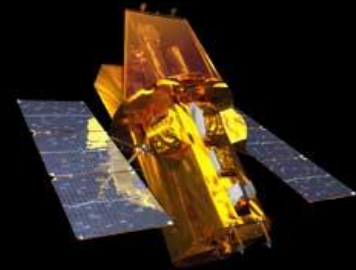


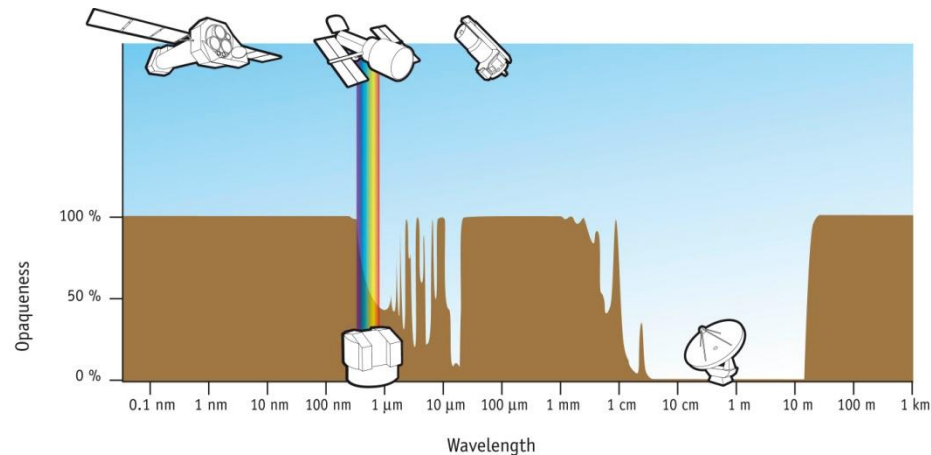
Space Based Gamma Ray Detectors

Iair Arcavi



Gamma Rays $E > 100 \text{ keV}$, $\lambda < 10 \text{ pm}$

- Atmosphere is opaque



- Pass through mirrors and lens
- Weak signals
- Cosmic rays

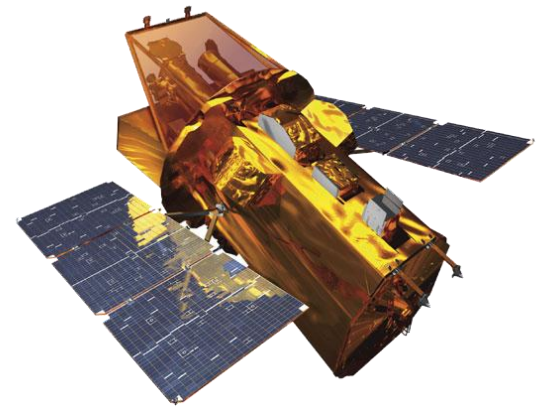
Gamma Ray Science

- Solar Flares
- SM black holes
- Pulsars
- Active galaxies
- Merging neutron stars
- Hypernovae
- GRBs
- What we don't know



Space Based Detection Techniques

- Scintillators
- Solid State Detectors
- Compton Scattering Detectors
- Pair Production Detectors

