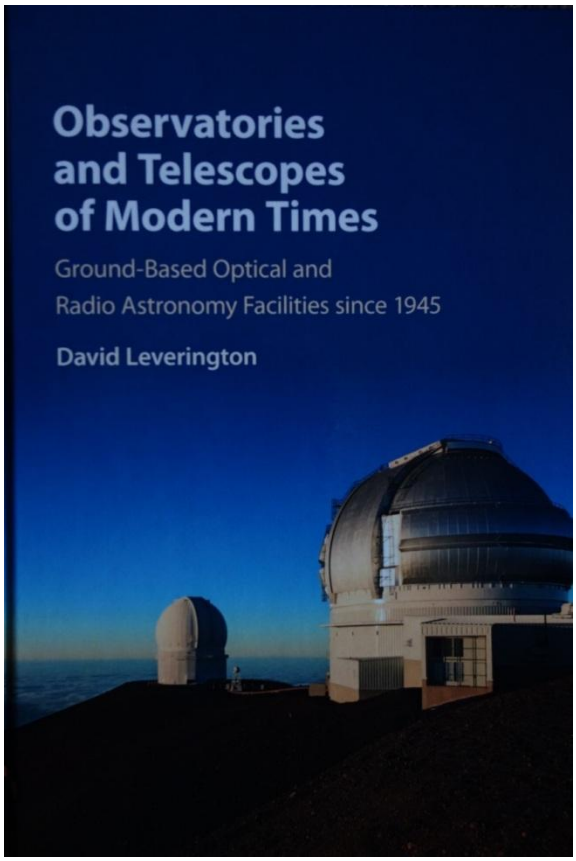
BOOK REVIEWS

***Observatories and Telescopes of Modern Times: Ground-Based Optical and Radio Astronomy Facilities since 1945*, by David Leverington. (Cambridge University Press, Cambridge, 2017). Pp. xii + 490. ISBN 978-0-521-89993-2 (hardback), 180 × 250 mm, US$175.**

Anyone even passingly familiar with astronomy during the past few decades knows the number of telescopes—especially large telescopes—has mushroomed. While other books have focused on a survey of telescopes and observatories in various eras of astronomy, this is the first to comprehensively tackle the complex task of the post-1945 era.



Dr David Leverington wisely looks in this book only at optical and solar observatories (in 260 pages) and radio telescopes (in 210 pages). Observatories dedicated to other portions of the electromagnetic spectrum are excluded, and are now sufficiently numerous to merit their own volume.

For each observatory, beginning with the 200-in Palomar Telescope, the author carefully explains the scientific and political considerations that led to their construction. It would have been easy to give the human dimension short shrift, but by examining often contentious conversations and negotiations, Leverington offers us a superb capsule history of each observatory.

Just to cite one example of many, he spends six pages on the divisive tale of the Very Large Telescope of the European Southern Observatory. It is a tale of bankruptcy, resignations and lawsuits. Another ESO project, the New Technology Telescope of 1989, had a jaw-dropping mistake: Zeiss realised the mirror had a curvature error, "… but they made a mistake in quoting the sign of the error, and so in trying to correct it had doubled the error." (page 88). The creation of these modern behemoths maintains an element of 'art' in addition to pure science and engineering. Leverington lovingly exposes every mis-step, which makes for a delightful read, as this extract about the Sloan Digital Sky Survey attests:

> Unfortunately early operation of the telescope indicated that it had been installed with a slight tilt, which caused problems with the scanning software. That problem was easily solved but a much more threatening one was the discovery in October 1999 that there was a crack near the centre of the secondary mirror. In this case the Mirror Lab cut out the centre and capped the hole. (page 226).

It seems that an expertise in surgery is now a prerequisite to build telescopes!

Just two minor quibbles: the travails of the telescopes he studies are so numerous that Leverington tends to rely a bit too much on the word "unfortunately", and while he is excellent on the technical details these are not always explained. One wonders, for example, what a Gascoigne astigmatic corrector is on page 223.

