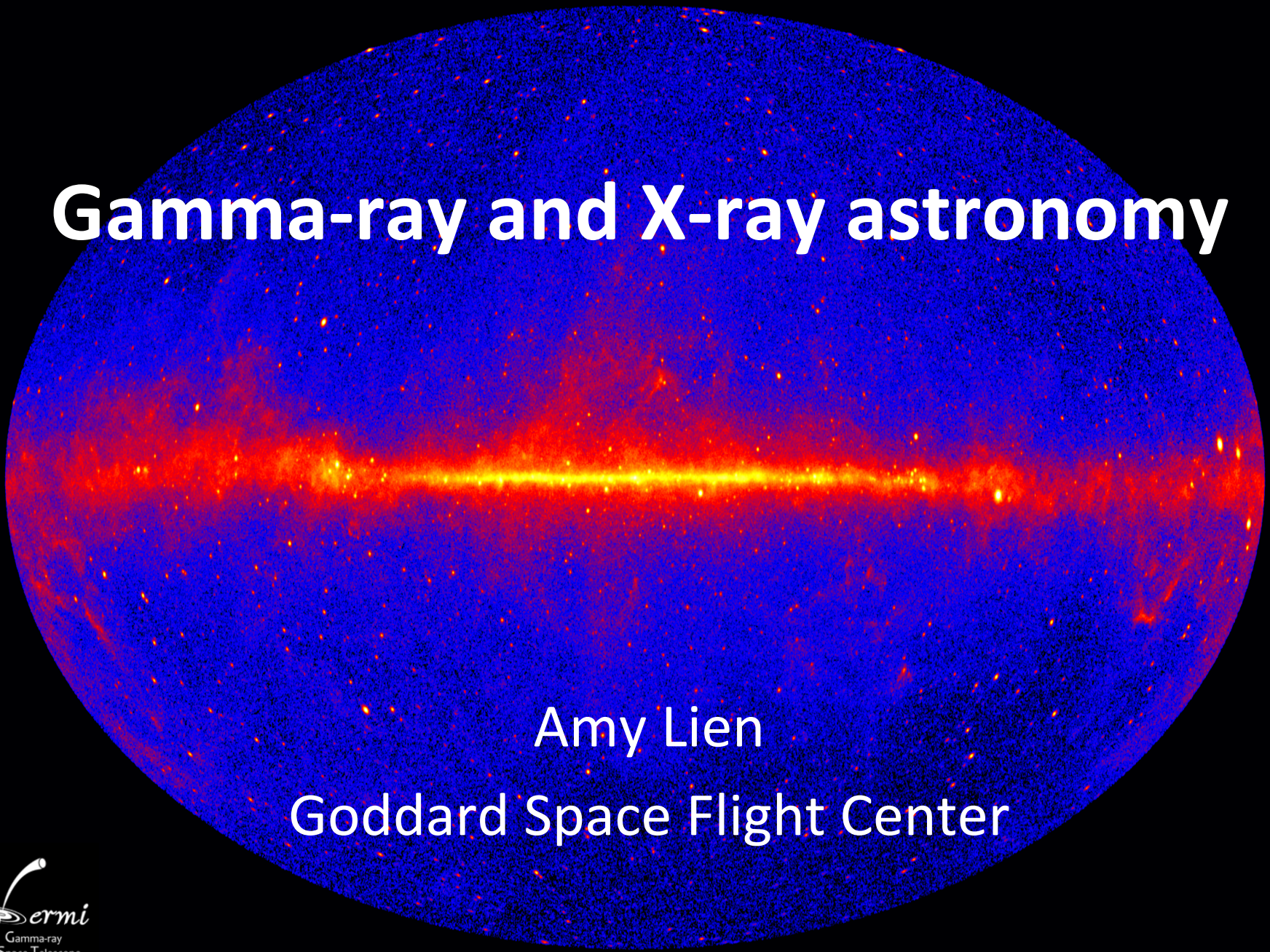
Gamma-ray and X-ray astronomy



Amy Lien

Goddard Space Flight Center

Fermi Gamma-ray Space Telescope

Homework 3

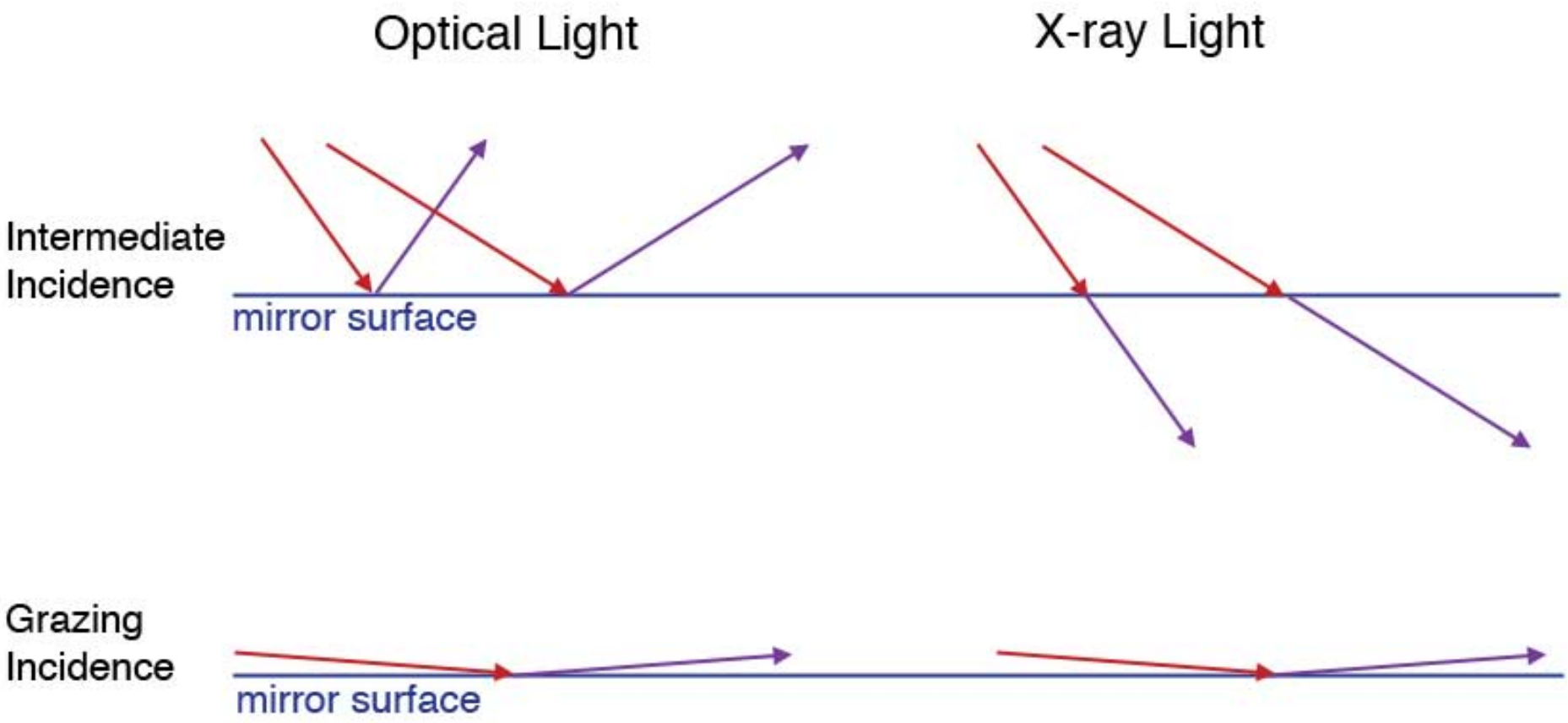
