H•A•D NEWS

The Newsletter of the Historical Astronomy Division of the American Astronomical Society

Number 106 * December 2025

In This Issue

Please tune in to our podcast for a 3-part interview with Thomas Hockey!
(episodes available Nov 27, Dec 30 & 31)

The 2026 LeRoy E. Doggett Prize Awarded to Thomas Hockey

Terry Oswalt
Embry-Riddle Aeronautical University

The American Astronomical Society's Historical Astronomy Division is proud to announce that Dr. Thomas A. Hockey, Professor of Astronomy at the University of Northern Iowa, has been named the recipient of the 2026 LeRoy E. Doggett Prize for Historical Astronomy. This biennial award recognizes individuals who have significantly influenced the field of the history of astronomy by a career-long effort.

After earning his Ph.D. at New Mexico State University, Dr. Hockey has been on the faculty at UNI since 1988. His academic work bridges astronomy, history, and education, spanning topics

Thomas Hockey, recipient of the 2026 Doggett Prize

from planetary observations and eclipse history to the cultural dimensions of astronomy. He has authored numerous influential works, including *Galileo's Planet: Observing Jupiter Before Photography* (1999), *How We See the Sky* (2011), and most recently *America's First Eclipse Chasers* (2023). He has also served as editor of *Archaeoastronomy: The Journal of Astronomy in Culture* and contributed to the preservation of astronomical sites and heritage through leadership in working groups within the AAS and IAU. Dr. Hockey is well known as the visionary behind the *Biographical Encyclopedia of Astronomers (BEA)*, a monumental reference work now entering its third edition. As Editor-in-Chief, he coordinated over 450 authors worldwide and personally contributed more than 250 biographies, ensuring the preservation of astronomy's human record.

In addition to his academic work, Dr. Hockey has a long record of service relevant to the history of astronomy. He is one of only three individuals* who have held *every* HAD leadership office! In these roles, he produced the AAS obituaries, edited the newsletter, and served on prize committees. He has been a reviewer for the Herbert C. Pollock Award given by Dudley Observatory for work in the history of astronomy.

In 2009, he organized the AAS Cultural Astronomy School. Dr. Hockey was also secretary of the former IAU Commission 41 Working Group Astronomy and World Heritage and organized cultural astronomy events in support of the International Year of Astronomy.

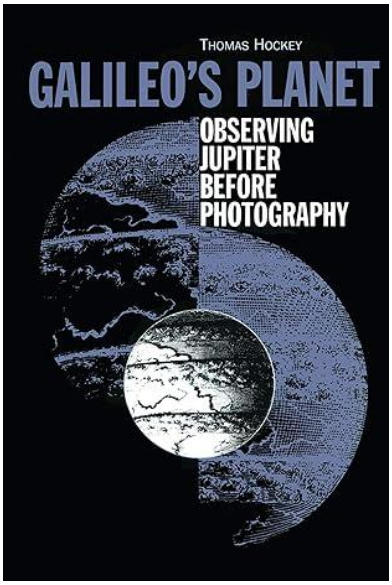
Through his scholarship, teaching, and leadership, Dr. Thomas Hockey has deepened our understanding of astronomy's past while safeguarding its legacy for future generations. In honoring him with the Doggett Prize, the Historical Astronomy Division recognizes not only his exceptional body of work but also his generosity, humility, and commitment to bridging science, history, and culture.

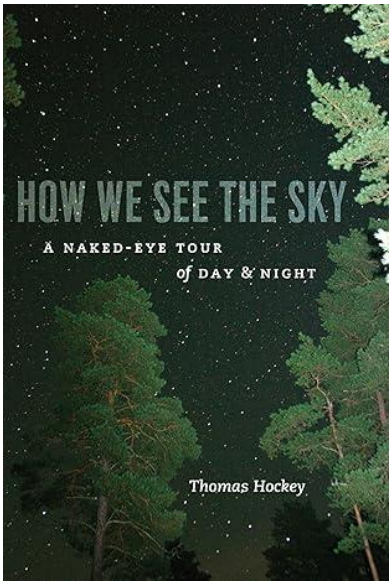
As Chair of the HAD Prize Committee, I would like to thank the Committee members for their diligence and hard work: J. Allyn Smith (HAD Chair), Susana Deustua (HAD Sec-Treas), Marcia Bartusiak, and Jennifer Lynn Bartlett. They have devoted a tremendous amount of time and effort in selecting this year's Doggett Prize winner, never an easy task. We deeply appreciate outgoing Committee member Sethanne Howard for her five years of service!

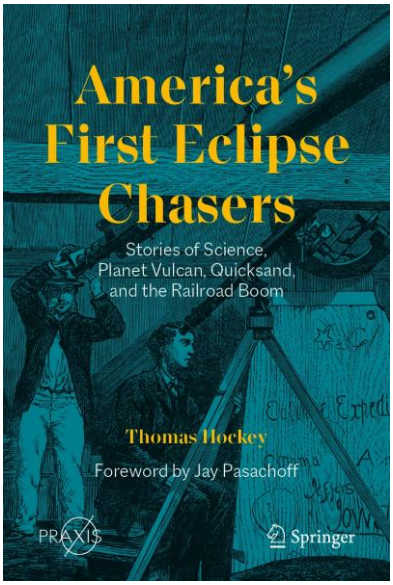
We are now accepting nominations for the 2027 Donald E. Osterbrock Book Prize for Historical Astronomy! If you would like to nominate a book for this prestigious award, please consult the prize rules on our website. Only books with publication dates from 2022 through 2025 are eligible for the 2027 prize, and only members of HAD may submit nominations. These must be received by me no later than March 1, 2026.

terry.oswalt@erau.edu

**The other two are David DeVorkin and Sara Schechner.*







Three fine books authored by Thomas Hockey

Seb Falk Receives the 2025 Osterbrock Book Prize

Kevin Krisciunas
Past Chair, AAS Historical Astronomy Division

Since 2011, the biennial Donald E. Osterbrock Book Prize is awarded to the author of a book that is judged by the HAD Prize Committee to have significantly advanced the field of the history of astronomy or that brings the history of astronomy to light. Eighteen books, published between 2020 and 2023, were nominated for the latest prize.

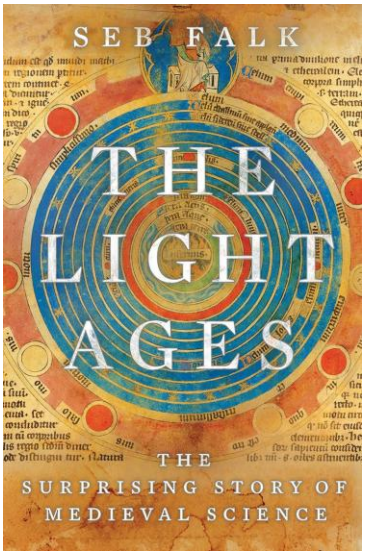
As noted in the December 2024 issue of *HAD News*, the winner of the 2025 Osterbrock Book Prize is Prof. Seb Falk, a science historian at Girton College, Cambridge, for his 2020 book, *The Light Ages: The Surprising Story of Medieval Science*. Unfortunately, a prior commitment prevented Dr. Falk from attending the 245th AAS/HAD meeting this last January in Bar Harbor, Maryland to receive his award in person. Provision was therefore made for him to receive his award and give a plenary lecture at the 246th AAS meeting this summer in Anchorage, Alaska.

In his book, Dr. Falk tells the story of an obscure Benedictine monk, John Westwyck, who at the end of his career in 1392, wrote an instruction manual (in Middle English) for an *Equatorie*, a device that computes a planet's location. Westwyck's identity as the manuscript's author was not discovered until 2015. *The Light Ages* fleshes out an era little known to readers interested in the history of astronomy: the mid to late 14th century. In Falk's plenary talk at the June meeting of the American Astronomical Society in Anchorage, he described the life and work of John Westwyck within the context of medieval astronomy and cosmology, along with a review of the history of cartography and navigation.

krisciunas@physics.tamu.edu

Kevin Krisciunas (at left) presents the 2025 Donald E. Osterbrock Book Prize to Seb Falk at the June 2025 meeting of the AAS in Anchorage, Alaska.

Seb Falk giving his plenary talk in Anchorage (June 11, 2025) to an audience of roughly 300 attentive listeners.



The Light Ages: The Surprising Story of Medieval Science (2020, W.W.Norton)

News From HAD Members

Ken Rumstay
Valdosta State University (Emeritus)

We're always glad to hear from our members, and have recently received the following news. If you have something to share for our next issue, please send it to us!

In our last issue, we noted that Rebecca Charbonneau's 2024 book *Mixed Signals: Alien Communication Across the Iron Curtain* (Wiley) had inspired an online article in *The New Yorker* magazine.

We're pleased to note this distinguished magazine has recognized the work of another HAD Member! On August 29th, subscribers were treated to the book review "The Long History of Life on Mars", which examines David Baron's *The Martians: The True Story of an Alien Craze That Captured Turn-of-the-Century America* (2025), which is described in our Book News section on page 6.

Baron's book has apparently created quite a stir! David notes that, "Not only did *The New Yorker* weigh in with an essay, but *The Martians* has received nice write-ups in the *New York Times*, the *Washington Post*, the *Wall Street Journal*, the *Los Angeles Times*, and the *New York Review of Books*; and I was especially pleased to see it reviewed in *Science*." Baron's book was also reviewed in the September 15th issue of the online journal, *The Space Review*. Well done, David!

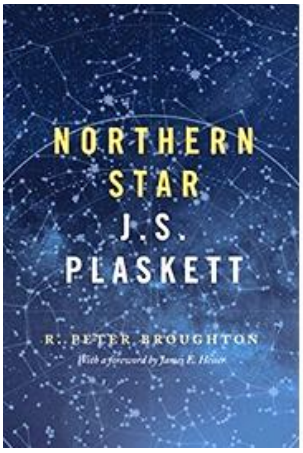
Speaking of Rebecca Charbonneau, her article "From radio with love: a Cold War astronomical collaboration" appeared in the September 2025 issue of *Physics Today*.

HAD Vice Chair Tiffany Nichols has had an article published in the September 2025 issue of *Isis*, widely regarded as the primary journal for the history of science! In her article, "One of the Best Sites on the East Coast": When LIGO Might Have Been in the Blueberry Barrens of Maine (*Isis* 116, no. 3. pp. 504-526), Tiffany explores the manifold issues encountered when selecting a site for a major scientific facility.

On July 1st (Canada Day, appropriately enough!) we heard from Peter Broughton in Toronto. Peter is, of course, the recipient of the 2023 Donald E. Osterbrock Book Prize for Historical Astronomy for the fascinating biography *Northern Star: J.S. Plaskett* (2019).

Peter wrote to tell us about a new documentary about J.S. Plaskett. "It is a very rare event," he wrote, "when a documentary is made to celebrate achievements in Canadian astronomy, or even Canadian science. So I could not resist the temptation, on Canada's 158th birthday, to let you know about *Northern Star* the movie [https://www.chekplus.ca/m/i8E0mv9W?e=TdNKcUY0]. The producer/director, Nick Versteeg, is attempting to interest other broadcasters, but for now the CHEK website is what's available."

I navigated to the chekplus website and signed up for a free account. The "Life of Canadian astronomer JS Plaskett" is the first episode of a multi-episode documentary. Sadly, the documentary episodes aren't available to U.S. viewers (pending rights?), though I could view two of the 'Trailer & Extras' - Behind the Scenes 3 and Behind the Scenes 7. I did find an excellent 9-minute short on The David Dunlap Observatory.



Peter Broughton's book *Northern Star: J.S. Plasket* and the documentary it inspired.

As noted in the May issue, the January sale of Owen Gingerich's personal library was a major event for historians of astronomy across the globe. Woody Sullivan wrote with information about one item: Owen's copy of John Flamsteed's *Historiae coelestis libri duo*. The description of Lot 81 on Christie's auction website began:

> "The unauthorized publication of Flamsteed's observations by Isaac Newton and Edmond Halley in 1712 is one of the most infamous episodes in astronomical history."

The complete description may be found here.

Woody informed us that the Linda Hall Library in Kansas City purchased this rare volume for $176,400, against a pre-auction estimate of $30,000–50,000. The library staff has prepared an excellent write-up about the Flamsteed-Newton feud and why this particular copy (with its annotations by Caroline Herschel) is invaluable: New Acquisition: John Flamsteed's Historia Coelestis - Linda Hall Library. This account is well worth reading, and the fact that the book sold for several multiples of Christie's estimate is astounding! In a future issue, I'll report on more results from the sale of the Gingerich collection.

In August, we heard from our good friend Hans Haubold in Vienna! He wrote to tell us about the publication of the United Nations' 50-year report:

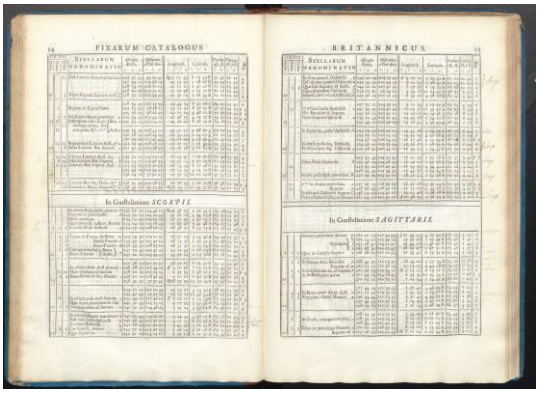
Pictorial and Documentary Guide for Research, Teaching, and Education through Astronomy, Physics, and Methematics Pursued under the Umbrella of the United Nations (1974-2024).

Principal author Hans describes this report thus,

> "This report was prepared for Open-Access-only publication as a guide reporting on Education (all aspects of space science and technology), Teaching (remote sensing and GIS, satellite meteorology and global climate, satellite communication, space and atmospheric sciences, global navigation satellite systems), and Research (solar neutrino problem, formation of structure in the Universe) in astronomy (solar physics, cosmology), physics (nuclear physics, neutrino physics), and mathematics (fractional calculus, special functions of mathematical physics) exercised over a period of 50 years (1974-2024). In this period, more than twenty workshops were held and seven regional centres for space science and technology education were established in all regions of the world: Asia and the Pacific, Latin America and the Caribbean, Africa, Western Asia, and Europe. This effort was undertaken in cooperation with ESA, NASA, JAXA, and 193 member states of the United Nations under the auspices of the UN, also supported by the Committee on Space Research (COSPAR) and the International Astronomical Union (IAU). The report provides access to most of the documents in the six official languages of the United Nations (Arabic, Chinese, English, French, Russian, and Spanish), proceedings, and published papers and books focusing on education, teaching, and research."

Hans also provided some interesting local news:

"A very special event is happening right now in the vicinity of Vienna: A lonely moose is wandering through the region of Vienna, and the police are providing 24-hour official guidance to ensure that nothing happens to him. We are following his trip on TV."



Pages 14 and 15 of Flamsteed's *Historia Coelestis*, with marginal corrections and annotations by Crothswait (image courtesy of the Linda Hall Library).

Emil the moose, found wandering through the Vienna area this summer, has been relocated to the Bohemian Forest in the Czech Republic.

Apparently, moose have not lived in Austria since 1700, but there is a small population in the Czech Republic and a larger one in Poland. It is known that they move back and forth between the two countries.

This moose, which became known as Emil, became a minor celebrity in Austria! His safety was monitored by the Vienna Police and Fire Departments who provided water, and his progress could be viewed online. He fed undisturbed on apples from trees.

On Thanksgiving Day, Hans wrote again to report that Emil is now living peacefully in the Bohemian Forest in the Czech Republic.

In early October Sarah Reynolds informed HAD members that she, Steven Case, and Connemara Doran were starting a new online working group on History of Astronomy through the Consortium for the History of Science, Technology, and Medicine (CHSTM). The group meets on the first Tuesday of each month for presentations and discussions on topics in the history of astronomy and related sciences.

The group held its first meeting at 10:00 am EDT on October 7th, with a discussion led by Steven Case. Those interested in joining this group may register through the CHSTM website at https://www.chstm.org/group/history-astronomy. If you have any questions, feel contact Sarah at reynoldssj@uindy.edu.

On November 5th, longtime HAD member (*and* former HAD Chair, Vice Chair, Secretary-Treasurer, and Doggett Prize winner!) David DeVorkin was to have presented a virtual NASA seminar on the life of George Carruthers, whose remarkable life and career are recounted in David's 2025 book *From the Laboratory to the Moon: The Quiet Genius of George R. Carruthers* (see p. 27 of the May issue of *HAD News*). Unfortunately, David's talk was cancelled, a victim of the recent government shutdown.

Luckily, we've just learned that David will give his talk in person as this year's final Lyne Starling Trimble Public Event Series on December 10th at the American Institute of Physics offices in downtown Washington, DC. His talk will be recorded and made available on the AIP History YouTube channel. Thank you, David!

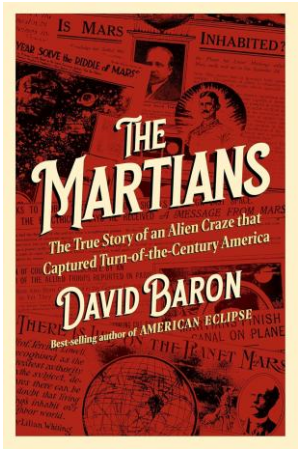
Book News

Ken Rumstay
Valdosta State University (Emeritus)

It is always a pleasure to inform our readers of new books that may be of interest, especially if the authors or editors are HAD members! We are pleased to tell you about four recently published monographs.

If you would like to suggest a recently published book for inclusion in this column, or (better yet) if you would like to review one, please contact me at krumstay@valdosta.edu or Loretta Cannon at NeptuneEdit42a@mail.com.

The first book is David Baron's *The Martians*, which (as noted above) inspired a recent *New Yorker* article.



The Martians: The True Story of an Alien Craze that Captured Turn-of-the-Century America, by David Baron (Liveright, 2025, ISBN 978-1324090663). Hardcover book $25.41, 336 pages; also available as a Kindle e-book and an audio CD.

Description from the publisher:

"Long before NASA began contemplating a visit to our neighboring world, a turn-of-the-century Mars craze invaded the public's imagination … ."

"This 1906 New York Times headline was no joke.

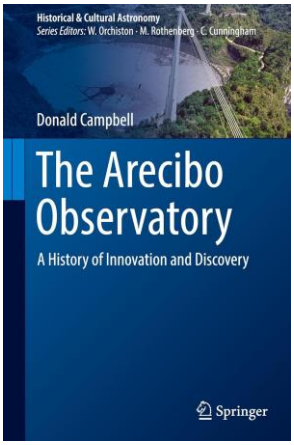
"In the early 1900s, many Americans actually believed we had discovered intelligent life on Mars, as best-selling science writer David Baron chronicles in The Martians, his truly bizarre tale of a nation swept up in Mars mania.

