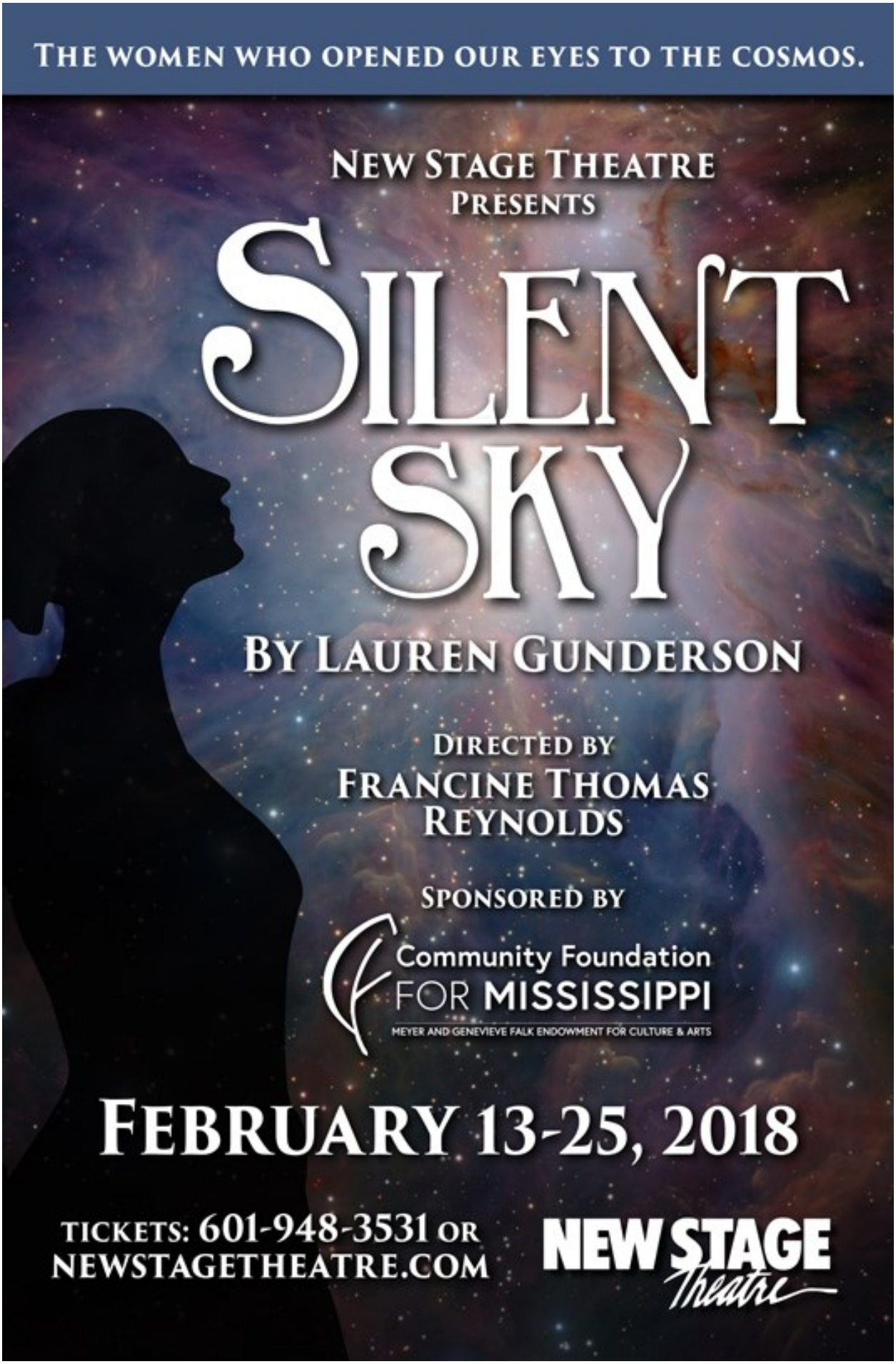
THE WOMEN WHO OPENED OUR EYES TO THE COSMOS.
NEW STAGE THEATRE
PRESENTS
SILENT SKY
BY LAUREN GUNDERSON
DIRECTED BY
FRANCINE THOMAS REYNOLDS
SPONSORED BY
Community Foundation FOR MISSISSIPPI
MEYER AND GENEVIEVE FALK ENDOWMENT FOR CULTURE & ARTS
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NEW STAGE Theatre

STUDY GUIDE

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DIRECTOR'S NOTE

As Henrietta Leavitt stared at the stars and struggled to chart our place in the universe, she charted a new path for women at the turn of the 20th century.

Have you ever heard of Henrietta Leavitt? Neither had I until I read Lauren Gunderson's ***Silent Sky***. I love when theatre brings to life stories the history books don't tell.

This early 20th Century female astronomer's discoveries gave us the ability to measure the universe. The much more famous (and male) astronomer Edwin Hubble built on her work and won the Nobel Prize for his work, which Henrietta could not because she died young before the full effects of her work were seen.

Playwright Lauren Gunderson, a woman who was recognized as the most-produced living playwright by American Theatre magazine in 2016, didn't know who was Henrietta Leavitt was either until she happened upon her story by chance.

> "I've always been drawn to tell stories of science. My earliest plays were about Isaac Newton and Leonardo Da Vinci as young men. But then I saw the inherent drama of women in science, who have it twice as hard (which means twice the drama). I found Henrietta's story by chance while perusing the stalls of used books in New York. There isn't that much known of her, but what is known is that in 1912 this unassuming but meticulous and curious woman gave the flagging field of astronomy the ingredient it needed to leap into the future. Without her finding a pattern in Cepheid stars, great astronomers like Shapley and Hubble wouldn't have shown us how huge and fast-moving our universe is. I went to Cambridge to visit Henrietta before the premiere of the play in 2011 and got to see her handwritten notes, the glass photographic plates she used, and her grave," said Gunderson.

