the time. Another conference proceeding I have often cited[8] has, at the moment of writing, 89 citations according to ADS, more than most refereed-journal papers.

The Moriond conferences have the best of all worlds: a proper printed book of (relatively long) conference proceedings (distributed to the participants but also available to others), a freely available PDF of the same[9], and the slides of the individual contributions on the web. (Alas, some other conference websites have disappeared after a few years.) The facts that there are only plenary sessions, that everyone sleeps and eats in the same hotel at the conference venue, and that there are more hours of talks in the week (six full days and a closing session on the seventh) despite a break of four hours or so each afternoon (with the opportunity for skiing) make them my favourite serial conference, and they are better organized than most high-profile one-off conferences.

Yours faithfully,
PHILLIP HELBIG

Thomas-Mann-Straße 9
D-63477 Maintal
Germany

helbig@astro.multivax.de

2024 April 11

References

(1) S. Phillipps, *The Observatory*, **144**, 93, 2024.
(2) https://moriond.in2p3.fr/2024/Cosmology/
(3) C. Lawrence, in C. S. Kochanek & J. N. Hewitt, eds., *Astrophysical Applications of Gravitational Lensing* (Kluwer, Dordrecht), 1996, p. 299.
(4) P. Helbig, *The Observatory*, **134**, 376, 2014.
(5) P. Helbig, *The Observatory*, **134**, 377, 2014.
(6) J. Baggott & J. L. Heilbron, *Quantum Drama* (Oxford University Press), 2024.
(7) P. Helbig, *The Observatory*, **144**, 257, 2024.
(8) R. Penrose, in E. J. Fenyves (ed.), *Fourteenth Texas Symposium on Relativistic Astrophysics* (New York Academy of Sciences), 1989, p. 249.
(9) https://moriond.in2p3.fr/previous-sessions.html

REVIEWS

Her Space, Her Time: How Trailblazing Women Scientists Decoded the Hidden Universe, by Shohini Ghose (MIT Press), 2023. Pp. 248, 22·5 × 15 cm. Price $29·95 (about £24) (hardbound; ISBN 978 0 262 04831 6).

Author Shohini Ghose is herself Professor of Physics and Computer Science at Wilfred Laurier University in Canada, and has been active in women-in-science issues for some time. Here she addresses seven topics in the recent history of physics, astronomy, cosmology, and such, focussing on contributions by women to our present understanding. You will find here many of the astronomers you might expect — Annie J. Cannon, Cecilia Payne-Gaposchkin, Henrietta Leavitt, Margaret Burbidge, Maria Mitchell, and Vera Rubin, with, I think, no major surprises in how the author describes their best-known contributions. At least the tip of the physics pillar might (should!) also be familiar — Lise Meitner (fission, who should have shared Otto Hahn's 1944 Chemistry Nobel), Maria Salomea Sklodowska (who received two Nobels, Chemistry and Physics, as Marie Curie), and C. S. Wu (Wu Chien-Shiung, the experimenter who found parity non-conservation as predicted by C. N. Yang and T. D. Lee, who got the prizes).

Surprises and potential disagreements arise when one looks more closely at who's in, who's out, and how the work and the person get classified. There is Margaret Burbidge (with her birth surname misspelled as Peachy rather than Peachey), sharing a chapter called 'About time: discoverers of the Big Bang' with Henrietta Leavitt. But Margaret was not a strong supporter of a hot, dense early Universe even in 1957 when the monumental B^2FH, 'Synthesis of the Elements in Stars', was published, and later in life definitely favoured some sort of quasi-steady-state or cyclic universe without a Big Bang starting time for everybody.

The chapter 'Escape Velocity: Pathfinders in Space Exploration' indeed includes women who worked for NASA and other space agencies (Valentina Tereshkova makes the cut; Sally Ride does not). Recently hailed Katherine Johnson is there, though not featured among "the Women who Powered NASA's Space Program". Most strangely, that chapter includes a Turkish woman whose name appears in IAU directories as Dilhan Ezer-Eryurt. Ghose calls her Eryurt in the text; lists her publications as Ezer, and apparently thinks that having worked at Goddard Institute of Space Studies makes her a contributor to space science. Actually her major contribution to astrophysics was calculations of the structure and evolution of stars with $Z = 0$, carried out with A. G. W. Cameron. She is sadly no longer with us, but was my 'go to' person in Turkey earlier in the century when American physicists were worried about conditions for scientists there.

The story in Chapter 6, 'Forces of Nature: the subatomic photographers', is a bit more complicated than the version here. Yes, Marietta Blau was unquestionably a/the pioneer of using nuclear emulsions as detectors for high-energy particles, and the Nobel went to Cecil Powell for using such emulsions to find mesons (as predicted by Yukawa who had won the previous year). What I missed were the contributions of Occhialini (who also worked with Patrick Blackett on his Nobel-graced work) and also in Powell's cosmic-ray group at Bristol, Cesare Lattes, who carried the technique back to his native Brazil. The Brazilian physicist in that chapter is Elisa Frota-Pessoa, who also worked with nuclear emulsions, and it is impossible not to suspect that she had learned of them from Lattes. I also felt in reading that chapter that author Ghose had not been hard enough on Herrtha Wambacher, Blau's student and apparently a loyal Nazi, who arguably tried to take more of the credit for nuclear-emulsion work away from Blau (who was in Vienna in 1938) than she, Wambacher, deserved.

