

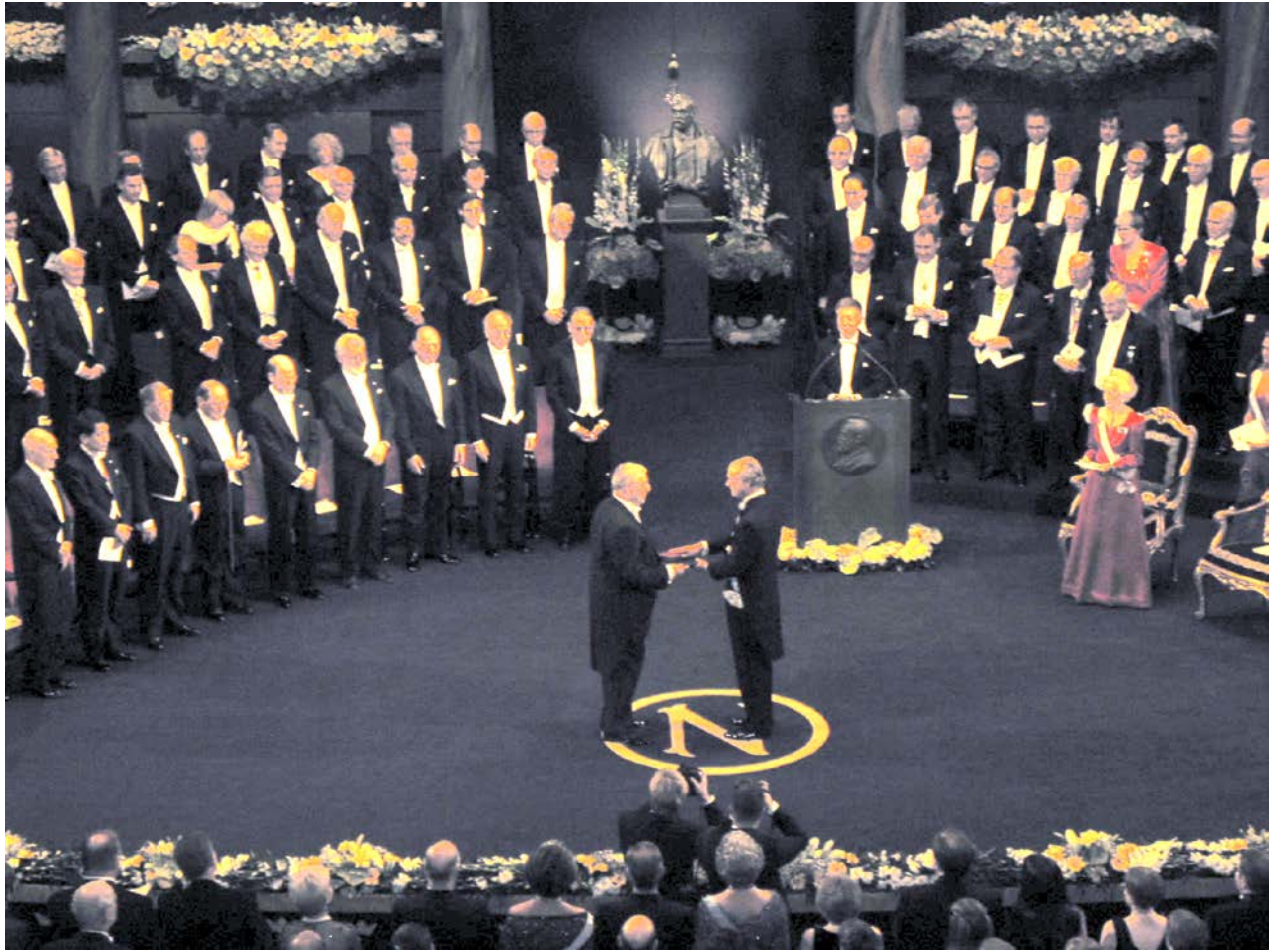
Riccardo Giacconi
A legacy of vision and transformation

