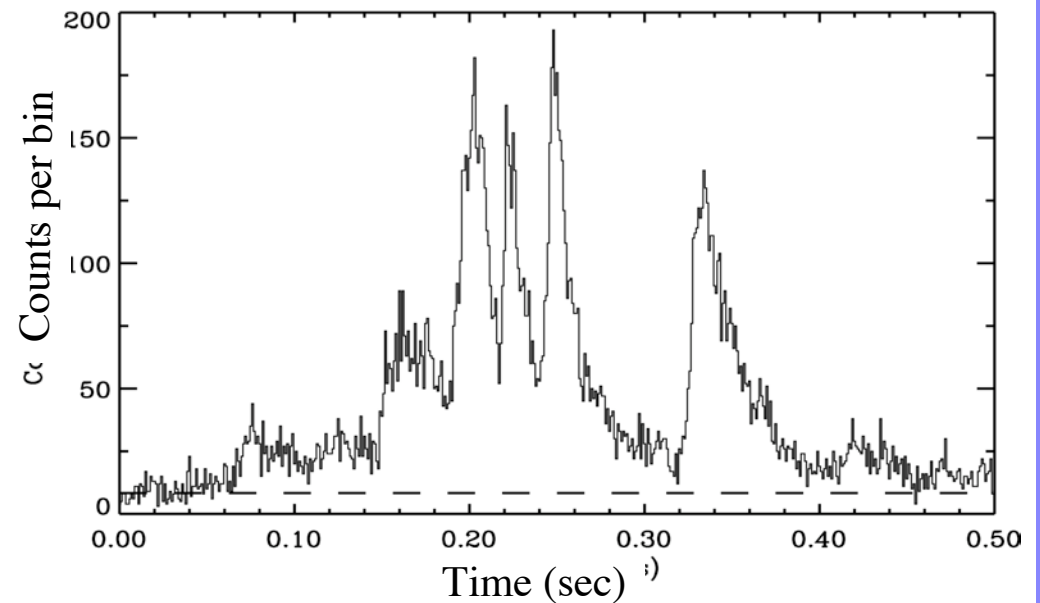
Variability

Short & long burst
both have highly variable
prompt emission

GRB 061121 - Long

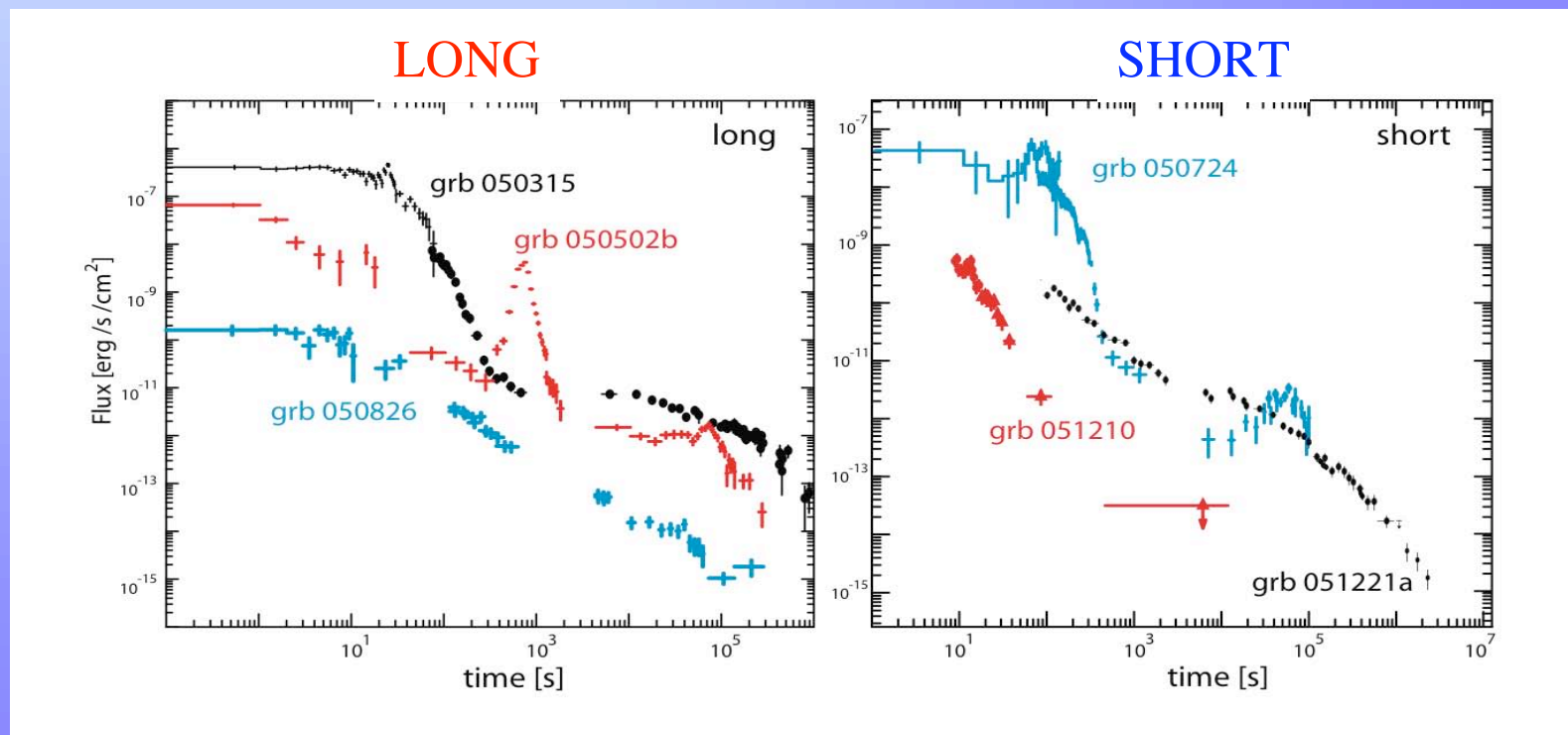


GRB 051221A - Short



X-ray Afterglows

- There are various types of light curves for both long and short
- X-ray afterglow is weaker on average for shorts but light curves are generally similar

