BOOK REVIEWS

Computers in Physics

Computers and their Role in the Physical Sciences. Edited by S. Fernbach and A. Taub. Pp. xiv+624. (Gordon and Breach: London and New York, December 1970.) £8.25; $20.

THIS book is a collection of twenty-four articles written for the non-expert by well-known American scientists and describing the application of computers to the major fields of physics. It will be of general interest to physicists and would be a worthwhile addition to any university library.

Following an introductory article by Hans Bethe describing the early use of computers at Los Alamos, the next two papers deal with the history of computer development. As is to be expected, the emphasis is mainly on American computers but due credit is given to the more outstanding British contributions.

The hardware of present day computers is very well described in articles by J. E. Thornton and Jan A. Rajchman. Then there are two articles on software which discuss operating systems, computer languages and interactive access. "Errors in Computing", by N. Metropolis, deals with the problems of computer arithmetic, especially those due to rounding errors, and describes the significant digit method for automatically monitoring the precision of numbers.

These articles occupy one third of the book. The remainder is a survey of the ways in which computers can be used in various branches of physics. To bridge the gap, there is a philosophical article on "The Role of the University in the Computer Age".

First, mathematical applications are discussed in two papers: "The Impact of Computers on Mathematics" by Peter D. Lax and "Monte Carlo Methods" by Malvin H. Kalos, both of New York University. The next three articles describe the use of the computer to simulate particles, plasmas and fluids respectively and they illustrate the use of the computer as a replacement and refinement of laboratory experiments. The following paper describes the large scale computations involved in nuclear reactor design concerning neutron transport and stress analysis of the reactor vessel.

"Numerical Calculations of Explosive Phenomena" describes work at Los Alamos in which theoretical models of shocks assist in the interpretation of experiment studies of explosive phenomena. "Optical Models for Nuclear Scattering" illustrates a different kind of model and its comparison with experimental results.

The on-line use of computers is discussed in an article on the routine automatic control of chemical apparatus, and the following two papers illustrate the use of the computer in the tremendous task of analysing photographs collected in experiments in high energy physics.

As in most books of this nature, the viewpoints of the various authors are diverse and it is difficult to find a unifying thread. However, all the articles are readable and well illustrated, and most are supplemented by comprehensive lists of references. It is a competent book. MARY ALMOND

Flash, Bang

Laser Interaction and Related Plasma Phenomena. Edited by Helmut Schwarz and Heinrich Hora. (Proceedings of the First Workshop, held at Rensselaer Polytechnic Institute, Hartford Graduate Center, East Windsor Hill, Connecticut, June 9–13, 1969.) Pp. xiv+509. (Plenum: New York and London, 1971). £11.70.

THE development, almost ten years ago, of high power lasers capable of producing radiation with spatial and temporal coherence of high degree has led to entirely new ways of studying the physics of the interaction of radiation with matter and to the discovery of many new non-linear optical phenomena. This in turn has led to important technological advances with far reaching consequences in many fields. This book places on record the twenty-one papers presented at Hartford in 1969. It gives an authoritative and well edited account of present knowledge and indicates likely future trends in the application of intense laser radiation. Although primarily devoted to the properties of plasmas produced by laser beams at solid surfaces, it is nevertheless an excellent introduction to some of the most advanced and sophisticated techniques.

A succinct historical introduction is followed by an excellent survey of methods for the generation of picosecond laser flashes and by a discussion of some of their applications to the measurement of very brief fluorescent lifetimes, the generation of ultra-short acoustic pulses, non-linear optics and harmonic generation.

The interaction with solids of relatively low energy (non-Q-switched) laser flashes and the evaporation and deposition, without chemical decomposition, of complex molecules for the formation of thin films is treated in detail and is followed by reviews of mass spectrometric techniques used in conjunction with laser produced plasmas and of laser radiation scattering processes for the identification and quantitative analysis of compounds. An important account of the properties of laser-triggered switches includes a wealth of detail about these novel methods of ensuring commutation at high voltages with extraordinary precision—a reproducible jitter of less than a nanosecond is reported.

The remaining sections of the book are devoted almost exclusively to experimental and theoretical studies of the production of plasmas at thin and thick metallic targets or at solid hydrogen and deuterium surfaces.

This well presented book will be welcomed by workers in the fields of non-linear optics and plasma physics seeking authoritative surveys of particular aspects of the interaction of powerful optical radiation and matter. It can be recommended strongly.

C. GREY MORGAN

Series for Orbits

Celestial Mechanics. Vol. 1: Dynamical Principles and Transformation Theory. By Yusuke Hagihara. Pp. xiii+689. (MIT: Cambridge, Massachusetts, and London, January 1971.) £11.65.

ALTHOUGH the perturbation methods based on trigonometrical series expansions that are used to analyse and predict the motions of the solar system have been refined since they were introduced into celestial mechanics by Laplace and Lagrange, they have not changed essentially. Towards the end of the nineteenth century, Poincaré showed that these series are not convergent but non-uniformly asymptotically convergent, and whereas such series can be more convenient than convergent series for numerical use, the non-uniform behaviour limits the time interval over which they can be used. For the natural solar system, where orbital eccentricities and inclinations are generally small, these series have sufficed to give adequate numerical approximations to the solutions of the equations of motion over the time intervals for which accurate predictions have usually been required, but in recent years this situation has begun to change.