reader off to the broader literature to come up with their own hypotheses and analyses. Such explorations would certainly be rewarding, but, in a world where students increasingly use Large Language Models to answer such homework questions, they may be less useful in a formal teaching environment. The goal of the book, to cover the field of astrobiology in its true breadth, from stars (and even from before stars form) to life, is fully achieved, and there will almost certainly be something new here for anybody involved in astrobiology. Highly recommended, and already added to the reading lists of relevant courses that I teach. — Dave Clements.

The Blue Straggler Mystery, by Martin Beech (World Scientific), 2026. Pp. 271, 23·5 × 15·5 cm. Price £55 (hardbound; ISBN 978 981 98 2008 5).

Blue stragglers are stars that lie in the vicinity of the main sequence in a cluster colour–magnitude (or HR) diagram, but bluewards of the cluster turn-off. The 'mystery' is, or rather, was, how they come to be there when, in the simplest scenarios, they should've evolved away to the red. This nicely produced little hardback (also available as an e-book) pursues that question, using the device of allusion to detective fiction (particularly Sherlock Holmes) to frame the chase.

This is more a scholarly book than a 'popular' one, though written in a relaxed narrative style. The first two chapters — roughly half the page count — present a primer in basic stellar astrophysics ('The measure of the stars', 'How the stars work'), with the third ('Making blue stragglers') reviewing the historical development of solutions to the 'mystery'. A final 50-page chapter ('And finally. . . ') is a speculative ramble touching on topics as diverse as alien civilizations, black holes, artificially engineered stars, and much else that seemed to me to be only tenuously linked, at best, to blue stragglers. Simple equations are sprinkled throughout the text (minimal calculus and no derivations), as are graphs and other diagrams, along with a few astronomical images. Colour is used to good effect, and each chapter is supported by a page or two of references. There is no index.

The acknowledgements don't include a nod to anyone for proof-reading the manuscript, which may explain the smattering of infelicities and oddities. Pretty much all are harmless (*e.g.*, are radio astronomers really not observers [p. 34]? Was a wide-field, shallow image of the Pleiades really obtained with *HST* [p. 57]?) or even amusing (stars "sliming down" [p. 88]), although the naïve reader may wrongly infer that neutron-star magnetic fields are a proximate consequence of convection [p. 137]. A forceful editor may've also reined in the author's rather intrusive predilection for the word 'indeed'.

Regardless of these trivial quibbles I found the book to be an engaging and pleasant enough read, even if the content of the last chapter wasn't much to my taste. The real mystery for me was: for whom is the book intended? It's too technical for a general readership; didactic, but not suitable for use as a textbook; and the principal topic is so narrow that the interested researcher is likely to go directly to the primary literature. I therefore turned to the World Scientific website, where I learned that, apparently, the "target audience for this book is the undergraduate science student, and the informed, general-reader on topics relating to astronomy and physics." Elementary. — Ian D. Howarth.

Crush: Close Encounters with Gravity, by James Riordon (The MIT Press), 2025. Pp. 287, 23 × 15 cm. Price $29·95 (about £22) (hardbound; ISBN 978 0 262 05098 2).

This might be the only book to discuss both event horizons and the anatomy of snakes.

The name James Riordon seemed familiar to me, but probably because I was thinking of James Riordan, who played a role in the *Apollo 13* mission. Or perhaps because I had come across something else by the author, NASA-affiliated science writer James Riordon. Confusingly, the author's father (also James Riordon) also worked for NASA, on the Apollo and Space Shuttle programmes. (Finally, an internet search for 'Riordon' and 'Apollo' will probably find Rick Riordon, author of *The Trials of Apollo*, who has written many books for children which adapt ancient Greek and other mythologies for a modern readership.) This is a book about gravity, but, compared to the books about General Relativity (GR) I've reviewed in these pages, it takes a very broad view of its topic.

It starts off familiar enough, with a short zeroth chapter on Newton. The next two chapters discuss the effects of gravity on humans and other animals. (The position of the heart in a snake depends on whether it lives mostly underwater, crawls on land, or climbs trees; the different positions are adaptations to the different effects of gravity on blood circulation.) While its effects on humans are of course familiar to me, there is much fascinating information on various experiments involving animals and their relation to gravity (mice suspended by their tails, leaping nematodes, *etc*.). The fourth chapter (Chapter 3) brings us back to astronomy, discussing the effect of gravity on the properties of planets. The next three chapters are a more-or-less standard overview of the history of gravity in physics, but with many details on Maupertuis, Cassini, and measuring the shape of the Earth. Special Relativity and GR are introduced, and there is a good discussion on measurements of the gravitational constant G, which is still the physical constant with the least-precise value.

