Lowell Milken Center for Unsung Heroes
ARTEFFECT

Impact Statement

Bea Holmberg, Grade 11
Leavitt's Standard Candle, 2026
Oil on canvas, 36 x 24 inches
Washington Waldorf School, Bethesda, MD
Unsung Hero: Henrietta Swan Leavitt

I chose Henrietta Swan Leavitt as my Unsung Hero because her quiet, meticulous work as a “human computer” for the Harvard College Observatory fundamentally changed the future of astrophysics and our understanding of the universe. She was highly educated and brilliant, but also shy, pleasant, and unassuming. She was known for her work ethic and intellectual curiosity. She persevered in her work despite sexist limitations and ongoing health challenges, including becoming increasingly hearing impaired and the stomach cancer that ultimately took her life at the age of 53 in 1921.

Ms. Leavitt began working at the Harvard College Observatory as a volunteer research assistant in 1892. She became a paid staff member in 1905, along with other highly intelligent women who were employed in part because they could be paid less than men in the same position. Even though she eventually became the Head of Stellar Photometry at the observatory shortly before her death, she and other female scientists were not allowed to use the large telescopes. Instead, her research was restricted to analyzing photographic plates. Despite these limitations, she made discoveries that reverberate through astrophysics to this day.

Ms. Leavitt made Nobel Prize-worthy discoveries, although her premature death prevented Swedish mathematician Gosta Mittag-Leffler from nominating her for the Nobel Prize in 1925. Her work focused on Cepheid variable stars found within the Magellanic Clouds, which we now know are two irregular dwarf galaxies that orbit the Milky Way. Using photographic glass plates, Leavitt catalogued the brightness of these stars and the time period between their dimming and brightness. The relationship between these two factors, known as the period-luminosity relationship, is the foundation of the “standard candle,” a cosmic yardstick that enables scientists to measure much farther distances in space than before. (Previously, scientists relied on stellar parallax, which could measure only close stars.) Ever since, astronomers have used Leavitt’s standard candle to uncover the nature of our universe. Edwin Hubble used Leavitt’s work to calculate the distance to the Andromeda Galaxy, discovering for the first time in 1923 that it was a separate galaxy from our own. Building further on Leavitt’s work, Hubble announced in 1929 his extraordinary discovery that the universe is expanding.

As Adam Riess, a 2011 Nobel Laureate in Physics for work discovering that the universe’s expansion is accelerating, explained: “By discovering a relationship for some stars between how bright they appear and how fast they blink, Henrietta Leavitt gave us a tool to gauge the size and expansion rate of the universe. That tool remains to this day one of our very best for studying the universe."

In my painting, Leavitt's Standard Candle, I sought to contrast Leavitt's quiet dedication to studying more than 2000 variable stars with the profound and far-reaching impact of her work on our understanding of the universe. I painted Ms. Leavitt in a realistic style to underscore her humanity and the realness of her unassuming life. I used oil paint, which supports meticulous and detailed painting, similar to her meticulous and detailed astronomy work. In the painting, she is writing in the book in front of her. Instead of text, the viewer sees the graphic representation of the Cepheid light curves she discovered. Next to her book sits a glass plate with her careful markings on it, meant to further underscore the painstaking nature of her work. Above and to her left, I have replicated the groundbreaking Period-Luminosity Relationship graphs she published in 1908 and 1912. Ms. Leavitt, her graphs, the photographic plate, and her book are all in sepia tones, representing the timeframe more than 100 years ago in which her discoveries were made. The remainder of the background, painted in a complementary but brighter blue and abstract style, represents Cosmic Microwave Background (CMB). CMB, radiation leftover from the Big Bang, is meant to highlight the enduring impact of her Cepheid standard candle, which enabled Hubble to observe that distant galaxies are moving away from us, which in turn was the first foundational evidence of the Big Bang. Also in blue, I included the Hubble Constants derived from standard candles (approximately 73 km/s/Mpc) and CMB (approximately 67 km/s/Mpc). This discrepancy is known as the Hubble Tension, an enduring cosmological puzzle astronomers continue to wrestle with today.

As an astronomy intern and student artist, I feel a strong connection to the life story of Leavitt – a pioneering female astronomer and, for a time, an art teacher. Leavitt's impact on cosmology cannot be overstated, which is an even more inspiring achievement given the outsize and unfair constraints on her scientific research due simply to being a woman. I was born 140 years after Ms. Leavitt, and her life inspires me to persevere in meticulous work (like oil painting and variable star research), while simultaneously feeling gratitude that I do not face the sexist constraints she did. For instance, I am allowed to use the large telescopes at the University of Maryland Observatory while observing variable stars and asteroid occultations under the mentorship of Professor Elizabeth Warner.

The topic of my Senior Project at the Washington Waldorf School is using creativity to make science more accessible, something that feels especially timely given the urgent importance of public trust in science. This oil painting will be part of my Senior Project that I will present to my school community, including students, teachers, and parents. I will also share this painting online and with my young neighbors, who have enjoyed seeing my artwork. Thus, I hope to reach a broad audience and help others see the value of contributions of those, like Henrietta Swan Leavitt, whose work often goes unseen.

References:

McNeill, Leila, "The 'star-fiend' who unlocked the Universe," 3/11/21, BBC.

Foxell, Emma, "Leavitt's Standard Candles," 3/8/2019.

Astrobites 1912: Henrietta Leavitt Discovers the Distance Key, Carnegie Science

Kruesi, Liz, "Decoding the cosmic microwave background," Astronomy.

Wargelin, Peggy, "Variable Stars," 2018, Wolbach Library.

Hicks Jennifer, "Henrietta Swan Leavitt," 2023, EBSCO.

"The Hubble Constant and Hubble Tension," NASA.

Warren, Sasha, "The Hubble Constant, Explained," 11/25, UChicago News.