- The names of space missions are commonly italicized, while the instrument onboard the spacecraft is in regular font

  → *Swift*/BAT

  in LaTex: {\it Swift}/BAT

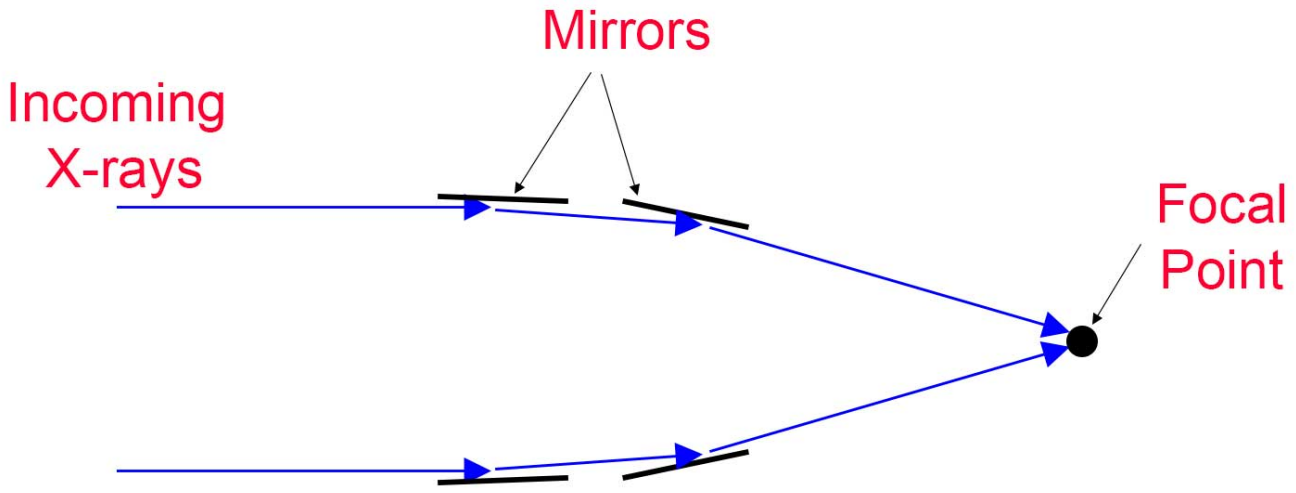
  (several people noticed this, very good!)