She continued, "This is going to sound crazy, but I stood there at her grave and said, "Thank you for letting me borrow your story. I promise I'll take care of it."

Theatre lovers are fortunate that Gunderson found inspiration in Leavitt's scientific discoveries, while persevering in a man's world, and borrowed her story to craft a marvelous play.

It is gratifying to work on a play with so many lovely elements – beautiful language, history, science, strong women characters, romance, and humor. Bringing to light historically significant and under-recognized women is an enjoyable process. I am very inspired by women who overcame all sorts of obstacles to make a place in their field or in the world. What makes me passionate about this, presenting ***Silent Sky***, is that some of those women are being given the credit they always deserved.

Francine

It is always fun to work on plays when the production team and cast research the history and periods of the real-life events depicted in the piece. Some of that research is in the paragraphs below.

> A decade ago, in a speech that enraged many women, Harvard President Lawrence H. Summers hypothesized why America's top universities had hired so few female professors in science and engineering. He suggested it was neither gender discrimination nor a consequence of the differences in how our culture socializes boys and girls but rather "issues of intrinsic aptitude" — an innate inequality of the sexes. It was an admittedly tactless remark, and Summers quickly apologized, but the resulting controversy raised an important question: If given encouragement and opportunity, how far might women rise in the sciences?
>
> In a turn of poetic irony, the central narrative of ***Silent Sky*** unfolds at Harvard itself and, perhaps, is a subtle comeback to Summers's comment. In the 1880s, the Harvard College Observatory launched an ambitious project: to photograph the entire night sky in exquisite detail, creating thousands of glass negatives that were stored like books in a vast library. The observatory's director, Edward C. Pickering, needed skilled "readers" to painstakingly study these images under magnifying glasses and classify each star based on its luminosity, variability (the tendency to fade and brighten again), and the component colors of its light separated by a prism, thereby revealing the star's chemical composition. The task, was to parse the starlight, and for this crucial assignment, Pickering assembled a team of "lady assistants."
>
> The story of "Pickering's harem" (a dismissive label some affixed to the team) demonstrates the oppression of women in the sciences. These women may not have received the same salaries or academic titles as their male counterparts, but when given the freedom to work as bona fide scientists at a time when that was nearly impossible for women they proved themselves to be intellectual peers.

'Women computers' often couldn't use Harvard's telescope. They changed astronomy anyway. In the 1800s, it was unseemly for women to search the night sky with male astronomers. Instead, they worked in the Harvard College Observatory as assistants. Between 1875 and 1927, more than 80 women were employed at the observatory as so-called "women computers," that is, women who performed scientific and mathematical calculations by hand. For 25 to 30 cents an hour, their task was the meticulous study and care of black and white astronomical photographs of the night skies. In most images, the stars were tiny black dots on a white background.

Day in and day out, the women explored the cosmos without looking through a telescope. It was painstaking work. Using a simple magnifying glass, they studied the stars, work that eventually led to discovering their composition. Staring at these stellar clusters, chemically captured on glass plates, helped them gauge immense distances in space and measure the brightness of stars.

Inside the archive of the Wolbach Library in the Harvard-Smithsonian Center for Astrophysics, center staffers have been digitizing the collection of more than 500,000 of those stellar glass photographic plates.

"It's really important to bring to light what these women did," said Katie Frey, assistant head and digital technologies development librarian at the Wolbach Library. "They made groundbreaking discoveries in astronomy. They really changed the course of astronomy."

**some of the above material is from articles in the Boston Globe, written by David Baron.*

THE PLAYWRIGHT

LAUREN GUNDERSON is the most produced living playwright in America, the winner of the Lanford Wilson Award and the Steinberg/ATCA New Play Award, a finalist for the Susan Smith Blackburn Prize and John Gassner Award for Playwriting, and a recipient of the Mellon Foundation's 3-Year Residency with Marin Theatre Co. She studied Southern Literature and Drama at Emory University, and Dramatic Writing at NYU's Tisch School where she was a Reynolds Fellow in Social Entrepreneurship. Her work has been commissioned, produced and developed at companies across the US including the Denver Center (***The Book Of Will***), South Coast Rep (***Emilie***, ***Silent Sky***), The Kennedy Center (***The Amazing Adventures Of Dr. Wonderful And Her Dog!***), the O'Neill Theatre Center, Berkeley Rep, Shotgun Players, TheatreWorks, Crowded Fire, San Francisco Playhouse, Marin Theatre, Synchronicity, Olney Theatre, Geva, and more. Her work is published by Dramatists Play Service (***Silent Sky***, ***Bauer***), Playscripts (***I and You***; ***Exit, Pursued by a Bear***, and ***Toil and Trouble***), and Samuel French (***Emilie***). She is a Playwright in Residence at The Playwrights Foundation, and a proud Dramatists Guild member. She is from Atlanta, GA, and lives in San Francisco. LaurenGunderson.com and @LalaTellsAStory.

HENRIETTA LEAVITT

Henrietta Swan Leavitt was born July 4, 1868 in Lancaster, Massachusetts. She died December 12, 1921 in Cambridge, Massachusetts. Her father was a minister in the Congregational church. She was the oldest of 7 children. She never married and had no children.

Henrietta spent most of her youth living in Lancaster, Massachusetts. Her family moved to Ohio when she was a teenager. While her family lived in Ohio, she attended Oberlin College for two years. She then transferred to Radcliffe college, where she earned an A.B. degree in 1892. She traveled and taught school for a time after her graduation.

