MSSL UCL

Memories of Ariel 5

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Copernicus: ~ the dawn of X-ray astronomy

Orbiting Astronomical Observatory OAO-3, named "Copernicus“ (1972 - 1981), collaboration NASA – UK SRC

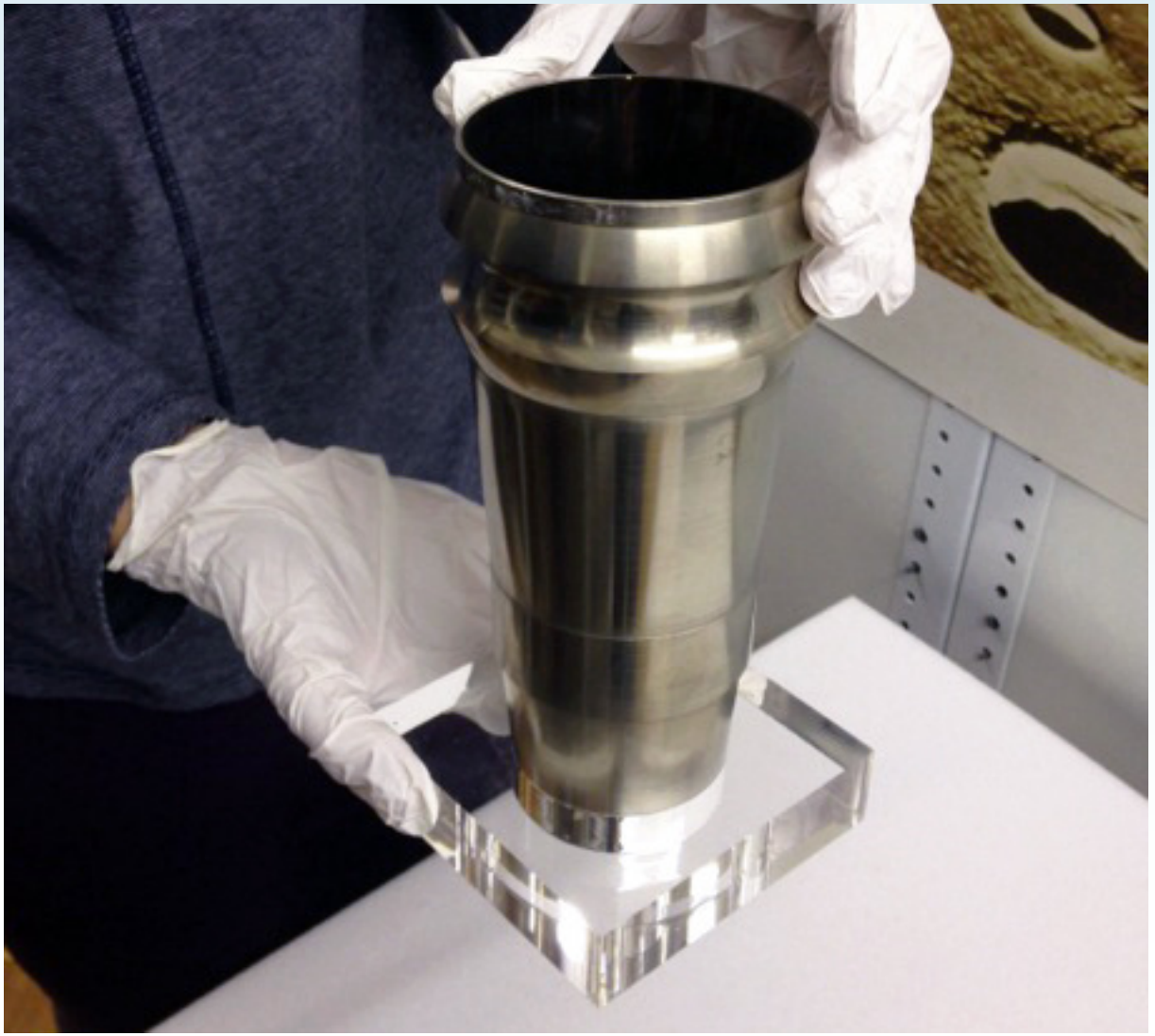
- Piggybacked on main UV telescope
- First X-ray telescope to be precisely pointed
- First grazing incidence focussing X-ray telescopes (3, non-imaging prop. counters)
- One collimated prop. counter (1 – 3 A)
- Enabled visible light identification of X-ray sources
- Resident astronomer at NASA GSFC
- US government SCAMA line
- Observing plan discussed and fitted in with prime UV instrument
- Guest Observers phoning in their suggestions