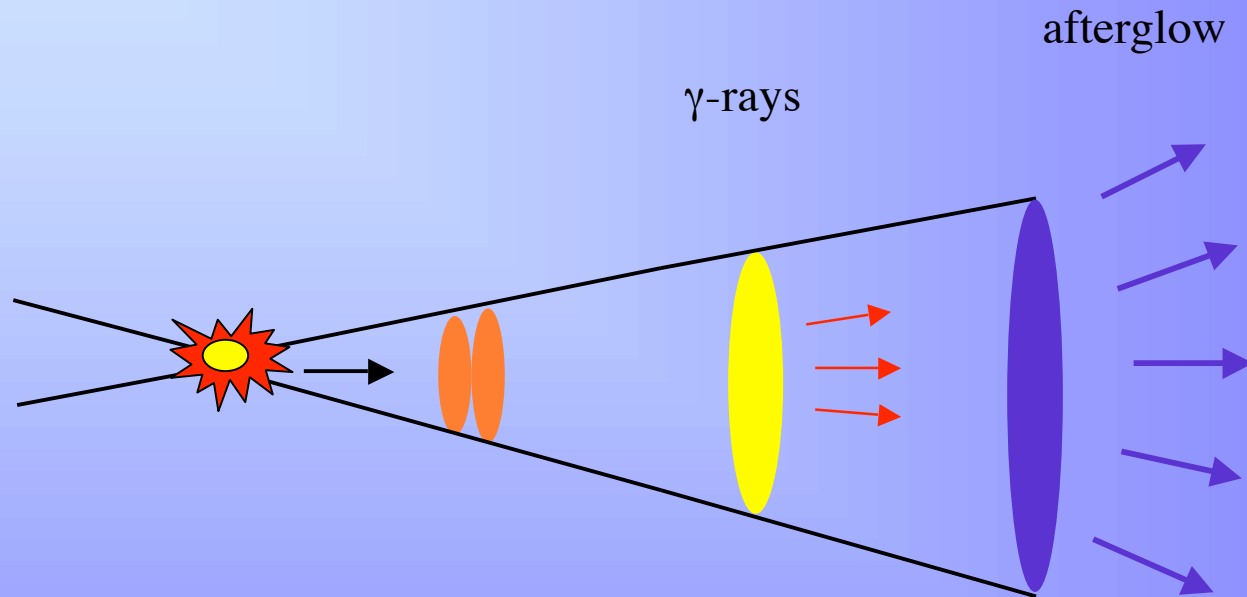


Gehrels, Ramirez-Ruiz & Fox, ARAA 2009

based on Sakamoto 2008

Fireball Model

(Meszaros & Rees 1997)

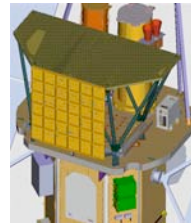
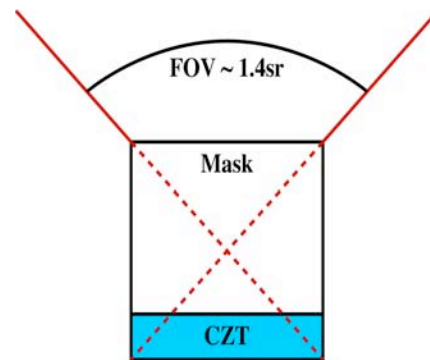


Conclusion: Given their very different origins, the observed characteristics of short & long bursts are remarkably similar.