Henrietta suffered an illness sometime in her young adulthood that left her profoundly deaf. She struggled with intermittent illness throughout her life. As such, there were extended periods of time when she was unable to work at the Harvard College Observatory. She ultimately died of cancer.

Henrietta first arrived at the Harvard College Observatory in 1895 as a volunteer, in part because she'd discovered an interest in astronomy during her final year at Radcliffe. She was assigned the task of searching for variable stars on the photographic plates. By comparing positive and negative plates of the same star taken at different times, Henrietta was able to determine if the star had changed in brightness between the time of the first photograph and the time of the second photograph. Henrietta left Harvard sometime around 1896, at which time she traveled Europe for a couple of years and then, when her family needed her, she went to stay with them in their home in Wisconsin.

In 1902, Henrietta asked Edward Pickering, director of the Observatory, if he knew of an observatory in a warmer climate, where she might be able to work without as much impact on her health. He told her he knew of no such place, and he brought her back at 30 cents an hour, more than the 25 cents earned by the majority of women computers. She began to focus on the variable stars in the Magellanic clouds. These stars were later named Cepheid variable stars.

In 1905, she noticed that the brighter the star, the longer its period of variation was.

In 1907, Pickering assigned her to study the stars in the northern sky (she had been studying stars in the southern sky).

In 1908 she published her findings in a paper called "1777 Variables in the Magellanic Clouds." Also in 1908, she left Harvard due to illness and went to her family in Wisconsin. She was able to continue working from a distance, to some extent, and appears to have briefly returned to the Observatory in 1910 until her father's death required her to return home to Wisconsin.

In 1912, she was back at the Observatory full time. She published a paper entitled, "Periods of 25 Variable Stars in the Small Magellanic Clouds." The findings presented in this paper provided the foundational work necessary for later astronomers to determine the distance between objects in space.

Between 1913 and 1917, Henrietta continued to study and publish papers. In 1921, she was named head of stellar photometry. She died shortly thereafter.

ANNIE JUMP CANNON

Annie Jump Cannon was born December 11, 1863 in Dover, Delaware. She died April 13, 1941 in Cambridge, Massachusetts. Her father was a well-off shipbuilder and politician. She was the eldest of three daughters. She loved to play the piano and was, by all accounts, a friendly person. She was also a suffragist and a member of the National Women's Party.

Her mother, Mary Jump Cannon, taught her about constellations and suggested that she study at Wellesley College. Annie earned an A.B. from Wellesley in 1884. She then returned home for 10 years. After her mother died, she returned to Wellesley to study and to teach. She later enrolled in Radcliffe to study astronomy. It was there that she met Edward Pickering and began work at the Harvard College Observatory.

Like Henrietta Leavitt, Annie was nearly deaf due to an illness, most likely scarlet fever. She died of heart disease.

Annie arrived at the observatory in 1896, one year after Henrietta Leavitt arrived. She was assigned the task of analyzing the spectra of bright southern stars. She and Pickering published her findings in 1901 in the Annals. In addition to analyzing most of the 1100 stars herself, Annie also revised the classification system that had been established by Williamina Fleming. Her system of classification was adopted as the standard by the International Solar Union in 1910.

In 1902, Annie was working on long-period variable stars, along with Henrietta Leavitt.

In 1903, Annie published a catalog of 1200 variable stars. In 1907, she published another catalog with 222 stars and also earned an M.A. from Wellesley.

In 1911, Annie was back to work looking at spectral characteristics of stars for a new Draper catalogue. She was also named "Curator of Astronomical Photographs," replacing Williamina Fleming, who held that position until her death in 1911.

She continued to study and publish catalogues analyzing thousands of stars until her retirement in 1940. She received a number of awards and honors. In 1914, she was given an honorary membership into the Royal Astronomical Society. In 1925, she became the first women to receive an honorary doctorate from Oxford University. She was the first woman to receive the U.S. National Academy of Science's Henry Draper Medal in 1931. She was the first woman elected as officer of the American Astronomical Society.

WILLIAMINA FLEMING

Williamina Stevens was born in Dundee, Scotland, on May 15, 1857. Her father (who dabbled in photography) died when she was 7, leaving her to be raised by her mother. Wiliamina died May 21, 1911 in Boston, Massachusetts.

Williamina was an extremely bright student in Scotland. By age 14, she was hired to tutor students at her school. She taught math, languages, and science at the school for six years before she married James Fleming in 1877. She never attended college.

Williamina and James emigrated to Boston in 1877. James abandoned Williamina and their then-unborn child. After her husband abandoned her, Williamina found employment as Edward Pickering's maid. Legend has it that one day, he was so frustrated with the pattern of mistakes being made by one of the male assistants at Harvard that he declared, "my Scottish maid could do a better job than you're doing." And then to prove a point, he brought Williamina in to the Observatory and trained her. And she did, in fact, out-perform the male assistant. In fact, in 1881 she was hired on full time and by 1887 Pickering had put Wiliamina in charge of what would become known as "Pickering's Harem" – a group of dozens of women computers.

In the late 1880s, Williamina developed a new system of classification, modified from the Secchi Class system that had previously been in place.

In 1899, she was named Curator of Astronomical Photographs, the first official position ever granted to a woman at Harvard. She trained and supervised more than 50 computers in her time at Harvard.

During her career, she cataloged thousands of stars and discovered over 310 variable stars and 10 novae.

In 1906, she was made an honorary member of the Royal Astronomical Society, the first woman to receive that honor. She was also made an honorary fellow at Wellesley College. Her publications include "A Photographic Study of Variable Stars" in 1907, a discovery of white dwarfs in 1910, and the "Spectra and Photographic Magnitudes of Stars in Standard Regions" in 1911. She died of pneumonia on May 21, 1911.

