

the rich range of worldwide studies being conducted to establish humanity's relationship to the cosmos.

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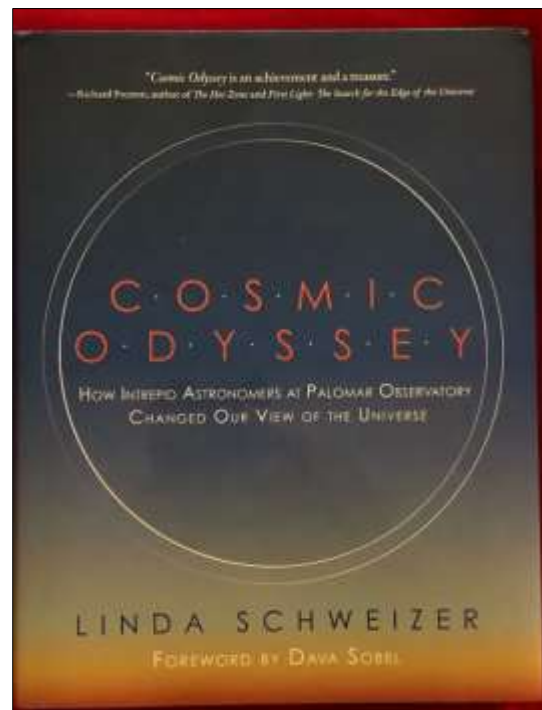
***Cosmic Odyssey: How Intrepid Astronomers at Palomar Observatory Changed our View of the Universe*, by Linda Schweizer. (Cambridge (Mass.), MIT Press, 2020). Pp. ix + 304. ISBN 978-0-262-04429-5 (hardback), 180 × 230 mm, US\$39.95.**

In 1928, *Harper's Magazine* published an article by astronomer George Ellery Hale titled, "The Possibilities of Large Telescopes". Hale outlined how, through the support of people such as Andrew Carnegie, John D. Hooker, and Charles Yerkes, astronomers built bigger telescopes which provided unparalleled views and new knowledge of the Universe. With funding from Carnegie, Mount Wilson Observatory constructed the world's largest telescope, a 60-inch reflector. Even before the telescope saw first light in 1908, Hale was already charting a path for the construction of a 100-inch telescope and the resulting Hooker telescope was completed in 1917. Mount Wilson's 100-inch telescope remained the largest in the world until 1949, but still Hale knew advances could be made with a larger mirror. In 1928, Hale wrote, "While much progress has been made, the greatest possibilities still lie in the future" (Hale, 1928: 639). Later that year, Hale corresponded with

the International Education Board of the Rockefeller Foundation, making the case for a new, more massive telescope. Hale argued that:

No method of advancing science is so productive as the development of new and more powerful instruments and methods of research. A larger telescope would not only furnish the necessary gain in light space-penetration and photographic resolving power, but permit the application of ideas and devices derived chiefly from the recent fundamental advances in physics and chemistry. (Fleishman, 2007: 38).

Hale's plead was granted and the Rockefeller Foundation committed \$6 million for a 200-inch telescope, twice as large as the Hooker. Twenty years passed from Hale's initial query to Rockefeller to the opening of the new telescope and observatory on Palomar Mountain. Though Hale was not alive to see the telescope set its giant eye on the Universe, it was named in honor of his efforts to make the telescope a reality.



Linda Schweizer's book recounts the monumental scientific discoveries made with the Hale Telescope and others at Palomar Observatory throughout the twentieth century. She sets out to show what Hale had argued—that with bigger telescopes, new fields of astronomy would be opened and new knowledge would be gained. Over twelve efficient chapters, Schweizer catalogs the variety of astronomical work done at Palomar. With occasional sweeping claims about the discoveries, Schweizer covers planetary ast-

ronomy, Fritz Zwicky's survey of the sky, the study of quasars, and the structure of the Universe, to name a few. All of Palomar's telescopes are given a time to shine. Schweizer recounts how the 48-inch Schmidt telescope was used during its first years to survey the night sky. Photographs over 900 fields were captured, providing details about star clusters and galaxies, seen for the first time. With the project, Palomar astronomers mapped three-quarters of the night sky, opening up further study of objects with Palomar's other, larger telescopes.

Equipped with a PhD in astronomy, Schweizer skillfully describes theories and discoveries and in many ways, this is a history of Palomar Observatory as told through the scientific breakthroughs it spawned. While the people behind the stories are given the occasional spotlight, once Schweizer dives into the science, the narrative around people slips away. However, it excels in a way of incorporating stories of people more fluidly than your average astronomy textbook. This is the main driving force behind Schweizer's account, not a history of the Observatory itself, but of the science produced over its seventy-five year history.

Schweizer does include, though briefly, Palomar's 'hero-astronomers', 'eccentric yet inspiring researchers', and 'some of the greatest minds of astrophysics' using personal interviews and materials to relay their experiences at the mountaintop observatory (pages xi–xii). Many of Palomar's extensive cast of characters make an appearance in the pages, receiving generous treatment of personalities alongside their scientific work. Because Schweizer pulls from the second half of the twentieth century, she is able to use interviews from those who still work at Palomar, or remember earlier days of working at the Observatory. For this reason, this account is able to add personal remembrances to accompany the scientific descriptions.

Visually, the book is stunning in its inclusion of both historic black and white photographs and those from the Hubble Space Telescope and more contemporary ground-based observatories. However, with the central theme of how Palomar astronomers changed our view of the Universe, the book would have been better supported with more historic photographs and less reliance on colorful Hubble images that seem to distract more than support the books' main thesis.

This is an excellent effort that will likely be of more interest to astronomers than histor-

ians, while also providing a broad account of science on Palomar Mountain.

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***Shakespeare's Knowledge of Astronomy and the Birth of Modern Cosmology*, by Peter D. Usher. (New York, Peter Lang, 2022). Pp. xix + 185. ISBN 978-1-4331-9170-1 (hardback), 155 × 235 mm, US\$92.65.**

A book at once excellent and contrarian, *Shakespeare's Knowledge of Astronomy* alternates between impressive insights and incredulous claims. A boring book it is not.

Dr Peter Usher, Emeritus Professor at Pennsylvania State University, has written extensively on the relationship between astronomy and Shakespeare's plays. His latest book appears, by its title, to be a rather comprehensive examination of the topic. Actually, it is much more focused: he devotes four chapters to *Hamlet*, and one each to *The Winter's Tale*, *Cymbeline* and *The Merchant of Venice*. This unfortunately leaves no room for astronomical allusions in other plays. Also missing is the curious use of the rare word 'disorbed' in *Troilus and Cressida*. And even in *The Winter's Tale* chapter, there is no mention of another rare word that reeks of astronomical significance: unsphere. [Cetera-Włodarczyk et al \(2021: 421\)](#) make a convincing case that both words suggest Shakespeare "... has a particular interest in, and fascination for, the concept of stars being moved out of their spheres." Thus, it is particularly mystifying why Usher did not focus on these words, as they clearly have cosmological implications of the first order.

A key element of Usher's argument (based on his reading of *Hamlet*) is that Shakespeare was aware that Saturn had rings, and that they could be seen at different angles as Saturn revolved around the Sun. This is a truly contrarian view; I am unaware of any historian of astronomy who subscribes to this assertion. Basing scientific claims of great magnitude on allusions in Shakespeare is