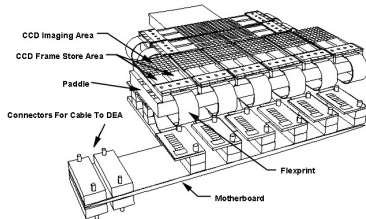


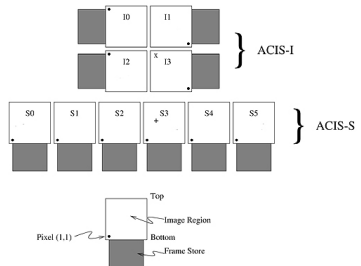
Instrumentación para Astronomía de rayos X y γ

Juan Fabregat

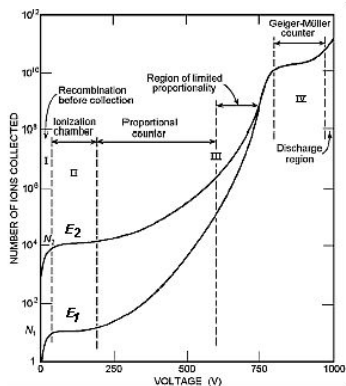
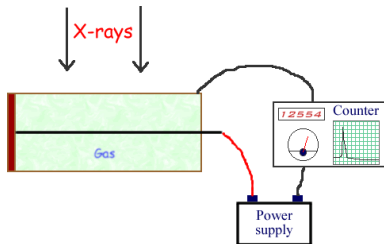
Observatorio Astronómico de la Universidad de Valencia



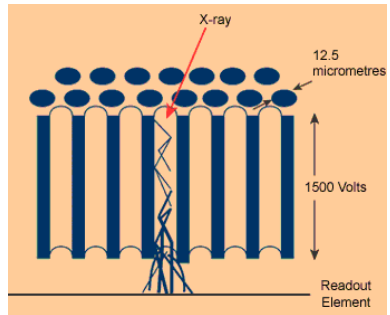
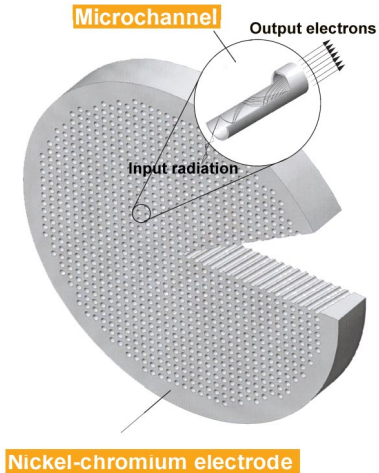
ACIS FLIGHT FOCAL PLANE



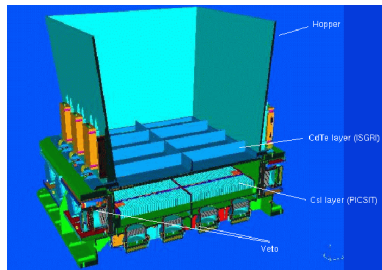
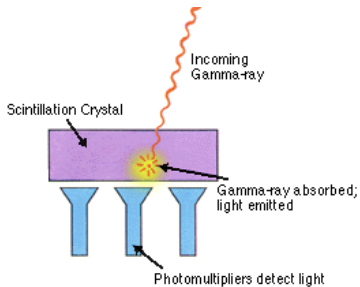
Contadores proporcionales



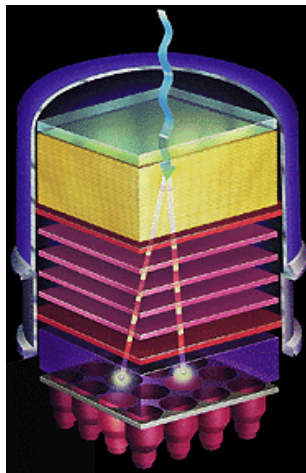
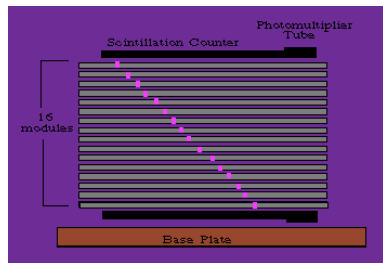
Placas de microcanales

