

detail, its copernican foundations included. All of the modern stuff is there, among it a reasonably detailed description of why inflation is so compelling. Silk even has a chapter on 'alternative cosmologies', even though most of them are straw edifices which are easily pulled down. A reader of Silk's book will confront rather than avoid the peculiar properties of curved space which are characteristic of some cosmological models.

Nathan Cohen's *Gravity's Lens* falls short of the high standards of the others. His writing is too confusing, and he introduces too many terms which are underlined as though the reader has to remember them. You can understand how a particular type of star called a Cepheid variable can be used to measure the distance to galaxies without memorizing definitions of inverse square law, apparent magnitude, absolute magnitude and distance modulus — all of which are introduced in two pages! Too many factual slips mar the book (for example, quasars were identified as optical counterparts to radio sources and not, as Cohen says, as variable stars; it is the BL Lac objects which were first recognized as variables). On the good side, this book includes all the weird beasts that inhabit the astrophysical zoo and make the Universe such an interesting place. The treatment of gravitational lenses, which includes an account of the role of gadflies Jenő Barndorff-Nielsen and Fritz Zwicky in anticipating their discovery by decades, is decent enough.

Larry Marschall's supernova book is a superb piece of writing; it reads almost as easily as a good novel. Marschall's vivid descriptions bring astronomy to life. For instance, he reports that the radio telescope through which pulsars were discovered looked "like a giant colony of clothes lines waiting for wash day". He resists the temptation to pay undue attention to the recent supernova, and presents a balanced look at the whole field rather than a journalistic account of the life and times of supernova 1987A. He begins with a general treatment of astronomy, showing how supernovae fit into a bigger picture, and includes a very complete account of historical observations of these celestial explosions, in which stars suddenly blaze forth into the night-time, and even the day-time, sky, then fade away. The book is remarkably up to date — there is even a complete discussion of the mysterious spot and the light echoes which were discovered in mid-1988.

Chaisson's brief treatment of relativistic astrophysics is less successful, though one chapter, "Einstein, the Man", is pretty good. It is a slim collection of 30-second sound bites and pictures loosely organized about Einstein's theory of relativity and its astronomical consequences. Over-statements abound. For example, Chaisson writes that "... people from all segments

of society seek to know whether the expansion of the Universe will continue for ever". He can't be serious. This question does not even count as a hot one for cosmologists in the 1980s, much less the average person; the inflationary model basically provides a positive answer. Indeed, the treatment of cosmology is rather dated, with little attention being paid to dark matter and the large-scale structure; it reads as though most of it were written ten years ago.

It seems to have become the fashion in books such as these to have few or no references either to other books or to the research literature. Although a popular

book does not demand the historian's detailed attention to footnotes and so on, some indications of further reading, or of where one can follow up a particular topic, are surely essential. Trefil includes a few passing references (but only to his own books), while Parker and Cohen have none at all. So here the plaudits go to Chaisson, Marschall and Silk, three authors who have taken the trouble to ensure that their books contain useful bibliographies. □

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## Mathland on \$17.95

C. J. S. Clarke

**The Mathematical Tourist: Snapshots of Modern Mathematics.** By Ivars Peterson. *W. H. Freeman:1988. Pp.240. \$17.95, £15.95.*

WE RESIDENTS have an ambivalent attitude to tourists: pleased that they are interested in the locality, irritated when they trample on the flowers. But Ivars Peterson behaves himself impeccably in his tour of the world of mathematics — one would almost think him a native — and his modestly subtitled collection of "snapshots" would serve as a good guidebook to the territory.

The emphasis is mostly on present-day culture rather than historical monuments, concentrating entirely on growth points in pure mathematics. Dramatic achievements of the past, even the recent past, such as the use of model theory in studying decidability in logic, are not explicitly included, nor are unsolved questions where there is little progress such as the Riemann hypothesis. The Poincaré conjecture, however, is given its proper place, along with the dramatic human interest of the failed Régé-Rourke attempt at proof.

The result is a very representative survey of those topics that have recently gained prominence. It should be accessible to quite a broad population, including the many readers who have been inoculated against all forms of mathematical reasoning by exposure to a de-natured form of it in their youth. Peterson succeeds in conveying a surprisingly good feel for the content of mathematics without, most of the time, actually doing any.

There is an inevitable bias towards the more spectacular and less abstract areas. Thus the account of the Mandelbrot set is one of the most successful parts of the book; but it is well placed in context, linked with the Julia sets and fully defined, and one forgives the few occasions when Peterson gets carried away by the graphics

("iridescent dragons clawing their own tails . . . and geometric jets spewing colored streams into still, black basins . . ."). At the other extreme of conceptual difficulty, he introduces the discovery of the non-standard differential structure on  $\mathbb{R}^1$  by Donaldson. It is doubtful whether the concept of differential topology (as opposed to topology or geometry) will really get across to those not already familiar with it, but a valiant attempt is made.

A recurring theme is the use of computers. Indeed, if there is any 'message' in the book it is that computation is changing the nature of mathematics. Peterson shows computers as vital to the exploration of a variety of areas by providing visual representations of mathematical objects and so suggesting both new conjectures and ways of proving them; computers as themselves sources of mathematical problems, concerning the encryption of data, protocols for computer communication or the whole area of computational complexity; and computers as playing an actual part in the proof of theorems (though the four-colour theorem remains the only major instance of this).

There are frequent mentions of applications, exports from mathematics to other lands, but these tend to be unconvincing, the applications being of doubtful utility and seeming only palely to reflect the fervour of the research front. Many astronomers, for example, would question the assertion that "Astrophysicists have now confirmed that . . . mass within the universe is distributed throughout space like a three-dimensional Cantor set", while the applications of knot theory to DNA structures involve little mathematics that was not available in the nineteenth century. The truth is that the real value of mathematics is not to be found in the latest Big Theorems, but in the whole integrated body of techniques and ideas that are needed to prove the theorems, and which they in turn give rise to. □

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