and subsequently connecting them to previously discussed GR solutions. A detailed examination of the thin-disc model follows, with attention to other disc types, particularly in the super-Eddington regime (slim discs and advection-dominated accretion flows). The chapter concludes by addressing accretion-flow simulations and associated numerical pitfalls.

The second half of the book delves into frontier research topics. Chapter 5 covers various theoretical aspects of black-hole growth, including gas-transport mechanisms and chaotic accretion. It extensively discusses misaligned accretion discs, applying the same theory to circumbinary discs and their significant role in orbital shrinking and the final-parsec problem. Tidal-eruption events and the novel field of quasi-periodic eruptions are also explored, with the latter potentially providing crucial insights into low-mass black holes. Chapter 6 is a deep dive into the black-hole–galaxy scaling relations, with a focus on the AGN wind-driven scenario, supplemented by alternative explanations like deriving scaling relations from the assembly history. Observational constraints, especially from AGN in dwarf galaxies, are also analyzed. Chapter 7 reviews other forms of AGN feedback, in particular radiatively-driven winds and jets. Different jet-production mechanisms and jet precession are discussed from both observational and theoretical perspectives. The book concludes with Chapter 8, which broadly addresses 'black-hole growth' and the process of constraining different theoretical models through observations, including the AGN luminosity function, supermassive-black-hole-mass limits, and deviations from the scaling relations. Each chapter includes problem sets for further engagement.

Personally, I found the book to be a highly enjoyable read, offering a comprehensive overview of crucial theoretical concepts related to supermassive black holes. Andrew King presents the material in an accessible manner, making it particularly well-suited for graduate students embarking on their journey in this field. Additionally, advanced undergraduates seeking background reading for research projects could find this book valuable. It is also an excellent resource for individuals transitioning from a general physics background to astrophysics, as it illuminates the connections between General Relativity, fluid dynamics, and the intricate world of AGN physics. As I pass the book on to my summer student, I wholeheartedly recommend it to anyone interested in exploring the fascinating world of supermassive black holes. — Sophie Koudmani.

Simulating the Cosmos. Why the Universe Looks the Way it Does, by Romeel Davé (Reaktion), 2023. Pp. 199, 22·5 × 14·5 cm. Price £15·95 (hardbound; ISBN 978 1 78914 714 8).

Who would have thought that a book on numerical modelling could be such fun! A leading practitioner of the art, Davé demystifies the black boxes of N-body simulations, hydrodynamical modelling, and the rest in irreverent style, exemplified, perhaps, by the final sentence of Chapter 1, prior to embarking on modelling the Universe: "To do this, we're going to need computers. Big ones." The first chapter itself sprints through the development of cosmology, both observational and theoretical, from Hubble and Lemaître through the CMB and inflation to the concordance model of ΛCDM in 40 pages. While unsurprisingly light on the nuances of the history, this provides an excellent background for the later chapters on 'Putting the Universe on a Computer' and on the ever-improving simulations of large-scale structure and the formation and evolution of galaxies (including a section 'Are We There Yet?'). The easygoing style means that you are soon reading about time steps and particle-mesh codes without realizing that it's become more technical. At the end, there is even room for a discussion of whether we live in a simulation. References to academic papers are provided for those wishing to dive in deeper, but this is essentially the nearest you can get to light reading on numerical cosmology. Highly recommended — especially given the remarkable price for a hardback these days. — Steve Phillipps.

The End of Everything (Astrophysically Speaking), by Katie Mack (Penguin), 2021. Pp. 238, 19·5 × 13 cm. Price £9·99 (paperback; ISBN 978 0 141 98958 7).

Katie Mack has "[bounced] back and forth between physics and astronomy departments, studying black holes, galaxies, intergalactic gas, intricacies of the Big Bang, dark matter, and the possibility that the universe might suddenly blink out of existence" and "even dabbled in experimental particle physics for a while"; she now holds the Hawking Chair in Cosmology and Science Communication at the Perimeter Institute for Theoretical Physics in Canada and has written many popular-science pieces in various media, though this is her first book. There are many books, from popular-science books to technical monographs, about the origin of the Universe, but comparatively few about the possible ways it might end. After an introduction and summary of the history of the Universe from the Big Bang until now, she looks at five ways the Universe could end: Big Crunch, Heat Death, Big Rip, vacuum decay, and bounce.* The final chapter before the Epilogue starts with a discussion of a paper[7] in this *Magazine* by the later Astronomer Royal Martin Rees, 'The collapse of the Universe: an eschatological study'. (At that time, a Big Crunch seemed most likely — though Rees also touched on a 'conventional' Big Bounce — but today that seems to be the least likely possibility.) That is followed by a look at Dyson's view[8] assuming that the Universe will expand forever before current (and future) experiments and various ideas about where theory might be heading are discussed. The Epilogue features Rees again and other scientists talking about their personal feelings regarding the end of the Universe.

On the whole, the book does its job well, giving a popular-science-level introduction to some ways in which the Universe could end (as well as a summary of its history). Many readers might not have heard of the Big Rip or vacuum decay, and those are explained clearly and well. My main gripe is that it gets some things wrong regarding traditional observational cosmology. While it is not uncommon for confusion to arise from over-simplification, that shouldn't be a problem for a professional science communicator. The problem is not a new one: confusion related to 'the redshift–distance and velocity–distance laws'.† At the latest after the publications of Harrison's paper[9] with that title, no-one should still be confused, but many, even some professionals, are.[10] The Hubble–Lemaître law, that recession velocity is proportional to

*Tegmark [1,2] (the latter reviewed in these pages[3]) also discusses five ways in which the Universe might end: Big Chill (Heat Death), Big Crunch, Big Rip, Big Snap (can occur if the fabric of space is not infinitely stretchable), and Death Bubbles (vacuum decay; also known as the Big Slurp), but not a bouncing Universe. Of course, in some sense a bouncing Universe doesn't end, but the main reason for the difference is probably that the Big Snap has not been discussed as much as the other four, while the old idea of a bouncing or, in general, cyclic Universe (*e.g.*, ref. 4) has become more popular recently in the context of the ekpyrotic model[5] and Conformal Cyclic Cosmology[6].

†The second footnote on p. 58 provides almost a textbook example of the confusion Harrison[9] addresses.