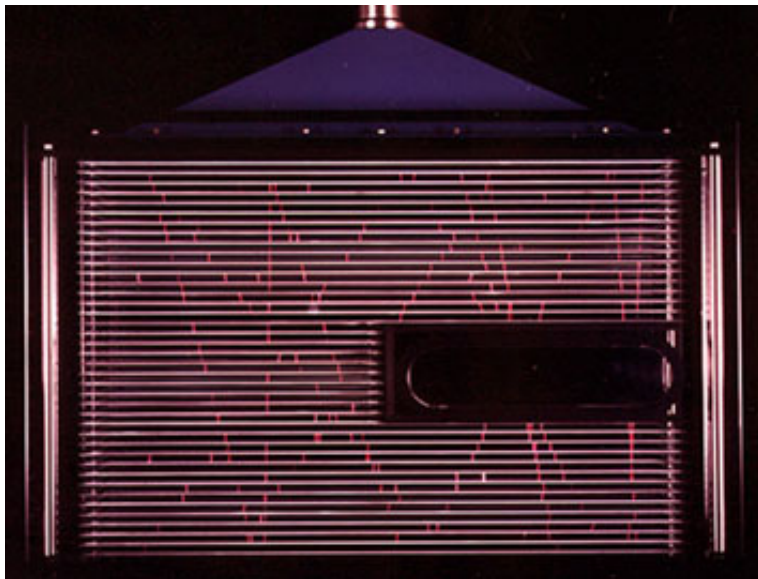


Cristales centelleadores

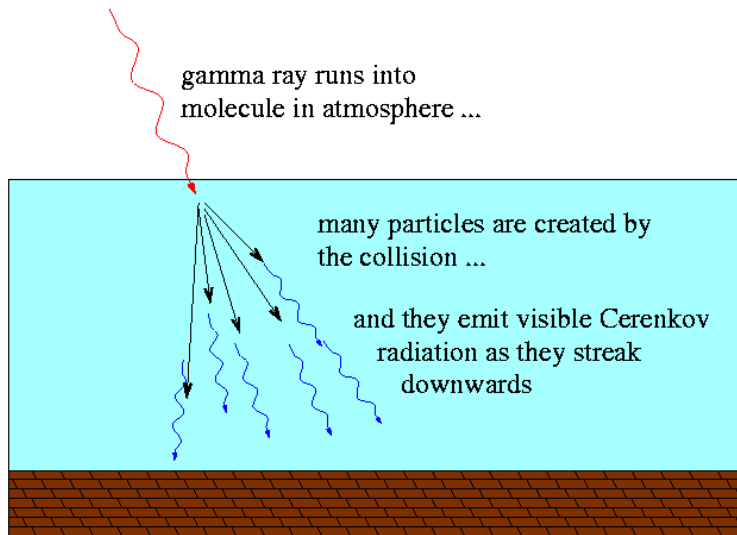


Cámara de chispas





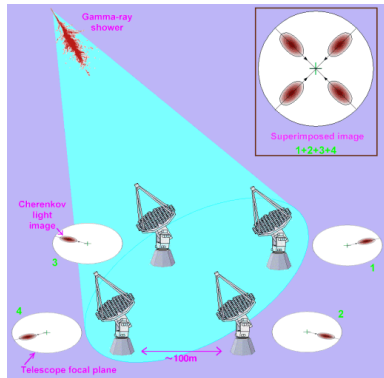
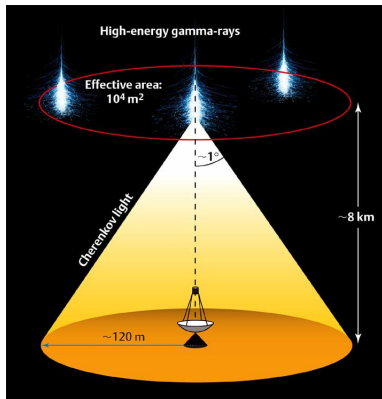
Telescopios Cerenkov



