esting and timely topics which nonscience students will want to know about and discuss in an introductory course. The fact that this is so, combined with the overwhelming importance to society of a scientifically literate citizenry, furnishes ample justification for other approaches than the one used by Kemble. That he has succeeded so well gives one renewed confidence that such education may indeed be carried out within the framework of a general education program.

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Summer Schools in Theoretical Physics

Tokyo Summer Lectures in Theoretical Physics, 1965. Part 1, Many-Body Theory. RYOGO KUBO, Ed. Syokabo, Tokyo; Benjamin, New York, 1966. 166 pp., illus. $6.75.

In the past 15 years summer institutes in theoretical physics have become an essential feature of the pattern of communication in the subject. To the first well-known sessions at Ann Arbor and Les Houches (still flourishing) have been added—to name only a few—semipermanent schools in Italy, Scotland, Corsica, India, Turkey, Canada, and South America and at Brandeis and the University of Colorado in the United States. The value of these institutes to the graduate students and postdoctorals participating has long been apparent. The schools provide an opportunity for the participant to form friendships with young people at their own stage of scientific development. They are brought to the frontiers of research without time-consuming and frequently aimless grappling with the "literature." For those who do not attend the sessions the printed lecture notes have largely taken over the function of indicating what the experts consider to be the results achieved and the outstanding unsolved problems in a field.

In view of the outstanding contributions of Japanese theoretical physicists, it is good to be able to add to the growing list the Tokyo Summer Institute of Theoretical Physics directed by R. Kubo. The first part of the proceedings, devoted to many-body physics, is a slim volume of some 160 pages—a good deal less than the norm. Yet it covers an astonishingly wide range of topics and conveys a lively sense of where worthwhile research can be done. It can indeed be recommended for perusal by a research student looking for something to work on. The price paid is that most of the contributions are sketches and guides to the literature rather than self-contained accounts.

The first lecture is by Kubo and is entitled "The fluctuation-dissipation theorem and Brownian motion." It continues Kubo's successful efforts to bring about a closer relation between the theory of random processes and many-body theory. H. Mori's article deals with relaxation phenomena near critical points. Although the equilibrium phenomena have been studied intensively, the understanding of transport processes in the immediate vicinity of critical points represents a fresh problem. Many students may find it necessary to read Mori's account with his original articles close at hand. There are three short contributions by K. A. Brueckner. The first one describes calculations of the properties of liquid He^3. It is emphasized that even in the normal phase the Landau theory of Fermi liquids is incomplete. "The theory of correlated crystals," by Brueckner and Frohberg, outlines a method of treatment of the ground-state energy of crystals of helium isotopes. This is an important problem conceptually, since the large zero-point motion implies the inadequacy of the Born-Oppenheimer approximation that is at the basis of most of solid-state physics. This subject has been slighted in the past—perhaps because the crystals have no properties that are as spectacular as superfluidity and superconductivity. Finally, Brueckner provides a report on the present status of the theory of the ground state and low-lying levels of nuclei.

W. Kohn presents a new simple yet rigorous formulation of the inhomogeneous electron gas problem. J. R. Schrieffer analyzes the limitations of the quasi-particle approximation in metals. J. M. Luttinger gives the first account the reviewer has seen of the Kohn-Luttinger theory that a sharp Fermi surface implies that even a system of fermions with purely repulsive interactions becomes superconducting at sufficiently low temperatures. Finally there are two more extensive and very readable articles by D. Pines and P. G. de Gennes. Pines analyzes the implications of inelastic neutron scattering data for the theory of finite temperature excitations in superfluid and normal liquid helium. De Gennes describes the use of the Landau-Ginsburg equations and the properties of type II superconductors.

In sum this volume is a pleasing package. The accounts may be too brief for complete newcomers, but they provide a good perspective on the present concerns of many-body theorists. Here also is a partial answer to the question, "What is there left to be done?"

