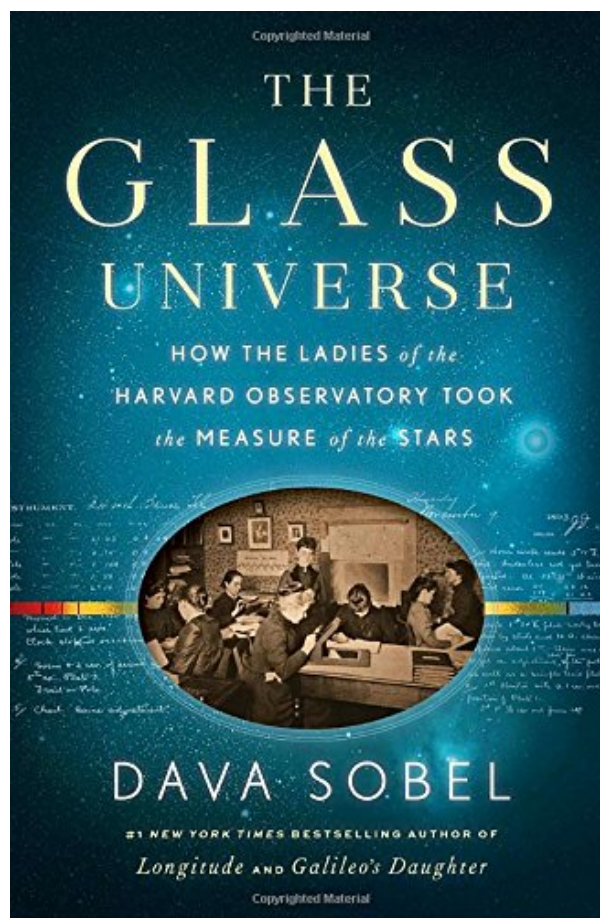
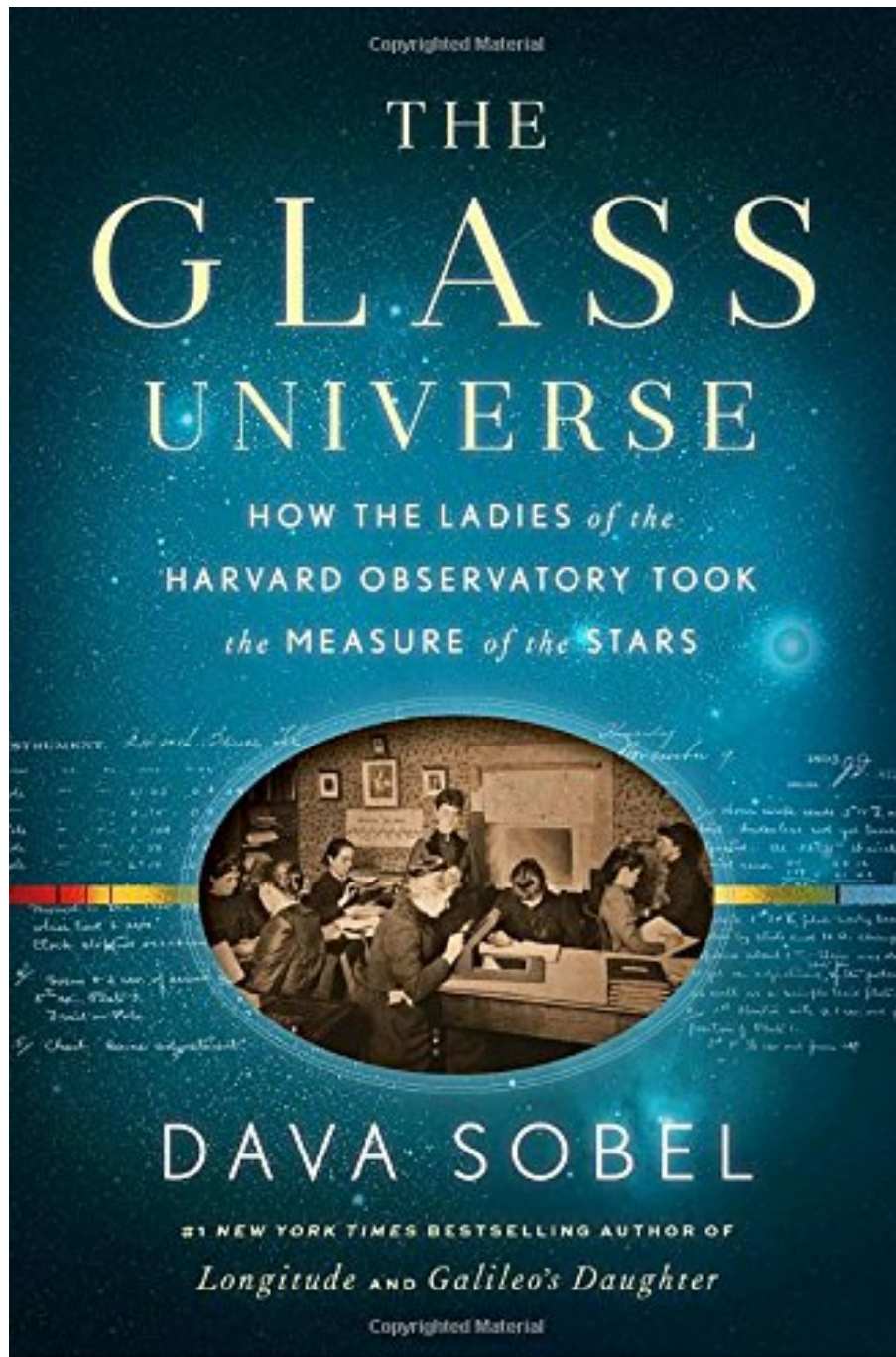