Ethan J Schreier

Memorial Symposium to Honor Riccardo Giacconi

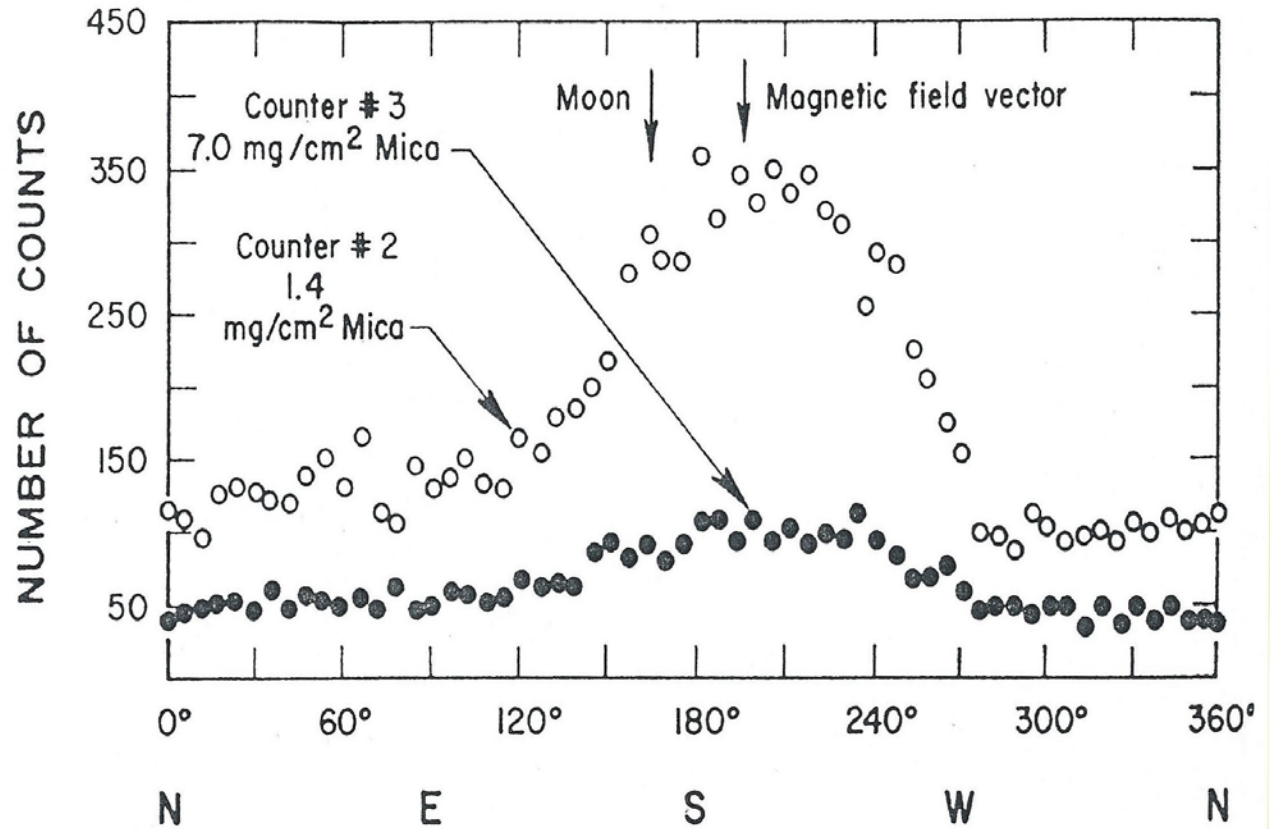
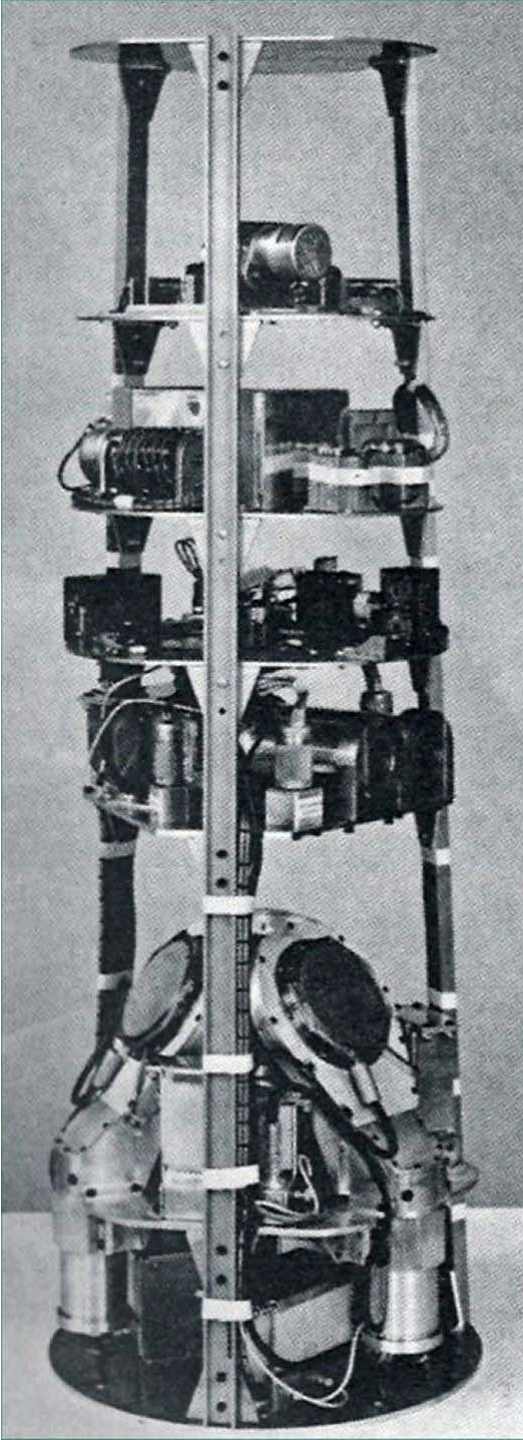
May 29-30, 2019