The book is profusely illustrated (all in black and white) so that each telescope or observatory has at least one photo or artist conception. The work of Professor Orchiston is well represented in the section on radio telescopes in Australia, with several of his papers in this journal cited in the references. The role of Dr Lequeux, one of our *JAHH* Associate Editors, is also included in a discussion of the IRAM radio telescope project of the 1970s.

I found a few typos: on page 102 Herzburg should read Herzberg (it is correct in the Index); on page 166 "There where" should be "there were"; on page 204 "That the had" should read "That he had"; and on page 304 "immediately the war" should be "immediately after the war". As a great assist to those using this as a reference work, considerable care was taken with the Index: there are separates ones for names, Optical/Infrared Observatories, Radio Observatories, and a general index. The text includes developments up until 2015 when the manuscript was completed, so the fact that Arizona State University joined the Giant Magellan Tele-

scope project in 2017 is not included. The text suggests the GMT will be ready with three of its primary mirrors in 2021, but the project website now pushes that back to 2023.

David Leverington has written the definitive account of modern observatories that is not only readable but a valuable sourcebook for the telescopic era of the past 70 years.

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***Radio Astronomer: John Bolton and a New Window on the Universe*, by Peter Robertson. (NewSouth Publishing, Sydney, 2017). Pp. viii + 421. ISBN 978-1-742-23545-5 (hardback), 158 × 242 mm, AU$59.99.**

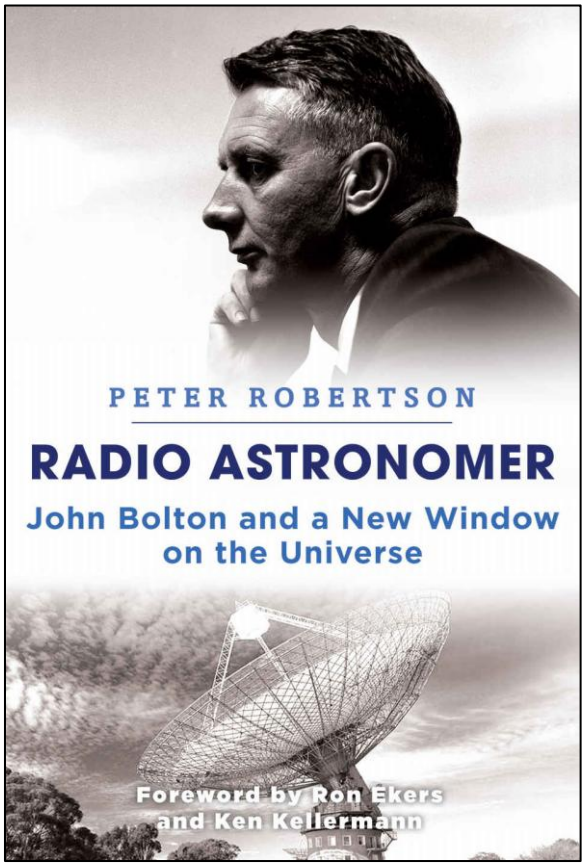
Although he died in 1993, John Bolton's name is well known today as the inaugural Director of the Parkes Radio Telescope, and the founder of radio astronomy at the California Institute of Technology in the USA. For those of us who knew John personally and worked with him, he was a hard task-master, as I found when using the 64-m Parkes Radio Telescope in the 1960s.

It was only much later, in the early 1990s (not long before his premature death) that I encountered the 'other' John Bolton, always happy to help me with my research on early Australian radio astronomy. And he had ideal credentials to do so: although born in England in 1922, he settled in Sydney when WWII ended and joined the Council for Scientific and Industrial Research's Division of Radiophysics (RP), leading the team at Dover Heights field station that identified optical correlates for the first discrete radio sources, thereby launching the new field of extragalactic radio astronomy. At the same time he forged close links with leading optical astronomers. These were the halcyon days of radio astronomy, with a seemingly never-ending supply of new discoveries, but elsewhere we have suggested that even though the Dover Heights team of John Bolton, Gordon Stanley and Bruce Slee would go on to build international reputations, none of them "… would produce another paper to rival the importance of their 1949 *Nature* letter." (Robertson et al., 2014: 302) that effectively launched extragalactic radio astronomy.