Lots of surprises — Otto Hahn won a medal for his WW I service at the Battle of Ypres. The death toll in the WW II Bengali famine was apparently more like four million people than the three million I had remembered. The author is apparently not aware of programmes at many universities (including UCI) that try to arrange "spousal hires" to facilitate recruiting new faculty members (one of our best astronomers arrived as the husband of a woman selected by another department!). She apparently also is not aware that Albert Abraham Michelson did his prize-winning work in the US, and she describes Millikan as our first physics Nobelist.

The author describes a D.Sc. degree as the equivalent of a PhD (but don't they generally get to wear nicer-coloured academic robes?). On the other hand, she does an unusually good job of tracing out the path of stellar nuclear reactions from hydrogen to iron and beyond. A few other items left me wanting to verify names, dates, and all, for instance the statement that Ray Davis detected solar neutrinos in 1965, and that Otto Frisch thought of using "pure uranium" for a fission bomb, Frisch and Rudolf Peierls concluding that a few kilograms would be enough. —Virginia Trimble.

Quantum Drama: From the Bohr–Einstein Debate to the Riddle of Entanglement, by Jim Baggott & John L. Heilbron (Oxford University Press), 2024. Pp. 335, 24·5 × 16·5 cm. Price £26·99/$32·99 (hardbound; ISBN 978 0 19 284610 5).

Jim Baggott* is known mainly as a writer of popular-science books; the late John L. Heilbron as a historian of science. Heilbron lived in Copenhagen 1962–1963, he interviewed many of the founders of quantum mechanics, and archived and microfilmed their correspondence; he has also written a biography of Bohr[3]. They have teamed up for something in-between, a popular history-of-science book, more detailed than most popular-science books and a breezier read than most technical history-of-science monographs. It covers the time from the origins of quantum theory up to the present. Obviously, it can't be even close to a complete account in only a few hundred pages. Rather, as the subtitle states, it concentrates on the idea of entanglement, covering various interpretations of quantum mechanics, philosophical issues, experiments, and practical applications.

Except for the last with six, each of the four parts (which follow a nine-page prologue) has four chapters. The first part covers the early days (roughly from Planck's first work, conveniently in the year 1900, until the end of the 1920s) of quantum mechanics and provides a basic introduction to the topic. The latter can be found in many other books; the former, with more emphasis on the people involved, is not as common in books at this level. The second concentrates more on the main theme of the book, covering events from the fifth Solvay conference in 1927 until about the end of the 1930s, with the famous Einstein–Podolsky–Rosen paper and Schrödinger's cat playing prominent roles. Quantum mechanics is no longer just a system of rules for calculating experimental quantities, but has become a philosophical subject, with topics such as the measurement problem, the reality (or not) of macroscopic superpositions, the uncertainty relation, and so on, occupying the best minds in the field, not always agreeing. The most famous such disagreements are the famous Bohr–Einstein debates. (I recently read that the traditional view is, in the physics community, that Bohr is seen as having been right and Einstein wrong, whereas in the philosophy community it is the other way around. However, that simple dichotomy is as much an oversimplification as each premise on its own.) The title comes from a quotation from Bohr: "At the next meeting with Einstein ... our discussions took quite a dramatic turn." The third part, picking up after the distraction of World War II (in which many of the key players were involved in more practical pursuits) and continuing until about the end of the 1950s, introduces the alternative approaches of Bohm and Everett. Interesting is the degree to which some of the 'non-Copenhagen' pioneers followed those new

*I reviewed[1] a previous book[2] by Baggott in these pages.

approaches while at the same time a new generation (Weisskopf, Wheeler, von Neumann, Wigner, *etc.*) took over*: Bohr died in 1962, Einstein in 1955, Fermi in 1954, Schrödinger in 1961, Pauli in 1958. (Interestingly, some of the earlier generation died much later, *e.g.*, de Broglie in 1987, Dirac in 1984, Born in 1970, Jordan in 1980, von Weizsäcker in 2007, but in their last decades they were no longer leading the discussion in the field.) There is also a good discussion of attitudes in the field as expressed at conferences (where opinions are often more clearly on display than in journal articles). The last part introduces John Bell and the current importance of his work, *e.g.*, the experiments by the winners of the 2022 Nobel Prize in Physics (Clauser, Aspect, and Zeilinger), quantum cryptography, and quantum effects observable in (almost) macroscopic objects. In between is an interesting discussion of popular-level mysticism in connection with quantum mechanics (Capra[4], Sarfatti, Zukav[5], *etc.*). While that is often (correctly, in my view) looked down upon, it is important to remember that Schrödinger was very interested in eastern mysticism, Pauli in the psychological theories of Jung, Bohr put yin and yang on his coat of arms, and so on. (At least Schrödinger's 'mystical side' might be more akin to the religion of Lemaître, who was a Catholic priest yet seemed to be able to separate that from his work in cosmology, which has also been the case among some more modern openly religious cosmologists such as John Barrow and George Ellis.)

