Books

La Théorie physique au Sens de Boltzmann et ses Prolongements modernes. By René Dugas. 308 pp. (Editions du Griffon, Neuchâtel) Dunod, Paris, France, 1959. 3700 fr. *Reviewed by R. Bruce Lindsay, Brown University.*

THE significant role which Ludwig Boltzmann played in the development of modern physics was recently re-emphasized in the brief biographical sketch of 1955 by Engelbert Broda. We now have before us from the hand of the late Maître de Conference of the Ecole Polytechnique of Paris a much more substantial critique of the scientific achievements of the great Viennese scientist. René Dugas made numerous valuable contributions to the history of mechanics in his later years and in this his last work he pays tribute to one of the founders of statistical mechanics in an analysis which has been based on a careful and thorough investigation and deserves close attention from all who are interested in the history and philosophy of physics.

Boltzmann was in some respects a tragic figure, who took all too seriously the scientific animadversions of his positivistic contemporaries like Mach and Ostwald. He believed in atoms and they did not. He had a strongly developed faith in the unfettered role of the human imagination in the creation of theories, a function whose worth was seriously doubted by many eminent physicists of his day, but which has eminently justified itself in the physics of the twentieth century.

Mr. Dugas provides first a fascinating nonmathematical review of Boltzmann's contributions to the critical study of the principles of mechanics, the general methods of theoretical physics, the theories of the school of energetics (represented by the rabid thermodynamicists), statistical mechanics, and philosophy. He then proceeds to a more detailed mathematical commentary on Boltzmann's gas theory, with the generalization of the Liouville theorem and the famous H theorem. This section concludes with a consideration of the statistical basis of the second law of thermodynamics and Boltzmann's rejoinders to the various objections raised to his views. The final section of the book is devoted to modern developments based on Boltzmann's work, including his relation to Gibbs, Poincaré, Planck, and Einstein. There is even a reference to the current controversy in the methodology of quantum mechanics between the Copenhagen school of indeterminists and the group represented by D. Bohm and J. P. Vigier, who believe that a deterministic version of quantum mechanics can ultimately be constructed. Dugas feels that Boltzmann, with his faith in bold intuitive insights as against the phenomenological, positivistic approach, would have sided with the latter group. This is an arguable point but it must be confessed it is very plausibly presented.

All who are interested in late 19th century and 20th century theoretical physics will enjoy this volume.

Probability and Related Topics in Physical Sciences. Vol. 1 of Lectures in Applied Mathematics: Proc. of Summer Seminar (Boulder, Colo., 1957). By Mark Kac with G. E. Uhlenbeck, A. R. Hibbs, Balth. van der Pol. 266 pp. Interscience Publishers, Inc., New York, 1959. $5.60. *Reviewed by J. Gillis, The Weizmann Institute of Science.*

DELIVERED at the Boulder Summer Seminar in 1957, this collection of lectures certainly makes delightful reading. The first four, by Kac, are respectively on the nature of probabilistic reasoning, some tools and techniques of probability theory, probability in some problems of classical statistical mechanics, and integration in function spaces and some applications. In these lectures both material and exposition are on the high level which could have been expected. The subjects are presented chiefly through examples and these have been selected for intrinsic interest, as well as for didactic value.

The bulk of the first lecture is devoted to the Littlewood-Offord theory of real roots of random polynomials and to an interesting excursus into prime number theory. The second lecture concentrates for its illustrations on a number of random walk problems. Throughout both of these lectures the aim seems to be to bring in as many powerful arguments as possible, for the edification and instruction of the student. The third lecture deals with the well-known problems of the connection between classical reversible mechanics and the Second Law of Thermodynamics. The author's own solution of the Ehrenfest problem appears, as does also the powerful and original method of Siegert and Hess. The fourth lecture presents a short and lucid account of the Wiener integral—certainly a long felt need—followed by some applications, including Feynman integrals and the Wigner-Kirkwood expansion of the quantum dynamical partition function.

Little is said of the foundations of probability theory; the emphasis is always on methods of analysis. As the author remarks in a footnote: "How much 'fuss' over measure theory is necessary for probability theory is a matter of taste. Personally, I prefer as little fuss as possible, because I firmly believe that probability theory is more closely related to analysis, physics and statistics than to measure theory as such."

Following the four lectures by Kac there is an appendix by Uhlenbeck on the Boltzmann Equation. This begins with a critical derivation and a careful discussion of its probable range of validity. The great interest in this equation of recent years is, to an important extent, the outcome of Uhlenbeck's own searching analyses. The next step is to discuss what happens at higher densities,