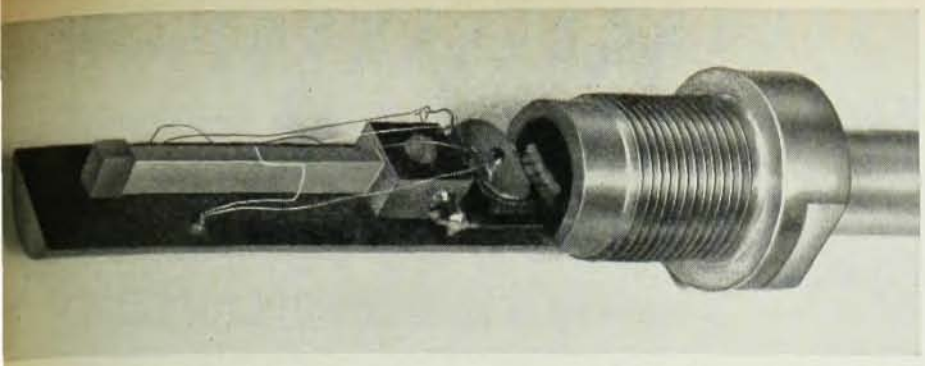
equations is as scanty as our present state of knowledge of the subject; a few ideas about singular linear equations, and an explanation that nonlinear ones can be very difficult, except where iterative or linearization methods happen to work. The section ends with two extremely interesting and important chapters, one on the integro-differential equations which occur in nuclear collision problems and the other on the Hartree-Fock equation. Part 3 is all fairly routine but is animated throughout by the principle of how to find the most efficient way to solve specific problems.

Part 4 is the one that will interest advanced readers. It is an extremely useful collection of short accounts of various practical problems and their numerical solutions. The range includes nuclear reactor problems, Monte Carlo methods in neutronics, plasma problems, and numerical weather prediction, to name only a few typical examples. And the real value of these accounts is in the fact that they were written by those actually concerned with the problems and who are therefore best qualified to expound their essential difficulties.

Théorie des Groupes en Physique classique et quantique. Vol. 1, Structures mathématiques et Fondements quantiques. By Théo Kahan et al. 664 pp. Dunod, Paris, 1960. 75 NF. *Reviewed by Nicholas Chako, Queens College.*

IF one defines group theory in rudimentary terms as the study of order, symmetry, and other common characteristics of objects and especially geometrical forms, then its history is as old as geometry and inseparable from it. The early manifestations can be traced back to the handiwork of primitive man, i.e., in the designs of ornaments and pottery and in regular geometrical patterns pleasing to the eye. Indeed, Nature displays a great variety of symmetrical forms, in both the living and inert states, which underly the group idea. As man advanced in civilization, the symmetry principle found applications in the creative arts, as seen in the great temples and palaces. Along with these advances, there was a great development in speculative and abstract thinking about natural and spiritual phenomena, originating from a desire to understand and harmonize the physical and human phenomena. As a result, science and philosophy developed, and became disciplines in the education of civilized societies. Mathematics was the most successful of the sciences, and with its development, the principle of symmetry, embodied in the idea of a group as we know it today, took a definitive form in the hands of Plato, Euclid, and other Greek thinkers.

However, in the strict mathematical sense, group theory has a more recent origin. One could, perhaps, assign its origin to that tragic figure, Evariste Galois (1811–1832). Even so, the profound ideas and implications contained in Galois' work were not clearly understood by his contemporaries, whereas systematic studies of applied group theory were carried out by crystallographers, especially F. Neumann, Bravais, and



elegant, but tiny refrigerator, utilizing Nernst-Ettingshausen effect, has been monstrated in the Solid State Physics boratories at Lockheed Missiles & Space mpany. This type of cooling is appli- ble below 200° Kelvin, where thermo- ctric cooling is no longer efficient. It ows particular promise for space appli- ion because of the reliability inherent its all-solid state construction.

n the Nernst-Ettingshausen effect, heat umped as a result of an electrical cur- t flowing in a magnetic field. The heart the present device is a bismuth anti- ny single crystal. Other crystal sys- ns are also being investigated.

his thermomagnetic cooling device is e of the results of the Lockheed research gram in transport phenomena in solids.

