stellation illustrations include brief descriptions of the stars' number and their location within the formations. They also have texts of Isidore of Seville (CE 560–636) in the earlier manuscripts and of Bede (CE 672–735) on heavenly motions and computus in the later copies.

The texts and images range in quality from sketchy, amateurish productions to outstanding royal treasures like the Leiden Aratea of CE 814 credited to 'The Astronomer'. An aspect of these cosmological compendia that still surprises is that, despite their creation by scribal monks, priests and religious figures, the illuminations retain their 'pagan' planetary gods, myths and iconography. The only concession to Christianity can be found in one miniature of the Leiden Aratea, Gemini, who display small Christian crosses on their caps.

The theme of Chapter 4, "Byzantine Dissensus", centers on Greek astronomical manuscripts in the Byzantine world where very few surviving manuscripts with cosmological texts are illustrated. The Vatican Ptolemy, eighth or ninth century, survives along with three other early copies of the Handy Tables and is the only copy with illustrations. It contains five colorful full-page diagrams and painted lunettes over the tables. Anderson claims the miniatures give the impression of a well-ordered cosmos ruled by a well-ruled empire. The study presents evidence that shows Byzantium's Emperor held abundant astronomical knowledge that enabled him to rule his Empire wisely and confidently. While in the Frankish and early Islamic Empires, the rulers were sufficiently educated in astronomical knowledge but proficiency in exact details was left to experts in the field. The cosmological imagery in Byzantine manuscripts established and promoted the idea that the ruler alone had the necessary skills and authority to rule. In contrast the Frankish and Islamic rulers were promoted as using the stellar imagery to establish a more communal sharing of knowledge with the audience who observed these artworks.

The book brings to the forefront some religious and secular manuscripts and regal paraphernalia that has had little previous exposure in Western research. The book and its sixty-seven color illustrations are of high-quality and well produced. There is one minor error on page 55 where Anderson names Charlemagne as the son of Charles Martel; of course, he was his grandson. In this study he does not discuss extensive details of the art historical aspects or the astronomical meanings, or techniques. Rather than discussing an item's contemporary acceptance or usefulness, he presents the social functions, the intentions and significance of each for the patrons, artists and viewers.

Anderson's original approach of invoking the concept of community is appealing for the social functions and significance of these cosmological illustrations and decorated artifacts. My main difficulty stands with the outreaching concept of 'community'. How many individuals in a Frankish, Byzantine or Islamic community would have had visual access to Charlemagne's Silver Table, Charles the Bald's Ivory Throne, Henry II's Star Mantle (some doubt he ever wore it), or the frescoed dome of a caliph's bathhouse at Qusayr' Amra, or Ptolemy's Handy Tables? Manuscripts in monastic, cathedral or regal libraries too could be accessed by very limited audiences as only the elite and clergy were literate. How many would ever see the miniatures or could understand the Vatican Ptolemy? That these luxury items illustrated with cosmological images had the ability "… to mediate between an individual and a community …" (p. 147) seems quite limited, exceedingly rare, or even doubtful.

Dr Marion Dolan
Independent scholar, Deerfield Beach,
Florida, USA.
Email: mdolan79@hotmail.com

Selene's Two Faces: From 17th Century Drawings to Spacecraft Imaging, edited by Carmen Pérez González. (Leiden, Brill, 2018). Pp. xvi + 310. ISBN 978-90-04-29886-6 (hardback), 160 × 240 mm, US$132.00.

This is an interesting book that mixes art and science, and as such it has authors from professional and amateur astronomy, from academia and from museums, inspired by editor Carmen Pérez González who has a Masters degree in astrophysics and a PhD in Art History.

Carmen sets the scene for the whole book in the first chapter:

> If any scientific object has over the course of human history aroused the fascination of both scientists and artists worldwide, it is beyond doubt the moon. (p. 1).

This book spans the time-range from the seventeenth century to the astronaut era of the twentieth century, and is

> … intermedial, intercultural and interdisciplinary … [bringing] together various media (photography,maps, engravings, lithographs, globes, texts), cultures and theoretical perspectives … (p. 2).

This catholic approach is reflected in the eight following chapters, which discuss the history of selenography; the Moon in Persian and Japanese astronomy; nineteenth century lunar photography; "The Digital Sky of Hamburg Observatory: Bringing Astro-photographic Plates from the 20th into the 21st Century", and finally a chapter with the subtitle "Close-up Detailed

Observations Performed by Spacecraft and Manned Exploration of the Moon". With the advent of lander, orbiter and fly-by missions, technology in the second half of the twentieth century opened a new window not just on our Moon, but especially on the Solar System.