While there are few equations in the book, the fourth part goes into more detail than one might expect in explaining the ideas of Bell and the experiments of Clauser, Aspect, and Zeilinger. While the book can't cover everything — and doesn't attempt to — all the same, many readers will probably come across concepts and people usually not mentioned in overviews of (the history of) quantum mechanics, such as Grete Hermann. As such, it is complementary to many other books broadly covering similar ground. It is also better written than most books I've reviewed in these pages. There are black-and-white figures scattered throughout the book. Twenty-five pages of endnotes are mostly references to the sources listed on twenty-seven pages. The thirteen-page small-print index is especially thorough, especially for a 'popular' book, and demonstrates again that this book is a cut above most broadly similar books, both in terms of content and in terms of presentation. It should appeal to a relatively wide readership, especially due to its combination of detail and readability, including, despite the lack of astronomy, readers of this *Magazine*. — Phillip Helbig.

References

(1) P. Helbig, *The Observatory*, **139**, 128, 2019.
(2) J. Baggott, *Quantum Space: Loop Quantum Gravity and the Search for the Structure of Space, Time, and the Universe* (Oxford University Press), 2018.
(3) J. L. Heilbron, *Niels Bohr: A Very Short Introduction* (Oxford University Press), 2020.
(4) F. Capra, *The Tao of Physics: An Exploration of the Parallels Between Modern Physics and Eastern Mysticism* (Shambhala Publications), 1975.
(5) G. Zukav, *The Dancing Wu Li Masters: An Overview of the New Physics* (William Morrow), 1979.

Splinters of Infinity, by Mark Wolverton (MIT Press), 2024. Pp. 271, 23·5 × 16 cm. Price $29·95 (about £24) (hardbound; ISBN 978 0 262 04882 8).

While the title *Splinters of Infinity* might suggest otherwise, this book is a history of the debate between Robert Millikan and Arthur Compton about

*I use 'generation' here less in relation to the year of birth and more in relation to the period in which the person in question was an active participant in the field.

the nature of cosmic rays and the fate of the Universe. The book tells a chronological story roughly from 1930 to 1937, with some backstory of each of the main characters and of the study of cosmic rays.

Known for their Nobel prizes in quantum physics, Millikan and Compton both shifted their careers to studying cosmic rays, then the cutting-edge physics of their day. Millikan, despite his prior work on electrons, believed cosmic rays were gamma rays. Compton, despite his prior work on X-rays and gamma rays, argued that they were charged particles. What's more is that Millikan, an openly religious man, claimed that cosmic rays were the "birth cries" of atoms being continuously formed and were proof that God's act of creation was still on-going. Following the Scopes trial of 1925, newspapers across the country, including the *New York Times* and the *Los Angeles Times*, revelled in reporting the most prominent American physicist pronouncing the harmony of religion and science and evidence that "the Creator is still on the job", in stark contrast to the prevailing theory even then that the Universe would end in heat death as it slowly disintegrates. Arthur Compton, rising in prominence, confidence, and funding, took up the challenge to align with the growing consensus, especially in Europe, that cosmic rays were charged particles. Articles chronicling the on-going dispute appeared in dozens of newspaper articles — sometimes on the front page — for years.

It may be hard to believe, even for experts in the field, that "cosmic ray" was once a household buzzword, front-page material, and the precursor to modern particle physics. Thought to be a possible source of free energy, cosmic rays attracted charlatans, crackpots, and 'healers' trying to sell their products with the buzzword of the day, much like one might find 'nano' and 'quantum' attached to modern-day equivalents. Cosmic-ray research was the biggest and most cutting-edge science around, and this book recounts the record-setting global expeditions by land, air, and sea to settle the debate.

Mark Wolverton, a science journalist and author of several books blending science and history, adopts a narrative approach to focus on this lesser-known story of scientific history. He is meticulous, evidenced by 22 pages of endnotes that are almost entirely references to books, newspaper articles, and personal correspondence among the main and supporting characters. The book is filled with biographical and historical details. For example, amid the "cosmic ray health centers" and comic-book stories about infinite free energy from the nucleus and from cosmic rays, Albert Einstein told reporters in 1934 that atomic energy was unlikely, giving a sense of the *zeitgeist* of the 1930s.

This book is not technical and would appeal to any reader interested in the historical details that led to our current understanding of cosmic rays and physics more broadly. *TIME* magazine described the Millikan–Compton debate as "one of the most reverberating scientific controversies of the century", more famous in its day than the Great Debate between Shapley and Curtis, but it is nonetheless a MacGuffin, a device to draw the reader in to a case study of science and of scientists, who, as always, are human. In their hunt for the secrets of cosmic radiation, they set hot-air-balloon altitude records, argue over primacy, invent the AND digital circuit, jump to faulty conclusions, drop their equipment to the bottom of a lake, and fall to their deaths in a crevasse — but save the data book. The story shows how science is a messy enterprise, full of ego and dead ends — literally! One also reads about how scientists of that time dealt with the press and public perception, in contrast to scientists of today.