X-ray Telescope



Credit: https://imagine.gsfc.nasa.gov/science/toolbox/xray_telescopes1.html

X-ray Telescope



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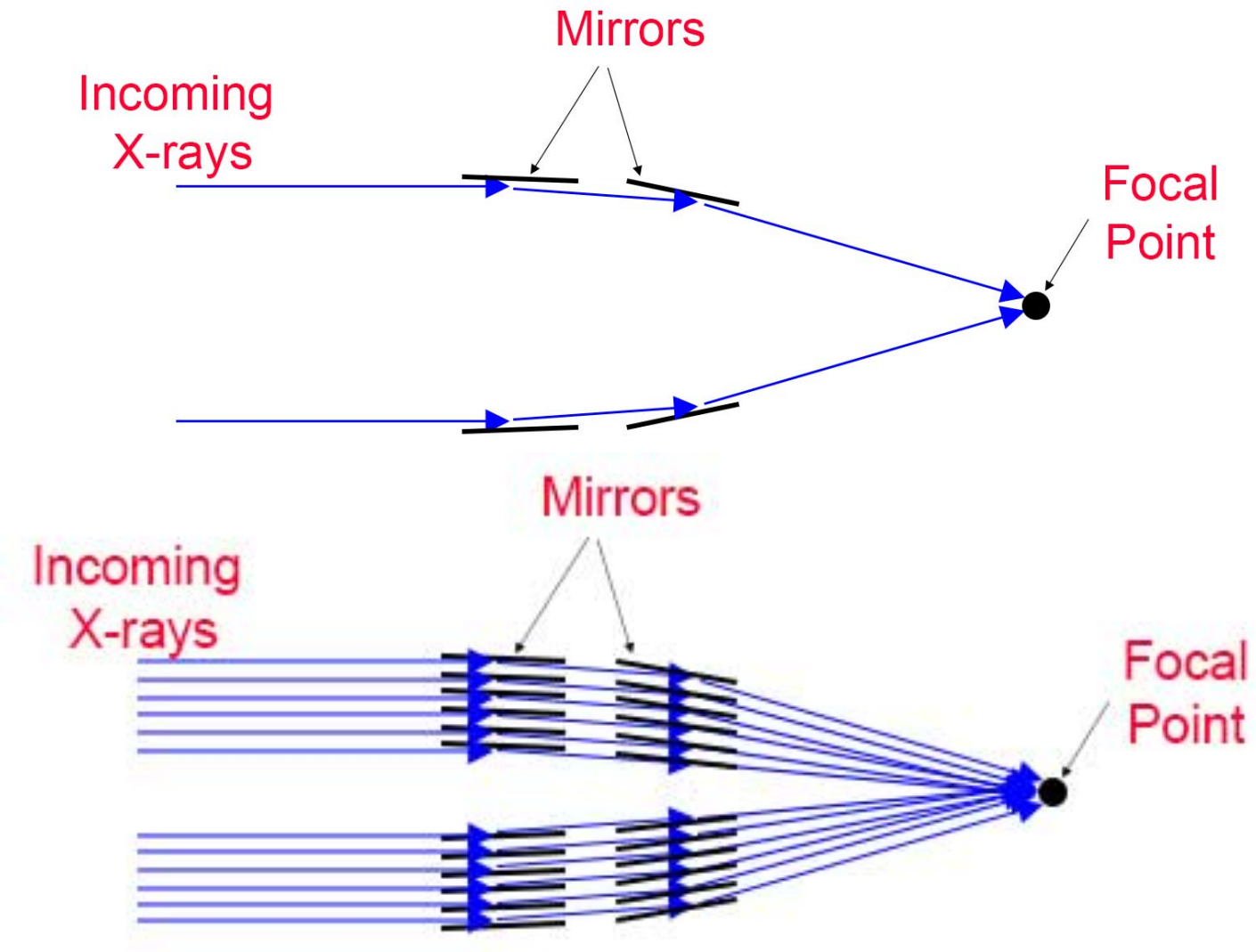
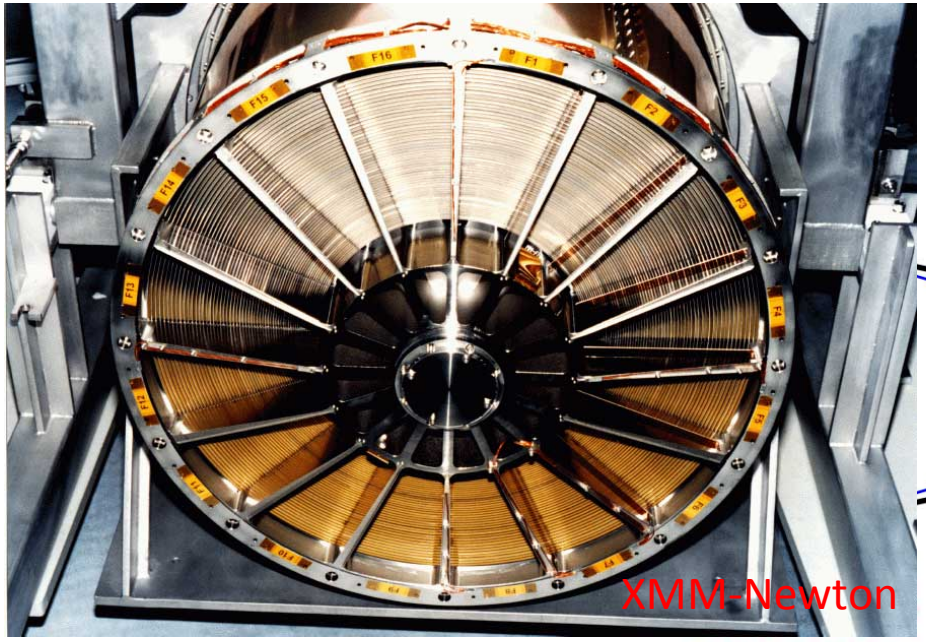
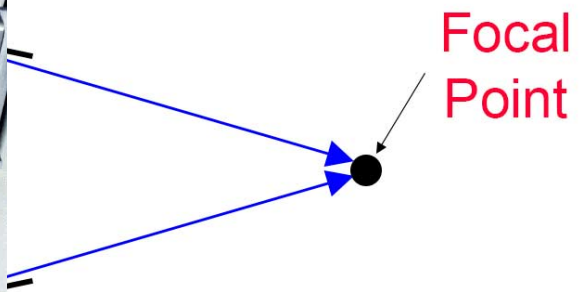
X-ray Telescope