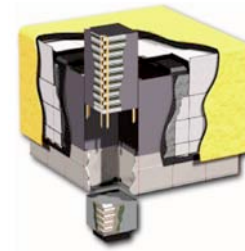
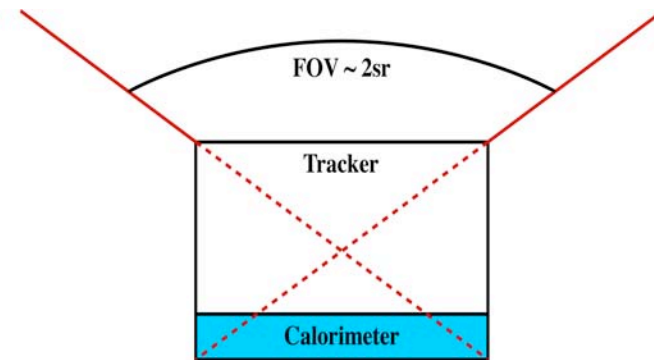
David's Idea: Fermi & Swift Working Together



Swift/BAT



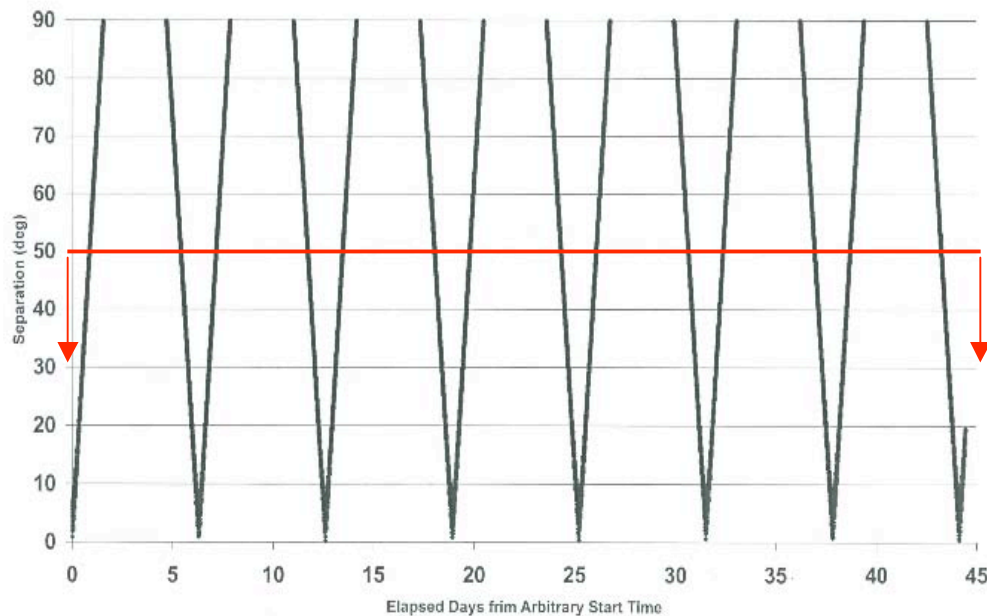
Fermi/LAT



David's Calculation of Pointing Overlap

BAT - LAT Joint Pointing

Orbit Assumption: Swift = $21^\circ \times 600 \text{ km}$
GLAST = $28^\circ \times 550 \text{ km}$



David's Conclusions



Summary

- **GLAST will operate in survey mode. Swift points at 5-6 different targets each orbit. Therefore, overlap will be optimized through Swift scheduling.**
- **Choosing to point Swift at/near the LAT FOV can increase the overlap by >3x! Operating constraints and Swift's other science objectives will reduce the actual overlap.**
- **Because of the large FOVs, GLAST's rocking, and Swift's pointing flexibility, the average overlap fraction is not sensitive to the relative inclination of the orbits.**
- **Therefore, we are currently developing the methodology to optimize Swift's pointing without adding a great additional burden to Swift's scheduling.**

Swift Follow-up of Fermi GRBs