National Academy of Sciences



Rocket Payload & Sco X-1

first extrasolar x-ray source

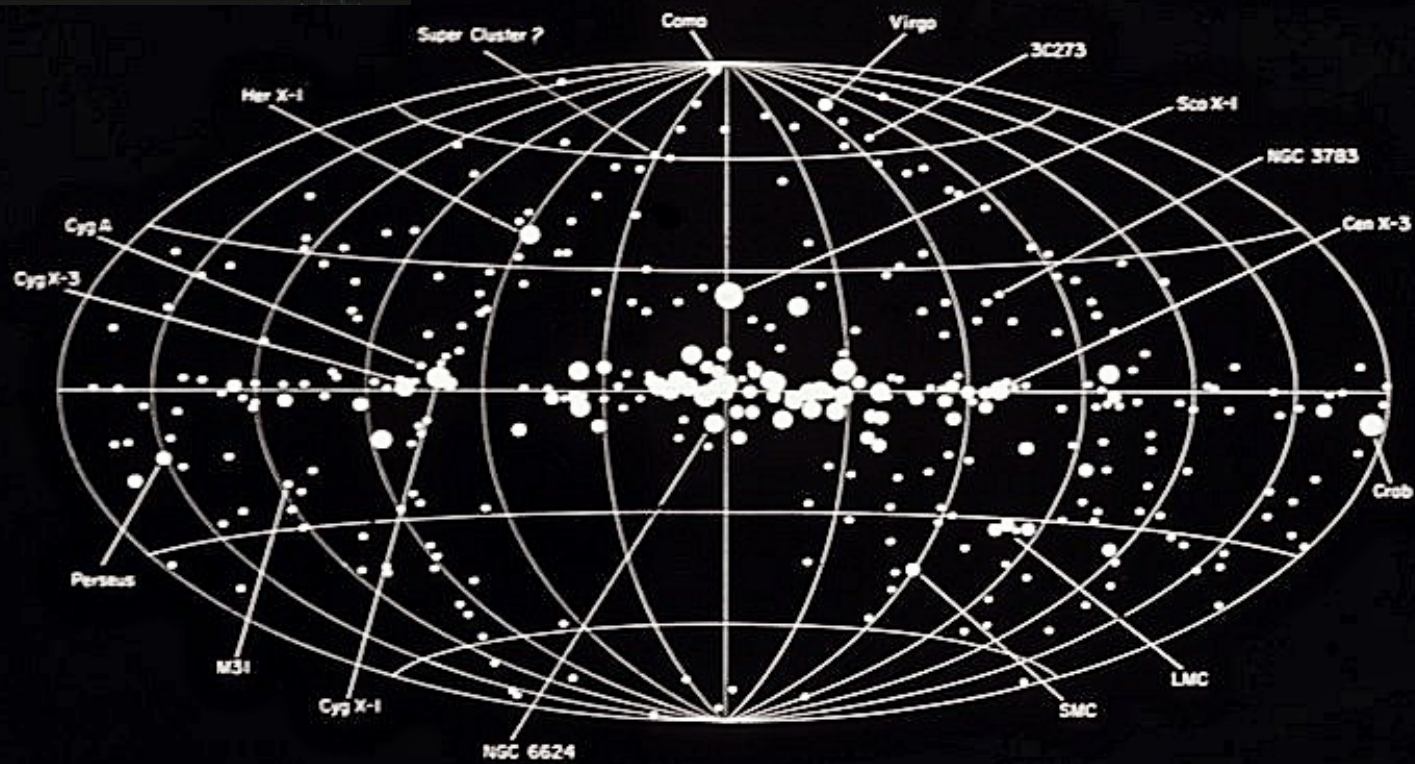




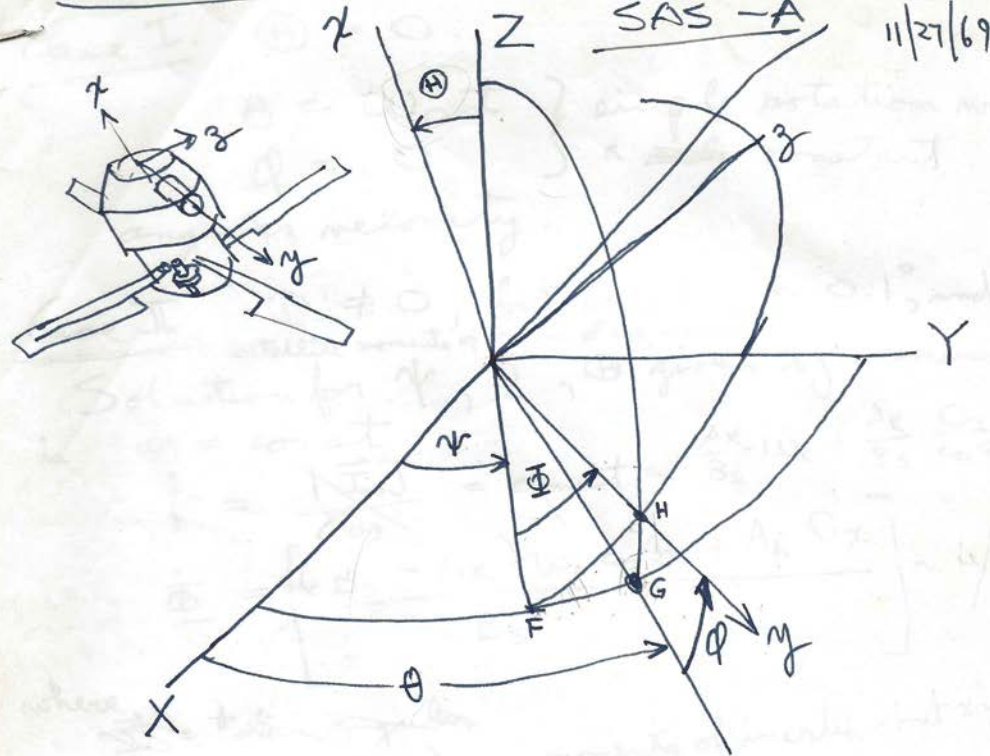
Uhuru

THE FOURTH UHURU CATALOG

BARBARO-FRANZ OBSERVATORY
RESEARCHER ANDREW W. ALLEN



EQUATIONS OF ROTATIONAL MOTION



α = angle between total angular momentum vector (Z) and rotor axis (x)

α, ψ, Φ = Euler angles between space-fixed system (locked onto celestial sphere) XYZ and spacecraft-fixed system xyz .

x = rotor axis, \parallel to principal moment of inertia of spacecraft.

