Riccardo Giacconi

Uhuru & Einstein: The Blossoming of X-ray astronomy
Ambitious plans were made for future missions, following the detection of Sco X-1 and an isotropic X-ray background on June 18, 1962 (Giacconi, Gursky, Paolini, Rossi 1962, Phys Rev Letters 9, 439)
Uhuru - launched December 12, 1970 (Kenyan Independence day) from an Italian launch platform off the coast of Kenya. Uhuru was built and operated by scientists at AS&E Giacconi, Kellogg, Gorenstein, Gursky, Tananbaum: 1971 ApJ 165, L27 Schreier, Murray, Matilsky, Tucker
“The launch of Uhuru was a triumph for our group, for me personally, and I daresay for all astronomy. … Nature, always kind, rewarded us with dazzling sights…..Had I but known it, those were the happiest years of my life.”

R. Giacconi

“Secrets of the Hoary Deep”
Uhuru scan of the sky

Individual scans (not summed daily scans) were used to measure and look for changes over time in intensities of X-ray sources e.g. pulsations (Cen X-3) or binary periods (Her X-1, 4U1700-17)
Scan of galactic plane

20% of daily Uhuru data received as “quick-look” allowed rapid changes in observing schedule.
Uhuru scans of the sky provided source “lines of position”

These were then used to determine source positions “Uhuru catalogs”
Accurate positions from Uhuru allowed optical identifications.

X-ray binaries with luminous optical counterparts - OB supergiants (not like Sco X-1)

Discoveries from Uhuru - X-ray pulsars in binary systems

Hercules X-1 (Tananbaum+ 1972)

Centaurus X-3 (Giacconi+ 1971)

Centaurus X-3 (Schreier+ 1972)

Hercules X-1 (Giacconi+ 1973)
X-ray source intensity variations on timescales of seconds - (e.g. Cyg X-1, Oda+ 1971, Schreier+1971) to years (e.g. recurrent transient 4U1630-47, Jones+ 1976)
Discoveries based on Uhuru observations -

Extended X-ray emission from clusters of galaxies

Forman et al, 1972
ApJ 178, 309
Uhuru detections of active galactic nuclei

X-ray emission from AGN
Centaurus A & 3C273

NGC4151 (Gursky1971
ApJL, 165,L43

Centaurus A with Uhuru lines of position
“During my university years in Milan, not one of my senior colleagues had ever invited me over to his home (except for Beppo Occhialini).”

“Secrets of the Hoary Deep”
Riccardo Giacconi
Riccardo and Mirella invited students and colleagues to their home for wonderful dinners or larger social gatherings.

They lived just a short walk from the observatory.

Imaging X-ray telescope
58 cm aperture

Einstein was as great an advance in sensitivity over early detectors on rockets, as the 200 inch Telescope was to Galileo’s 1610 telescope.

Increase in sensitivity \( \sim 1,000,000 \).
Scientific direction from the HEAO 2 Consortium Institutions
Harvard-Smithsonian Center for Astrophysics
Center for Space Research, MIT
Columbia Astrophysics Laboratory
Laboratory for High Energy Astrophysics/GSFC

Centaurus A

Cas A

M87

Harvard-Smithsonian Center for Astrophysics
Christine Jones
First Einstein images!

Leon
Pepi
Arnie
Graziella
Mirella
Riccardo
Einstein contributed to understanding planets, stars, supernova remnants, galaxies, clusters, AGN/jets and resolving the X-ray background!
Selected Discoveries from Einstein - I
Draco & Eridanus Einstein HRI observations - the first Deep Survey Giacconi+1979 ApJL, 234, 1

Limiting flux $1.3 \times 10^{-14}$ ergs/cm$^2$/s in 1-3 keV energy band

Resolved 26 (+/- 11) % of 1-3 keV background

(with Chandra, Luo+ (2017) resolve 81(+/- 4)% of 0.5-2 keV bkgd)
Crab Nebula - pulsar in “on” and “off” phases with HRI
Most clusters of galaxies are not “old”, relaxed systems, but are dynamically “young” merging systems.

Selected Discoveries from the Einstein Observatory IV

Discovery of hot gaseous coronae in early type galaxies
(Forman, Jones and Tucker 1985 ApJ 293, 201)

Harvard-Smithsonian Center for Astrophysics

Christine Jones
Although Einstein was a PI mission, Riccardo recognized the importance of enabling Guest Observers, including distributing well-calibrated data to observers. After first year, 50% of time was available to Guest Observers. Fred Seward was the lead.

“We are convinced that participation by a broad segment of the astronomical community in the utilization of this facility will substantially enhance the scientific return of this mission.” (R. Giacconi)

Few rules for proposals....
Recognition received through major awards

National Medal of Science 2003
for his pioneering research in X-ray astronomy and his leadership of major astronomy facilities

Harvard-Smithsonian Center for Astrophysics

Christine Jones
“... those were the happiest years of my life.”
Thanks