

# X-ray Eyes Above the Skies: The gamma-ray burst story

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Winter, 2019

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# $\gamma$ -ray burst

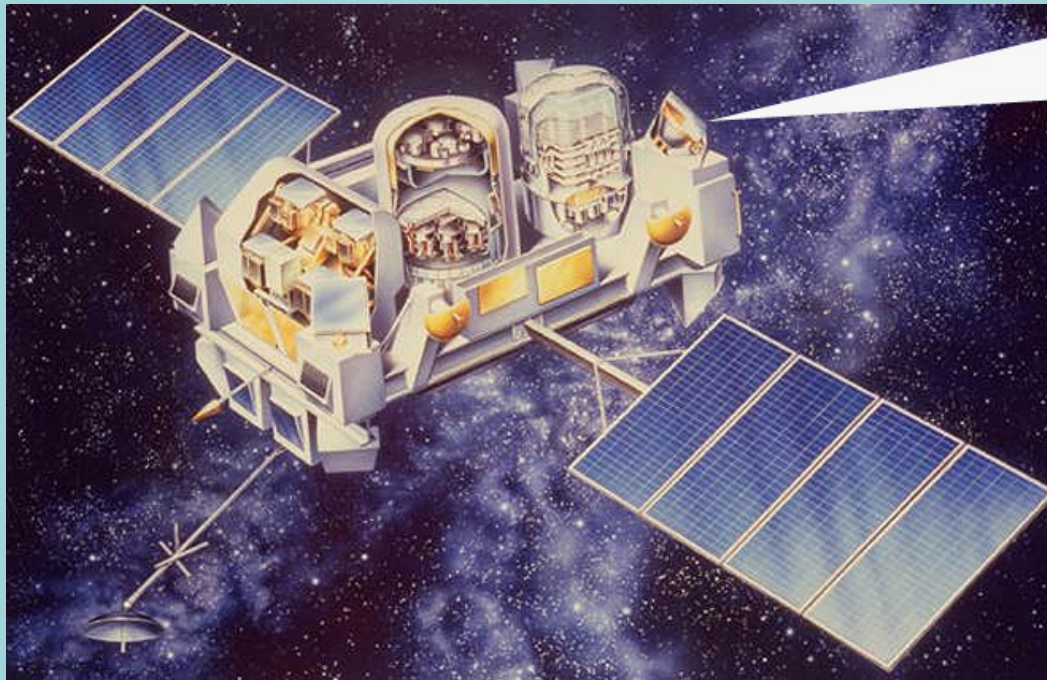
Remember the 1960s??

- U. S. Vela satellites
  - Verifying the atmospheric test ban treaty (1963)

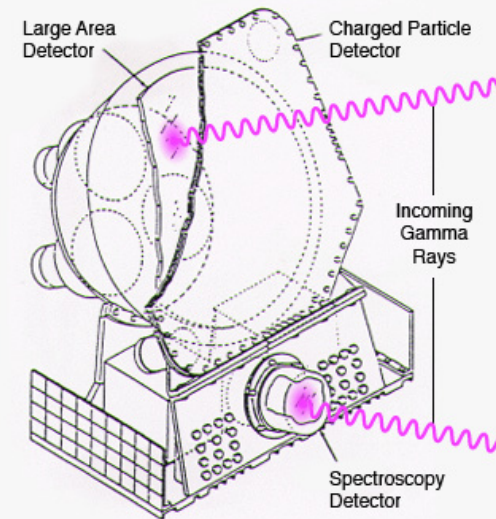
# What other eyes do we have?

- UHECR
- GAMMA RAYS finish origin of cosmic rays
- $\gamma$ -ray bursts
- x-ray astronomy
- ACE, stereo
- Parker probe
- Other
- Gravitational waves
- CALET

