ing the Spring of the Air and its Effects (1660) is the one best known to most physicists, the latter will naturally be interested mainly in what the author has to say about the work on fluids. There is an attractive though all too brief section on pneumatics, in which certain modern attempts to deprive Boyle of the credit for having established the law that bears his name are successfully rebutted.

Though Boyle never prepared a thorough treatise on what is now called philosophy of science, it is clear from notes that remain that he thought a good deal about this subject. In particular he paid much attention to the role of hypotheses in science and had clear ideas about the distinction between good and bad ones.

The actual excerpts from Boyle's writings occupy somewhat over two thirds of the book and are carefully chosen to illuminate every aspect of his scientific work and thought. The reader of this material who is not previously acquainted with seventeenth century scientific literature will be impressed by the prolixity of Boyle's style and the often elaborate and tedious detail in which he indulges. Nevertheless, his evident sincerity and real desire to inform the reader precisely what he had done or was thinking about are usually persuasive and often engaging.

All who are interested in seventeenth-century physics will wish to look into this volume.

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R. Bruce Lindsay, who is Hazard Professor of Physics at Brown University, writes frequently on the history of science.

Ad hoc philosophy of science

BOSTON STUDIES IN THE PHILOSOPHY OF SCIENCE. Volume 2: In Honor of Philipp Frank. Robert S. Cohen, Mark W. Wartofsky, eds. 475 pp. Humanities Press, New York, 1965. $9.75

by Peter Caws

Volumes like this provide convincing evidence, if any is required, that the philosophy of science is enjoying a period of unprecedented intellectual and academic prosperity—intellectual because of the quality of the papers collected here, academic because of the auspices under which they appear. The thirteen contributions were originally presented, between 1962 and 1964, to the Boston Colloquium for the Philosophy of Science, a group that has been meeting for a number of years under the aegis of Boston University and the National Science Foundation. The Boston Colloquium is one of the better known enterprises of this sort, and it is easy to see why. As in the previous volume in the series (published in the Synthese Library by Reidel of Dordrecht in 1963) the material covered makes a good ad hoc cross section of current work in the philosophy of science. In addition the editors have had the genial idea of dedicating the book to Philipp Frank, who was one of the great figures in the recent history of the discipline and who has died since the publication of the book (PHYSICS TODAY, September 1966, p. 119). A series of tributes to him, by friends and colleagues, together with a bibliography, precedes the main papers. An excellent photograph of Frank appears as frontispiece.

The papers are not all equally relevant to the concerns of contemporary philosophers of science. Some of them are occasional, for example Sir George Thomson's reflections on the scientific method—well worth reading nevertheless, since it is a rare privilege to hear a Nobel physicist's view of the philosophical enterprise from the perspective of the working scientist. Some are downright peripheral, such as Norman Rudich's erudite but ponderous essay on "The Dialectics of Poesis," which, if presented as given here, must have caused a good deal of fidgeting in seats and consulting of watches among the members of the Colloquium. But a few are central, and between them give an excellent idea of what the discipline is all about. In this respect the contributions of Ernan McMullin, Wilfrid Sellars, Norwood Russell Hanson, J. J. C. Smart and Abner Shimony deserve special attention.

Of all these the one paper that gives the clearest view of the preoccupations of *professional* philosophers of science is Smart's, not so much because of what it says (lucid and informative as that is) as because of what follows it. Most of the essays are followed by critical comments; Smart's brief contribution gets three comments, each longer than the paper, by Sellars, Hilary Putnam and Paul Feyerabend, a hundred pages in all of philosophical polemics in the best tradition. The point at issue is the nature of explanation—that is, the nature of the relation between theory and observation. Smart discusses the views of Feyerabend and Sellars against the background of the (by now) standard view, for which he chooses Ernest Nagel as the spokesman. (Nagel gets no chance to participate in the debate, although Putnam strikes a glancing blow for him before setting upon Feyerabend.) The standard view maintains that elements of the theoretical structure correspond to and imply, but are not convertible into or exchangeable with, elements of observation. Feyerabend on the other hand holds that there is no sharp distinction between the observational and the theoretical, that the latter is a kind of extension or ramification of the former and that it would be quite proper (and not merely figurative) to *describe* the observed work of common sense in theoretical terms. Sellars agrees with Nagel that the elements of ordinary everyday observation are to be distinguished from elements of theory, and therefore disagrees with Feyerabend, since it follows that theoretical language is unsuitable for most descriptive purposes; but he does not think that ordinary observational terms correspond to theoretical terms either—*scientific* observations, which form a very select and specialized subclass of observations in general, must be described in theoretical language. There is no point in reproducing here the arguments between these positions, but they make absorbing and at times exciting reading.

McMullin's paper exemplifies a rather different concern; it is an exercise in what might be called the "history of ideas" in a scientific context, which traces the link between the ancient concept of *matter* and the modern concept of *mass*. Sellars' independent contribution—that is, apart 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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