THE GLASS UNIVERSE: HOW THE LADIES OF THE HARVARD OBSERVATORY TOOK THE MEASURE OF THE STARS BY DAVA SOBEL



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Review

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New from #1 New York Times bestselling author Dava Sobel, the "inspiring" (People), little-known true story of women's landmark contributions to astronomy

"A joy to read." —The Wall Street Journal

Named one of the best books of the year by NPR, The Economist, Smithsonian, Nature, and NPR's Science Friday

Nominated for the PEN/E.O. Wilson Literary Science Writing Award

In the mid-nineteenth century, the Harvard College Observatory began employing women as calculators, or "human computers," to interpret the observations their male counterparts made via telescope each night. At the outset this group included the wives, sisters, and daughters of the resident astronomers, but soon the female corps included graduates of the new women's colleges—Vassar, Wellesley, and Smith. As photography transformed the practice of astronomy, the ladies turned from computation to studying the stars captured nightly on glass photographic plates.

The "glass universe" of half a million plates that Harvard amassed over the ensuing decades—through the generous support of Mrs. Anna Palmer Draper, the widow of a pioneer in stellar photography—enabled the women to make extraordinary discoveries that attracted worldwide acclaim. They helped discern what stars were made of, divided the stars into meaningful categories for further research, and found a way to measure distances across space by starlight. Their ranks included Williamina Fleming, a Scottish woman originally hired as a maid who went on to identify ten novae and more than three hundred variable stars; Annie Jump Cannon, who designed a stellar classification system that was adopted by astronomers the world over and is still in use; and Dr. Cecilia Helena Payne, who in 1956 became the first ever woman professor of astronomy at Harvard—and Harvard's first female department chair.

Elegantly written and enriched by excerpts from letters, diaries, and memoirs, *The Glass Universe* is the hidden history of the women whose contributions to the burgeoning field of astronomy forever changed our understanding of the stars and our place in the universe.

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- Original language: English
- Number of items: 1
- Dimensions: 9.31" h x 1.13" w x 6.31" l, 1.19 pounds

- Binding: Hardcover
- 336 pages

Features

- Viking

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Most helpful customer reviews

51 of 51 people found the following review helpful.

The Glass Universe is a fantastic read

By Cindy B. (ThoughtsFromAPage)

The Glass Universe meticulously delineates the previously little-known story about the contributions of a group of women hired by the Harvard College Observatory as "human computers" beginning in the mid-1800's. While Dava Sobel at times employs incredible scientific detail while relaying these women's stories, overall The Glass Universe is a fascinating tale of the impact of a multitude of female astronomers on the field of astronomy. As the story develops, photography begins revolutionizing the field of astronomy creating a new field called spectrophotography. Accordingly, a number of these women begin studying the thousands of glass photographic plates created nightly at the observatory in Cambridge and at times from other areas including Peru and South Africa. The images created via photography magnified the views of the cosmos to degrees far beyond what the naked eye could see even with a telescope. As a result, the women (and some men too) discovered thousands of new stars, learned what stars are composed of, and characterized stars into groupings with similar traits. Sobel also pays tribute to the individuals who funded much of this research including Anna Draper whose husband was on the forefront of spectrophotography and sadly died young, Andrew Carnegie and Catherine Bruce, a wealthy New York socialite who came to love astronomy late in life.