"At the center of Baron's historical drama is Percival Lowell, the Boston Brahmin and Harvard scion, who observed "canals" etched into the surface of Mars. Lowell devised a grand theory that the red planet was home to a utopian society that had built gargantuan ditches to funnel precious meltwater from the polar icecaps to desert farms and oasis cities. The public fell in love with the ambitious amateur astronomer who shared his findings in speeches and wildly popular books.

"While at first people treated the Martians whimsically – Martians headlining Broadway shows, biologists speculating whether they were winged or gilled – the discussion quickly became serious. Inventor Nikola Tesla announced he had received radio signals from Mars; Alexander Graham Bell agreed there was "no escape from the conviction" that intelligent beings inhabited the planet. Martian excitement reached its zenith when Lowell financed an expedition to photograph Mars from Chile's Atacama Desert, resulting in what newspapers hailed as proof of the Martian canals' existence.

"Triumph quickly yielded to tragedy. Those wild claims and highly speculative photographs emboldened Lowell's critics, whose withering attacks gathered steam and eventually wrecked the man and his theory – but not the fervor he had started. Although Lowell would die discredited and delusional in 1916, the Mars frenzy spurred a nascent literary genre called science fiction, and the world's sense of its place in the universe would never be the same.

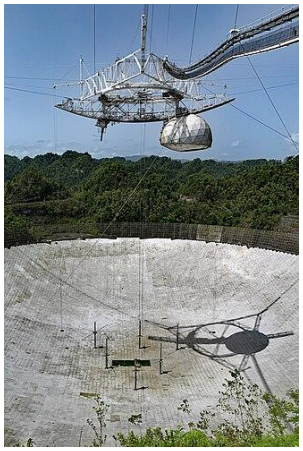
"Today, the red planet maintains its grip on the public's imagination. Many see Mars as civilization's destiny – the first step toward our becoming an interplanetary species – but, as David Baron demonstrates, this tendency to project our hopes onto the world next door is hardly new. The Martians is a scintillating and necessary reminder that while we look to Mars for answers, what we often find are mirrors of ourselves."



The Arecibo Observatory: A History of Innovation and Discovery (Historical and Cultural Astronomy series), by Donald Campbell (Springer, 2024, ISBN 978-3031752247). Hardcover $179.99, 391 pages; also available as a Kindle e-book.

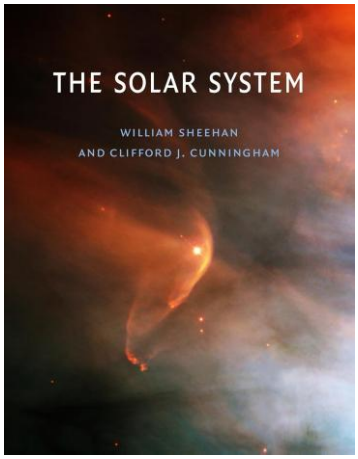
From the publisher:

"Written by its former Director, this book presents a historical account of the famous Arecibo Observatory and its 305-meter radio astronomical telescope, widely known for its groundbreaking scientific discoveries and starring role in the James Bond movie, *Golden Eye*.



LEFT: Arecibo in 2019

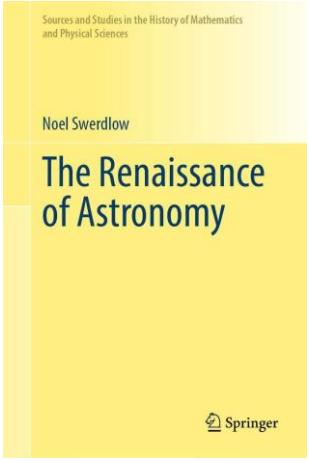
"The story details the planning, funding and construction of the telescope; the people who masterminded and contributed to the project; and the involvement of the US Department of Defense in funding the construction. It also includes the seminal scientific achievements in the three research areas to which the telescope contributed, ionospheric physics, planetary science and radio astronomy. The book continues through later upgrades made to the site, showing how the Arecibo telescope has arguably remained the world's most versatile and productive radio science instrument for over 50 years. This historical account will fascinate astronomers and historians of science, serving as a valuable contribution to the history of 20th century astronomy."



The Solar System (Kosmos), by William Sheehan and Clifford J. Cunningham (Reaktion Books, 2025, ISBN 978-1836390640). Hardcover $35.53, 248 pages; also available as a Kindle e-book.

From the publisher:

"As recently as the dawn of the Space Age, the solar system was still largely unknown. The first probes to the Moon, Venus and Mars ushered in a golden age of planetary science, transforming planets from distant mysteries into vividly realized worlds. This book provides a comprehensive, accessible survey of the entire solar system, covering all major planets from Mercury to Saturn, the outer solar system and asteroids. It includes insights from leading scientists through in-person interviews, offering an engaging overview for general readers and amateur astronomers. Noting Earth's small, beautiful and precarious nature, this book fills a unique niche, presenting the latest discoveries without losing sight of the broader picture, making it essential for anyone interested in our celestial neighbourhood."



The Renaissance of Astronomy (Sources and Studies in the History of Mathematics and Physical Sciences), by Noel Swerdlow (Springer, 2025, ISBN 978-3031847592). Hardcover $299.99, 994 pages.

From the publisher:

"The Renaissance of Astronomy provides a comprehensive, technically grounded account of the works of Regiomontanus, Copernicus, Tycho, Kepler and Galileo. There is nothing comparable to it in scope and detail. It is the fruit of a lifetime of study devoted to the subject.

"It is the first book to provide systematic, rigorous introductions to the work of the five great astronomers who replaced the geocentric model of the planetary system with a heliocentric one. It also offers novel analyses on many points of detail--for example, the astrological interests and practices of Regiomontanus, Kepler, and Galileo. Technical expositions are accompanied by a very large number of diagrams of high quality, made by the author, Noel Swerdlow. The section on Tycho Brahe was left incomplete at Swerdlow's death."

We conclude with news of a forthcoming book, edited by Steven J. Dick, to be published by Cambridge University Press in 2026.

This volume will include contributions by fifteen historians, ten philosophers, and five astronomers, many of whom are HAD members! Steven has provided the following description:

"The book is inspired by the insight that philosophical problems infuse the theory and practice of astronomy, including metaphysical foundations and influences, the limits of reasoning as in black holes and the multiverse, the problematic nature of observation and inference ranging from the canals of Mars to dark matter and dark energy, the role of technology and science

policy in our present understanding of the universe, and the epistemological status of astronomy and its central concepts, including space and time, life and intelligence, prediction and explanation. Yet, the conceptual and methodological foundations and challenges of astronomy have not received systematic attention as they have in other fields such as philosophy of physics, biology and chemistry, which have their own books and journals. While a few books have appeared on the philosophy of astrophysics and cosmology, the volume argues for a unified history and philosophy of astronomy to include not only classical astronomy, astrophysics, and cosmology, but also space science and astrobiology. Examining such influences is an important step toward scientific advance. In addition to being useful for astronomers, historians, and philosophers of science, the book is also written for a broad audience.

"The Table of Contents is listed below.

Astronomy and Philosophy:
Conceptual and Methodological Foundations and Challenges

Steven J. Dick, editor

Part I. The Nature of Reality: Physical and Metaphysical Foundations of Astronomical Science

What are the physical and metaphysical foundations of astronomy and how have they developed?

Part II. Metaphysical and Social Influences on Astronomy and the Cosmic Worldview

What are the roles of metaphysical preconceptions and cultural influences in astronomy, and can astronomy form the basis for a scientific worldview for the masses?

Part III. The Nature and Limits of Reasoning

What is the nature of reasoning in astronomy, including the relative roles of observation, theory, models, simulation, experiment, and analogy? And what are its limits, starkly evident in the black hole, dark matter, and multiverse controversies, among many others.

Part IV. The Problematic Nature of Observation and Inference

How problematic is the nature of observation in astronomy and cosmology?

Part V. Conceptual Issues in Astronomy, Cosmology, and Astrobiology

What is the epistemological status of astronomy and its central concepts, including explanation and prediction, discovery and classification, life and intelligence, and dark matter?

Part VI. Technology, Policy, and Methodology

What role does technology play in shaping the discipline of astronomy and our view of the universe? And how does science policy affect technology?

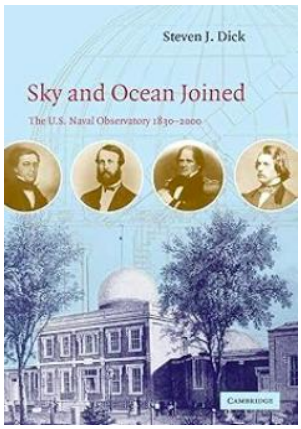
Part VII. Embedded History and Philosophy of Science

How can history and philosophy benefit astronomy?"

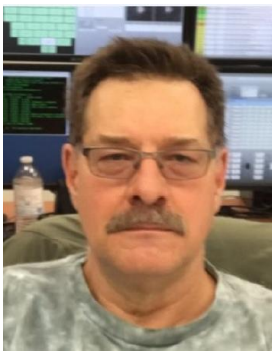
We look forward to reading this!

krumstay@valdosta.edu

For those of you who aren't familiar with Steven, he has written and/or edited many interesting books. A favorite of mine (more listed on his website) is:
Sky and Ocean Joined: The U. S. Naval Observatory, 1830-2000 (Cambridge University Press, 2003). Winner of the 2004 Pendelton Prize of the Society for History in the Federal Government, and the 2002 John Lyman Award of the North American Society for Oceanic History.



Loretta



From the Chair

J. Allyn Smith
Austin Peay State University

As I write this, I'm riding out a rainstorm in Flagstaff rather than actually observing. I did take two of my students to visit Lowell Observatory yesterday and we had a marvelous time. The historical tie was the tour of the 24-inch Clark refractor with a 4-inch Alvin Clark finder scope and the Pluto discovery telescope. While the weather is not cooperating on this trip, we are using (when/if it's clear) the old 42-inch Hall telescope. This was the first large research telescope I ever used, some 40+ years ago. Then, we used a dry ice-cold box and PMT; now it's a closed-cycle cooled CCD. One CCD image contains more data volume than the entire week with a PMT did on my first observing run. But clouds and humidity are still the bane of an astronomer's existence as we have only opened the dome for about two hours so far in three nights.

The HAD officers are busy preparing for the Phoenix meeting this coming January. We hope it will be a good and fulfilling meeting for the Historical Division. We are planning the Town Hall, currently slated for Monday, and other sessions (scheduled for Sunday through Tuesday). One of these sessions will be a remembrance of Owen Gingrich and should appeal to all astronomers. Another will look at the historical observatories of the south-western area of the United States. The meeting facility, the Phoenix Convention Center, is downtown and centrally located near museums, the symphony hall, and sports complexes. Plenty of restaurants are within easy walking distance. The light rail has stations nearby to easily get to other portions of the city.

The Doggett Prize will be awarded at this meeting. The Historical Astronomy Division awards the LeRoy E. Doggett Prize biennially to an individual who has significantly influenced the field of the history of astronomy by a career-long effort. This year's winner is no exception, having worked in the history of astronomy for several decades. The plenary session for this award promises to be an insightful review of the winner's years of effort to preserve the history of astronomy.

In other news, we now have a new editor for *This Month In Astronomical History*: Dr. Mugdha Polimera of CfA will take over as editor for the next two years. Welcome aboard, Mugdha!

smithj@apsu.edu

The Phoenix Convention Center, site of the January 2026 AAS/HAD meeting

Showing Our Roots and Branches

Jennifer Lynn Bartlett
Director, AstroGen

If you searched the Astronomy Genealogy Project (AstroGen) recently, you have been greeted by our exciting new logo. If not, we invite you to explore our website and not just to admire the elegant design.

It uses the traditional tree symbolism of family genealogy against a starry sky to evoke our mission: tracing the academic lineages of astronomers. Our records follow the networks of student-advisor relationships back in time to their roots in the earliest research-based dissertation. Our branches sprout fresh leaves when newly defended dissertations are submitted. Like the trunk, our science connects all of us as our knowledge of the universe grows. AstroGen is tended and grows through the volunteer efforts of those who submit additions and corrections.

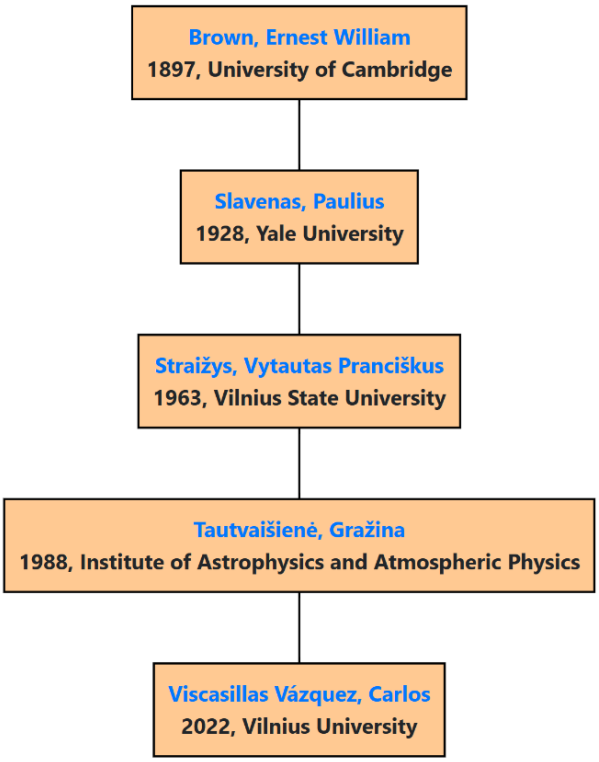
Carlos Viscasillas Vazquez (Vilnius University, Lithuania) designed the new logo with AI assistance. He has been an enthusiastic AstroGen contributor, providing details of Lithuania and Galician astronomers. In addition to his artistic endeavors, he gave a talk last summer on the roots and growth of Galician astronomy, featuring AstroGen genealogies. Viscasillas Vazquez earned his doctorate under the direction of Gražina Tautvaišienė in 2022 at Vilnius University in Lithuania with a thesis on "Chemical abundances of neutron capture elements in the Milky Way." Moitas grazas Carlos, for all your amazing work: science, history, and art.

Documenting who trained whom and where lays the foundation for future historical and sociological research, which will help us understand how we come to know what we know. Understanding the networks within our community also reveals the pathways along which opportunity and knowledge are transmitted. Compiling dissertation metadata and links makes those research products more findable. If you would like to be part of this work, we welcome your participation, whether you want to uncover deep roots or add the newest leaves.

astrogendirector@aas.org

AstroGen

AstroGen logo, design courtesy of Carlos Viscasillas Vazquez



Academic genealogy of Carlos Viscasillas Vazquez, from AstroGen

Mugdha Polimera, TMIAH Editor!

Jennifer Lynn Bartlett
Director, AstroGen

I would like to introduce Dr. Mugdha Polimera to you as our new editor of "This Month in Astronomical History" by saying she is patient enough to train service dogs, and she has a red pen. However, I doubt any editor terrorizes authors with red pens these days. Editing an online column, even for a history organization, must keep with the times.

Mugdha is one of the talented software engineers that keeps the Astrophysics Data System (ADS) running and one of the creative astrophysicists that ensures it has a vision to serve the astronomy community into the middle of the 21st century. She appreciates the science and the folklore of astronomy, not only Western but also Hindu. She is an accomplished science communicator having rocked talks on "Black Hole Hunting" and "Astronomy in Film" for Astronomy on Tap and the Raliegh Museum of Natural History, respectively.

Mugdha recently published a method for identifying active galactic nuclei (AGN) in star-forming or low-metallicity dwarf galaxies. This work grew out of her 2023 dissertation work at the University of North Carolina, Chapel Hill, on a black hole census of nearby galaxies. She earned her master's degree in Astronomy at the University of Florida among the 'gators. Born in India, Mugdha grew up in Abu Dhabi, United Arab Emirates. With limited local options to pursue astronomy, she earned an honors Bachelor of Engineering in electronics and communication from Birla Institute of Technology & Science, Pilani – Dubai.

Having beauty, brains, a love of dogs, and a metaphorical red pen, the only thing Mugdha lacks as your editor are articles. Please contact her with your pitch for a month and a corresponding person or event that hasn't been covered yet or a new perspective on an previous topic; it's that simple. Please contact mugdha.polimera@cfa.harvard.edu.

astrogendirector@aas.org

Please note that all This Month in Astronomical History columns may be found on HAD's TMIAH website.

Mugdha Polimera, our new Editor of *This Month in Astronomical History*, with Hero, her other best friend

Drawing by Jason E. Ybarra, Editor of *This Month in Astronomical History* from 2019 to 2020.

Notre Dame XVI Biennial History of Astronomy Workshop

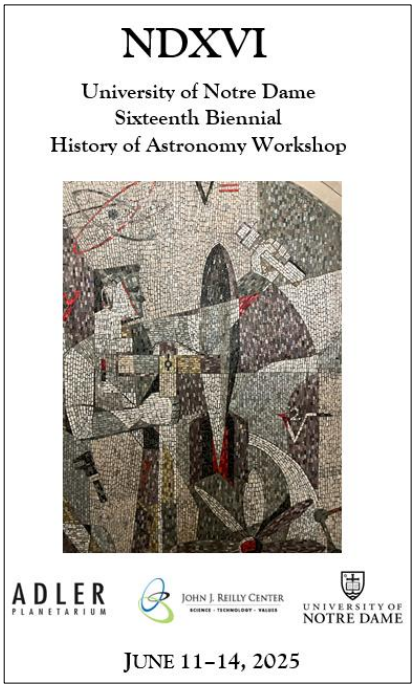
Steven J. Dick
Former NASA Chief Historian

As most HAD members know, the Biennial History of Astronomy Workshops have been held at the University of Notre Dame in South Bend, Indiana since 1993. Prof. Michael Crowe instigated and hosted these workshops, and they have been organized successively and jointly with Mike by Marc Rothenberg, John Lankford, David DeVorkin, Matthew Dowd, Sarah Reynolds, and myself, among others. These meetings have provided a stimulating forum for historians of astronomy, and typically attract about 60 scholars, including many graduate students.

This year was no exception, though the post-Covid numbers were down to about 40 people who gathered June 11–14. The workshop theme was "Visual practices in the production and transmission of astronomical knowledge." The invited speaker was Dr. Matteo Valleriani from the Max Planck Institute for the History of Science in Berlin. His opening public lecture was on "the knowledge economy of geocentric astronomy from the 13th to the 17th century." In this context Valleriani focused, in impressive detail, on the rise of Johannes Sacrobosco's *Tractatus de Sphaera*, a foundational text for centuries. Professor Valleriani also gave the closing after-dinner keynote lecture "Exploring the Computational History of Astronomy," focusing on the evolution of astronomical knowledge, practices, and instruments.

