

Riccardo Giacconi - a hard act to follow



Ken Pounds
University of Leicester

in 1956

Riccardo was studying cosmic radiation with Beppo Occhialini in Milan

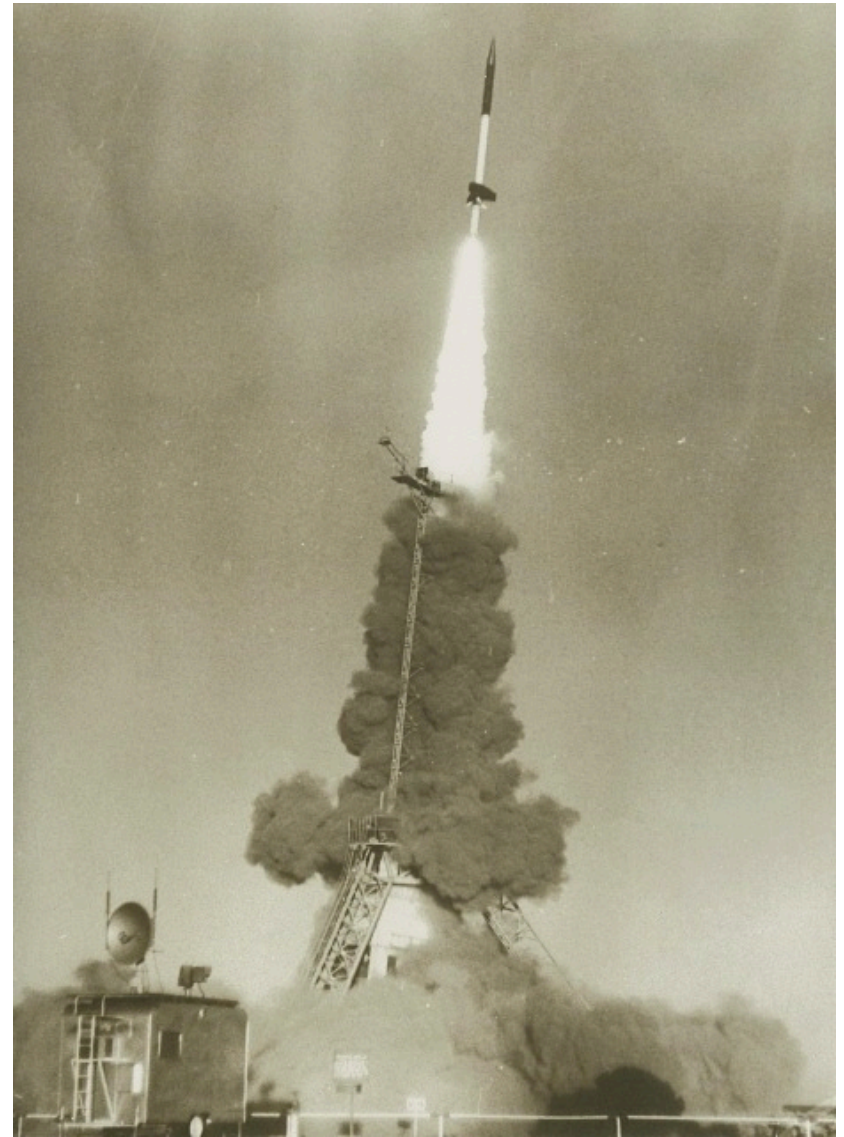
as I graduated in Physics at UCL and accepted an Admiralty grant to join the new **Rocket Group**

