

A Truly Human Identity Takes the Stage in *Silent Sky*

by Ian Overton and Kesha Rogers

Nov. 22—Prior to 1912, nobody could prove that the Milky Way was not the entire Universe. Henrietta Swan Leavitt's contribution to astrophysics changed that, although as a woman at Harvard, she was not even allowed to look through a telescope.

A powerful presentation of Henrietta Leavitt's life—and her passionate commitment to a creative intellectual identity—has been brought to the stage in Lauren Gunderson's play, *Silent Sky*. While little is actually known about the real Miss Leavitt—historians lack much correspondence and have no diaries—one can surmise enough to present, as Gunderson has, what must have been driving her to pursue the life she lived, facing the obstacles she faced.

This production, by Main Street Theater in Houston, Texas, directly counters the decades-long slump into populist *Regietheater* performances in which the director severely changes the original setting to shock or amuse the audience—and expresses clearly the profound quality that Friedrich Schiller taught in his essay, *Theater as a Moral Institution*:

The theater is the common channel through which the light of wisdom streams down from the thoughtful, better part of society, spreading thence in mild beams throughout the entire state. More correct notions, more refined precepts, purer emotions flow from here into the veins of the people; the clouds of barbarism and gloomy



The heroine of Silent Sky, Henrietta Swan Leavitt, 1868-1921. Her discovery led to major changes in our understanding of the Universe.

superstition disperse; night yields to triumphant light.

Determined Women Master the Stars' Destiny

In the play, Leavitt pursues her hypothesis about stars that go through a cycle of variation in brightness. She establishes that the length of the cycle is related to the star's intrinsic brightness (see box, next page). This discovery paved the way, shortly after her death in 1921, for Edwin Hubble and others to measure the distances of stars beyond the reach of visual parallax, which resulted in establishing that they were outside the Milky Way Galaxy. Leavitt's conclusion overturned existing theories about the limits of the universe. No, the Sun was not

the center of the Galaxy. And the Galaxy was not the Universe or the center of the Universe.

Leavitt initially got no credit for her discovery as being a critical breakthrough leading to this result. After her death, however, Hubble said that she had deserved a Nobel Prize. The Swedish mathematician Gösta Mittag-Leffler recommended her for the prize, not knowing that she had died. It is never awarded posthumously.

The dozen or so women working at Harvard under Dr. Edward Pickering were not merely human "computers" (as they were called), but a cadre of scientific minds who classified tens of thousands of stars. In addition to Leavitt, two of the other women are included in the play, Annie Jump Cannon and Williamina Fleming, women who made well-known contributions in the

field of astronomy and astrophysics. Throughout the play these women express agapic qualities of tough yet compassionate love, a collaborative sense of mission and discovery, and a mutual mentoring relationship with Henrietta, encouraging her in her passion for achieving her breakthrough. Henrietta too, pushed these women to be great.

Williamina Fleming ascended from her job as Pickering's housekeeper to the head of the computing group.

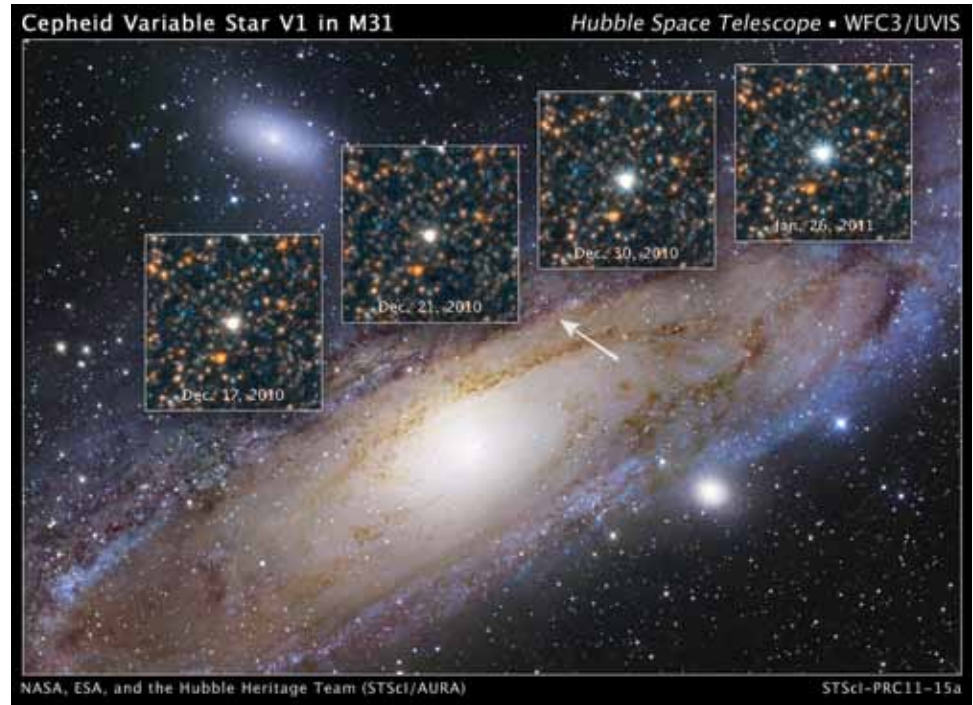
She became recognized in the astronomical community at large, examined the thermal spectra of more than 10,000 stars, and developed a classification system of 22 star classes according to the amount of hydrogen seen in their spectra.