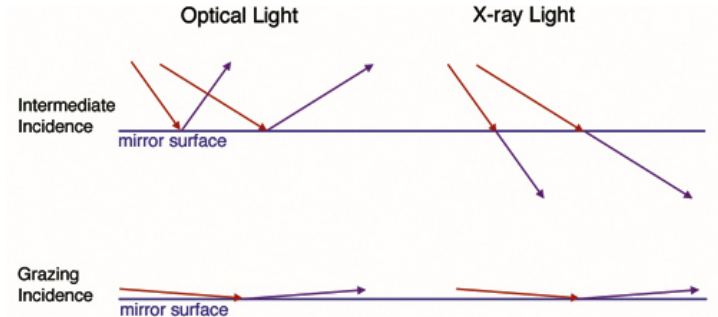
Telescopios Cerenkov



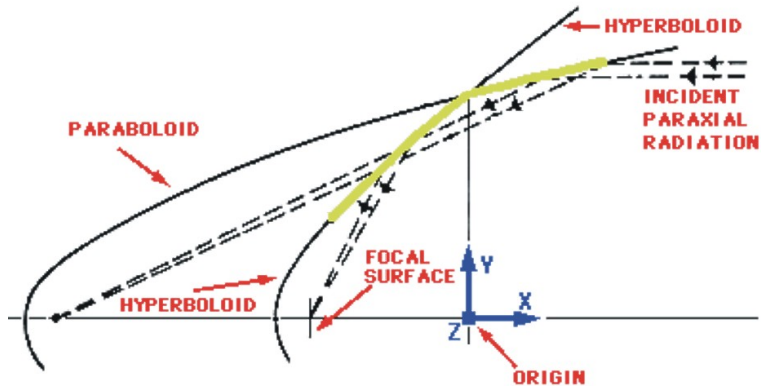
Telescopios Cerenkov



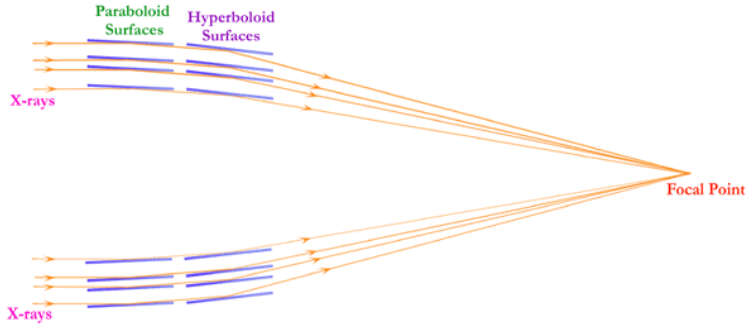
Telescopios de incidencia rasante



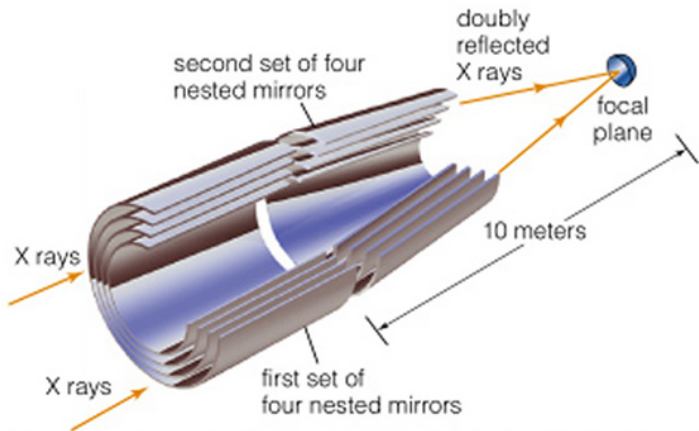
Telescopios de incidencia rasante



Telescopios de incidencia rasante

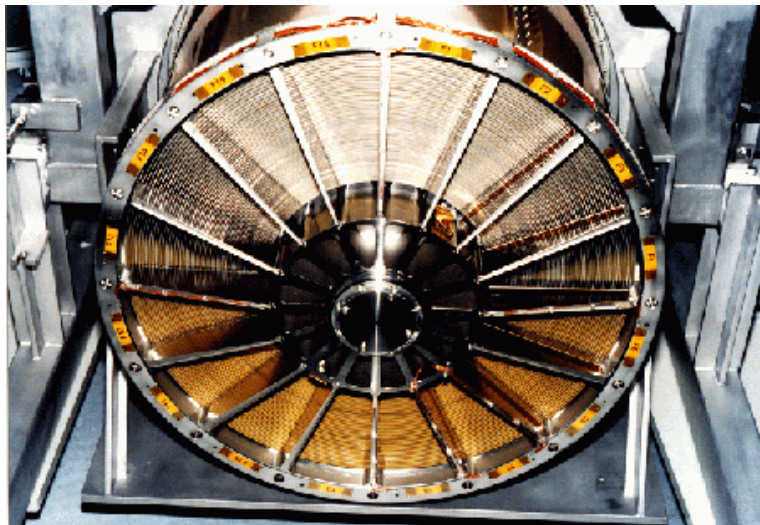


Telescopios de incidencia rasante

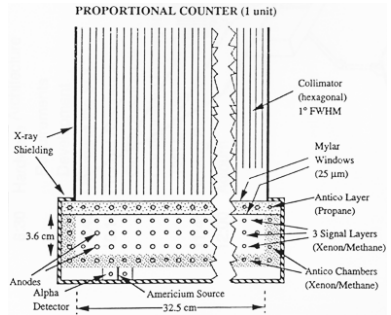
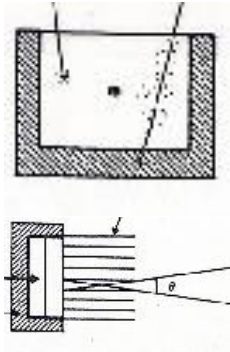


Mirror elements are 0.8 m long and from 0.6 m to 1.2 m in diameter.

Telescopios de incidencia rasante (XMM)



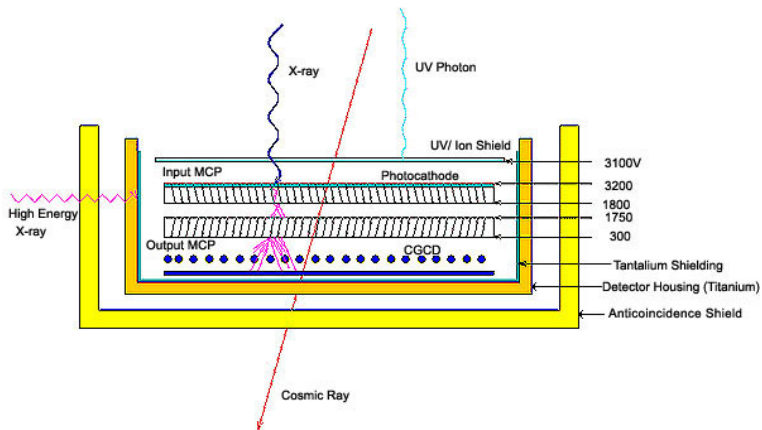
Colimadores



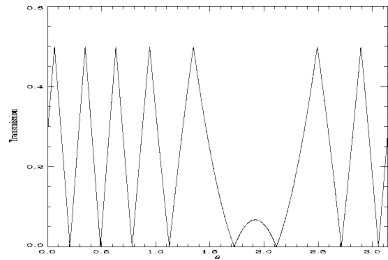
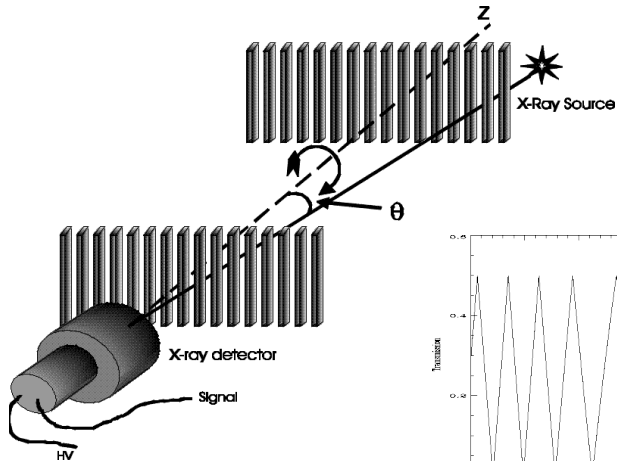
Colimadores



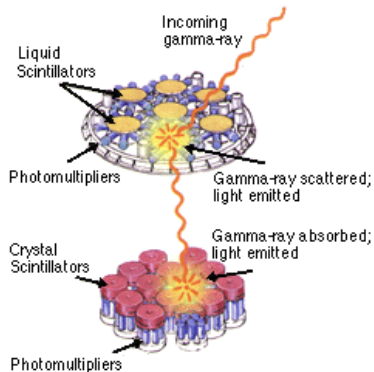
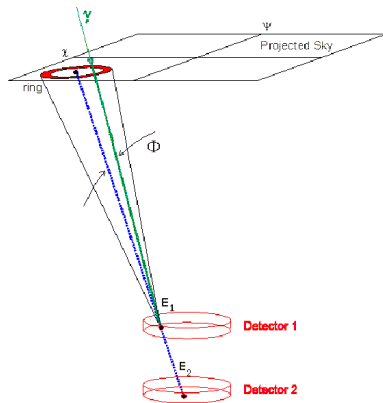
Vetos activos



Modulación rotacional



Telescopio de Compton



Telescopio de Compton

- Dispersión de Compton

$$\frac{\nu'}{\nu} = \frac{1}{1 + (h\nu/m_e c^2)(1 - \cos \theta)}$$

- $\frac{\nu}{\nu'} = 1 + \frac{h\nu}{m_e c^2}(1 - \cos \theta)$

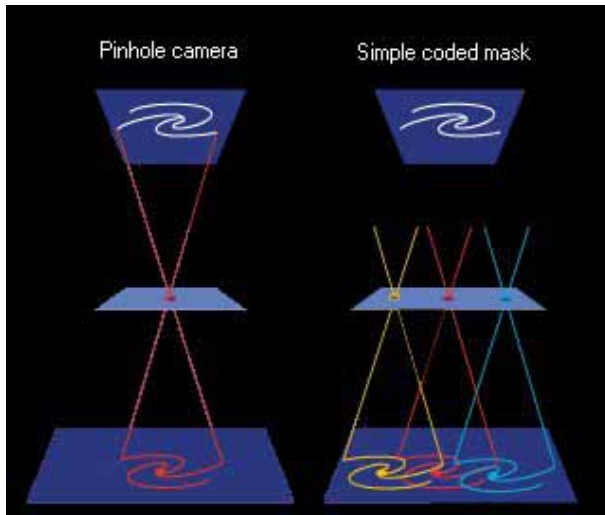
- $\frac{E}{E'} = 1 + \frac{E}{m_e c^2}(1 - \cos \theta)$

