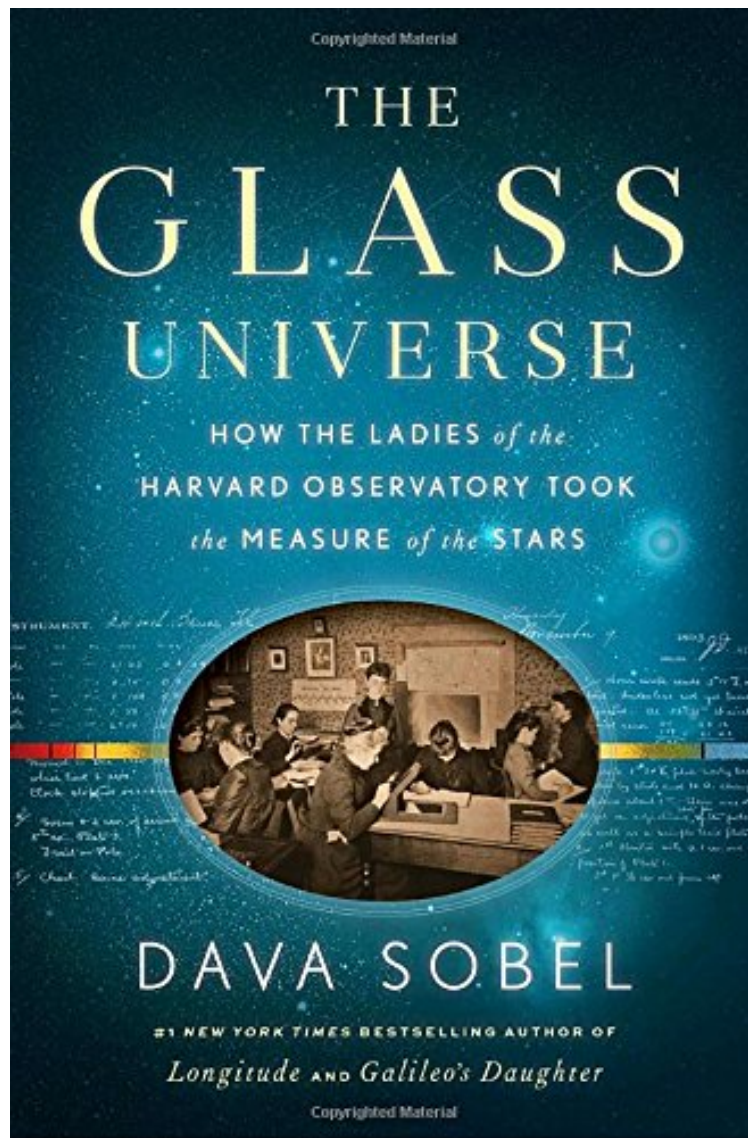


The Glass Universe: How the Ladies of the Harvard Observatory Took the Measure of the Stars

Dava Sobel

*ebooks / Download PDF / *ePub / DOC / audiobook*



[Download](#)

[Read Online](#)

#15673 in Books Dava Sobel 2016-12-06 2016-12-06 Original language: English PDF # 1 9.31 x 1.13 x 6.311, 1.19 #File Name: 0670016950336 pages The Glass Universe How the Ladies of the Harvard Observatory Took the Measure of the Stars | File size: 21.Mb

Dava Sobel : The Glass Universe: How the Ladies of the Harvard Observatory Took the Measure of the Stars before purchasing it in order to gauge whether or not it would be worth my time, and all praised The Glass Universe: How the Ladies of the Harvard Observatory Took the Measure of the Stars:

64 of 64 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-1800s. 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. 3 of 3 people found the following review helpful. Must read for AAVSO members and variable star observers everywhere. By GRK_Astronomer Being an amateur astronomer who enjoys the stars on clear nights and a good book on astronomy and its history on cloudy ones, this is a very well researched and written book. Any member of the AAVSO would appreciate knowing about how it got started. Dava Sobel does a great round trip study of variable stars, the research to discover them, the human computers used to establish theories and the relationship used to establish one of the rungs in the cosmic step ladder and to uncover the people behind it all. 2 of 2 people found the following review helpful. I am a fan because I have enjoyed Sobel's *Longitude* and *Galileo's Daughter* many times each. By Meribeth Meixner Reed Meribeth Meixner Reed, PhD 6 June 2017 Sobel, Dava. (2016). *The Glass Universe: How the ladies of the Harvard Observatory took the measure of the stars*. New York, NY: Viking. Women's expeditions into advanced mathematics and science are not the same as men's. That was notoriously true in 19th and 20th century America, as gate-keepers protecting the realm of men (while ostensibly and disingenuously protecting the fairer sex) unapologetically denied gender equality. Recall that before 1920, women in most of the US did not have the right to vote. *Glass Universe* is an important women's history overlaid on a history of astronomy and astrophysics. The title refers to the half million glass photographic plates on which stellar observations were recorded, and the subtitle reveals the subject of Dava Sobel's exploration, developed through a series of biographies. A chronologic approach was taken, focusing on several key players with a large supporting cast, while the observatory is the stage. Award-winning science writer Sobel introduces a cadre of astronomers previously known to few of us, although their discoveries and taxonomies are fundamental today. I am a fan because I have enjoyed Sobel's *Longitude* and *Galileo's Daughter* many times each. Her research is rigorous, and she treats her subject astronomers with admiration and love, describing women pioneers in photography; spectroscopy; stellar origins, evolution, and chemistry; and astrophysics. Positions of primacy are given to Williamina Fleming (1857-1911), who devised a classification scheme for stars and discovered more than 300 variable stars; and Antonia Maury (1866-1952), whose enhanced spectral classification scheme based on improvements in photography distinguished between giant and dwarf stars, and who identified spectroscopic binaries. Henrietta Swan Leavitt (1868-1921) established a system to measure distances across space based on the brightness of stars, and her co-worker of two decades, Annie Jump Cannon (1863-1941) classified and cataloged the light spectra of hundreds of thousands of stars. Cannon also mentored Cecilia Payne (Gaposchkin) (1900-1979), who revealed the physical and chemical nature of stars, the articulation of physics and astronomy, or astrophysics. Hers was the first PhD in Astronomy conferred by Harvard/Radcliffe (1925). Heiresses Anna Palmer Draper (1839-1914) and Catherine Wolfe Bruce (1816-1900) also advanced astronomy as generous benefactors. Reading this book required three and four bookmarks. The text is 323 pages, including bibliography and index. There is so much information -- unwrapping the life stories of many astronomers -- that I frequently flipped back and forth between sections to help me distinguish between individuals. An extensive timeline is concealed under the title *Highlights of the Observatory* (pp. 273-279), and that was important to bookmark, as is the alphabetic catalog of astronomers and others (pp. 285-292), and the glossary located between them. Six color photos are centered in the