For anyone working on cosmic rays, this book is a must-read. While *Splinters of Infinity* doesn't focus on physics that revolutionized modern technology, like atomic power or lasers, it will, however, interest readers who enjoy the personal and historical sides of science. The reader may also find this lesser-known area of physics interesting in its own right. As Mark Wolverton writes, "Cosmic rays remain one of the most intractable scientific puzzles of all time." — PAUL SIMEON.

At the Crossroads of Astrophysics and Cosmology: Period–Luminosity Relations in the 2020s, edited by Richard de Grijs, Patricia A. Whitelock & Márcio Catelan (Cambridge University Press), 2024. Pp. 333, 25·5 × 18 cm. Price £120/$155 (hardbound; ISBN 978 1 009 35304 5).

The best-known period–luminosity (P–L) relation in astronomy is undoubtedly that for Cepheid variables, discovered (as several of the chapters in this volume tell us) by Henrietta Swan Leavitt, though the powers-that-be have not (yet?) persuaded most practitioners to call it the Leavitt Law. Actually there are many such laws for many kinds of Cepheid variable stars and many other categories. The volume and the symposium it reports address only stellar sources (including binaries), though reverberation mapping of active galaxies (AGN) has a bit of the same flavour.

Did the SOC manage to corral a presentation touching on every known variable category? Not quite. Only the editors' preface mentions ZZ Ceti, V777 Herculis, and GW Virginis, pulsating white dwarfs of spectral types DA, DB, and DOther, which have their own instability strips, but were presumably declared not relevant to cosmology. I am not quite sure this is true, given potential implications for the ages of various stellar populations. But beta Cep, roAp, delta Sct, and gamma Dor do appear among the less-famous classes, not to mention BL Her and SX Phe. And yes, binaries, because the Roche geometry forces a period-separation–stellar-size limit that leads to a correlation of period and absolute brightness.

The front matter lists names of 126 participants, with no affiliations or countries of residence given (those appear only for first authors of the 27 articles). The conference photo, in glorious black and white like all the rest of the volume, is compressed onto a standard single page in portrait format and probably includes a comparable number of people, about whom it can be said that most paid the registration fee (name badges displayed) and at least those in the front row appear to have two legs each and shoes.

Wendy Freedman and Barry Madore are given the first word, on past, present, and future of the Cepheid extragalactic distance scale, and several other papers look specifically at Cepheids (including Type II's and anomalous Cepheids). Stars at the tip of the red-giant branch also get a fair amount of attention. In comparison to earlier studies of variable stars, the dominant impression here is MORE. Data on very many variables have recently come — or are coming — from the *Kepler* mission, OGLE, and *Gaia*. *JWST* is proving its worth both by extending P–Ls into the infrared and also by angular resolution much improved from *HST*. Cepheids in double-lined eclipsing binaries and in open clusters have become routine sources of extra information, though they were, once upon a time, thought not to exist.

Several things left me puzzled. There is a map of Japan (p. 164) showing the location of four 20-metre antennae spread somehow across the country, but the outline is an oval, and no islands are shown. The array is being used to measure parallaxes and circumstellar masers of massive AGB stars. The first author is A. Nakagawa of Kagoshima University, who undoubtedly knows where the antennae are.

Second, one paper discusses the variability (at the level of millimagnitudes) of red supergiants. I had thought of such stars as displaying just a few really big rising and falling convective blobs, which I would not have described as "granulations". Seeking enlightenment from our friend Google, I lit first on a reference to this book chapter and second to the journal article reporting roughly the same information from the same authors.

My third puzzlement concerned a paper dealing with the Period–Wesenheit relations for anomalous Cepheids (though with brightnesses between the two normal types of Pop I and Pop II). Who, I wondered, was Wesenheit? No references with that author's name cited in the paper carrying that title (or any of the others). Could it possibly be a word, not a name? Sounds German. Dust off German–English dictionary from grad school. Well, 'heit' is a particle that turns an adjective into a feminine noun. But Wesen is already a noun (spirit, essence, or some such). Back to the target paper. Lots of light-curves and an expression defining W, but no explanation of the name. Google to a paper by Barry Madore in 1982, which blames or credits our good friend Sidney van den Bergh 1975. Oops. His chapter in Vol. 9 (the last of the eight published) in the Kuiper Compendium, Stars and Stellar Systems. Not on ADS. Query a native speaker of German about the word, which he said is something like essence, but not obvious why it is part of a period–luminosity relation. Back to Madore; well, it is a combination of colours that will remove the effects of reddening if you have the good luck already to know that ratio of total to selective absorption in the colour system you are using, for instance, $A_v = 3{\cdot}1 \times E(B-V)$. And a visiting colleague has just suggested that perhaps Wesenheit is more informative in Dutch. — Virginia Trimble.