- $\frac{E}{E'} - 1 = \frac{E}{m_e c^2}(1 - \cos \theta)$

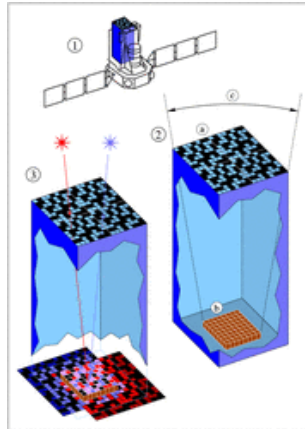
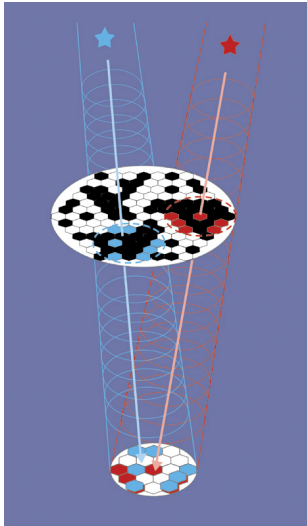
- $\frac{m_e c^2}{E'} - \frac{m_e c^2}{E} = 1 - \cos \theta$

- $\cos \theta = 1 + \frac{m_e c^2}{E} - \frac{m_e c^2}{E'}$

Máscaras codificadas

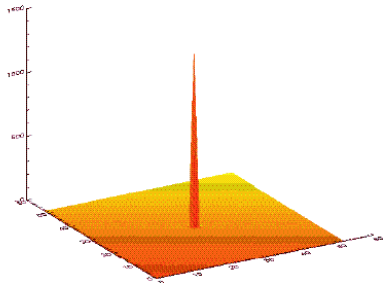
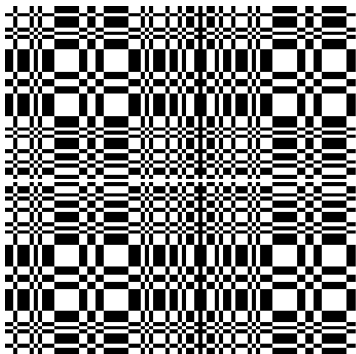


Máscaras codificadas



- Llamamos:
 - $S(x,y)$ al plano objeto
 - $A(x,y)$ a la apertura
 - $A'(x,y)$ a la apertura proyectada
 - $P(x,y)$ al plano imagen
 - $G(x,y)$ al proceso de decodificación
 - $\hat{S}(x,y)$ a la imagen reconstruida
- Codificación: $S(x,y) * A'(x,y) = P(x,y)$
- Decodificación: $P(x,y) * G(x,y) = \hat{S}(x,y)$
- $\hat{S}(x,y) = S(x,y) * [A'(x,y) * G(x,y)]$
- Si $A'(x,y) * G(x,y) = \delta \rightarrow \hat{S}(x,y) = S(x,y)$

Máscaras codificadas (IBIS-INTEGRAL)



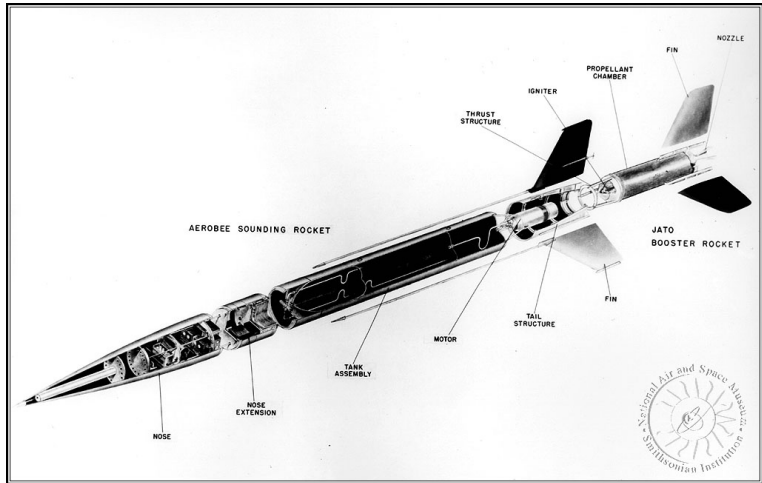
Máscaras codificadas (INTEGRAL)