Another investigation concerns the quantum theory of the electronic structure of crystals. An ingenious computer program has been devised for determining the essential features of the energy band structure of a wide variety of crystals. Results for a given case can be obtained in an hour or less. Conclusions drawn from the theoretical solution elucidate many of the electronic properties of crystals, and have widespread significance.

Lockheed scientists and engineers are also studying: Electron spin echo phenomena; the interaction of electrons with microwave phonons; coupled traveling waves in crystals; semiconductor lasers; antiserromagnetic resonance; various theoretical and experimental aspects of superconductivity.

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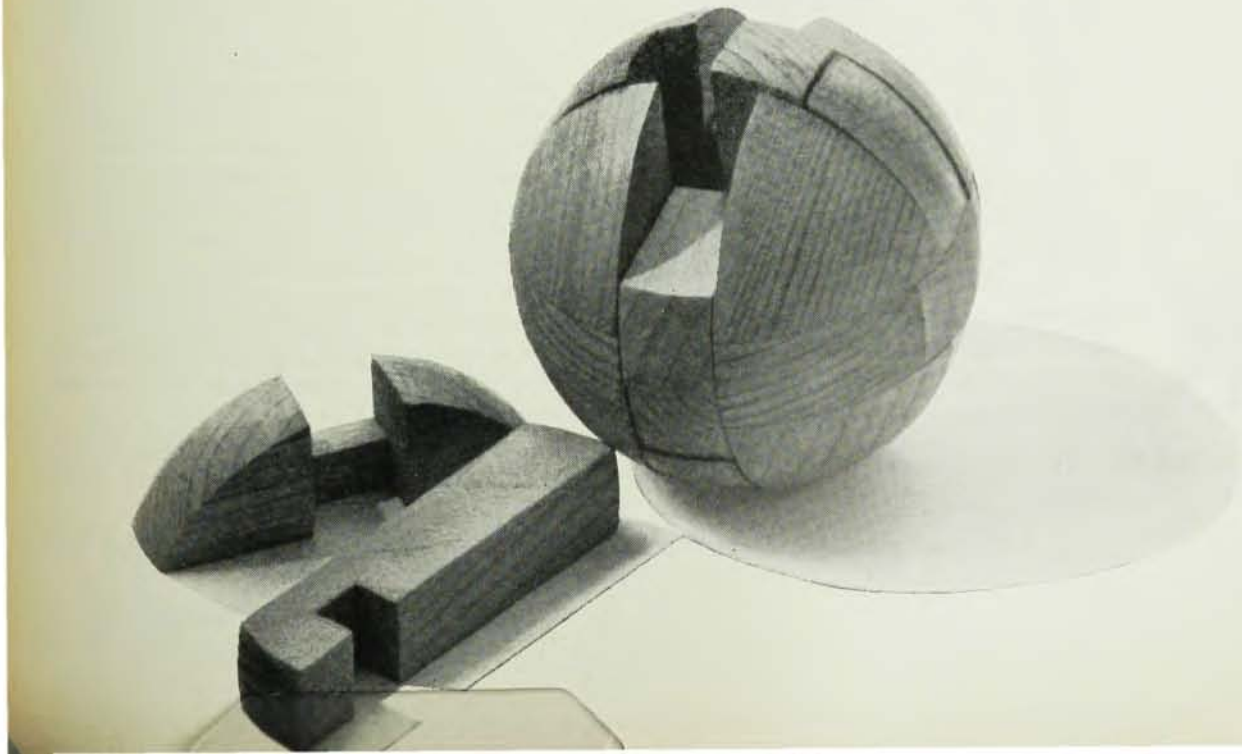

Sohnke. However, in the latter decades of the 19th century, due to the efforts of Burnside, Cayley, Jordan, Klein, Kronecker, Lie, and their associates, there was a great development of group theory—as a separate discipline—in its abstract formulation, as well as in its applications to other branches of mathematics and science.

The volume under review is based on lectures given at a seminar under the direction of Dr. Kahan at the Henri Poincaré Institute in Paris. It contains seven parts, each written by one of the specialists who participated in the seminar.

The first part, written by Th. Kahan and P. Cavaillès, develops group theory from the axiomatic point of view. The treatment is slanted to those parts of group theory which are of interest to physicists. However, both the introductory chapters and the main body of the text are written in the language of that mythical figure, Nicholas Bourbaki, so the mathematicians will find interesting material as well. Some of the topics of interest are spinor representation of the Lorentz group and structure of topological groups and analytic spaces (Minkowski and other metric spaces) with an extensive discussion of their group properties. Considerable space is devoted to Lie and Clifford algebras. An interesting account on integration in topological groups is added in the form of an appendix under the name of G. Lochak. This part contains not only the essentials of group theory as a preparation for the rest of the book, but also enough material on which to base a course for graduate students in physics or applied mathematics.

