intended at least as much for on-line reading as paper, because at a few points, the author advises those reading on paper to go to some specific web site to see a larger, better-resolved, version of some image. And the volume is sufficiently expensive that, by not buying it, you could almost afford the computing device on which to see the e-versions. With luck, there will be copies on display on the publisher's table at future conferences, so you can, by skipping lunch, stand in a corner and read it, turning pages rapidly, for free. — VIRGINIA TRIMBLE.

The Cosmos: Astronomy in the New Millennium, 5th Edition, by Jay M. Pasachoff & Alex Filippenko (Cambridge University Press), 2018. Pp. 730, 27·5 × 22 cm. Price £59·99/$79·99 (paperback; ISBN 978 1 108 43138 5).

A truly massive tome, this is an undergraduate textbook intended as "a descriptive presentation of modern astronomy for liberal-arts students", though it should appeal as well to those who enjoy popular-astronomy books. Both authors have extensive teaching experience, and the areas of their own research (the Solar System and observational cosmology) are at opposite ends of the scale. Essentially all of astronomy is covered in the twenty chapters; roughly a quarter each is assigned to general background (physics, history of astronomy, instrumentation), the Solar System, stellar astronomy and the Milky Way, and extragalactic astronomy and cosmology. Apart from the usual one-page table of contents just listing the chapters, an 11-page (though with photos) detailed table of contents makes it easy to find what one is looking for, as does the 22-page small-print index. It is impossible to summarize the contents in more detail in the space of a review in this *Magazine*; suffice it to say that the material is correct, up-to-date, and well presented (with very few typos); the book is obviously a labour of love. (The book would be impressive enough if the authors were only teachers; Filippenko is also one of the most highly cited research astronomers.) The authors state that it is a 'how and why', rather than a 'what and where', book. In other words, although not intended for science majors, and though maths is kept to a minimum, the presentation is not just qualitative, but an attempt (successful, but at the intended level) is made to explain the reasons behind the phenomena. Neither is it a 'who and when' book, though some basic history of astronomy is of course included.

A paragraph on origins, a nod to NASA's Origins programme, is at the beginning of each chapter, followed by a list of aims and a chapter introduction. There is at least one colour image, often several, on almost every page, with detailed captions, all referred to in the text. In addition to the main text, boxes of various sorts — self-contained side shows, so to speak — provide additional information: 'Figure It Out', 'A Closer Look', 'Star Party' (suggestions for stargazing), and 'Lives in Science'. Important terms appear in boldface in the main text and in the end-of-chapter summaries, and are defined in a 16-page small-print glossary. Following the summary, each chapter ends with about 50 questions (regular questions as well as true-or-false, multiple-choice, and fill-in-the-blank varieties), with those requiring a numerical answer specially marked, and a handful of topics for further discussion. Eight appendices, including photos of all Messier objects, are a nice addition. Six-and-one-half pages of suggestions for further reading (again in small print), grouped by topic, some with comments, will probably satisfy the curiosity of most readers. The front and end papers (inside cover and facing page) contain eight sky charts, one for each season with views to the north and south, as seen from North American latitudes. (My only criticism is that the book sometimes assumes a North

American readership, though to be fair courses for which the book is intended are much more common there than elsewhere.) Even with modern technology, I still hear that publishing in colour can make the price prohibitive; the literally thousands of high-resolution colour images in this book are presumably made possible by economies of scale; indeed, the price would be reasonable for a book of this size with no pictures at all.

The preface is mostly an aggressive sales pitch, but the rest of the book more than lives up to it. This is the fifth edition, so previous editions obviously have been successful. Although many other readers should enjoy it, it is clearly intended as a textbook. The book itself is a treasure trove of information, but additional resources can be found at http://thecosmos5.com/, including some which can be accessed only by instructors authenticated by CUP; those include the figures in .JPG and .PPT formats, making it easy to tie one's own presentation in with the book, as well as test-banks and a solutions manual. Although the book itself is very up-to-date, the website provides chapter updates with even newer information. Some of the (very few) errata do not correct mistakes as such, but update material in the text (*e.g.*, revised names for facilities, changing the description of others from future to present tense). In an unusual move, the authors provide their institutional postal and email addresses for comments and corrections and promise a personal reply to each writer.

Recommended? Of course; very highly! — PHILLIP HELBIG.

MHD Waves in the Solar Atmosphere, by Bernard Roberts (Cambridge University Press), 2019. Pp. 508, 25 × 18 cm. Price £135 (hardbound; ISBN 978 1 108 42766 1).

The solar atmosphere can be compared with a classical symphony orchestra, which generates transverse oscillations in kink-modes (string instruments), longitudinal acoustic oscillations (wind instruments), as well as shock waves initiated by loud bangs (percussion instruments). This rich new field of scientific research should be called 'solar music', but instead has been dubbed 'coronal seismology', in contrast to the field of 'helioseismology' which describes the global oscillations and reflected waves in the *interiors* of the Sun and stars. Interestingly, the theory of magneto-hydrodynamic (MHD) waves has largely been developed in the 1980s by Bernard Roberts of St. Andrews University, building on previous theoretical work of Alfvén, Cowling, Parker, and Spruit. But observational confirmation with direct imaging of oscillating and propagating MHD waves in the solar corona started only in 1999, with data from the NASA spacecraft, the *Transition Region and Coronal Explorer* (*TRACE*). Triggered by those key observations, multi-faceted studies in all aspects of MHD modelling have been tackled, on the observational as well as theoretical side, such as by DeMoortel, Edwin, Erdelyi, Goedbloed, Goossens, Nakariakov, Oliver, Pascoe, Ruderman, Terradas, T. J. Wang, and Zhugzhda (to name a few with quintuple citations). What Bernard Roberts offers in his new book is a rigorous treatment of MHD waves propagating in uniform plasma, coronal loops, magnetic slabs, and magnetic flux tubes, including dispersion relations, wave speeds, gravitational effects, wave damping, and other nonlinear aspects. Parker is quoted: "The fundamental equations of physics may contain all knowledge, but they are close-mouthed and do not volunteer that knowledge". Nevertheless, Roberts lets no less than 2524 equations speak the truth eloquently, which testifies to the complexity of resonant cavities in solar and stellar atmospheres. The book is highly recommended to those students,