

Fog, clouds, and light pollution limit the effectiveness of even the biggest optical telescopes on Earth. Astronomers who study ultraviolet or X-ray emission of stars have been more limited because Earth's atmosphere blocks almost all of that radiation. Nancy Roman has devoted her career to designing telescopes that orbit the Earth. Outside the Earth's atmosphere, these telescopes easily detect and measure gamma ray, X-ray, and ultraviolet wavelengths.

## *Mother of the Hubble Space Telescope*

*Swarthmore College Newsletter*



# NANCY GRACE ROMAN

**born 1925**

Whispers and giggles floated up through the dark as the girls of the sixth-grade Astronomy Club spread their blankets on the lawn of the Roman family's backyard.

"I see Orion."

"Look! There's Cassiopeia."

"Do you think we'll see any meteorites tonight?"

This would be the last star party for the club. When school started next week, twelve-year-old Nancy Roman and her friends would be going to bed too early for star watching. After tonight, they would meet inside and study star charts to learn the names of stars and constellations.

Born in Nashville, Tennessee, Nancy Roman says she can't recall a time when she was not determined to be an astronomer and to learn everything she could about stars. Her father, Irwin, was a U.S. Geological Survey geophysicist who encouraged her interest in science. Many of her friends and teachers tried to discourage Nancy from studying astronomy, telling her it was not a field for women. But she persisted, and read every astronomy book she could find in school and city libraries. "I am glad I was stubborn," she says now. "I have had a wonderful career."

After high school, Nancy studied astronomy at Swarthmore College in Pennsylvania, where she worked at the Sproul Observatory. She studied for her PhD in astronomy at the University of Chicago and worked at the Yerkes Observatory, earning her degree in 1949. Roman did research at the McDonald Observatory in West Texas also. "In those days, we could get substantial telescope time, and I often spent as much as four months a year at [McDonald]," she said in an interview. "I enjoyed both research and teaching, but forty years ago it was nearly impossible for a woman to get tenure in an astronomy research department. Therefore, I left the university to join the radio astronomy branch at the Naval Research Laboratory."

Roman's focus in astronomy has always been to try to understand the nature of stars. In her effort to understand the life cycle of stars, she used optical, radio, and X-ray telescopes. In time, other astronomers also became more interested in the formation and evolution of stars. "Where they used to think it would be possible to identify all the stars in the sky, now they don't try so hard to discover more stars as to understand the ones we know about," says Roman. "The Milky Way holds enough stars for anyone."

At the U.S. Naval Research Observatory, she worked in radio astronomy and was soon named head of the microwave spectroscopy section. Roman loved research. But a chance observation made earlier in West Texas was about to change her career completely.

While collecting data on high velocity stars at McDonald Observatory, she noticed that a star she was studying did not match the published data about it. The information described the star as being very

like our own Sun. But Roman saw that it was very different. “It didn’t look anything at all like the Sun,” she said. She published her observation in a short paper in *The Astrophysical Journal* and thought no more about that star. Others did think about it, however.

Her short paper caught the attention of a Russian astronomer, who invited her to be a speaker at the dedication of a major new Russian observatory. She was one of just three American astronomers invited to the event, and her public trip to Russia generated headlines in U.S. newspapers. The publicity brought Roman to the attention of NASA administrators. “I was asked if I knew anyone who would like to set up a program in space astronomy,” she said in an interview. “I knew that taking on that responsibility would mean that I could no longer do forefront research. But the challenge of starting with a clean slate, to formulate a program that would influence astronomy for decades to come, was too great to resist.”

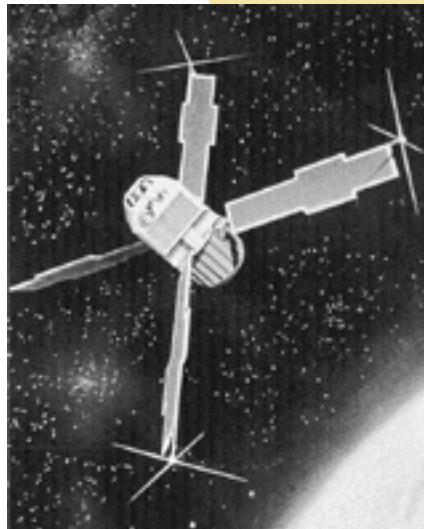
For nearly twenty years, Nancy Roman designed the orbiting instruments that detect

## Non-optical Telescopes

By the middle of the twentieth century, astronomers realized that stars emit the full spectrum of electromagnetic radiation. That was both good and bad news. The good news was that high energy emissions, such as X-rays and radio waves, would be detectable on Earth. Designers immediately began work on telescopes that could detect these emissions.

The bad news was that low-energy emissions, such as infrared radiation, would not penetrate the Earth’s atmosphere. Detection of the infrared emissions put out by a star would have to be detected by telescopes away from the Earth. Astronomers eagerly developed satellite telescopes and launched the first X-ray

telescope in 1970, shown here. It was named Uhuru, which means “freedom” in Swahili, the language of Kenya, where it rocketed into space.



Nancy Roman, as Chief of the Astronomy Program in NASA's Physics and Astronomy Programs Office, explains the Advanced Orbiting Solar Observatory (AOSO) satellite to astronaut Edwin (Buzz) Aldrin.



and measure gamma rays, radio waves, X-rays, and visible light. Among Roman's satellite observatories were three solar observatories that use ultraviolet light

and X-rays to study the Sun. She was also responsible for the launch of three small astronomical satellites that use X-ray and gamma-rays to study the sky, one International Ultraviolet Explorer, and four astronomical observatories that make optical and ultraviolet measurements.

The programs she directed gave astronomers important information about planet surfaces and led to the successful Viking probes that landed on Mars in 1976. Roman helped design and produce nearly all the orbiting observatories launched during the 1970s and 1980s. She collected data from the ultraviolet and X-ray detecting Copernicus satellite in 1972, and from the U.S. space station Skylab that circled the Earth from 1973 until 1979.

*Skylab orbited Earth from 1973 to 1979; then, it broke into pieces in the atmosphere upon re-entry over Perth, Australia.*



*Launch of the Delta rocket, which carried the OSO 8 into orbit in June, 1975.*

Roman's most important contribution to orbiting telescopes may have been her participation in the design of the Hubble space telescope. Her tireless efforts lobbying NASA and Congress eventually obtained funds to build the world's first orbiting optical telescope.

Using the Hubble Space Telescope, optical astronomy advanced farther in fifteen years than it had in the previous fifty years before the Hubble. The stunning images sent to Earth by the Hubble have increased public interest in astronomy as well as understanding of our universe. Images provided by HST are available to any person at the NASA web site.

Now retired from NASA, Roman serves as a consulting astronomer to NASA and a senior scientist for the Astronomical Data Center at NASA's Goddard Space Flight Center. The ADC collects astronomical data from researchers worldwide, converts it into digital catalogs, and makes the information available to astronomers all over the world.

After twenty-one years of designing and launching orbiting telescopes that gathered data unobtainable on Earth, Nancy Roman now continues the tradition of Harvard women whose enormous amounts of data supported astronomy for the first half of the last century. Instead of pens and paper, Roman uses a computer. Instead of depending on steamships or telegraph to distribute data, Roman sends and receives data over the Internet. Still, like the women at Harvard, she provides much of the glue that holds astronomical research together. ●



*Above: Nancy Roman with one of the Orbiting Solar Observatories she designed while at NASA. Below: Roman continues her interest in education, volunteering with the organization Retired Scientists, Engineers & Technicians. Here she works with a student on a science project.*