The second part, written by T. V. Newton, is devoted to inhomogeneous Lorentz groups, which have attracted in recent years the attention of a number of eminent mathematicians and have found many applications, especially in quantum field theory. The following part (by R. Gouarné) contains a treatment of abstract groups. It forms a good introduction to the treatises and special monographs on this subject. The next two parts (by G. Rideau) contain a detailed analysis of representation and permutation groups and an account of characters of symmetry groups and the methods for their calculation for various types, as well as the procedure of decomposition of Kronecker products of irreducible representations. Part six (Th. Kahan) is devoted primarily to group-theoretical representation (axiomatization) of quantum mechanics. The last part contains a rather detailed analysis of rotational groups, which play important roles in modern theoretical physics (atomic, molecular, and nuclear spectra, elementary particles, etc.). Here one finds a clear discussion of the methods for calculating Clebsch-Gordan and Racah coefficients and the algebra of irreducible tensor-product operators which are encountered in the study of many-body problems.

Extensive references to original literature, and author and subject indices are given at the end of each part.

In the second volume (not published yet), the au-

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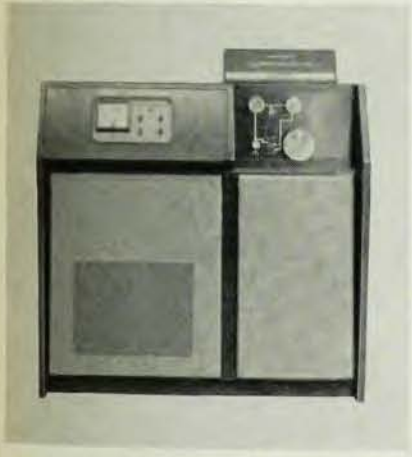

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thor proposes to consider applications of group theory to the whole breadth of classical and modern physics: fields as diverse as crystallography and thermodynamics; dynamical systems and molecular physics; electrodynamics; general relativity and ergodic systems; atomic, molecular, and nuclear spectra; solid state and crystals (vibration and ionic spectra); and finally the role of groups in elementary-particle theory.

Judging from the depth and the extended treatment of the topics covered in the present and in the proposed companion volume, the author and his collaborators have aimed at producing no less than a treatise of encyclopedic character. It goes without saying that an undertaking of this scope will have enduring value in scientific circles. The specialist will find an unusual wealth of ideas and material to draw from, well organized and clearly presented as one expects from the pen of French scientists. The nonspecialist and advanced student, having neither the time nor the interest to study the original papers, will acquire more than a bird's-eye view of the beauty, elegance, and power of group theory and its vast applications to practically the whole field of theoretical physics.

Introduction to Scientific Inference. By Robert Hooke. 101 pp. Holden-Day, San Francisco, 1963. $4.74. *Reviewed by William S. Bickel, Pennsylvania State University.*

MUCH has been written about statistics and the statistical treatment of data, but *Introduction to Scientific Inference* is different in that its few pages emphasize the ideas of quantitative inference and not the mathematical techniques. But even though it is not intended to be a detailed work on statistical theory, it does present a concise mathematical introduction to many topics with which the author feels scientists and engineers should be more familiar. Obviously sympathetic with P. W. Bridgman's comment about statistics being bad enough but bad statistics being intolerable, the author has succeeded in displaying the modus operandi of the statistical treatment of data, starting with the selection of the population-sample model, leading through a discussion of confidence statements and uncertainty to fitting the mathematical model to real situations. This interesting treatment is written in a way that will be beneficial and stimulating to anyone involved in the harvest of information from experimental data.

Quantum Mechanics. By D. B. Beard. 309 pp. Allyn & Bacon, Boston, 1963. $8.95. *Reviewed by Leonard E. Porter, University of Wisconsin.*

THE avowed objective in writing this textbook was to offer an introduction to quantum mechanics which avoids the postulatory approach. The basic plan was to establish familiarity with the description and properties of wave motion, to consider evidence for the particle behavior of electromagnetic waves and the