Copernicus spare grazing incidence mirror

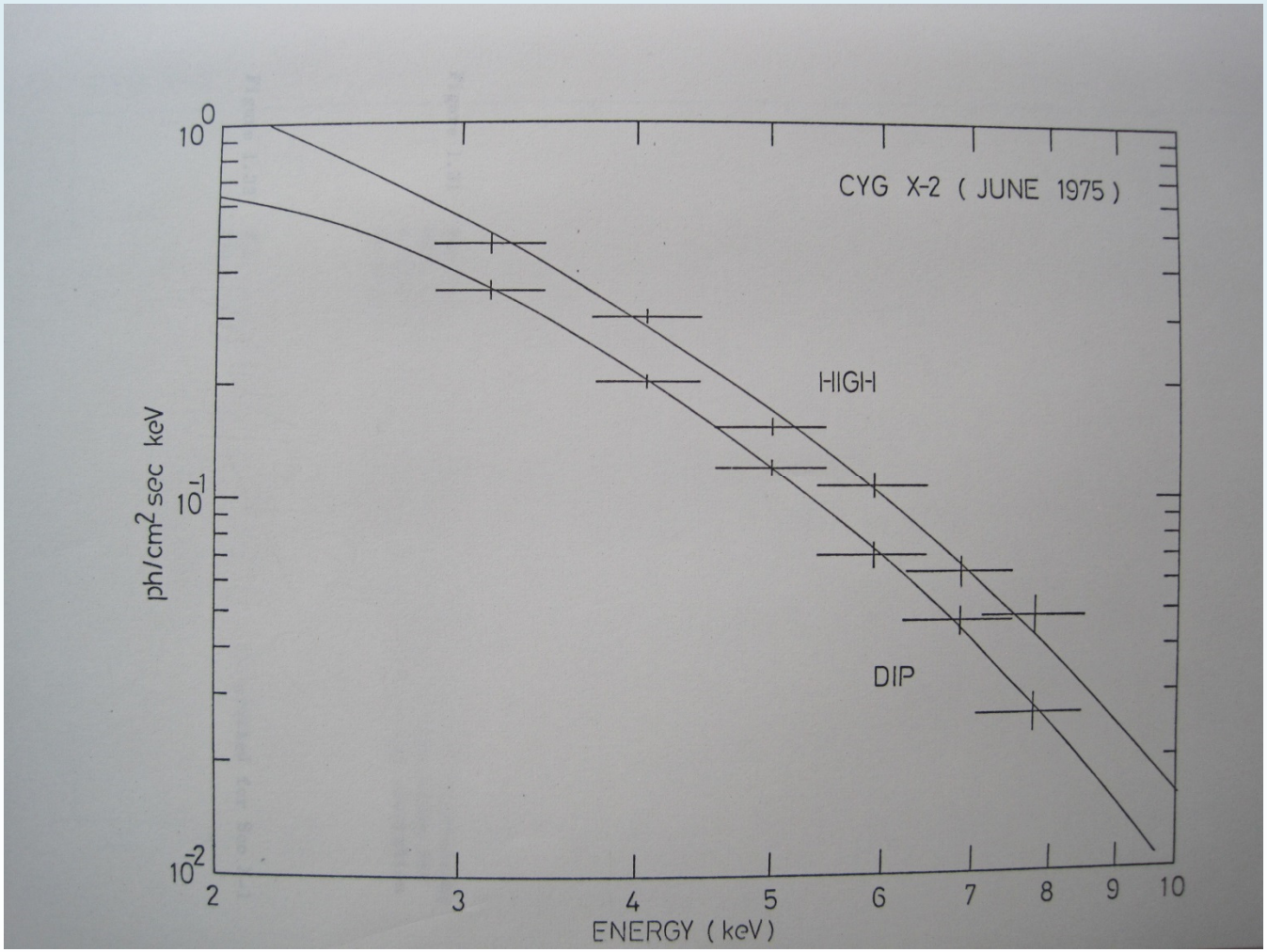
A flight spare of one of the grazing incidence mirrors

The mirror was part of the X-ray telescope built by MSSL.

