than being separated by chapters or sections, say), readers not interested in the latter (I can't think of any who would be interested in the latter but not the former) can't easily read around them.

I learned much about Penrose which I didn't know before. How much I needed to learn (and about what) is another question, and I would have liked more in-depth descriptions of various aspects of his work, such as the singularity theorems, spinors, non-periodic tiling, *etc*.— but at a level less demanding than in his rather technical *magnum opus*[5]. (Other aspects of his work, such as his recent ideas on cosmology and his somewhat older ideas on consciousness, don't interest me as much, and also Penrose has documented them well at the desired level in other books[1,2,6].) As there is not much concrete description of science (Penrose's or others'), there was little opportunity to notice mistakes. However, an expanding Universe does not necessarily imply that it must have a beginning. A newborn certainly has more than two trillion atoms. I also doubt that Hawking had to pursue mainstream success because he needed money to cover medical and physical care.*

In summary, I didn't feel that reading the book, which is written well, was a waste of time, but I think that a shift of emphasis would have made that time more valuable. — Phillip Helbig.

References

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(5) R. Penrose, *The Road to Reality* (Jonathan Cape, London), 2004.
(6) R. Penrose, *Cycles of Time: An Extraordinary New View of the Universe* (Bodley Head), 2010.
(7) R. Penrose, *Fashion, Faith, and Fantasy in the New Phusics of the Universe* (Princeton University Press), 2016.

Starwatchers: Our Journey of Discovery in the Night Sky, by Joanne Baker (Bloomsbury), 2026 (first published 2025). Pp. 271, 20 × 13 cm. Price £10·99 (paperback; ISBN 978 1 5266 0801 7).

I remember Joanne Baker from cosmology conferences in the second half of the 1990s. After a good career start in academia (doctorate from the University of Sydney, NASA Hubble Fellow at Berkeley, Royal Society University Research Fellow at Oxford), she moved into writing (books) and editing (for *Nature* and *Science*). This book has three (long) chapters (divided into sections) on the Moon, the Solar System, and the rest (stars, galaxies, the Universe). Like a few other books[1–4] I've recently reviewed[5–8] in these pages, it is not about just astronomy but also the relationship between humanity and the heavens. The emphasis on the latter is strongest in the first chapter and weakest (but still present) in the third. I particularly enjoyed the first part, perhaps because I learned the most from it. While many expected topics are explored, we also get details on James Nasmyth and his lunar models, 'Moon madness', and non-Western cultures. The second chapter is the longest. It is not a systematic survey of the Solar System, but a mixture of planetary science, the history thereof, and the role the planets have played in human history. Like the rest of the book, the aim is to explore selected topics in a bit more detail, rather than give a superficial survey of many more. The third chapter covers astrometry, stellar distances, the Milky Way, spiral galaxies,

*Hawking has stated that he was happy with NHS care. Much later, after his tracheotomy in 1985, the NHS would have paid for nursing-home care or less than round-the-clock care at home, but as his wife wanted him to remain at home with round-the-clock care; the bill was footed by the MacArthur Foundation.

and the 1920 'Great Debate' between Shapley and Curtis*, before shifting gears somewhat to discusss the influence of modern physics on astronomy, radio astronomy, extraterrestrial life, radio astronomy, black holes, the dark sector, philosophical aspects of cosmology, and the possible fates of the Universe. The epilogue, like the introduction, provides details of Baker's own quest to connect with the Universe.

As usual, I have a few complaints about the discussion of cosmology. While some of them concern what are probably just careless typos or bad editing (on the whole, though, the book is written and edited well), the claim that "there was no need for a repulsive force to counter gravity, or to fling bodies apart" in Einstein's original cosmological model, and thus astronomers struggled to explain the expansion of the Universe, is essentially backwards: *without* such a force (a positive cosmological constant), Einstein noticed that he could not have the static model he wanted, so introduced such a repulsive force, though to keep the universe from collapsing, rather than causing it to expand. (It was later realized that there are non-static cosmological models both with and without a cosmological constant.) Perhaps the confusion stems from the wrong idea (which I've noted in some other reviews) that the cosmological constant (or dark energy) somehow causes the expansion of the Universe (not just its acceleration). Later on, she writes "Back in the 1910s, Einstein set [the value of the cosmological constant] to zero and it was effectively dropped: there was no need for it, and it made no difference to the calculations." Again, essentially backwards. (Later on, Einstein did drop the cosmological constant once he realized that the Universe is expanding, and of course it can make a profound difference to the calculations.) Another blunder is lumping different sorts of Multiverse into the same category; Tegmark[9,10] spells things out clearly. However, that is made up for by alerting me, in the suggestions for further reading, to a book on the Multiverse I hadn't yet heard of[11].

The book is written well and there are fewer typos and questionable style choices than in most books I've reviewed in these pages. There are 16 pages of high-resolution colour plates at the middle of the book, a useful addition. There are neither footnotes nor endnotes. The main text is followed by two pages of acknowledgements, four of suggestions for further reading grouped by chapter (about 20 suggestions, mostly books, for each), a particularly thorough ten-page small-print index, and a page of picture credits. I've read several of the books suggested for the topics in the third chapter, and reviewed some of them here.

