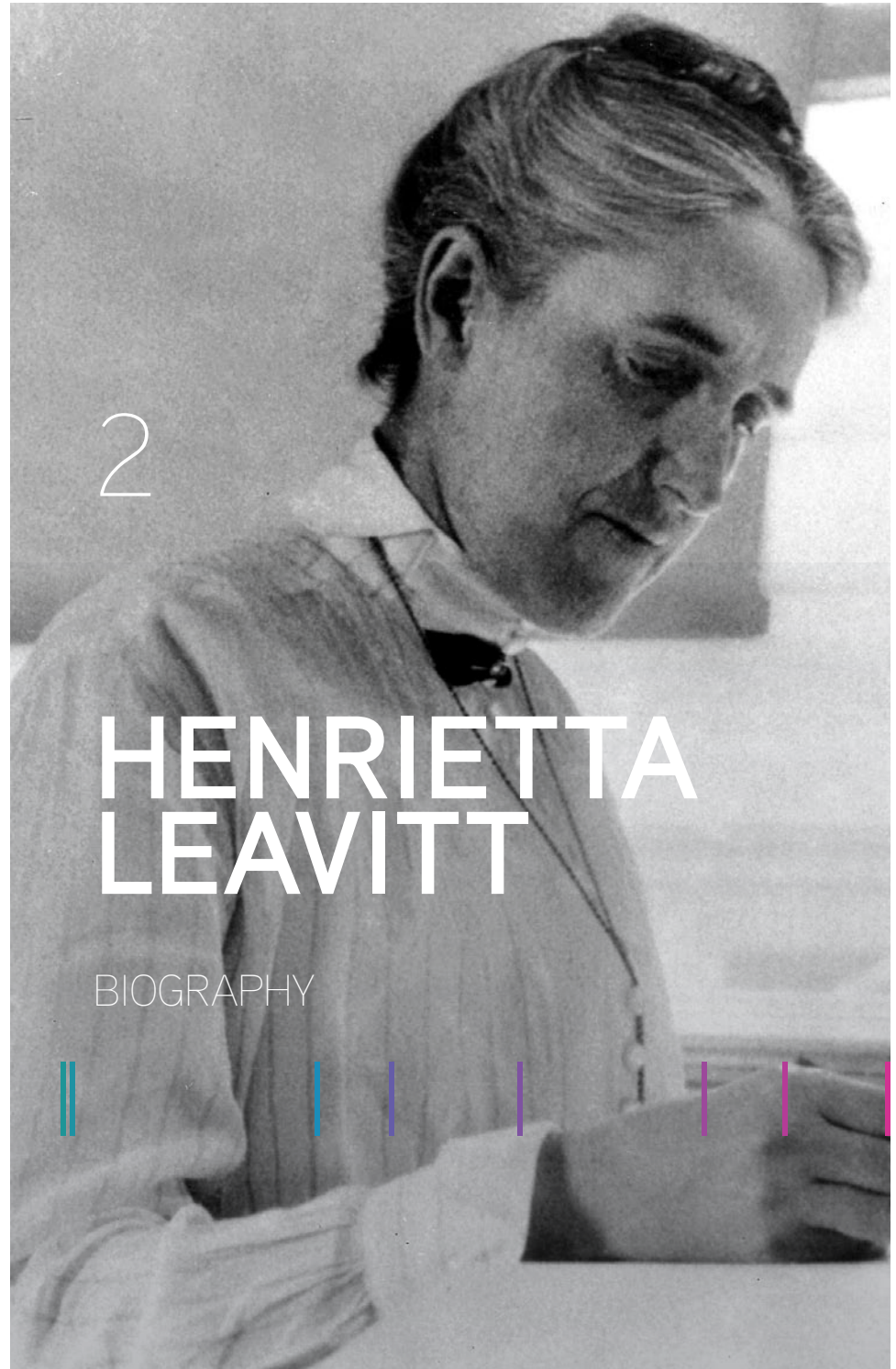


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# HENRIETTA LEAVITT

BIOGRAPHY



BIG HISTORY PROJECT



# HENRIETTA LEAVITT

MEASURING DISTANCE  
IN THE UNIVERSE

**Born**  
July 4, 1868  
Lancaster, Massachusetts

**Died**  
December 12, 1921  
Cambridge, Massachusetts

By Cynthia Stokes Brown

Henrietta Leavitt discovered the relationship between the intrinsic brightness of a variable star and the time it took to vary in brightness, making it possible for others to estimate the distance of these faraway stars, conclude that additional galaxies exist, and begin mapping the Universe.

## Early life and education

Henrietta Swan Leavitt was born on July 4, 1868, in Lancaster, Massachusetts. Since her father was a Congregational minister, the family moved frequently. Henrietta was the eldest of seven children, two of whom died as toddlers. When Henrietta was about 14 the family moved to Cleveland, Ohio, and in 1885 Henrietta enrolled in Oberlin College to prepare for the strict entrance requirements of the college she really wanted to attend — the Society for Collegiate Instruction of Women, later known as Radcliffe College (now part of Harvard University), in Cambridge, Massachusetts. When she was 20, in 1888, Leavitt returned to Massachusetts, to Cambridge, where her uncle lived, and achieved her dream to enroll in the Society for Collegiate Instruction for Women. She became interested in astronomy when she took a course in it during her senior year. She graduated in 1892.

## At the Harvard College Observatory

Leavitt liked astronomy so much that after graduation she became a volunteer at the Harvard College Observatory as a “computer.” This was the name used for women who examined tiny dots on time-exposed photographs of the night sky and then measured, calculated, and recorded their observations in ledger books. “Eventually, in 1902, Leavitt was hired at 30 cents an hour; she continued to work at the observatory, save some absences for illness and family obligations, the remaining 19 years of her life.

