

Vera Rubin, who paved the way for women astronomers, dies at 88

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Vera Rubin uses a measuring engine in this photo taken in the 1970s and provided by the Carnegie Institution of Washington, D.C. Rubin, a pioneering astronomer who helped find powerful evidence of dark matter, died on December 25, 2016. She was 88 years old. Photo: Carnegie Institution of Washington via AP

As a woman, Vera Rubin had to fight just to get access to telescopes. When she did, she came up with a startling theory that is now widely accepted.

Theory Of Dark Matter

She was an astrophysicist, a scientist who studied stars and other bodies in space. Her work found galaxies, or star systems, that were rotating more quickly than expected.

This movement, she concluded, could be explained if the universe was filled with a type of mass that no one had ever seen, mysterious stuff that came to be known as dark matter.

Her once-startling theory is now an accepted part of the still-evolving story of the universe. Finding firm evidence of dark matter stands as the pioneering achievement of a scientist known for breaking barriers and helping others to build on such work.

Rubin died Sunday at 88 in the Princeton, N.J., area after a period of declining health, according to her family. She worked for decades at the Carnegie Institution for Science, based in Washington, D.C.

Studying Galaxies Far Away

Although dark matter hasn't been directly observed, scientists widely accept that it makes up about 27 percent of the universe. That makes it far more abundant than the normal matter that makes up the stars, planets and everything else we can observe, which total 5 percent. The bulk of the universe is thought to be made of another mysterious thing called dark energy.

The idea of dark matter had long been proposed. However, it had limited evidence behind it in the 1970s as Rubin and Kent Ford studied the dim light reaching Earth from distant galaxies across great stretches of space.

They examined how quickly galaxies revolved. The light became bluer as one side of a galaxy rotated toward them, compressing the electromagnetic waves, and redder as the other side rotated away, causing the waves to stretch out. But the outer reaches of the galaxies were turning much too fast, according to the physics of gravity. Their rotation should have been much slower if they had only the small amount of mass that they appeared to contain.

Dark Matter Helps Explain Things

This problem disappeared, however, if there was much, much more mass in these galaxies, mass that did not give off light and so was seemingly invisible, Rubin and Ford theorized in a 1978 paper. Other scientists were reaching similar conclusions through studies of radio waves.

Rubin's uncovering of evidence for dark matter revealed that "there's much more out there than we would expect based on our common sense experience," said James Bullock, professor of physics and astronomy at the University of California, Irvine. "Today, the standard interpretation is that 80 percent of matter is in this form that's different than anything that is known to science. And without this dark matter, a lot of other things about the universe don't make sense: Galaxies themselves wouldn't exist; stars wouldn't exist, and we would not exist."

Sleepless Nights Of Stargazing

Rubin was born Vera Cooper on July 23, 1928, in Philadelphia. Her father was Pesach Kobchefski, who immigrated from Latvia to the U.S. in the early 1900s. There he became Pete Cooper and eventually an engineer at Bell Telephone, where he met Rose Applebaum, a first-generation American who gave up her career of calculating routes and costs of Bell telephone lines after their marriage.

Rubin recalled that, as a child, “from my bed against a window, I had a clear view to the north sky. Soon it was more interesting to watch the stars than to sleep.”

Her father helped her build a telescope, improving her view.

She attended Vassar College, where there were no male students to bar her access to the school telescope.

First Woman At Palomar Observatory

In the summer of 1947, she met Robert J. Rubin through their parents. He’d interrupted college to enlist in the Navy, which sent him to Cornell University for chemistry and officer training, and he stayed to complete his doctorate degree. Robert and Vera married when he was 21 and she was 19 — and already a college graduate.

Vera Rubin earned her master’s degree from Cornell and her doctorate from Georgetown University, and she joined a department at Carnegie in 1965.

Standard practice at the time was to bar women from using the nation’s major telescopes. Rubin became the first to break that taboo at Palomar Observatory in San Diego County, California.

She also pressured a club of scientists in Washington to open its doors to women, said longtime co-worker Rick Carlson, a director at Carnegie.

Science At The Kitchen Table

Rubin had four children and was proud that all four earned doctorate degrees, according to Carnegie. David and Allan Rubin are geologists and Karl Rubin is a mathematician. Judy Young, who died in 2014, was an astronomer. Vera Rubin’s husband, Robert, a mathematician and physicist, died in 2008.

“I think it’s no coincidence that the four children all ended up doing science,” Allan Rubin wrote in a family book. “A pervasive early memory of mine is of my mother and father with their work spread out along the very long dining room table, which wasn’t used for eating unless a lot of company was expected.”

Rubin was the second female astronomer elected to the National Academy of Sciences, and in 1993, she received the National Medal of Science, the country’s highest scientific award.

“Don’t shoot for the stars; we already know what’s there,” Rubin said wryly on Twitter early last year. “Shoot for the space in between because that’s where the real mystery lies.”

Quiz

1 What is the relationship between the following selections from the article?

Her once-startling theory is now an accepted part of the still-evolving story of the universe.

Rubin's uncovering of evidence for dark matter revealed that "there's much more out there than we would expect based on our common sense experience," said James Bullock, professor of physics and astronomy at the University of California, Irvine.

Standard practice at the time was to bar women from using the nation's major telescopes. Rubin became the first to break that taboo at Palomar Observatory in San Diego County, California.

- (A) They all develop the idea that Rubin was interested in science from an early age.
- (B) They all develop the idea that Rubin's evidence of dark matter changed scientific theories about the universe.
- (C) They all develop the idea that Rubin had groundbreaking accomplishments in the field of science.
- (D) They all develop the idea that Rubin worked to change the role of women in science.

2 Which sentence would be MOST important to include in an objective summary of the article?

- (A) Vera Rubin, best known for her work finding evidence of dark matter and decades of research in astronomy, died on Sunday at age 88.
- (B) Vera Rubin, one of the most important scientists of the 20th century, should have received more public recognition for finding evidence of dark matter.
- (C) Vera Rubin was interested in astronomy from a young age, and frequently stayed up late at night to look at the stars through a telescope.
- (D) Vera Rubin concluded that rotation of galaxies could be explained by dark matter, though her work was limited by the sexism of male scientists.

3 Why does the author include the section "Sleepless Nights Of Stargazing"?

- (A) to show that Rubin's parents supported their children no matter what
- (B) to show how Rubin's background helped develop her love of astronomy
- (C) to describe the immigration and career of Rubin's father
- (D) to describe what it was like for Rubin to go to Vassar College

- 4 Read the paragraph from the final section of the article.

“I think it’s no coincidence that the four children all ended up doing science,” Allan Rubin wrote in a family book. “A pervasive early memory of mine is of my mother and father with their work spread out along the very long dining room table, which wasn’t used for eating unless a lot of company was expected.”

What is the MOST likely reason why the author included this information?

- (A) to suggest that Rubin's children did not really want to become scientists
- (B) to show that Rubin rarely entertained because she worked too much
- (C) to provide a detail about what it was like to grow up in a home of scientists
- (D) to emphasize Rubin's lifelong dedication to science and its impact