Annie Jump Cannon is known as the theorist of stellar spectra. The major classes of stars were (and still are) known by a single letter in the sequence OBAFGKM. Cannon coined the mnemonic phrase for this se-

How Far Is a Star?

Astronomers can only measure the distance to a star indirectly. For nearby stars, parallax can be used by viewing the star from two different points in the Earth's rotation. But Henrietta Leavitt made a discovery leading to the first indirect method for those stars too distant for parallax to work. She studied Cepheid variable stars and identified thousands of them, earning her a reputation as a "star finding fiend" among Harvard professors. Cepheids are a class of variable stars that vary in brightness (technically speaking, luminosity) because they expand and contract, which they do in regular, clock-like periods.

Leavitt discovered that brighter (hotter) Cepheids have longer periods, and dimmer (cooler) ones have shorter periods. Of course, a bright, distant star and a faint, nearby star can look equally bright to us; hence the distinction between intrinsic and apparent brightness. Leavitt compared Cepheids that were in one or the other of the two Magellanic Clouds—coherent bodies whose members have to all be at about the same distance from Earth (they are now known to



Cepheid variable V1 in the Andromeda Galaxy.

NASA, ESA, and Hubble Heritage Team

be two small, irregular galaxies close to our Galaxy). This meant that differences in brightness resulting from differences in distance were negligible, and this enabled her to discover the period-luminosity relationship: It was possible to identify the intrinsic luminosity of any Cepheid by measuring its period.

From her discovery, other astronomers realized that the distance of a galaxy can be determined by measuring the periods of its Cepheids, and then comparing the calculated intrinsic luminosity with the apparent luminosity. Hubble did this in 1923 with the star V1 in the spiral nebula that became known as the Andromeda Galaxy (or M31), proving that it was too far away to be part of our Galaxy.



Professor Pickering's "computers" at the Harvard College Observatory, pictured in 1890.

quence, still used today, "Oh, Be A Fine Girl—Kiss Me!" Later in life, as represented in the play, Cannon also became active in the Women's Suffrage movement of the 1920s.

Music of the Soul

Although Leavitt's two siblings died early in life, playwright Gunderson revives her sister, giving the two characters a profound relationship. In *Silent Sky*, Leavitt's hypothesis comes during a period of immense creative tension. She is represented at home listening to her sister play the piano, while her father is dying from the effects of a stroke; she is away from her laboratory and unsure of her suitor's faithfulness. Hearing the arpeggios, she connects the periodicity between the low and high notes, and the low and high luminosity of the variable stars, exclaiming, "I grasp it now! It's music! It's music!"

Wittingly or not, here Gunderson is reflecting what Lyndon LaRouche has emphasized as the very essence of the fight over the epistemology of science in the early Twentieth Century, as a battle between the soulless logical positivism of Bertrand Russell, and the immortal legacy of the creative individual dedicated to pursuing a discovery, even though she doesn't yet know what it

is. Throughout the play, the passionate character of Miss Leavitt moves the audience to understand that the true nature of human beings lies in the discovery of the unknown; we come to know the universe not through mathematical calculations, but through addressing paradoxes only recognizable and understood by the human mind.

