

invaluable source book and reference work which presents in a remarkably compact form material which is otherwise rather widely dispersed throughout astronomical literature.

N. C. WICKRAMASINGHE

## FIERY APPARITIONS

### The Taming of the Thunderbolts

The Science and Superstition of Ball Lightning. By Maxwell C. Cade and Delphine Davis. Pp. 176+5 plates. (Abelard-Schuman: London and New York, April 1969.) 30s.

BALLS of fire, or ball lightning, which this book is about, have not been tamed; they are shrewish, ill-disposed and mischievous as ever. If anybody does not believe in them, let him read this book. It is best to read straight through, for the dispersion of numbered "case histories" in the text results in a somewhat fragmented appearance. The authors say the book is for the man in the street. He will enjoy it, and the specialist in atmospheric studies will not be disappointed. The book is free from typographical errors, is well produced, and is excellent value for money. It includes a useful bibliography, and an impressive list of 107 case history sources where *Proceedings of the Royal Society* keeps company with the *News of the World* and *Bede's History of the English Church and People*.

In the first half of the book we have stories of ball lightning and related phenomena dating to the beginning of the Christian era and earlier. According to the authors, Pliny regarded a thunderbolt as forked lightning, from which he distinguished ball lightning. The latter they now call a thunderbolt, which seems to be hardly in accord with what we read of fireballs, for instance: "the awful apparition slowly descended . . . wreaking havoc before leaving", and, on another occasion, "floating lazily out of the door of a sealed room". Early scientific investigations of lightning are described, including the work of those reckless, or perhaps ignorant souls who sought to extract the electricity from clouds. There follow eyewitness accounts of fifty fireball sightings, selected from reliable sources, each with its own bibliographical reference. They ring true; some are by scientists, two by a former deputy director of the Meteorological Office. The characteristics of fireballs are examined and classified, past and present theories are reviewed, and all is readable by everybody, apart from a few lines culminating in a partial differential equation which shows how seriously some scientists are taking ball lightning. No theory is at present acceptable, which is not surprising because most observations have been made by frightened, unskilled observers, and without the aid of scientific instruments.

The authors next consider strange happenings in the past and unpleasant possibilities for the future. Apparently when 90 per cent of "unidentified flying objects" have been explained away as balloons and so on, the remaining 10 per cent may nearly all be accounted for by ball lightning, cometoids and meteorites, leaving only a tiny fraction to sophisticated fancy. The Great Siberian Meteorite of 1908 was evidently not a fireball, but we may not be so sure about the cause of the power failure which blacked out New York in 1965. On a smaller scale, strange happenings in sealed rooms, including alleged poltergeist activity, may perhaps be due to ball lightning. From the ways of evil spirits we turn to the evil ways of men. Already the possibility has been examined of making war weapons based on the principle of ball lightning, especially in view of Kapitza's model of an electromagnetic standing wave system. But perhaps man will benefit in the long run. If he solves the riddle of ball lightning, he should be nearer to making peaceful use of controlled thermonuclear reactions.

W. C. A. HUTCHINSON

## CALCULATING SEISMOLOGY

### Mathematical Aspects of Seismology

By Markus B ath. (Developments in Solid Earth Geophysics, Vol. 4.) Pp. xii+415. (Elsevier: Amsterdam, London and New York, 1968.) 200s.

SINCE Lamb published his elegant solution of wave propagation in an elastic half-space, theoretical seismology has become increasingly mathematical and, to many seismologists, obscure and lacking in practical application. This book is an attempt to provide seismologists with sufficient mathematics to study theoretical problems. It assumes an elementary university knowledge (1-2 years) of both mathematics and seismology.

The book is divided into four parts. The first three—"Integration Methods", "Special Functions" and "Selected Mathematical Methods"—are concerned largely with mathematical techniques, but each chapter contains examples from seismology. The mathematics in these sections can naturally be found in other textbooks although the presentation and emphasis differ. The choice Professor B ath has made seems very suitable for the purpose of this book and the presentation is very clear and accurate. Detail is ample without becoming incomprehensible or valueless to the seismologist. In fact these chapters should provide useful reference for any student of applied mathematics and, in particular, wave propagation. The seismological examples and the remaining part of the book, "Selected Seismological Applications", represent a far greater problem of choice for the author and of potential interest to the reader.

The problems the author has chosen to expand in some mathematical detail, for example, Cagniard's method (chapter eight), Lamb's problem (chapter twelve), Pekeris's problem (chapter thirteen), are regarded as the classics of elastic wave propagation. While they provide a useful basis for demonstrating the mathematical methods introduced previously in the book they have all appeared in seismological textbooks before. The treatment, while perfectly accurate, only represents an expansion, not an extension, of these and it is unlikely to inspire great interest in the reader or give an accurate impression of modern theoretical seismology. Particularly unfortunate is the lack of references to more recent developments in these and other problems. de Hoop's modification of Cagniard's method is of such mathematical elegance and simplicity as to deserve mention, and the theory of "leaking modes" has explained many features of seismograms not contained in Lamb's or Pekeris's solutions. Mathematical solutions are only of value when they explain observed features of seismograms and except for Lamb's problem no results are illustrated thus.

While the principal purpose of this book is clearly to introduce mathematical methods to seismologists, which it does excellently, it is indeed unfortunate, especially in view of its cost, that the author has not chosen more recent work in his examples. CHRIS CHAPMAN

## ALGEBRAIC EPIC

### Algebraic K-Theory

By Hyman Bass. (Mathematics Lecture Note Series.) Pp. xix+762. (Benjamin: New York and Amsterdam, 1968.) \$12.50 cloth; \$5.95 paper.

THIS publication follows the current trend of making the lecture notes of eminent mathematicians readily available. It means that not only are current research ideas presented, but also an attempt is made to give essential background material a coherent exposition. The author