But Dover Heights was only the beginning of John Bolton's long and remarkable career in radio astronomy. In 1955 he launched radio astronomy at Caltech, culminating in the construction of the twin 90-ft antennas at the Owens Valley Radio Observatory. John was not your typical ivory-tower academic scientist. He believed the best way to effectively utilise scientific equipment was to build it, or help build it, yourself, and this included the Owens Valley interferometer. He also expected his graduate students to follow his example, so as two of them, Ron Ekers and Ken Kellermann, recount in their Foreward to Peter Robertson's book,

> … Barry Clark, who was the brains behind the Very Large Array, started at Owens Valley by learning how to use an oxyacetylene torch; Bob Wilson, who went on to win a Nobel Prize, did the circuit design for the Owens Valley instrumentation; and one of us (KK) wired the cables for the interferometer. The other of us (RE) started his PhD by using a tractor to grade the north-south track for the Parkes interferometer … (page vii).

Thus, when I worked at RP in the 1960s, 'Ph.D.' meant 'Post-hole Digger'!



In *Radio Astronomer: John Bolton and a New Window on the Universe*, Peter Robertson skilfully weaves the story of Bolton's life in and out of radio astronomy, starting with his childhood in England, and progressing to his role as the 'Dishmaster' at Parkes. Along the way we learn how the construction of the Parkes Radio Telescope led to the destruction of the RP field stations and the disintegration in the early 1960s of RP as arguably the world's foremost radio astronomy research group. We also learn about quasars, and the role that John Bolton played in the initial discovery and numerous later discoveries. And scattered throughout the book are accounts of John and Letty Bolton's numerous overseas trips, to attend conferences and meet-

ings, to visit old friends whose names are now famous in the astronomical world, or to conduct optical follow-up observations of sources detected at Parkes. I found some of these accounts particularly appealing and informative. Also well worth reading was the discussion on whether or not Bolton should have been a co-recipient of the Nobel Prize awarded for the discovery of quasars.

These comments aside, *Radio Astronomer* … is not just about scientific research and its just rewards—like John Bolton's long-awaited election as a Fellow of the Royal Society, his involvement at a very senior level in the IAU, his role in the development of the 3.9-m (150-in) Anglo-Australian Telescope; and his television appearances. We also learn about the problems created by the popularity of the Parkes Dish as a tourist destination and how the (eventual) construction of a visitor centre effectively solved this; and about the Dish's involvement in the American Space Program, including the first manned landing on the Moon.

Nor is this book solely about radio astronomy,-notwithstanding the title, for Peter Robertson also traces John Bolton's short sojourn in RP's cloud physics and rain-making group prior to his move to Caltech.

In 1992 Peter Robertson produced what for more than two decades has remained the standard reference on the Parkes Radio Telescope, and he has now written another well-researched and very readable tome about one of Australia's and the world's foremost radio astronomers. This very affordable work belongs on the bookshelves of all those with an interest in radio astronomy, and like its 1992 predecessor is bound to become a classic.