As someone with a special interest in Asian astronomical history, I was pleased to read Carmen's summary on pages 17–24, with many familiar references and images, not to mention Tsuko Nakamura's chapter about "Japanese Lunar Drawings, Maps and Photographs Before the 1870s". Among the images Carmen presents is Figure 0.5, an old favourite of mine that appears to show Siam's King Narai and a contingent of French Jesuit astronomers observing the total lunar eclipse of 11 December 1685 from near Lop Buri. However, we should note that this drawing was made in Paris (not SE Asia) by an artist who had never been to Siam (let alone seen the eclipse), and that it exhibits *considerable* artistic license (for details see Orchiston et al., 2016). Nonetheless, what makes this eclipse observation even more interesting is that Cassini's 1679 map of the Moon was used for reference purposes (see Gislén et al., 2018).

Then comes a chapter by Adler Planetarium's Pedro Raposo that briefly reviews the history of selenography, mentions all the key early maps of the Moon and reproduces copies of some of them, before moving on to lunar globes, and includes what surely must be the most remarkable globe made in the nineteenth century. Inspired by Julius Schmidt, the curator Thomas Dickert crafted an impressive 19-feet diameter globe of the Moon for the National History Museum in Bonn, and this is shown in Figure 1.8.

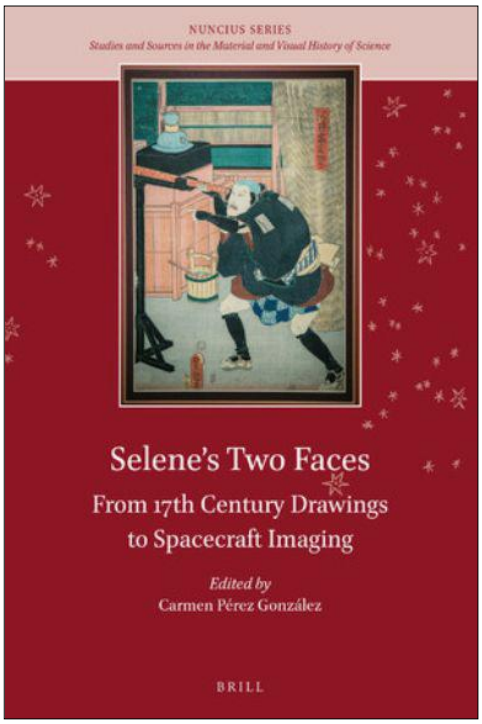
Carmen Gonzalez's second chapter in this book is about the Moon and Persian astronomy during the second half of the nineteenth century. This is an important contribution to the literature on Middle Eastern historical astronomy, bringing as it does, into the public domain new archival sources and historical photographs (many of which have not been published previously). But Carmen sets the scene by reviewing earlier Persian astronomers, including al-Şūfī and his famous *Book of the Fixed Stars* (which was the research topic of one of my former graduate students, Ihsan Hafez; I was pleased to see that Carmen references his PhD Thesis).

An important element in Carmen's 34-page chapter is the introduction of the telescope to Iran, and the manufacture of the first telescope in Iran by the Frenchman Raphaël du Mans. By a remarkable coincidence, Ramesh Kapoor (2019) discusses du Mans' telescope-making activities (among other topics) in a paper in this very same issue of *JAHH*!

In Chapter 3 Japan's leading astronomical historian, Dr Tsuko Nakamura reviews Japan's love affair with the Moon, through drawings, maps and photographs, but he also discusses the mandatory topics of (a) the introduction of the telescope to Japan, and (b) the first telescope made in Japan. Tsuko had previously published much on early Japanese astronomy, but he strengthens his chapter by including new material (including previously-unpublished drawings).

Charlotte Bigg provides a *tour-de-force* on the early development of lunar photography in Chapter 4 by

> Rather than studying how photography was *applied* to astronomy … we then need to understand how photography and astronomy mutually made each other: in the elaboration of what came to be known as astrophysics,



> for instance; or in establishing the idea of photography as a reliable witness and scientific instrument. (p. 118).

She discusses photographic maps and atlases of the Moon, and because of the convenience of her Paris domicile she draws extensively on French sources for her examples. *C'est trez bon!* However, on page 137 she discusses attempts by John Herschel and Warren de la Rue to launch an on-going solar photography program at Kew Observatory. For the very latest on this topic, readers should refer to the review of Lee Macdonald's book, *Kew Observatory* …, on pages 373–374 in this issue of *JAHH*. Charlotte Bigg ends her chapter with an *exposé* on the important role that amateurs

have played in lunar astronomy.

