BOOK REVIEWS

***The Collected Correspondence of Baron Franz Xaver von Zach*, by Clifford J. Cunningham (Star Lab Press, 250 Frederick St., Suite 1707, Kitchener, Ontario N2H 2N1, Canada, 2004 seq.).**

Under review are the first four volumes of this edition of the collected correspondence of this famous astronomer, geodesist, geographer, science historian and, last but not least, science organizer, editor and publisher. Franz Xaver von Zach (1754–1832) lived and worked in many European countries. Born in Budapest, he was the founder and first Director of the Seeberg Observatory near Gotha (in today's Thuringia, Germany), and for many years the Chamberlain of his patron's widow, Duchess Marie-Charlotte Amalia of Saxe-Gotha-Altenburg, with whom he travelled for many years through France and Italy. Although his name is not connected with a major astronomical discovery, he was instrumental in the discovery (or rather recovery) of the dwarf planet Ceres. The three journals edited by him, *Allgemeine Geographische Ephemeriden* (first 4 volumes), *Monatliche Correspondenz* (28 volumes) and *Correspondance Astronomique* (15 volumes), of usually biannual appearance, and long defunct, were the first journals dedicated exclusively to astronomical and also geographical, geodetical and nautical news. The interested reader is directed to the biographies by Peter Brosche (2009) and Magda Vargha (2005).

Zach's wide-ranging interests make his correspondence with many scientists in Europe most interesting reading, and Clifford Cunningham has done a lot of work collecting, editing, translating (with several helpers for the various German, French and Italian letters) and putting into context a major part of the existing letters of Zach and his correspondents. While almost all the letters to Zach are lost, long excerpts were published in his various journals, so that the essentials of the correspondence are preserved.

Volume 1, *Letters between Zach and Jan Sniadecki 1800-1803* (2004, ISBN 0-9708162-4-4, 100 pp.)*. These are 8 letters from Zach kept at the Jagiellonian University Library in Cracow, plus copies of 9 letters by Sniadecki, taken from a 1954 Polish edition of his correspondence, from the estate of Professor Ludwik Kamykowski from Crakow. They deal with the discovery of the first asteroids, the newly-founded V.A.G. (United Astronomical Society), and possibilities of fostering Sniadecki's career.

Volume 2, *Letters from Zach to his Fatherland 1796-1825* (2008, ISBN 0-9708162-7-8, 150 pp.), is a new edition of the letters edited by Brosche and Vargha (1984): 8 letters to Lajos Schedius, and two to Charles Rumy, preserved in the Library of the Hungarian Academy, as well as 8 excerpts of his correspondents. In this volume, the letters are richly annotated. They offer a glimpse into Zach's ongoing research, as well as Zach's early years and his unfortunate relations with Jesuit scientists.

Volume 3, *Letters in British Archives 1783-1825* (2008, ISBN 0-9708162-8-6, 190 pp.). These are mainly letters by Zach to eight correspondents (Joseph Banks, William Herschel, William Henry Fox Talbot, and others), plus a few replies by Herschel, copied by his sister Caroline. Zach made the acquaintance of most of his British correspondents when he stayed in England between 1783 and 1786. The letters exchanged with Fox Talbot, the future pioneer of photography, cover a wide range of topics.

Volume 4, *Letters between Baron von Zach and Giovanni Battista Amici 1822-1825* (2008, ISBN 0-9708162-9-4, 166 pp.) is a new edition of the letters edited by Alberto Meschiari in 2002: 16 original letters of Zach and 15 copies of letters of Amici, all kept at the Estense Library in Modena, which holds the huge estate of the astronomer, microscopist and instrument maker Amici. Zach was very impressed by Amici's talents.

Volumes 5, 6 and 7a in the series (ISBN 0-9822411-0-0, 232 pp.; 0-9822411-1-9, 81 pp.; and 978-0-9822411-2-7, 264 pp. respectively) have also been published (in 2009), and contain letters between Zach and Carl Friedrich Gauss; letters to German dukes and to Johann Wurm (the latter being a relatively unknown amateur astronomer in Württemberg); and letters to Abraham Schiferli, a physician and chamberlain of another duchess. A subsequent volume will contain Zach's correspondence with Johann Kaspar Horner, one of Zach's students.