initially with no rocket and no project

but 3 more years of student life in London was attractive

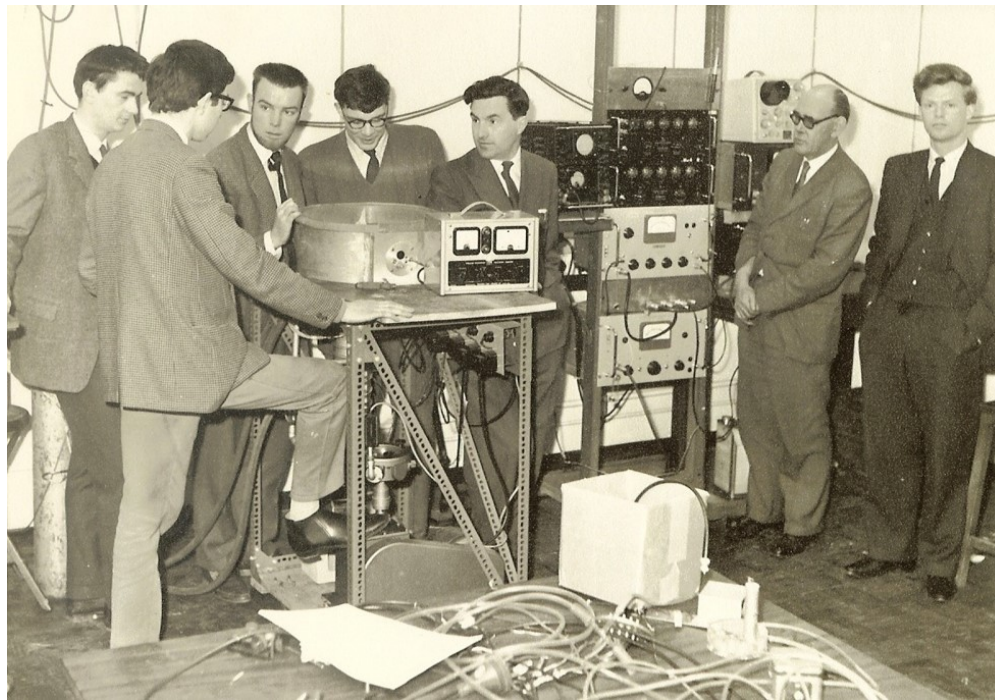
1957 Skylark duly arrived

- first flight at Woomera in February
- payloads of 150 kg to 300 km (10 mins for x-ray observation)
- Sun-pointing version from 1964
- PhD project : 'Observing the Sun's X-ray emission'
- data from flights in 1959 and 1960



1959 RG joined American Science and Engineering, a small military-space company in Cambridge

1960 I was 'transferred' to a Lectureship at Leicester to set up a Research Group to study 'solar and stellar X-ray sources'



with the Sun as the first (only realistic ?) target

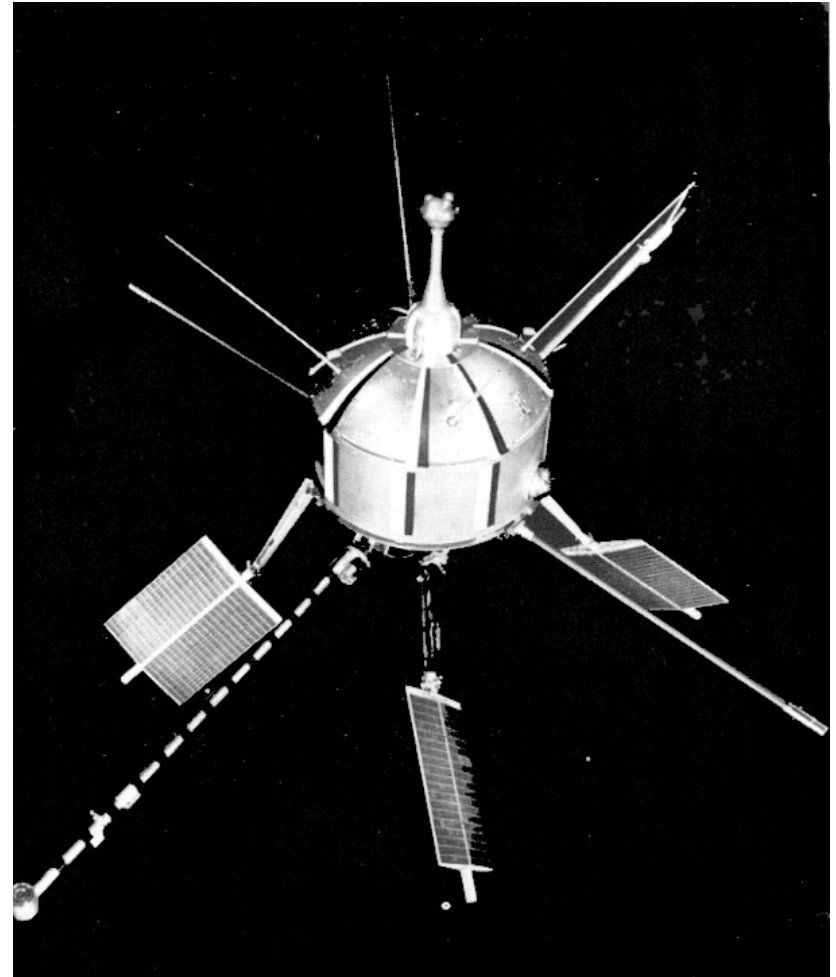
April 1962

Ariel 1 – exploring the ionosphere

taking my solar spectrometer into orbit

Delta launch from Canaveral
on 26 April

All worked fine for 2.5 months,
then ...