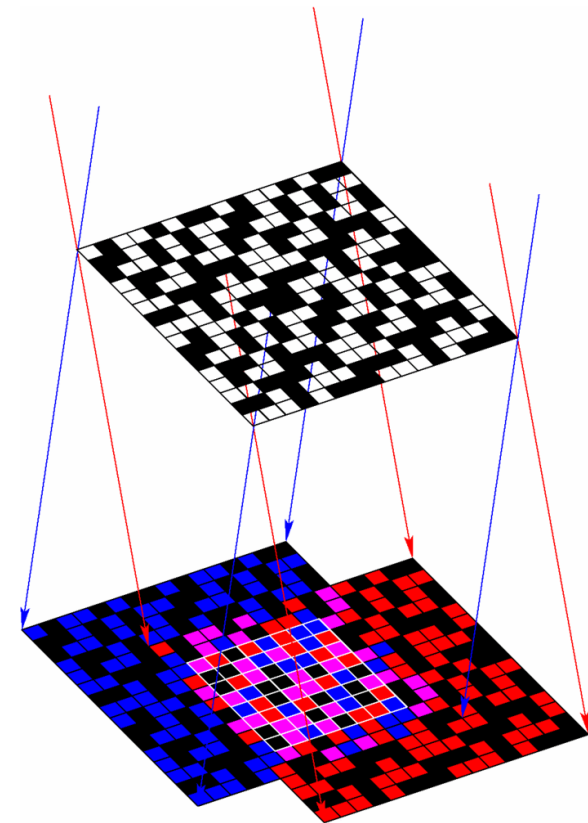
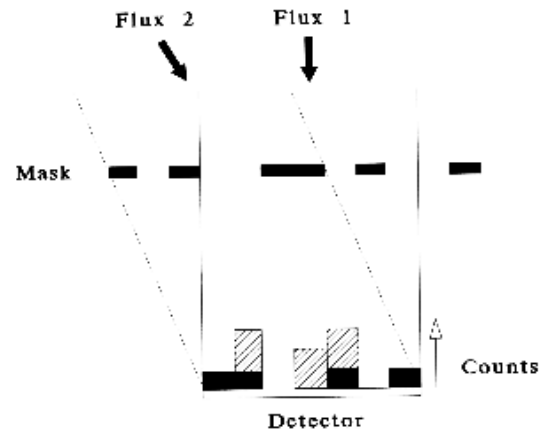
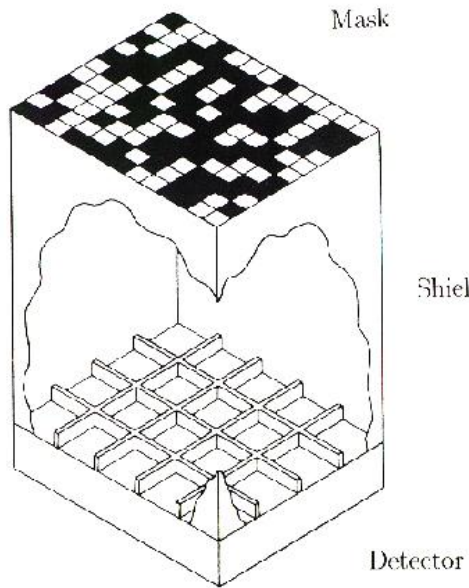


Scintillators

- NaI(Tl) / CsI(Na)
- Charged particle \rightarrow light
- Gamma ray \rightarrow charged particle \rightarrow light
- No direction information



Coded Masks



Coded Masks



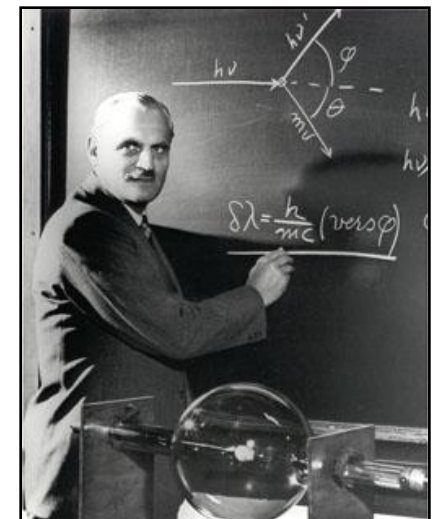
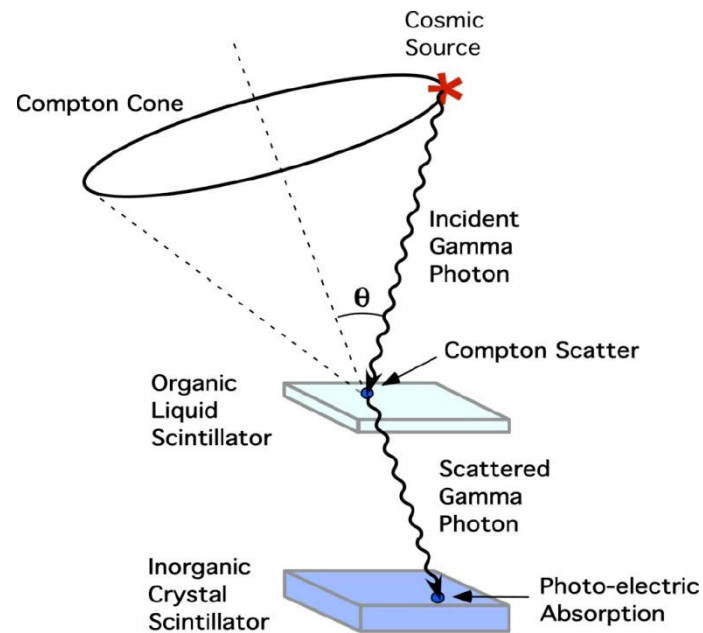
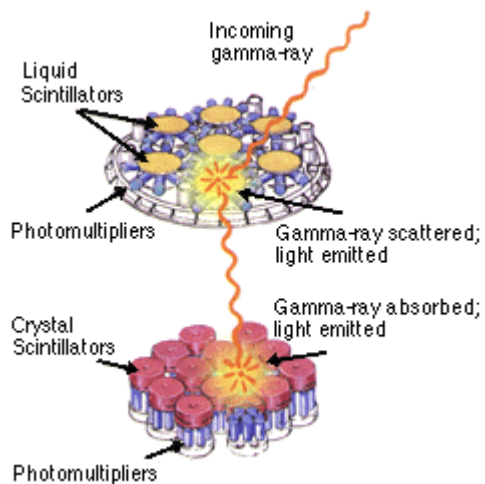
Coded mask for Swift's Burst Alert Telescope

