ered the Second Law of Thermodynamics from the pedestal of a law of nature to the level of a useful approximation was an erratic motion of small particles suspended in liquids already observed by an English botanist Brown in 1827.

The two scientists who almost simultaneously and quite independently (using, in fact, wholly different methods) provided us with a theory of this remarkable phenomenon were Albert Einstein and Marian Smoluchowski.

Smoluchowski died in 1917 of dysentery at the age of forty-five at the height of a brilliant and remarkable career, and in his death physics lost, to quote from Einstein's obituary, "one of the most penetrating ('einer der feinsinnigsten') modern theoreticians".

We are now offered the first complete biography of Marian Smoluchowski and it is a great pity that because of the language the book will be relatively inaccessible.

For it is an excellent biography and the author has succeeded remarkably well in giving us both a living portrait of a great man and a popular summary of his scientific achievements.

He has also managed to convey (mostly by quotations from letters) the general atmosphere of the times and gives us many lively glimpses of famous contemporaries (Einstein, Boltzmann, the Ehrenfests etc.).

To attempt a summary of a biography would be to reduce it to a nearly meaningless succession of dates and facts. It would be beyond the ability of the reviewer to convey to the modern American reader the true impression of the world into which Smoluchowski was born in 1872 in Vienna. It would be equally impossible to reproject the charm of the man or to explain how in him there came to blend the Polish cultural background with the best in western civilization and upbringing. Fascinating as the reviewer found the purely biographical parts of the book it is with the chapters dealing with Smoluchowski's scientific activity that this review must be primarily concerned.

These chapters are excellent both as a popular presentation of a difficult subject and as history of science. We find in these chapters numerous excerpts from Smoluchowski's correspondence with contemporary scientists bringing into the narrative a sense of lively immediacy.

The biographer discusses all of Smoluchowski's scientific works but treats in great detail and with noteworthy expository skill those contributions which are of truly lasting significance and which concern the phenomena of fluctuations. Fluctuations are deviations from the average or normal. Were it not for the atomistic structure of matter fluctuations would not exist. As it is they are extremely small and at first (1903) Smoluchowski was skeptical as to whether they could be actually observed.

Only four years later Smoluchowski writes "All of us have observed them [fluctuations of density] on innumerable occasions while admiring the blueness of the sky". For Smoluchowski has just demonstrated in a classical paper devoted mainly to a related phenomenon of the so-called "critical opalescence" that density fluctuations in the atmosphere are responsible for the scattering of light resulting in the blueness of the sky.

Were we to judge Smoluchowski on the basis of his technical achievements, his work on Brownian motion, critical opalescence, blueness of the sky, and colloidal suspensions would certainly put him among the leading physicists of his day.

But what made him a great physicist was that he recognized the profound bearing of his theory of fluctuations on the question of validity of the Second Law of Thermodynamics.

In a series of papers which should forever serve as models of expository skill and elegance, Smoluchowski subjected the Second Law to a penetrating analysis and emerged with a new, now universally accepted, formulation based on probability.

All this is admirably told in the biography and it is gratifying to have such a lucid record of one of the most important developments in physics.

It is almost forty years since Marian Smoluchowski died. His life and work belong to a period which to many of us seems remote because both the world and the science of physics have changed so much in the meantime. And yet the pleasure (and profit!) the reviewer derived from reading this little volume makes him believe that there is a great deal to be gained by a journey to this "remote" past to get really acquainted with the people who have had such a profound and deeprooted influence on our thinking that some of us may have forgotten how much we owe them.

The Scientific Revolution 1500–1800: The Formation of the Modern Scientific Attitude. By A. R. Hall. 390 pp. The Beacon Press, Boston, Mass., 1956. Paperbound $1.75. *Reviewed by J. C. Polkinghorne, University of Edinburgh.*

The character of modern science was formed in the period 1500–1800. Although our knowledge has increased manyfold in the succeeding century and a half there has been no essential change in method or purpose.

We are all familiar with the great apostolic succession of Copernicus, Galileo, Kepler, and Newton. These years also saw the development of chemistry in the hands of Boyle and Lavoisier and the development of systematics by the natural historians, culminating in Linnaeus. Dr. Hall admirably achieves his purpose of presenting not merely the facts but also an analysis of how this great revolution of ideas came about.

There are two popular and facile explanations of the scientific revolution. One is the economic theory, especially beloved of Marxists, which sees in the expansion of technology the spur to all achievement in pure science. The second, and more subtle, lays stress on the "new philosophy" of induction and experiment formulated by Francis Bacon. Both contain elements of truth but are inadequate as complete explanations. This book shows most clearly the part that has been played by

the individual intuition of men of genius, able to leap beyond the confines of empirically well-founded ideas to frame original concepts of the greatest power. Science has its moments of revelation too. Galileo seems to have been very little concerned with the experimental verification of his ideas of motion. It is a sobering thought that "we cannot exclude from science, which is rational, the influence of factors which are irrational."

Analytical Experimental Physics (2nd Revised Edition). By Michael Ference, Jr., Harvey B. Lemon, and Reginald J. Stephenson. 623 pp. U. of Chicago Press, Chicago, 1956. $8.00. *Reviewed by Arthur Beiser, New York University.*

The new edition of *Analytical Experimental Physics*, like its well-known predecessor, has a refreshingly straightforward, no-nonsense approach to the teaching of physics. The authors neither skip nor slur unappetizing topics, and, in spite of this, have managed to produce what seems to be an unusually clear text. The two-column format of the book seems to help matters, except that the illustrations are consequently tiny and not always intelligible. (I might add that the book has been shrunk to only $10\frac{1}{4}'' \times 7\frac{1}{2}''$, and will now fit in many bookcases.) The conventional material in mechanics, heat, electricity and magnetism, and optics receives detailed treatment. Differential and integral calculus are introduced gradually and mks units are employed. Modern physics is emphasized: the radiation laws, elementary spectral theory, x-rays, the solid state, various aspects of nuclear physics and instrumentation, reactors, and cosmic rays are all discussed. Unfortunately, considering their efforts to be modern and complete, the authors' coverage of special relativity is both scanty and feeble. Still, they have done a first-class book, one that has few rivals as a pre-engineering text.

The Language of Modern Physics: An Introduction to the Philosophy of Science. By Ernest H. Hutten. 278 pp. (Allen & Unwin, England) The Macmillan Co., New York, 1956. $3.75. *Reviewed by Erich M. Harth, Duke University.*

Van Melsen, the philosopher and historian of science, once remarked that "man has endeavored to escape philosophic problems in many ways and with a considerable display of intelligence". Hutten's new book offers physicists and others interested in science a chance to mend their ways.

The book bears the subtitle *An Introduction to the Philosophy of Science*. In this field, which is beset by controversy and fairly invites going out on some limb at every turn, the writer has shown remarkable restraint. "Nothing that I have said, or tried to say," he concludes in a final paragraph, "implies that I have a doctrine to spread, or a new *-ism* to found."

Following a short introduction, Hutten deals with the requirements of logic and the linguistic formulation of