We are then introduced to the flowing-space interpretation of GR.[*] That is a simple example of the otherwise rather technical idea of 'analog gravity', and for many might provide a more intuitive understanding of GR. There is also an appendix describing concrete experiments one can do in a kitchen sink, with flowing water standing in for flowing space.

We are back in more-standard territory with the discussion of gravitational waves, which starts with a quote from Joseph Weber: "They'll put a bullet in my head." That is from one of the first interviews in the author's science-journalism career; it was also the last interview ever with Weber, who was willing to talk but only after being promised strict confidence as long as he was alive. (Weber died not long after the interview, but from lymphoma[†], rather than a bullet from the National Science Foundation or anywhere else.) When an undergraduate at the University of Maryland, Riordon knew Weber, who features prominently in the acknowledgements, as one of his professors. Riordon notes, though, that "Joe Weber may not have detected gravitational waves" and that his Lunar Surface Gravimeter, placed on the Moon by the *Apollo 17* astronauts, never worked either.

Chapter 9 gives an overview of various ideas for quantum gravity, and the next one of dark matter and dark energy. Those are familiar topics for myself and presumably many readers of this *Magazine*. Like the rest of the book, it is well written and essentially correct (see below for a few common mistakes in other areas). However, despite mentioning Milgrom and Finzi and their ideas of modified gravity — rarely mentioned in popular-science books — , the dark-matter story is essentially limited to Rubin (and — also rare — her long-time collaborator Ford) and Zwicky; Babcock, Bosma, and Roberts should at least be mentioned. There is the familiar trope of Rubin not getting enough credit for her work and even being overlooked for a Nobel Prize (though the common claim that that was due to sexism is not repeated).[‡] Interesting, though, is a quotation from Rubin: "Only the future will tell us

[*]In contrast to various interpretations of Quantum Mechanics, different ways of looking at GR, such as the standard way involving curvature, the flowing-space interpretation, the membrane paradigm, *etc*., do not differ in their claims about the underlying physical reality, but rather are just different approaches, with a certain approach more mathematically convenient for certain problems.

[†]I survived lymphoma twice; the first time in 2004. At least for my type of lymphoma, much progressed had been made in the few years immediately before, in particular the introduction of rituximab.

[‡]No Nobel Prize has been awarded for the discovery of dark matter; had one been awarded while she was still alive, my guess is that she would have been one of three recipients, though which of the three still alive then would have been a difficult decision — but the difficulty of such a decision is almost certainly not the reason for not awarding a Prize at all. Ford died in 2023, Roberts in 2024; of the obervational pioneers, only Bosma is still alive. To some extent, the award to Peebles recognized his theoretical work on the role of dark matter in astrophysics and cosmology.

what dark matter is, or whether our lack of knowledge of gravitation on the largest scales has fooled us." In other words, Rubin herself wasn't sure whether she had discovered dark matter. (She also cited her predecessors in the field of flat rotation curves.) Other methods of finding evidence for dark matter are covered, such as 'direct' detection in the lab (*via* a rare interaction between a dark-matter particle and an atomic nucleus), observing radiation from the decay or annihilation of dark-matter (anti)particles, and creating such particles in an accelerator. (Those methods are often dubbed 'shake it', 'break it', and 'make it'; if modified gravity rather than dark matter is responsible, then that would be 'fake it'.) The discussion of dark energy is brief, but that topic is only mildly relevant to the main subject of the book.

The next chapter covers more speculative aspects of GR: white holes, worm holes, naked singularities, time machines, and warp drives, and points out the impossibility of anti-gravity devices. Other cutting-edge topics such as 'dark stars' (not dark, but rather powered by the annihilation or decay of dark matter as opposed to fusion), the Multiverse, and theories of everything ("the Moby Dick of gravity") are briefly mentioned.