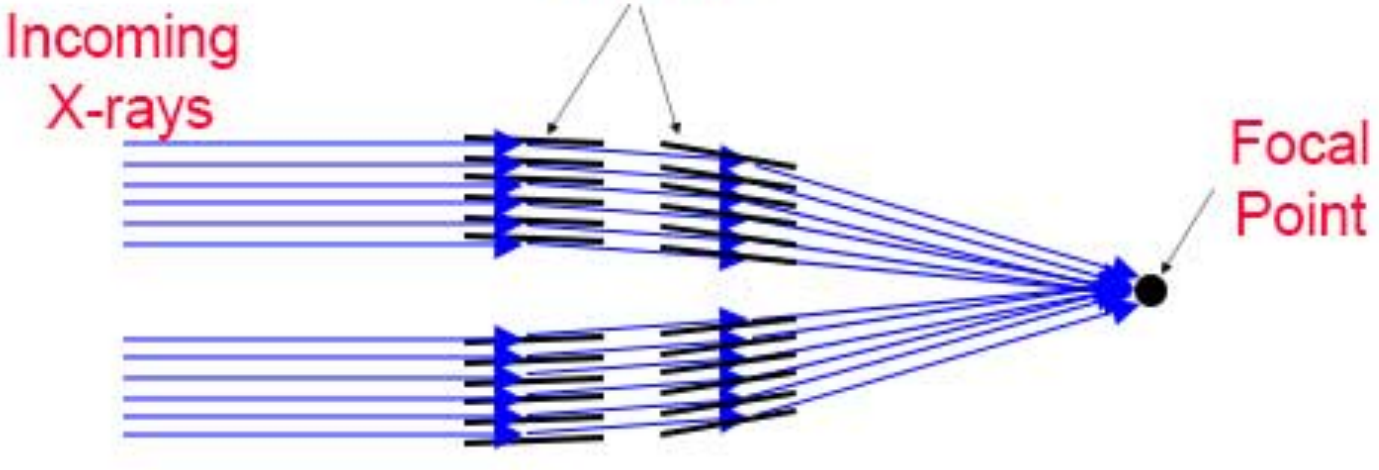


Credit: https://imagine.gsfc.nasa.gov/science/toolbox/xray_telescopes1.html

X-ray Telescope



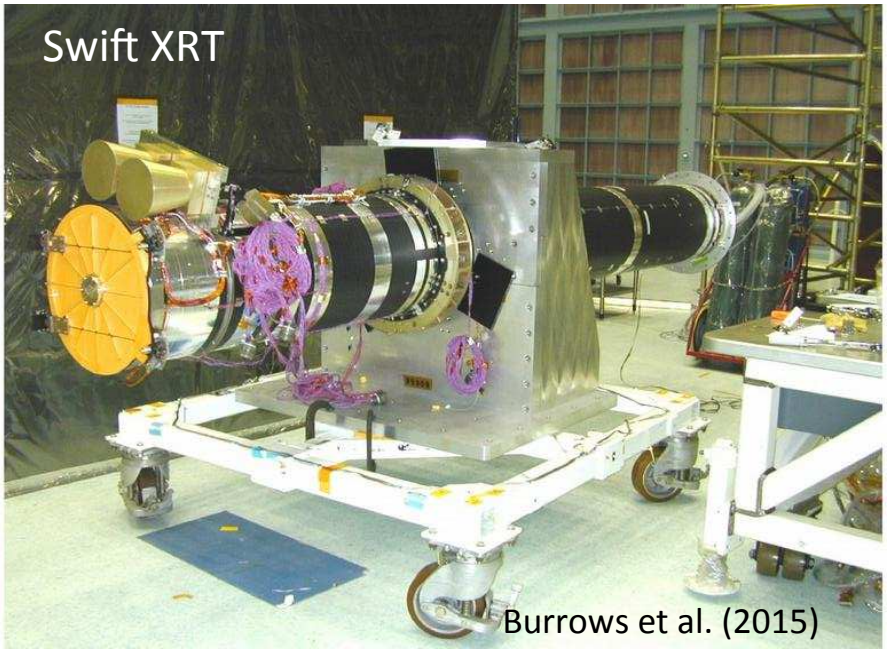


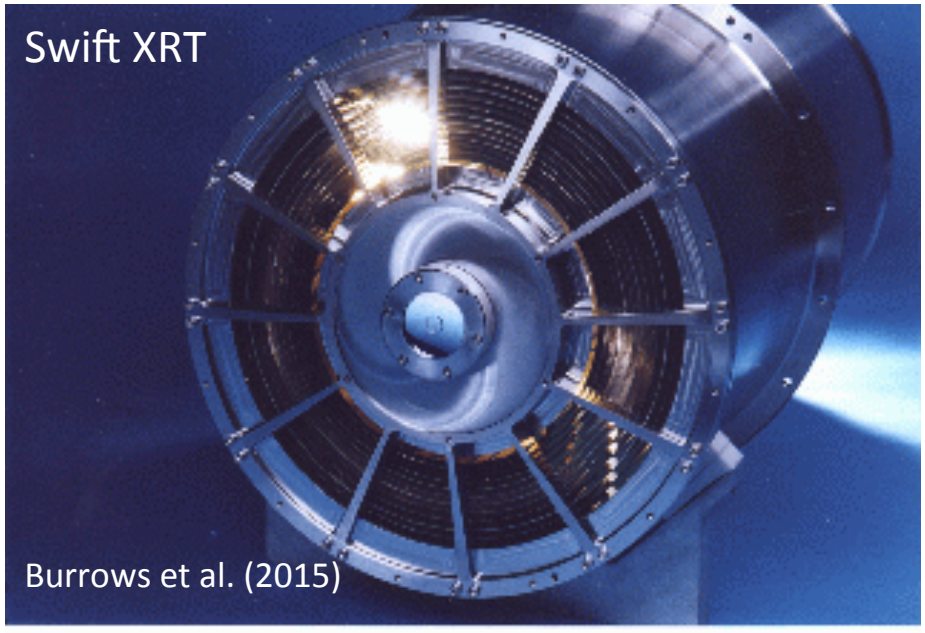


Credit: https://imagine.gsfc.nasa.gov/science/toolbox/xray_telescopes1.html

Swift X-ray Telescope

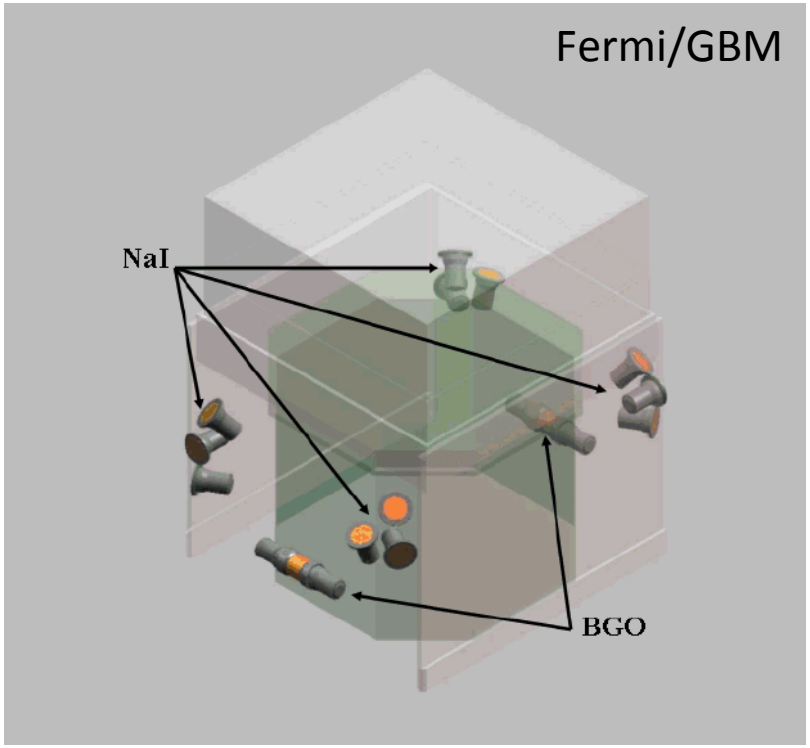
- Energy range: 0.3 – 10 keV
- Field of view: 23.6 x 23.6 arcmin
- Angular resolution: 18 arcsec