Now held in the collections of the Science Museum, London



Copernicus: Cyg X-2



Branduardi 1977

Copernicus: X-ray pulsators

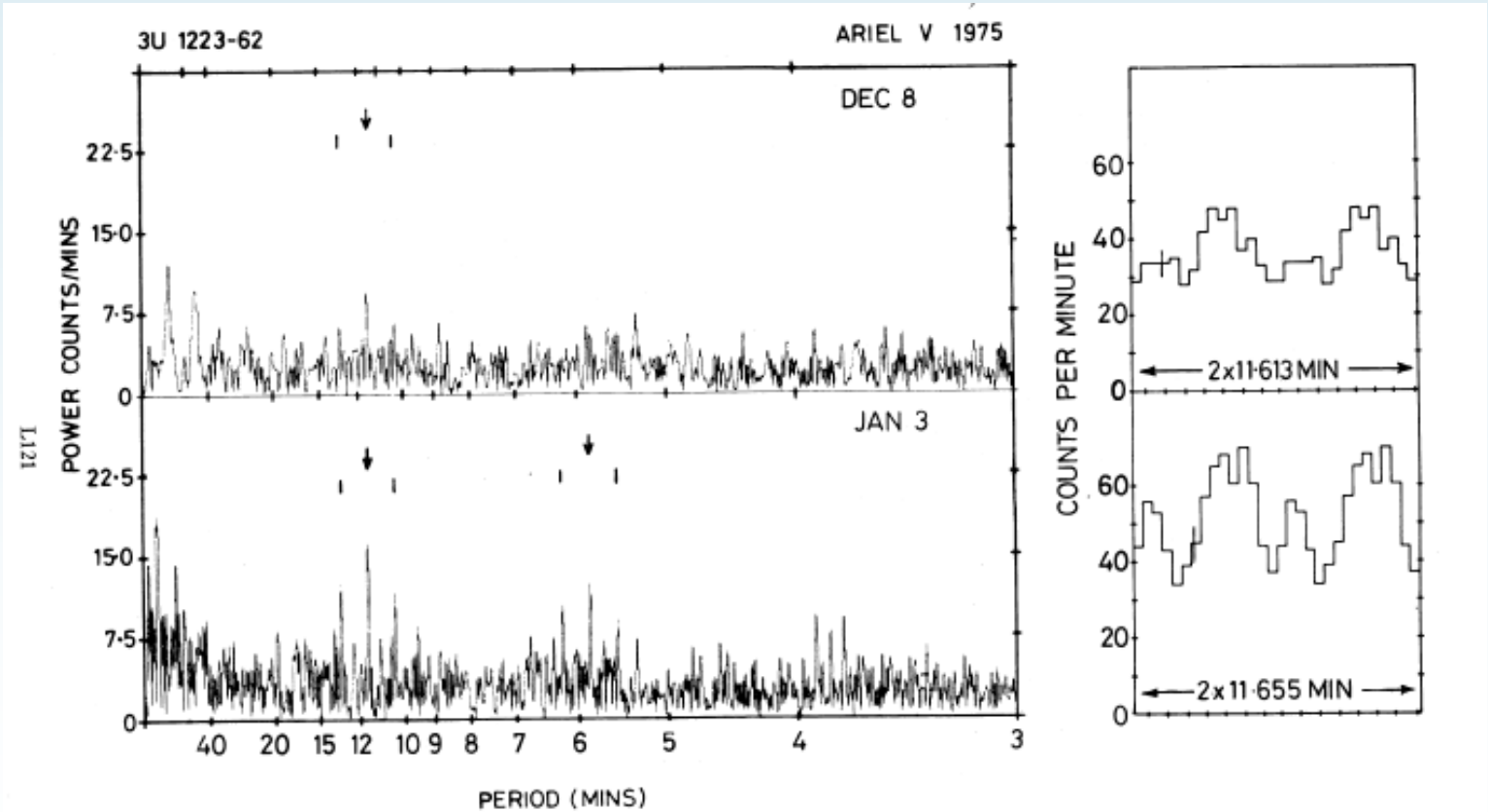


FIG. 1.—(*a*) The two periodograms for 3U 1223−62. Primary peaks are marked by arrows and those resulting from convolutions with the window spectrum by bars. Power at periods ≥ 40 minutes results from both the effects of the orbital period of the satellite and long term variability of the source. (*b*) The data for 3U 1223−62 folded into 15 bins and repeated twice.

White et al. 1976

Copernicus: the dawn of X-ray spectroscopy

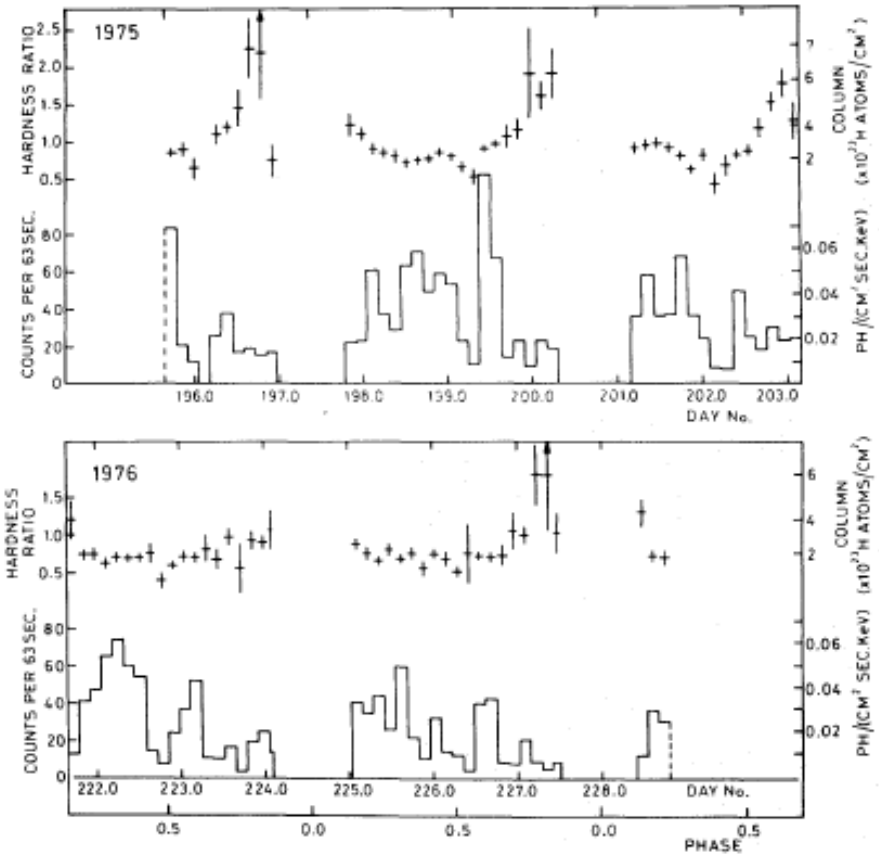
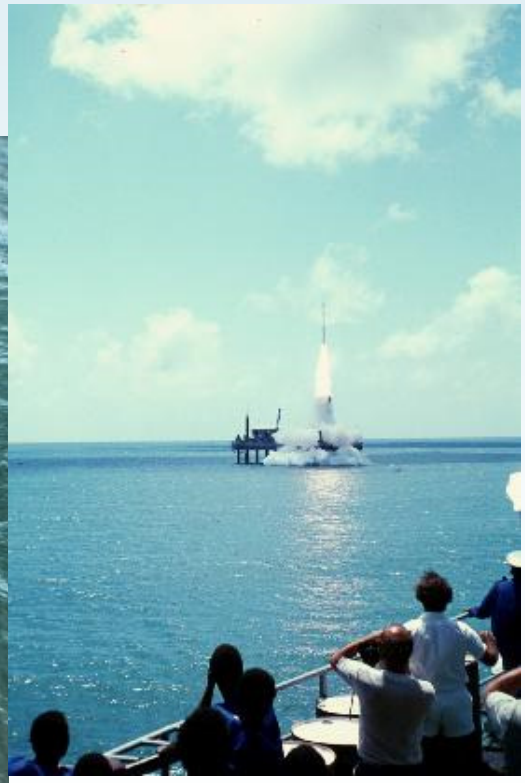