y = star sensor optic axis

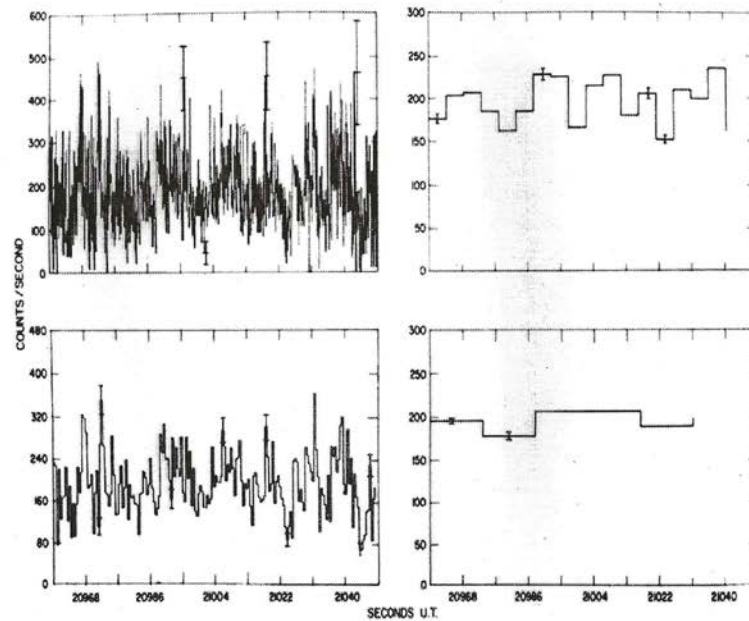
θ = azimuth angle of y

ϕ = elevation angle of y

We wish to derive equations of motion for θ, ϕ .