# BATSE: a simple idea

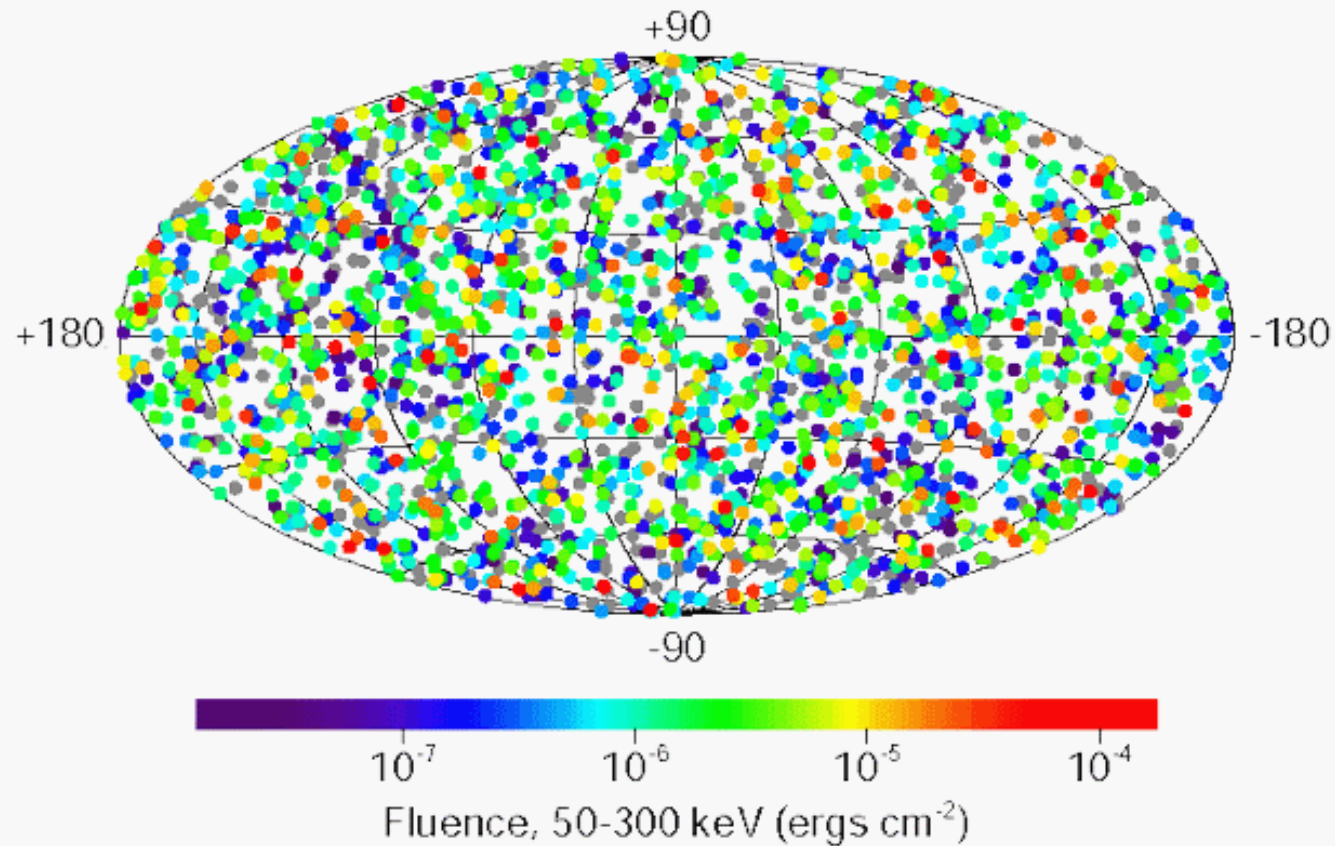


BATSE Detector Module (1 of 8)