Solid State Detectors

- Ga, CdZnTd
- Gamma ray \rightarrow knock out electron
 \rightarrow electron-hole pair in SM
- Apply voltage \rightarrow current
- Compared to scintillators:
 - Better energy resolution, less noise, better spatial resolution
 - More expensive \rightarrow smaller

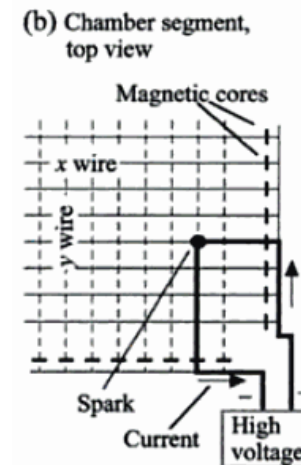
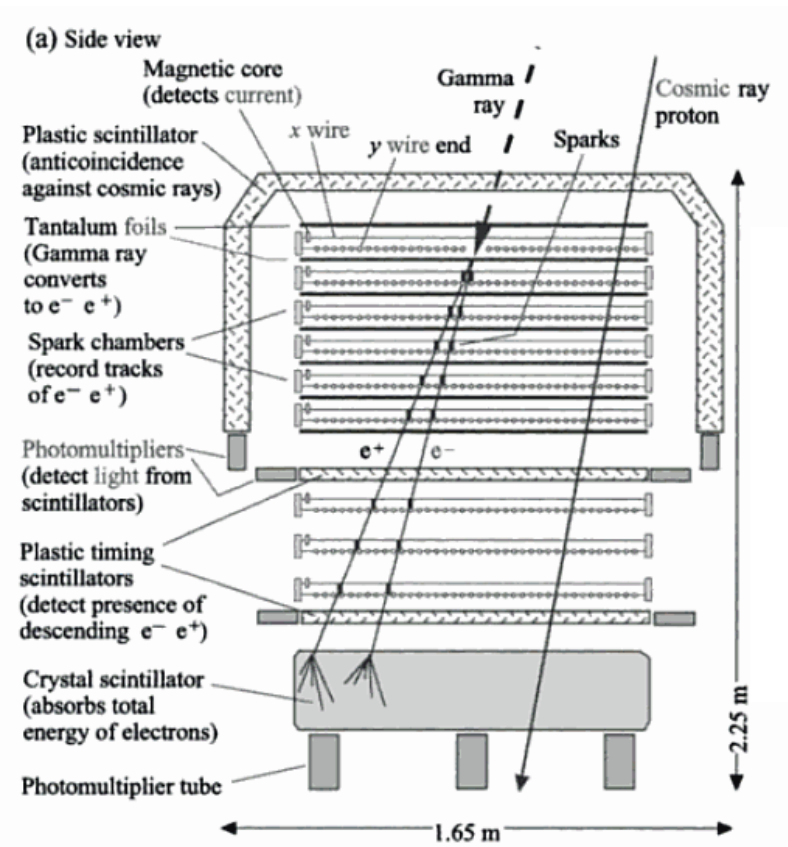
Compton Scattering Detectors