Early Disk-Galaxy Formation from JWST to the Milky Way, edited by Fatemeh Tabatabaei, Beatriz Barbuy & Yuan-Sen Ting (Cambridge University Press), 2024. Pp. 133, 25 × 18 cm. Price £110/$145 (hardbound; ISBN 978 1 009 39875 6).

This slim volume is the proceedings of IAU Symposium 377, held in Kuala Lumpur, Malaysia, in 2023. According to the preface the meeting was the first in South-east Asia since 1990 and was intended as a vehicle for raising the profile of astronomical research in Malaysia. There are 20 papers in two sections, 'Galaxies and Cosmic Dawn' and 'Milky Way and M31' plus a single paper on 'Astronomy in Malaysia' (which concerns the possibility that the creation of an ancient inscription was inspired by the AD 760 apparition of Comet Halley). The first section covers a range of topics, most of which have been, or could be, addressed by *JWST* observations, particularly at very high redshifts. The second section is more focussed, with several papers on chemical abundances in early Milky Way stars. Many of the papers are individually very interesting, but the volume as a whole is no more, arguably rather less, than the sum of its parts. Most contributions have already been published elsewhere, where the reader will actually be able to see the magenta crosses, orange dotted lines, *etc.*, alluded to in one figure caption, unlike in the entirely monochrome figure reproduction here. It is also noticeable that since the IAU Symposium volume which I reviewed last year (No. 374), the price has risen by 12%, despite No. 377 being only 40% of the length. It is hard to imagine there being any individual buyers at more than £5 per article, though libraries with long-term CUP/IAU contracts will presumably receive it, even if it never subsequently leaves their shelves. — Steve Phillipps.

Strong Gravitational Lensing in the Era of Big Data, IAU Symposium 381, edited by Hannah Stacey, Alessandro Sonnenfeld & Claudio Grillo (Cambridge University Press), 2024. Pp. 183, 25·5 × 18 cm. Price £120/$155 (hardbound; ISBN 978 1 009 39899 2).

Many of my own papers are on strong gravitational lensing and I considered attending the conference, so it seems appropriate for me to review the proceedings, in part to update myself on the field, which has already benefitted, and will continue to benefit, from recent and planned improvements in observations, hence the 'big data' in the title. The first strong-lensing system (defined as a gravitational-lens system which produces multiple images of the source, as opposed to weak lensing which is limited to magnification and, for resolved sources, distortion) was discovered about 45 years ago[1]. I was involved in a radio survey for strong lensing[2], which, discovering 22 lens systems (including one previously known), approximately doubled the number of known strongly lensed quasars.* As noted in the first contribution in these proceedings, it is expected that instruments such as *Euclid* and the *Roman Space Telescope* will discover about 100 000 such systems. Not only is that a quantitative change, but a qualitative one as well: no one person can have even a passing familiarity with all systems, and 'manual' modelling will have to give way to automated procedures.†

The book consists of five 'chapters' (really parts, if an article is a chapter). Those have no names but roughly correspond to the main topics mentioned in the preface: cosmology, dark matter, galaxies, clusters of galaxies, and high-redshift sources. More-specific topics are machine learning, measuring the Hubble constant, and substructure in galaxies. The book is far too short to give even an overview of the field‡, but does provide a useful short introduction to several currently hot topics. In some areas, applications of gravitational lensing, such as measuring the Hubble constant or small-scale structure in galaxies, are comparable to or better than other methods. For a while now, the theoretical side of lensing has been clear; the next several years will concentrate on the massive amounts of observational data; in that sense, the field now reminds me of that of the cosmic microwave background between *COBE* and *WMAP*, with interesting hints about what is to come, but a while before practical observational limits are reached. It appears that the community is ready.

My goal of getting a feel for current research was fulfilled, though I wonder what I am missing, since, comparing the book with the on-line programme, fewer than half of the contributions are included in the proceedings. (Most of

*At the end of 1998, Wambsganss[3] mentioned that by then "about two dozen multiply-imaged quasar systems [had] been found, plus another ten good candidates". Somewhat more than twenty years later, Hamed & Weisner[4], in an attempt to catalogue all known strong-lens systems, listed 1832.

†Another change is that most people now working in the field are younger than I am (I also know only about half a dozen of the hundred or so participants and recognize perhaps that many names in addition). That is not a problem in itself, but I wonder why there is so little knowledge of the history of the field. Several times at conferences, when meeting someone new who works on gravitational lensing, I've mentioned that I had been a student of Sjur Refsdal, only to be astounded by the fact that the other person had never even heard of him. That's almost as bad as working on the Hubble constant and not having heard of Hubble, especially since Refsdal essentially single-handedly founded the modern study of gravitational lensing, in a series of papers about sixty years ago (while also finding time to co-author what I consider to be the most interesting paper in relativistic cosmology[5].)