The last chapter on astrophysics concerns the origin of the elements. While of course many elements are made in stars and gravity plays an important role in stellar structure, gravity plays a more direct role than was assumed until recently as several heavy elements appear to be formed in the collision of neutron stars. One of those is iodine, which is essential for life as we know it. Keeping with the theme of the broad spectrum of the book, the next chapter explores the role of gravity, or the lack of it, in dreams, and the final chapter ties the falling sensation common in dreams to Einstein's 'happiest thought', namely realizing that a person in free fall feels no gravity. The previously mentioned appendix proves that this book contains everything, *including* the kitchen sink. Another appendix contains the only real maths in the book, using the flowing-space interpretation to derive common formulae in GR. I'm surprised that that interpretation is not better known, especially since to most it is probably easier to understand than the concept of spacetime curvature. (It is far from new, having been proposed independently by Painlevé in 1922 (a mathematician who was also prime minister of France) and Gullstrand (a Swedish[*] ophthamologist) in 1925.)

The breadth of topics covered is also demonstrated by the facts that for the second time in recent book reviews of popular-science books (which normally don't cite the technical literature at all), papers on the long-term future of the Sun[1,2†] are cited — the other book[3] was reviewed[4] in the 2026 February issue of this *Magazine* — as well as three works on life on other planets written by Dirk Schulze-Makuch[5–7] (see the review[8] of another of his works[9] in these pages). Unusual for a book on gravity, there are also references to papers in *Developmental Psychology*, *Clinical Psychology Review*, *Western Journal of Emergency Medicine*, and *Brain Research Reviews*.

Of course, most books I review have a few mistakes, and an honest review must mention them. Kepler's Laws, numbered, are stated, but the second is not the usual one, but rather the (correct) claim that "the Sun isn't at the center of the Solar System, but instead moves on its own, small elliptical orbit". An image of a distant blue galaxy gravitationally lensed into an almost perfect Einstein ring would of course be more impressive if in colour, but the caption mentions those colours with respect to the black-and-white image. The text at least implies that Hulse and Taylor were both at Princeton when they discovered the binary pulsar; they weren't. (Similarly, Adam Riess is now at Johns Hopkins, but wasn't when he did the work leading to his share in the 2011 Nobel Prize.) In contrast to claims in the text, Einstein

[*]The book makes him Swiss, reminding me of my friend from Vienna who used to wear a sweater with 'There are no kangaroos in Austria' on the front. Ironically, Gullstrand thought that relativity is wrong and used his influence on the Nobel committee to prevent Einstein from receiving the prize for relativity. Even more ironically, Gullstrand was known for his highly mathematical writing, much of which concerned the bending of light — but within the eye.

[†]I heard lectures from the first author when he was an assistant professor and I was a student in Hamburg; the second is a frequent contributor to and former Editor of this *Magazine*.

wasn't directly inspired by the negative result of the Michelson–Morley experiment, perhaps not even indirectly. Nor is inflation characterized by the Universe expanding faster than the speed of light, nor has the Universe "been expanding at a steadily accelerating rate" ever since. (At least he does clearly (and correctly) state that the Universe will expand forever even though we don't know whether it is exactly flat or even the sign of the curvature.) "The fact that something is running down toward an end implies that it also must have had a beginning." No. See ref. 10 for a detailed historical study (which mentions the fact that many *believed* such a claim) and ref. 11 for more recent thoughts on an eternally old cosmos with ever-increasing entropy. There might be a lot of dark matter in the Universe, but its average density is several orders of magnitude less than that corresponding to a small virus in a typical living room as claimed in the book. Although stated just briefly, the text implies that an infinite universe with stars distributed throughout would be infinitely bright and thus that the darkness of the night sky suggests that the Universe has limits. The latter is true, but the limits are temporal; the Universe is not infinitely old. As is the case with most issues in cosmology about which people are confused, Edward Harrison clears them up nicely.[12,13*] (I'm willing to put the comparison of the masses of *two* atoms of hydrogen to one of helium in the context of stellar fusion down to an oversight.) "A tiny bump on a neutron star, roughly as tall as a grain of sand, would result in a detectable signal in LIGO, provided the star is spinning faster than 200 times per second anywhere within a few thousand trillion kilometers of us." Misleading at best: the spin rate is not unrealistic, and the distance is only somewhat closer than the nearest known pulsar. A mountain of height 1 mm, say, might be just possible, given what we know about the crust of neutron stars. But to be detectable by *LIGO*, its area would have to be much, much larger than that of a grain of sand, which doesn't seem very realistic, again based on what we know about the crust of neutron stars.