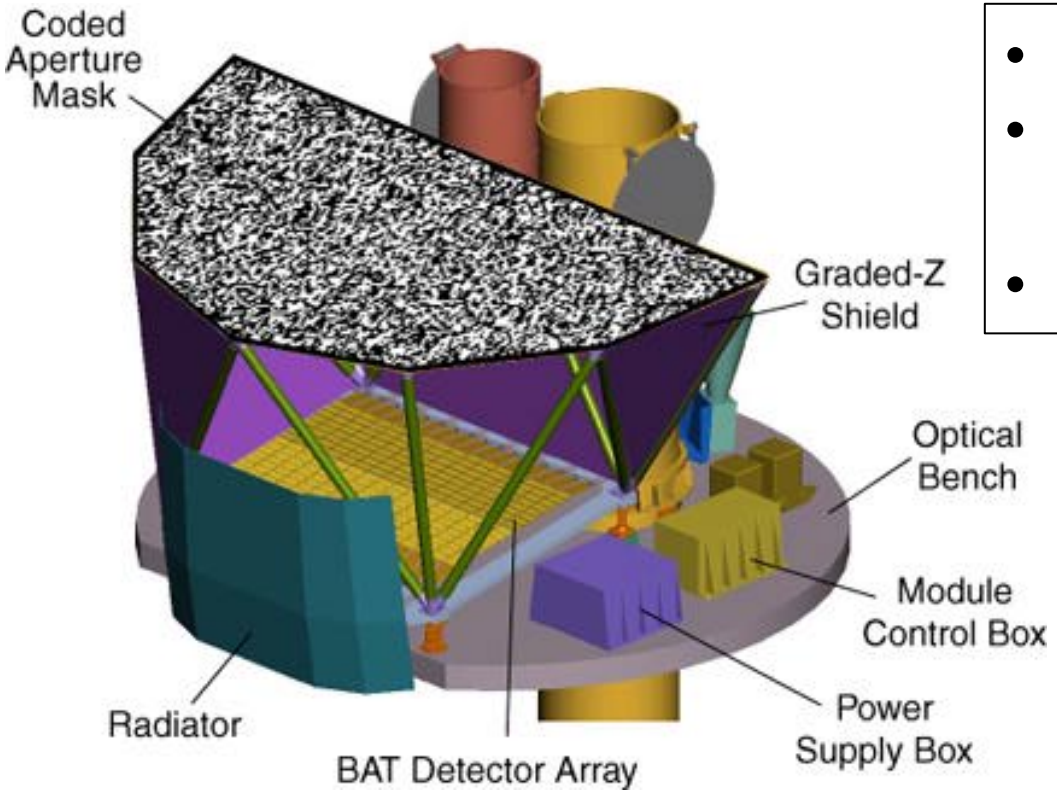


Gamma-ray telescopes

- Gamma ray photons are extremely energetic
  - Penetrate/interact with almost all the material
  - Hard to focus



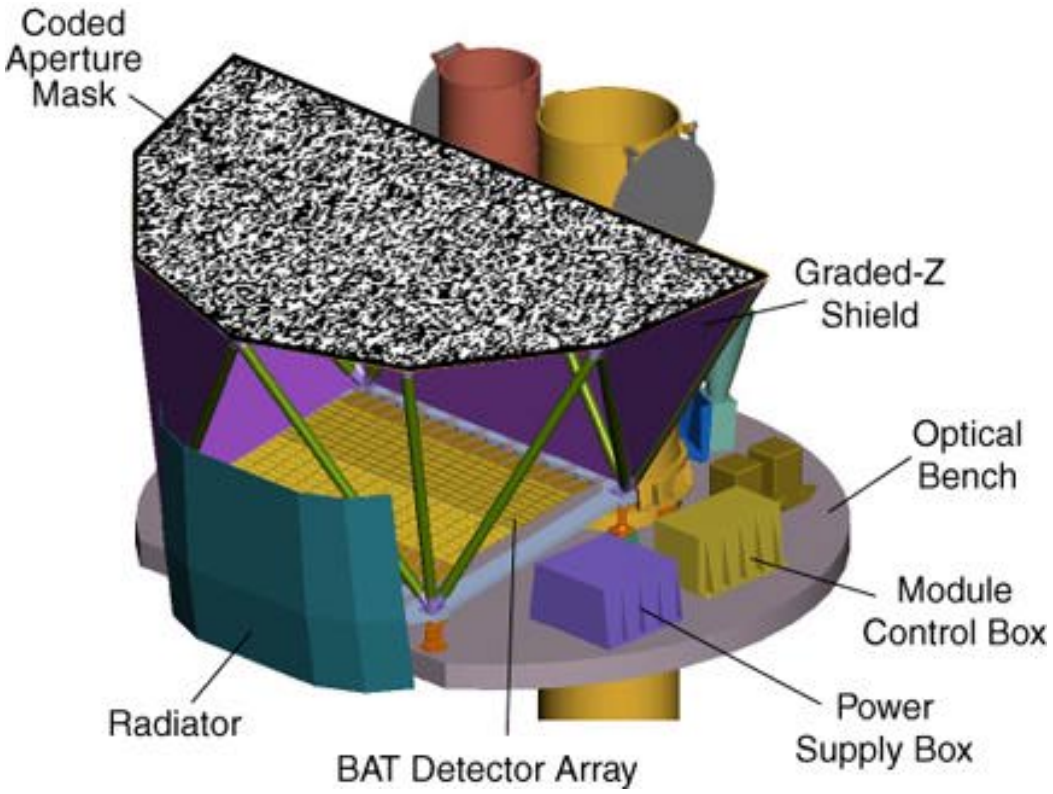
Imaging in gamma rays
Coded-mask aperture

