sophisticated—solid geometry, vector algebra and Fourier analysis—but the subject has a language of its own which must be acquired by deliberate study. Nobody being drawn into the great maw of "materials science" can afford to be ignorant of the conceptual apparatus of Brillouin zones, Fermi surfaces, and the like.

Dr Altmann has attempted the most difficult task of a teacher: he has written a book that is both simple and precise. He assumes no more than the elementary mathematics I have mentioned, and yet gives a careful and complete account of the basic principles of this theory. One can judge the didactic power of such a book only by practising with it on defenceless students; but it seems very good indeed. The emphasis on the simple symmetry properties of wave functions is especially helpful, and would be an admirable introduction to more advanced group theoretical methods in this field.

This is, of course, essentially a textbook (third year undergraduate or beyond), so that there is little new to say. I doubt the value of a whole chapter on quantum mechanics, which can scarcely be considered a mere auxiliary to the physics of metals, but it serves to define the essential terms and principles. I am also completely opposed to the retention of 2π in wave-like exponentials, but Altmann gives his reasons and this is the sort of arbitrary quarrel that can only be settled by a toss of a coin—or by cold steel! The book is perhaps weakest in the final chapters where the connexions of the mathematical theory with experimental physics are demonstrated by a few examples. Alas, the classical explanation of the Hume-Rothery rules looks very thin nowadays, as the author admits, and electronic specific heats are not very convincing as mere numbers. The trouble is that the theory really comes into its own in the study of Fermi surfaces, which demands, of course, a whole lot more physics than can be accommodated here, while the actual calculation of band structures is a complete art on its own. But the book can be most warmly recommended for the excellent exposition of the principal theme.

J. M. ZIMAN

ATMOSPHERIC TIDES AND WAVES

Atmospheric Tides

Thermal and Gravitational. By Sidney Chapman and Richard S. Lindzen. Pp. ix+200. (Reidel: Dordrecht, 1970.) 38 florins.

THERE cannot be many examples in the geophysical sciences where such a minute effect as the 12-hourly barometric pressure oscillation at sea level has led to an almost continuous discussion in the literature during the best part of two centuries. In their book, Chapman and Lindzen give an excellent account of the various efforts to explain the predominance of the solar semidiurnal over the corresponding lunar oscillation, because the latter should have the largest amplitude if the effect is understood as the result of air motions similar to the gravitational tides of the sea. Already, at an early stage, thermal excitation had been considered but, because of the large diurnal term in the heating function, a 12-hour resonant mode was ascribed to the atmosphere in order to account for the observational picture. The book describes how, on the one hand, the theory of atmospheric tides became more and more sophisticated and how, on the other, observational data made its validity more and more doubtful.

About 20 years ago the theory seemed perfected, only to be found untenable shortly after in the light of newly found atmospheric parameters. The experimenter in the field was no little alarmed by this state of uncertainty and the situation has only just become more relaxed as a result of the sensible use of rocket measurements in conjunction with the dynamic theory of atmospheric tides. At the present stage the critical reader of this book, having studied the various sections on dynamic theory and having acquainted himself with the observational data, should no longer be surprised by the amplitude of the solar semidiurnal mode in the daily pressure pattern.

Although much attention is given to atmospheric phenomena at ground level, the book is also generally concerned with travelling waves and diurnal oscillations of solar as well as lunar excitation in the whole range of atmosphere up to ionospheric heights. The sections on methods of data analysis are of special interest to the experimenter who will also benefit from the treatment of mathematical methods dealing with various theoretical equations relevant to his work. As far as the presentation of observational material is concerned, the book is somewhat heavily biased towards meteorological data applying to the lower atmosphere, and it is regrettable that comparatively little space is devoted to upper atmospheric parameters, particularly those obtained with the various radio techniques.

Considering that the last monograph on the subject dates back more than 20 years the book is certainly meeting a long-standing demand for a comprehensive summary of present-day understanding of tidal phenomena in the terrestrial atmosphere. It is clear that the authors prepared chapters individually, including numerous references to their own specific investigations. Within the available space they have managed to concentrate on the principal features of the subject without neglecting important detail, and there is an exhaustive list of references for those who wish to go into more extensive studies.

H. G. MULLER

EMPIRICAL BAYES

Empirical Bayes Methods

By J. S. Maritz. (Methuen's Monographs on Applied Probability and Statistics.) Pp. viii+159. (Methuen: London, May 1970.) 50*s*.

EMPIRICAL Bayes methods have been developed to deal with the following situation. An observation x has a probability distribution which depends on an unknown parameter λ about which it is required to estimate or to test hypotheses. Additional observations x_i, similarly dependent on $\lambda_i, (i=1,2, \ldots n)$ are also available, the unknowns λ and λ_i having come from a common unknown distribution, $G(\lambda)$, say. A practical example is quality control where x is a sample value from a batch of quality λ and $x_1, x_2, \ldots x_n$ are similar observations on previous batches. It is clear that estimation of λ might be improved by using experience gained in sampling other batches.

This monograph is the first text devoted to these methods and is welcome on that account. After an introductory chapter there follows one on the estimation of the distribution $G(\lambda)$—which is not straightforward because the λs are unobserved and can only be approached by means of the xs—and two on estimation and hypothesis testing respectively. This material is mostly confined to the single parameter case: there then follows a chapter on two-parameter problems. A related situation is the compound decision problem where all the λs are to be estimated: this is discussed in a final chapter.

Empirical Bayes methods have been hailed as one of the major advances in modern statistics. This is not the place to argue my view that this is incorrect and that the methods are unsatisfactory. Anybody interested in Bayesian methods will learn nothing from this book because an empirical Bayesian eschews Bayesian methods entirely.

The text covers the material adequately. Particularly valuable features are the wealth of illustrative examples and the detailed computational results. A fair number of errors remain and there are some defects of exposition, but these do not seriously disturb a valuable contribution to this curious corner of statistics.

D. V. LINDLEY