On the other hand, it was a pleasure to learn some new things, such as Benjamin Franklin showing how a spoonful of oil tossed into the water of Mount Pond in Clapham Common could smooth wind-induced ripples of hundreds over square metres[14]; Franklin was so fascinated by that property of oil (which was known to Pliny the Elder) that he carried a supply of oil in a chamber of his bamboo cane, so that he could demonstrate the effect whenever desired. That was mentioned because the site is near where Cavendish conducted his experiments to measure G and thus the mass of the Earth. Cavendish used an improved version of a pendulum developed by John Michell, usually (and in this book as well) mentioned as probably the first person to come up with the idea of a black hole in the sense of an object with an escape velocity exceeding the speed of light. (While the 'Schwarzschild radius' turns out to be the same, one can move outward across the 'event horizon' of such a 'Newtonian black hole', just not escape to infinity ballistically even if moving at the speed of light when leaving the surface; the event horizon in GR is much stricter.)

There are a few black-and-white figures scattered throughout the text, some due to his daughters (who are also mentioned in the text, one also the subject of a photograph with her head angled down by six degrees to simulate some of the effects of space flight on humans). There are no footnotes; their function is covered by the endnotes, most of which, however, are references (including titles of articles). A couple of pages of 'Further Reading' contain short descriptions of eight books. Sadly, I've read only one completely, parts of another three, and an earlier version of a fifth; the other three are on my (very long) list of books to read before I die. (One of the ones which I've read partly is Newton's *Principia*: "A challenging read due to dated language [not to mention the original Latin], long-winded explanations, and roundabout derivations. Still, it's worth looking over the law of universal gravitation in the words of the genius who revolutionized physics.") A seven-page index ends the book.

Despite my complaints above, I enjoyed reading the book. It is well written and offers a

*I'm aware of almost a dozen articles as well in which Harrison makes his point, published in a variety of places, including very well-known journals.

fresh take on a subject about which very much has already been written. The few personal anecdotes add to the book rather than detract from it. From biology to Gullstrand–Painlevé coordinates to the psychology of dreams, there is something for everyone here. — Phillip Helbig.

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Machine Learning in Astronomy: Possibilities and Pitfalls (IAU Symposium 368, edited by J. McIver, A. Mahabal & C. Fluke (Cambridge University Press), 2025. Pp. 147, 25 × 18 cm. Price £98 (hardbound; ISBN 978 1 009 34519 4).

Similar to a book[1] reviewed[2] a while back in these pages, this volume of proceedings of an IAU symposium is a mostly bad record of what was probably an interesting meeting. Machine learning (ML), a more prosaic name for artificial intelligence, is all the rage now. However, the symposium took place almost four years ago, and as Ofer Lahav points out in his very good contribution, it was used already in the early 1990s for galaxy classification (at least by Lahav himself and his collaborators). His contribution is perhaps the most interesting for those who don't work in the field, giving a good overview, helped by the fact that he has a background in traditional astronomy but is up to date on the latest ML techniques. Other contributions are more specialized, which is to be expected from the proceedings of a specialized meeting. I have no qualms with that and am not really a member of the target readership. However, starting with the too thin paper (the two covers are almost as thick as all the pages) through which the print on the other side is visible, other production mistakes such as bad editing, lack of consistent formatting, mentioning colours in a book in which all figures are in black and white, and too detailed references lead to a book which is distracting to read, which is unfortunate because the material is new and interesting and relevant not just to astronomy; I found many of the contributions interesting, even though they are far from my own work.

The twenty-seven contributions range from two to seventeen pages and cover topics such as exoplanets, spectra, stars, star clusters, galaxies, gravitational waves, galaxy clusters, and cosmology. The longer contributions can provide a good overview, especially those intended as such, such as Lahav's piece on ML in cosmology or 'An Astronomer's Guide to Machine Learning' by Webb & Good; the two panel discussions also offer something more typical of a conference than the normal literature. Most of the shorter contributions (presumably originally posters) are too short to be of much use: too brief for those not familiar with the topic, and unnecessary for those who are. (While many of the items end with a mostly blank page, the fact that many of the short contributions do so leads to much wasted space.) Interesting to me was that the first contribution, on using ML in exoplanet surveys, starts off by mentioning the exquisite precision of modern spectroscopy, "approaching that needed to detect the motion of a Sun-like start due to the gravity of an Earth-mass planet in its habitable