events with different techniques and get different results. What is badly needed is a serious attempt at intercorrelating many different observations of the same event. This book is the proceedings of a symposium whose purpose was precisely that.

The event chosen for study was the 2B flare of 25 February 1969. Unfortunately there were four other flares from the same active region within 24 hours of the 2B flare. As a consequence it is difficult to determine which flare caused some of the delayed events (for example the shock wave), although for the majority of observations there is no ambiguity.

The first half of the book is devoted to a series of review papers concerned with the various effects produced by flares. The important subjects of solar x-rays, energetic particles, and changes in the solar wind are well summarized by C. de Jager, F. B. McDonald, and A. J. Hundhausen respectively. The earth's magnetosphere, bow shock, magnetotail, and ionosphere all respond to solar flares, and there are several review papers about each of them. There are two noteworthy shortcomings in the first half of the book. Some of the review papers are extremely narrow in perspective, amounting to little more than presentations of the authors' own data. Furthermore, the inclusion of at least one discussion of the numerous current theoretical ideas about the physics of solar flares would have been desirable.

The rest of the book consists of short contributions describing a variety of observations of the 25 February flare. About half of them present satellite and rocket data giving time histories, fluxes, anisotropies, and energy spectra of the solar protons, electrons, and alpha particles. The combined coverage is extensive (for example protons are observed over a range in energy from 100 kev to over 25 Gev) and therefore quite valuable. There are also papers on the solar wind, the interplanetary magnetic field, and auroral zone phenomena.

In conclusion W. I. Axford wisely suggests that future solar satellites be designed to provide more complete coverage (including multiple satellites and satellites at high ecliptic latitudes) and better particle composition measurements.

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Mathematical Astronomy

Celestial Mechanics. Vol. 1, Dynamical Principles and Transformation Theory. YUSUKE HAGIHARA. M.I.T. Press, Cambridge, Mass., 1970. xiv, 690 pp. $25.

Judging by the contents of this first of five projected volumes, the series promises to be an exhaustive treatment of its subject. It is clear that the series is not intended for students but for those who are already knowledgeable in the field.

The author states that his goal is "to examine on rigorous mathematical grounds the question of whether the deductive process [of determining the motion and figure of celestial bodies by pure mathematical deduction based on the laws of dynamics] can be logically justified." This is a serious question, for until recently very little was known even about the convergence of the series expansions customarily employed by celestial mechanicians. With the current second flowering of the field due to the space age and the invention of electronic computers, this is indeed a worthy undertaking.

This first volume is almost entirely devoted to classical topics. Most of the material was well known by 1950, and the bulk of it is much older. Such basic topics as the theory of Hamiltonian mechanics and canonical transformation theory, quasiperiodic and almost-periodic functions, and exact solutions of the n-body problem are treated in great detail in part 1. Part 2 is devoted to the applications of transformation theory to celestial mechanics, with particular emphasis on Lie's theory of continuous groups. Here will also be found a discussion of Bruns's and Poincaré's theorems on the nonexistence of certain types of integrals to the n-body problem.

Despite the importance of the topics covered and the detail into which the author goes, this is a difficult book to read. Part of the difficulty is due to the author's frequent choice of obsolete or unusual terminology and notation. For example, his treatment of differential forms and their applications to celestial mechanics closely follows that of Cartán's classic work, *Leçons sur les Invariants Intégraux*, despite the fact that Cartán's notation is seldom used any more. There is nothing wrong in this, but it seems that the book could reach a wider (and younger) audience if its notation were more in line with current practice. Again, the word "symplectic" is used (p. 90) not to describe the symplectic group of matrices in the usual sense but to describe the general matrix with complex entries.

A particularly disturbing feature of the book is that important terms and concepts are introduced long before a proper discussion of them is presented. For example, "group" is used on page 92 and defined 200 pages later and "involution" is used on page 136 and defined on page 304. On page 207 the elliptic functions *sn* and *cn* are used (together with some of their important properties), but there is no discussion of these functions anywhere in the book; true, the information can be found elsewhere, but these functions are unfamiliar enough that they should be explained in the text. There are many other examples.

Finally, there is often insufficient motivation for the introduction of many topics and terminologies. The book does not lead one easily from one topic to another.

Nevertheless, this is a valuable book despite its deficiencies. The series promises to bring together in one place the relevant material in the field of celestial mechanics, and that is very much needed at this time.

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Books Received

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Advances in Pharmacology and Chemotherapy. Vol. 8. Silvio Garattini, A. Goldin, F. Hawking, and I. J. Kopin, Eds. Academic Press, New York, 1970. x, 260 pp., illus. $14.50.

Advances in Reproductive Physiology. Vol. 5. Marcus W. H. Bishop, Ed. Academic Press, New York, 1971. viii, 218 pp. + plates. $15.

African Elite. The Big Men of a Small Town. Joan Vincent. Columbia University Press, New York, ed. 2, 1971. x, 310 pp., illus. $11.

Atomic Absorption Spectrochemical Analysis. B. V. L'vov. Translated, with revisions, from the Russian by J. H. Dixon. Elsevier, New York, 1971. xii, 324 pp., illus. $43.

Les Bedik (Sénégal Oriental). Barrières Culturelles et Hétérogénéité Biologique.

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