The ongoing publication of the Zach correspondence offers interesting insight into personal careers, astronomical and related work and technical matters. The editorial comments are usually short, but informative. I would have wished to see the letters in their original language face-to face with the English translation, but the inclusion of footnotes and many facsimiles would have made this a difficult task. In any case, Clifford Cunningham is to be congratulated for having attacked a difficult task. We wish him (and his collaborators) much success for its completion.

References

Brosche, P., 2009. *Der Astronom der Herzogin. Second Edition*. Frankfurt/M, *Acta Historica Astronomiae*, 12.

Brosche, P., and Vargha, M., 1984. Briefe Franz Xaver von Zachs in sein Vaterland. *Publications of the Astronomical Department of L. Eötvös University*, 7 (Budapest).

Meschiari, A., 2002. Corrispondenza di Giovanni Battista Amici con Franz Xaver von Zach. *Nuncius*, 17, 165-245.

Vargha, M., 2005. *Franz Xaver von Zach. His Life and Times.* Budapest, Konkoly Observatory (Monograph No. 5).

* Each of these volumes measures 215 × 280mm. The price per volume is US$70 plus postage & packing ($5 to US and Canada and $10 to other countries); there is a special discount price for the complete set. For enquiries, orders and payment options email starlab@the-beach.net

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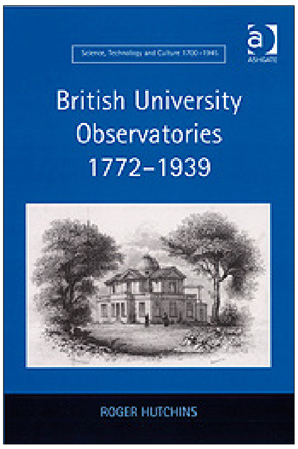
***British University Observatories 1772-1939*, by Roger Hutchins (Aldershot, Ashgate, 2008), pp. xxiii+533, ISBN 978-0-7546-3250-4 (paperback), £60.00, 239 × 164 mm.**



The year 1772 might seem to be an odd date to start this history when, for example, you consider the fact that Britain's two greatest astronomers, Isaac Newton and Edmund Halley, 'did' astronomy at Cambridge and Oxford Universities long before that date. Newton went up to Trinity in 1661 and was elected to the Lucasian Chair of Mathematics in 1669, and Halley went up to The Queen's College in 1673 and became Savilian Professor of Geometry in 1703. But these two scholars did not benefit from university observatories. 1772 was the date of the foundation of the Radcliffe Observatory at Oxford. As you might expect, when one university obtained one, others had to follow: Dunsink in 1783, Cambridge in 1820, Glasgow in 1838, Durham in 1840 and Mill Hill (London) in 1924.

The university component of British astronomy was very meagre in 1772, coming a poor third in the ‘pecking order’. In the lead was the work done by the Royal Greenwich Observatory—a government establishment that concentrated on both meridian observations and the production of stellar, lunar and planetary tables for navigational usage. Then came the lavishly-equipped private observatories funded and run by wealthy gentlemen and inquisitive aristocrats. But by the 1840s university astronomy was beginning to improve instrumentally. Cambridge had the impressive Northumberland 11.75-in (29.8-cm) refractor and Oxford was soon to acquire a 7.5-in (19.05-cm) split-lens heliometer. But staffing was an on-going problem, and the tension between teaching and observation meant that research was at best a part-time university activity. In addition, the fact that Professor Challis at Cambridge overlooked Neptune did not help the university cause.