Cohete V2



Cohete Aerobee



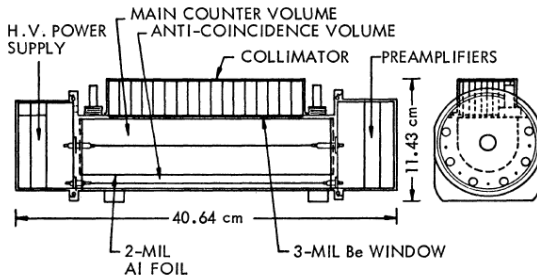


FIG. 1.—Cross-sectional view of a typical detector used in these experiments

Cohete Aerobee

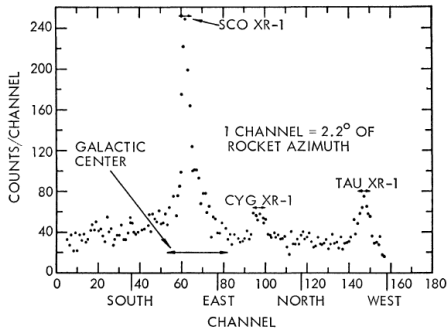
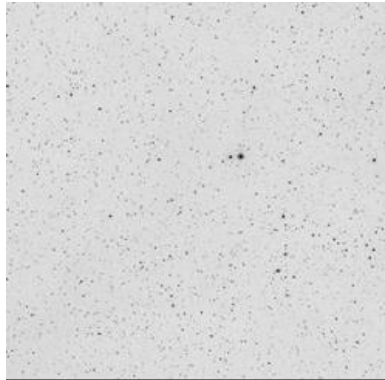
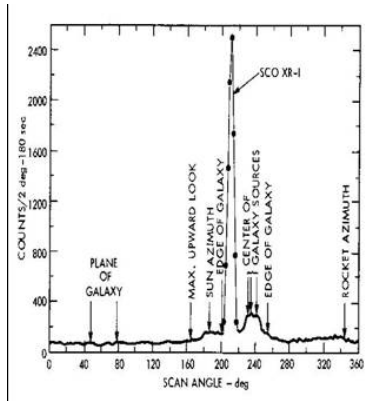
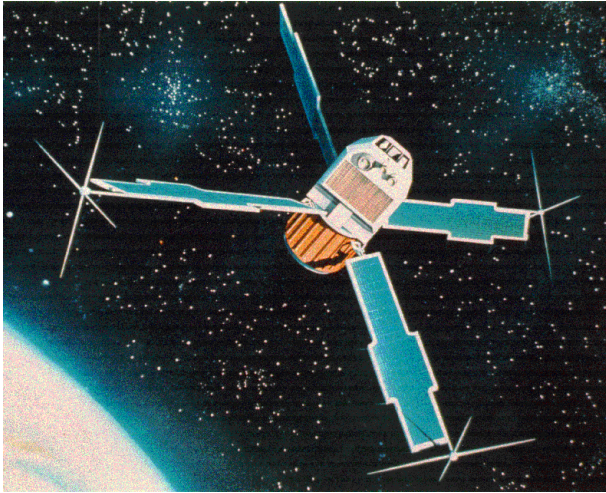


FIG. 4.—Total number of X-rays with energy between 4.3 and 28 keV observed for the 282 sec that the rocket was above 95 km as a function of azimuth during the July 28, 1966, rocket flight. One channel is 2.2° of azimuth. Dead time in the equipment resulted in exclusion of 20° of azimuth between 270° and 250°.

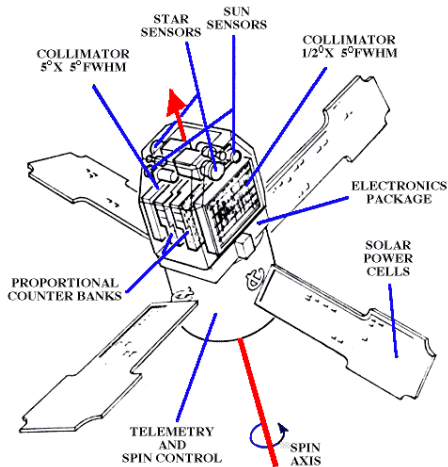
Cohete Aerobee



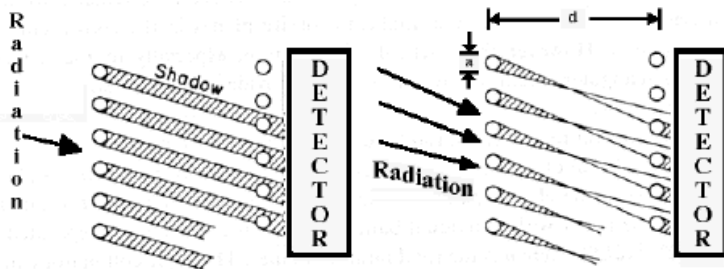
UHURU (Small Astronomic Satellite 1, SAS-1, 1970-1974)



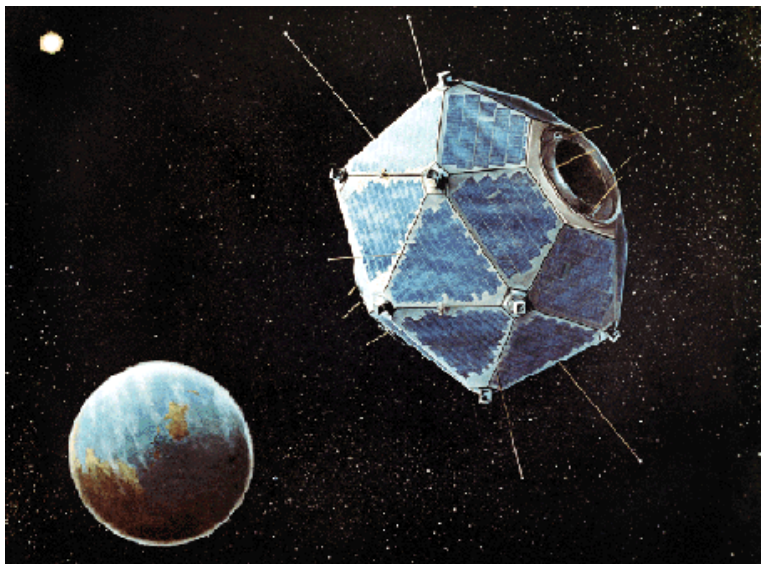
UHURU (Small Astronomic Satellite 1, SAS-1, 1970-1974)



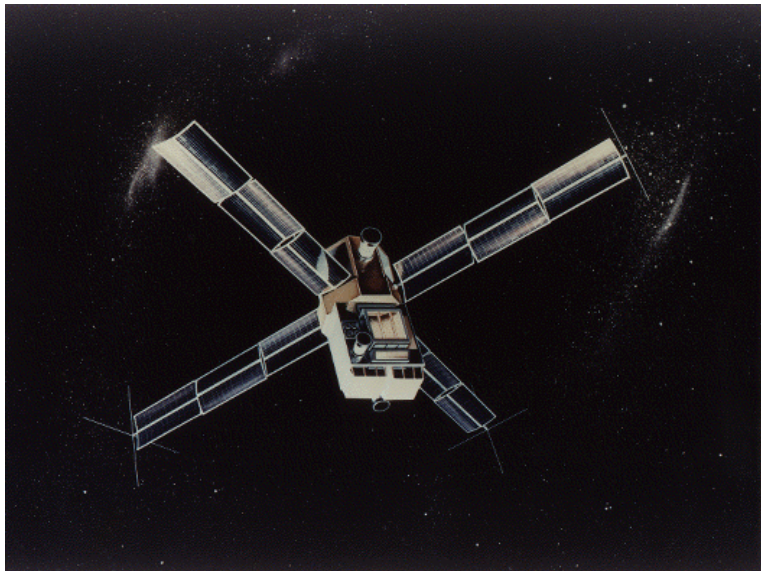
UHURU (Small Astronomic Satellite 1, SAS-1, 1970-1974)