Despite the focus on the production and transmission of knowledge, the ten paper sessions over three days ranged far and wide, from Babylonian astronomy and the Toledan tables to 19th century solar studies and the dissemination of Fraunhofer's refractor in the United States, and from the philosophy of astronomy to the visual and digital approaches to the history of astronomy and astrophysics. The latter featured Molly Laumakis, astronomer Richard Kron, and a number of graduate students from the University of Chicago, who gave a fascinating account of their Capturing the Stars Research Group and their online OCHRE project to study the historical legacy of Yerkes Observatory. The panel highlighted two case studies of glass plate technology, including the Yerkes Glass Plate Collection consisting of more than 175,000 glass plate negatives and their associated logbooks, representing images from the 1890s to the 1990s (you can view these on this UC website): https://www.lib.uchicago.edu/collex/collections/yerkes-plates/.

In addition to the paper sessions, Chris Graney and Dennis Danielson organized a Roundtable "Starring the Earth: Science, Our Planet, and the Plurality of Worlds," based on a book they have authored coming out from Oxford University Press. The session included commentary from astronomer Paul Gabor, S.J., Vatican Observatory Director Guy Consolmagno, S.J. (virtually from Rome), and myself. It is available for viewing at https://www.vaticanobservatory.org/sacred-space-astronomy/earths-plural-at-notre-dame/.
The session, part of a tradition of papers on that subject that Mike Crowe has led over the years as one of its leading scholars, demonstrated that the extraterrestrial life debate and its implications for society are still subject to lively debates today!

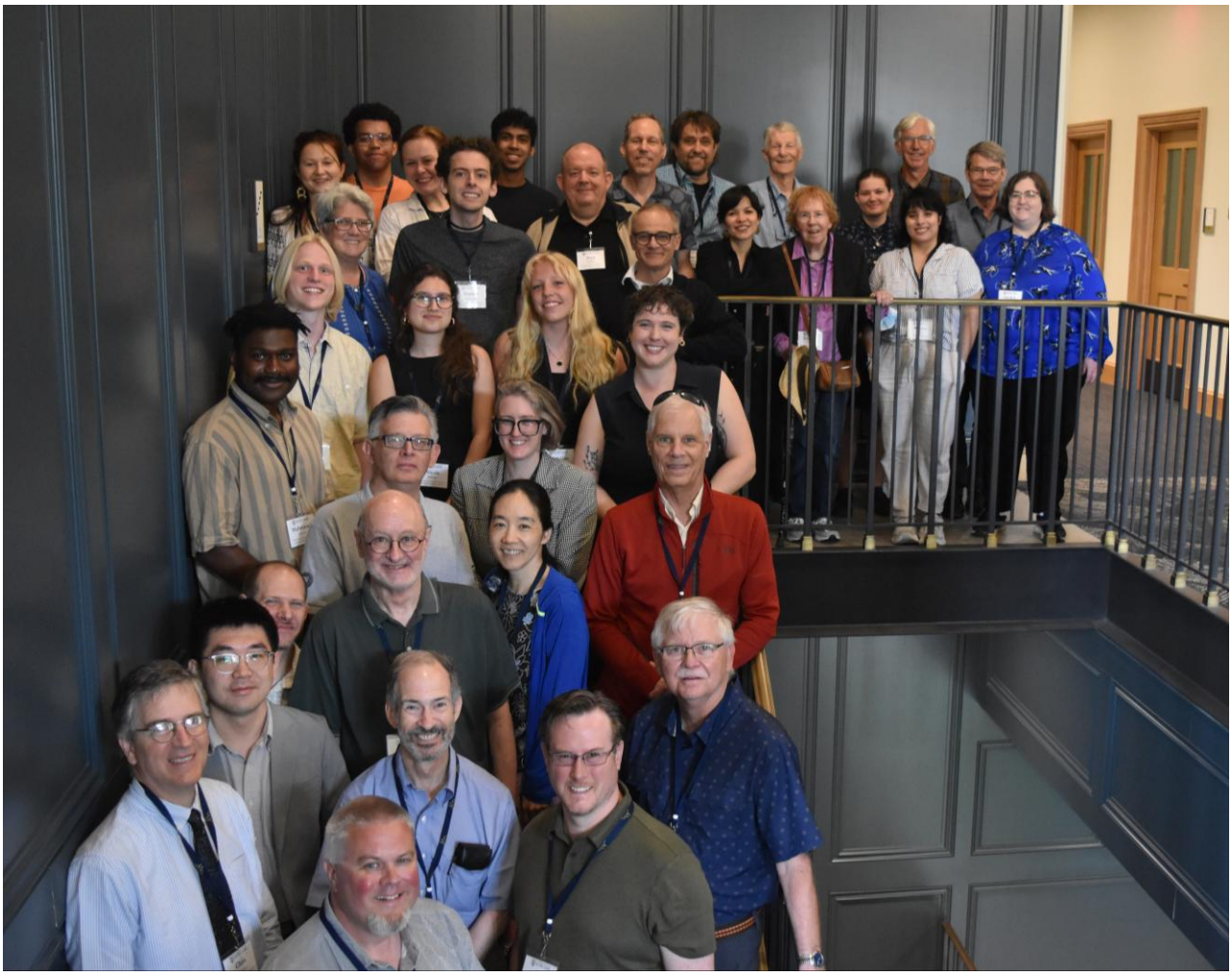


As is tradition, one day of sessions was held at the Adler Planetarium in (a foggy) Chicago, where Vice President of Collections Andrew Johnson gave welcoming remarks. More paper sessions were presented, and another Roundtable was held on "The Space of Knowledge: Technologies of Transmission at the Adler Planetarium." There was also the opportunity to enjoy the Adler exhibits, both old and new.

Michael Crowe is still living near the Notre Dame campus, but was unable to attend the meeting. Kudos go to his initial inspiration, and to the meeting organizers, including Sara Reynolds, Matt Dowd, webmaster Dana Freiburger, as well as our gracious Adler hosts. Notre Dame really is a great gathering, and a great place to network. Here's hoping we can regain our strength in the post-covid era. I urge more people to attend the next gathering in two years.

FYI, all abstracts for the meeting are available at https://www3.nd.edu/~histast/workshops/2025ndxvi/abstracts.shtml. Programs and abstracts for all sixteen past Notre Dame meetings are available at https://www3.nd.edu/~histast/workshops/index.shtml.

stevedick1@comcast.net



The 2025 Notre Dame Workshop attendees:

First row: Chris Graney, Linyuan Li, Matt Dowd, Adam Apt, Jon Voisey, Steve Dick
Second row: Christopher DeCou, Robert Smith, Eun-Joo Ahn
Third row: Mahmoud Jalloh, Durruty Jesús de Alba Martínez, Erika Meszaros, Jamie Brannon
Fourth row: Boden Komorech, Nicole Millan Ortiz, Madeline Prible, Katie Boyce-Jacino
Fifth row: Andrea Twiss-Brooks, Daniel Babnigg, Matteo Valleriani
Sixth row: Gabriela Radulescu, Molly Laumakis, Paul Gabor, Michael Korey, Johanna Garzon, Trudy Bell, Roxanna Bell, Sarah Reynolds
Seventh row: Devin Snow, Snehil Vidyarthy, Marv Bolt, Dennis Danielson, Grace Dybing, Dana Freiburger, Richard Kron

Take the Gloves Off!

Richard Tresch Fienberg
AAS/Sky & Telescope

I recently served as expert astronomer on *Sky & Telescope's* "Galileo's Italy" tour. Our group of 25 spent time in Rome, Florence, Pisa, and Padua, visiting places where Galileo lived and worked. One highlight was standing in the garden in Padua where the father of modern science made the telescopic discoveries that he described in *Sidereus Nuncius* in 1610. But that wasn't the most exciting part of the trip for me.

I experienced the most intense rush of emotion at the Angelica Library in Rome, where we were invited to examine a selection of historic astronomy books. Among them were a first edition of Kepler's *Astronomia Nova*, in which he presented his first two laws of planetary motion in 1609, and a first edition of *Sidereus Nuncius* itself. Some members of our group were astonished when the librarians opened the books without wearing gloves. I wasn't, because through my friendship with several rare-book collectors, I knew that recent studies have shown that clean, dry hands pose less risk to centuries-old books than the white cotton gloves used by librarians, archivists, and collectors in the past.

What did astonish me was a librarian's encouragement to page through the books myself, which I was willing to do only because the last thing I did before entering the library was to use the restroom and wash my hands!

Why are clean, dry hands better than gloves? Gloves contain abrasive fibers that can catch on old, fragile paper and cause it to tear. They also reduce dexterity, making it hard to sense the right amount of pressure to apply when turning pages. And unless your gloves have just come out of the washer and dryer, they risk transferring unnoticed dirt and grime to the books. It's quicker and easier to wash your hands than to do the laundry!

As long as you don't touch ink and illustrations, it's perfectly fine to page through historic old astronomy books. Unlike modern ones printed on cheap paper that self-destructs within a few decades, books from the Renaissance era were printed on much more durable paper made from linen and cotton recycled from old clothing and rags. So the next time you have an opportunity to hold a rare copy of *Sidereus Nuncius*, or any other centuries-old book, take the gloves off and wash your hands!

rick.fienberg@aas.org

Gloveless Rick Fienberg pages through a 17th-century astronomy book at the Angelica Library in Rome. (*Photos by Scilla del Mastro*)

What Are You Going to Do with That?

Jennifer Lynn Bartlett
Chair, WGPAH

Cool! I am so thrilled to see that you have

- *Photographic plates from a total solar eclipse in 1869*
- *Expense reports from the transit of Venus in 1882*
- *Private papers marked "Please do not examine contents"*
- *An observing logbook recording an unexpected dental procedure*
- *Recordings of conversations with …*
- *Embargoed, but reputedly tell-all, memoir of …*
- *A Gaertner Plate Measurer*
- *A mechanical voting machine, c. 1980*
- *An Alvan Clark comet seeker telescope*
- *A Spitz starball planetarium projector*
- *A Perkin-Elmer computerized microdensitometer*
- *900 boxes of referee reports, a refrigerator, and some respirators*

I get excited about a whole lot of things, to be sure, which explains the antique spectroscope and boxes of books and microfilm littering my office. Thanks to Harvard Plate Stacks, the photographic plates that mysteriously appeared on my desk earlier this year have found an "always" home.

I desperately wanted the voting machine when it was offered to me. I even had a business plan for using it. However, it weighed over a ton, and my mother would not let me store it in her basement until I found a better solution.

Whether we represent a large, dispassionate institution with an archive and collections plan or are an enthusiastic individual concerned about maintaining a connection to our history, we are all resource-constrained. None of us can, nor should, preserve everything.

The decision, however, to keep one thing is also a choice not to keep something else. If you are trying to decide what to preserve, you might consider the uniqueness of the item, its human connections, its association with historical people or events, and whether you can maintain it.

Frank Mills, Yerkes plate vault volunteer, examines 40"×40" photographic plate by E. E. Barnard during his 1901 total solar eclipse expedition to Sumatra. (*Photo courtesy of W. Osborn*)

Professor Philip Fox, director of the Adler Planetarium, right, and Maude Bennot, assistant director, circa 1931.
(*Image credit Chicago Tribune*)

A Volvo Crawler Excavator severs the airframe, separating the tail section from the fuselage, of the modified C-141 Kuiper Airborne Observatory, (KAO) (NASA-714), at Moffett Field, California, on 20 March 2025. (*Image credit: NASA Ames, D. Richey, via Wikimedia Commons*)

Astronomical photographic plates abound, but the 40”×40” plate exposed by E. E. Barnard during his 1901 total solar eclipse expedition to Sumatra is unique.

Logbooks record not only who was observing what using which instrument and specifications, but also in some cases more personal information.

A measuring machine can reveal much more realistically the processes and practicalities of reducing observations in this manner.

Lecture materials prepared by Maude Bennot (1892–1982) may be more compelling today than similar materials by others in the 1940s.

Pieces from the former 300-foot Green Bank radio telescope may tell part of the story of its catastrophic collapse on November 15, 1988.

No matter how beloved the Kuiper Airborne Observatory was to those who flew in it, none of them had room for a C-140 aircraft.

We ask these questions to help us decide what to preserve of our rich heritage. We choose to invest in specific artifacts because they help us and future historians understand the history of our field.

Astronomy, like all science, is a human endeavor. We do our science as part of a culture and ecosystem that affects *how* we do our science: the questions we ask, the hypotheses we pursue, and the theories we prefer.

Astronomy is not a series of proven facts to be memorized. It is our scientific understanding of the universe modeled on the incomplete observations we have. It is shaped by our human experience; and it will be revised as new data challenge current thinking, or we open ourselves to new ways of thinking.

Neither, then, is the history of our field a set of names and dates to be memorized, but a story woven together from the incomplete artifacts and records that have come down to us. It is also shaped by our social expectations; and it will be revised as new material is uncovered, or we open ourselves to new ways of thinking. What we choose to preserve tells not only the story of the object’s role in the pageant of science but also the story of our own time: our choices signal what stories we value telling ourselves about our science.

If we must choose, let us choose to tell the stories that point us in the direction of our best selves as scientists, as citizens, as humans.

wgpah-chair@aas.org

Three artifacts of historical value! From left to right:

1. The 5-inch comet seeker at the U.S. Naval Observatory. Made by John A. Brashaer Co., of Allegheny, PA, it has an objective lens of 5 inches aperture and 40 inches focal length. Equipped with an altazimuth mount, the observer looked through an eyepiece (to the right of the setting circle) on the horizontal axis (*photo courtesy USNO Glass Plate Publication Images*).
2. The Gaertner measuring engine used at the Lick Observatory in the early 1900s. Designed by Frank Schlesinger in the early 20th century, and built by the Gaertner Scientific Corporation of Chicago, the Gaertner engine allowed for rapid measurements by relying on a single bisection by the microscope reticle lines, which would then permit the measurement to be read from a dial (*Image courtesy UCSC Special Collections and Archives*).
3. The Perkin-Elmer microdensitometer used half a century ago at the at the David Dunlap Observatory in Toronto. Tom Bolton purchased this machine for approximately $150,000 in 1974. He used it to measure stellar and galactic spectra, as well as direct photographic images of the sky taken with the DDO’s 74-inch telescope (*image courtesy Ingenium*).

Eclipse, Nebraska: An Astronomical Allusion in Middle America?

Maxwell Crees
University of Northern Iowa

ABSTRACT

I used documents and interviews to determine how the name, belonging to the once-populated town of Eclipse, Nebraska, originated. I concluded that it was the result of a real, astronomical event.

BACKGROUND

Certain types of eclipses have attracted attention through history. Yet, Eclipse remains an unusual name for a city in the United States. There currently are no towns by this name, and among ghost towns the location of only one remains known: that of Eclipse, Nebraska. This site still is home to the Eclipse Church and Eclipse Cemetery.

QUESTION

Is the name of this village (populated from 1905 to circa 1923) connected to an actual astronomical event?

METHOD

An internet search revealed several potential sources of information.

A telephone call and letter to the Hooker County Historical Society suggested that this organization is defunct. Contacting the Hooker and McPherson County Clerk's Offices led to no further information. (There is ambiguity as to the county in which Eclipse, Nebraska, was situated, at the time it appeared under that name.)

The Hooker County Library shelves a book on the history of Hooker County. Also in its holdings is a manuscript in which Eclipse is said to be named, "independently from any place or person" (Fitzpatrick and Fairclough, 1960). This leaves an event as a possible name source.

The Nebraska State Historical Society provided me with an archived article that includes an interview with Chauncey Tucker, an Eclipse founder, and the county attorney in Mullen, Nebraska at that time. The Society alerted me to relevant post-office records, period maps, and a manuscript on the naming of Nebraska Post Offices, held in their collection.

The local newspaper has on file an article documenting the changing postmasters in Eclipse. The last ended his tenure in 1923.

Finally, I recently visited the environs of Eclipse for three days (15–17 June, 2025). The area is defined in post-office documents.

Eclipse Cemetery Gate

Gravestone of Chauncey Tucker

RESULTS

The data reveal that the effort to establish a post office near to the Dismal River was the first documented regional use of the place-name Eclipse. The story emerges that local (presumed) ranchers gathered in 1905 at the home of Albert Judd Gragg to petition for a post office in "Eclipse, Nebraska" (Fitzpatrick and Fairclough, 1960). The idea of a post office named Eclipse—if not the name of the town itself—appears to date from February of that year.

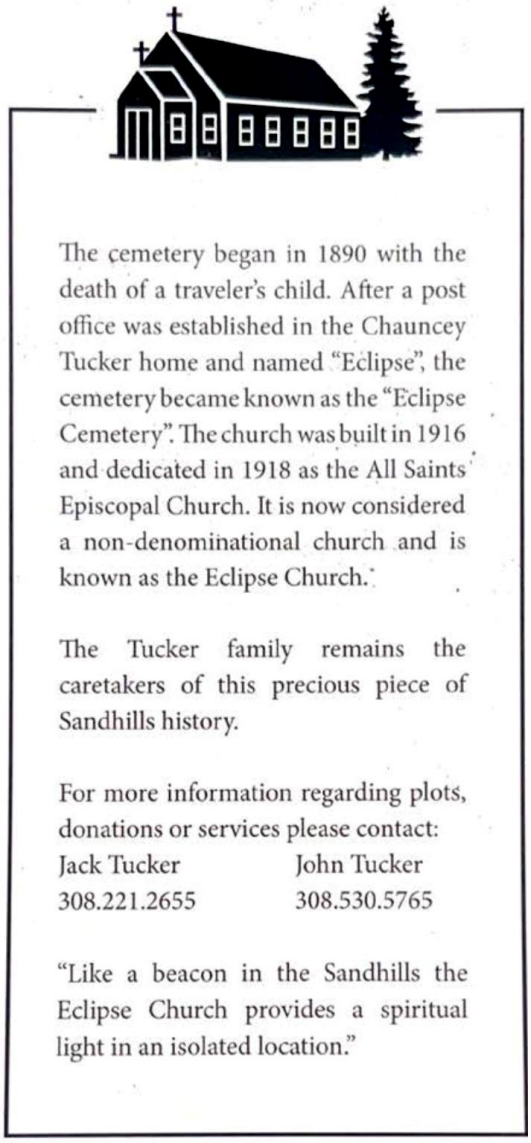
A manuscript, written by a University of Nebraska conservationist, includes a quote on the geographical name Eclipse involving a postal inspector: *"[The] road to this place had 'eclipsed' anything he had ever traveled..."* (Link, 1933). However, this unattributed comment is anachronistic; the name pre-dates the formal establishment of the post office.