Figure 1. 1975 and 1976 *Copernicus* X-ray light curves of 3U 1700 – 37, after background subtraction, plotted as histograms with bins of ~ 3 hr duration. A hardness ratio (see text) is also shown. On the right side of the graph the equivalent values of the line of sight hydrogen column density are given for a bremsstrahlung fit to the data (with constant temperature T = 21.5 keV).

Branduardi et al. 1978

Ariel 5: mission and logistics

Two weeks after I arrived at MSSL as a new PhD student, Ariel 5 was launched (Oct. 1974 – March 1980)

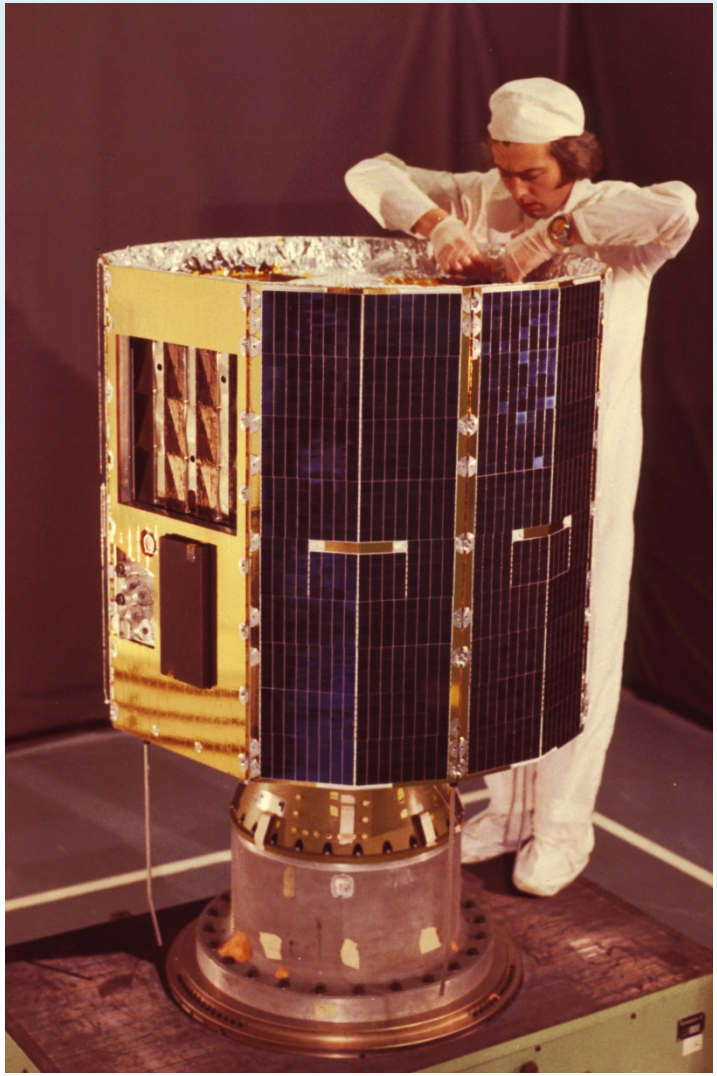


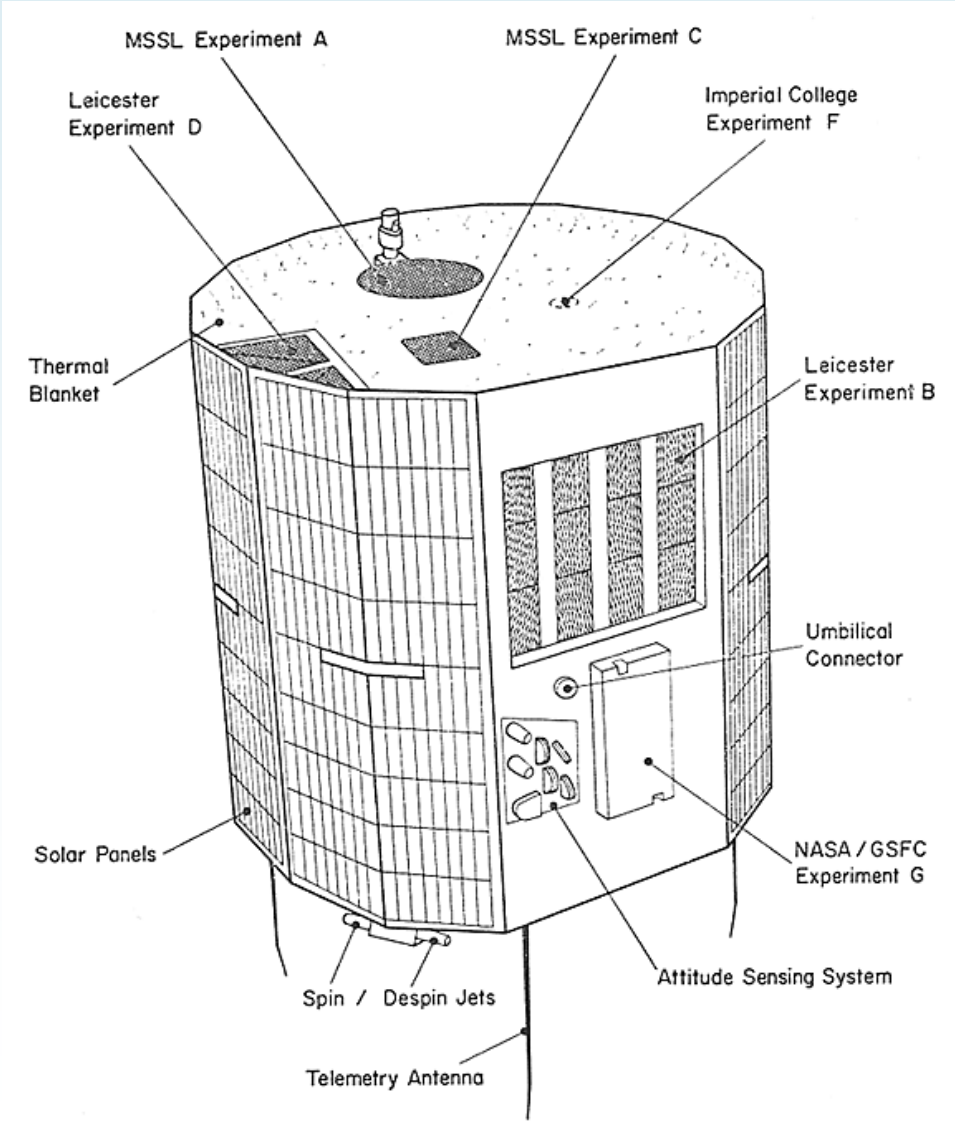
Ariel 5: mission aims and make up