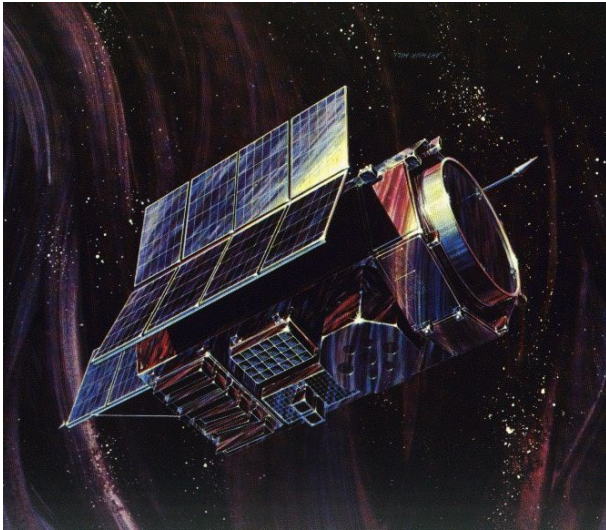
Vela (1969-1979)



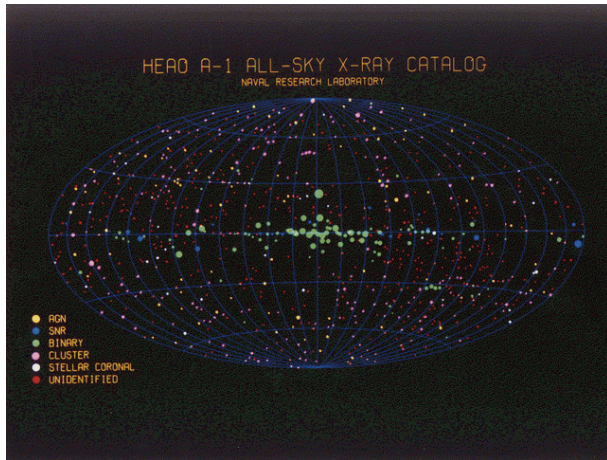
SAS-3 (1975-1980)



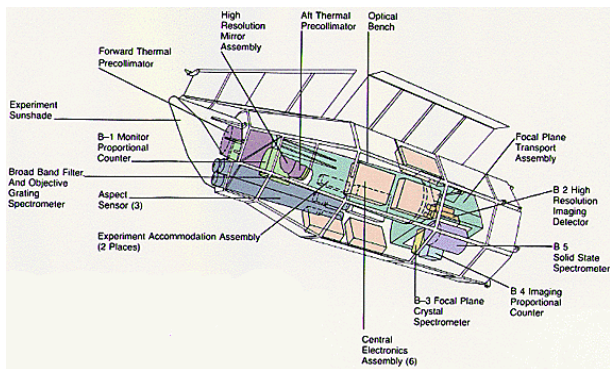
HEAO-1 (High Energy Astronomy Observatory) (1977-1979)



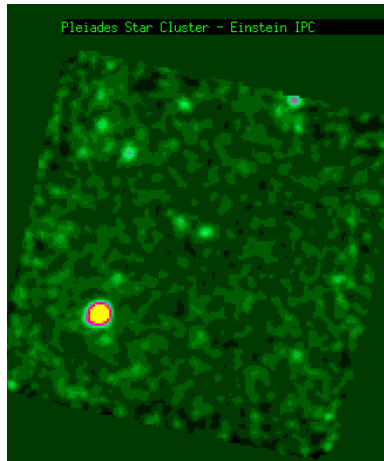
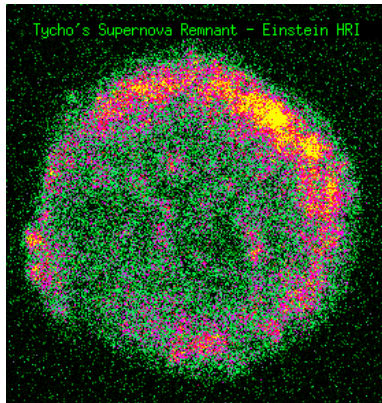
HEAO-1 (High Energy Astronomy Observatory, 1977-1979)



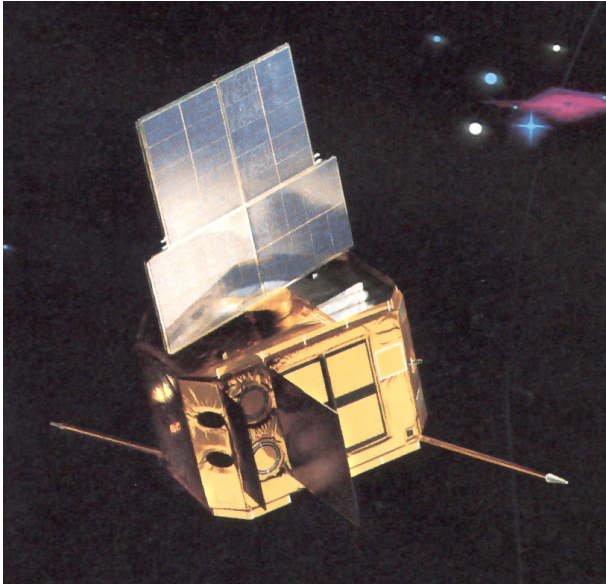
Einstein, (HEAO-2, 1978-1981)



Einstein (HEAO-2, 1978-1981)



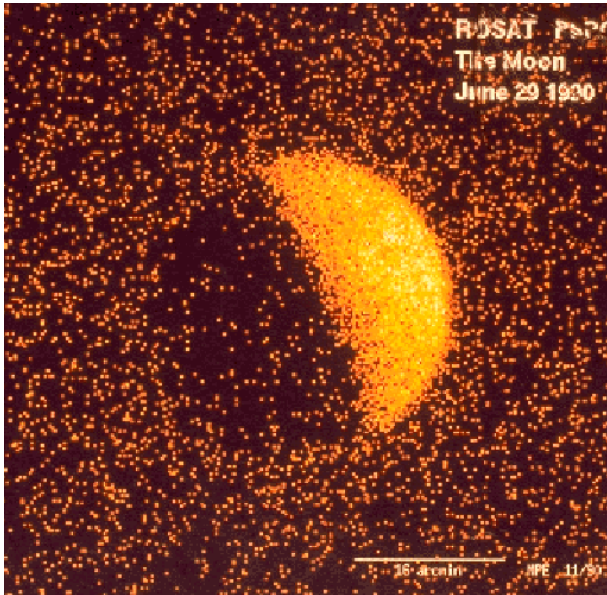
Exosat (1983-1986)