‡The proceedings of the 1993(!) gravitational-lens conference ran to 747 pages[6].

those in the proceedings refer to refereed-journal papers, so assuming that that is also true of those not included as well, the information is out there, but not all in one place.) Unfortunately, instead of 'edited', 'collated' might be more appropriate, as apparently little actual editing was involved. Apart from my usual peeves about language and style, the number here probably setting a new record, there are several other annoying aspects: the list of participants is not in alphabetical (nor, as far as I can tell, any other) order; the author index (there is no subject index) lists some people twice, according to the number of initials; the reference format is not uniform; while it is sometimes good to list the titles of papers and even all authors, that is not the case for such a proceedings volume — some of the reference lists which do (the formats differ) are thus longer than the corresponding contributions; many figure captions refer to colour, though in the book itself all of the many figures are in black and white — unless one is already familiar with the topic, it is hard to guess which colour should correspond to which of the fifty shades of grey*; hyperlinks (not showing the actual URL nor any corresponding information) are useless on paper.

One can question the value of publishing books of conference proceedings in this day and age, especially if most contributions are essentially condensed versions of refereed-journal papers which will have already appeared before publication of the book (see also my correspondence piece in this issue[7]). (Although, with many journals now on-line-only, books of proceedings might be an alternative to printing a large number of pages for those who prefer reading on paper.) However, for contemporary readers, they can offer up-to-date reviews of rapidly developing fields (many traditional review articles are somewhat out of date by the time they appear), and questions and answers could prove useful for future historians of science, but neither of those is realized here.

Despite my qualms, for me it was an interesting read, and the relatively short length might even be an advantage if the goal is to get a taste of current research in the field. — Phillip Helbig.

References

(1) D. Walsh, R. F. Carswell & R. J. Waymann, *Nature*, **279**, 381, 1979.
(2) I. W. A. Browne *et al.*, *MNRAS*, **341**, 13, 2003.
(3) J. Wambsganss, *Liv. Rev. Rel.*, **1**, 12, 1998.
(4) A. Hamed & M. Wiesner, *BAAS*, **52**, 140.02, 2020.
(5) R. Stabell & S. Refsdal, *MNRAS*, **132**, 379, 1966.
(6) J. Surdej *et al.* (eds.), *Gravitational Lenses in the Universe: Proceedings of the 31st Liège International Astrophysical Colloquium*, University of Liège, 1993.
(7) P. Helbig, *The Observatory*, **144**, 254, 2024.

Astrophysics is Easy, 3rd Edition, by Mike Inglis (Springer), 2024. Pp. 434, 23·5 × 15·5 cm. Price £24·99 (paperback; ISBN 978 3 031 16804 8).

The third edition of Mike Inglis's book has been expanded to add extra chapters on exoplanets, relativity, and more on cosmology. Various thought questions have been added in the text along with some more mathematical ones at the end of chapters. In a book of this type obviously only a limited coverage can be given to any one topic but I was disappointed to see that in the discussion of planetary nebulae no mention was given to the fact that some of

*Each contribution is available *via* its own DOI. According to the notes on the first page of each contribution, some, but not all, are open-access (confirmed by spot checks). Colour figures are thus available on-line.

the shapes are caused by binary nuclei.

The general idea behind the book is to give the reader some idea of the background physics behind the kind of objects they may be observing. As such most chapters include examples of the kind of objects being discussed so that you have something to follow up on. Unfortunately, the coverage of topics has to be shallow as in most cases a whole book would be needed to cover them in much detail. I thought the chapter on amateur spectroscopy was good as this is an area more amateurs are getting into. I am not sure about the chapters on black holes and relativity. These are undoubtedly things that amateurs like to talk about but the detail here is shallow and the subject is complex.

I found a number of minor issues in the book. In the galaxy-cluster section, it is Stephan's Quintet not Stephen's Quintet. Wolf-Rayet stars are very massive stars that will explode as supernovae not planetary nebulae. In the galaxy section lenticular galaxies are mentioned but no indication is given as to how they form. My biggest quibble, however, was Inglis's use of Caldwell numbers in the sections where he gives objects to look at. There is enough of a problem in the literature with the tower of Babel of names for objects without adding another name to objects that already have perfectly good ones. No serious amateur would ever use a Caldwell number as it only adds to the confusion. Inglis also uncritically refers to some of the more extreme observations that are claimed in the (in particular US) amateur community. I would also question the reference section as it is mostly Springer books of variable quality and accuracy.

Given the above I would suggest that if someone wanted an overview of many of the topics the book would work but they would need to find another book to cover the interesting parts of many of the topics. I must admit I liked the earlier editions of the book, this one not so much. — OWEN BRAZELL.

Essays on Astronomical History and Heritage: A Tribute to Wayne Orchiston on his 80th Birthday, edited by Steven Gullberg & Peter Robertson (Springer), 2023. Pp. 700, 24 × 16 cm. Price £109·99 (hardbound; ISBN 978 3 031 29492 1).

