from his comment on Smart—is at first less obviously in the philosophy of *science* than most of the others; it deals with a current controversy about the plausibility (and/or probability) of the assertion that mental states are identical with brain states, but at the end of the paper's fifty-two numbered and tightly argued paragraphs the implications for the theory-observation problem discussed above become clear. Hanson pursues what he calls "a loose analogy" between the crisis in the foundations that plagued number theory early in this century and a less notorious crisis in Newtonian mechanics; Hilbert's consistency proof is seen as corresponding roughly to Laplace's stability proof, and the comparison of cases leads to a helpful clarification of the relation between mathematics and physics. Shimony discusses Whitehead's philosophy of science—one might almost say Whitehead's *science*, since he conceived of it as directly applicable to the physical world—and asks how it stands after forty years in the light of developments in quantum physics; he concludes that it is falsified in detail but that its general principles might still be of value if only they were followed seriously.

The six remaining papers—by G. Schlesinger (with a commentary by Hempel), Everett Mendelsohn, Dagfinn Follesdal, Herbert Marcuse, Michael Stock and Milic Capek—are all serious pieces of work, and of high quality. There has been no intention of slighting them here; another reviewer, with other preoccupations, might have chosen some among them for emphasis. In fact this volume presents an embarrassment of riches, and although it is not inexpensive it is one of the best buys available among recent publications following this pattern.

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On the average, difficult

BERKELEY PHYSICS COURSE. Volume 1, Mechanics. By Charles Kittel, Walter D. Knight, Malvin A. Ruderman. 480 pp. McGraw-Hill, New York, 1965. $5.50

by R. Bruce Lindsay

Much of the recent interest in the preparation of textbooks of elementary college physics has centered on the presumptive need for more substantial fare for those embarking on the subject with scientific careers in mind. Among university physicists, well known for their research contributions, there has evidently been a growing impatience with the conventional type of introductory text and a desire to get the student more quickly into the more exciting modern aspects of physics like relativity and quantum theory. Part of this attitude is based on the conviction that secondary-school courses are improving to the extent that emphasis on so-called classical physics is no longer so necessary in the elementary college course, thus permitting closer attention to the development of the powerful and sophisticated tools needed for an appreciation of what is going on in physical research today. This increased concern for stronger teaching on the elementary level being exhibited by research physicists is undoubtedly welcome. It has led to the development of a number of new texts of which the one under review is a good example.

The book is the first volume in a series of five, the remaining four of which will be devoted to electricity and magnetism, waves and oscillations, quantum physics and statistical physics. These volumes are to be used in a four-semester elementary physics sequence at the University of California at Berkeley, and presumably in the hope of the authors at other institutions as well. The students at which it is directed are majors in science and engineering.

The aim of the authors is to present the subject "as far as possible in the way in which it is used by physicists working on the forefront of their field." A perusal of the book makes it evident that by the physicists in question are meant those in the currently fashionable fields of atomic, nuclear and solid-state physics.

In line with the stated intention of the course as a whole, the initial volume on mechanics lays great stress on relativity, introducing the subject through a lengthy discussion of Galilean invariance and Newtonian relativity. Four subsequent chapters (about 100 pages) are devoted to the Einstein theory of relativity, including relativistic dynamics. These are prefaced

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by a long chapter on the speed of light and its measurement, a topic not usually found in texts on mechanics.

Much emphasis is placed on the conservation principles. Newton's third law is found lacking and hence the recommended derivation of the principle of conservation of momentum is based on the generalized principle of the conservation of energy, an interesting procedure. There is a good chapter on harmonic oscillations with stress on the analogy with electrical oscillations. Nonlinear effects are discussed. The short chapter on rigid dynamics (26 pages) is recommended for omission on first reading of the volume: the modern physicist's interest in the rigid body is minimal.

In the numerous examples of dynamical systems most attention is paid to motions of charged particles and astronomical bodies. There is, for example, no reference to mechanical oscillations as sources of acoustic radiation. Waves in the mechanical sense are not mentioned, being presumably postponed to a later volume in the series. The book is profusely illustrated with clear and well-drawn figures, though the plan of reproducing them on a gray background raises some questions about maximum legibility. Numerous well chosen historical notes, with actual quotations from original sources, enliven the text.

The book should have great appeal to the intelligent, well prepared, enthusiastic and conscientious student of elementary physics, but the reviewer fears that the average physics major will find the going very difficult. It is probably churlish to criticize such an interesting venture into the pedagogy of physics, but in view of the authors' stated intentions to emphasize vigorously "the foundations of physics" in their series, it seems a pity that more efforts along this line are not apparent in the text of this first volume. Thus there is no careful definition of a physical law and no discussion of the relation between law and theory in physics. Moreover it seems distinctly unsafe to assume that the student acquires adequate definitions of the fundamental concepts of mass and force in his secondary-school course. No attempt is made in this text to define these concepts, which are basic for mechanics and indeed for all of science. Mechanical energy is handled more adequately, but justice is scarcely done to the generalized form of the principle of the conservation of energy needed to meet the existence of mechanical dissipation. However, the student must learn early in his career that no book is perfect, and that he must broaden his perspective by wide reading and deep meditation if he is ultimately to understand what physics is all about.

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'Round and 'round and 'round go the deuterons

THEORY OF CYCLIC ACCELERATORS. By A. A. Kolomensky, A. N. Lebedev. Trans. from Russian by M. Barbier. 403 pp. Wiley, New York, 1966. $15.50

by Denis Keefe

This is an outstanding addition to the literature on accelerator theory. The original work was published in Russian in 1962 and the English-reading scientific world should be indebted to M. Barbier for his clear translation.

Compared with some other branches of physics, major advances in accelerator physics take a relatively long time to become realized in practice. Thus to some it may appear as a comparatively slowly moving field. In fact, impressive quantities of theoretical and experimental material have been amassed over the last few decades and continue to be produced. It is, therefore, somewhat surprising that there are very few comprehensive texts that do justice to most of this work. To obtain an understanding of, or to teach a course on accelerators, the linear approximations of particle orbits in magnet systems or the more simplified treatment of phase stability that can be found, for example, in the texts by J. J. Livingood and by M. S. Livingston and J. P. Blewett, are completely adequate. The accelerator physicist today is, however, faced with the more difficult problems concerning passage through resonances, negotiation of transition, distortions of the equilibrium closed orbit, nonlinear resonances and the many coupling problems that can occur in circular accelerators.

It is more than four years since the