- 1-30 MeV: Compton Scattering is dominant

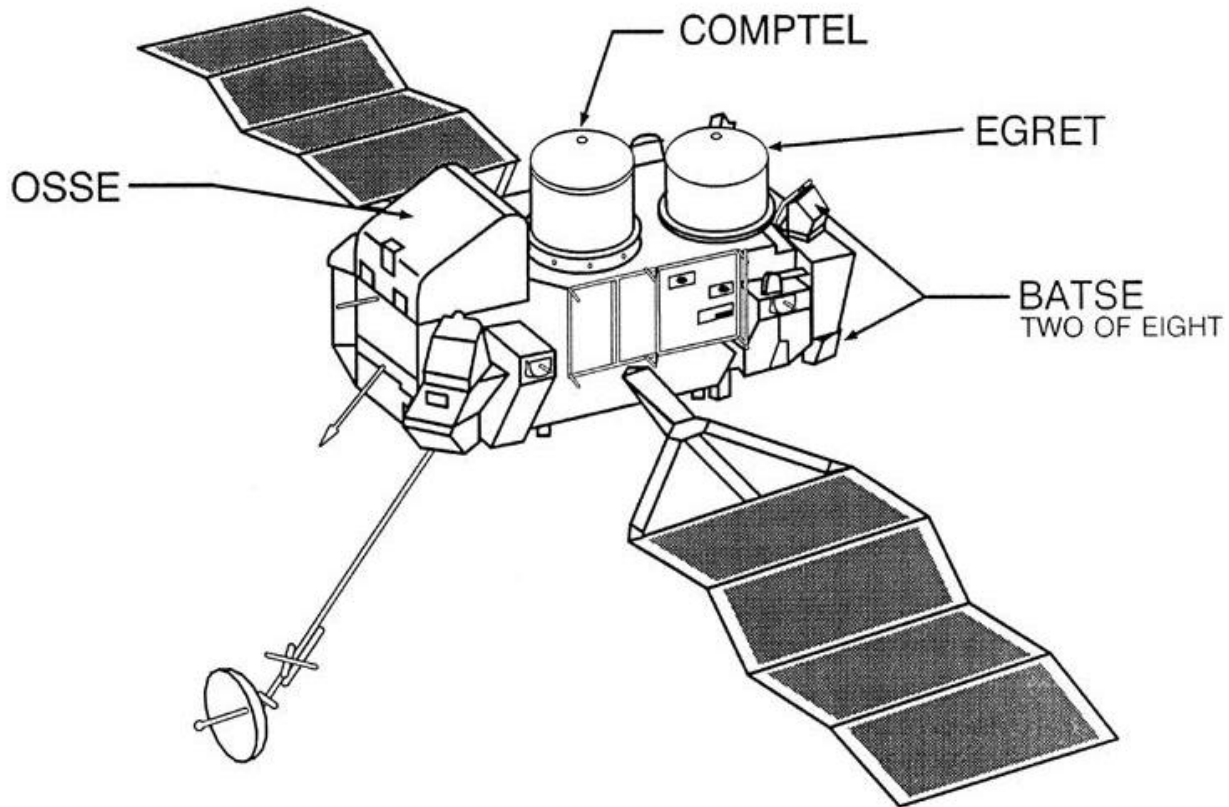


Pair Production Detectors