This book should be added to a list of books to read on the history of the relationship between humanity and the heavens. While modern astronomy gives us more data than ever before, even many astronomers, not to mention non-astronomers, don't have the emotional connection to the sky which was common in the past. While observations improve almost automatically due to better technology, the emotional bond, in the past part of the culture, is something for which today one has to take the time to form on one's own. The rewards might not be conventional ones, but nevertheless worth pursuing. — Phillip Helbig.

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(1) M. Capaccioli, *The Enchantment of Urania: 25 Centuries of Exploration of the Sky* (World Scientific), 2024.
(2) R. Trotta, *Starborn: How the Stars Made Us—and Who We Would Be Without Them* (Basic Books), 2023.
(3) L. Gamwell, *Conjuring the Void: The Art of Black Holes* (MIT Press), 2025.
(4) H. S. Kragh, *The Universe: A Guide to Everything* (Reaktion Books), 2026.
(5) P. Helbig, *The Observatory*, **145**, 42, 2025.
(6) P. Helbig, *The Observatory*, **145**, 180, 2025.
(7) P. Helbig, *The Observatory*, **146**, 2026, 211.
(8) P. Helbig, *The Observatory*, **146**, 2026, 214.

*Baker describes Curtis as "working just up the road" from Shapley. At the time of the debate, Shapley was at Mount Wilson and Curtis at Lick (moving to the Allegheny Observatory later in the year). After his move to Harvard the following year, Shapley perhaps became more famous, but at the time Curtis, more than 13 years older, was the senior figure.

(9) M. E. Tegmark, *Our Mathematical Universe* (Allen Lane, London), 2014.
(10) P. Helbig, *The Observatory*, **134**, 150, 2014.
(11) M.-J. Rubenstein, *World Without End: The Many Lives of the Multiverse* (Columbia University Press), 2014.

Weird Universe: Everything We Don't Know About Space (and Why It's Important), by Erika Hamden (Mango), 2025. Pp. 189, 20·5 × 13 cm. Price £15·99 (paperback; ISBN 978 1 68481 728 3).

Erika Hamden is professor of astrophysics at the University of Arizona, where she is also director of the Space Institute. In 16 chapters (plus introduction and conclusion), this is an 'interesting facts' book, in that respect similar to a few[1–3] I've reviewed[4–6] in these pages, though the chapters here are longer. One could group them into 'General Relativity and Cosmology', 'Stars', 'Planets' — moving in — before moving out to the early Universe, the future of the Universe, and the dark sector, concluding with a couple of summary chapters. The topics are perhaps 'weird' in the sense that they differ from our day-to-day experience, but are thoroughly mainstream science. (Of course, the book doesn't really include *everything* we don't know.) By choosing only a few topics, somewhat more depth is possible than with typical popular-science-level introductions to astronomy.

Sometimes good things come from mistakes. In this case, her clear statement (p. 90) that 'revolution' in the political (or similar sense) is due to Copernicus's 'revolutions' (the *revolutionibus* in the title of his famous book) having a similar effect on science caused me to investigate the etymology. Both stem from the Latin term for 'turn around', but both meanings arose independently. (In fact, in the political sense the original meaning was more that of a cycle or return to the 'good old days' than the violent overthrow of an *Ancien Régime*, the latter becoming common only after the French Revolution.) Thus, 'Copernican revolution' is a pun or loaded metaphor. But sometimes they don't. As is often the case, some common cosmological misconceptions are repeated, such as the ideas that dark energy is responsible for the expansion of the Universe (p. 158). A very charitable reading could make a case for a confusing passage (p. 165) being correct, but most readers will probably take from it that a 'coasting universe' "in which the expansion continues forever, but at an unchanging rate" would be substantially younger than our Universe. Actually, by what appears to be coincidence, the age of our Universe is almost exactly the same as that of such a 'coasting universe'[7,8]. It's not the first time I've wondered why an author is so confident (p. 165) that our Universe is spatially infinite (though of course the observable Universe is not). Observationally, we don't know, since it is very close to being spatially flat, which is the border between finite and infinite. Theoretically, there are various arguments favouring a finite Universe. Similarly, I've often read that it is possible to measure the recession velocity of a galaxy (p. 167); it can be calculated *via* $v = H_0 D$ (the Hubble constant relates the expansion rate to the proper distance, independently of the cosmological model — but if we already know the distance, we don't need the velocity to do cosmology.*) A somewhat rarer claim (p. 168) is that "the most distant galaxies . . . were moving away from us *faster* than they should have been if the expansion of the universe were constant" [emphasis in the original]. Actually, it is the other way around, as the present expansion rate is fixed by H_0; acceleration thus implies that distant galaxies were moving *more slowly* when the light we detect today was emitted. (The current expansion rate is of course given by $v = H_0 D$.) On p. 176: "Dark matter was first discovered and observed by the American astronomer Dr. Vera Rubin in the 1960s." The concept of dark matter and observational evidence for it goes back much further (*e.g.*, ref. 10 and references therein). (Also, "in the 1960s" is stretching it a bit; presumably the first flat-rotation-curve paper co-authored by Rubin[11] described some work which might

*See the more detailed discussion in another review[9] in these pages.