The ranchers bid for a United States Post Office was successful. Chauncy Tucker became the first post-master and maintained the Eclipse Post Office at his ranch (Post Office Department, 1950). Ancestry.com, and headstone inscriptions visited at the Eclipse Cemetery, confirm that Tucker and Gragg likely were local residents in 1905. Mail to the territory that at one time was serviced by the Eclipse Post Office is now handled by the post office in Mullen, Nebraska, one of the closest surviving towns. [Cox, M. & Tompkins, C., 1989].

In surveying the countryside once identified with Eclipse, I counted five current ranches that could have once been part of the town. At least one of them, the Tucker ranch named Eclipse, still is in the hands of the founding family.

I interviewed, in person, John Tucker, who is the current owner of the Tucker Ranch. Along with Jack Tucker, he also maintains the extant Eclipse Church and Eclipse Cemetery. (Investigation inside the Eclipse Church resulted in no new leads.) Both men are descendants of Chauncy Tucker. John Tucker told me that the inspiration for the town name came from a lunar eclipse that occurred in the very early 1900s.

I examined the circumstances of all the eclipses that took place in a two-year period. In 1904 there were five eclipses (three lunar and two solar); in 1905 there were four eclipses (two lunar and two solar).



The cemetery began in 1890 with the death of a traveler's child. After a post office was established in the Chauncey Tucker home and named "Eclipse", the cemetery became known as the "Eclipse Cemetery". The church was built in 1916 and dedicated in 1918 as the All Saints' Episcopal Church. It is now considered a non-denominational church and is known as the Eclipse Church.

The Tucker family remains the caretakers of this precious piece of Sandhills history.

For more information regarding plots, donations or services please contact:

Jack Tucker 308.221.2655

John Tucker 308.530.5765

"Like a beacon in the Sandhills the Eclipse Church provides a spiritual light in an isolated location."

Pamphlet from Eclipse Church

Inside the Remodeled Eclipse Church

THE ECLIPSES

The Lunar Eclipses

The 1904 eclipses were all penumbral (Espenak and Meese, 2009). That a penumbral eclipse played a role in the naming of Eclipse is difficult to imagine.

Both 1905 eclipses were partial. One was not visible from the United States. The other was but occurred after Eclipse was named. More importantly, partial lunar eclipses historically do not attract a great deal of popular interest.

The Solar Eclipses

In 1904, one was partial (technically annular), but the other was total — universally considered to be much more spectacular and locally rare than any other type of eclipse. Notwithstanding, these eclipses were oceanic: Both were visible over very little land, exclusively from the Southern Hemisphere (Espenak and Meese, 2006).

In 1905, one eclipse was annular, visible over Australia. However, the other was total and visible in the Middle East, Africa, Europe, and — most importantly — the northern United States.

This latter eclipse was not total over Hooker County Nebraska. (It was visible as a partial.) Though the date of August 30 occurs after the naming of Eclipse I have found news articles discussing the eclipse as early as January of 1905.

CONCLUSION

So newsworthy would be a total *solar* eclipse, visible through a highly populated path in the United States, that it could have been discussed ahead of time in the media of the day. While the informant used the term “lunar eclipse,” it is very common for members of the public to confuse the two major types of eclipses. (Recall that this recollection was oral history for multiple generations). Thus, I propose that Eclipse, Nebraska, was named after the total solar eclipse of 30 August 1905.

SOURCES

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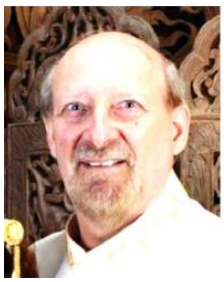
Photographs by the author.

thomas.hockey@uni.edu

Max Creese is a freshman student of Thomas Hockey




History of Astronomy at the May 2025 Annual Conference of the Royal Astronomical Society of New Zealand

Professor Wayne Orchiston
University of Science and Technology of China (Hefei) and Centre for Astrophysics, University of Southern Queensland (Toowoomba, Australia)
Glen Rowe
Deputy Director, RASNZ Historical Section

The weekend Annual Conferences of the Royal Astronomical Society of New Zealand (RASNZ) are the flagship events that offer the professional and amateur astronomers of New Zealand a chance to showcase their recent research, educational activities. or instrument-making feats. Ever since its founding in November 2022, the Historical Section of the RASNZ has had a prominent presence at these conferences.

The 2025 May 9–11 event at the North Island coastal city of Whakatane was no exception, with the Section offering four oral papers and displaying 14 posters during a very busy two-day schedule (the Friday night is reserved for registration, a business meeting, and a reception).

One of the Section's valued overseas members, Dr. Hisashi Hayakawa from Nagoya University, gave a paper where he explained how New Zealand could make a major contribution to our international understanding of historic space weather events because of New Zealand's unique geographical position on the globe (something that will resonate especially with HAD members Steve Dick and Bill Sheehan), the plethora of regional and local newspapers there, and a relatively large scientifically literate population that was happy to report their observations in these newspapers. Hisashi's paper built on two posters that were displayed at last year's conference and a poster that was displayed in October 2024 at an international Space Weather Conference in Japan.

Secondary school science teacher and former RASNZ President and Secretary John Drummond reported on New Zealand observations of the Great Comet of January 1910, C/1910 A1, which many people later mistakenly recalled as Comet 1P/Halley (which graced New Zealand skies three months later). This study forms part of John's part-time off-campus research on New Zealand cometary astronomy for a PhD with the Centre for Astrophysics at the University of Southern Queensland in Australia, which Wayne Orchiston is co-supervising.

Meanwhile, Wayne's historical conference paper followed on from last year's innovation: providing a regional overview of the astronomical history of the region where the Conference was held. Given the Whakatane conference venue, Wayne and the presidents or former presidents of the three local astronomical societies in Whakatane, Tauranga and Rotorua reviewed the Bay of Plenty–Taupo–Coromandel Peninsula region from Māori times through to the present day (the title slide is shown in Figure 1). Amongst other topics, they discussed a number of solar eclipses that would have been visible to Māori astronomers (see Figure 2), observations by Cook and Green of the 9 November 1769 transit of Mercury, astronomical activities of the internationally-known Thames cometary astronomer John Grigg, the late Dr. Frank Bateson's Directorship of the Variable Star Section of the RASNZ, and known meteorites from the region.

The historical posters displayed at the Whakatane conference were on the following topics:

1: *"Welcome to the RASNZ's Historical Section: researching the past to understand the present and the future"* by Wayne Orchiston and Glen Rowe
2: *"Māori cometary astronomy and the Tarawera [volcanic] eruption"* by Wayne Orchiston and John Drummond
3: *"Observations by Cook and Green of the 9 November 1769 transit of Mercury from the Coromandel Peninsula"* by Wayne Orchiston, Darunee Lingling Orchiston, and Glen Rowe
4: *"Henry Severn of Thames and his 11-in Newtonian reflector: the largest telescope in New Zealand in 1874"* by Wayne Orchiston
5: *"John Grigg: Thames' other talented amateur astronomer"* by Wayne Orchiston
6: *"Grigg, Skjellerup and their comet: the Kiwi connection"* by Wayne Orchiston and John Drummond

7: *"The Whakatane Astronomical Society and the historic 8-inch Grubb 'Tebbutt Telescope'"* by Wayne Orchiston and Norman Izett

8: *"The 1989 Opotiki bolide: in search of a new carbonaceous chondrite from the North Island of Aotearoa/New Zealand"*, by Wayne Orchiston and John Drummond

9: *"New Zealand observations of the Great Comet of 1881"* by John Drummond and Wayne Orchiston

10: *"The international importance of the 9.5-inch Cooke refractor at the Wanganui Observatory"* by Wayne Orchiston and Ross Skilton

11: *"The historic 6-inch refractor at the New Plymouth Observatory: New Zealand's only known Alvan Clark telescope"* by Wayne Orchiston and Rod Austin

12: *"Carter Observatory's involvement in early New Zealand radio astronomy: Ivan Thomsen's 1948 Nature paper"* by Wayne Orchiston

13: *"University of Canterbury research on radar meteor astronomy: the Rolleston Field Station"* by Jack Baggaley and Wayne Orchiston

14: *"Peter Read and his observations of the Moon and planets: a selection of drawings from his Observations Book"* by Wayne Orchiston

Note that posters 2–8 all had direct links to the 'local region', while poster 14 continued the study of Peter Read first presented at last year's Conference. Posters 4, 7, 10 and 11 all continued the "Historic NZ Telescopes" theme and posters 12 and 13 the "Early NZ radio and radar astronomy" theme, both of which have been promoted at previous Conferences. Posters 2 and 3 also followed earlier posters about Māori astronomy and Cook Voyage astronomy, respectively. Meanwhile, posters 2, 5, 6 and 9 were about comets, reflecting John Drummond's PhD project and Wayne Orchiston's own research interests, while links between overseas and NZ astronomy are apparent with posters 3 & 10 (UK), 6, 7 and 9 (Australia) and 11 (USA). Two of these posters are shown in Figure 4, and note that poster 11 has been converted into a short article that is published elsewhere in this Newsletter.

For free pdf copies of any of these posters, please email me at wayne.orchiston@gmail.com .

The RASNZ Conference also promoted the collaborative research of the RASNZ's Historical Section and its Fireballs Aotearoa Section (which is about meteors and meteorites). Apart from poster 8 mentioned above, Wayne Orchiston presented a coauthored oral paper on "Introducing New Zealand Meteorites: Welcome Visitors From Outer Space" (the title slide is shown in Figure 3). All five authors were members of both Sections, and this paper built on two posters they displayed at last year's RASNZ Conference. Meanwhile,

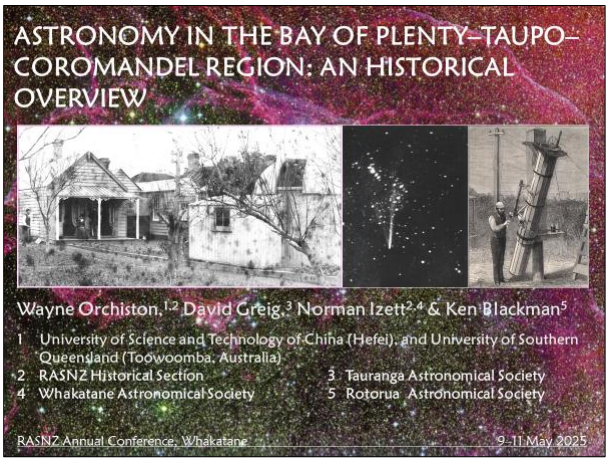


Figure 1: Title page of the RASNZ review paper of the history of astronomy in the Bay of Plenty–Taupo–Coromandel region, showing three images relating to John Grigg (left and center) and Henry Severn (right) of Thames.

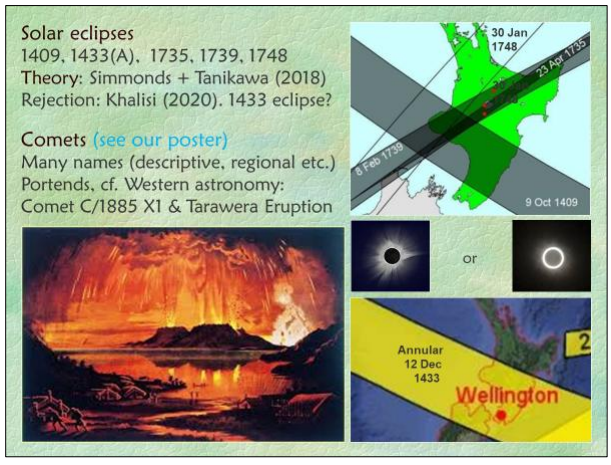


Figure 2: A slide from the regional history overview oral paper, about comets and five total or annular solar eclipses. The painting at lower left shows the 10 June 1886 destructive eruption of Mt Tarawera, which the Māoris believed was forecast by the prominent prior appearance of Comet C/1885 X1 (Fabry).

research by Section members on known New Zealand meteorites is on-going, with John Drummond and Wayne and Darunee Lingling Orchiston visiting and identifying the find-site of the 1915 Waingaromia Meteorite prior to attending the Whakatane Conference. They are planning to prepare a poster on this for next year's Conference.

During and after the conference there were excellent opportunities to discuss some on-going collaborative research projects with Historical and Fireballs Aotearoa Section members, both in Whakatane and in Auckland. All in all, Whakatane was another excellent conference.

wayne.orchiston@gmail.com
growe511@outlook.com

Figure 3: Title slide of the oral review paper about New Zealand meteorites

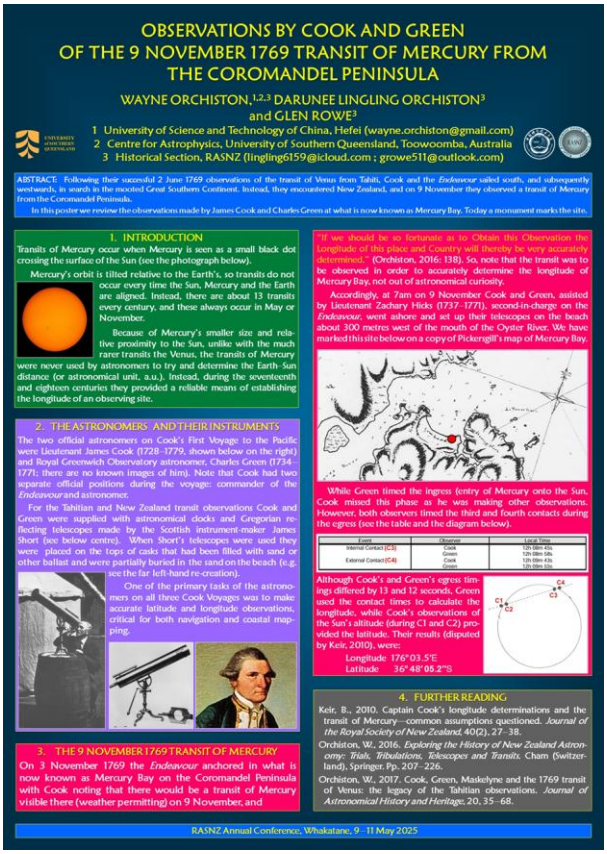


Figure 4: Two of the colourful Historical Section posters displayed at the Whakatane RASNZ Conference. The one at right is about the historic 9.5-inch Cooke refractor at the Wanganui Observatory in the West Coast North Island city of Whanganui. This telescope has the first-ever metallic English equatorial mounting, so is an international 'type specimen'. Originally it was used for double star observations, but is now restricted to astronomy education and outreach.

The Historic 6-inch Refractor at the New Plymouth Observatory: New Zealand's Only Known 'Alvan Clark Telescope'

Professor Wayne Orchiston
University of Science and Technology of China (Hefei) and Centre for Astrophysics, University of Southern Queensland (Toowoomba, Australia)
Rod Austin
RASNZ Historical Section

1. Introduction

To our knowledge, the New Plymouth Astronomical Society's observatory (Figure 1) houses the only known Alvan Clark telescope in New Zealand. This is a 6-inch (15.2-cm) refractor that was made in 1881 and "… was associated with one of Australia's leading professional observatories and then with one of the nation's leading amateur astronomers … [but] only made a valuable contribution to astronomy after coming to New Zealand." (Orchiston, 1991: 277).

In this article we examine aspects of the history of this telescope.

2. Sydney Observatory and the Transit of Venus

Sydney Observatory (Figure 2) opened in 1858 and quickly was involved in astronomy, meteorology, tidal studies, timekeeping, and the trigonometrical survey.

The third Director, Henry Chamberlain Russell (1836–1907), was keen for the Observatory to join international colleagues and observe the 1874 and 1882 transits of Venus, both of which were visible from eastern Australia (Orchiston, 2004).

Valuable observations were made from four different observing sites during the 1874 transit, which inspired Russell to mount an even more ambitious 1882 program. The Government funded him to purchase four new telescopes, one of them from Alvan Clark & Son (Lomb, 2011).

Figure 1: A recent photograph of New Plymouth Observatory. The smaller dome at the rear houses the C14 telescope, while the historic Alvan Clark telescope is in the dome at the front (*Photo courtesy New Plymouth Astronomical Society*).

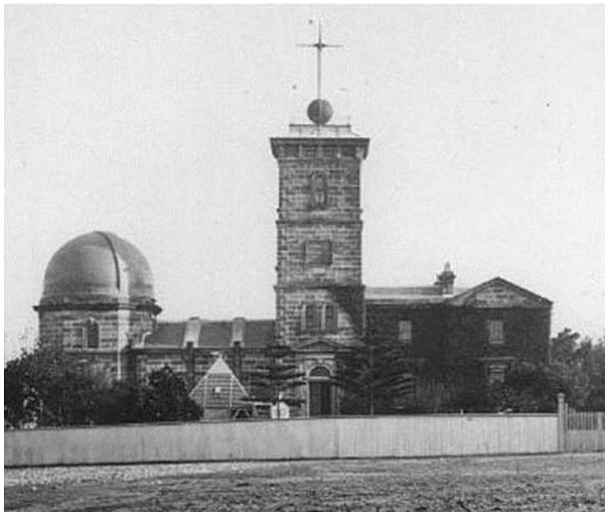


Figure 2: Sydney Observatory, the original owner of the 6-inch Alvan Clark refractor. This telescope was never mounted at the Observatory. The principal telescope at this time was an 11.5-inch Schroeder refractor, which was housed in the dome on the left. (*Photo courtesy Dr. Harley Wood*).

Figure 3: An undated photograph of Alvan Clark (*https://en.wikipedia.org/wiki/Alvan_Clark#/media/File:1891_AlvanClark_Boston.png*).

3. Alvan Clark: Telescope-maker

Alvan Clark (1804–1887; Figure 3) was America's premier telescope-maker during the second half of the nineteenth century (Warner and Ariail, 1997). He and his son, Alvan Graham Clark (1832–1897 "… between them built a great many refracting telescopes, some of which at the time of their manufacture ranked as the largest in the world." (Orchiston, 1991: 281).

In 1866 they held that record with the Chicago Astronomical Society's 18.5-inch refractor. Cooke then took the record with a 25-inch in 1871, and the Clark's reclaimed it in 1873 with the 26-inch telescope at the U.S. Naval Observatory. Grubb took the record in 1881 with the Vienna Observatory's 27-inch refractor, then the Clarks claimed it again in 1885 with the 30-inch Pulkovo Observatory telescope. Thereafter the record remained with A.G. Clarke, as his firm completed the 36-inch Lick and 40-inch Yerkes telescopes in 1888 and 1897 respectively.