Leavitt took a special interest in the Magellanic Clouds, a pair of luminous hazes now known to be irregular galaxies, the nearest ones to our Milky Way. At the time no one knew what the clouds were. Since the Magellanic Clouds are only visible in the southern hemisphere, Leavitt could not see them directly. She could merely look at photographic plates taken at Harvard’s auxiliary observatory, in Arequipa, Peru, and sent to Cambridge by ship around the tip of South America.

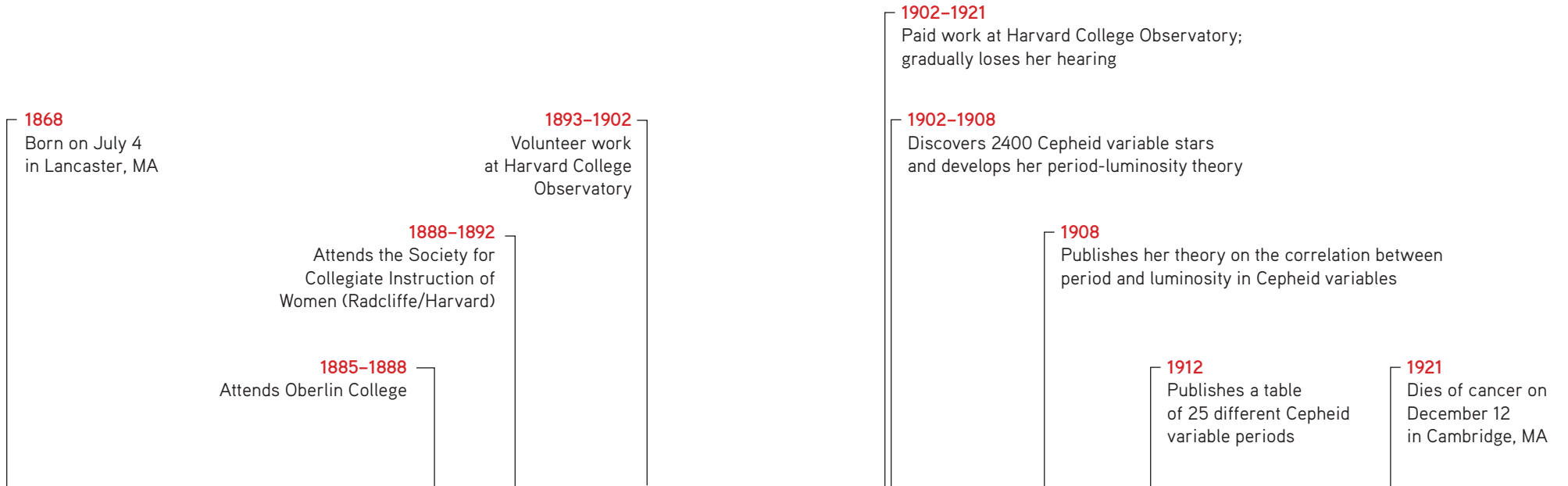
## Using Cepheid variables

One of Leavitt’s jobs was to examine the variable stars, which, unlike most stars, vary in brightness because of fluctuations within themselves. In the course of her work, Leavitt discovered 2,400 new variable stars, half the known ones in her day. A certain group of variable stars, later called Cepheid variables, fluctuate in brightness (luminosity) in a regular pattern called their “period.” This period ranges from about one day to nearly four months.

By comparing thousands of photographic plates, Leavitt discovered a direct correlation between the time it takes for a Cepheid variable to go from bright to dim and back to bright, and how bright the star actually is (its “intrinsic brightness”). The longer the period of fluctuation, the brighter the star. This meant that even though a star might appear extremely dim, if it had a long period it must actually be extremely large; it appeared dim only because it was extremely far away. By calculating how bright it appeared from Earth and comparing this to its intrinsic brightness, one could estimate how much of the star’s light had been lost while reaching Earth, and how far away the star actually was.

Leavitt published her first paper on the period-luminosity correlation in 1908, and four years later she published a table of the periods of 25 Cepheid variables. Nine years later, in 1921, she died of cancer at age 53 in Cambridge, Massachusetts.

# Timeline of Leavitt's life



During the time of Leavitt

## Legacy

Before Leavitt established the period-luminosity relationship, astronomers could determine cosmic distances out only about 100 light years. Using her insights, astronomers were able to estimate the Magellanic Clouds to be in the range of 100,000 light years from Earth — much further than anyone had imagined — meaning they could not be within the Milky Way galaxy.

The largest telescope then in existence opened in 1904 at Mount Wilson, near Los Angeles, California. In 1919 the astronomer Edwin Hubble took a job there, after finishing his PhD in astronomy at the University of Chicago. Using the Mount Wilson telescope and building on Leavitt's work, Hubble located Cepheid variables so far away that they conclusively established the presence of other galaxies. By 1925 most astronomers agreed that our galaxy is one among a multitude — a small outpost in a Universe full of galaxies.

Leavitt initially worked under a director of the Harvard College Observatory who did not encourage theorizing but preferred only to accumulate data. A later director even tried to take some of the credit for her work after her death. Now, however, Leavitt is recognized as a key contributor to our understanding of the size of the Universe.

## A modest life

Leavitt never married. She lived in Cambridge, initially with her uncle, then with her mother, and eventually alone. She gradually became deaf, starting with an illness when she was a young adult that she first mentioned in 1902. She was buried in Cambridge in the family plot, near the graves of Henry and William James. Her total estate was appraised at \$314.91. In her obituary a senior colleague wrote: “[She] was possessed of a nature so full of sunshine that, to her, all of life became beautified and full of meaning.”

# Image credits

Henrietta Leavitt

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