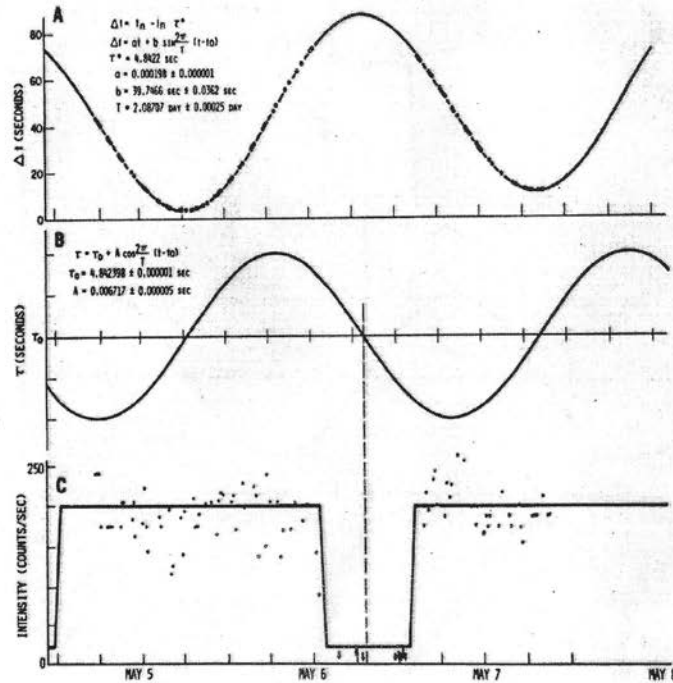
Cygnus X-1

varying on all scales



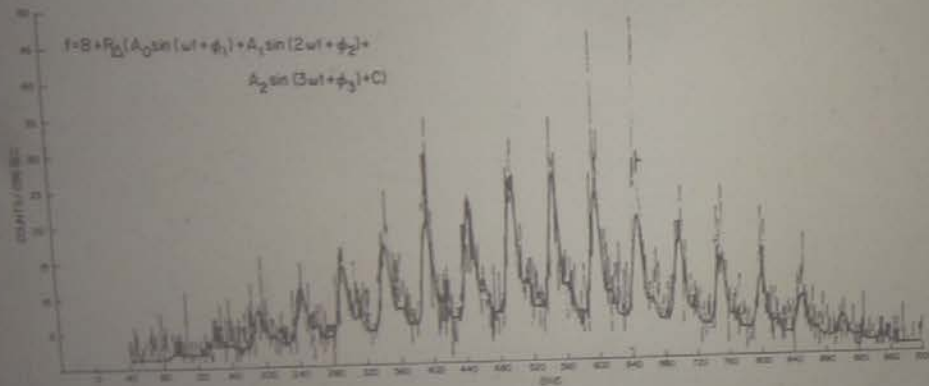
Centaurus X-3

occultation and Doppler shift



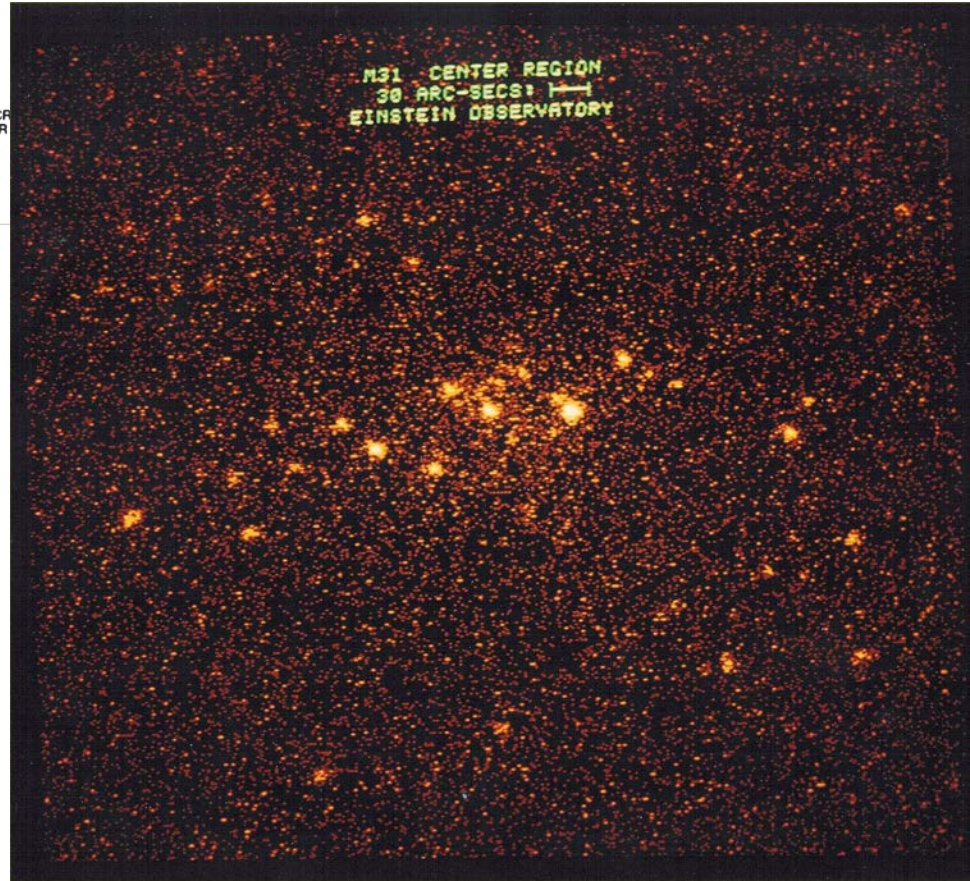
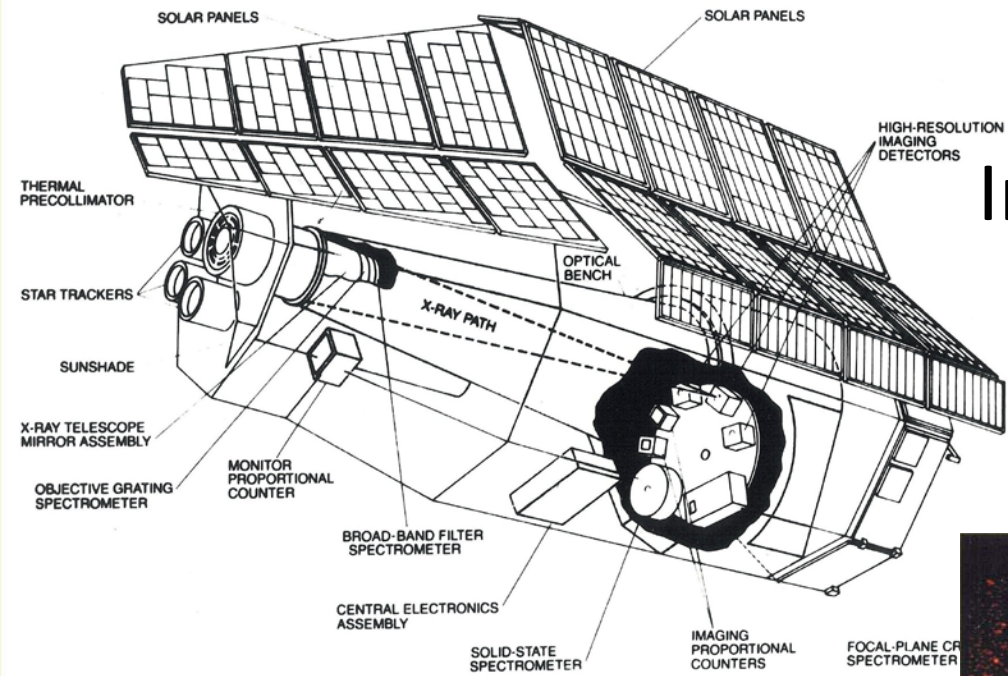
CENTAURUS X-3 (2ASE 1119 -60)

May 7, 1971



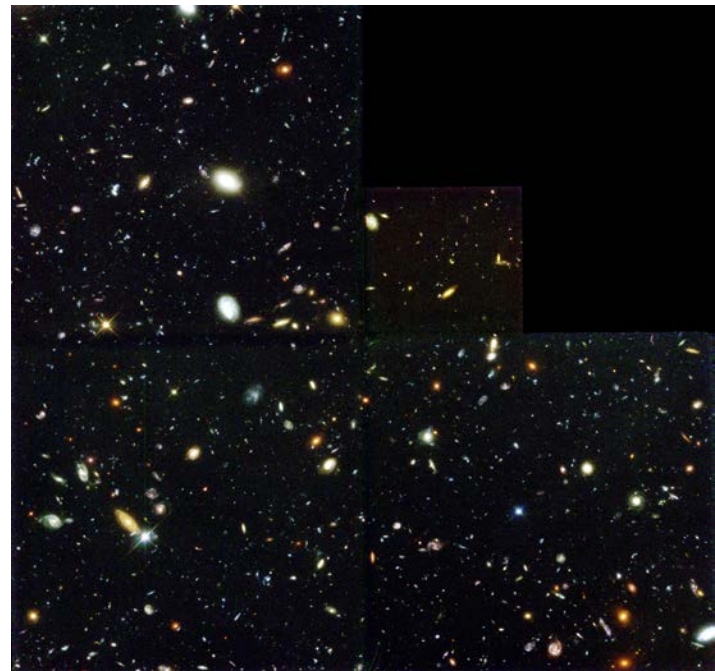
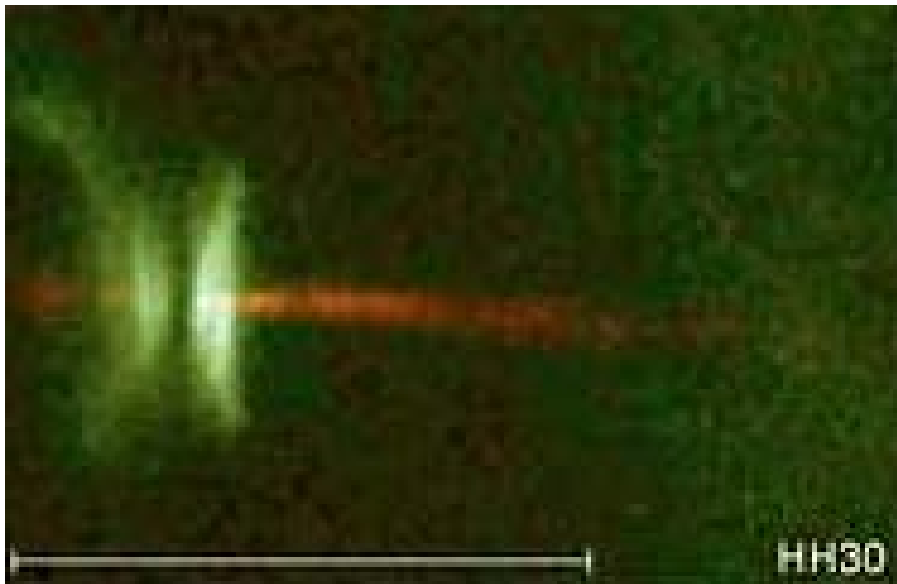
Einstein