One of these very same amateurs, the industrial James Nasmyth, is the subject of the next chapter, by Omar W. Nasim, Professor of History of Science at the University of Regensburg in Germany. While Nasmyth is probably best known to most astronomers for his telescope-making prowess, and the 'Nasmyth focus' used with large reflecting telescopes, he was also an accomplished observer and co-author of a celebrated book about the Moon. In 1874 Nasmyth teamed with James Carpenter to produce *The Moon, Considered as a Planet, a World, a Satellite*. An early addition to my own library, this still fascinates with its remarkable photographs, many of which, as Nasim reminds us,

> … are actually prints of photographs of plaster and wood models of the moon … [that] have been appreciated for their realism as well as their positivism, for their uncanny resemblance to science fiction effects and their relation to mechanical objectivity; and for the ways in which they straddle science and art. (p. 147).

Nasim's excellent chapter paints a picture of Nasmyth as a telescope-maker, observer, model- maker, map-maker, lecturer, author and above all accomplished selenographer. It also informs on Nasmyth's friendship with fellow-Scot and Astronomer Royal of Scotland, Professor Charles Piazzi Smyth who took a liking to selenography. All in all, I found this a very rewarding chapter to read.

The next chapter switches the focus to a professional astronomer, Bonn Observatory's Professor Karl Freidrich Küstner, and the lunar photography that he carried out between 1901 and 1903 with a 30-cm astrograph and 36-cm guide-scope. The author of this chapter, University of Bonn's Michael Geffert, suggests that Küstner took these lunar photographs not for research purposes but to test the quality of the double telescope. Because of this, Geffert is using Küstner's lunar photographs in exhibitions, to interest the public in astronomy.

Chapter 7 continues the professional astronomer-German observatory theme by examining the development of astronomical photography at Hamburg Observatory using a variety of telescopes and for a range of different research projects. This resulted in a large plate collection, but only about 170 of these are of the Moon. As the author of this chapter, Hamburg Observatory's Dr Detlef Groote, points out,

> The advantage of photographic plates as a storage medium is their high density of information … On the other hand, they are a non-digital medium that suffers from ageing and bad storage conditions, such a high temperatures, humidity, and dust, scratches … Moreover, after a century some of the photographic plates show damage such as darkening and silvering, or dissolution and rupture of the emulsion. (pp. 210–211).

Groote then describes in detail the digitization of the Hamburg Observatory plate collection. This began in 2010 as a pilot project, and at the time of writing (presumably 2017),

> … more than 41,000 plates had been scanned … plus the same number of plate envelopes. Additionally, so far 175 observer notebooks and logbooks have been scanned, leading to an approximate total of more than 190,000 image files. The disk space so far needed amounts to roughly 43 TB. (p. 225).

This illuminating chapter highlights the enormous potential that photographic plate collections around the world hold for certain types of astrophysical research projects.

The final chapter in this book is co-authored by Dr Pedro Ré, an amateur astronomer who works as a zoologist at the University of Lisbon (Portugal), and Carmen González. The primary title of this chapter is "From Astronomer-photographers to Astronaut-photographers", and it shows how

> Photographing from spacecraft changed the concept of a human being behind a camera, or more precisely, a human being behind a telescope coupled with a camera … (p. 230).

But not all photographs from spacecraft were taken by human beings, and this chapter discusses unmanned lunar missions of 1957–1967 and Soviet lunar probes, before focusing on the U.S. Apollo Mission, and later the unmanned Clementine Lunar Prospector Missions. An interesting aside is the account of how Hasselblad cameras became the 'official' U.S. space cameras on the manned lunar missions, and the authors devote two pages with tables summarising this, not to mention the various lunar photographs that are scattered throughout the text. The chapter ends with a summary of Japanese, Chinese and Indian lunar missions, and photographic opportunities that the Moon now holds for amateur astronomers in this age of high-resolution digital imaging and image manipulation.

Rounding out this book are a 7-page "History of Moon-photography: Timeline" (by Ré and González), a 22-page Bibliography, and an Index.

Selene's Two Faces is an interesting book, on a topic that has not been written on before (well in book form, anyway). It is easy reading, and chapters are well illustrated and all are literally supported by footnotes, supplemented by an excellent Bibliography. Carmen González is to be congratulated on coming up with the

idea of this book and seeing it through to publication. It will surely appeal to anyone with an interest in the Moon or astronomical photography.

References

Gislén, L., Launay, F., Orchiston, W., Orchiston, D.L., Débarbat, S., Husson, M., George, M., and Soonthornthum, B., 2018. Cassini's 1679 map of the Moon and French Jesuit observations of the lunar eclipse of 11 December 1685. *Journal of Astronomical History and Heritage*, 21, 211–225.

Kapoor, R., 2019. On two seventeenth century Persian paintings depicting comets or fireballs. *Journal of Astronomical History and Heritage*, 22, 301–321.