ROSAT (Roentgen Satellite, 1990-1999)



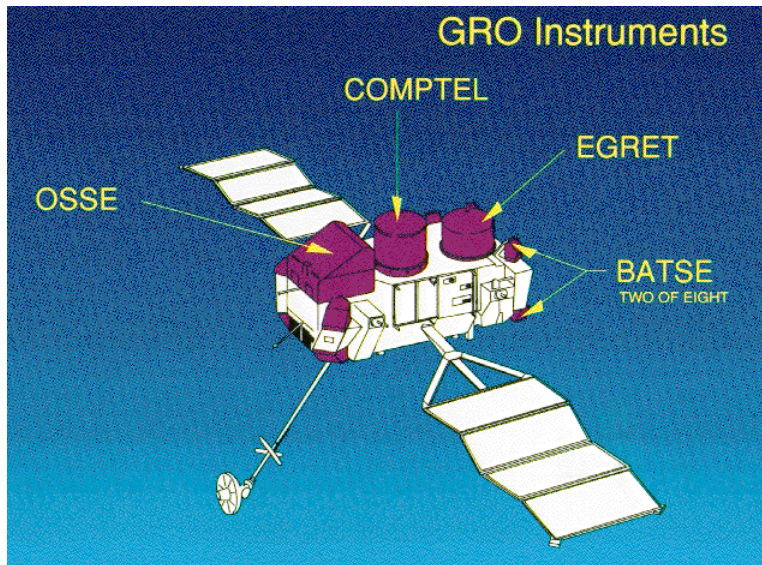
ROSAT (Roentgen Satellite, 1990-1999)



Compton Gamma-Ray Observatory (CGRO, 1991-2000)

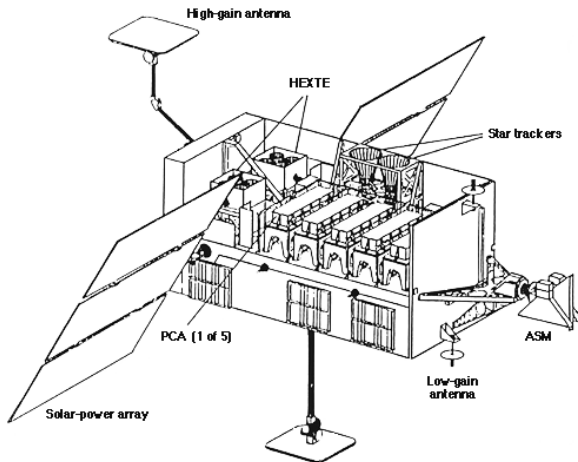


Compton Gamma-Ray Observatory (CGRO, 1991-2000)

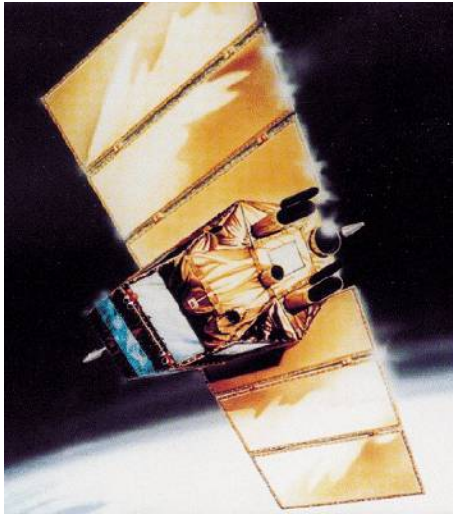


RXTE (Rossi X-ray Timing Explorer, 1995-2012)

XTE Spacecraft



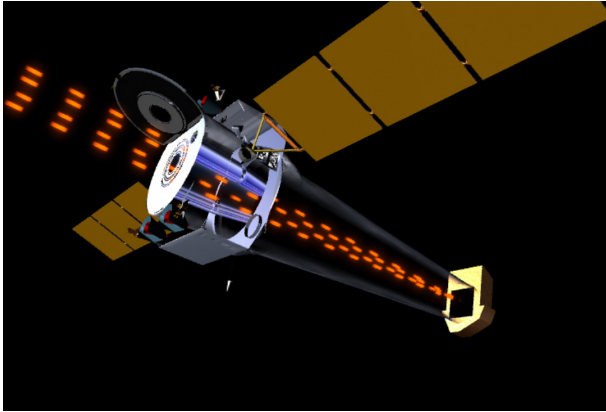
BeppoSAX (1996-2002)



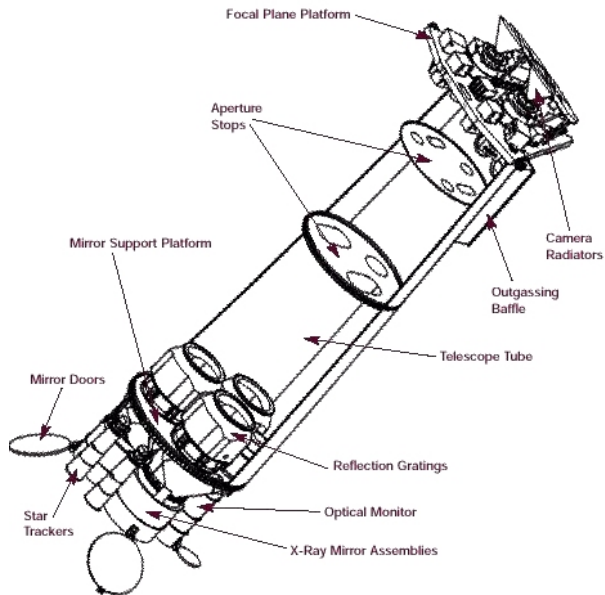
Chandra X-ray Observatory (1999)



Chandra X-ray Observatory (1999)