- British-US collaboration, aimed at monitoring the X-ray sky with a comprehensive payload
- Experiments aligned with the spin axis:
  - A - Rotation Modulation Collimator (0.3-30 keV, 2' positioning)
  - C - High resolution proportional counter spectrometer (0.3-20 keV)
  - D - Polarimeter/spectrometer (2-8 keV)
  - F - Scintillation telescope (time/spectra study up to 40 keV)
- G - All-Sky Monitor (ASM): a small (~1 cm^2) pinhole camera (3-6 keV)
- B - Sky Survey Instrument (SSI) composite of two proportional counters with 290 cm^2 effective area each (1.5-20 keV)

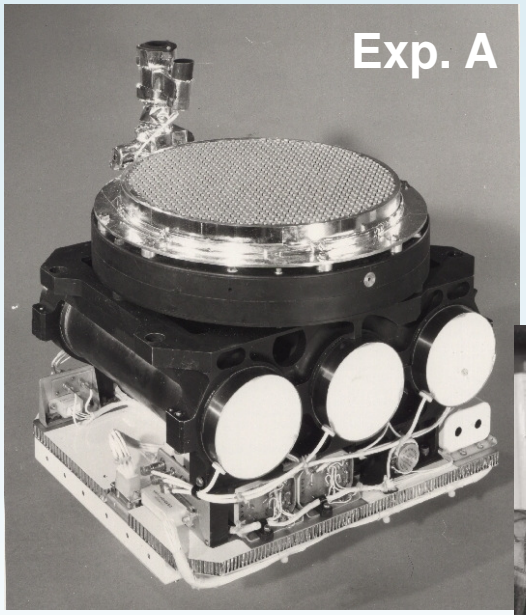
- Data collected at RAL:
  - 'Electric' (remote terminal and smelly printouts)