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Recent Developments in Particle Symmetries. Proceedings of the International School of Physics "Ettore Majorane," Erice, Sicily, 1965. A. ZICHICHI, Ed. Academic Press, New York, 1966. 472 pp., illus. $12.

Tokyo Summer Lectures in Theoretical Physics, 1965. Part 2, High Energy Physics. GYO TAKEDA, Ed. Syokabo, Tokyo; Benjamin, New York, 1966. 127 pp., illus. $5.75.

In theoretical physics 1965 was above all the year of long debates on symmetry principles in strong and weak interactions of fundamental particles, on their consistency, validity, and violations. Not only were there bold introductions of larger and larger approximate symmetry groups containing internal and external symmetries, including those containing an infinite number of particles, but serious doubt arose over some of the very firm symmetry principles such as time-reversal invariance and symmetry between particles and antiparticles. The first volume under review clearly reflects this trend. In their lectures A. Pais, J. S. Bell, N. Cabibbo, and L. A. Radicati discuss the significance, successes, and difficulties of the so-called broken symmetries in particle physics. These approximate higher symmetries involve the internal quantum numbers of particles (charge, hypocharge, isotopic spin), whose real nature is still quite elusive to the physicist. The time-reversal invariance problem (actually *CP* invariance, which is generally accepted as equivalent to time reversal) is discussed in lectures by J. Prentki and J. Steinberger. In a brief closing speech V. F. Weisskopf remarks, "Science could develop only when men began to restrain themselves not to ask general questions, such as: What is matter made of? How was the universe created? What is the essence of life? They had to ask limited questions, such as: how does an object fall? . . . Instead of asking general questions and receiving limted answers, they asked limited questions and found general answers." This is nowhere more evident than in the particle physics of today; one has to ask limited questions first about a huge number of experimental facts of a huge number of new particles. The theoretical physicist at times has to stay close to the experiment, without abandoning his search for more general relationships. Thus it is good that this volume also includes lectures on experimental results by P. Franzini, J. Lee Franzini, G. A. Snow, S. Focardi, and V. Meyer-Berkhout.

The Tokyo lectures contain rather brief expositions of a variety of lectures and a larger review by R. E. Marshak on the "Present status of weak interactions." Other topics dealt with are *S*-matrix theory (G. F. Chew), the *S*-matrix at very high energy (L. Van Hove), high-energy behavior of the forward scattering amplitude (T. Kinoshita), and the effects of hadrons on the hyperfine structure of hydrogen (Y. Nambu). There are in addition three papers on symmetries, by Y. Ne'eman, S. L. Glashow, and S. A. Bludman.