9 July 1962



‘The sky glowed red over Honolulu as X-rays from the Starfish nuclear test excited atomic oxygen in the atmosphere’

2004 report to US Congress

USAF 100Mt hydrogen bomb detonated 400 km above Johnstone Island in the Pacific

swamping PCS detectors with radioactive debris!

- also seriously damaging the spacecraft solar arrays

DOD denials but then other satellites failed....

Riccardo was there!

meanwhile – a few weeks earlier (12 June) – Herb Gursky led the ASE team at White Sands where....

- Sco X-1 was detected in the historic Aerobee night-time rocket flight from – an x-ray source brighter than the Sun above $\sim 5\text{keV}$
- then in
- 1963 extended emission from the Crab Nebula – and Sco X-1 seen again during an NRL rocket flight

Cosmic X-ray astronomy became our priority at Leicester.....
with Skylark allowing early access to the Southern Hemisphere

Our plan was to fly the largest PCS arrays that would fit under the nose cone



- SL 118 (10 April 1967)
- 295 cm² PC. FOV 30x30 deg.
- First use of PSD background reduction
 - Cen X-2 brighter than Sco X-1 !
 - Cen X-3 not seen !
- SL 723 (July 1968) and 724 (April 1969)
- 2 x 1380 cm² PCs (similar to Uhuru)
- X-ray spectra of brighter sources

1970 UHURU launch made such surveys redundant

1967 6-month Sabbatical at AS&E after a Leicester visit by Martin Annis



- a great experience for my young family.....
- and a culture change for me
- few constraints on my involvement