# Isotropic

## 2704 BATSE Gamma-Ray Bursts



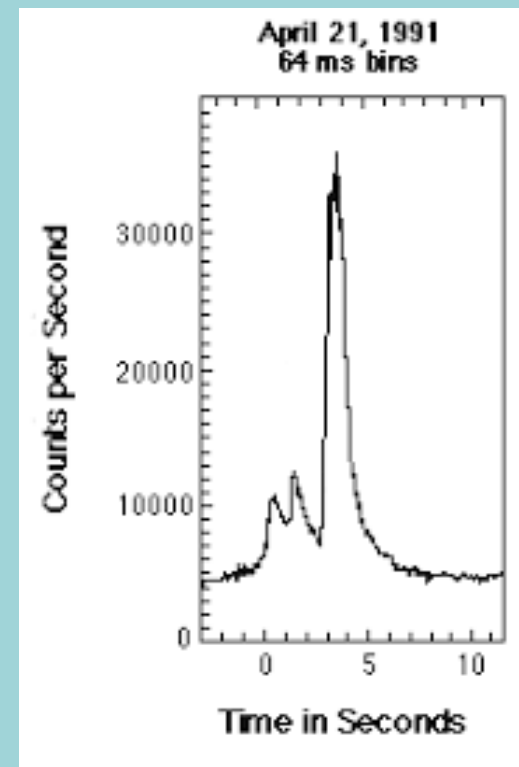
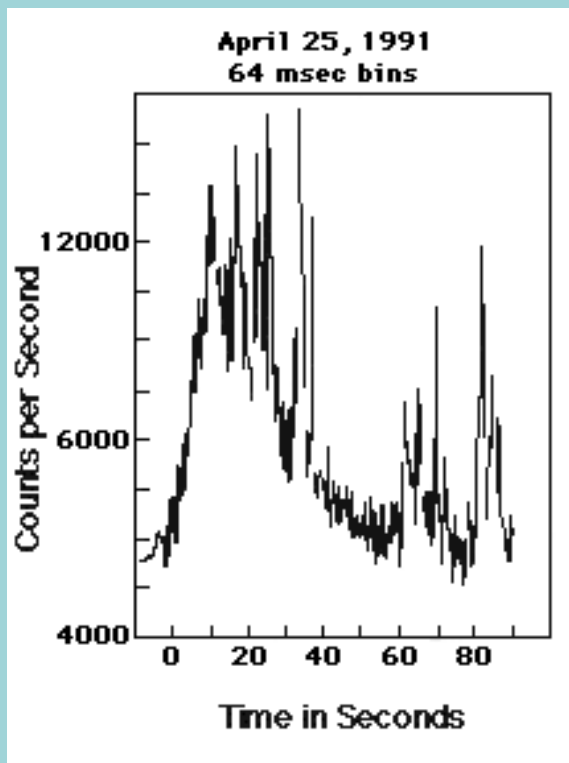
# Neil Gehrels SWIFT Observatory



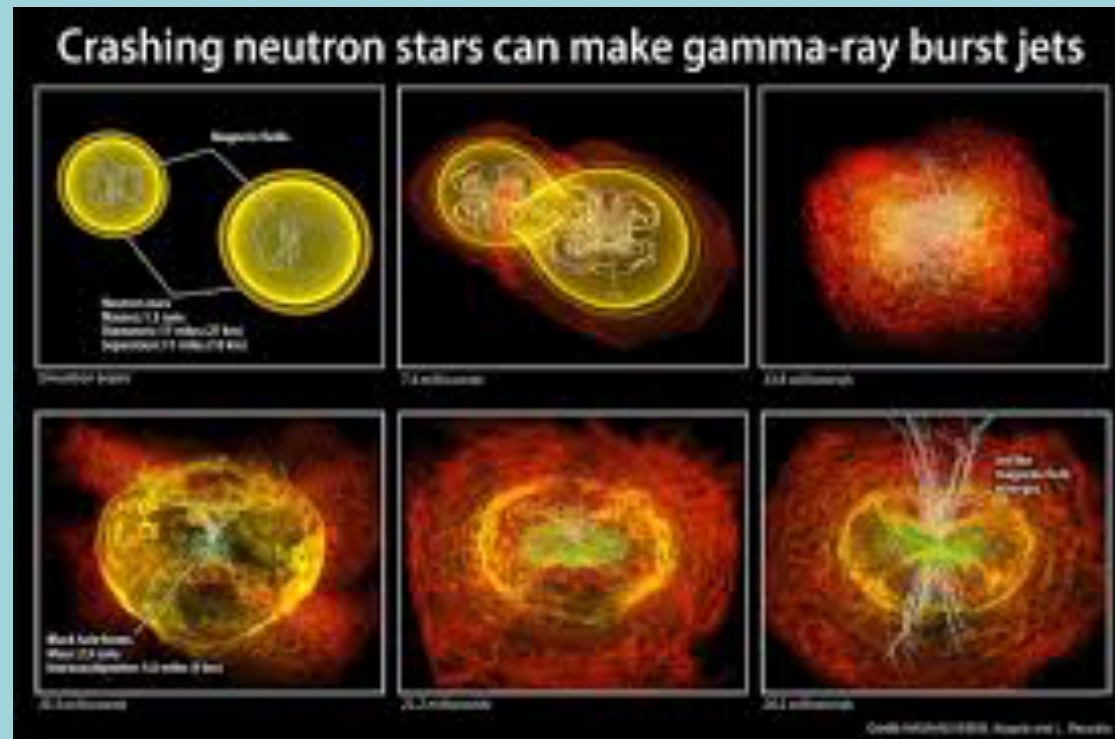
Rapid slewing to location of burst to find x-ray and optical counterparts.