Then three things happened. The first was the blossoming of astrophysics and photographic spectroscopy. With Greenwich confined to ‘meridian bashing’ this provided a great opportunity for the universities. Secondly, 1881 saw the retirement of Sir George Biddell Airy at Greenwich, and conservative old-fashioned astronomy could be swept aside by a new wave of fresh talent. And thirdly, you had the joy and freedom of university tenure. You could be a ‘better‘ astronomer at a university. There was no one leaning over you telling you what to do. You could make up your own mind as to which branch of the subject you wanted to study; the university provided the ‘well-funded laboratory’ and your publication rate was governed by self-motivation and not the haranguing of an overbearing grants committee. Also the instruments were here in the British Isles, and apart from the odd eclipse expedition you did not have to spend time wandering the world searching for better telescopes.

The twentieth century saw everything change. The amateur astronomers simply gave up, because cutting edge instrumentation was beyond their grasp. The Greenwich Observatory stuck to what it did best (positional astronomy), while the universities flourished until at the present time we see that they have completely taken over the British astronomical endeavour, so much so that no university physics and mathematics department seems to be viable without a substantial number of astronomers. The academics have triumphed.

Roger Hutchins is an Oxford man who took a first degree in modern history, and then chose ‘British University Observatories’ as the subject of his D. Phil. thesis. The book under review is an expanded and polished version of the latter, and what a marvellous, worthwhile and rewarding book it is. Not only does Hutchins write well, but he also carefully distinguishes between data and opinion. Much of the complexity has been summarised in tables. These list such topics as the details of the foundations, the names and salaries of the astronomers, the establishment of the science facilities, the intricacies of the unofficial relationship between Greenwich and Cambridge, the numbers of graduates and the instrumentation and how it compared to the facilities of Europe and the USA. Nearly every extant image of a university observatory, its instruments and its occupants has been beautifully reproduced. Each chapter is superbly referenced, and the bibliography is extensive. The book sensibly ends at the start of the Second World War.

What an upheaval that War was, but in the post-War years astronomy blossomed across the wavelengths, with radio, infrared, ultraviolet and X-ray astronomy muscling in on the old fashioned visual astronomy. Telescope mirrors doubled in size, telescope numbers increased tenfold and observatories went into space. Also logarithm tables and hand-cranked calculating machines were relegated to the museum and digital computers appeared on every desk and opened up new horizons. Before WWII university astronomy was a struggle, funding was limited and the success of individual departments was mainly due to dedicated leadership and personal sacrifice. It is also clear that much of the public interest in astronomy was generated and encouraged by university dons, who benefited hugely from the discipline of having to teach their subject as well as research it.

Read this book. It will make you proud to be at the chalk-face of tertiary astronomy education. Having said that, I eagerly await the follow up volume which will bring the story up to the present day.

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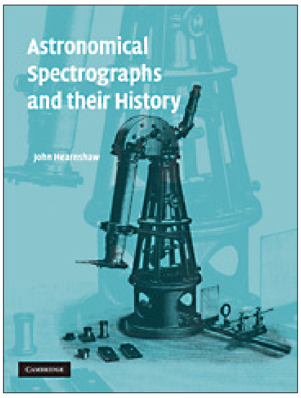
***Astronomical Spectrographs and their History*, by John Hearnshaw (Cambridge, Cambridge University Press, 2009), pp. xi + 228, ISBN 13; 978-0-521-88257-6 (hardcover), £70.00, 246 × 189 mm.**



John Hearnshaw has once again provided specialists in the history of astronomy with an important reference tool, this time including both historical and theoretical background information that should be useful as a means of appreciating and assessing the highly varied applications of spectroscopy to astronomy at the end of the twentieth century. Although the book takes in all periods of photographic astronomical spectroscopy, it sets limits within the technologies that employ dispersive means rather than filtering.

The book starts with an historical prefatory chapter, ending approximately in 1900, and then delves at some length into the theory underpinning the designs of spectroscopes and spectrographs. Coudé-fed high dispersion échelle designs warrant an entire chapter, followed by one devoted to solar spectroscopy, which returns the reader to the nineteenth century. There are following chapters devoted to objective prism spectrographs, their theory, history and use, and similarly-structured chapters for ultraviolet and nebular spectroscopy and multi-object spectrographs. A final chapter describes in some detail ten “pioneering spectrographs” of recent vintage.