Because so many women participated in the development of a new understanding of the cosmos, there are a tremendous number of characters in The Glass Universe. Repeatedly while reading, I kept wishing that there was a character listing at the front of the book to help me keep track of them all. When I finished the book, I was happy to ascertain that Sobel had compiled a lengthy Catalogue of Harvard Astronomers, Assistants, and Associates at the end of the book. While it was helpful to peruse this after finishing The Glass Universe, I feel it would have been more useful at the front of the book instead of after I was finished reading. At the end of the book, Sobel also includes a timeline with the highlights of the Harvard College Observatory which places many of the developments and discoveries into a coherent, satisfying format.

Sobel's story is uplifting, and I loved reading about the recognition these women received at a time when women working was highly uncommon. Not only did their fellow workers at Harvard Observatory

acknowledge the success and importance of these individuals, but astronomers worldwide respected and recognized the contributions made by them. I highly recommend *The Glass Universe*. Thanks to Viking Books and NetGalley for the chance to read this ARC in exchange for an honest review.

32 of 34 people found the following review helpful.

Women (and men) who changed how we look at the universe

By Horace Smith

Subtitled "How the Ladies of the Harvard Observatory Took the Measure of the Stars", Dava Sobel's new book widely covers the contributions and lives of the women of the observatory during the directorships of Edward C. Pickering and Harlow Shapley, while not neglecting their male contemporaries. Between the 1880s and 1910s, Harvard College Observatory under Pickering arguably contributed more to the advance of astronomy than any other single institution. By 1920 the telescopes of HCO began to be dwarfed by new large instruments at other institutions, but under Shapley HCO remained at the forefront of astronomical research and education in many areas. During these years, Henrietta Leavitt discovered the Cepheid period-luminosity relation that would be vital to determining the distances to other galaxies, Annie Jump Cannon studied the spectra of hundreds of thousands of stars, and Cecilia Payne pioneered methods for determining the chemical composition of the stars. These and other stories are followed in Sobel's fascinating work. Sobel also writes of the lives and motivations of the wealthy sponsors of the observatory's research, including scientifically minded women such as Anna Palmer Draper and Catherine Wolfe Bruce. Considering the breadth of the book, I noticed remarkably few errors, and I strongly recommend its story of the people of HCO and their science.

8 of 8 people found the following review helpful.

Women in astronomy

By Eden Eskin

This well researched book came as a revelation to me about the many women to whom we owe our modern understanding of astronomy. Dava Sobel makes the individual women and men come alive on the page. She also writes so that the lay person gains a sense of the way discoveries were made and why they were important.

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"Sobel has distinguished herself with lucid books about scientists and their discoveries . . . [She] vividly captures how her brilliant and ambitious protagonists charted the skies, and found personal fulfillment in triumphant discovery." —The National Book Review

"A fascinating and inspiring tale of . . . female pioneers who have been shamefully overlooked." —Real Simple

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"Sobel knows how to tell an engaging story...With grace, clarity, and a flair for characterization, [she] places these early women astronomers in the wider historical context of their field for the very first time." —Publishers Weekly, Starred Review

Praise for *The Planets*

"[*The Planets*] lets us fall in love with the heavens all over again." —The *New York Times* Book Review

"[Sobel] has outdone her extraordinary talent for keeping readers enthralled. . . . A splendid and enticing book." —*San Francisco Chronicle*

"An incantatory serenade to the Solar System." —*Entertainment Weekly*

Praise for *Galileo's Daughter*

"Sobel is a master storyteller. . . . She brings a great scientist to life." —The *New York Times* Book Review

Praise for *Longitude*

"This is a gem of a book." —The *New York Times*

"A simple tale, brilliantly told." —The *Washington Post*

Praise for *A More Perfect Heaven*

"Ms. Sobel is an elegant stylist, a riveting and efficient storyteller, a writer who can bring the dustiest of subjects to full-blooded life." —The New York Times

"Lively, inventive . . . a masterly specimen of close-range cultural history."—The Wall Street Journal

About the Author

DAVA SOBEL is the author of five books, including the New York Times bestsellers *Longitude*, *Galileo's Daughter*, *The Planets*, and *The Glass Universe*. A former New York Times science reporter and longtime contributor to *The New Yorker*, *Audubon*, *Discover*, and *Harvard Magazine*, she is the recipient of the National Science Board's Individual Public Service Award and the Boston Museum of Science's Bradford Washburn Award, among others.