EDWARD PICKERING

Edward Pickering (1846-1919) was an American astronomer and served as director of the Harvard College Observatory from 1877 until his death in 1919.

He was one of the pioneers of using photography to study astronomy, and in 1882 he developed a method a way to photograph the spectra of multiple stars at the same time by placing a large prism in front of the photographic plate.

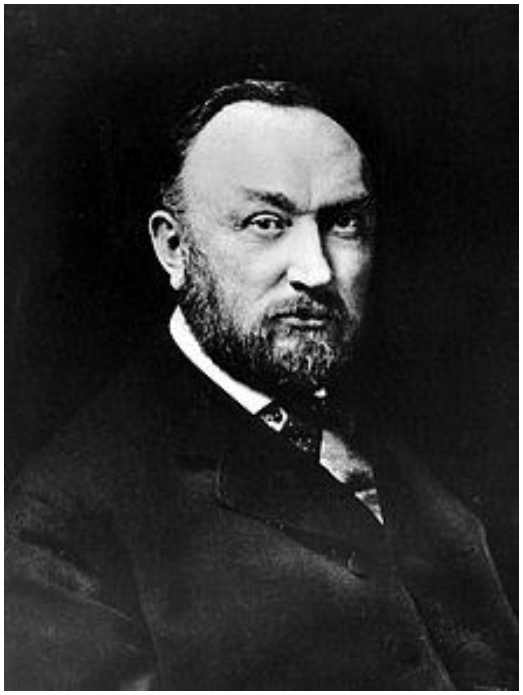
He was influential in obtaining funding for the Draper Catalog, and he had numerous publications detailing his astronomical findings.

He was a fellow of the American Academy of Arts and Sciences, won the Gold Medal of the Royal Astronomical Society, won the Henry Draper Medal, and has a crater on the moon named after him.

Pickering chose to hire female computers because they were cheaper, but also because he believed they were more skilled at repetitive, detailed work than were men.

Despite not paying his women as much as he paid the men, he was apparently quite committed to ensuring that the women be given credit for their work in publications.

One reason why women were not permitted to actually work with the telescope is that the telescope room was freezing cold and therefore not suitable for women's constitutions.



THE LIFE OF A COMPUTER AT HCO

Wages:

Most women at the observatory were paid 25 cents an hour, which amounted to about $546 per year. By comparison, male astronomers of the time were paid about $800 per year. And even male sales clerks made at least $780 per year. (Note: in today's dollars, the women would have been paid between $6.75 and $7.50 an hour)

Work Day:

The women worked six days a week (Sunday was their day off), for 7-9 hours a day. Tasks varied from person to person. Some women reduced photographs in order to make the image as clear as possible. Other women catalogued the photographs themselves. Others classified the stars by comparing them to stars with established brightness and spectral characteristics. The women wore long dresses and sat at desks in the "women's work room."

The women also had fun and socialized with one another. Here's a picture of Williamina Fleming and several female computers on a ship outing:

THE PROCESS OF CLASSIFYING THE STARS – STAR SPANKING!

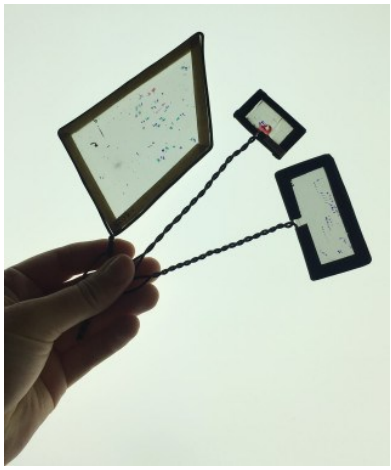
After the men captured images of stars on photographic plates, those plates were sent to the women's work room where they were analyzed.

First, the women placed the plate on a light lectern, a stand with a back-light that allowed them to view the image on the photographic plate.

In order to classify a particular star, the computer would use a smaller piece of photographic plate that contained a "key" or "legend" of sorts, with images of stars with well-established degrees of brightness. By visually comparing the new star's brightness to the legend, the computer was able to assign a brightness classification to the new star.

This smaller photographic plate had a wire handle and was known as a "fly spanker".

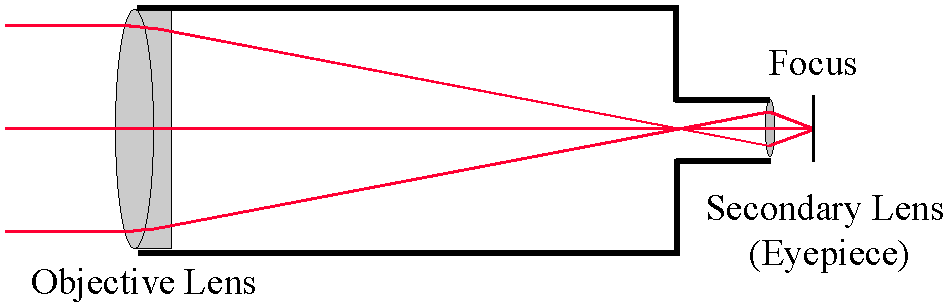
Henrietta Leavitt may have coined the term "fly spanker" when she observed that the tool looks like a fly swatter, but that it is too small to kill a fly, it just "spanks" it.



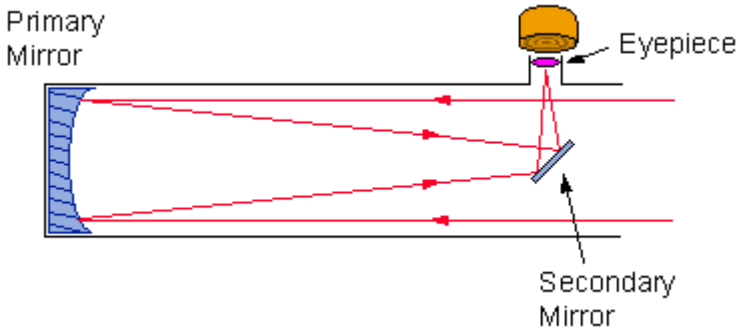
TELESCOPES AND THE GREAT REFRACTOR AT HCO

There are two primary types of telescopes: refracting and reflecting.