# Long and short bursts

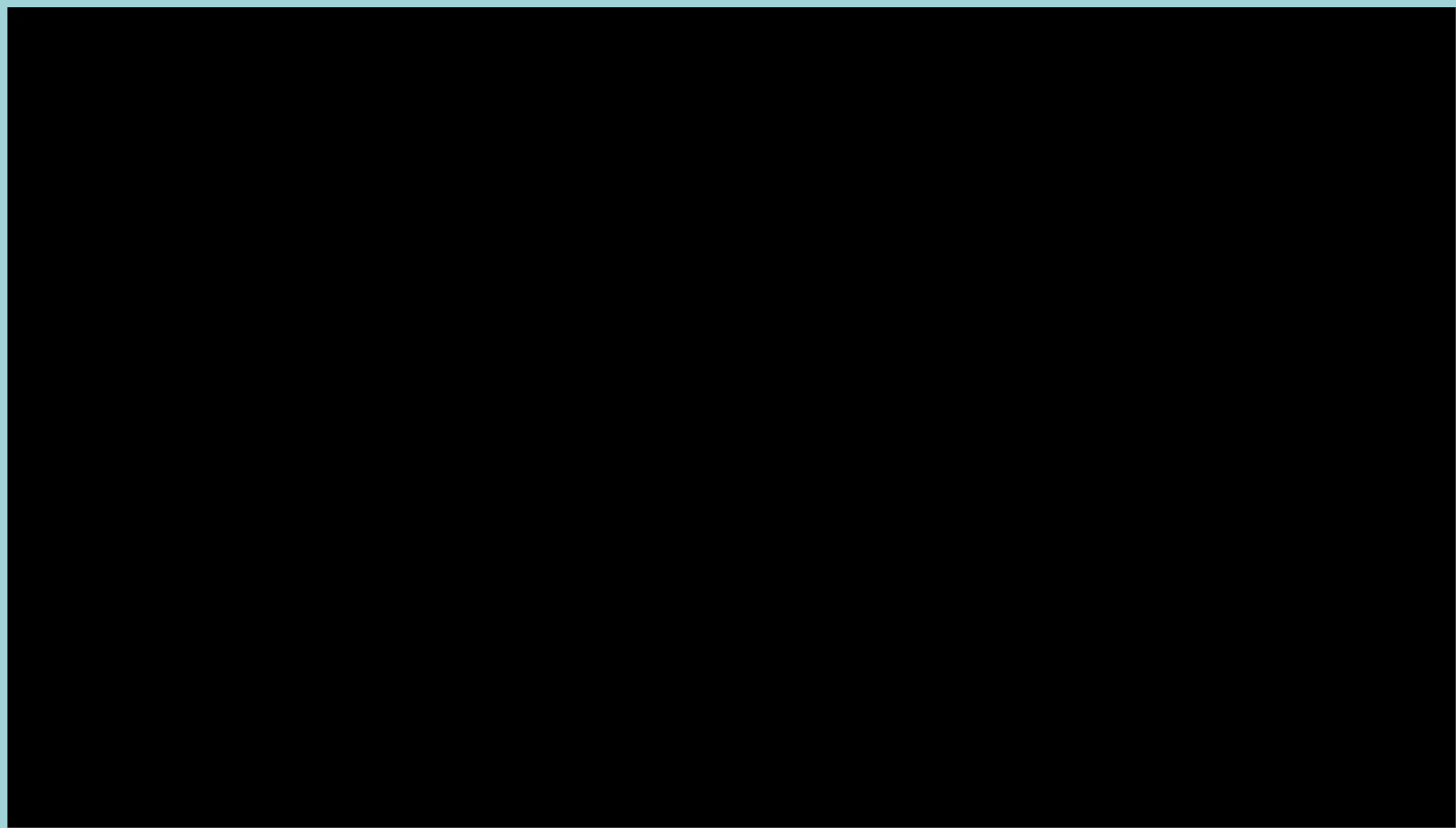


# Neutron star collisions simulated



<https://www.nasa.gov/topics/universe/features/gamma-ray-engines.html>





# $\gamma$ -ray burst history

- U. S. Vela satellites
  - Verifying the atmospheric test ban treaty (1963)
  - Became public in 1973
- Interplanetary network
  - Pinpointed the events
  - Nothing there
- Compton Gamma-ray Observatory
  - Burst and Transient Source Explorer (BATSE, 1991-2000)
  - Bursts are isotropic on sky
  - Very near or very far; not galactic
  - Bursts in two categories (short and long)
- HETE, Beppo SAX, SWIFT