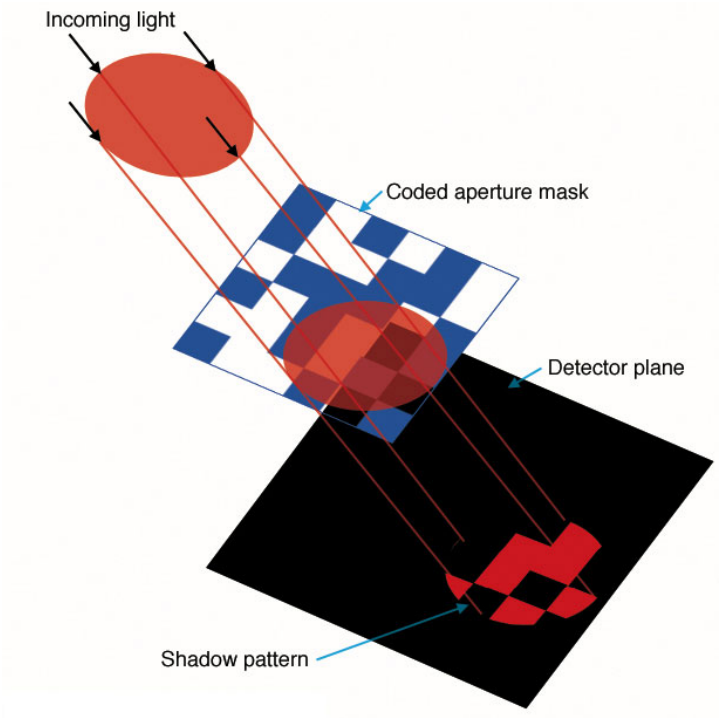


- Energy range: 15-350 keV
- Position accuracy: ~ 3 arcmin
  (depends on the source brightness)
- Field of View: ~ 1.4 sr