So, by the time the Clarks built the 6-inch refractor for Sydney Observatory in 1881, this was—by their standards—a very modest telescope. Yet all Clark telescopes were known for their quality, and even a 6-inch refractor was capable of doing useful work if placed in the right hands.

4. Walter Gale's Role

The weather did not cooperate in 1882, and all of the Sydney Observatory transit of Venus sites were clouded out (Orchiston, 2004). Most of the associated telescopes were then placed in storage, only to emerge in 1904 when Russell's successor, Henry Lenehan (1843–1908), agreed to sell them to local amateur astronomers.

The successful bidder for the 6-inch Alvan Clark was a well-known Sydney businessman and amateur astronomer named John St Vincent Welsh (1876–1918). Although he went to the trouble and expense of constructing an impressive domed observatory for it (see Orchiston, 1997: 103), he had few opportunities to observe with it and eventually sold it to Sydney amateur astronomer Walter F. Gale (1865–1945, Figure 4). Alternatively, Gale may have purchased the telescope from Welsh's estate in 1919. Despite his amateur status Gale was one of the powerbrokers of New South Wales astronomy (Orchiston, 2017: 402–403; Wood, 1946), and one of those behind the founding of the New South Wales Branch of the British Astronomical Association. Gale was also well known for his comet discoveries and his

Figure 4: A cartoon of banker–amateur astronomer Walter Gale of Sydney, reflecting his special interest in telescopes and the planet Mars (*Image courtesy Orchiston Collection*).

Figure 5: An early 2025 photograph of the refurbished 6-inch 'Alvan Clark refractor' back in its original wooden dome at the New Plymouth Observatory. Note that the German equatorial mounting shown here is not original, but in 1921 replaced the makeshift mounting that Gale had provided with the telescope. The current whereabouts of the original Alvan Clark mounting (and perhaps even the tube assembly) is unknown (*Photo courtesy: New Plymouth Astronomical Society*).

observations of Mars, and he already owned several much larger telescopes, so he decided to sell the Alvan Clark refractor.

5. New Plymouth and the 'Alvan Clark Telescope'

The New Plymouth Astronomical Society was founded in the West Coast North Island New Zealand city of New Plymouth in 1920 (Gladstone, 2018), and one of their objectives was to establish an observatory and furnish this with a quality telescope. Gale sold them the Alvan Clark refractor, but with a makeshift mounting, not the one that originally came with the telescope, and in 1921 the Society replaced this with an equatorial mounting with a drive (Woods, 1970). Later there were suspicions in New Plymouth about whether the whole tube assembly was indeed from Alvan Clark, as the tube itself may have been made in Sydney, with the eyepiece assembly taken from a Cooke telescope. So only the 6-inch objective was an Alvan Clark! If this was indeed so, it is somewhat charitable to refer to this as an 'Alvan Clark telescope'. Be that as it may, the telescope functioned well enough, and from 1921 was used extensively for education and outreach (Gladstone, 2018; Morsehead, 1945).

In 2017 the Society obtained a C14 and in 2023—after a little over a century of continuous use— the 'Alvan Clark dome' was closed down and the telescope was removed and refurbished. The 144-year-old telescope was only returned to its original home under the main dome in early 2025 (Figure 5).

New Zealand has astronomical societies and public observatories in most cities, scattered throughout the nation (see Orchiston 2016), but currently the New Plymouth Observatory is the only one that is host to an Alvan Clark telescope—if indeed it really is an Alvan Clark 'telescope' rather than just an objective. This surely highlights the care we must take in describing historical telescopes, especially if their objectives, tube assemblies and/or mountings have been subject to change over time (e.g. see Orchiston, 2022 for another New Zealand example).

wayne.orchiston@gmail.com
rodcomet@gmail.com

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Recent Research and Conferences

Professor Wayne Orchiston
University of Science and Technology of China (Hefei) and Centre for Astrophysics, University of Southern Queensland (Toowoomba, Australia)

This year Darunee Lingling Orchiston (henceforth DLO) and I have been very busy with conferences seminars and lectures. Since the beginning of 2025 these have taken us from our home in northern Thailand by Zoom or in person to Australia, New Zealand, Britain, and Australia again (in that order). We also paid a two week visit to the University of Science and Technology of China in Hefei, in connection with my job as Co-Editor of the *Journal of Astronomical History and Heritage*, and *en route* to and from Britain we spent time in France.

On 2 February I Zoomed in to Sydney, Australia, to join a half-day seminar celebrating the founding 130 years ago of the New South Wales Branch of the BAA in Sydney. As a former President of that now defunct group I have been researching its history for decades (for recent papers, see Lomb *et al.*, 2024a; 2024b). At the seminar another former President (Colin Bembrick) and I combined to present a paper about an historic 18-inch reflector that was made by one of the early stalwarts of the Branch (Figures 1 and 2). That member was a successful businessman, and he became an important patron of amateur astronomy in New South Wales (see Orchiston and Bembrick, 2025).

The concept of patronage in astronomy greatly interests me, and is something I've recently also been researching in India (see Orchiston, 2025a), in the context of British colonialism in India, and the independent development of Western-style observatories by aristocrats (see Figure 3) and tertiary colleges and universities (Kapoor and Orchiston, 2023; Orchiston and Kapoor, 2023, 2024). Sadly, my collaborator and close friend,

Figure 1: During the 1 November 1948 partial solar eclipse, photographs of the Sun were taken with the 6-inch Cooke guidescope attached to the 18-inch Hoskins Telescope at the Central Technical College in Sydney (*photo courtesy: CSIRO Radio Astronomy Image Archive, B1899-7*).

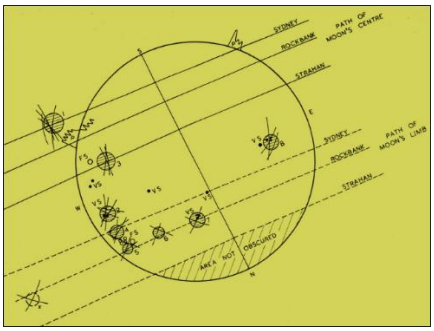

Figure 2: The optical observations mentioned in Figure 1 were used to pinpoint sunspots present during the eclipse. Through triangulation, radio observations conducted from three widely spaced Australian sites showed the locations of the different 600 MHz active regions (hatched) during the 1 November 1948 eclipse. The small black dots indicate visible sunspots (VS), P indicates a prominence, and FS marks the position of a sunspot group that was prominent 27 days earlier. Through this ingenious project radio astronomers for the very first time were able to pinpoint the precise locations of radio-emitting regions in the solar corona (*diagram after Christiansen et al., 1949: 513*).

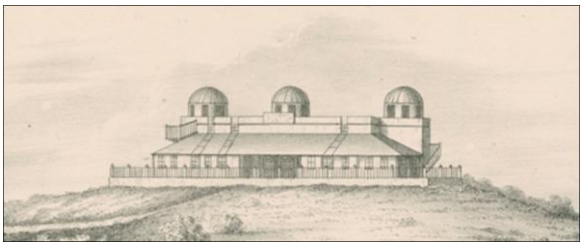

Figure 3: Trivandrum Observatory near the southern tip of India was built in 1836–1837, and funded by the Maharaja of Travancore, Swathi Thirunal (1813–1846). The Maharaja had a fascination for Western and traditional Indian astronomy, and he supplied the Observatory with the latest in the way of English astronomical instruments (*drawing after Caldecott, 1837: facing 57*).

Professor Ramesh Kapoor, died suddenly on 21 August after a brief illness. We had planned to bring together many of our papers about nineteenth century Indian astronomy and publish them as a book. I don't know if this will still happen.

Ramesh's unexpected death was not only a great shock but also a wake-up call for me. As I age (I'm 82, five years his senior) I increasingly look back to my astronomical roots as a pre-teenager in New Zealand and a teenager in New Zealand and Australia. With increasing urgency, I continue to research and publicize amateur astronomy in these two former British colonies. Each had a strong amateur astronomy tradition, and recently I have been promoting this through published papers (e.g. Orchiston and Drummond, 2024a; 2024b; Orchiston and Hearnshaw, 2024) and conference presentations. For example, I presented a review paper on Australia's foremost late nineteenth-century astronomer, John Tebbutt (1834–1916; Orchiston, 2017a) at the 2025 Annual Meeting of the Historical Section of the British Astronomical Association in Exeter, Britain, on 31 May, while two of my posters at the 9–11 May 2025 Annual Conference of the Royal Astronomical Society of New Zealand in Whakatane discussed Tebbutt's 1881 Great Comet (C/1881 K1 Tebbutt; Figure 4) and his 8-inch Grubb telescope. Other posters at this conference discussed prominent NZ amateur astronomers John Grigg and Peter Read.

Building on earlier work (e.g. Anderson and Orchiston, 2021; 2022; 2023; Orchiston, 2015), I have also been researching the amateur-professional interface in Australia and New Zealand, and the Amateur-Turned-Professional (ATP) Syndrome in these nations and in India. The paper about Indian patronage mentioned earlier (Orchiston, 2025a), also discusses this interesting topic (Figure 5)—which is the subject of on-going research.

Another area of strong research interest is the history of radio astronomy, especially in Australia (Orchiston *et al.*, 2021b), France, India (Orchiston and Phakatkar, 2019; Orchiston, 2022), Japan (Orchiston and Ishiguro, 2017) and New Zealand (Orchiston, 2017b). Lately, my first PhD student, Dr. Harry Wendt (University of Southern Queensland), and I have published on early low frequency research conducted at the CSIRO's Fleurs field station near Sydney (Wendt and Orchiston, 2024; Wendt et al., 2024; see Figure 6).

Figure 4: Étienne Léopold Trouvelot's chromolithograph of Tebbutt's Great Comet of 1881 over Maria Mitchell Observatory on 25–26 June 1881, when it was a splendid object in the Northern sky. This comet arrived at just the right time in history: it was the first to be successfully photographed in its entirety and the first for which the spectrum of an entire comet (not just the head) was obtained (*for details see Orchiston, 2017a: 255–291*).

Figure 5: The British amateur astronomer John Caldecott (1801–1849) who was employed by Maharaja Swathi Thirunal as Director of Trivandrum Observatory. Caldecott gained great mileage by promoting his position as 'Astronomer Royal' to an 'Eastern King' when in England in 1840, and at the time was elected a Fellow of both the Royal Astronomical Society and the Royal Society (*painting after Walding n.d.*).

These are the 11th and 12th papers, respectively, in a series that we hope will include one or two further papers. In France, Dr. James Lequeux has translated into French the series of papers that we and other French colleagues researched and wrote under the umbrella of the IAU Historical Radio Astronomy Working Group between 2007 and 2011 and published in the *Journal of Astronomical History and Heritage*. James has repackaged these research papers and added a concluding chapter, and this will be published as a book at the end of this year or early next year (with *JAHH* keeping me far too busy, this will be my first book since 2021). For my part, I have continued to promote early New Zealand radio and radar astronomy, through research papers (Baggaley and Orchiston, 2024; Orchiston, 2025b) and conference posters (Figure 7). Meanwhile, Dr. Hisashi Hayakawa from Nagoya University has kindly offered to team up with me and help research and write the two papers remaining papers in the series of early Japanese radio astronomy, so we can finally bring this long and ambitious project, also initiated through the IAU Historical Radio Astronomy Working Group, to a satisfactory end.

The final area of research I want to mention is what DLO and I call 'Multidisciplinary Ethnoastronomy', a new field we pioneered some years ago and have been promoting around the world. Here we have an ambitious plan to assimilate data drawn from anthropology, astronomy, genetics (especially mtDNA), geology, history, hominid paleontology, linguistics, palaeoclimatology and prehistory to trace demographic and environmental changes in the Indian and SE Asian regions over the past 70,000 years and try to correlate these with changes that must have taken place in indigenous astronomical systems (see Orchiston and Orchiston, 2017). This is especially interesting—and challenging—when key new archaeological or mtDNA papers are published (see Figure 8) and force us to reinterpret our earlier conclusions (e.g. c.f. Dela Cruz *et al.*, 2022 and Orchiston *et al.*, 2021a). In early July DLO and I attended the IAU-sponsored Oxford XIII Cultural Astronomy Conference in Melbourne, Australia, where we presented a paper titled "New Directions in Cultural Astronomy: Rethinking the Past". Here we gave examples of changing astronomical systems we have been able to document in India, Indonesia, the Philippines and New Zealand.

Figure 6: The enigmatic American radio astronomy pioneer Grote Reber with his electric car, Pixie. Reber spent much of the last four decades of his life living in the southern island state of Tasmania (Australia), where he carried out a succession of low frequency experiments with radio telescopes that he built. One of these was the world's first Square Kilometer Array. But Reber also carried out one project in collaboration with CSIRO radio astronomers in Sydney, using data from their 19.7 MHz Shain Cross at Fleurs field station (see Wendt *et al*., 2024.

Figure 7: Three pioneers of radio/radar astronomy, all with New Zealand associations. (Left): British-born and Cambridge-educated Dr. Elizabeth Alexander (1908–1958), who was head of the Government's Radio Development Laboratory in Wellington during WWII and was the first female radio astronomer to detect solar radio emission (Orchiston, 2016: 629–651); (Centre): Professor Alan Maxwel((1926–2021), who completed what we believe was the world's first Master's thesis in radio astronomy, at Auckland University College in 1948, and went on to do a PhD at Manchester University and then head Harvard's radio astronomy program (Skinner et al., 2022); and (Right): Professor Clifton Ellyett (1915–2006), who in 1948, along with his British and American colleagues J.A. Clegg and O.G. Villard, obtained the world's first Doctorate in radio/radar astronomy, from Manchester University (Sullivan, 2009: 510–511), and went on to build an international reputation in radar meteor astronomy at the University of Canterbury in Christchurch (Baggaley and Orchiston, 2024). Posters about all three were displayed at recent annual conferences of the Royal Astronomical Society of New Zealand.

With more presentations (and sometimes posters) scheduled for the USA, Japan and China between now and the end of 2025, this is surely going to be a bumper year for conferences. More on these, perhaps, in a 2026 newsletter.

wayne.orchiston@gmail.com

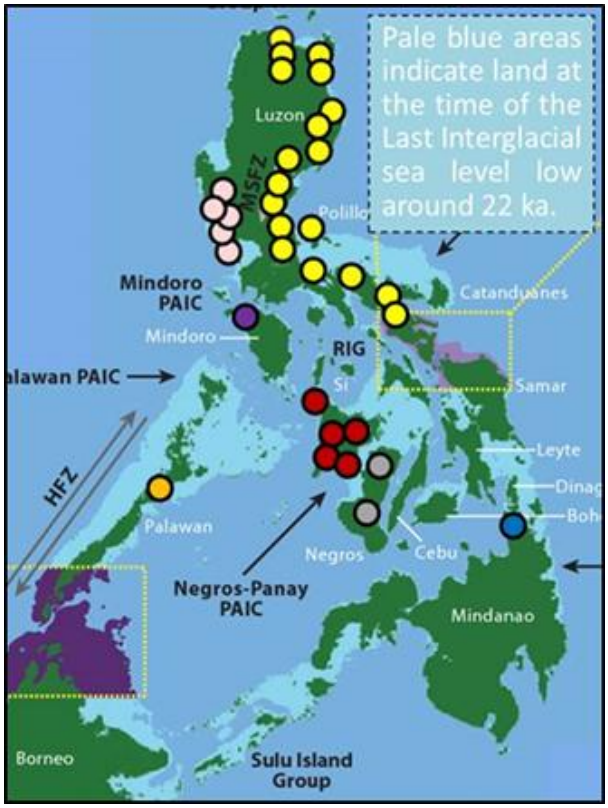

Figure 8: A map showing the current distribution of the seven different negrito ethnic groups in the Philippines (after Orchiston *et al.*, 2021a: 81). We are now using the latest mtDNA and other multidisciplinary evidence to try and track the histories of these groups so that we can compare and contrast their associated astronomical systems and explain changes in these that took place over time.

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Concepts, Claims and Reality in the Development of the Astronomical Telescope

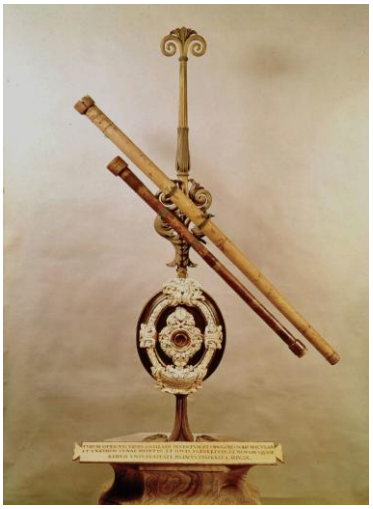
Douglass F. Rohrman
Amateur Astrophotographer

I. Introduction

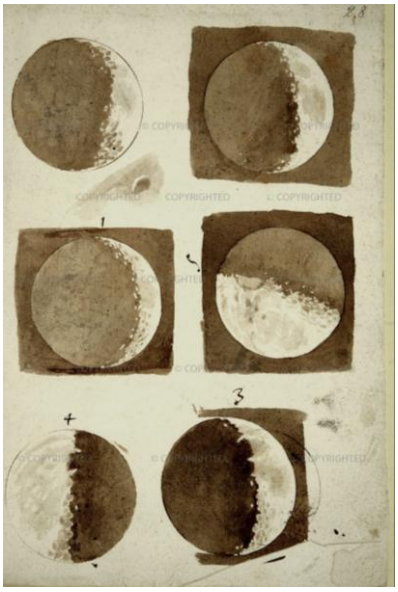
The telescope and Galileo Galilei (1564–1642) are inextricably bound. In 1610 Galileo famously announced in Biblical terms: "[H]aving dismissed earthly things, I applied myself to the exploration of the heavens".[1]

It is commonly accepted that at the beginning of 1608 virtually nobody had a "telescope", or any comparable device for astronomical viewing, but by the end of 1609 a "spyglass" curiosity was readily available throughout Europe. This resulted in what one historian termed a "gossip-fueled political bear-pit" of claims, theories and exaggerations.[2] That someone would turn spyglasses to the night sky seems inevitable in the years of the scientific revolution; and, that the telescope's first conception and use are celebrated is no surprise. As this paper will illustrate, the creation of the telescope and its first use would become universally controversial.

Just who first conceived of or invented the telescope or used the early spyglass as an astronomical instrument is an oft-examined question primarily because there are many claims without definitive answers. Some contemporaries have from time-to-time credited Galileo with the earliest use of a telescope for astronomical purposes. He learned of the first "spyglass" or *perspicilli* designs sometime in July 1609[3]. He had studied Kepler's practical optics, applied deductive reasoning, and clearly devised his own instrument during that summer. There is an alternative narrative: that Galileo actually acquired a simple spyglass and thereafter constructed his own.[4]



Whichever is correct, by winter 1609–1610 he had created an instrument and is credited by most for the first depictions of the moon from November 30, 1609 to January 19, 1610 and planets there-after. He recorded lunar phases and, starting on January 7, 1610, the famous "Medician Stars", the satellites of Jupiter:



These amazing drawings are based on aided observations using an adjustable concave (ocular) and convex (objective) lens system of his construction.