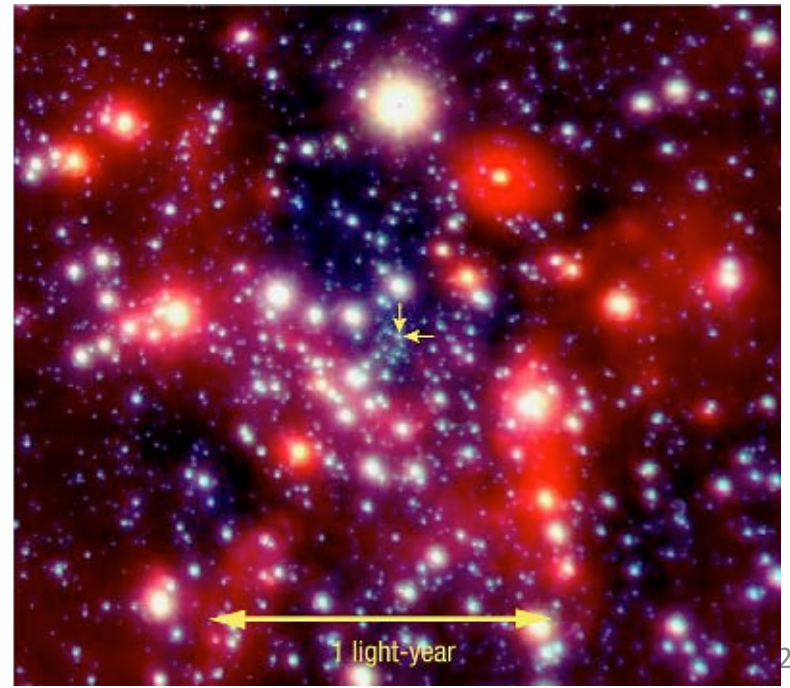
Imaging X-ray Observatory

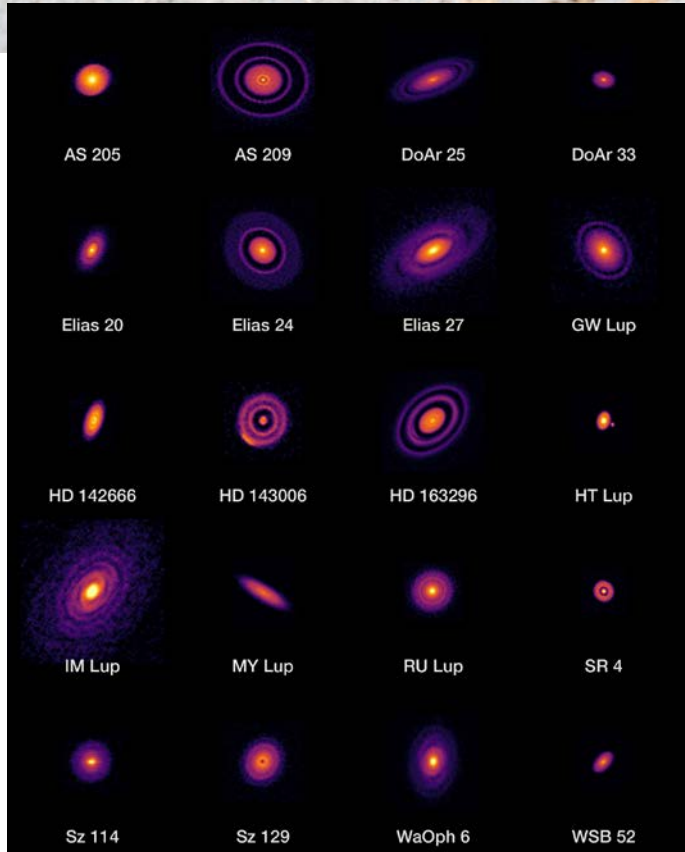
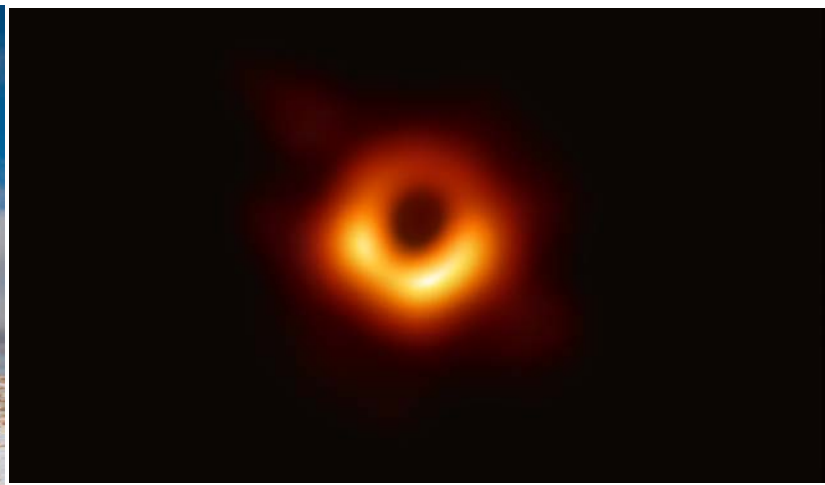
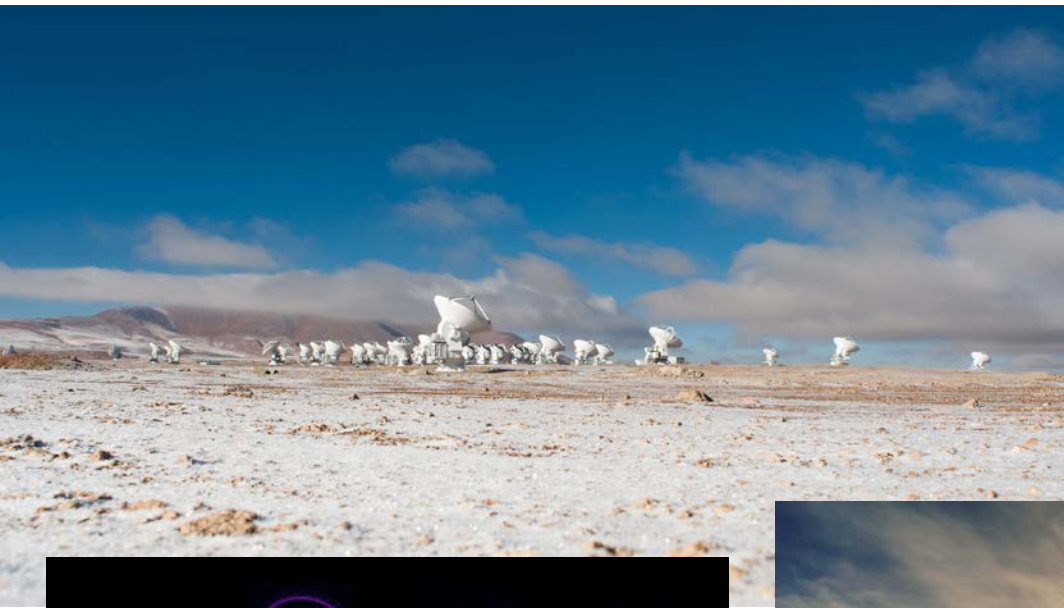