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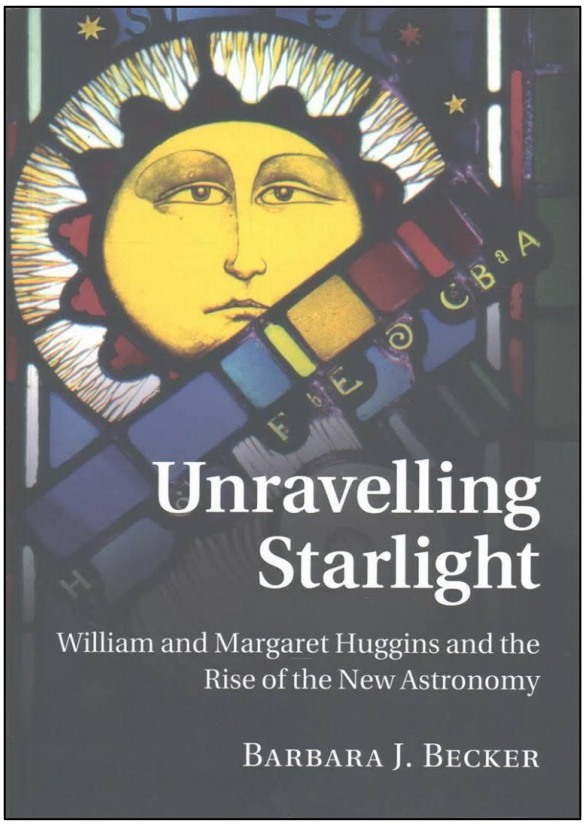
***Unravelling Starlight: William and Margaret Huggins and the Rise of the New Astronomy*, by Barbara J. Becker. (Cambridge University Press, Cambridge, 2016). Pp. xx + 380. ISBN 978-1-316-64417-1 (paperback), 170 × 244 mm, £36.99.**

Six years after the publication of the original hard-copy version of *Unravelling Starlight* … Cambridge University Press has produced a paperback edition, thereby bringing this important volume within the price-range of all astronomers. And by "all astronomers" I include amateurs, for William Huggins was surely one of the world's foremost nineteenth century amateur astronomers.



William Huggins was—by his own admission—one of the 'founding fathers' of astrophysics, the 'new astronomy' of the nineteenth century. As Barbara Becker reminds us in *Unravelling Starlight* …,

> Astrophysics is built on a range of questions and methods that were unimaginable to individuals in the first half of the nineteenth century [and in 1824, when Huggins was born]. At that time, positive knowledge of physical and chemical structure of celestial bodies was presumed to be unattainable by proper scientific methods, and hence relegated to the no-mans-land of mere speculation. (page 2).

William Huggins, with substantial help from his wife Margaret, was one scientist who completely changed this.

But as Barbara Becker recounts, Huggins came from a business background, and some of his pioneering research was opportunistic and aimed not only at progressing science but also increasing his own international standing as a scientist. Huggins was a master astronomical entrepreneur, something that is not apparent from reading earlier accounts of him written by others. As pointed out on page 156, after conducting

spectroscopic observations of prominences outside of an eclipse, Huggins

> … became more aware of the need to establish and preserve his priority whenever he engaged in some research project he believed to be original.

One of the advantages Huggins had as an amateur astronomer was that he was not swayed by the dictates of observatory or university policy, and could follow his own interests and inclinations. Thus, he attacked a wide range of spectroscopic research programs, involving the Sun (sunspots, prominences, the corona, a total solar eclipse), stars (including variable stars, and a nova), nebulae and meteors. Arguably the most important of these related to unravelling the true nature of (gaseous) nebulae and revealing that by marrying the spectroscope and the Doppler effect astronomers could determine the line-of-sight motions of individual stars. Nor were all Huggins' observations spectroscopic, for he also carried out visual observations of the anomalous lunar crater Linné over a 6-yr interval.

One of the strengths of this book is the space assigned to Huggins' involvement in astro-politics (e.g. the Devonshire Commission and British Government funding of astronomy and observatories). Barbara Becker also skilfully presents the deteriorating relationships between Huggins and Norman Lockyer and Huggins and Dr Henry Draper, and the growing friendship between Huggins and George Ellery Hale. She also reveals the critical part played by Margaret Huggins (née Murray) in her husband's research, and in continuing to actively promote his public persona after his death in 1910 (see Chapters 10, 12 and 15). Margaret was 24 years younger than William Huggins, but in her "… he found both a lifelong and devoted companion as well as an interested and capable collaborator." (page 170). Largely through Margaret, astronomical photography became an important part of the research strategy at Huggins' Tulse Hill Observatory.