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Miss Cannon had classified one hundred thousand stars when she set the work aside to spend the summer of 1913 in Europe with her sister, Mrs. Marshall. They planned to attend three major astronomy meetings on the continent, plus all the banquets, garden parties, excursions, and entertainments that such international congresses entailed. On her previous trip to Europe, with her friend and Wellesley classmate Sarah Potter in 1892, Miss Cannon had made the grand tour of popular tourist destinations, camera in hand. This time she would go as a respected astronomer and the only female officer in her professional organization. At the 1912 meeting of the Astronomical and Astrophysical Society of America, the members had voted to change their name to the American Astronomical Society and to make her their treasurer. Now she would seek out her foreign colleagues, many of whom she knew only by reputation or correspondence, in their native settings.

"There are no women assistants," Miss Cannon noted of the Royal Observatory, Greenwich. Travel broadened her appreciation for the singularity of Harvard's large female staff, although she easily befriended men wherever she went. At Greenwich, "Without the slightest feeling of being out of place, without the smallest tinge of embarrassment, I discussed absorbing work with one and another." That evening the astronomer royal, Frank Dyson, called for Miss Cannon and Mrs. Marshall at their London hotel and escorted them to a soiree at Burlington House, the headquarters of the Royal Astronomical Society and four other scientific fraternities. "Never has it been my good fortune to have such a kindly greeting, such hearty good will, such wonderful feeling of equality in the great world of research as among these great Englishmen." At the society's meeting a few days later, she gave a formal presentation about her recent investigation into the spectra of gaseous nebulae.

Mrs. Marshall understandably avoided the scientific sessions, at which Miss Cannon inured herself to being the sole woman in a roomful of as many as ninety men. In Germany, she reported, "Not a single German woman attended these Hamburg meetings" of the *Astronomische Gesellschaft*. "Once or twice, two or three would come in for a few minutes but I was generally the only woman to sit through a session. This was not so pleasant but at the recesses the men were so kind that nothing seemed to matter, and at the luncheon women appeared in great numbers."

In Bonn, where the Solar Union gathered from July 30 to August 5, the astronomers were treated to a flyby visit of a military zeppelin, a side trip to the Gothic cathedral at Cologne, a riverboat ride up the Rhine, and a gala night in the Bonn observatory that prompted the English-speaking delegates to sing "They Are Jolly Good Fellows" to Director Friedrich Küstner and his wife and daughters. "Luncheon and indeed all meals in Germany," observed Canadian astrophysicist John Stanley Plaskett, "are a much more important and solemn function than with us and take at least twice the time."

Pickering, an elder statesman in this community, spoke at several banquets during the week. He shared impressions of his previous stays in Bonn, a city he had long regarded as the world capital of photometry. It

was here that the legendary Friedrich Wilhelm Argelander assembled the Bonner Durchmusterung star catalogue and perfected the Argelander method of studying variables by comparing them to their steady neighbors. Argelander's own small telescope, still mounted at the Bonn observatory, proved an object of veneration for the visiting astronomers.

Only about half the members of Pickering's Committee on Spectral Classification, first convened at Mount Wilson, had come to the Bonn meeting. Those present included Henry Norris Russell, Karl Schwarzschild, Herbert Hall Turner, and of course Küstner, of the local observatory. They met Thursday afternoon, July 31, to polish their report before Friday's discussion and vote. The group had considered incorporating some symbols into the Draper classification that would account for the widths of spectral lines, but ultimately rejected the idea. Rather than retrofit the Draper system, they preferred to look forward and explore the possibility of an entirely new design for stellar taxonomy.

On Friday morning Chairman Pickering read the committee's recommendation to the full assembly at the Physical Institute. He proposed postponing "the permanent and universal adoption" of any system until the committee could formulate a suitable revision. In the interim, however, everyone should foster the well-known and widely praised Draper classification. Approval of the resolution was swift and unanimous. Ditto the subresolution regarding a refinement originally suggested by Ejnar Hertzsprung and already practiced by Miss Cannon. It consisted of a zero subscript for lone letters. Going forward, A₀ would denote a star of purely A-category attributes, showing no B tendencies whatever. The new A₀ reduced plain A to a "rough" categorization.

At the final session on August 5, the Solar Union dissolved its old committees and regrouped into new ones for the work to be done over the next three years, before they would all meet again in Rome. "When the names of committees were read," wrote Miss Cannon, "I was very much surprised to find that I was put on the Committee on Classification of Stellar Spectra—and one of the novel experiences of the summer was to meet with this Committee. They sat at a long table, these men of many nations, and I was the only woman. Since I have done almost all the world's work in this one branch, it was necessary for me to do most of the talking."

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