These findings were reported by Galileo in *Sidereus Nuncius*[5] in 1610, in which he may have created an impression in the frontispiece that constitute his claimed invention or construction of the telescope: "*perspicilli nuper a se reperti*". This has been translated to fit several narratives and could alternatively mean "spyglass recently discovered [or "devised"] by himself". With it he had nevertheless made the astounding drawings of the moon.

In the past 400 years, proof has evolved that Galileo neither first constructed nor first used the telescope to observe and share his observations. Indeed, despite the ambiguous frontispiece statement, Galileo himself admitted in *Sidereus Nuncius* that "about ten months ago a report reached my ears that a certain Fleming had constructed a spyglass by means of which visible objects, though very distant from the eye of the observer, were distinctly seen as if nearby."[6] A former pupil of Galileo, the French courtier Jacques Badovere (1575–1620), may have written Galileo's friend Sarpi soon thereafter confirming this news. Further, in *Il Saggiatore* in 1623, Galileo stated that did not invent the telescope and that he had "discovered the same by means of reasoning." There is now no debate that Galileo, however his statements are interpreted, "was not the first to do so. He was not even the second, though he had no knowledge of earlier observers at the time."[7]

However, to whom shall fall the distinction is not so clear. As we will see, many had claims on priority in invention, and at least Fontana, Harriot and Marius all had prior claims of first astronomical use of some sort of telescopic device. Circumstances, persistence and genius propelled Galileo, and not the others, into lasting fame. He was smart, adept at drawing, a master of communication, and was, as his biographer noted, the first "recognizably modern" scientist. But Galileo was not without his critics. "In six short years Galileo went from being a somewhat obscure mathematics professor who ran a student boarding house in Padua, to becoming a courtly star in Florence in the wake of his telescopic discoveries, to receiving a dangerous censure from the Inquisition for his support of Copernicanism".[8]

So, if not Galileo, who actually invented this major augmentation of human senses? To use the old phrase, "take a number"—throughout the late 16th and early 17th centuries there appear many examples of early claims of telescope concepts, construction, and use. Some are claims and nothing more; others have more substance.

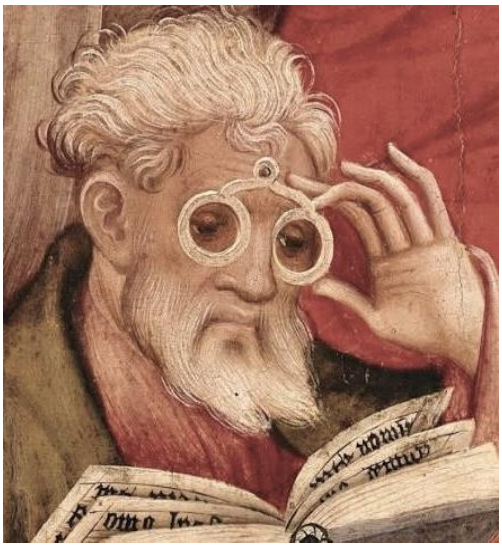
There are fine lines between invention, construction and first use—blurred by time, obscurity and shaded by plain old human avarice. Also, the telescope as we now think of it was likely first meant to be purely terrestrial in nature—it was seen as one of great military significance, or at the least, an intrusive novelty. Perhaps it does not matter, astronomy has progressed far beyond these curious beginnings. However, scholars and contemporaries have argued the issue for years. Claims were made back and forth. Who was the inventor of the telescope? And, who made the first use of a telescope in an astronomical context? There are several interpretations that lead to credible claims. In an age of rivalry, suspicion and competition among Renaissance scientists, inventors and artisans, long before any concept of intellectual property protection, there were pervasive conflicting claims. Innovation was undeniably stifled by convoluted means to protect their efforts. The use of anagrams and secrecy to prove priority in invention, discovery and use was common. Even today, the law grants patent protection but requires proof of priority to assure novelty in patent rights. Thus, Renaissance scientists, inventors and artisans seeking credit, recognition and patronage tended to hold back information until publication, lest it be claimed by another. State or royal protection of innovation was in its infancy. Consequently, modern patent protection evolved to grant exclusive rights to make, use and sell inventions in return for the public dissemination of information to stimulate advancement.[9]

Much information from this time has faded or is simply lost. Some data that may be interpreted as conclusive was forgotten until the last few decades. This paper summarizes the chronology of events available to us that involves the conception, invention and first astronomical use of a telescope. Along the way, we shall attempt to navigate the confusion and perhaps piece together some coherence out of the many claims and blank pages of scientific history.

II. The Origin — Chronology of the Early Development of Eyeglasses

To understand fully the development of the telescope, it is logical to review the development of its elder cousin, eyeglasses. Prior to the first decade of the 17th century, there are several intriguing claims and events—not without the usual scientific controversies of the times—that provide a background to the 1608–1610 telescopic renditions of the moon and planets. In the first decade of the 17th century there appeared in Europe many small telescopic instruments with terrestrial and astronomical potential. They were, after all, relatively easy to make, requiring patience and precision in grinding good quality crystal, quartz, or glass, set in a tube of some sort. In addition, as optical theory was more fully understood and lens grinding progressed and refined, workable instruments were made by many artisans. Nevertheless, glass and lens quality differed markedly.

The root of these claims, inventions and refinements were of course lenses and their first use, eyeglasses. It seems likely that the invention of moveable type by Johannes Gutenberg in 1450 made even more acute the need for eyeglass lenses to be ground for many more people. As books proliferated, so too with eyeglasses.



We seldom think of modern glasses as having medieval origins, but they have—at least in concept—been around at least since "Dr. Mirabilis" himself: Roger Bacon (1219–1292). The famed English polymath and scientist observed that many people could not read because of poor eyesight. He theorized about eyeglasses for a prolonged period but failed to get the practical result. However, conceptually, magnification for the eyesight can be focused on Bacon. The perhaps apocryphal story tells us that after a night of rain, Bacon was walking and found the cobweb over the tree leaves sprinkled with many raindrops. When he examined the raindrops more closely, he found the details and tiny hairs on the leaves could be seen clearer and appeared enlarged. He realized these raindrops were magnifying leaf details. In part V of his half-million-word Opus Majus, Bacon examined optics, sensation, and especially astronomical magnification in this prescient paragraph that ties optics to astronomy:

One of the most difficult problems is that of the scintillation of the fixed stars. Aristotle remarks their contrast in this respect with the planets, and attributes it to their greater distance; the eye, being more strained, is tremulous. Scintillation is different from the tremor sometimes seen in the sun and other planets at rising and setting. If distance were the sole explanation, we should expect Saturn to scintillate, which it does not. Further, it is only the larger of the fixed stars that do so. Therefore, strength of light must be a condition. And yet, since the sun at noon does not scintillate, the light must not be too strong. One of the causes would seem to be the internal strain of the eye at very distant objects. The planetary bodies are easily perceived to be near, and with them there is no strain. Moreover, the fact of extreme distance in itself weakens the visual rays. It may be objected that the strain is greater in the case of small stars than of large, but here the condition of sufficiently strong light is wanting. Again, it is objected that if ocular strain be one of the factors, this depends upon each observer's choice and will. But this is not so. It is one of those actions which have become involuntary through habit. But how is this difference of distance between the planets and the stars to be known? Its quantity doubtless is not known. But the fact that there is a difference is a matter of sensation.[10]

It may be that Bacon has been given too much credit. Bacon only dealt with the concept of eyeglasses and their magnification potential. Arabic astronomers and many Italian and Spanish inventors and claimants must be added to the list of contributors on the progress of eyeglasses.

Actually, many of his thoughts were preceded by over 200 years. Described by some as "the first true scientist", the Arabic scholar Ibn al-Haytham ("Alhazen") (965–1040) from Basra, is sometimes

called the predecessor and equal to Newton's *Principia* in the formation of modern physics. He laid the foundation for the science of optics around the year 1021, theorizing in *Kitab al-Manazir* ("The Book of Optics")[11] that lenses could correct vision problems, although he apparently did not build any prototypes himself. In addition, Alhazen wrote some 25 astronomical tracts, dealing primarily with Ptolemaic celestial motion, the moon, and planets.

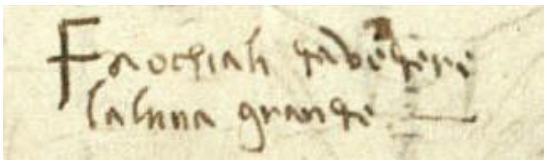
Following Alhazen and Bacon is Salvino D'Armate (1258–1317), a Florentine who is often credited with creating the first eyeglasses in 1284. The evidence comes primarily from a sermon given by Friar Giordano da Pisa in 1306; but he never actually mentioned D'Armate by name. These glasses were designed to aid those with presbyopia (farsightedness).[12] Not unlike other achievements at this time, the event has been celebrated and also attacked as a hoax. Almost immediately, Alessandro della Spina (d. 1313), a Dominican friar associated with D'Armate, was also widely credited with inventing or expanding the technology of eyeglasses around 1285. According to the story, della Spina, when given eyeglasses by someone, perhaps D'Armate, at first kept the method secret, then made a pair to share with others. The confusion has not been solved.[13]

By the 16th century spectacles were in more common use. Lenses could be ground to correct both long and short sight from rock crystal and fine quartz. These were often held in place by a bow-shaped continuous bridge, almost of a modern appearance, sometimes flexible depending upon the material, such as leather or whalebone. The bridge was as much an area to be gripped as to rest on the nose; however, eyeglasses were still usually held in place with the hand while being used temporarily for a brief period of reading or close inspection.

III. The Origin: The Chronology of Concepts, Claims, and Reality in the Development of the Astronomical Telescope

While the first decade of the 17th century is the focal point for the first telescope, there were important previous events. A chronology of these developments, claims, hoaxes, and surprises follows:

1513 – Leonardo Sets the Stage: "Fa *ochiali per vedere la luna grande".*



As with many things, a century before Galileo, in about 1513, Leonardo da Vinci (1452–1519) makes one of his many prescient marginal notes in the Codex Atlanticus on leaf 518r : "Make glasses to see the moon larger".[14] That phrase succinctly states the issue, one of those many incredible thoughts on which Leonardo failed to act. In the next century his idea, tying eyeglasses to the telescope, would bear fruit.

From the mid-16th century on there were sporadic mentions, concepts, and claims of creation of the first telescope and the first astronomical use of such a device. Many predate Galileo but some may be spurious or disingenuous attempts to rewrite or invent historical fact. The transition between eye-glasses, a spyglass, and a telescope in retrospect seems obvious. The key to the development of eyeglass and telescopic optics was the ability to grind convex and concave lenses for various levels of presbyopia (convex) and myopia (concave). As a result, eyeglasses could be made almost to prescription by the early 17th century. Those very glasses, when examined by modern expert analysis vary wildly in quality, and have failed the test of time, the glass having physically and chemically deteriorated significantly.[15]

1538 – Frascatoro Mimics Leonardo

Giorlamo Frascatoro (1476–1553), who preceded Galileo at Padua, was a noted scholar in medicines and contagious diseases. He noted (as a matter of visual anatomy and an interest in astronomy) in *Homocentrica* (1538) that looking through two eyeglasses makes things larger: if a person looks "through two eyeglasses, one on top of the other he will see everything larger and closer." This of course is the very basic idea of telescopic optics.[16] Frascatoro, however, is much more well known for his enlightened analysis of infections and the origin of fossils. We have no record of any further development of this observation.

1578 – The Digges and Bourne Achievements—A Possible Elizabethan Telescope

Forty years after Frascatoro's anatomical observations, things get interesting in Britain. Leonard Digges (1515–1559), an English mathematician and surveyor, is credited by his son Thomas Digges (1546–1595), an astronomer and popularizer of Copernican theory, as inventing the first telescope. He termed it a "proportional glass" design, a reflecting device that showed *"the miraculous effectes of perspective glasses".*[17] Almost a century later, in 1682, in the minutes of the Royal Society in London, Robert Hooke noted that Thomas Digges' 1571 *Pantometria,* (a book on measurement, partially based on his father Leonard Digges' notes and observations) seemed to support an English claim to the invention of the telescope, describing Leonard as having a "*fare seeing glass"* in the mid-1500s based on an idea by Roger Bacon. Thomas described it as "*by proportional Glasses duly situate in convenient angles, not only discovered things far off, read letters, numbered pieces of money with the very coin and superscription thereof, cast by some of his friends of purpose upon downs in open fields, but also seven miles off declared what hath been done at that instant in private places."* Comments on the use of proportional or "perspective glass" are also made in the writings of Elizabeth's court astronomer/astrologer, John Dee (1527–1608).

More substantively, the mathematician (and the designer of a would-be submarine) William Bourne (1535–1583) describes the design of what might be the Digges reflecting telescope. Bourne was a colleague of Thomas Digges and was asked in 1580 to investigate the Digges device by Queen Elizabeth I's chief advisor William Cecil, Lord Burghley, likely for military use. Bourne would later write an interesting compilation, *Inventions and Devices* (1578), in which no. 110 is the best description perhaps of the Digges instrument:

"For to see any small thing a great distance from you, it requireth the ayde of two glasses, and one glass must be made of purpose…a very large looking glass that is well polished…. "

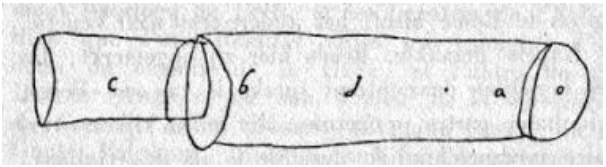
From his description, terrestrial and military use seems to have been the focus: *"very necessary in divers respects, as the viewing of an army of men, and such other like causes, which I doo omits, etc."*[18]

Some believe that Bourne may have actually made the design he describes, but that is lost to us today.[19]

Several scholars, including British historian and science philosopher Colin Ronan, have made the case that Leonard Digges made the first telescope. Ronan believes it was created between 1540 and 1559.[20] This was several decades before others are believed to have invented the telescope. Nevertheless, there is no way of verifying this design, much less its use in any fashion.

1584 – Della Porta's Magic

The Neapolitan Giambattista Della Porta (1535–1615) claims to have invented (or, perhaps just developed the concept of) the telescope in *de Telescopio* (vol 17, chapter 10 of his *Magiae naturalis*), However, no instrument of his is known. In translation: *"Or if the visible object be lost by too great a distance, … moreover, you shall fit another glass just against the former, upon a right line, which may divide the right angle, or else it will not be done, and you shall see the place you desire."* Della Porta explained in greater detail: *"In a concave lens you see small things from far away and clearly; with a convex lens you see near things magnified but blurry. But if you know how to combine them properly, you will see both far and near things magnified and clear."* [emphasis added]. While no concrete evidence exists, Della Porta's rough drawing of a telescope was contained in a letter dated October 29, 1609.[21]



1588 – Harriot's Perspective Glasse

The Elizabethan mathematician, linguist and astronomer Thomas Harriot (1560–1621), who we will investigate further, reportedly took with him on Grenville's 1588 Raleigh/Virginia expedition a "perspective glasse" that showed many "strange sightes". While unclear, this may have been a magnifying glass, not a telescope.

1598 – The "Dark Tube"

Raffael Gualterotti (1544–1638), a Florentine poet, philosopher, astrologer and sometime astronomer, after reading *Siderius Nuncias*, wrote Galileo in 1610 that he "had made an instrument" 12 years previously for military purposes. Gualterotti had written in 1605 "The Appearance of a New Star", a supernova. Apparently, he knew Galileo as a young man and showed him how stars could be seen in daytime through a long hole in a castle wall. The

1610 letter, according to Stillman Drake, "mentioned observations of stars through a "dark tube", and from a letter written shortly after Galileo's telescopic discoveries it appears that he, like Porta, had employed a lens or lenses in a tube without developing the potentialities of the device…. "[22]

1608 or…1593 – Telescope invented by Roget in Spain

Before 1608, one Juan Roget (1550–1624) a spectacle maker from Girona, Spain is credited with the first telescope[23] by way of a book published in 1618: *"Telescopium: sive ars perficiendi novum illud Galilaei visorium instrumentum ad sydera in tres partes divisa"* ("Telescope, or a performance of the art and means to Galileo's new vision of the stars, in three volumes") by an Italian author named Hieronymi Sirturi Mediolanensis, aka Girolamo Sirtori (1580? –1631?) of Milan. Sitori describes a 1609 meeting with a "withered old" spectacle maker in Girona named "Roget" who claimed to have invented the telescope as early as 1593. Simón de Guilleuma (1886–1965), a Catalan optometrist and amateur historian, researched the register of deaths of Rodez Cathedral in Aveyron and found that there was a "Roget" family of spectacle makers, leading him to conclude that the spectacle maker in the Situri story was Juan Roget.[24]

1608 (August/September) – Marius and Janssen

Galileo's German rival/astronomer to the Margraves of Brandenburg, Simon Marius (or "Mayr"), (1573–1625) relates the story that his patron, Hans Philip Fuchs von Bimbach (ca. 1567–1626) met a "Belgian" with a telescope at the 1608 Frankfurt Fair. Modern researchers believe this may have been Zacharias Janssen. Whatever the source, Fuchs apparently found two telescopes by 1609 for Marius for his use in Ansbach.[25] We will discover more on about Marius and Janssen.

1608 – A Trio of Dutch Opticians Square Off

In 1655, the Dutch diplomat William de Boreel (1591-1668) tried to solve the mystery of who invented the telescope. He had a local magistrate in Middelburg in Zeeland investigate recalled rumors from Boreel's childhood and early adult recollections of a spectacle-maker named "Hans", who he remembered as the inventor of the telescope. He came down on the side of Janssen, but he may have been wrong. It is still in debate.

1608 (September) – Hans Lipperhey

Perhaps the first written contemporaneous description of a working telescope is found in the records of a bureaucracy in the Committee of the Councilors of the State of Zeeland on September 25, 1608. The description was contained within Hans Lipperhey's (1570–1619) 30-year patent application for a spyglass, that came to be known as "Dutch Trunke" instrument *"for seeing things far away as if they were nearby."* Lipperhey and the Councilors negotiated back and forth, and Lipperhey was paid an advance for his future efforts to refine the claimed invention and create binocular spyglasses, but no further rights of process secrecy or exclusive patent rights were ever granted. There is no evidence that Lipperhey ever developed such refinements. Whether and how many devices were created privately before his death in 1619 is unknown. However, at least four devices made by Lipperhey were created between September 1608 and February 1609.[26] The instrument was a single tube with a concave eyepiece and a convex objective.