It was only when he was in his 70s that Huggins

> … began reaping the recognition of colleagues and the nation for the fruits of his life's work. Knighthood [in 1897] and other honours were capped by election as President of the Royal Society. Although he had no interest in retiring yet as an active investigator, he nevertheless became increasingly nostalgic and wary of encroachment upon his past accomplishments. In this important phase of his career, he – with the invaluable assistance of his wife Margaret – began the challenging task of carefully laying out the groundwork for what would become the foundations of his historical image. (page 267).

That "historical image" appeared in a 23-page paper by William Huggins titled "The new astronomy: a personal retrospect", which was published in 1897 in *Nineteenth Century: A Monthly Review*. It is this 'sanitised' autobiography that later scholars used to recount Huggins' life, but through access to original letters, observational notebooks and other archival sources, Barbara Becker has been able to create a more realistic account of the life of Sir William and Lady Huggins.

Barbara has an appealing style of writing, and consequently *Unravelling Starlight* … is an entertaining and easy read. For those wishing to go further, most chapters are accompanied by numerous endnotes, and a 28-page Bibliography (including a listing of all of the Huggins' published papers) and a 6-page Index round out this fascinating book. My only regret is that the paperback review copy I received was very poorly bound, so that the book literally fell apart as soon as I opened it.

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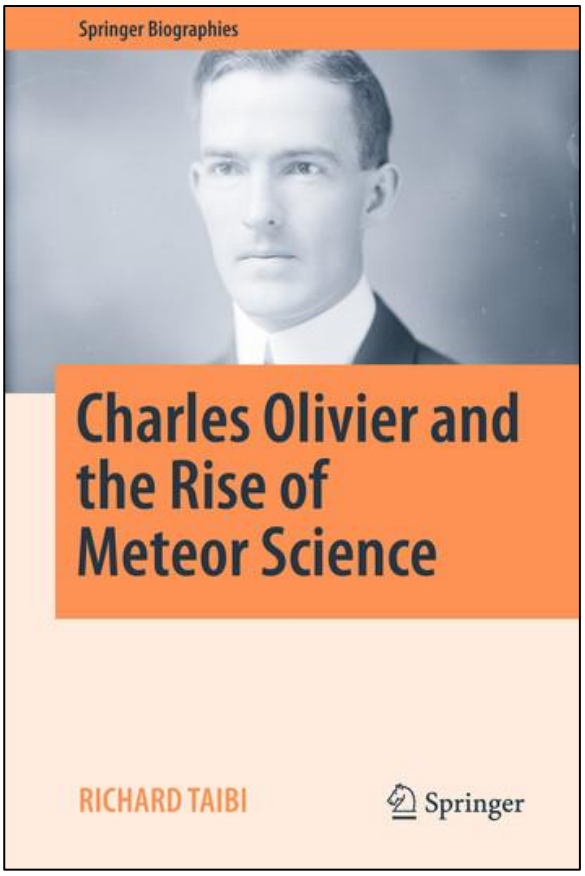
***Charles Olivier and the Rise of Meteor Science*, by Richard Taibi. (Springer International Publishers, 2017). Pp. xxxii + 497. ISBN 978-3-319-44518-2 (hardback), 165 × 240 mm, €99.99.**

When I began visual meteor observing in 1960 I wrote to Professor Charles P. Olivier from the American Meteor Society seeking advice on observing programs and techniques. He was quick to reply with encouragement that led eventually to the publication of my first two, albeit very short, research papers (Orchiston, 1963, 1964). Although I was a rank unknown from the Antipodes, even as a busy academic Professor Olivier found time to assist me, and I was suitably impressed. Now, upon reading Richard Taibi's book I realise that I was not alone: over the decades Professor Olivier helped wean thousands of amateur astronomers—many, like me, still in their teens—into meteor astronomy.