In a **refracting** telescope, light enters the telescope through the objective lens (or object glass). The lens slows the light down and bends it. The beams form at the top and the bottom of the lens, then cross as they travel inside the telescope. The eyepiece lends bends them again, enlarges the resulting image, and sends it to the eye of the observer (or a camera).



In a **reflecting** telescope, the light enters, strikes a primary mirror at one end of the telescope. The mirror is tilted so that the light is bounced onto a secondary mirror, which in turn, sends the light to an eyepiece lens. From the eyepiece lens, the light travels to the eye of the observer (or a camera).



The Great Refractor at the Harvard College Observatory was a refracting telescope. When it was installed at Harvard in 1847, it was the largest refracting telescope in the United States. It retained that distinction until 1867. Harvard's Great Refractor had a 15-inch lens.

The telescope was located in the dome of the original building at the observatory, within walking distance of the building in which the women worked.

GLOSSARY OF ASTRONOMICAL TERMS

Cepheid Stars

A type of star that pulsates radially. It varies in diameter, temperature, and brightness throughout its cycle. Henrietta Leavitt discovered that it is possible to determine the true brightness of a Cepheid star by observing the pulsation period. That discovery led to an ability to measure distance between objects in the sky. These stars are called Cepheids because the first discovered star of this kind is part of the constellation called Cepheus. Classical Cepheids undergo pulsations with regular patterns, anywhere from days to months. These stars are used to determine distance to galaxies. Type II Cepheids pulsate with periods between 1-50 days. Anomalous Cepheids have periods less than 2 days.

Declination

Angular distance north or south from the celestial equator.

Draper Catalogue

The Draper Catalogue was first published in 1890, with significant work done by Williamina Fleming, who developed a new classification system for the Catalogue. The catalogue was named for Henry Draper, who made the first photograph of star's spectrum showing distinct spectral lines. After his death, his widow agreed to fund Pickering's project to catalogue the spectroscopic classification for more than 10,000 stars. In subsequent editions and extensions (HDE for Henry Draper Extension), hundreds of thousands of stars have been classified and catalogued.

Luminosity

The amount of light a star gives off; its true brightness, after correcting for the dimming effect of its distance from earth.

Magellanic Clouds

Named after the explorer Ferdinand Magellan, who wrote about using the "shining clouds" to stay on course. The Magellanic Clouds are located in the southern celestial hemisphere. They are two irregular dwarf galaxies orbiting the Milky Way galaxy. The Large Magellanic Cloud is 160,000 light years away. The Small Magellanic Cloud is 200,000 light years away. Henrietta Leavitt studied stars in the Magellanic Clouds. Her discoveries made it possible to calculate the distance of the stars in the Magellanic Clouds.

Nebula (plural nebulae)

An cloud of dust, hydrogen, helium, and other ionized gases surrounding a star.

Nova (plural novae)

A star that seems to get suddenly brighter and then fades over weeks or months. It is actually two stars that are close in proximity to one another. They interact with one another, and it is this interaction that generates a kind of nuclear explosion. This explosion reads like a bright new star.

Photometer

A device for measuring the brightness of stars.

Right Ascension

The distance of a point east of the First Point of Aries.

Spectroscope

A device that creates and displays spectra.

Spectrum (plural spectra)

The full range of colors of visible light.

Supernova

An astronomical event that happens at the very end of a massive star's life. It is one massive explosion to end all explosions for that star. We see what looks like a bright new star.

Theory of Relativity

Einstein's theory of special relativity was published in 1905. His theory of general relativity was published in 1916. The term "theory of relativity" was first used in a 1906 paper by Max Planck.

AN ASTRONOMICAL GLOSSARY

Cepheids
Cepheid Variables are very large, luminous, yellow stars. They change in magnitude (brightness) regularly, with periods of 1 to 70 days between peaks. The stars are called Cepheids after the first star of this type to be discovered, Delta Cephei, a bright star in the constellation of Cepheus.

Declination and Right Ascension
Similar to geographic latitude and longitude but projected onto the celestial sphere: Declination is expressed in degrees north or south of the celestial equator, and right ascension measures an angle that increases toward the east as measured from a zero point (the place in the sky where the Sun crosses the celestial equator at the March equinox).

Draper Catalogue
Its first edition published in 1890, the Draper Catalogue of Stellar Spectra contained spectroscopic classifications for 10,351 stars. Most of the classification was done by Williamina Fleming at the Harvard Observatory. The catalogue is named after Henry Draper, an American doctor and amateur astronomer who pioneered the field of astrophotography.

Great Refractor Telescope
A 15-inch telescope installed at Cambridge in 1847. For 20 years it was the largest telescope in the United States, the most significant American astronomical instrument and equal to the finest in the world. It formed the nucleus for development of the Harvard College Observatory.

Light Year
The distance traveled by light in one year, equal to about 6 trillion miles.

Magellanic Clouds
Known to astronomers since the tenth century, the Large Magellanic Cloud and its neighboring Small Magellanic Cloud are irregular dwarf galaxies visible in the southern hemisphere. They orbit our own Milky Way galaxy, whose gravitational force has contributed to their distorted shape and cloudy appearance.

Period-Luminosity Relation
The relationship between a variable star's luminosity (the total amount of radiation it gives off in one second) and the period of its pulsation (the length of time between successive peaks in its brightness). In Cepheids this relationship is well defined, a discovery made by Henrietta Leavitt.