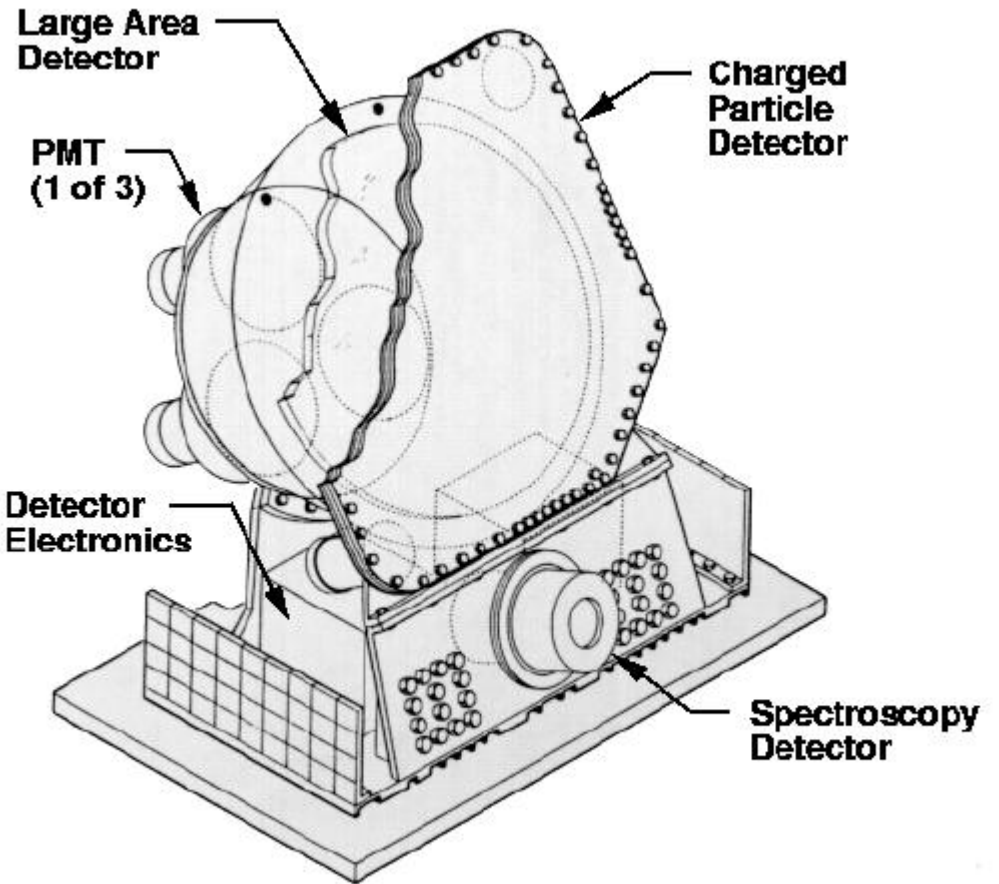
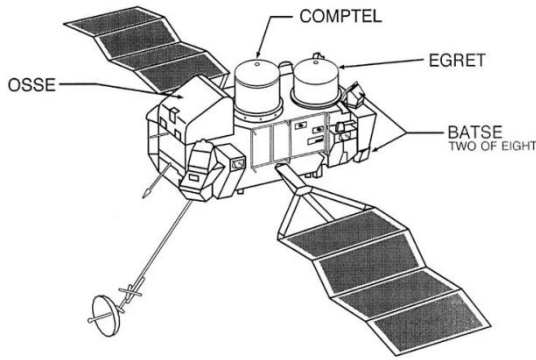
- > 30 MeV: Pair production is dominant