Naturally I was first drawn to the last chapter. After a short introduction Hearnshaw describes nine ground-based instruments and one space-based instrument commissioned between 1984 and 2003. This imbalance implies a slight bias, which I thought interesting because he states that his selection was based upon illustrating the “… flavour of the extraordinary innovation of the optical designers working in astronomy today.” (page 195). As these were admittedly his personal choices, he makes no excuses for including his own instrument, Hercules, at his University’s observatory. Such license is more than welcome, especially since it is candid, considering that in this case, at least, the reader gains perspective on what drove his other choices. Hearnshaw emphasizes that he chose his top ten based upon ‘innovation’, ‘ingenuity’ and ‘complexity’. These are all fine and reasonable criteria. However, as I went through his examples looking for the innovations, I was disappointed that I did not find technical or even rhetorical social and scientific markers that would have helped me better understand his choices. I had to infer, or decide for myself, what he considered to be innovation. One hint came in a comment that a particular design was “… quite unusual in spectrograph design.” (page 196). Another comes in being described, from a quoted remark, as a “… threshold instrument.” (page 198). More guidance appears in his description of ELODIE, the échelle spectrograph at Haute–Provence that provided the first successful detection of a perturbing mass of planetary dimension orbiting another star. Here Hearnshaw identifies a high blaze angle grating as an innovation. Another innovation is the use of both crown and flint glass prisms for the cross-disperser. These are fine and worthy design issues, but they seem to me to be refinements or extensions, not innovations. I raise this point because there is a rich historical literature that explores the many processes that can be classified as instrument innovation that would have allowed the author to provide deeper and more helpful perspective on the nature of instrument innovation in astronomy. One more helpful definition is available in the work of Tom Gieryn and Richard Hirsh (1983) in their study of X-ray astronomers. Elaborating on the standard definition issued by the U.S. National Science Board in 1978, they identified innovation as "… contributions that challenge dominant theoretical, empirical or technical assumptions, and which result in palpable changes in problems chosen for research, theories adopted and techniques exploited." (page 93).

Given this definition, I would have given more weight to the fact that the spectrograph was fed by fibre optics, allowing it to be stationary and thus avoiding all sorts of nasty instrumental errors associated with motion on the telescope. In his top ten chapter Hearnshaw does cover fibre-fed designs, especially his own 2001 Hercules instrument, recognizing it as "… one of the first of the vacuum fibre-fed high resolution échelle spectrographs …" (page 210). ELODIE was in service as early as 1993, and fibre-fed designs date back to the 1980s, as he well points out in an earlier chapter.

Hearnshaw's insights on innovation throughout the book can be gleaned by the deliberate knowledgeable reader. At one level one can presume that if a particular instrument or technique is discussed, it represents innovation of some sort. To access deeper levels, however, one needs to dig through the copious references and engage the secondary historical literature, which unfortunately is absent from this book.

The book is well documented by references to the primary scientific literature in abbreviated bibliographical style, but unfortunately there is no comprehensive bibliography for the book, or any discussion of the nature of his sources. That made it difficult to determine if there was any significant engagement with views of the field by earlier reviewers, such as Ira S. Bowen. I did find that the watershed series *Stars and Stellar Systems* from the 1960s was queried by references to Bowen's chapter on spectrographs in the *Astronomical Techniques* volume (1962). But I found no commentary on how Hearnshaw's perspective, from 2009, contrasted with Bowen's from the 1960s. Nor were there any references to the important review articles in the 1930s on astronomical spectroscopy in the *Handbuch der Astrophysik*. Since those works represent received scientific opinion in their times, it would have been very useful to engage them as historical signposts to see how opinion, inclusiveness, and emphasis has changed over time. I also found it curious that the historical introduction chapter, to 1900, had some 236 references, but only one was to an explicit historical paper, by Don Osterbrock in the *JHA*.