Photometry
The branch of astronomy that deals with the accurate measurement of the brightness, color and temperature of stars and the changes in their brightness over time.

Spectral Class
One of seven classes designated by the letters O, B, A, F, G, K and M; the hottest stars (O and B) are blue-white in color, while the coolest (M) are red. Each of the letter classes has subdivisions indicated by numerals 0 through 9.

CLASSIFICATION OF THE STARS

Before Wiliamina Fleming began to work at the Harvard College Observatory, stars were most commonly classified using a system developed by Angelo Secchi. At the time Williamina began working with Pickering, the Secchi system identified four classes of stars. Class I, Class II, Class III, and Class IV.

Wiliamina Fleming decided to use alphabetical letters rather than Roman numerals in her classification. She took the previously used classes (I-IV) and replaced them with letters. This allowed the stars to be identified with more specificity than had been possible using Secchi's scale. This new scale, known as the "Draper System" was first published in the 1890 Draper Catalogue.

Secchi's Scale	Williamina's Classification (the Draper system)
Class I	A, B, C, D
Class II	E, F, G, H, I, K, L
Class III	M
Class IV	N
	O – used for stars whose spectra consisted primarily of bright lines
	P – used for planetary nebulae
	Q – used for stars that didn't fit in any other class

Antonia Maury, another computer at the HCO, briefly returned to Roman numerals (I-XXII) in the 1897 Draper Catalogue. While Maury's system was later abandoned by Annie Jump, she did first recognize that B stars were actually brighter than A stars, meaning that the order would have more accurately been listed B, A, C, D instead of A, B, C, D.

In the 1901 Draper Catalogue, Annie Cannon returned to the alphabet. However, she dropped all letters except for O, B, A, F, G, K, and M – in that order. The order (O, B, A, F, G, K, M) was based on the spectral characteristics of the stars. "O" stars are the hottest, and "M" stars are the coolest.

Most stars are currently classified under the Morgan-Keenan (MK) system, which is essentially directly derived from Annie Cannon's system. Each letter is now also subdivided with a numeral, with 0 being hottest and 9 being coolest. So, a star classified F3 would be a hotter star than one classified F9. But both of those stars would be cooler than a star classified by letters O, B, or A, which are, as a class, hotter stars than the F class stars.

THE CAST

ANNIE CLEVELAND (Henrietta Leavitt) is thrilled to be back at New Stage Theatre, working on one of her very favorite plays! Other roles at New Stage include: Shelby in ***Steel Magnolias***, Honey in ***Who's Afraid of Virginia Woolf?***, and Babe in ***Crimes of the Heart***. Other favorite roles include Bec in ***4,000 Miles*** with The NOLA Project, Jane in ***Miss Bennet: Christmas at Pemberly*** with Southern Rep, and Lady Anne in ***Richard III*** with Chicago's Wayward Productions. Big love to Dave, Mom, and Dad. "There's a reason we measure it all in light."

EVAN MCCARLEY (Peter Shaw) is excited to be joining New Stage Theatre for the first time. His previous theatre work in Memphis included playing Jim the world premiere of ***Byhalia, Mississippi***, Morris Townsend in ***The Heiress*** and Trevor in ***The Submission***. Offstage, he is an instructor in government, writing, and speech and debate at Jackson Academy. He wishes to thank Francine and the entire cast and crew for this incredible experience.

WENDY MIKLOVIC* (Annie Cannon) is happy to be back on the boards at New Stage where she was last seen in ***Steel Magnolias***. Local credits: ***Dividing the Estate***, ***Merrily We Roll Along***, ***Equus***, ***Romeo and Juliet***, ***Torch Song Trilogy***, ***Let Freedom Swing***, ***I Love You, Your Perfect, Now Change***, ***Oncepiece***. Regional credits: ***Evita***, ***Cabaret***, ***Closer Than Ever***, ***Putting it Together***, ***Oklahoma!***, ***Crimes of the Heart***. Film credits: ***Ender's Game***, ***God's Not Dead***, ***Bending the Rules***. Television credits: ***NCIS: New Orleans***, ***Common Law***, ***Breakout Kings***. Much love to John and Lincoln for their unending support. wendymiklovic.com

JO ANN ROBINSON* (Williamina Fleming) has worked professionally for more than 35 years in television, film and regional theatres across the U.S. From 1978-1989, she was based out of Los Angeles where credits included co-starring roles in ***The New Love American Style*** and the nationally syndicated ***Comedy of Comedies***. She also appeared as a stand-up comedienne at Hollywood's Laugh Factory and The Ice House, famous for featuring headliners such as Jay Leno and Joan Rivers. She was also a founding member of the comedy group Half-A-Deck, named as 'Best Bet' by the *LA Times*. Robinson has been a regular at New Stage since 1990. Some show credits include ***Who's Afraid of Virginia Woolf?***, ***A Time to Kill***, ***The Grapes of Wrath***; ***Lombardi***; ***First Baptist of Ivy Gap***; ***The Trip to Bountiful***; ***The Skin of Our Teeth***; ***Idols of the King***; ***Don't Dress for Dinner***, ***Broadway Bound***; ***Marvin's Room***; ***Proof***; ***Grace & Glorie***; ***Misery*** and ***Rumors***. Other regional theatre credits include ***A Streetcar Named Desire***, ***Angels in America I and II*** and ***Lips Together, Teeth Apart***, and ***Always Patsy Cline***. Robinson's film credits include the Arliss Howard/Debra Winger film ***Big Bad Love*** and ***Worry Dolls*** released in 2015, and she played Aaron Treit's mother in the recently released film ***Created Equal***. Robinson was also nominated for Best Actress for the prestigious B. Iden Award given by the Austin, Texas Critics Circle.