1971 a second summer visit to Cambridge and the chance to work on UHURU data



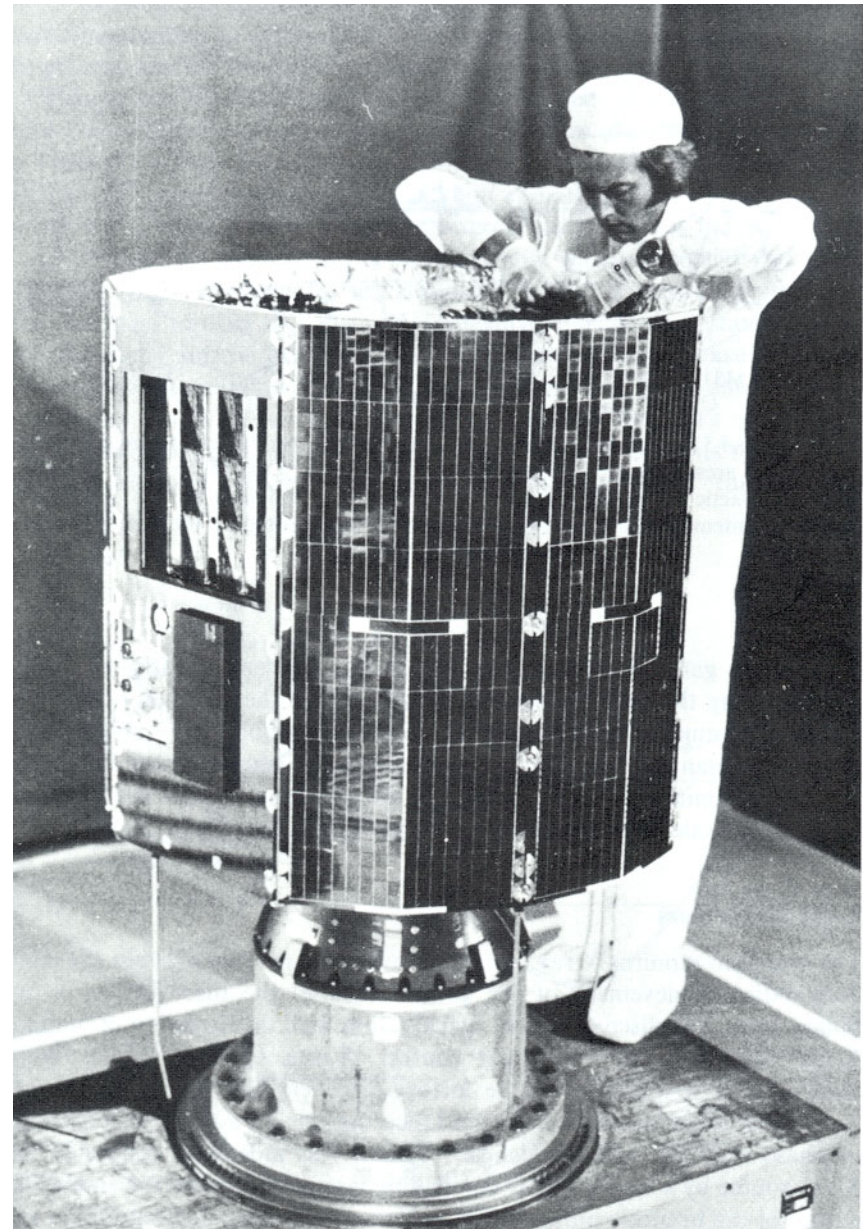
and plan our response with Ariel 5

Ariel 5 (1974-1980)

- Sky survey instrument (Leicester)
- On-axis PC spectrometer (UCL)
- Bragg spectrometer/polarimeter
- Hard X-ray instrument (Imperial)
- All-sky-monitor (Goddard)

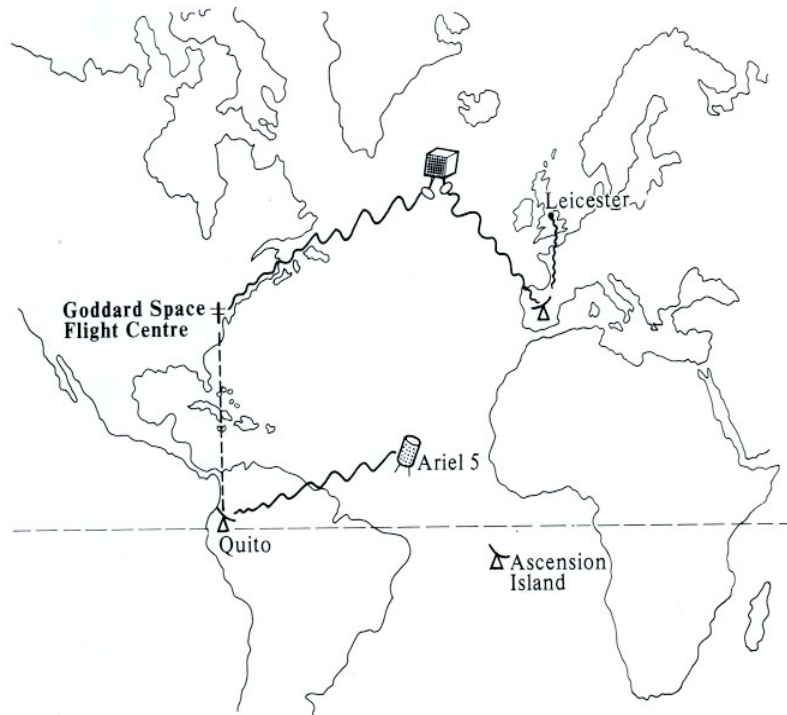
a more complex payload but same
Scout launch vehicle and LEO orbit