The emphasis throughout the book is on the instruments and their designs, not on the people. There is some information on what these instruments were used for, and this is also welcome. Although there is frequent mention of the types of detector systems employed—photography, electronography, solid state detectors—these are merely mentioned in passing without substantial discussion of the impact new detectors had on instrument design, or even if there was impact. Thus, there is a welcome richness of detail, but here and there I was left wishing for a broader perspective, such as that provided in the latest issue of the *JAH*[2]; the paper by Lamy and Davoust on "General-Purpose and Dedicated Regimes in the Use of Telescopes" provides just such a refreshing and fruitful conceptual framework that I wished to find in this otherwise important work.

References

Gieryn, T.F., and Hirsh, R.F., 1983. Marginality and innovation in science. *Social Studies of Science*, 13, 87-106.

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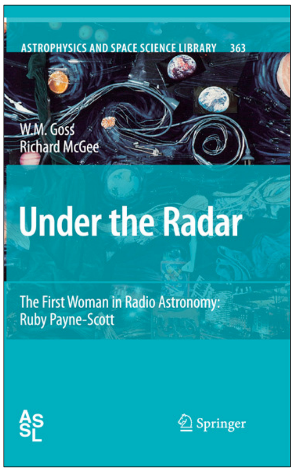
***Under the Radar. The First Woman in Radio Astronomy: Ruby Payne-Scott,* by W.M. Goss and Richard X. McGee (Heidelberg, Springer, 2009), pp. xxii + 354, ISBN 978-3-642-03141-0 (hardcover), €59.00, 242 x 160 mm.**



By all accounts Ruby Payne-Scott (1912–1981) was an amazing person. Back in the late 1920s and early 30s she studied physics at the University of Sydney when few women did, then after brief diversions she joined the CSIR's secret Radiophysics Laboratory in Sydney and worked on radar developments during WWII. It was at this time that she carried out her first exploraations in radio astronomy, a field in which she would quickly build a fine international reputation. While all this was occurring she was a member of the Communist Party of Australia when such affiliations were frowned on (to say the very least), but, more importantly, she was a wife. Her marriage only became common knowledge at CSIRO headquarters in 1950, and the following year she felt impelled to resign from the Division of Radiophysics (RP) given the imminent arrival of her first child. Maternity leave was not available in those days, and legislation prevented married women from holding permanent research posts in the Commonwealth public service. Those surely were draconian times!

The skeletal account presented above is fleshed out with admirable tenderness by Miller Goss and Dick McGee, two well-known radio astronomers. Miller's time at Radiophysics came long after Ruby had left, but she was still spoken of by long-standing staff members, whereas Dick joined RP soon after Ruby's departure, when her image was still very much part of the 'corporate culture'.

After providing an introductory chapter, Goss and McGee launch into a series of chronologically-ordered chapters where they deal with Payne-Scott's education; her early career with the Cancer Research Committee of the University of Sydney while she carried out part-time studies for an M.Sc.; her short stay as Science Mistress at Woodlands Church of England Girls' Grammar School in Adelaide after obtaining teacher training qualifications at her *alma mater*, the University of Sydney; and her two years at Amalgamated Wireless Australasia.

For those of us with a passion for radio astronomical history, this book takes a new turn on page 37, with the start of Chapter 4. Titled "Personnel File from CSIR/CSIRO", this recounts Payne-Scott's appointment to the Radiophysics Laboratory in August 1941 and events leading up to her departure in July 1951. During this decade of service she made an important contribution to the war effort and then to international science, and this is surveyed in the following five chapters. Apart from her wartime contributions to radar development, the pioneering solar research she carried out at Collaroy, Dover Heights, Hornsby Valley and Potts Hill is well-known to those familiar with early Australian radio astronomy, and has been covered by various authors in a series of papers and at least two books, but Goss and McGee succeed in expanding this story by incorporating material drawn from archival sources and personal reminiscences from some of Payne-Scott's contemporaries. Complementing the main thread of their account throughout is a plethora of interesting footnotes. These five chapters collectively span 134 pages, and I found them entertaining and illuminating. This applies equally to the following chapter about the 1952 URSI meeting, which was held in Sydney, but involved field visits to the Division of Radiophysics' field stations at Dapto, Hornsby Valley and Potts Hill. This major international meeting was to be Payne-Scott's last serious involvement in radio astronomy, although she did not end up presenting a paper at any of the sessions.