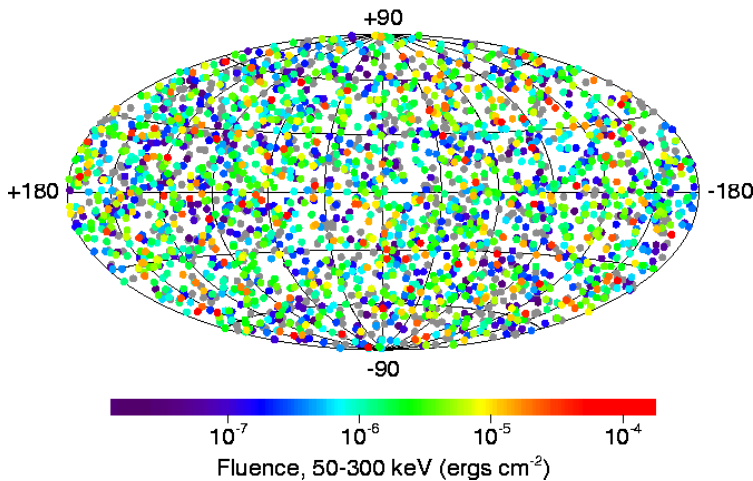
Telescopes CGRO



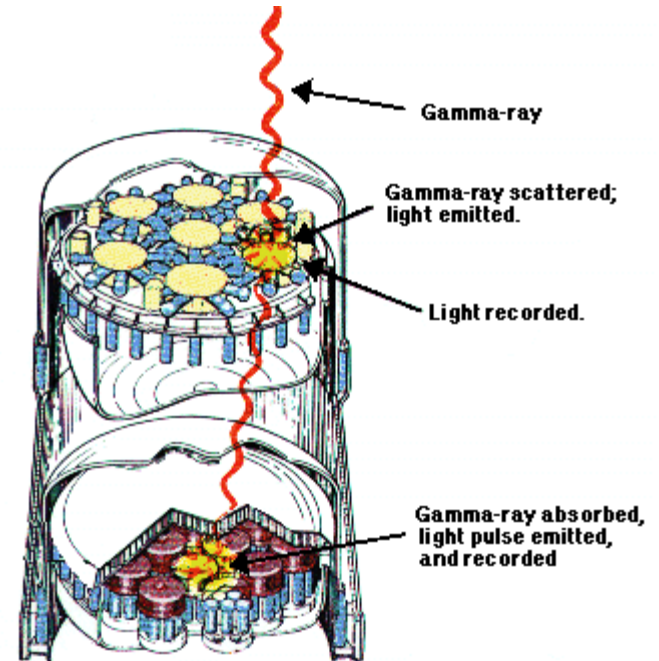
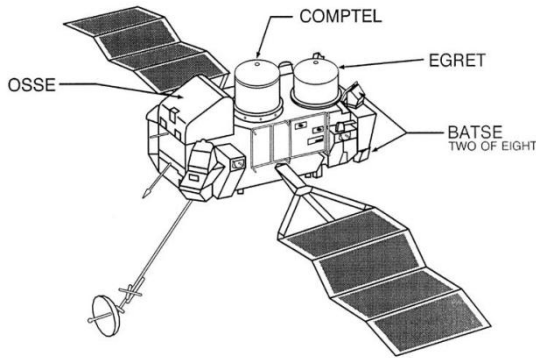
Telescopes CGRO > BATSE (Scintillator)



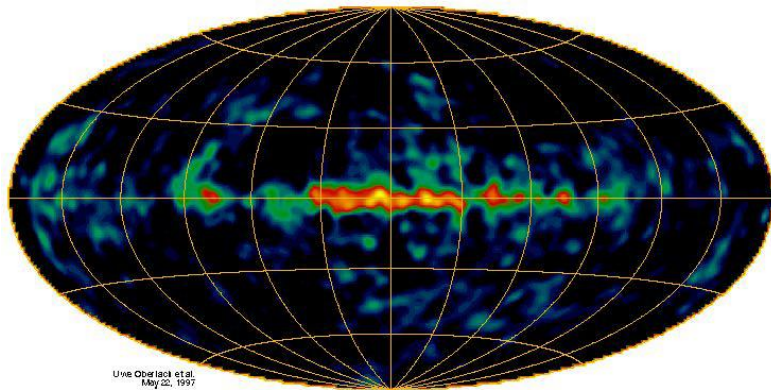
2704 BATSE Gamma-Ray Bursts



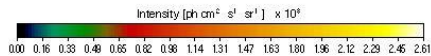
Telescopes CGRO > CompTel (Compton)