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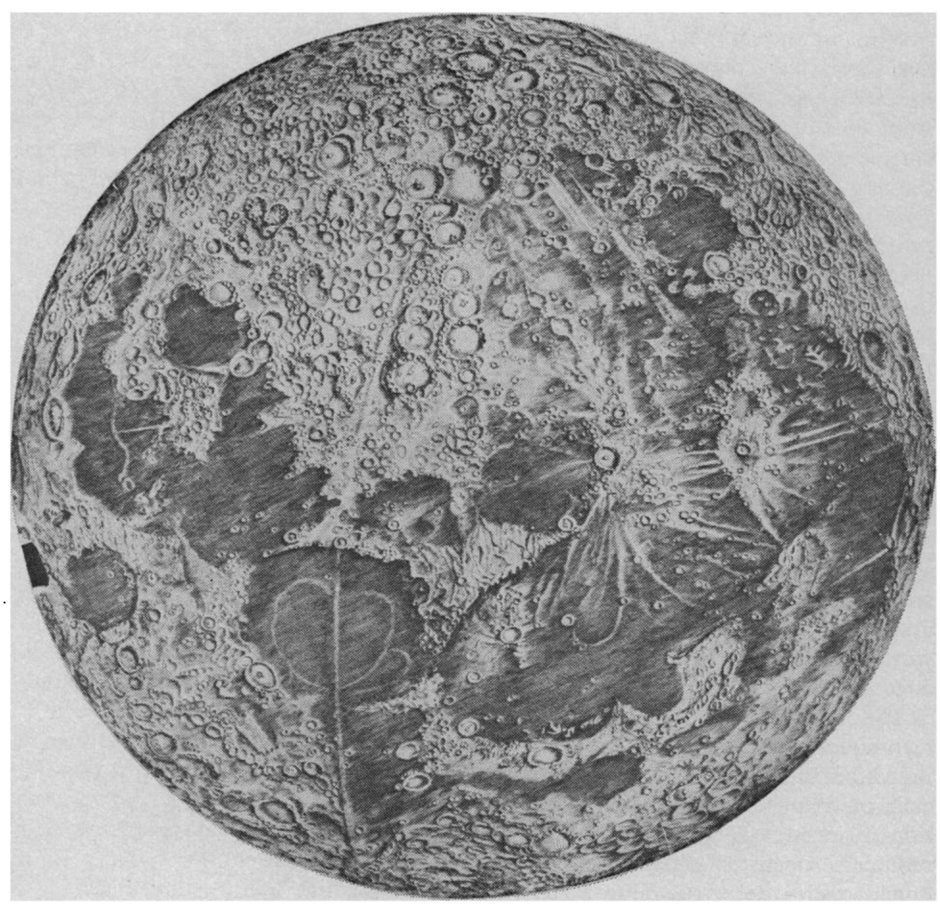
Lunar Astronomy

An Introduction to the Study of the Moon. ZDENEK KOPAL. Reidel, Dordrecht; Gordon and Breach, New York, 1966. 476 pp., illus. $27.50.

Kopal's book is in four parts. Part 1, with six chapters, covers the mechanics and dynamics of the moon regarded as a rigid body in space. It includes the celestial mechanics of the moon's rotational motions but barely touches the orbital problems. The significant problems of distance and mass of the moon are treated in terms of the latest radar information. The second section considers the theory of the moon's interior. First comes the classical hydrostatic theory of Clairaut and his successors; next the thermal history, as it has been treated by Levin, MacDonald, and others; then the stress history; and then what can be surmised about the chemical composition. The third part, on the topography of the moon, includes several chapters on the technical problems of setting up a coordinate system and mapping the moon. There follows a description of the kind of formations which are seen on the moon and some discussion of the origin of the lunar formations in terms of both impact and volcanic theories. In the fourth section, the nature of the lunar surface is deduced from the usual four sources: its photometry (including polarization and color), its thermal behavior, its radiation in radio frequencies, and its radar properties. There follow discussions on the somewhat speculative luminescence properties. Finally, the implications of the previous work are summed up in two chapters on the structures of the lunar surface and the origin of these structures.

The scope of the book is remarkably comprehensive, from gravitational librations to radar reflectivity. This reflects the fact that Kopal is a skillful mathematical physicist and enjoys complexities. Few readers can go straight through this book. Most will have to reconcile themselves to reading only the results in most chapters and reading thoroughly those mathematical sections where they have special interests.

Comparing Kopal's with a book such as Baldwin's *The Measure of the Moon* (University of Chicago Press, 1963) one notices, on the positive side, the aforementioned mathematical facility; on the negative side, one sees that there is no discussion of the recent work on impact metamorphism. The names of E. C. T. Chao and C. S. Beals are nowhere referred to, nor is there any discussion on the significance of the discoveries of coesite and stishovite or the Ries Kessel or the Canadian impact craters. The analysis of the lunar grid system by Fielder is not discussed. One has the feeling that in terms of a physical understanding of the lunar surface, Kopal's book is not as far ahead as it is in his grasp of the mathematical intricacies.



Map of the moon, 1680, by J. D. Cassini, engraved by C. Mellan. This is one of the earliest maps. South is at the top, as was the convention at the time. [From *An Introduction to the Study of the Moon*]