Wayne Orchiston, who turned 80 in 2023, has a great many friends, and 37 of us have contributed to the chapters of this volume. Though planned several years ago, it was not quite ready for presentation on his birthday celebration, and many months after official publication, many of us are just receiving the complimentary copies that are our second most important reward for contributing. The most important, of course, was the opportunity to say good things about Wayne! Orchiston was the founder of the *Journal of Astronomical History and Heritage* and still keeps a few fingers in that pie. He also founded two IAU Working Groups, and has been a leading presence in history of astronomy for many decades. Editor Robertson, after a career in science publishing, went "back to school" and earned a PhD in history of science with Orchiston. Gullberg (also an Orchiston student) recently (2024 May) announced triumphantly that the IAU Working Group he had been chairing was being abolished. Why? Because it is going to become a Commission (C5) on Cultural Astronomy.

What is on these 700 pages? It has been claimed that a complete model of the Universe would have to be as large (and perhaps as old) as the Universe itself. That is, a proper description of this tribute volume would also be 700 pages long, exceeding the capacity of the brown paper envelopes in which *The Observatory* travels to us. But my late Aunt Esther from Missouri said every meal needed seven sweets and seven sours. So here are seven frivolous items and seven serious ones (though the distinction is probably debatable for most, depending on whether you hear Mozart's last piano concerto as triumphant or mournful): (*i*) a five-metre-tall snowman on the campus of Williams College, posing with (sadly now deceased) author Jay Pasachoff and his wife Naomi, connoisseurs of solar eclipses; (*ii*) a Chuppah illustrating a transit of Venus, quilted by author Sarah Schechner for her 2013 marriage to the mechanic who had helped her dismantle a historic telescope, so that it could be reassembled and used for viewing the 2004 Venus transit; (*iii*) a calendar on which February has 30 days, while Sweden was switching from Julian to Gregorian calendar as described by author Lars Gislen; (*iv*) William Herschel claiming "the great probability, not to say almost absolute certainty of the Moon being inhabited" in the chapter by W. T. (Woody) Sullivan (more often associated with the history of radio astronomy); (*v*) a shepherd herding Inca constellations of the Serpent, the Toad, the Tinamou, the Mother Llama, the Baby Llama and the Fox, followed immediately by the Roasted Guinea Pig for dinner during author Steve Gullberg's trip to Peru; (*vi*) Joseph Weber with his childhood Jew-fro hairstyle only partly tamed by the US Naval Academy, shown to authors Trimble and Robertson; (*vii*) Joe Shklovsky wearing a 10-gallon Texas hat at the Fourth Texas Symposium in Dallas (1968 December) as immortalized by the camera of author Ken Kellerman.

And the Seven sours: (*i*) "the sad reality that this traditional [Australian Aboriginal] knowledge has been severely damned from the effects of invasion, colonialism, and community displacement" as discussed by authors Trevor Seaman and Duane Hamach; (*ii*) "the vexed and tendentious history of lunar nomenclature" that seems to have deprived some astronauts of "their" lunar craters, as pointed out by author William Sheehan (but, back at "frivolous" you should see Mount Marilyn!); (*iii*) the crew abandoning the incandescent USS Lexington in the Battle of the Coral Sea, shortly before John Bolton joined the British aircraft carrier HMS *Unicorn* which just barely fit under Sydney Harbour Bridge according to Trimble & Robertson; (*iv*) the rise and fall of time determination and dissemination as a justifying purpose for astronomical observatories, appearing in the chapters by Steven J. Dick and Roger Kinns; (*v*) what is apparently a genuine 1917 photograph of Sydney Observatory followed by dismissals from the government astronomer William Cooke in both 1925 and 1926 noted by author Nick Lomb; (*vi*) the sad-looking images of the sites of what were once the pioneering field stations of Australian radio astronomy, many photographed by author Harry Wendt; (*vii*) the narrow bounds of what astronomy should mean, as set by Bessel writing to Humboldt to encompass "precise measurement of the positions and orbits of celestial bodies…their appearance and the constitutions of their surfaces is not unworthy of attention, but is not the proper concern of astronomy," as quoted by [the late*] Alan. H. Batten. Luckily he was outvoted by astronomers adopting photography and spectroscopy. And every one of the chapters from which no quote is given above has something in it to cheer, puzzle, or inspire astronomers who are interested in our own history! — Virginia Trimble.

Atlas of the Messier Objects. Highlights of the Deep Sky, 2nd Edition, by Ronald Stoyan (Cambridge University Press), 2024. Pp. 372, 31·5 × 27 cm. Price £59·99 /$79·99 (hardbound; ISBN 978 1 00 936406 5).

The first edition of Ronald Stoyan's *Atlas of the Messier Objects* was an

* See obituary on p. 268

instant success and although now out of print commands a significant price on the second-hand market. Thus, the appearance of a second edition is to be welcomed. First of all it must be said this is not a guide that you would take into the field but a reference book for the home. The second edition has been considerably updated with new images for many of the objects and the astrophysical data updated to include distances from *Gaia* DR3 along with other information that has come to light since the publication of the first edition. Although the book has more pages than the first it is also thinner indicating a different type of paper. It is, however, still very heavy.