After almost 200 pages, one would expect Ruby Payne-Scott's story to be nearing an end, but in fact we are little more than half way through the book! Successive chapters then focus on: "Reminiscences and Anecdotes of Ruby Payne-Scott as Told by Friends and Colleagues"; "A Remarkable Family: Bill and Ruby Hall" (this was her married name), including biographical sketches of her two remarkable children, Peter Hall (an eminent Professor of Mathematics) and Fiona Hall (artist extraordinaire). Then there is a fascinating chapter about Payne-Scott's communist sympathies and Party affiliation—apparently she was known to some at RP as "Red Ruby"! The final two short biographical chapters review her time as a part-time science and mathematics teacher at a private girls' school in Sydney from 1963 to 1974, and discuss "The End of Payne-Scott's Life: A Retrospective". By the time she retired from Danebank School the early stages of Alzheimer's disease were apparent, and as the disease took hold she aged rapidly, dying on 25 May 1981, just 3 days short of her 69th birthday. Thus ended the life of one of Australia's most remarkable female scientists.

In the final two and a half page chapter in this book Miller Goss and Dick McGee tell us why they wrote this book and how the journey was to take them more than a decade. Rounding out the book are 14 illuminating appendices, spanning almost 70 pages, a ten-page Bibliography; and an Index.

This is a beautifully-researched, copiously-illustrated and well-written book that tells us much more than the life of one amazing female radio astronomer. It also provides a profile on radar developments during WWII and on Australia's pre-eminent place in solar radio astronomy in the years following WWII. *Under the Radar* is compelling reading, and if you have taken the time to read right through this review then it certainly belongs on your bookshelf!

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***Geschichte der Geodäsie in Deutschland*, by Wolfgang Torge (Berlin, Walter de Gruyter, 2007), pp. 379, ISBN 978-3-11-019056-4, €118.00, 244 x 176 mm.**

The history of geodesy in Germany, written by the retired professor Wolfgang Torge from the Institute of Geodesy at the Technical University of Hanover, is much more than the title implies. It describes the development of geodesy in Germany (although during most of the time, this meant a patchwork of small states) and central Europe. After some preliminaries about the concept of geodesy and ordnance surveys, the second chapter deals with the history of surveying in Babylonia, Egypt, Greece and in the Roman Empire. Following a survey of the tradition in the Middle Ages, the fourth chapter starts with the Copernican revolution, triangulation and plane-table methods, and early surveys in Bavaria, Saxonia and Württemberg. The fifth chapter introduces the new geodesy, i.e. the proof of the Earth's oblateness by Cassini I and his collaborators, the rise of state observatories, and the introduction of the meter. The *Carte Géométrique de la France* (1747-1793) by Cassini III (and IV) was completed at the end of the monarchy in France. Along the same lines, the military surveys of the Napoleonic era were carried out in central Europe, especially in the south of Germany and in Austria, as well as in the German southwest, then under French administration, a task completed by Prussian surveyors only after Napoleon's defeat.

Important contributors to geodesy in this period were Christian Mayer in Mannheim, Johann Georg von Soldner in Bavaria, and Carl Friedrich Gauss in Göttingen for the establishment of a geodetic network, as well as Franz X. Zach, who initiated work on a geodetic arc. The seventh chapter describes the Hanoverian and Prussian ordnance survey and similar enterprises in other German states, as well as educational efforts for surveyors and the establishment of mechanico-optical workshops. Chapter 8 describes the central European collaboration as well as international ones, and the role of the Geodetic Institute in Potsdam under Friedrich Robert Helmert. The closing three chapters deal with standardisations in Prussia and other states, the homogenization of German surveying offices, and modern trends in surveying in the second half of the twentieth century.

Readers will find the names of many astronomers of the sixteenth to nineteenth centuries in this informative book, and will learn about the work they carried out beyond astronomy: to provide tools, methods and often a major part of their working time for the progress of surveying and geodesy.

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