....with similar operational features



Sky Survey Instrument

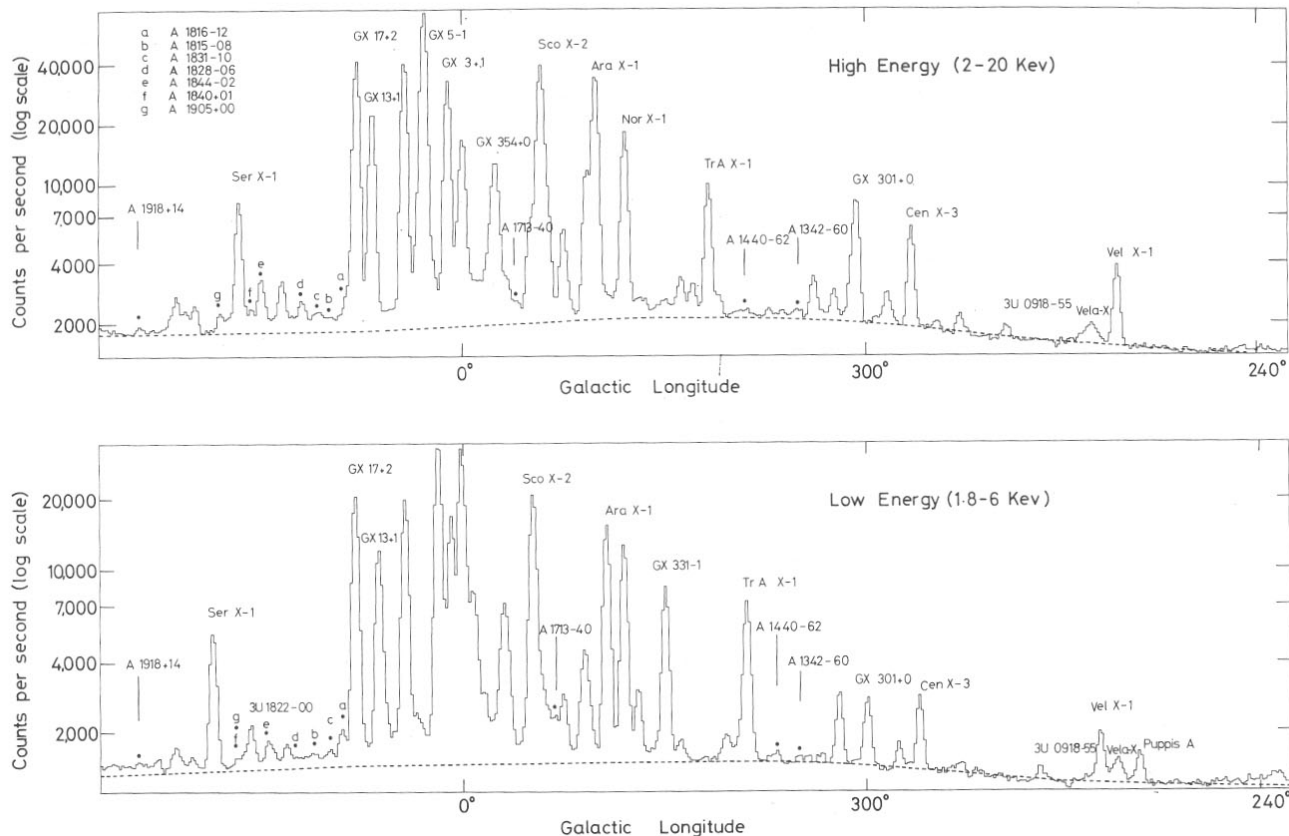
6 orbits of data and commands in near real-time
with bulk data within 24 hours



- SSI data (sector, time, energy) stored in 1024 (16 bit) words over each orbit
- quick-look data monitored by duty scientists

(Elvis, Griffiths, Lawrence, McHardy, Seward, Turner, Watson, Villa)

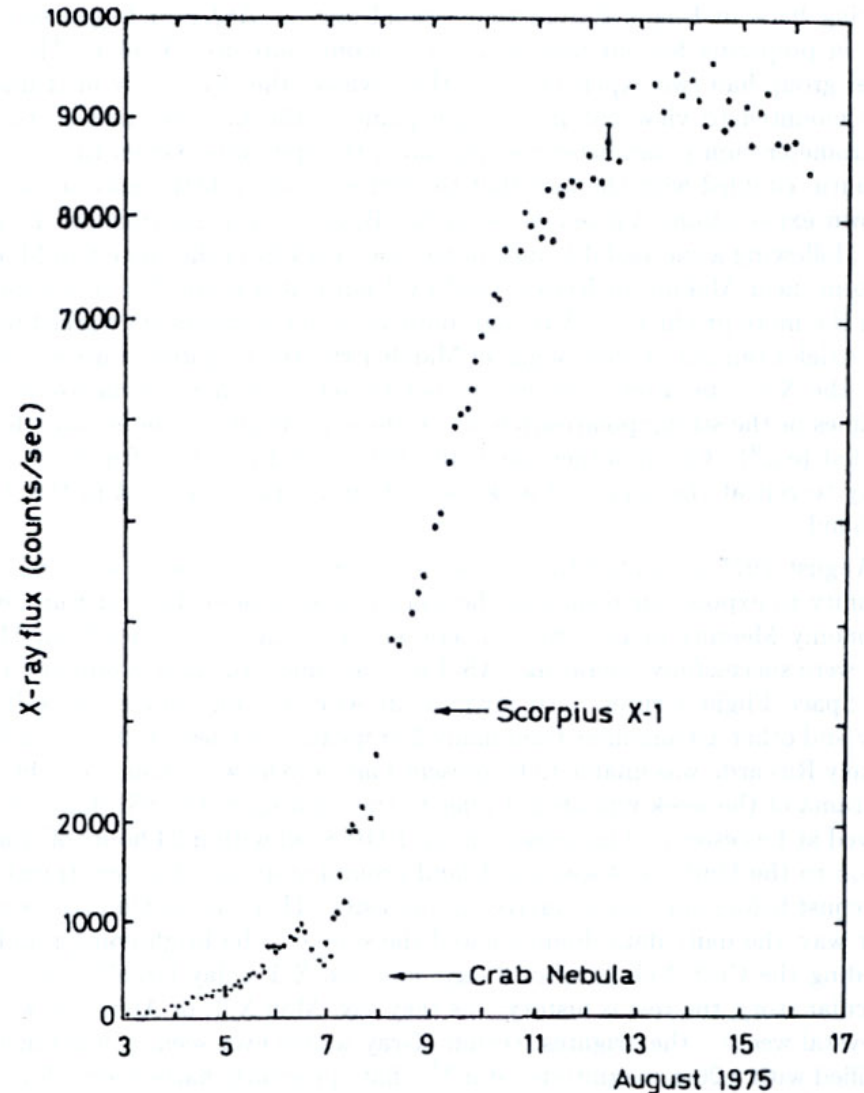
Strategy to leave the satellite spin axis pointing at the Galactic pole for periods of 10 - 14 days was productive