KERRI COURTNEY SANDERS (Margaret Leavitt) is excited to be reappearing at New Stage Theatre in this stunning work. Sanders has enjoyed such recent New Stage credits as Ellen Roark in ***A Time to Kill***, Rachel Crabbe in ***One Man, Two Guvnors***, Rose of Sharon in ***The Grapes of Wrath***, Mrs. Webb in ***Our Town***, and Jordan Baker in ***The Great Gatsby***. She also served as New Stage acting/directing intern for the 2011-2012 season and has been an instructor for several education programs at the theatre including New Stage's Youth Acting Troupe. Sanders also serves as Director of Theatre Arts at Jackson Academy. Some of Sanders' other favorite acting credits include Helena in ***A Midsummer Night's Dream***, Tamra & Bridgette in ***Quiet on the Set***, Nora in ***A Doll's House***, and host of MPB's *Job Hunter* series. She currently lives in Brandon with her husband, Michael, who makes every performance possible.

TIMELINE OF HISTORICAL EVENTS, SCIENTIFIC DISCOVERIES, AND INVENTIONS, 1900-1920

1900: Galveston hurricane killed 8,000+

1901: President McKinley assassinated and Teddy Roosevelt sworn in as President
Queen Victoria died
First transatlantic radio transmission
First vacuum cleaner
Annie Cannon's classification of stars
First Nobel Prizes awarded

1902: First permanent movie theatre building in the United States in L.A. (*The Great Train Robbery* would come out in 1903)
End of the American-Philippine War
Inaugural run of the 20th Century Limited passenger train between Chicago and NYC

1903: Ford Motor Company formed
First World Series
Wright Brothers first powered flight
Mary Anderson invents windshield wipers

1904: Teddy Roosevelt elected President
Ice Cream cone "invented" at Saint Louis World's Fair

1905: Einstein's first articles about relativity
Chainsaw invented
The Institute of Musical Art (now Juilliard) was founded in NYC

1906: San Francisco earthquake
Upton Sinclair's *The Jungle*
Pure Food and Drug Act
Meat Inspection Act
Air Conditioner invented (may have been as early as 1902)
3rd Law of Thermodynamics

1907: Oklahoma becomes a state
Electric clothes washer invented
Synthetic plastic invented (Bakelite)

1908: Model T hits the market
Cellophane invented
The FBI is established
Henrietta Leavitt's first article about Cepheid stars

1909: Taft becomes President
Admiral Peary reaches the North Pole
NAACP founded by W.E.B. Du Bois

1910: Williamina Fleming discovers the 1st white dwarf star
Boy Scouts of America founded

1911: Triangle Shirtwaist Factory fire kills 146
Supreme Court breaks up Standard Oil
Rutherford discovers the atomic nucleus

1912: The Titanic sinks
New Mexico and Arizona become states
Henrietta Leavitt's second publication about Cepheid stars
Geiger counter developed
x-ray diffraction
Girl Scouts founded

1913: Woodrow Wilson becomes President
Income tax established
Moseley defined the atomic number
Ford developed the assembly line
The bra was invented
The modern zipper was invented/patented

1914: Start of WW1
Panama Canal completed
Federal Trade Commission is established

1915: The Lusitania is sunk by a German U-Boat
Einstein publishes his work on general relativity, a decade long effort
Early work/discovery of black holes
The first STOP signs used in the United States, in Michigan

1916: First woman elected to US Congress (Jeanette Rankin, Montana)
Emma Goldman arrested for lecturing on birth control
Norman Rockwell's first cover for the *Saturday Evening Post*
Pancho Villa leads an attack on Columbus, New Mexico

1917: United States enters WWI
Wilson begins second term
The Selective Service Act–the draft begins
The first Pulitzer Prizes awarded