In summary, experts believe Lipperhey may have the best claim as the inventor of the telescope.[27] However, during World War II the archives of the Library of Middleburg, including his files and correspondence, were destroyed. It seems improbable that more evidence exists.

1608 (October 14) – Janssen

After his trip to the Frankfurt Fair earlier in the late summer the Councilors heard testimony by Zacharias Janssen (1585–1632) claiming, without any evidence or corroboration, that his father (ca. 1590) invented a telescope, although that claim was not entertained and was likely spurious. It is possible that Janssen actually described a microscope, and that the telescope claims were a fraud.[28] Janssen was known to have counterfeited coins, and thus his claim has been discounted.

1608 (October 15) – Metius

James Metius (Jacob Adriaanzoom) (1571–1628) who was known to have been a pupil of Tycho Brahe, claimed before the Councilors that he had invented a telescope "for seeing faraway things as though nearby", consisting of a convex and concave lens in a tube, and the combination magnified three or four times. While given a small stipend, Metius withdrew his device and petulantly stipulated in his

will that all evidence be destroyed; nevertheless Descartes was impressed by Metius's case.[29] Today, Metius is a footnote.

1608 – The Spanish Enter the Fray – Ambrogio Spinola (1569–1630)

The historical military involvement of Spain in the Lowlands and Netherlands in the 16th and 17th centuries fills volumes. The Spanish controlled the Dutch lowlands and their mercenary commander there was Spinola, a well-versed Italian military commander and strategist, who was in power until the fall of 1608 when a treaty was reached and he returned to Spanish-Controlled Brussels. There he brought information to Spain and the Pope through Archduke Albert of Brussels and Cardinal Borghese regarding Lipperhey's invention and its military importance. One of the Lipperhey spyglasses was thereafter sent to Albert around March 1609, and by May 1609 to the Archduke in Brussels.[30] Thereafter, the Spanish military use is unknown.

1608 – Proliferation of "Lipperhey" Type Devices

It is now well-established that between 1608 and mid-1609 telescopes/spyglasses in Dutch or imitative form were available throughout Europe. And, according to Galileo, "a Fleming" had invented a telescope, per the Parisian Jacques Badovere in correspondence with Galileo's close friend, Paolo Sarpi. Sarpi passed on this information to Galileo who notes Badovere in the preface to *Siderius Nuncius*. Another report from November 1608 reported news of telescope sales in Paris.[31] That news of the Lipperhey instrument also had reached Rome and the Jesuits began use, especially, as we shall soon see, by Christopher Clavius and Christopher Grienberger, perhaps by May 1609.

1608 – The Latter-Day Fontana Claim

Francesco Fontana (1585–1656) was a Neapolitan lawyer turned telescope maker. He was a brilliant and ambitious entrepreneur and, in the course of his business, claimed first astronomical use of a telescope. This was documented in 1646 in his lunar drawing in *Novae coelestrium*[32] dating the image as 1608 (within a semicircle in drawing at p. 51 of *Novae*). All of Fontana's images are dated in the plates, as is this detailed image of the moon. However, we must remember that Fontana was interested in publishing his renditions as advertisements for his telescope business. This one in *Novae*, despite the dated drawing, wasn't published until 1646. A claim of this 38-year-old event has been met with skeptical silence…caveat emptor.

Fontana's claim was nevertheless apparently substantiated by a Jesuit named Giovanni Zupus (1589–1667) who used Fontana's instrument in 1614, and with it, was the purported discoverer of Mercury's phases. No one has been able independently to confirm the 1608 date; however, Fontana is known to have undertaken a rather impressive continuous lunar phase observing and illustrating program before 1630. In the late 1620s, also, he is thought to be the first using a telescope with two convex lenses as his drawings suggest. Furthermore, three years after Fontana's death, Christiaan Huygens in 1659 made tribute to Fontana in *Systema Saturnium*: "*For a succession of other strange and marvellous forms was revealed, which I find first described by Josephus Blancanus and Franciscus Fontana —forms of such unusual appearance that they were considered by many as a mockery of the eyes, shapes adhering to the lenses rather than existing in the heavens; but after the same forms had been seen by more, it became clear that it was no false evidence that revealed them.*"[33]

1609 (May)

"Dutch trunkes" reportedly appeared in Milan, and in other cities thereafter. In 1610, the banker George Fugger (1579–1643) claims that he had seen a telescope previous to Galileo's lunar drawings.[34]

1609 (July 26) – Thomas Harriot's Moon and William Lower's "Tarte": The First Documented Use of a Device in an Astronomical Context

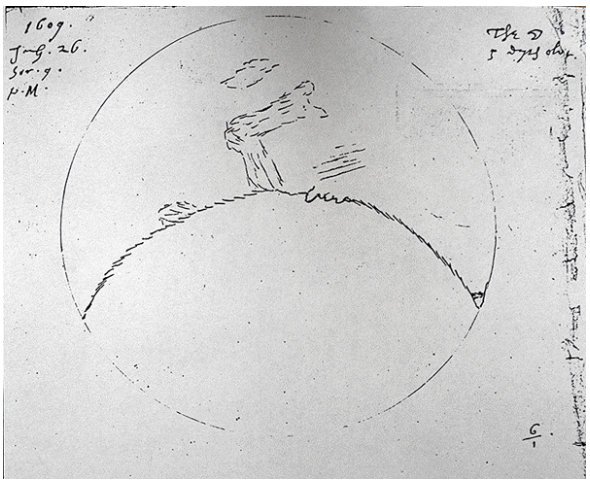
Perhaps the persons with the best challenge to the claim that Galileo first used a telescope in an

astronomical context is the one man least interested in notoriety, and his astronomer friend.

The extraordinary Elizabethan scientist Thomas Harriot (1560–1621) was a gifted and lucky person: he had the financial support of Walter Raleigh and Henry Percy. Harriot had the resources and time to delve deeply into, among other things, astronomy. Harriot's biographer states that he "was the equal of Galileo in taking astronomical observations and making astro-nomical calculations". That led to Harriot being styled "The English Galileo".[35] Sir William Lower (1570–1615), the astronomer/comet observer, was Harriot's close friend and astronomical ally. Harriot and Lower are now recognized as likely to have been the first to observe and describe an astronomical object by use of a telescope. But many years passed before this could be acknowledged. Harriot had many friends and admirers, but it is those very friendships with accused traitors and their patronage that became deadly political liabilities dictating strict caution. Thus, we see Harriot's reclusive nature, and belated acknowledgement. It was if he were faced not with the "publish or perish" dilemma but one of "publish and perish".[36]

While known by only a few close colleagues, like Lower, in his time, it is now well established that Harriot created a lunar drawing dated July 26, 1609 using a 6× "Dutch trunke"-type telescope made for him in England by his assistant, Christopher Tooke, some weeks before Galileo. Galileo's biographer, Stillman Drake, concedes this much: "*the first known attempt to map the moon was made by Thomas Harriot in mid-1609, before Galileo had conceived of any astronomical use for his instrument*." Thereafter, Lower with his assistant, John Protheroe, may have actually been the second to record an observation of the moon through Harriot's telescope in Wales on February 6, 1610. The moon was described by him to "*appear like a tarte my cooke made me last weeke*."[37] After reading *Siderius Nuncias* Harriot's neglected observing was excitedly renewed, but the records are perhaps spotty, if not lost.

Harriot's telescopic achievement has been neglected by history because he kept a low profile, given his friendship with Northumberland and Raleigh (who ended under life sentence arrest in the Tower and eventual execution for a plot against James I). Thus, Harriot's notes and drawings were forgotten until uncovered (literally) 175 years later, under piles of Northumberland's stable accounts, by the Austrian astronomer Baron Franz van Zach (1754–1832) in Wales in 1784. Von Zach originally concluded that the bales of paper were ordinary estate records[38], and while eventually curated this confusion caused Harriot's now famous figure not to be published until 1965.[39]



Although a reticent late-comer to the argument, Harriot's event cannot be ignored. Harriot is also credited by some with the first systematic observation of sunspots before Galileo.[40] There are extravagant claims about English scientists. One author suggested that long before Galileo, a "group" of English astronomers, including Harriot and Lower, were using telescopes. However, there is no solid evidence of a "Tudor Telescope" in Elizabeth's court (supposedly) to be employed in early warning of the Spanish fleet.[41] While Galileo's moon drawings are more elegant, clearly more topographic, Harriot's renditions are two-dimensional, those of a cartographer—one of his many fields of expertise—and thus more map-like.[42] Harriot's July 26 chicken-scratch drawing in the British Library is far from revelatory, but in the end it seems to be the first such drawing using a telescope in an astronomical context.[43] Harriot lived out his life in planned obscurity, rarely corresponding with fellow scientists, and even his gravesite remains a mystery, lost in the Great Fire of 1666.

1609 (August 29) – Galileo's "Invention" and the Venetian *Quid Pro Quo* Described

Meanwhile, on the continent, Giovanni Bartoli, Secretary to the Tuscan Ambassador to the Doge of Venice, wrote to Belisario Vinta (1542–1613), the Medici Secretary of State: "*more than about almost anything else, people talked this week about Sr Galileo Galilei, Professor of Mathematics at Padua, and his invention of a spyglass or tube for viewing objects at a distance. It is related that a*

foreigner who came here with a secret…that he would do no business here, having sought a compensation of 1,000 zecchini, and so went on his way…."

Paolo Sarpi, being a friend of Galileo's, gave him a description of the secret, which he had seen, and they say that Galileo, applying his knowledge and examining another similar instrument of inferior quality that came from France, studied the problem and found the secret. And having put together the device, thanks to the benevolence and assistance of several senators, he obtained from these gentlemen an increase in his salary of 1,000 florins a year, with the obligation of serving in his professorship permanently."[44]

1609 (November 30) – Galileo's First Use of a Telescope.

Galileo's first use of telescope, the lunar drawings and recordation of Jupiter's moons, led to *Sidereus Nuncia* published in 1610. By that time, Galileo was using a 30× telescope of his own making.

1609 (December 29) – the Galileo Galilei – Simon Marius Feud

Simon Marius's (1573–1625) claims in *Mundus Jovialis anno M.DC.IX Detectus Ope Perspicilli Belgici* ("The Jovian World discovered in 1609 by means of the Dutch Telescope", 1614) are of significance as recordation of the first discovery of Jupiter's moons—or as he called them, "Jovian stars". These discoveries were claimed to have been on December 29, 1609 (using the Julian calendar; January 8, 1610 on the Gregorian calendar), months before Galileo's publication, in a later-verified position: *"these stars…were visible in a straight line from Jupiter to the West."* Marius procured a telescope from the Netherlands in the summer of 1609 according to DeWaard and Van Helden.[45] Thereafter, Marius began using the device.

Marius would later rub it in and mock Galileo's naming of the satellites the "Medicean Stars" in honor of his patrons, the Medici: "*who is to find fault with me…. if I name these …'Brandenburg Stars'?*"

No one has been able either to confirm or deny conclusively Marius's claims, but that they were published over four years after the events seems somewhat problematic. Galileo claimed the priority was a fraud. And the squabble lives on. Galileo's scientific biographer Stillman Drake, backing Galileo, takes issue with Marius's *"effrontery [that] gained him unwarranted celebrity in histories of astronomy."*[46] Drake is of the opinion that Galileo likely first saw the satellites in December of 1609, and definitely recorded viewings on January 7, 1610, and recognized them as satellites of Jupiter in March 1610.[47]

1610 – Giovan Paolo Lembo's Telescopes

The mathematicians Christopher Clavius (1538–1612) and Christopher Grienberger (1561–1636), were Jesuits of the Collegio Romano in Rome. They became interested in Galileo's discoveries but were unable to verify them. Both corresponded with Galileo after *Siderius Nuncia*.

Meanwhile, in Rome the Jesuit Giovan Paolo Lembo may have made telescopes on his own. Further, he may have made observations prior to *Siderius Nuncia*. According to Grienberger, in a 1610 letter to Galileo: *"one of our Order…Lembo, who before he had any knowledge of your telescope using certain glasses…observed not only the unevenness of the Moon, but also the stars in the Pleiades, in Orion, and very many in other constellations. But he did not see any new planets [satellites of Jupiter]."* Apparently, the Collegio was able to procure other telescopes, that Grienberger recognizes: "*But afterwards…he managed to make telescopes of such perfection, that they could only be compared with the ones you sent to various men in Rome, or even be preferred to them. With them we finally could see the new planets [Jupiter's moons], at least on a clear night."*[48]

The proliferation of small Lipperhey telescopes or their clones by 1608–-1610 is now obvious. Perhaps earlier devices were made and used. But the confluence at this time of many choices for astronomical use cannot be denied.

We may now be able to conclude that Harriot was the first to make these discoveries, but he chose obscurity rather than fame. Galileo was close to finishing the winner in this scientific race that he did not know he was running, but his desire for recognition and a patron, his persistence, skill at publicity and depiction, were far better. To use a modern term…a "dead heat".

1611 – Johannes Kepler (1571–1630) and the Publication of *Narration de Jovis satellitibus*

We close this chronology fittingly with Kepler—Tycho Brahe's right-hand man, a strict Copernican and Imperial Mathematician (albeit an unpaid one) to the court of Rudolph II, the Holy Roman Emperor. Along with Copernicus, Tycho, Galileo, Descartes and Newton he is on every "greatest" list among the Renaissance physicists and astronomers. Maybe others should join that list, but this is not the place for votes to be cast. Kepler was, as in all things, unique. While he set up a mechanism to view eclipses in Graz in 1600, it wasn't until August 1610 that he used a telescope, one lent him by Elector Ernest of Cologne. From August 30 to September 9, 1610, Kepler observed Jupiter; he published in Frankfurt the results in *Narratio de Jovis satellitibus,* a booklet that was quickly reprinted in Florence. It provided a strong witness to the authenticity of Galileo's "new discoveries". It further included information on the mountains of the moon. But Kepler wouldn't have called himself an astronomer. He was a theoretician of what he called "celestial physics". He improved on Galileo's (and the others) refractors with his own design, the "Keplerian Telescope" in which two convex lenses produced higher magnification than Galileo's combination of convex and concave lenses. More importantly Keplerian laws have stood the test of time, even as dark matter and dark energy have invaded the scene of theoretical physics. His optics theories are clear cut and elegant; they were published in *Dioptrice* in 1611 and were as important as any of its time.[49]

IV. Conclusion

Galileo's achievements have earned him deserved acclaim, but the others: Alhazan, Bacon, Lipperhey, Marius, Fontana and Harriot, at the very least, deserve some, if not the lion's share of credit in the development of the telescope. Undeniably, Galileo had superb skills and he was driven. But it is Thomas Harriot and William Lower that perhaps deserve more notoriety. Harriot made the personal choice, however. He secured his freedom by seeking obscurity. As one historian put it: "Harriot is now securely recognized as one of the greatest mathematical scientists of the Renaissance, we should not forget that it was [through him] in Sion Park, and at Traventi, in South Wales, that mankind first saw the heavens as they had never been seen before."[50]

drohrman@gmail.com

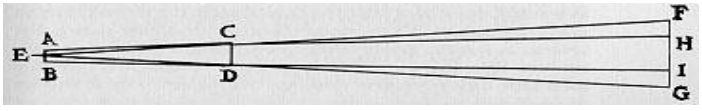
END NOTES

[1] Galileo, *Sidereus Nuncius*; see the University of Chicago's copyrighted version of Van Helden's 1989 translation online at Reed.edu., at p. 10. Photo courtesy Museo Galileo, Florence.

[2] See Pelling, "Juan Roget and the Catalan Telescope" online in *La Vaca Ciega Disconfiada* (2014). See also Gingerich, "Galileo, the Impact of the Telescope, and the Birth of Modern Astronomy", *Proceedings of the American Philosophical Society*, Vol. 155, No. 2 (June 2011), pp. 134–141; Van Helden, "The Telescope in the Seventeenth Century" *Isis*, March 1974 vol. 65 at p. 39; and Drake, *Discoveries and Opinions of Galileo*, (Garden City, 1957) at pp. 28–29. "There is no nation which has not claimed for itself the remarkable invention of the telescope; indeed the French, Spanish, English, Italians, and the Hollanders have all maintained that they did this." Pierre Borel, *De Veo Telescopi Inventori* (1656).

[3] Drake, *Galileo at Work—His Scientific Biography*, (New York, 1978 at 137).

[4] See Endnote 1; below is Galileo's drawn telescopic design:



[5] Entire Latin text is viewable online at Internet Archive.

[6] See the excellent article by Paolo Molaro "Francesco Fontana and the Birth of the Astronomical Telescope" *Journal of Astronomical History and Heritage*, **20(2)**, 271–288 (2017).

[7] As to the first use in an astronomical context, see Westfall, "Science and Patronage: Galileo and the Telescope" *Isis*, **76**, 11–30 (1985), and see *Il Saggiatore* at the Internet Archive online. See Biagioli, "Did Galileo Copy the Telescope? A New Letter by Paolo Sarpi" in Van Helden *et al*., n. 21 infra. Biagioli quotes Fra Sarpi, a friend of Galileo's in Venice, in a letter to the Huguenot Francesco Castrino dated July 21, 1609: "There is nothing new here in Italy, except a spyglass has arrived that makes farway things visible…" Rosen in "Did Galileo Claim He Invented The Telescope" *Proc. Am. Phil. Soc.* **98**:304–312 (1954), without knowledge of Harriot's yet to be revealed 1609 drawing, thoroughly examines the usage of the term "invention" in the 17th century.

[8] Biagioli, *Galileo's Instruments of Credit—Telescopes, Images, Secrecy* (Chicago, 2008), at p. 1. Galileo was not everyone's favorite; while he was incredibly intelligent and well-read and had a strong, dismissive personality; he was accused of "plume[ing] himself with the feathers of others, drawn from here and there—like the crow in Aesop. So he intends to be considered the inventor of that ingenious spyglass, despite the fact that some Netherlander, on a trip here via France, brought it here first. It was shown to me and others, and after Galileo saw it, he made others in imitation of it and, what is easy, made some improvements to what was already invented." German banker George Fugger to Johann Kepler April 16, 1610 from Johannes Kepler *Gessamelte Werke* (Munich 1937) xvi, at p 302. But Galileo's fame spread throughout Europe. For instance, in England, it was not the scientific community that spread the word, rather, it was the poet John Donne who, in "Anatomy of the World", actually was negative about the discoveries and expressed depression that the new stars were an end to a coherent world. See *Poems of John Donne* (Oxford 1912) I: p. 237 ff.