transient sources and X-ray binary light curves a strong feature

A0620-00 (nova Mon)

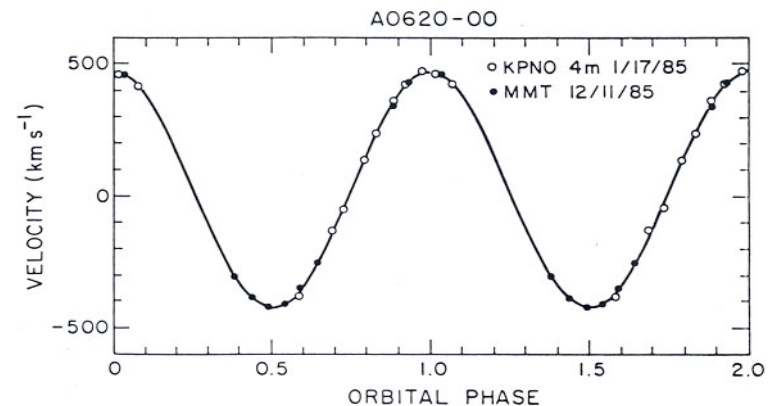
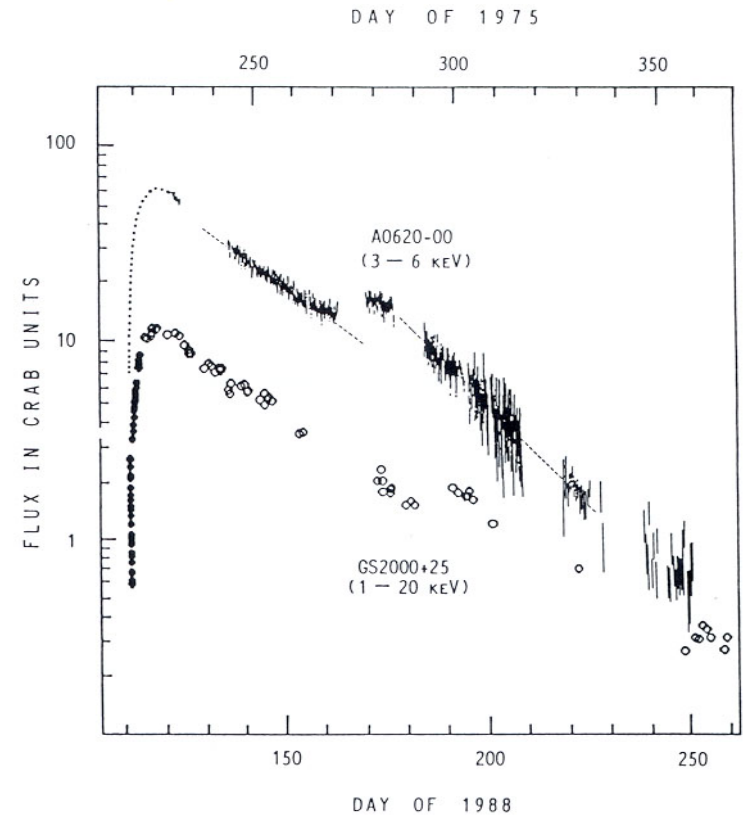
- new X-ray source seen over weekend 2/3 August 1975
- brightened rapidly as astronomers arrived for arrived for 1st European Astronomical Society meeting, at Leicester
- priority target for radio and optical telescopes worldwide