Credit: NASA's Imagine the Universe and NASA/Swift

Imaging in gamma rays
Coded-mask aperture

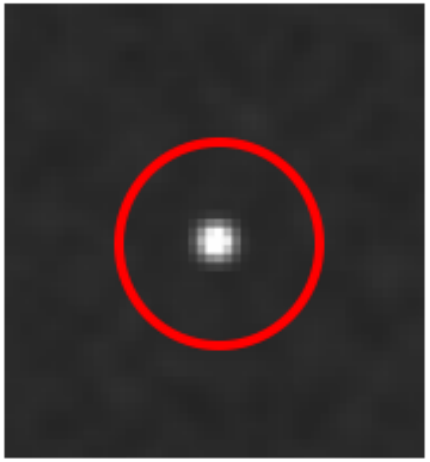




Credit: NASA's Imagine the Universe and NASA/Swift

Imaging in gamma rays
Coded-mask aperture

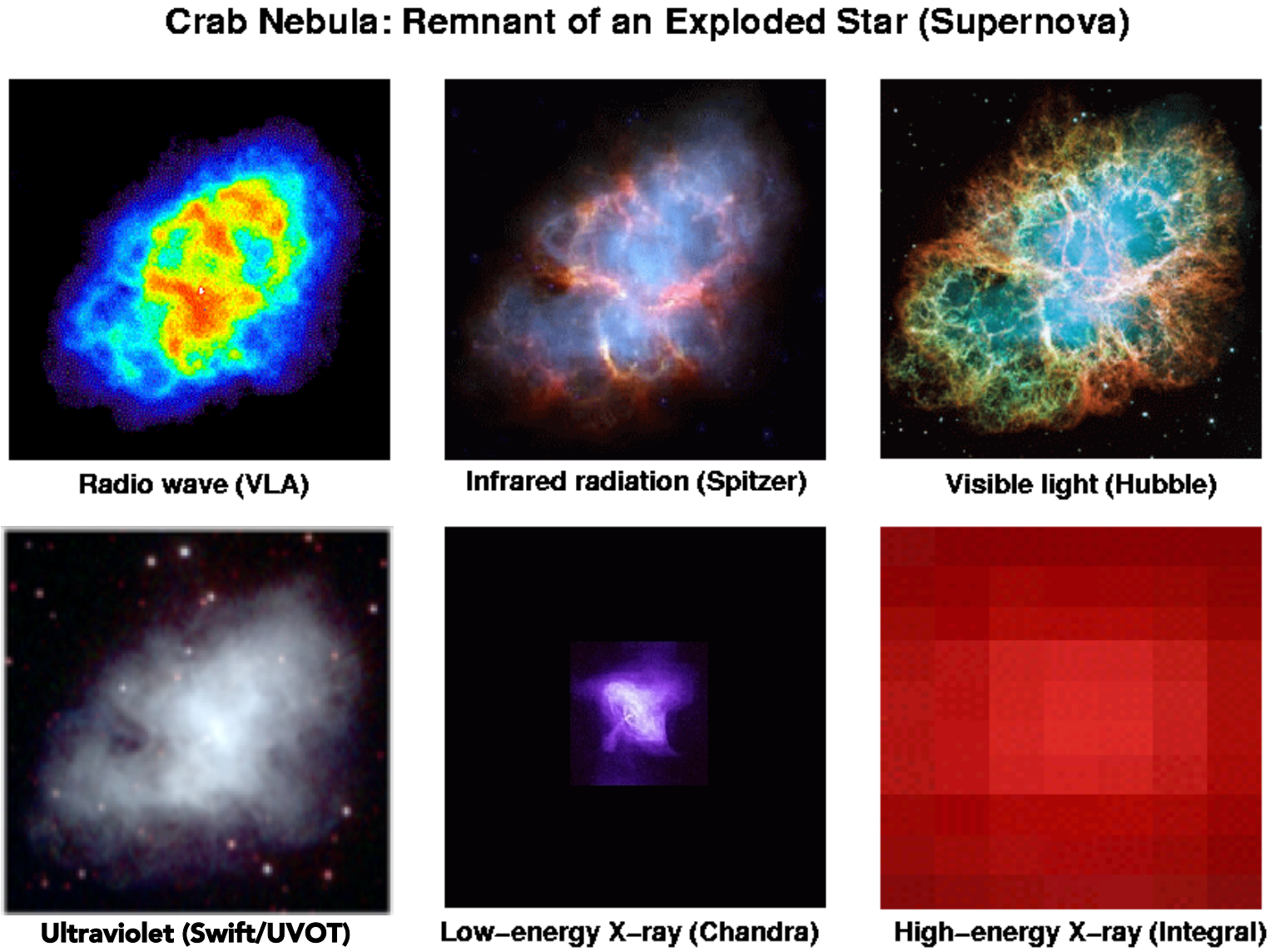
BAT Detectors



Credit: NASA's Imagine the Universe and NASA/Swift

Markwardt et al. (2007)

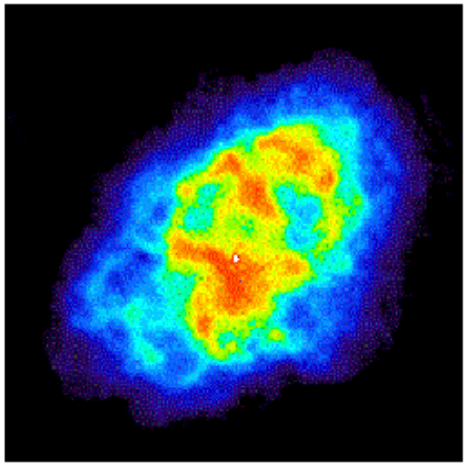
Angular resolution comparison



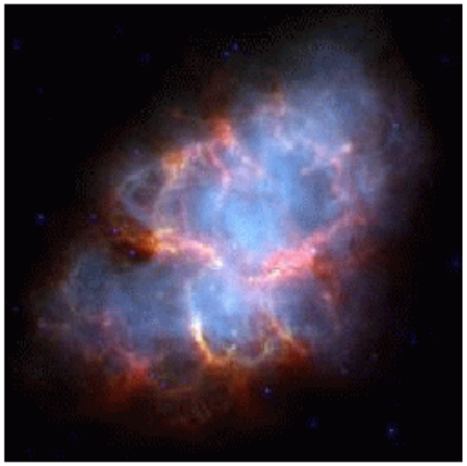