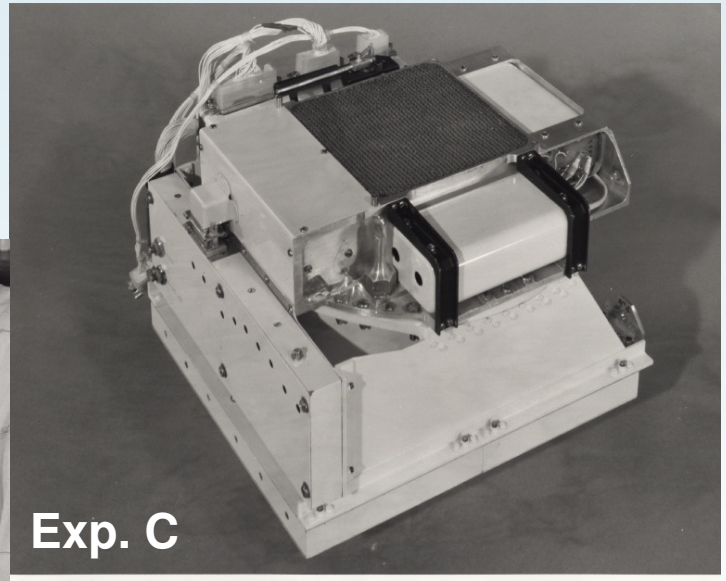
Ariel 5: what it looked like

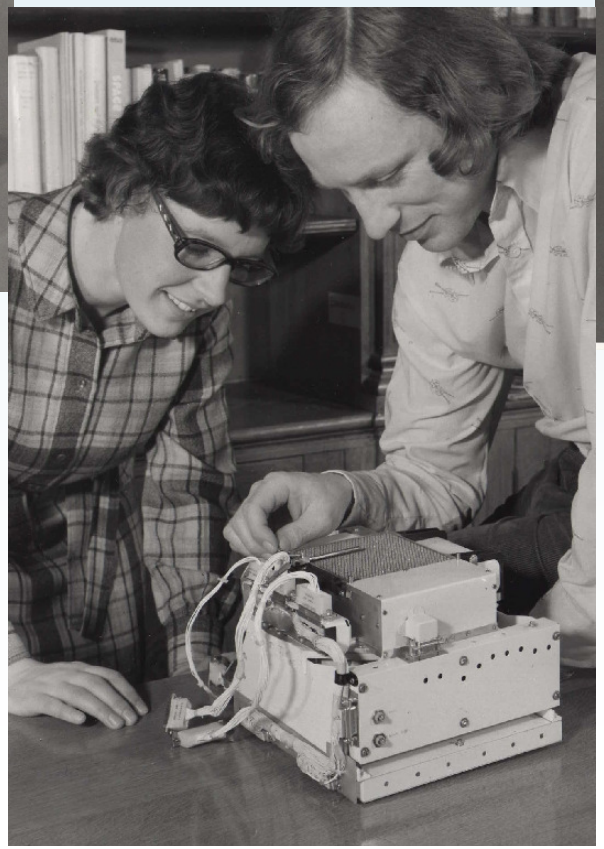




Ariel 5: MSSL Exp. A and C







Jocelyn
Bell Burnell

John Ives
and Exp. C

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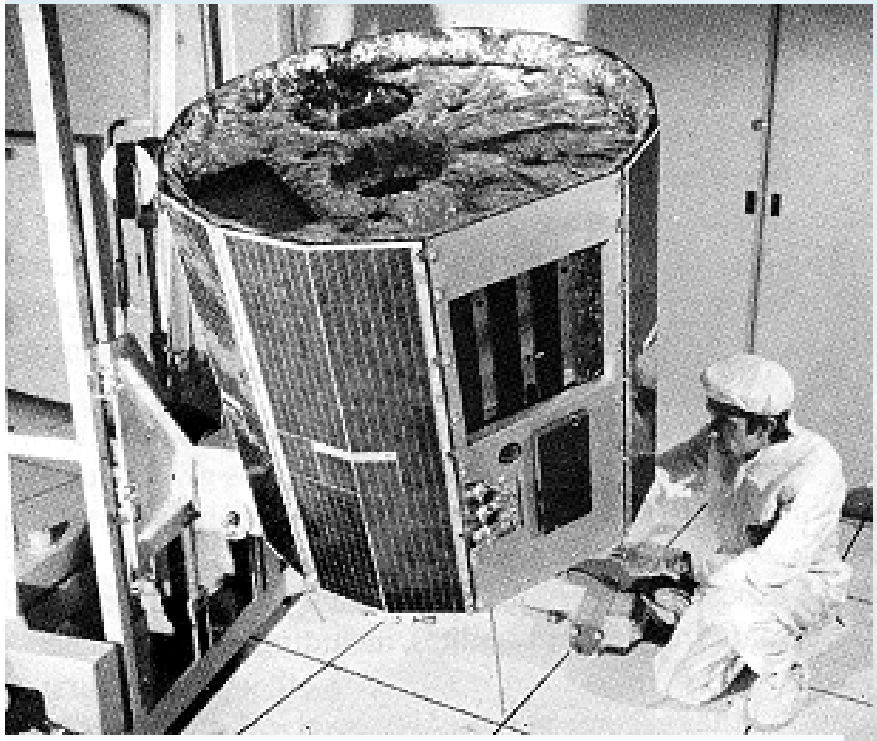
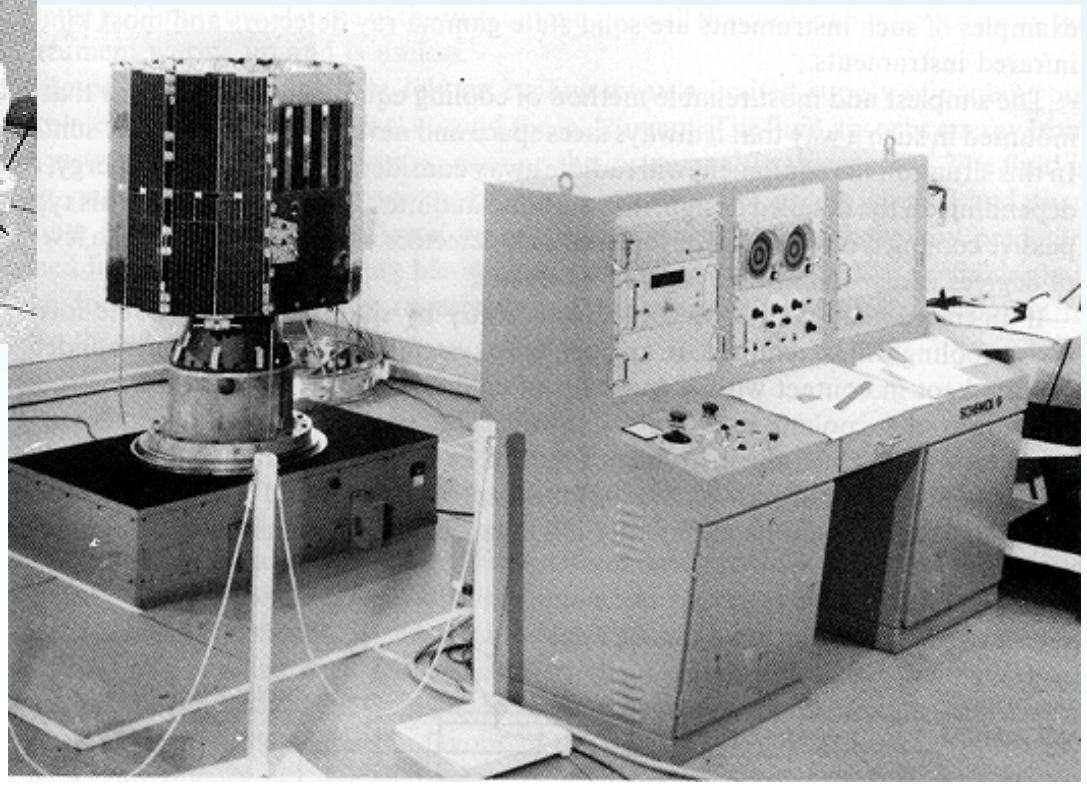
Ariel 5: Assembly and spin test





Ariel 5: Science highlights

- Long-term monitoring of numerous X-ray sources
- Discovery of several long period (minutes) X-ray pulsars

  White et al. 1976, 77
- Discovery of several bright X-ray transients probably containing a black hole (*e.g.* A0620-00 = Nova Mon 1975) ***Elvis et al. 1975***
- Establishing that Seyfert I galaxies are a class of X-ray emitters

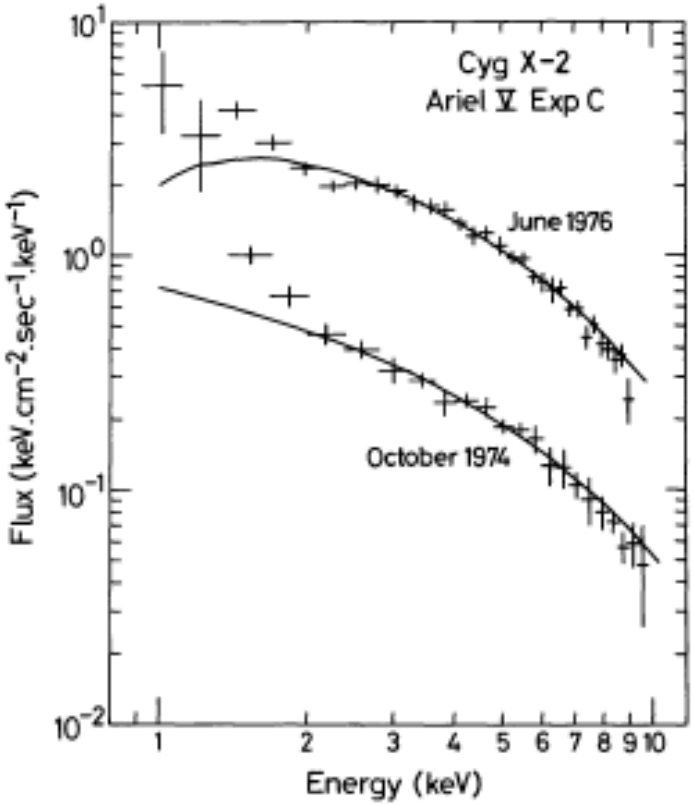
  Hayes et al. 1980
- Discovery of iron line emission in extragalactic sources

  Mitchell et al. 1976

Ariel 5: Cyg X-2

Summary. The spectrum of Cyg X-2, determined by Ariel V Experiment C observations, is best fitted by a thermal Bremsstrahlung model only at energies higher than ~2 keV. At lower energies an excess of flux above the theoretical curve is clearly present and on occasions there is evidence for a feature between 2 and 3 keV: the latter may be indication of a break in a two-component spectrum or an absorption feature of the type expected from X-ray transfer in an optically thick environment. The 2–10 keV flux of Cyg X-2 is seen to vary by about a factor of 5 between two Ariel V observations 20 months apart. In the present paper we attempt to interpret these observational results in the context of X-ray reprocessing in a neutron star binary system.