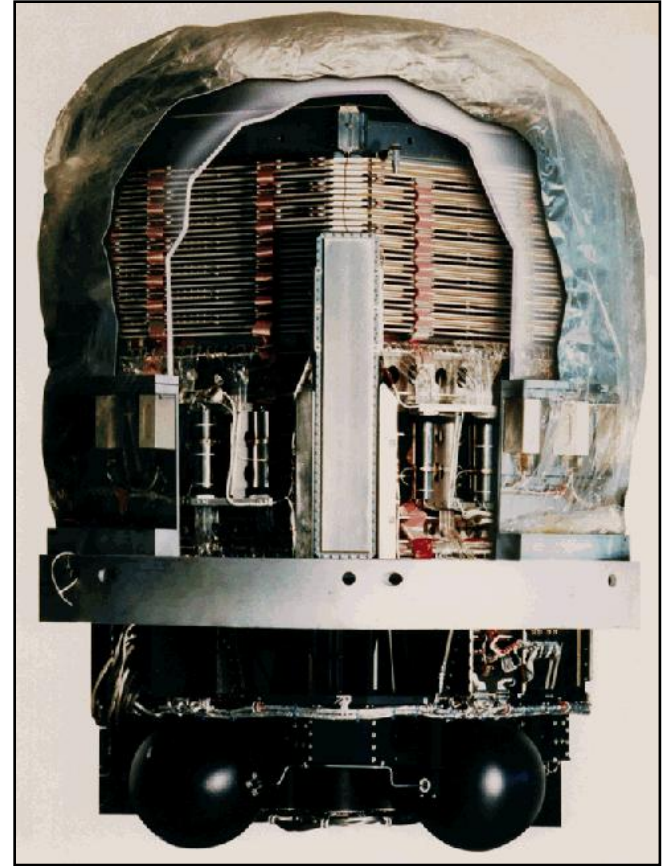
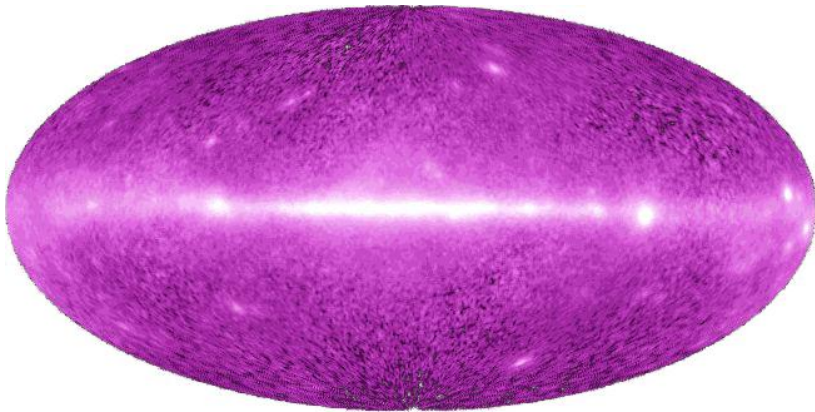
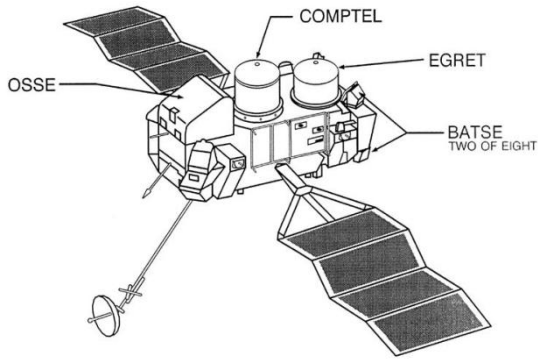
CGRO / COMPTEL 1.8 MeV, 5 Years Observing Time



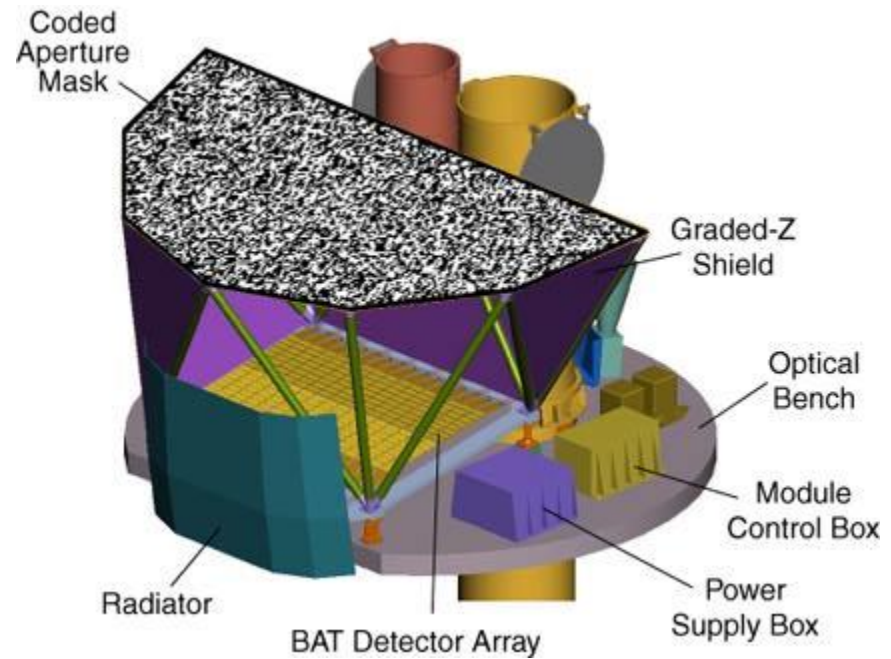
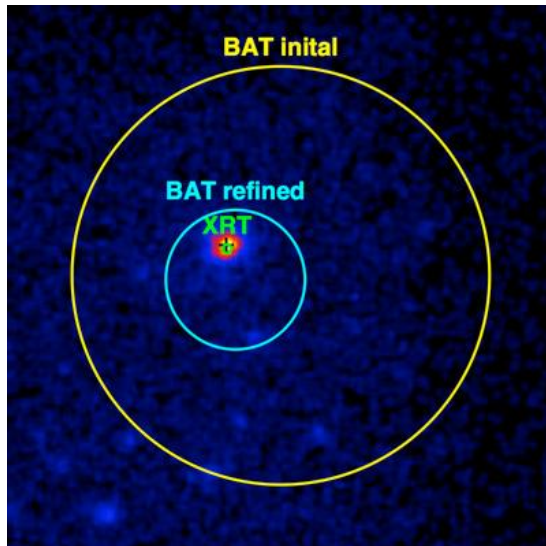
Uwe Oberlack et al.
May 22, 1997