Source: www.srl.caltech.edu

Angular resolution comparison

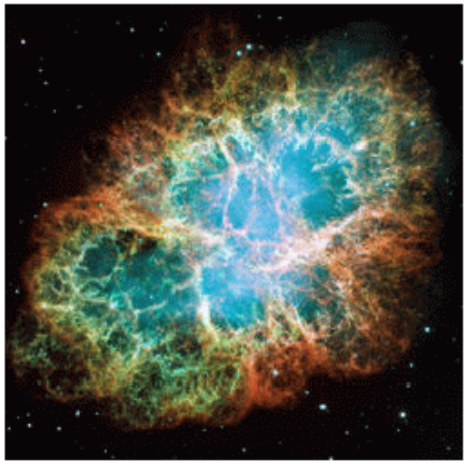
Crab Nebula: Remnant of an Exploded Star (Supernova)



Radio wave (VLA)

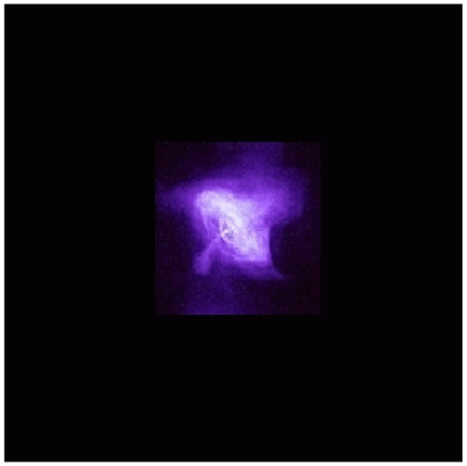


Infrared radiation (Spitzer)

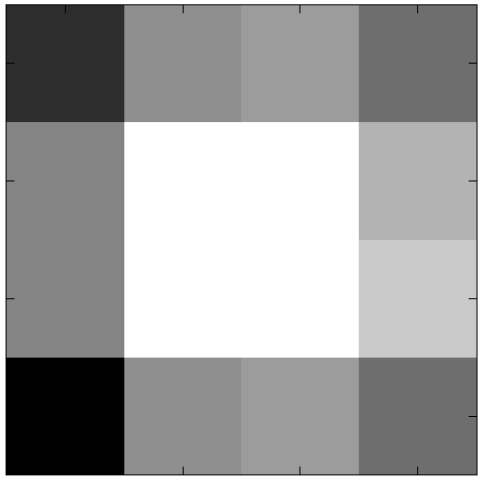


Visible light (Hubble)

Ultraviolet (Swift/UVOT)



Low–energy X–ray (Chandra)



Swift BAT

Source: www.srl.caltech.edu

Lab 5
GRB data from *Swift* BAT and XRT