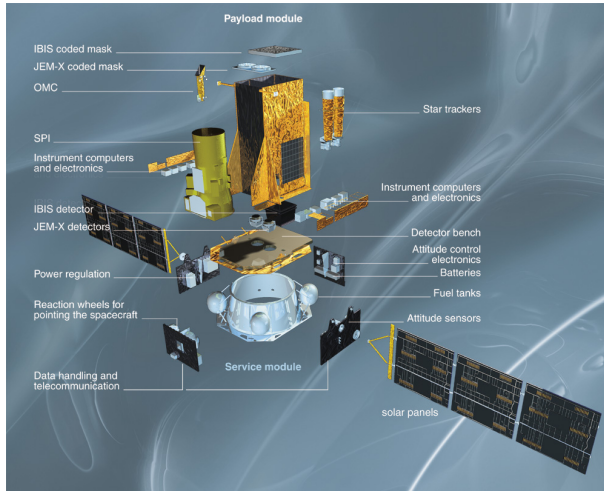
X-ray Multi-Mirror Mission (XMM-Newton, 1999)



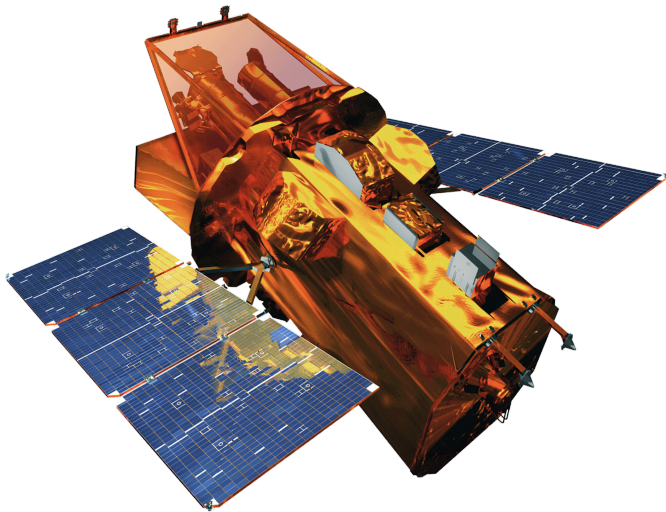
International Gamma-Ray Astrophysical Laboratory (INTEGRAL, 2002)



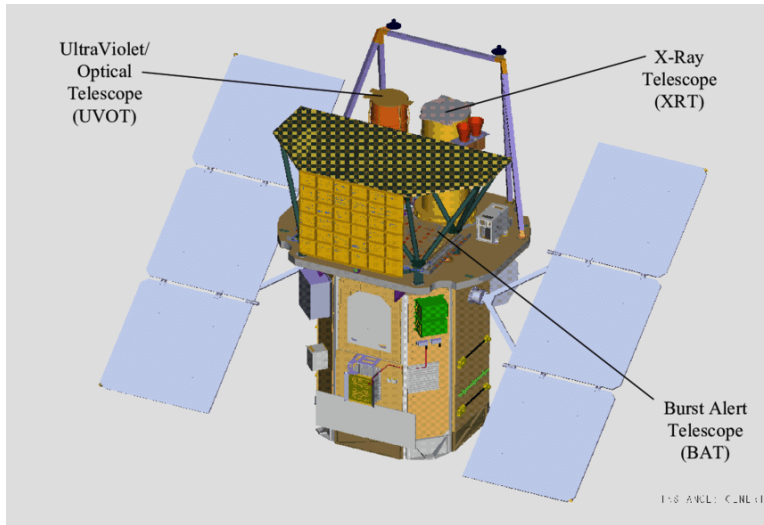
International Gamma-Ray Astrophysical Laboratory (INTEGRAL, 2002))



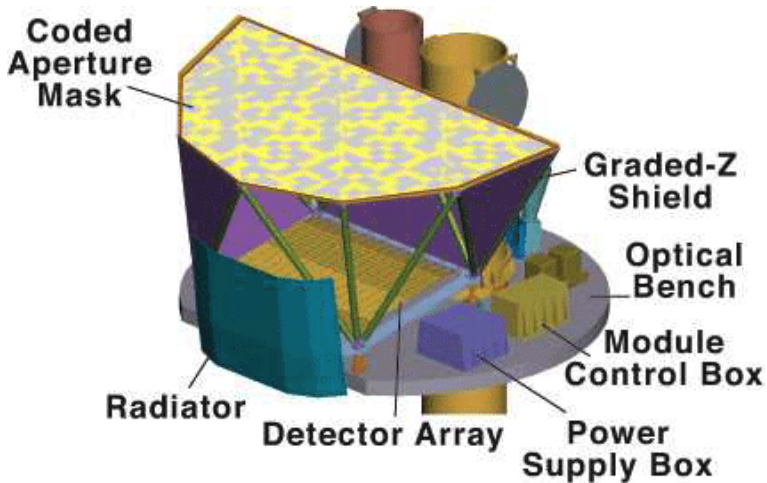
Neil Gehrels Swift Observatory (2004)



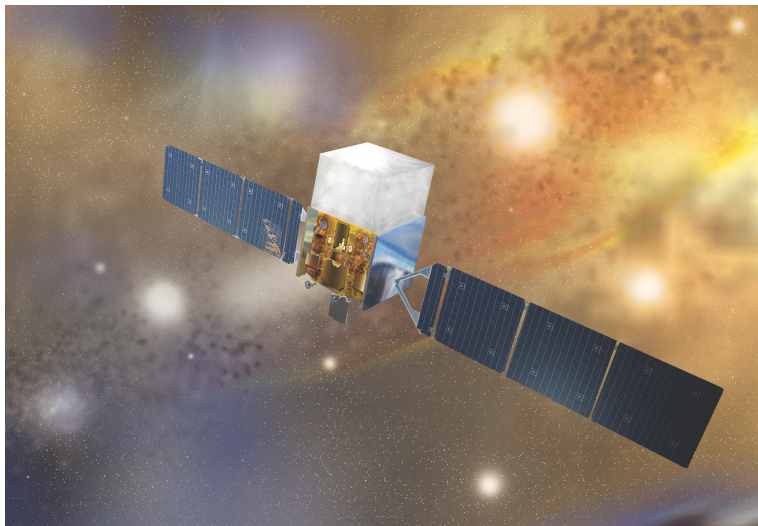
Neil Gehrels Swift Observatory (2004)



Neil Gehrels Swift Observatory (2004)



Fermy Gamma Ray Space Telescope (2008)



Fermi Gamma Ray Space Telescope (2008)