Orchiston, W., Orchiston, D.L., George, M., and Soonthornthum, B., 2016. Exploring the first scientific observations of lunar eclipses made in Siam. *Journal of Astronomical History and Heritage*, 19, 25–45.

Professor Wayne Orchiston
National Astronomical Research Institute of Thailand, Chiang Mai, Thailand; and Centre for Astrophysics, University of Southern Queensland, Toowoomba, Queensland, Australia.
Email: wayne.orchiston@gmail.com

Starlight Detectives: *How Astronomers, Inventors and Eccentrics, Discovered the Modern Universe*, by Alan Hirshfeld. (New York, Bellevue Literary Press, 2014). Pp. 397. ISBN 978-1-934137-78-0 (paperback), 150 × 228 mm, US$19.95.

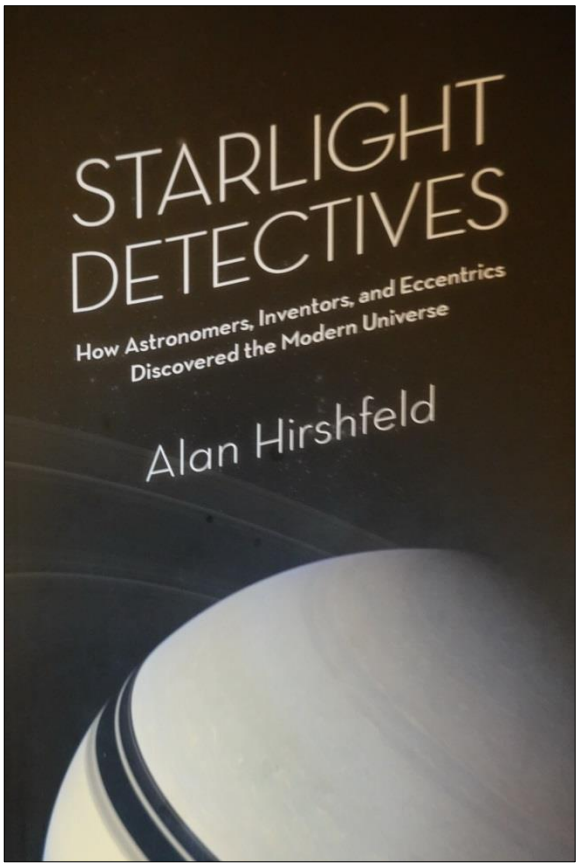
The development of astrophotography in the nineteenth century, to its employment by Hubble in the 1920s and 1930s that revealed a Universe of galaxies, is the subject of this book. The author is current President of the History of Astronomy Division of the American Astronomical Society, and Professor of Physics at the University of Massachusetts, in Dartmouth.

One hesitates to pronounce any book definitive, but this work by Hirshfeld has set a standard that will not soon be equalled, much less surpassed in just a single volume. In addition to fleshing out the details which are broadly known, he rescues from oblivion several, eccentrics who contributed mightily to astrophotography.

The first astronomical image was taken by New York University chemistry professor John W. Draper in 1840. It was a 20-minute exposure of the Moon, since lost in a fire of 1866. Draper used the only method available, a daguerrotype, invented by Louis Daguerre and inspired by his friend Joseph Niépce, who took the first photograph from nature in 1826. By 1841 there was a second way to take images—the calotype—developed in England by William Henry Fox Talbot, but he patented the process, hindering its widespread use:

> Neither the daguerreotype nor the calotype were [*sic*] astronomy-friendly. In fact, they were downright hostile ... Until exposure times were shortened and telescope drives improved, astronomers would remain hostage to every flutter of the air and lurch of the drive gear. (p. 69).

One of the eccentrics Hirshfeld mentions is Richard Leach Maddox (1816–1902), who engaged in a "… noxious hobby of wet-collodion photomicroscopy. This he pursued in an unventilated closet in his home." His use of gelatin, "… a true chemical advance over collodion …", was the key breakthrough in the development of dry plates: "The hoary thirty-minute daguerrotype had evolved into the dry-plate snapshot." (pp. 113–114). That was in 1871, but it was not until the 1890s that photography proved its value:



> It was pictures of the controversial spiral nebulae that were to cement the acceptance of photography by professional astronomers. (p. 143).

The second part of the book focuses on the rise of spectroscopy, pioneered by Robert Bunsen "… the amiable lord of the laboratory …" (p. 156) and Gustav Kirchhoff, who was plagued into adulthood by 'neurotic demons' that had their root in angst about his slight stature. Bunsen, by contrast, was a bearish man. Hirshfeld dubs them "… the odd couple." (p. 155). Going from the laboratory to the instrumental perspective, the author describes