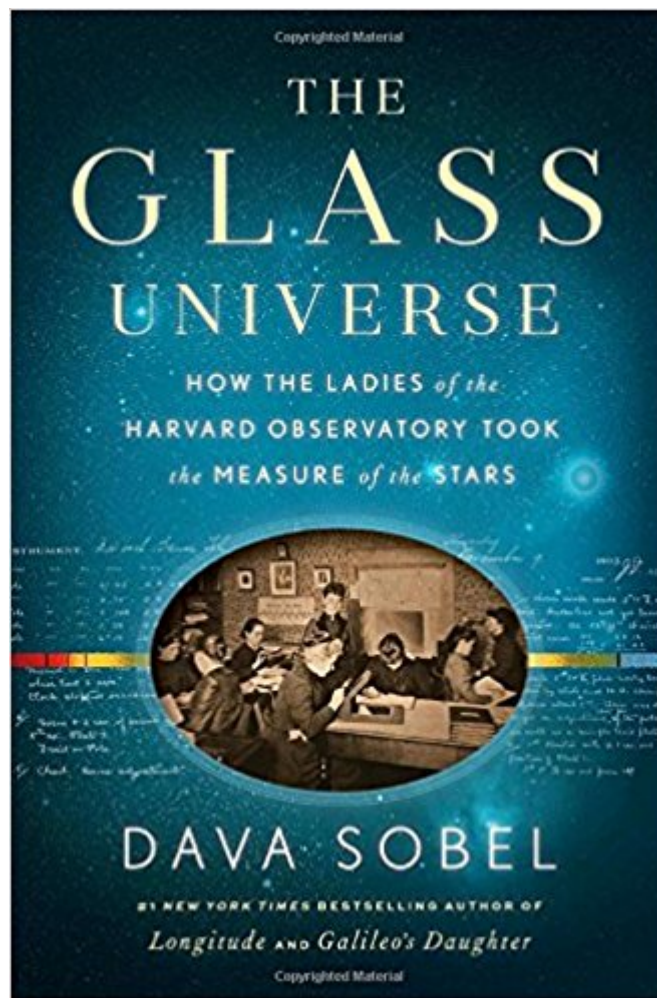




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The Glass Universe: How The Ladies Of The Harvard Observatory Took The Measure Of The Stars



Synopsis

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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Customer Reviews

Named one of the best books of the month by Flavorwire, Bustle, Harper's Bazaar, Real Simple, Refinery29, Men's Journal, BBC, and The National Book Review "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. • Harper's 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 Review "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 Review* "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*

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.

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.

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.

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.

Like earlier books by Dava Sobel (*Longitude*, *Galileo's Daughter*) this book gives opportunities to learn about the history of science, blending little-known facts of astronomical and astrophysical discovery and invention, with the appreciation of underappreciated folks, in this case the women "computers" of Harvard Observatory. These women worked for a fraction of what men would get, initially without any title, recognition or reward. Yet they laid the foundation of the modern understanding of star structure, lifecycle, and evolution. We meet on a personal level such giants as Annie Jump Cannon (1863-1941), inventor of the well-known star classes, O-B-A-F-G-K-M, Henrietta Swan Leavitt (1868-1921) who established the Cepheid variable relation that enabled the gauging of our galaxy and other nearby galaxies, and Cecilia Helena Payne-Gaposchkin (1900-1979) who first established that hydrogen dominates the composition of stars, and provided the first estimates of many other trace elements of the stars, and that was in her Ph.D. thesis, when she was just getting started! We also learn of instances of insensitivity to these women from certain well-known male scientists of the time, but also much encouraging forward-looking behavior of

certain directors of the Harvard Observatory, such as Pickering and Shapley, which lends inspiration from which we men of our own time might learn. An engaging, inspiring, and exciting read!

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