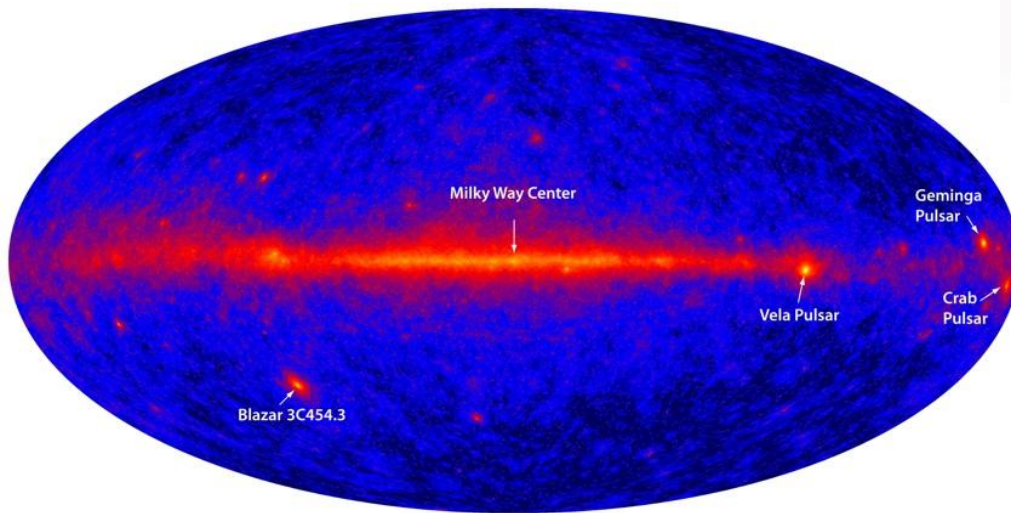
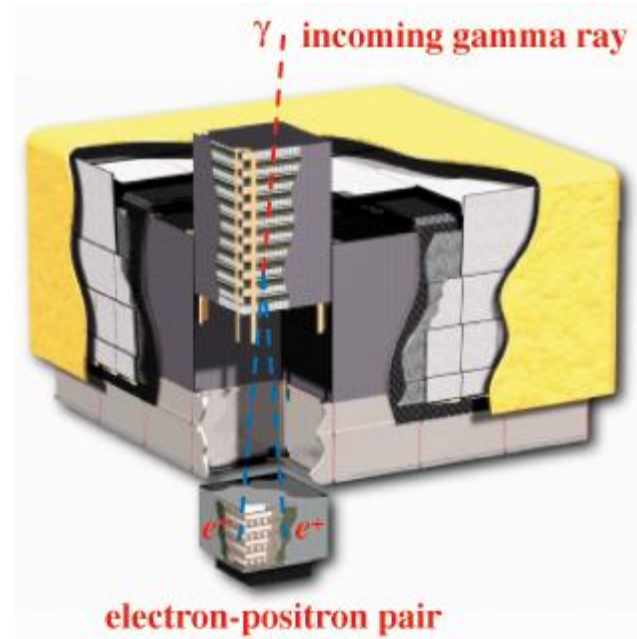
Telescopes CGRO > EGRET (Pair Production)



Telescopes Swift > BAT (Solid State)



Telescopes Fermi > LAT (Pair Production)



Thank you