A0620-00

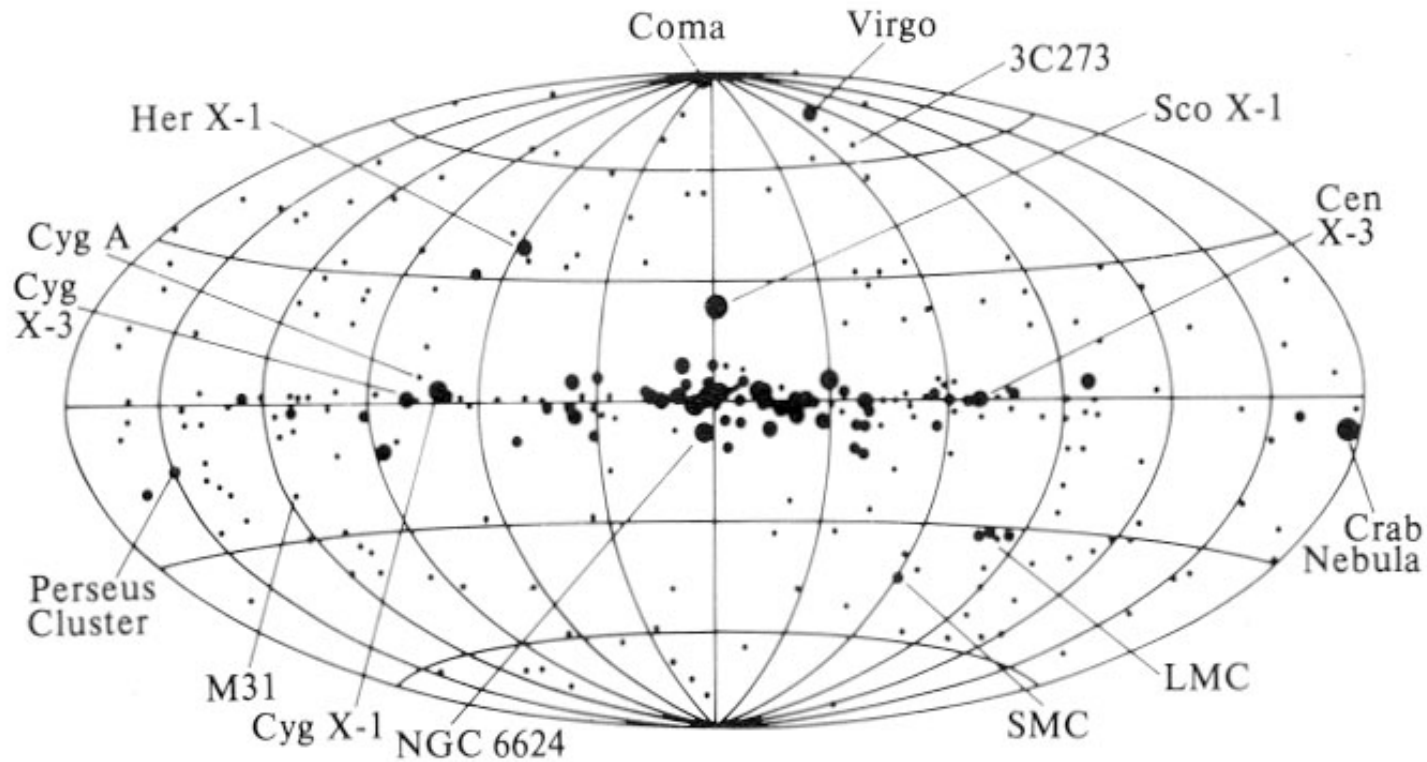
- optical spectra showed a 7.8 hr binary
- high orbital velocity implied unseen companion too massive for neutron star
- now confirmed as $\sim 6.5 \pm 1.5$ solar mass black hole with spin $\sim 0.12 \pm 0.15$
- predicted to flare again in 2033