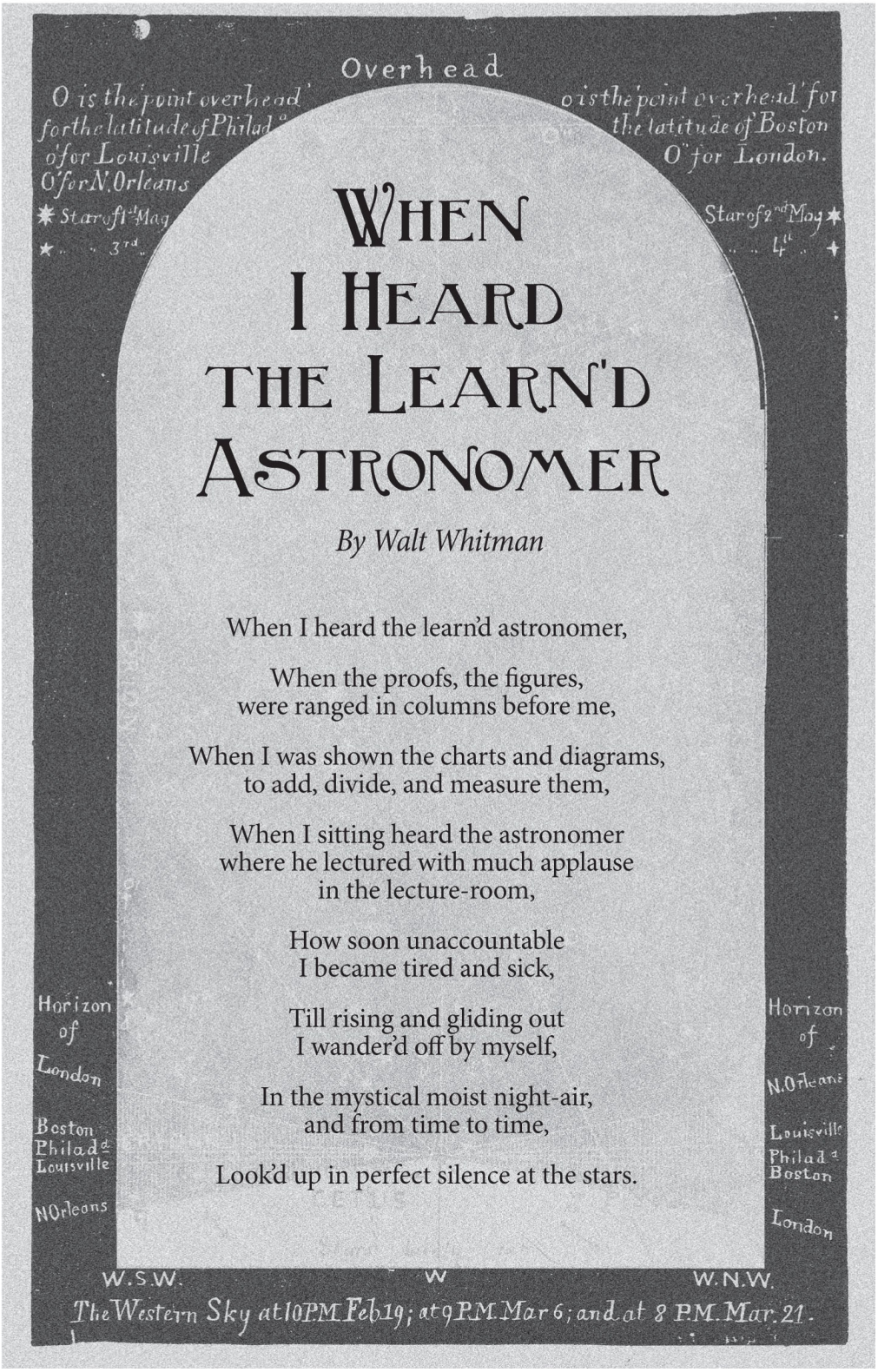
1918: End of WWI
Time zones are established and Daylight Savings Time goes into effect
Spanish flu epidemic

1919: 18th Amendment–prohibition
Emma Goldman and others deported, Red Scare
Ongoing conflict between Pancho Villa and US Army
First transatlantic flight

1920: 19th Amendment–women's suffrage
League of Women Voters created
Tommy gun patented
First domestic radio sets hit the stores
National Football League is established

WHEN I HEARD THE LEARNED ASTRONOMER

This wonderful poem by Walt Whitman is read by one of the characters in ***Silent Sky*** at a very poignant moment. Here it is for you enjoyment



When I heard the learn'd astronomer,

When the proofs, the figures,
were ranged in columns before me,

When I was shown the charts and diagrams,
to add, divide, and measure them,

When I sitting heard the astronomer
where he lectured with much applause
in the lecture-room,

How soon unaccountable
I became tired and sick,

Till rising and gliding out
I wander'd off by myself,

In the mystical moist night-air,
and from time to time,

Look'd up in perfect silence at the stars.

Audience Etiquette

For many of your students, a visit to New Stage Theatre to see *Silent Sky* may be their first theatre experience. It may be helpful to discuss with them the expected behavior of an audience. New Stage asks that prior to the performance, students are made aware of the following:

- Stay with your group at all times and pay attention to your teachers and chaperones.
- Listen to the New Stage staff member who will board your bus and escort your group to the lobby.
- Be sure to go to the bathroom before the performance begins. It is hard to leave once the performance begins.
- Make yourself comfortable while keeping movement to a minimum.
- Please do not stand up, walk around or put your feet on the seat in front of you.
- Absolutely no gum chewing, eating or drinking in the theatre.

Noise

Live theatre means live actors who can hear not only what is happening on the stage, but in the audience as well. While laughter and applause at appropriate time are appreciated by the actors, excessive noise and talking is not. Even whispering voices can be distracting to the actors and others in the audience.

- Do not talk during the performance.
- Cell phones are prohibited in the theatre. If you have one turn it off and put it away and do not bring it out during the performance.

Applause

Applause is used to acknowledge the performers and to voice appreciation or approval. Traditionally, applause comes before intermission and at the performance's conclusion. Dimming the lights on the stage and bringing up the house lights usually signals these intervals. A curtain call in which the cast returns to the stage for bows usually follows a performance.

Student Evaluation Form—*Silent Sky*

Name:_____
School:_____

What was your overall reaction to the play?

What was your reaction to the production values of the play (costumes, scenery, acting, etc.)?

What was your favorite part of the play?

Did you learn anything from this production? If so, what?

What other stories would you enjoy seeing staged by live actors?

Please list other comments and observations?

Please help New Stage by sharing your thoughts with us! Return this form to
Sharon Miles/ Education Director/ New Stage Theatre/ 1100 Carlisle St/ Jackson, MS 39202 or fax to 601.948.3538

Teacher Evaluation Form—*Silent Sky*

Name:_____School:_____

What is your overall reaction to the production?

How do you feel about the production values of the performance (costumes, set, performers, etc?)

How did your students react to the production? (We would appreciate any written response from your students)

Please comment on the educational value of the program.

What is your overall reaction to the question and answer (talk-back) session?

How did you hear about the New Stage production of *Silent Sky*?

What other plays would you like for your students to see?

Please list other comments and observations.

Please help New Stage by sharing your thoughts with us! Return form to:
Sharon Miles/ Education Director/ New Stage Theatre/ 1100 Carlisle St/ Jackson, MS 39202 or fax to 601.948.3538.

Information in this study guide was provided by Silent Sky dramaturg Elissa Sartwell, Associate Professor of Theatre at Belhaven University where she is the head of the university's BFA acting program.