

graphy of nearly six hundred references; this is not, and is not intended to be, exhaustive, but each reference mentioned is touched on in the text. It indicates the careful consideration given by the authors to available results.

It should be emphasized that this book is concerned with principles and not with practice. There are no descriptions of flotation machines or flotation plants, although certain types of machine are referred to in the chapter on kinetics. The treatment of many specific minerals by froth flotation is mentioned, but it is surprising that the froth flotation of coal, which is becoming more and more important in the preparation of coal, is not mentioned (except incidentally in connexion with the adhesion of bubble to mineral).

The book is well written and well produced. There are few errors or misprints, but the error in definition of Reynolds's number given at the foot of p. 363 should not have escaped detection when the proofs were checked. The indexes are very good. This is an outstanding book, not suitable for the beginner but of considerable value to the advanced student, the research worker and the inquiring operator of the flotation process and, not least, to the teacher.

S. G. WARD

THE POLAR AURORA

The Polar Aurora

By Prof. Carl Størmer. (International Monographs on Radio.) Pp. xvii+403+34 plates. (Oxford: Clarendon Press; London: Oxford University Press, 1955.) 55s. net.

IT would be presumptuous to attempt to 'review' the present volume by Prof. Carl Størmer on the polar aurora—a field of study which he has truly made his own. At an advanced age he has collected together in book form the greater part of his researches on the observations and interpretation of the aurora. Everyone interested in this fascinating phenomenon will be greatly indebted to him, not only because, as he reminds us in the preface, his long series of papers on the subject is difficult to obtain in complete form, but also because of the invaluable and extensive theoretical investigations which the book contains.

On several occasions Prof. Størmer has related how his interests were diverted from the field of pure mathematics by the striking experiments carried out by his compatriot Birkeland on the deflexion of cathode rays in the field of a uniformly magnetized sphere. His great mathematical skill served him well in discussing the idealized, but nevertheless difficult problem of the motion of a charged particle in the field of a magnetic dipole with which he sought to illustrate the results of Birkeland's experiments. The great variety of orbits possible, beautifully illustrated by many plates in the book, is testimony to the infinite patience of the man who pursued the laborious calculations involved. These theoretical investigations, which form the second part of the book, were primarily intended as a contribution to the corpuscular theory of the aurora in the form proposed by Birkeland. The trajectories derived by Størmer indeed showed many analogies with the forms of the aurora, and though the neglect of the mutual interaction between the corpuscles in the stream makes the bearing on auroral theory uncertain, it is most gratifying that the theory has found

a secure place in the interpretation of the global incidence of cosmic rays.

The first part of the book is concerned with the observation, forms, height measurement and spectroscopy of the aurora and also with its close connexion with geomagnetism. Our present knowledge about the position of the aurora in space is indeed almost entirely due to the photographic measurements of Størmer and Vegard; the methods used as well as the results they obtained are extensively described, as are also the geographical distribution and the methods of observing and photographing the aurora. Here will also be found an account of Størmer's important discovery of sunlit auroræ and of their intensity and colour. Other chapters are devoted to the auroral spectrum, auroral radio wave emission and radio echoes from the aurora. The author also considers such questions as the possibility of the existence of electrical currents outside the Earth's atmosphere, reviews the spectroscopic evidence for a solar corpuscular stream between the Sun and the Earth and considers the absorption of corpuscular radiation in the atmosphere and the emission of electric corpuscles from the Sun.

Though the accent in the theoretical parts lies on the Birkeland-Størmer theory of the aurora, brief accounts of other theories are given; and perhaps because in this field one is too apt to indulge in speculations, Prof. Størmer has kept almost entirely to verifiable facts. Thus, though it is generally believed that magnetic storms and auroræ are due to solar corpuscular streams, the evidence so far has been indirect and not entirely unassailable. The detection of hydrogen lines in the spectrum of the aurora by Vegard, Gartlain and Meinel clearly points to the entry of protons in the atmosphere. Nevertheless, as Størmer seems to imply, definite evidence that these originate from the Sun is perhaps still not definite.

The book is very well produced and the typography excellent.

V. C. A. FERRARO

NUCLEAR POWER ENGINEERING

Thermal Power from Nuclear Reactors

By Dr. A. Stanley and Oliver E. Rodgers. Pp. xiii+229. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1956.) 7.25 dollars; 58s. net.

A MECHANICAL engineer, noting the title of this book and reading the introductory remarks on the jacket, might expect to find a work designed to give him an idea of the special difficulties associated with the design of a nuclear power plant. If so, he would be disappointed. He would, perhaps, be surprised to find nearly one-third of it devoted to an elementary treatment of familiar topics such as thermal stress in isotropic elastic solids, laminar and turbulent pipe flow and convective heat transfer. Very little space is devoted to the fundamentals of topics such as thermal stress in non-isotropic and plastic materials, thermal shock, and transient heat transfer, which have increased in importance since the advent of nuclear power, and which are less familiar to the non-nuclear engineer. No literature references to specialist papers are given.

In restricting themselves to fundamentals, the authors have avoided dealing with any particular reactor system. This is a pity, since only by so