message from Lucy Hawking on the way
to A0620-00



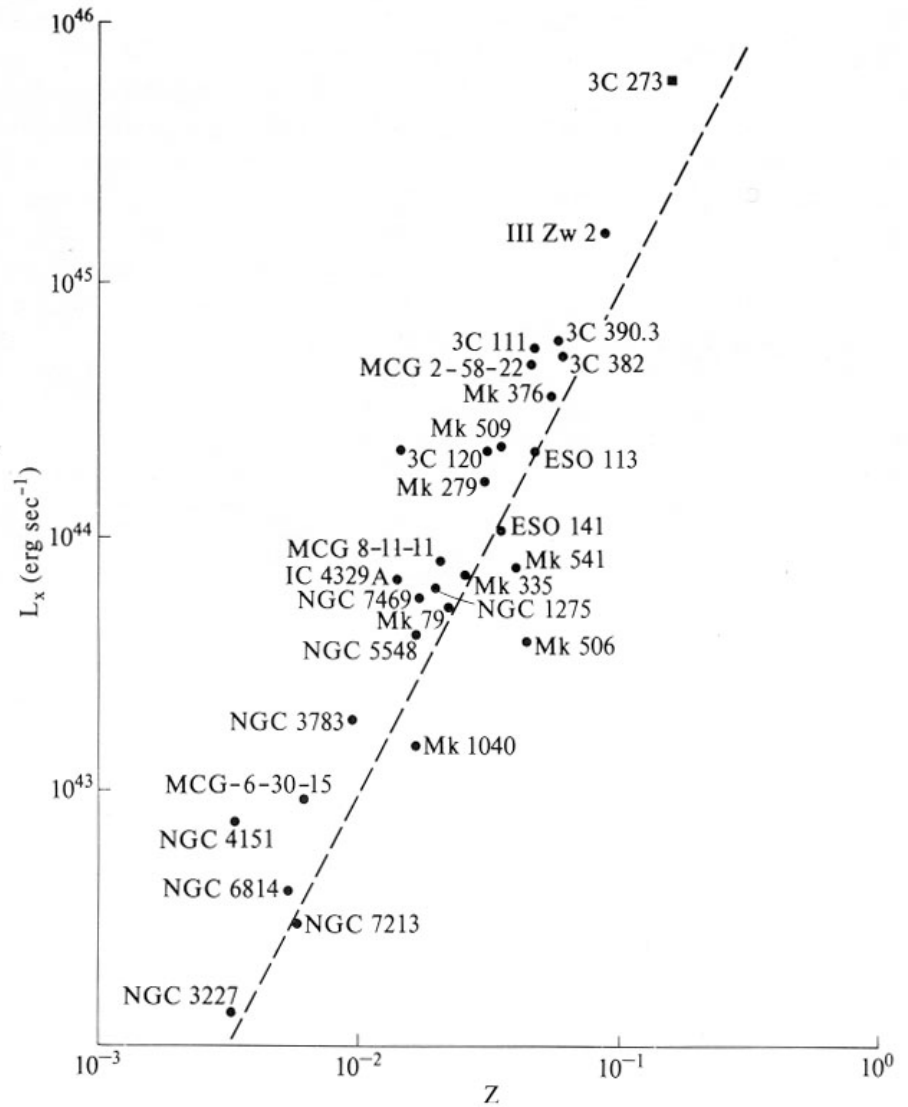
1978

297 cosmic X-ray sources in 2A catalogue



many as in the 3U catalogue – but others at high latitude were unidentified
..... briefly termed the UHGLS

- optical follow up by Cooke, Elvis, Wilson et al showed many of the UHGLs to be normal Seyferts – with others being galaxy clusters
- in 3A and 4U catalogues Seyfert galaxies now appear as a major class of luminous x-ray source



1979 Einstein Observatory – the first imaging X-ray Telescope

- arc second imaging
- George Fraser contributed to development of the HRI
 - rewarded opportunities for Leicester postgrads and postdocs to visit CfA

and a challenge to identifying a first X-ray mission for ESRO



In 1981 RG moved to Baltimore as Director of the Hubble Telescope Operations

- the pace of the US programme slowed, with the challenge of delivering AXAF, a larger, higher resolution X-ray telescope, stretching the NASA budget
- But other missions filled the gap...

with Leicester contributing to Exosat (1983), Ginga (1987), Rosat (1990), Swift (2004)

and XMM-Newton

Fast forward:

1999 saw two major X-ray Observatories launched

Chandra –
formerly AXAF



XMM-Newton



With 20th anniversaries in December providing a worthy tribute to Riccardo Giacconi truly the 'Father of X-ray Astronomy'