Bulletin of the AAS • Vol. 53, Issue 2

Nancy Grace Roman (1925–2018)

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Published on: Jan 11, 2021

DOI: 10.3847/25c2cfef.a0dde5a5

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**Nancy Grace Roman died on
Tuesday the 25th of December, 2018.**

In her two decades of service as NASA's first Chief of Astronomy programs Nancy Grace Roman shepherded some three generations of space-borne astronomical instruments to study the Sun, planets, stars and galaxies, culminating in the Hubble Space Telescope. Born in Nashville, Tennessee, on May 16, 1925, to a music teacher and geophysicist, Roman was early on sensitized to science. As her father, Irwin Roman, took various jobs, working for an oil company and then finally for the U.S. Geological Survey, the family moved constantly, from Texas, New Jersey, Michigan and Nevada, and finally to Baltimore, Maryland.

Photo courtesy of NASA.

She became fascinated with the sky at an early age. During the family's two years in Nevada living in the outskirts of Reno, she recalls, "To the extent that I can list any single thing that was an influence on me, it was probably the time in Reno, with the very clear skies" (Roman Oral History, AIP). At age 11 she started an astronomy club with other girls in her neighborhood, reading books together and having star parties. After an accelerated program for gifted children in a Baltimore high school, she entered Swarthmore College and went on to the University of Chicago for a PhD in astronomy, studying and working at Yerkes Observatory, and graduating in 1949. She remained on the research staff in optical astronomy until 1955 and then worked at the Naval Research Laboratory in radio astronomy.

In 1959 Roman was invited to join the newly formed National Aeronautics and Space Administration to set up a program in space astronomy. Her job was to create and develop programs by working between two worlds: the rapidly growing NASA infrastructure of engineers, managers and scientists faced with overcoming the

embarrassment of Sputnik by achieving new technical firsts in space, and the astronomical community, few of whom were enthusiastic to spend so much money on space telescopes. As Robert Smith has observed in his comprehensive history of the Space Telescope, “In so doing, she showed herself to be a hard infighter who was not overly concerned with bruising egos in her support for programs” (Smith, 1989, 55).

Her decision to leave academia and work for government laboratories was prompted by her sense that, as a woman, she would not be competitive for advancement beyond low-level positions at places like Yerkes. Peter van de Kamp at Swarthmore had initially tried to discourage her, and at Yerkes some of the senior staff did not feel that it was proper for women to be astronomers (Roman OHI AIP). Ironically, the research she performed there had real consequences in galactic research. Though it was not highly appreciated at the time, Roman had made a significant contribution finding a correlation between the motions of stars in the galaxy and their heavy metal abundances, a key ingredient to better understand the evolution of the galaxy. It was also something she felt most proud of towards the end of her life (Roman, 2016, 1346 [1]; Rubin, 1999 [2]).

Once at NASA she never looked back, though the challenges she faced were daunting. On the one hand, she found she had to temper the enthusiasms that a few ardent astronomers expressed for a really large orbiting telescope by helping them appreciate the technical limitations they were facing. And on the other, she was faced with working within a government agency as the promoter of astronomical programs helping both sides to learn to talk to one another. One of her first duties was to make official visits to astronomy departments across the country promoting the advantages of space flight. She also promoted and mentored feasibility studies bringing NASA technical and engineering staff into contact with astronomers to craft strong arguments for practical stepwise continuous programs.

Although she was a central figure in most if not all of NASA's astronomy missions in the 1960s and 1970s, including the first generation Explorers and Orbiting Solar and Geophysical Observatories, the second generation Orbiting Astronomical Observatories and many related missions, some 20 satellite missions in all, her longest-lasting effort was to help establish, among other key players, what today is known as the Hubble Space Telescope. She lived long enough to enjoy its many successes and has been warmly remembered by her colleagues and followers as the “Mother of Hubble.”

One of the first astronomy departments Roman visited in her first years of campus hopping was at Princeton, where Lyman Spitzer was the chair and director of the observatory. Spitzer had long envisioned space telescopes and was then in the midst of fostering a series of balloon flights by his colleague Martin Schwarzschild, sending first a 12-inch telescope into the stratosphere to image the Sun at high resolution, and then helping Schwarzschild develop a 36-inch balloon-borne telescope to resolve the cores of galaxies. Spitzer had been one of a number of space-friendly astronomers who had responded to an early appeal from the National Academy of Sciences to suggest scientific space projects and was very much encouraged by Roman's visit in 1959 to approach NASA not only for their "Flying Telescope" but for what would become NASA's third Orbiting Astronomical Observatory, a 32-inch spectrophotometric instrument dubbed "Copernicus." Both Spitzer and Schwarzschild saw these efforts as leading to a Large Space Telescope, and Roman more than agreed, always preferring a stepwise continuous process, learning from each stage. This question lasted throughout the decade as everyone debated the best path to what was originally a fully diffraction-limited 120-inch Large Space Telescope. Roman was in the middle of the debate, promoting attention to the practical details like adequate pointing and setting controls, and the critical importance of a free-flying instrument, rather than a man-tended telescope employing film return. This brought up the question of the best way to record and return data. Once again, Roman was at the cusp in the 1970s, advocating solid-state sensors over electronographic detectors or SEC vidicons.

Underscoring all the design questions like pointing and guidance and detector systems, the biggest question was the size of the telescope. The debate seemed endless until Roman, as program scientist, teamed up with C. R. O'Dell, project scientist, and directed the Space Telescope's Science Working Group to come up with minimum operational standards for the Large Space Telescope. Balancing the scientific goals with the engineering challenges, the costs, what Congress might accept and, frankly, what could be launched by the new Space Shuttle program, which NASA had committed itself to in the post-Apollo years, they finally decided that the 120-inch goal for the mirror had to be reduced to 94-inches, working on a scale that had already been proven in the classified world. And even this downsizing had to be defended in the following years against pressures, both political and scientific, to reduce it further or even cancel it. At one point, when the planetary sciences communities demanded more support for their programs, Roman advocated expanding the scientific goals of the Space Telescope to include planetary imaging, knowing full well that one of the

major proposers for what was a wide field imaging system included the option of a dual mode camera for imaging planetary surfaces.

We have only touched the surface here, but should add that one of her last battles was to support ardently the establishment of an independent Institute (what would become the Space Telescope Science Institute in Baltimore) to manage the scientific aspects of the Space Telescope. In summing up her NASA years, dominated at the end by the Space Telescope, she recently reminisced:

I left the project before substantial management problems arose, leaving their solution to my successor, Ed Weiler. He also had to handle the discovery of the mirror problem. It was clear from his actions in these major fiascos that I had left the project in good hands (Roman, 2019, 25 [3]).

Roman retired from NASA in 1979 partly because she “was angry with the games that Congress was playing with our salaries” but she was also getting tired of the fight, particularly with disgruntled NASA Goddard staff over her support to establish an independent Institute to manage the scientific aspects of the Space Telescope. At that time she was also caring for her aged mother and decided that full-time work was just too much (Roman, 2019, 30–31 [3]). She remained active on many fronts, consulting, lecturing, advising, and returning to some of the unfinished astronomical research she enjoyed so much.

An earlier version of this essay was prepared for a Physics Today website.

<https://physicstoday.scitation.org/doi/10.1063/PT.6.4.20200401c/full/>

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