This process is captured eloquently in the second act when Henrietta is weakened by cancer and questions the value of her contribution in the face of her own mortality and obscurity. Henrietta's devout sister Margaret challenges her on how their seemingly incompatible notions of God and science,

heaven and the lasting effect of one's discovery of creation's laws on the world, are actually the same.

Like her contemporary Max Planck, Henrietta Leavitt gave up her original career choice as a concert pianist for physical science. Having lost most of her hearing, she picked up astronomy at the tail-end of her education at Radcliffe College, and went on to work at Harvard—for several years as an unpaid intern, and then for about 30 cents an hour (about \$7.21 in 2015 wages).

What actually provoked Leavitt's hypothesis and discovery is not known, but such a musical representation is consistent with the same universal quality of genius found in such brilliant minds as Max Planck and Albert Einstein, who leaned heavily on their musical backgrounds to assist them when coming up against seeming limits to their creativity in their attempts to comprehend primary causes.

The Main Thing is the Effect

The founding artistic director of Houston's Main Street Theater, and director of *Silent Sky*, Rebecca Greene Udden, along with the other actor and actresses of the play, must have foreseen the profound effect this play would have on their audiences. They organized a

series of talks following their performances of *Silent Sky* so that representatives of space science in the community could provide outlets for inspired attendees.

The speakers included Dr. Carolyn Summers, head of the astronomy section of the Houston Museum of Natural Sciences; Dr. Thomas Williams, professor emeritus at Rice University; Dr. Bonnie Dunbar, astronaut and former International Space Station (ISS) Commander; and Dr. Leroy Chiao, former ISS Commander, the first Chinese-American astronaut, and CEO of OneOrbit.

Representatives of the LaRouche movement attended these performances and discussions, and contributed to the already elevated discussion, raising the key epistemological elements of the play mentioned here, and inspiring the speakers to go beyond their existing conceptions.

Summers and Dunbar deplored the fact that today very few people even look at the sky to be inspired by it. For Bonnie Dunbar, as a child growing up in west Texas, "...observing the plane of our galaxy was a [nightly] fact of life." Now a professor at the University of Houston, she polemicized that only two or three of her 187 students even know there is an International Space Station; yet upwards of 80% of them erroneously believe that carbon dioxide is a pollutant. She pointed out that field trips to the local George Observatory inspire her students to become excited about discoveries that change their concepts about our potential future.

LaRouche PAC organizer Joseph Jennings raised the problem of Bertrand Russell's *Principia Mathematica* in this context, pointing out that the subordination of scientific passion to pre-ordained mathematical rules has eliminated discovery from among the joys of human life, to which Williams exclaimed, "I agree with you! We've stopped looking for causality—that's a problem."

Chiao said that the play and the achievements of Henrietta Leavitt inspired him to include the arts as part of OneOrbit's focus on bringing science, technology, engineering, and mathematics into school programs. LaRouche PAC Policy Committee member Kesha Rogers posed to Chiao that *Silent Sky* reminds us that space is not about mere profits nor the planting of flags out somewhere on the cheap, but about discovery and the profound sense of wonder about the vastness of



Leavitt: "I grasp it now! It's music! It's music!"

Universe that the human mind can know and love, as was demonstrated through the life of Henrietta Leavitt. She asked for his thoughts on how plays like this could revive a national mission in space exploration, given an appropriate mission.

Chiao responded at length, noting that the next phase of human space exploration is not Obama's "silly" asteroid retrieval mission, nor a vaguely defined, unfunded, one-way Mars landing, but a thorough expansion of civilization into cis-lunar space, including near and far lunar telescope bases, breakthroughs in biomedical research relating to cosmic radiation and micro-gravity, and political breakthroughs for world collaboration in space exploration. Chiao is a leading advocate of U.S.-Chinese space cooperation.

LaRouche activist Ian Overton asked Chiao how his experience at the ISS changed his concept of what is important in life. Dr. Chiao said, "I would look out the window, and see the beauty of the Earth down below. But at the same time, I knew that some places I saw, though they looked beautiful from above, were engulfed in war or hunger. And when I returned, this caused me to be far less concerned about the trifling things of life, and more concerned about what unifies us all as human beings."

A timid teenage girl in the audience, through her mother, asked how she, too, could become an astronaut. Rarely has any play, opera, or concert inspired a teenage girl to seek to become an astronaut. This power of discovery should be afforded every human being.

Gunderson's *Silent Sky* expresses a true principle of theater, and functions as a moralizing power for the nation.