So who is this remarkable man? Charles Pollard Olivier was born in Charlottesville, Virginia, in 1884. The family lived quite close to the University of Viriginia's Leander McCormick Observatory and from an early age Charles Olivier showed an interest in astronomy, which was encouraged by Professor Ormond Stone. In 1898 14-yr old Olivier observed the Leonid meteor shower, which launched what would become a lifelong commitment to meteor research. After graduating with B.A. and M.A. degrees in Astronomy from the University of Virginia Olivier went to Lick Observatory, where he completed a

Ph.D. on meteor astronomy in 1911. But while engaged in his Master and Doctoral studies he also conducted micrometric observations of double stars with the 26-in (66-cm) and 36-in (91.4-cm) refractors at the Leander McCormick and Lick Observatories, and he also carried out variable star observations and photometry of standard stars at the former facility, so not all of his research efforts (and publications) were in meteor astronomy.

After teaching undergraduate Astronomy at Agnes Scott College in Georgia from 1911 to 1914 Olivier joined the staff of his *alma mater*, and stayed there until 1928 when he accepted a Chair in Astronomy at the University of Pennsylvania and Directorship of the Flower Observatory (which housed an 18-in (45-cm) Brashear refractor). Charles Olivier remained at the University of Pennsylvania until his retirement, and his long and productive life came to an end in 1975.



Richard Taibi tells us that by 1911, Olivier

> … had a very ambitious goal: no less than gathering scientific data on *every meteor which fell over North America and its adjacent waters*. He hoped that volunteer citizen scientists would accomplish a great deal, but to improve chances of achieving that goal, he asked members of all organisations with scientific interests related to astronomy to relay meteor observations their members happened to make in the course of official or academic duties. (page 41, my italics).

Olivier also responded by founding the American Meteor Society (AMS), and much of *Charles Olivier and the Rise of Meteor Science* between pages 41 and 270 recounts the vicissitudes of that Society through to 1936, including its observational programs, Olivier's publications, and the general response of other professional astronomers to meteor astronomy.

Meanwhile, in 1925 Olivier's book, *Meteors*, was published, and this would remain a standard reference for many years. In 1930 his second book, *Comets*, was published. Unfortunately, both books are mentioned almost in passing in Taibi's book, and it would have been nice to learn more, especially about Olivier's first book.

To round out his detailed review of Olivier's involvement with the AMS, between pages 270 and 286 Taibi summarises non-USA amateur meteor astronomy up to 1936. Apart from a 'lengthy' (4-page) discussion of Germany, all of the other national accounts are short. The Canadian account, for example, mentions P.M. Millman, but does not include Jarrell (2009) or Tors and Orchiston (2009) in the references. It is to be hoped that Taibi and others (e.g. Martin Beech) will publish further details in the future.

The author of *Charles Olivier and the Rise of Meteor Science*, Richard Taibi, is a retired clinical and forensic psychologist with a lifetime interest in astronomy, and an avid meteor observer. Taibi tells us that his project started off as a history of the American Meteor Society, but instead evolved into a biography of its founder, Charles Olivier, from 1899 to 1936, along with scores of amateur astronomers "… who volunteered to produce the data he analysed and published." (page viii). Taibi refers to these as "The Stalwarts", and they number more than 80 and occupy pages 291–481 of this 529-page book. Putting biographical flesh onto this skeletal list of names was valuable, but if this book should go to a second edition it is important that Taibi expands some of these biographies by networking effectively with colleagues who have relevant information. For example, in reviewing only the Australian and New Zealand 'Stalwarts', there is further published and unpublished information available on Murray Geddes, Ronald McIntosh (e.g. see Orchiston, 2017), J. Fraser Patterson (he was an Australian and never lived in Auckland, New Zealand) and Ivan Thomsen. Meanwhile, it is to be hoped that Taibi will now publish papers (in refereed journals) on some of the more distinguished individuals in his book who have been thoroughly researched.

Charles Oliver and the Rise of Meteor Science is a book long overdue. C.P. Olivier is a famous name in the annals of meteor astronomy, and it is a pleasure to learn more about him, while the history of the American Meteor Society was cry-

ing out to be told. Each chapter is complete with extensive footnotes (some of which even extend for more than half a page), and at the end a list of references. So we have much to thank Richard Taibi for in producing this timely book, which belongs on the bookshelves of all avid visual meteor observers with an interest in history.

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