Hubble Activation









ALMA

from protoplanetary disks to black holes



The Baltimore Charter for Women In Astronomy

"Women Hold up Half the Sky" -- Chinese saying

Preamble

We hold as fundamental that:

- Women and men are equally capable of doing excellent science.
- Diversity contributes to, rather than conflicts with, excellence in science.
- Current recruitment, training, evaluation and award systems often prevent the equal participation of women.
- Formal and informal mechanisms that are effectively discriminatory are unlikely to change by themselves. Both thought and action are necessary to ensure equal participation for all.
- Increasing the number of women in astronomy will improve the professional environment and improving the environment will increase the number of women.

This Charter addresses the need to develop a scientific culture within which both women and men can work effectively and within which all can have satisfying and rewarding careers. Our focus is on women but actions taken to improve the situation of women in astronomy should be applied aggressively to those minorities even more disenfranchised.

Rationale

Astronomy has a long and honorable tradition of participation by women, who have made many significant and highly creative contributions to the field. Approximately 15% of astronomers worldwide are women but there is wide geographical diversity, with some countries having none and others having more than 50%. This shows that scientific careers are strongly affected by social and cultural factors, and are not determined solely by ability.

The search for excellence which unites all scientists can be maintained and enhanced by increasing the diversity of its practitioners. Great discoveries have always occurred in times of cross-cultural enrichment: along trade routes, in periods of geographical exploration, among immigrants and multinationals. The introduction of new approaches frequently results in new breakthroughs. Achieving such diversity requires revised, not lesser, criteria for judging excellence, free of culturally-based perceptions of talent and promise.

A review of available information on the relative numbers and career histories of women and men in science reveals extensive discrimination. Access to the profession -- graduate education, hiring, promotion, funding -- is not always independent of gender. Unequal treatment of women in the laboratory, the lecture hall and the observatory, more subtle but at least as important as overt discrimination, creates a chilly climate which discourages and distresses women, alienates them from the field, and ultimately damages the profession.

Existing inequities can be eliminated only partially by legal stricture or they would not continue today.

WOMEN IN ASTRONOMY

Proceedings of a workshop held at the
Space Telescope Science Institute, Baltimore, Maryland
September 8-9 1992

Interactions

A business approach to modern astronomy

American Science and Engineering Inc, of Cambridge, Massachusetts, supplies scientific payloads for many NASA astronomy experiments. The company has achieved great fame for its success with the Uhuru X-ray satellite. What is it like to do pure research in a company rather than a university?

Dr Simon Mitton



Left to right:
Ethan Schrafer,
Riccardo Giacconi,
Terry Matlael,
Harvey Tannanbaum,
Edwin Kellog

No expense is spared at American Science and Engineering to provide space scientists with a pleasant working environment. The company has just moved into lavish new premises, off Harvard Square in Cambridge, Massachusetts, which are a fitting monument to the spectacular success of this unique company. AS&E is the home of the world's foremost X-ray astronomy group, responsible for the first orbiting X-ray satellite, Uhuru. The company's turnover exceeded \$13 million last year, and the space research and systems division generated two-thirds of the sales. As this is a company with a stockmarket quotation, the public participates in the striking discoveries being made at AS&E. Even though these are scarcely profitable commercially, they have caused a great stir in professional circles. To find out more about this remarkable organisation, I recently visited their headquarters.

Riccardo Giacconi, the enthusiastic leader of the X-ray astronomy group, quickly squashed the myth that AS&E got into the business of astronomy by chance. The company was in fact founded in 1958 by Martin Annis, a former research student of the cosmic-ray physicist Bruno Rossi, who is also a distinguished rocket scientist. At its inception, AS&E was a typical MIT spin-off company, and the group was set up to do contract research on weapons systems. Bruno Rossi accepted an invitation to be chairman of the board of directors, a position which he still holds. As he is principally interested in space research and education, it is not surprising that these are still the main areas of interest at AS&E.

