is a very detailed discussion of the concepts of power laws in astrophysics with comparison to observations both from space and ground-based. In the realm of solar physics, which is the main expertise of the author, power laws in size distributions are extremely common and are particularly well illustrated in this book. For those not especially familiar with self-organized criticality, possibly a more general introduction to the subject might profitably be read in combination with this specialized monograph. — Ken Phillips.

A Brief History of Black Holes: And Why Nearly Everything You Thought You Know About Them is Wrong, by Dr. Becky Smethurst (Pan Books), 2023 (originally published 2022). Pp. 290, 19·7 × 13 cm. Price £10·99 (paperback; ISBN 978 1 5290 8674 4).

According to the back-cover blurb, Smethurst is YouTube's most popular astrophysicist. With an impressive list of awards, she is also an RAS Research Fellow at the University of Oxford, focussing on the interaction of supermassive black holes and galaxy evolution. In contrast to the next book I read[1,2], this is very much a book about astrophysics and the roles black holes play in it. The scope is broad and starts with background, both physical and historical, about stellar structure and evolution and General Relativity (GR) before coming to black holes themselves (some pre-GR ideas about black holes are briefly mentioned). Throughout the book, the history of the topic is well entwined with the astrophysics being discussed, an organic whole rather than a straight history of science about a topic which is still relevant or a book on astrophysics with historical footnotes. Traditional (non-quantum) black holes and other compact stellar remnants set the stage for more concrete astrophysics (the chapter on why black holes are not black is not about Hawking radiation, but about X-ray astronomy). Black-hole mergers and their detection *via* gravitational waves, the possibility that Planet 9 is a black hole, supermassive black holes, accretion discs, and the role of black holes in galaxy evolution are among the topics in the fifteen relatively short chapters. The final chapters deal more with the mathematical theory of black holes and Hawking radiation, though like the rest of the book in a non-technical manner.

The book is well written in an entertaining style and is a good non-technical introduction to the importance of black holes in astrophysics. Since her research is also on that topic, I feel safe in recommending it. I enjoyed reading it except for the very end. The book only briefly discusses the CMB, but I found it strange that while *WMAP* is mentioned, *Planck* is not. Although they make up only a small part of the book, the final pages discussing cosmology contain several mistakes. First, the density parameter is explicitly defined to include matter, radiation, and dark energy, but is followed by an almost standard textbook discussion for the case of no dark energy. But even that is not correct, because the description of eternal (asymptotically exponential in the case of a positive cosmological constant) expansion is conflated with the idea of the Big Rip, in which even (gravitationally or otherwise) bound objects will be torn apart, though that could happen only with a non-standard, highly speculative form of dark energy. If, as explicitly stated, the cosmological constant is not assumed to be zero, then the relation between geometry and destiny, *i.e.*, between spatial curvature and the future expansion (or contraction) of the Universe, is much more complicated. However, again the textbook version with no cosmological constant is presented. While it is correctly stated that *WMAP* measured the Universe to be at least very nearly spatially flat, that is characterized as being

on the border between Big Rip and Big Crunch; in fact, there is no uncertainty at all in the concordance model of cosmology that the Universe will expand forever (unless something unknown has not been taken into account, but that would go beyond the concordance model); geometry and destiny are not so simply related. Those are not fine technical details but rather the most basic ideas in cosmology, so I find it rather strange that those and other basic misconceptions are also found within other popular-science books written by people who obviously know more than enough people who could have critically read the manuscript (*e.g.*, refs. 3,4). (There are a few other things a proof reader should have caught: Kirchhoff always has one 'h' too few and Secchi sometimes one too many; Rutherford won a Nobel Prize, but for chemistry, not physics.)

There are a few black-and-white figures scattered throughout the book. The brief bibliography contains twelve references, but it is not clear why those twelve (which are not mentioned explicitly in the text). One hundred and sixteen footnotes (easy to count since numbering doesn't restart with each chapter) will appeal to those who, like myself, like footnotes (especially when compared with endnotes). A twelve-page small-print index ends the book. The book does what it sets out to do well, but shouldn't have included the few pages on cosmology at all; even if they were correct, they don't really belong in a book about the astrophysics of black holes, so I can recommend it if the last chapter is skipped. — Phillip Helbig.

References

(1) B. Cox & J. Forshaw, *Black Holes: The Key to Understanding the Universe* (William Collins), 2023.
(2) P. Helbig, *The Observatory*, **145**, 129, 2025.
(3) P. Helbig, *The Observatory*, **144**, 38, 2024.
(4) P. Helbig, *The Observatory*, **144**, 201, 2024.

Annual Review of Earth and Planetary Sciences, Vol 52, 2024, edited by R. Jeanloz & K. H. Freeman (Annual Reviews), 2024. Pp. 692, 24 × 19·5 cm. Price $529 (for institutions; about £420) $126 (for personal copies; about £100) (hardbound; ISBN 978 0 8243 2052 2).

The latest volume of *Annual Review* covers a nice diversity of subjects that includes the biosphere, mantle composition and dynamics, the atmosphere, and the hydrosphere. An old Icelandic saying is that a good story should start with an earthquake and then build up to a climax. This year's volume seems to have paid attention to this, and starts with chapters on volcanism in Hawai'i and aftershock forecasting. Highly recommended. A chapter on microbial life brings home the message that this is the foundation, both in longevity and mass, of life on Earth. Microbial life is not just the icing on the cake. The development of this is covered by a following chapter on early Paleozoic evolution and the door is then closed by a chapter on the Pleistocene extinction. The interior of Earth is discussed in a variety of chapters on halogen cycling, diamonds, lithosphere, and mantle rheology. As regards the deeper mantle, despite all our work it seems still unclear whether it has a similar composition to the upper mantle (and thus convects as one with it) or not. Differences of up to 10% seem possible. Climate is represented by chapters on the stability of ice shelves and past hothouse climates. A chapter on carbon-climate feedbacks directly addresses the implications of the Paris Agreement. The situation is challenging, even if the main goal is met, which itself seems improbable. Uncertainties are large, but one thing we can confidently say is that natural carbon sinks will become less efficient with time. An interesting chapter deals with that part of deep