Key words: X-ray binaries – Cyg X-2



1. Introduction

B-R et al. 1984

Ariel 5 & Copernicus: The X-ray transient A1742-28 at the Galactic Centre

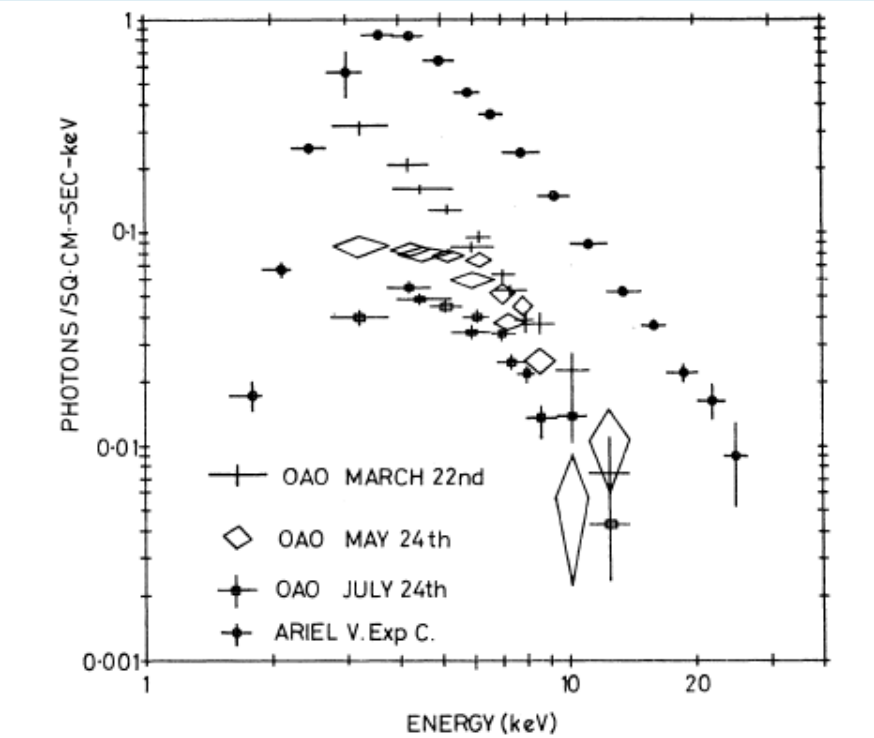


FIG. 4. *Comparison of spectra of A 1742−28 obtained in 1975 February with Ariel 5 Exp. C and in 1975 March, May, July with Copernicus.*

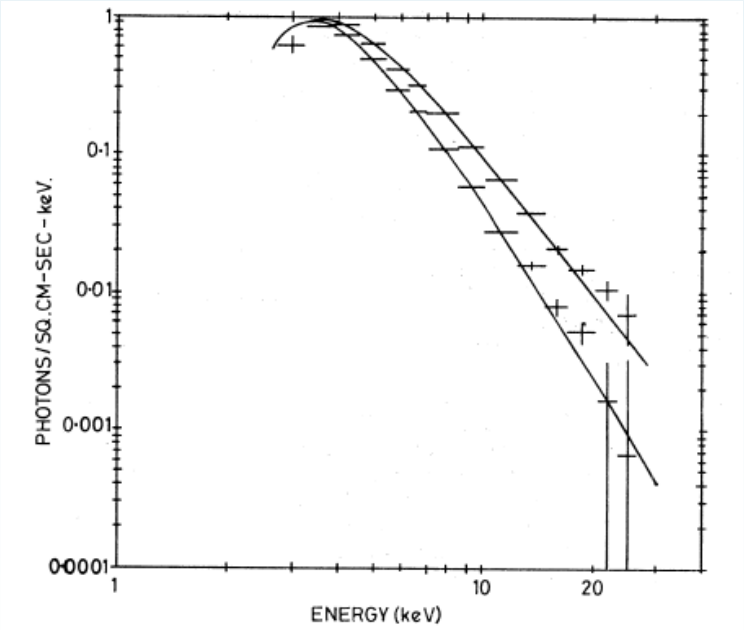


FIG. 5. *Ariel 5 Exp. C spectra of A 1742−28, at minimum and maximum relative intensity of the source during the event between 1975 February 26 and 28.*

Branduardi et al. 1976

Cherished memories of fast developing science, a field still uncrowded … when whenever you looked at in X-rays you would make some form of discovery!

Thank you!