One striking innovation is the use of an unnamed symbol for the Helmholtz free-energy. It is formed by running together A and F. J. S. ROWLINSON

SOLAR SYSTEM ASTRONOMY

Moon and Planets

Edited by A. Dollfus. (A Session of the Seventh International Space Science Symposium held in Vienna on May 10-18, 1966.) (Sponsored by COSPAR and IAU.) Pp. 321 + 26 photographs. (Amsterdam: North-Holland Publishing Company, 1967.) 90s.

THE progress which space science has made during its first decade has astonished even some of its more optimistic proponents, and it has become difficult in these days of the information explosion for astronomers pursuing their work in extra-solar-system astronomy to keep abreast of developments in space science (apart from a few well-publicized glamorous discoveries). And in spite of the developments which have taken place, it must be recognized that our new knowledge is fragmentary, and that new questions are being asked faster than they can be answered. Many of us look forward to the day when it will be possible to publish an important textbook, with all its chapters fully integrated one with another, and covering the main aspects of planetary and lunar astronomy, with a full and adequate account of modern developments. Clearly, such a book, if written now, would be premature. We must therefore be grateful for the present volume. Its most valuable feature is undoubtedly a number of survey papers, which will be of interest to a wider audience than some of the individual contributions and abstracts. I single out for mention articles by G. P. Kuiper on the lunar surface and the US Ranger programme, by A. D. Kuzmin on the results of radio observations of the planets, by I. I. Shapiro on planetary radar astronomy, by O. W. Nicks on the Mariner IV results, by R. K. Sloan on the Mariner IV photographs of Mars, and by W. C. DeMarcus on the general theory of (the internal structure of the) planets. The volume is a required purchase for libraries of physics and astronomy because of these surveys, and the latter will be valuable as basic references for astrophysics and space science students until such a time as more integrated treatment of solar system astronomy becomes available.

R. H. GARSTANG

QUANTUM THEORY OF FIELDS

Lectures on Quantum Field Theory

By Paul A. M. Dirac. (Belfer Graduate School of Science Monograph Series, No. 3.) Pp. viii + 151. (New York: Belfer Graduate School of Science, Yeshiva University, 1966. Distributed by Academic Press, New York and London.) 60s.

PROFESSOR DIRAC'S book, as its title and colloquial style suggest, is based on a lecture course given by him in the session 1963-64 at Yeshiva University, New York. This is not a textbook in the conventional sense: it is, rather, a critical essay in which the essayist describes lucidly his thoughts on the difficulties and illogicalities of the traditional approach to the quantum theory of fields; then in developing the theory of quantum electrodynamics he demonstrates just how he has come to terms with the problems he has raised.

The underlying philosophy of the book has already received considerable publicity^{1,2}. Letters to *Nature*^{3,4} on the subject of the first article indicate that the ideas put forward are not altogether uncontroversial.

The essential point which Professor Dirac makes is that, in the field theoretic context, "the Heisenberg

picture is a good picture and the Schrödinger picture is a bad picture and that the two pictures are not equivalent". The essence of this point is made explicit when a simple field theoretic model is analysed. Thereafter the author sets about the task of developing a quantum field theory (quantum electrodynamics) working entirely within the framework of the Heisenberg picture and avoiding any direct use of the Schrödinger picture. In any theory which does not admit Schrödinger wave functions the usual probabilistic interpretation of the theory must be abandoned. This problem is tackled by the author and a new basis of interpretation is suggested. Important in these new interpretative proposals is the normal ordering of operators and this, being deemed of physical significance, is taken over from work done in the Schrödinger picture. By developing quantum electrodynamics in the Heisenberg picture many but not all of the "illogical" infinities of the traditional approach are successfully eliminated; it is proposed that other infinities be removed by the introduction of cut-offs, and the arguments presented here seem to me plausible rather than strictly logical. Professor Dirac is careful to point out that each standpoint adopted is merely that which seems to him to be the best at the present stage of knowledge and that we must always be ready to alter our point of view in the light of new facts.

In this formulation there is no place for an *S*-matrix and it would have been interesting to have had Professor Dirac's evaluation of the extensive literature on *S*-matrix theory and other modern outgrowths of traditional field theory.

I am certain that *Lectures on Quantum Field Theory* will provide the serious student with most interesting and stimulating reading: the arguments are presented with great clarity and the layout (despite the absence of an index, which is largely compensated for by the paragraph titles) is good.

JOHN CUNNINGHAM

¹ Dirac, P. A. M., *Nature*, **203**, 115 (1964).

² Dirac, P. A. M., *Phys. Rev.*, **139B**, 685 (1965).

³ Perlman, H. S., *Nature*, **204**, 771 (1964).

⁴ Simon, J. M., and Taylor, J. G., *Nature*, **205**, 1305 (1965).

MAN'S WORLD

The Science of Society

An Introduction to Sociology. By Stephen Cotgrove. (The Minerva Series of Student's Handbooks, No. 19.) Pp. 310. (London: George Allen and Unwin, Ltd., 1967.) 40s. net.

THIS is an erudite, yet readable and easily assimilated, introductory textbook of sociology. Using the structure-function approach, in particular the "theories" and perspectives developed by Talcott Parsons, the author marshals a judicious mixture of British and American research findings into a text which both serves as an introduction to the elements of sociological analysis and offers the reader a description of contemporary British institutions. This is something of an achievement, for the "theoretical" frame of reference is not a simple one, and its exponents are not noted for clarity and simplicity in their prose style. The book differs from many introductory sociology textbooks by adopting the refreshing approach of assuming that its readers read other books. In particular it was pleasing to find that the author had dispensed with the traditional obeisance to the "Founding Fathers of Sociology" and settled for a discussion of what sociology is about today.

The work of Talcott Parsons has had a great influence on modern sociological teaching and research. Good textbooks using his frame of reference, however, have been rare. Those using it have made the mistake of forcing the material into the conceptual framework in the mistaken belief that it is a verified theory. While Professor Cotgrove closely adheres to the scheme he does not fall into