[9] "It appeared that this conception [of the telescope] was on the minds of many men, so that once they heard about it, any ingenious person began trying to make with [the help of] a model." Girolamo Sesi (1612), quoted in Zuidervaart, "The True Inventor of the Telescope", in Van Helden, *et al., The Origins of the Telescope* (Amsterdam 2010) at p.16.

It is no surprise that eminent inventors and scientists of the time avidly sought not only protection and recognition of their work and discoveries, but also life-changing financial support. So, to name a few, Galileo would come under the favor of the Medici, Harriot with the Sir Walter Raleigh and the Duke of Northumberland, and Kepler, the Holy Roman Emperor.

[10] Bacon, *Opus Majus* pt. V chap VII—Robert Belle Burke Translation (Oxford,1928). Note also the Roman story from Pliny the Elder in *Naturalis Historia* (77AD) that Nero used finely polished emeralds to view more clearly Amphitheater games: "[he] viewed the combats of the gladiators in a smaragdus", or green stones. If true, it may be they were the first "sunglasses" rather than corrective in nature. See Woods, "Pliny, Nero and the 'Emerald"Arctos, *Acta Phil*., **40**: 189–196 (2006).

[11] *The Optics of Ibn Al-Haytham* (Translation, Warburg 1989)

[12] Ilardi, *Renaissance Vision from Spectacles to Telescopes* (Philadelphia, Pennsylvania: American Philosophical Society, 2007.

[13] To close the circle, Edward Scarlett. In 1727, the British optician is credited with designing the modern version of eyeglasses by adding side temples with secure hooks to go over the ears. To close and dispose of a minor myth, Benjamin Franklin is commonly thought to have invented eyeglasses. In fact, he was not, rather; he invented bifocals in the mid-1700s to correct both nearsightedness and farsightedness in a single pair of glasses…for which many of us are thankful.

[14] See DaVinci Online Archives; the quote is more or less the same in the Codex Leicester, which suggests Leonardo was intrigued by the possibility.

[15] See Willack: *The Long Route to the Invention of the Telescope* (Philadelphia, 2008) that examines in fascinating detail the creation, optics, and defects of early spectacles, using modern technological analysis.

[16] A 1528 painting of Frascatoro by Titian in London is well known, the payment for which may have been a curative course for the painter's syphilis. A statue of Frascatoro by the Venetian sculptor Cattaneo in 1559 stands on an arch in center of Verona, near the monument to Dante. According to a local legend the stone ball Fracastoro holds in his right hand, symbolizing the world, will fall on the first honorable person to walk under the arch. Over some 450 years, many thousands of people, including the author, have passed every day under the arch, however, the ball has yet to dislodged, not even by Veronese "gentlemen".

[17] Johnson "The Influence of Thomas Digges on the Progress of Modern Astronomy in Sixteenth-Century England", *Osiris* **vol 1**, pp 390–410 (1936). The Digges's *A Geometrical Practice Named Pantometria* is found online at Internet Archive. Digges extols the virtues of the device for military use: "I minde to imparte with my countrey men some suche secretes, as hath I suppose in this our age ben reuealed to very fewe, no lesse seruing for the securitie and defence of our naturall countrey, than surely to be meruailed at of straungers." (*Pantometria*, ch. 21).

[18] See Online Internet Archive at pp. 96-97; and see Dupre, "William Bourne's Invention: Projecting a Telescope and Optical Speculation in Elizabethan England" in Van Helden *et al.*, n 21, at 135 ff.

[19] It should be noted that one Ettore Ausonio (ca 1520–1570) had come to similar conclusions, per Willack at 88. Willack believes that Bourne himself may have made the Digges design.

[20] See Ronan, "The Origins of the Reflecting Telescope", *J. British Astr. Assoc.* **101**; 335 (1991).

[21] See Smith, Optical Magic in the Late Renaissance (Philadelphia 2019); and see n.2 supra. Pelling's mention that De Waard found this story compelling, and that "Recently, in her book *Galileo's Glassworks*, Eileen Reeves pointed out that though Della Porta had indeed described, in an extremely elliptical fashion, something broadly similar to a telescope, a careful reading shows that this relied not on two lenses like the Dutch design, but on a combination of

a curved mirror and a lens. This would seem to make Della Porta's claim to inventorship untenable. She similarly cast doubt on Gualterotti's claims, for, though he did use both hollow tubes (cerbottana) and single lenses to look at the sky, he did not arrange them together in a telescope-like form." Della Porta in a letter to Prince Federico Sesi dated October 29, 1609 made a rough sketch of a telescope. Van Helden, "Galileo and the Telescope" in Van Helden *et al*., *The Origins of the Telescope* (Amsterdam 2010) at p. 184.

[22] See n 4, Drake, *Galileo at Work*, at pp. 451–2.

[23] Quoted in Van Helden, Supra, in *De Uitvindling der Verrekijers* (The Hague,1906).

[24] See Pelling n 2 supra: "the Milanese Girolamo Sirtori related how in 1609 he had met an ageing spectacle maker called Roget in Gerona, the real 'first inventor 'of the telescope. Sirtori also asserted that an unknown 'genius 'had ordered a set of convex and concave lenses from the Dutchman Hans Lipperhey and that it was the curious way in which this mysterious person held them up to check them that had alerted Lipperhey to the fact that something new was being devised."

Pelling in making his case for Roget states "But Simón de Guilleuma didn't stop there. Guessing that Juan Roget must have actually sold some of his telescopes, he broadened his search to include inventories of goods from deaths in Barcelona around this period that mentioned an ullera, which originally meant 'eyeglass', but was later used for 'telescope'.The earliest came on April 10th, 1593, when Don Pedro de Carolona passed down una ullera larga guarnida de lautó ('a long eyeglass/telescope decorated with brass') to his wife Doña María de Cardona y Eril. When she died on December 13th, 1596, the same object was inherited by their son Enrique de Cardona. Simón de Guilleuma was intrigued by the notary's careful description and inferred that, as it would probably have been kept in an arquillita (small lockable casket) with other objects such as letters, it could have been no longer than 20 cm."

[25] See Pelling, n 2 supra.

[26] See Sluiter, *"The Telescope Before Galileo", JHA* vol. 28 (1997).

[27] *Ibid.*

[28] *Ibid*, and see Zuidervaart in Van Helden *et al.*, n 21, supra.

[29] See Zuidervarrt, in Van Helden, *et al*,, n 21, supra, and Vermij, "The Telescope in the Court of the stadtholder Maurits "in Van Helden *et al.,* n.21 supra. And see King, *The History of the Telescope*, Mineola, NY, 2003, pp. 31–32).

[30] Sluiter , n. 26, at p. 226.

[31] *Ibid*, at p. 228.

[32] see Internet Archives online at p7.

[33] In 1659 Christiaan Huygens published *Systema Saturnium*, in which he credits Fontana's telescope and drawings. Note: Giuseppe Biancani (1566–1624), mentioned by Huygens, was a Jesuit astronomer famous for lunar measurements.

[34] See Van Helden *et al*., *The Origins of the Telescope* (Amsterdam 2010)

[35] See Arianrhod, *Thomas Harriot, A Life in Science*, (Oxford 2019) at p. 221 and see *Chapman, Stargazers: Copernicus, Galileo, the Telescope and The Church* (Oxford, 2014) at pp. 264 ff.

[36] See Pumphrey, "Harriot's Maps of the Moon: New Interpretations" *Notes Rec.R. Soc*. **63**:163 ff (2009). Raleigh was one of several supporters of Harriot's work, but was highly controversial. He raised the ire of Elizabeth I when he married one of her court without her permission. But his alleged participation in the "Main Plot" against her successor, James I (and replace the King with Arabella Stuart), that found him jailed in the Tower. Evidence against Raleigh and the others in the plot was at best tenuous, and a death sentence commute to life imprisonment. All his friends and associates, including Harriot and the Earl of Northumberland William Percy (1569-1632), were detained briefly, questioned, and released. Raleigh remained in the Tower but after 13 years convinced James to release him and lead an expedition to hunt in South America for "El Dorado". Raleigh and his expedition got into a fight with the Spanish and he returned home in failure and to a diplomatic crisis. Thereafter, he was executed. The experience left Harriot wary and withdrawn. Raleigh's execution made a profound impression and Harriot avoided any notoriety thereafter. Harriot confided to Kepler as early as July 13, 1608 that he could not "philosophize freely". See Frisch, *Kepler Omnia Opera*, vol II, p. 74 (1837).

[37] Chapman, "Thomas Harriot: The First Telescopic Astronomer", *J. Brit. Astr. Assoc*.,**118**: 315–25, 322 (2008) and see Drake, *Galileo at Work*, n 3 at p. 154.

[38] See Chapman, Supra n. 35, at p. 268.

[39] The drawing, and Harriot's other manuscripts, was preserved in the West Sussex County Archives in Chichester, however, it is now under care in the British Library. See also, Chapman, n 35 at p. 267 and see Chapman, n 37. The first person who tried to map the moon by sight may have been Leonardo, but William Gilbert (1544–1603), the Queen's physician, seems to be a better bet to be the first. After July 26, 1609, Harriot seems to have been otherwise

diverted, and Lower's observations continued apace, at least until Harriot is thought to have read *Sidereus Nuncius* sometime later in 1610. See Bucciantini *et al*., at n.42 infra, at pp. 139 ff.

[40] See North, "Thomas Harriot and the First Telescopic Observations of Sunspots" in Shirley, *Thomas's Harriot, Renaissance Scientist* (Oxford 1974) at pp. 129–157 and Chapman n.37 supra at pp. 322–323.

[41] see Chapman Supra n. 37 at pp. 323-324. And see Johnson, "The Influence of Thomas Digges on the Progress of Modern Astronomy in Sixteenth-Century England*", Osiris* vol 1, pp. 390–410 (1936).

[42] See Pumphrey, n 36, supra; Bucciantini *et al*., *Galileo's Telescope—A European Story*" (Translated by Bolton, Cambridge, 2015) and Bloom , "Borrowed Perceptions: Harriot's Maps of the Moon" *J. Hist Astronomy* **9**, 117–122 (1978).

[43] See Ronan, "Leonard and Thomas Digges: Inventors of the Telescope" *Endeavour* **16**, 91–94 (1992) and Pumfrey, n. 36, supra at pp. 163–168.

[44] Quoted in Sluiter , n 26. at 231.

[45] See Sluiter, n 26.

[46] Drake, *Galileo at Work* n. 3 at p. 235. Galileo replied angrily to Marius in Il Saggatori, at pp. 164–5: "he had the temerity to claim that he had observed this Medicean planets which revolve about Jupiter before I had done so. But because it rarely happens that truth allows herself to be suppressed by falsehood, you may see how he himself, through his carelessness and lack of understanding, gives me in that very work of his the means of convicting him by irrefutable testimony and revealing unmistakably his error, showing not only that he did not observe the said stars before me but even that he did not certainly see them until two years afterwards; and I say moreover that it may be affirmed very probably that he never observed them at all." The modern interpretation is that Marius's contributions to astronomy are, nevertheless, largely valid and significant: "It appears certain that Marius was observing Jupiter's moons by December 1610. Yet, Marius did not produce any actual observations of the moons in his book, and the few examples he gives all date from 1613. Regardless of this priority question, Marius was the first to publish tables here of the motions of the satellites. Mundus Iovialisalso contains a telescopic discovery whose priority has never been disputed: in 1612 he was the first to observe the Andromeda nebula, which could not be resolved into stars at that time." Rice University, Galileo Project online.

[47] *Ibid* at pp. 146 ff.

[48] Quoted in Sluiter, n 26 at p. 230.

[49] Having obtained new knowledge of a telescope in 1610 Kepler was finally in a position to observe with his own eyes what he had hoped to see. In the presence of Benjamin Ursinus, the young mathematician, and several other guests, he observed Jupiter from August 30 to September 9. In Keplerian fashion, to preclude any error, each one individually, without the knowledge of the other, had to draw in chalk on a tablet what he had seen in the telescope; only afterwards were the observations from time to time compared with one another. Kepler published the results of these observations in *Narratio de Jovis satellitibus*. This was reprinted in Florence in the very same year so that, in Italy it served as a strong witness for the credibility of the new discoveries. In *Dioptrice* Kepler discusses optics, specifically the optics of the telescope, as well as how a telescope works. Thanks to the telescopic observations in both Sidereus and Narratio, the *Dioptrice's* inclusion in his body of work is logical. Linda Hall Library (2024).

[50] See Chapman, n 37 at p. 325.

What's New in the JAHH

Ken Rumstay, Valdosta State University (Emeritus)

The *Journal of Astronomical History and Heritage* was founded by Wayne Orchiston and John Perdrix in 1998. It is published by the University of Science and Technology of China (USTC), with Wayne and Yunli Shi as Co-Editors. It is an Open Access electronic journal, published quarterly in March, June, September, and December. In addition to Wayne, many HAD members play an active role in the production of this journal—Clifford Cunningham and Steven Dick serve as Associate Editors, and six active HAD members serve on the Editorial Committee.

The journal publishes research papers, review papers, short communications, and book reviews. All papers submitted to the *JAHH* are refereed prior to publication. No publication fees are charged, and all papers in the current and back issues are freely downloadable on the journal's website, as well as on the SAO/NASA ADS and the Rizal Technological University website. In 2025–2028, the journal is partly supported with funding provided by the China Minsheng Bank

As a service to our readers, the front covers and content listings of the two most recent issues of *JAHH* are included below. If you would like to submit a paper for inclusion in a forthcoming issue, please register here. For additional information, please contact the journal's Editors at jahh@ustc.edu.cn .

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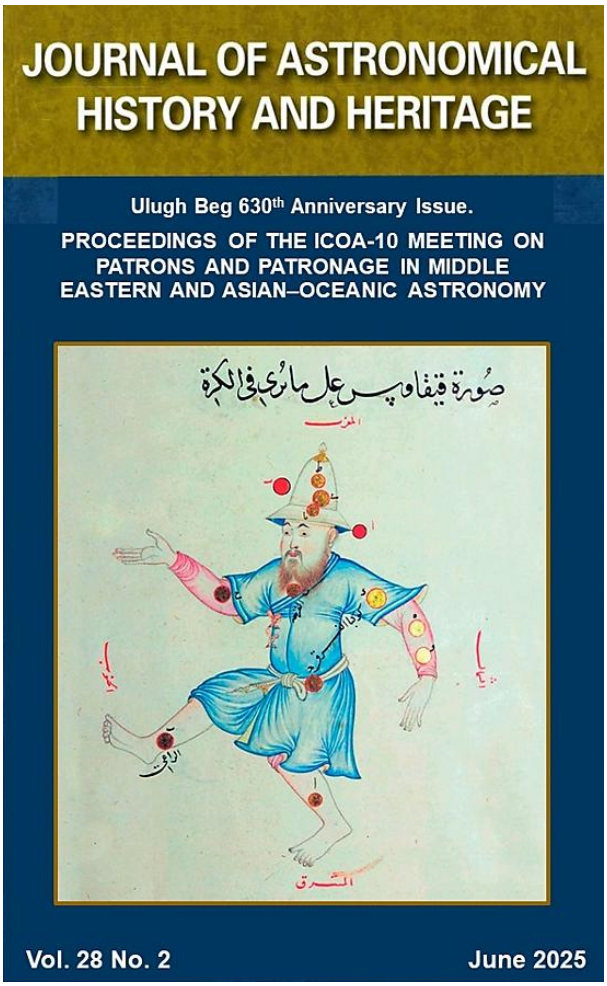

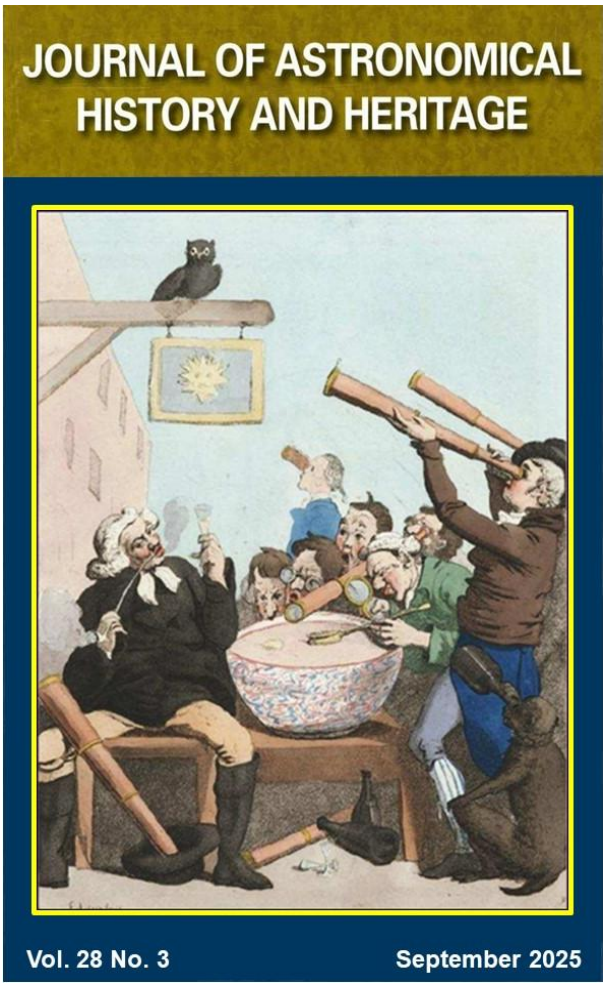

Front covers of the June and September issues of the *Journal of Astronomical History and Heritage*. The June cover features an illustration of the Constellation Kai-Kaus (Cepheus) from a manuscript copy of al-Sufi's Kitāb suwar al-kawākib in the Bibliothèque nationale de France (Arabe 5036). It appears in the paper "Ulugh Beg's patronage and astronomical book-making" by Shuhrat Ehgamberdiev *et al.* on pages 337–342 of the June issue. The cover of the September issue features a humorous image from R.C. Kapoor's article "Chasing Mercury: transit tales from india" (pp. 648–688).

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ULUGH BEG 630TH ANNIVERSARY ISSUE. PROCEEDINGS OF THE ICOA-10 MEETING ON PATRONS AND PATRONAGE IN MIDDLE EASTERN AND ASIAN–OCEANIC ASTRONOMY

CO-EDITORS: SHUHRAT EHGAMBERDIEV, WAYNE ORCHISTON, SHI YUNLI, LEE EUN-HEE, JI CHEN AND YANG BOSHUN

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HAD News issue #106 is edited by Ken Rumstay and Loretta Cannon. Please send contributions (articles, book reviews, news, etc.) for inclusion in the Spring 2026 issue to krumstay@valdosta.edu, neptuneedit42@gmail.com, or hadsec@aas.org.

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