Giacconi, who is the driving agent behind the present research programme, joined the company after doing research in cosmic-ray physics at Milan. Like several of the people

in his research group, Giacconi describes himself as a maverick from the usual academic research environment. First he tried cosmic-ray research at Indiana University, but found that boring. A spell at Princeton followed, but here, too, he failed to find a suitable niche. As his status as a visitor at Princeton rapidly evaporated, he began to think of alternative employment. By chance, AS&E had just started to do research in space science, and Giacconi wasted no time in investigating possible openings in X-ray astronomy. At this stage a great deal of research had already been done, mainly from balloons, on solar X-rays. Also, many scientific payloads had been flown by rockets in connection with defence research. At AS&E, Rossi and Giacconi plotted to match up X-ray astronomy to rocket technology.

In the early 1960s, when the groundwork for Uhuru was laid, the X-ray group decided to get an X-ray detector of some sort aloft as soon as possible. Giacconi emphasises the great psychological push which flowed from this decision. The idea of an X-ray telescope was particularly appealing because even rough measurements in a completely new field hold the potential for many unsuspected discoveries. The basic strategy adopted was to convince NASA of the need to send X-ray detectors into orbit (initially aboard rockets, then satellites), and finally to develop a fully operational satellite capable of supporting a high-resolution X-ray telescope.

At first this proposal fell on stony ground as NASA preferred taking a look at the Moon with X-ray eyes. It was felt that some intermediate target should be tried first. Once concrete results came in, then equipment for looking deeper into space could be developed. AS&E finally got off the ground in 1962, and achieved fame overnight with the amazing

Riccardo's Garibaldini

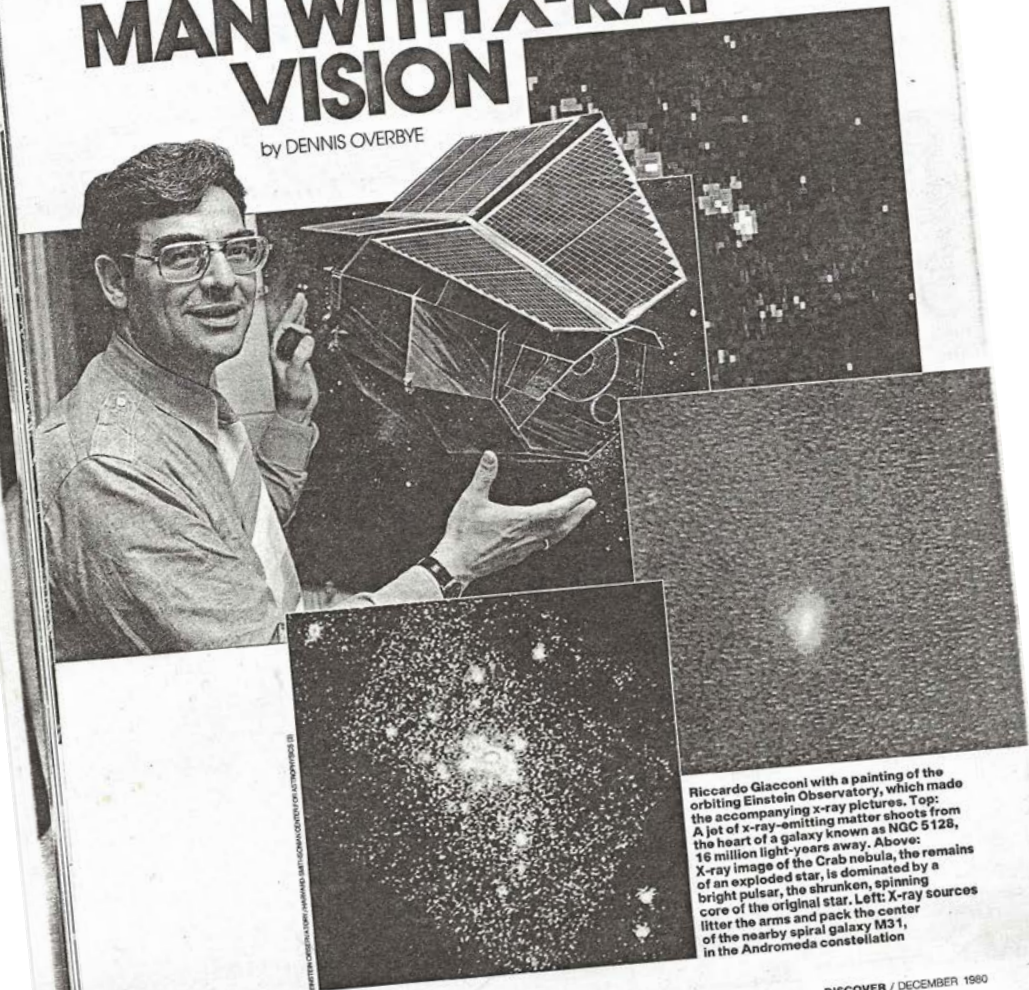


PERSONALITY

THE MAN WITH X-RAY VISION

With tenacity and love, Riccardo Giacconi and his stalwarts opened a new window on the universe

by DENNIS OVERBYE



Riccardo Giacconi with a painting of the orbiting Einstein Observatory, which made the accompanying x-ray pictures. Top: A jet of x-ray-emitting matter shoots from the heart of a galaxy known as NGC 5128, 16 million light-years away. Above: X-ray image of the Crab nebula, the remains of an exploded star, is dominated by a bright pulsar, the shrunken, spinning core of the original star. Left: X-ray sources litter the arms and pack the center of the nearby spiral galaxy M31, in the Andromeda constellation

PHOTO: COURTESY OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