The book contains much useful information on Messier himself and the telescopes he used, as well as an English translation of his catalogue. The book also contains some information on the forerunners to his catalogue and the work that contemporaries were doing in cataloguing nebulae. There is also a brief section on the astrophysics of the types of objects found in the Messier catalogue. The main part of the book is ordered by the Messier catalogue number and the section on each object contains information on its history, what is known about it, and observations of it. Note that there are no charts to show where they are, hence it not being a field guide. The book could be combined with Stephen O'Meara's Messier book from the CUP *Deep Sky Field Guides* series to get more information, although much of the information in that book is now out of date. The reproduction of the drawings and images in the *Atlas* is first class which adds to the lustre of the book.

I found very few issues with the book and only a couple of nit-picking errors where the discoverer of M 1 was called Charles Bevis rather than John Bevis in one part, although correctly attributed later, and Admiral Smyth was referred to as Admiral Smith. I also found the text in the reference section was so small that one would need a magnifying glass to read it. These, however, in no way detract from an excellent publication that should be on the bookshelves of any deep-sky observer. I would suggest that this is now the definitive guide to the Messier objects. — Owen Brazell.

From The Library

Three Views of the Cosmos

The Great Ideas Today: Ptolemy, Copernicus, and Kepler, by Owen Gingerich, in *Encyclopedia Britannica*, 1993. Pp. 137–180.

Cosmology, by E. Finlay-Freudlich, in *International Encyclopedia of Unified Science* (University of Chicago Press), 1951. Vol. 1, No 8, 1951. Pp. 1–59.

The Recent Renaissance of Observational Cosmology, by D.W. Sciama, in *Atti della Reunion di Studio su Problemi di astrofisica* (Torino), 1969. Pp. 21-47.

These three came to me as part of the RAS Library deaccession project, with some of their pages still uncut. A nail file completed that task, revealing three very different opinions on what has been known about the Universe at various times and who is likely, or should be likely, to care about it all anyway

Each of the three has something you may never have thought of and could potentially enjoy. Gingerich uses the methods and data given in Ptolemy's *Almagest* to calculate the longitude of Mars on a particular date some 361 years after the death of Alexander the Great. And yes, he gets Ptolemy's answer, given in *Almagest* X, 8, but then has to ask the question "Did Ptolemy cheat?" The catch is that the observations Ptolemy used to select values of the five necessary quantities in the method (things like the ratio of the epicycle to the deferent) disagree with what the actual positions were on the advertised dates by as much as 1·4 degrees. Gingerich ends that section by telling us that astronomers have been aware of such problems with Ptolemy's data for a couple of centuries, and that, what is more, it is not the task of the historian of science to cast moral judgements on pioneers of the past.

For Finlay-Freundlich (who added the birth surname of his mother after moving out of Germany), the most important question is whether the Universe is closed and finite. He was of the opinion that "the relativistic treatment of the cosmological problem promises to give in the future a definite answer to the one question which appears to be the highest prize of all efforts, namely the question: Is the universe closed and finite?" He was worried that with H_0 somewhere around 500 km/sec/Mpc, "closed" would be rather small. And he carries lambda as a lower-case Greek letter with him for the rest of the chapter to expand the range of possibilities. Can we say that another 53 years of observations have justified his optimism? Maybe.

But as has been the case with others of my RAS Library acquisitions, perhaps the most interesting item in this brief volume is a yellowing invoice made out by B. H. Blackwell, Ltd., University Booksellers of Oxford to G. J. Whitrow, Esq. of Clapham, London SW4. That is to say that Whitrow's interests extended beyond philosophy of time to the observed Universe at least to the extent of 9 shillings, 9 pence (including 3 pence postage). This in turn gives your reviewer an opportunity to thank reader Steven Phillipps, who has found Rev. Richard Lacey Webb, a mystery guest in an earlier 'From the Library' review. He was the son of a bank clerk from Brecon, Wales, born in Bristol on 1909 May 29. He died as recently as 2004 November 30 in Norwich, having been rector of Wacton in Norfolk and later Rural Dean of Rockford and Norfolk. He was sufficiently interested in the cosmos to supplement one of his purchases with information from a newspaper article.

This brings us to Dennis Sciama, who by 1969 had given up confidence in Steady State cosmology in favour of the very isotropic microwave background radiation (implying a singularity in the past). He even presents Cavendish data on counts of radio sources ($\log N - \log S$), showing a slope steeper than $n = -1{\cdot}5$ at the bright end, implying evolution of the source populations. He accepts that He/H would be only about 0·01 by number, not 0·1, if stars were the only source, writes of the αβγ proposal, and cites Wagoner, Fowler, and Hoyle for their 1967 calculation of the production of H, He, D, He-3, and Li in a hot Big Bang. The observation Sciama was looking forward to was the motion of our Earth relative to that microwave background, as a "linkup with Mach's Principle, which asserts that local inertial frames are unaccelerated relative to the Universe as a whole. We are on the verge of great clarification." Well, Mach's Principle, fondness for a finite closed Universe, and repeating Ptolemy's calculations do seem to have gone more or less out of fashion. But we still live in both wonderful space and 'Interesting Times', with the possibility of continuing to learn from our predecessors. — VIRGINIA TRIMBLE.