book, which includes 20 pictures of the visionaries. But the unconventional lack of scholarly references and citations is not explained, despite the wide use of quotations, and it is not clear why the academic title Dr. was so seldom and inconsistently used. Through this book, Sobel opened a new universe for me, sending me searching for more information on these fascinating women of science. These astronomers who changed our understanding of the universe demonstrated resilience in the face of denied academic degrees, titles, awards, positions, and reasonable pay based explicitly on their gender, even as they published seminal works in the science. Like artists, scientists pursue original thoughts and intellectual challenges. The interpretation of findings and written expression are steps in a solitary creative endeavor. They must have great faith in those to whom they reveal and entrust their discoveries. I imagine these pioneers created a supportive environment for each other, a privileged sisterhood, enabling them to retain their unique positions in the observatory and the academy, fully aware that most women were denied access to such work and study. And they were probably not surprised when others took credit for their work. Yet the women remained committed to expanding, generating, and then sharing knowledge. They were as brilliant as the stars they were measuring in as many dimensions.

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.

Named one of the best books of the month by Flavorwire, Bustle, Harpers Bazaar, Real Simple, Refinery29, Mens Journal, BBC, and The National Book Ms. Sobel writes with an eye for a telling detail and an ear for an elegant turn of phrase. . . . [The Glass Universe is] a joy to read. The Wall Street Journal Sobel lucidly captures the intricate, interdependent constellation of people it took to unlock mysteries of the stars . . . The Glass Universe positively glows. NPR An elegant historical tale [from] the master storyteller of astronomy. The Boston Globe "Sobel mixes discussions of the most abstruse topics with telling glimpses of her subjects' lives, in the process showing how scientific and social progress often go hand in hand." The New Yorker "A peerless intellectual biography. The Glass Universe shines and twinkles as brightly as the stars themselves. The Economist At once an exhaustive and detailed account of a breakthrough moment in the world of science, as well as a compelling portrait of pioneering women who contributed as much to the progress of female empowerment as they did to the global understanding of both astronomy and photography. Harpers Bazaar "[Sobel] traces a remarkable line in American female achievement [and] captures the stalwart spirit of Pickering's female finds." USA Today 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 A fascinating and inspiring tale of . . . female pioneers who have been shamefully overlooked. Real Simple "Sobel shines a light on seven 19th- and 20th-century women astronomers who began as 'human computers,' interpreting data at Harvard Observatory, then went on to dazzle... An inspiring look at celestial pioneers." People "An astronomically large topic generously explored." O, The Oprah Magazine "It takes a talented writer to interweave professional achievement with personal insight. By the time I finished *The Glass Universe*, Dava Sobel's wonderful, meticulous account, it had moved me to tears... Unforgettable." Sue Nelson, Nature "A compelling read and a welcome reminder that American women have long desired to reach for the stars. Bookpage "Sensitive, exacting, and lit with the wonder of discovery." Elizabeth Kolbert, Pulitzer Prize-winning author of *The Sixth Extinction* "This is intellectual history at its finest. Dava Sobel is extraordinarily accomplished at uncovering the hidden stories of science." Geraldine Brooks, New York Times bestselling author of *The Secret Chord* and Pulitzer Prize-winning author of *March* [Sobel] soars higher than ever before... [continuing] her

streak of luminous science writing with this fascinating, witty, and most elegant history...The Glass Universe is a feast for those eager to absorb forgotten stories of resolute American women who expanded human knowledge."Booklist, Starred "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 Praise for The Planets "[The Planets] lets us fall in love with the heavens all over again." The New York Times Book "[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 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 Boards Individual Public Service Award and the Boston Museum of Sciences Bradford Washburn Award, among others. Excerpt. Reprinted by permission. All rights reserved.

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 Kstner 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 Kstner, 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.