X-rays in Research.

La technique des rayons X. Par Dr. A. Dauvillier. (Recueil des Conférences-Rapports de documentation sur la Physique, vol. 10, 2ᵉ série. Édité par la société *Journal de Physique.*) Pp. 195. (Paris: Les Presses universitaires de France, 1924.) 22·50 francs.

DURING the first seventeen years after the discovery of X-rays in 1895, the development of apparatus for their production was chiefly influenced by the requirements of medical radiologists. Progress was rapid, and attempts at standardisation were swept away by a flood of ideas, applications, and devices. In the year 1912, however, a great advance in a new and purely physical direction was made possible by the work of Laue. Following this lead and under the inspiration of Rutherford, Moseley, Bragg, de Broglie, Duane, and others, physical research in which X-rays play a conspicuous part has now become of outstanding importance.

Since the immediate questions opened up by this work and by the problems ever before the medical radiologist differ somewhat in their scope and aim, it is not surprising that the appliances evolved in the laboratory for X-ray research work should have come to be very different from those used to-day in medical practice. This evolution is traced out by Dr. Dauvillier in his book. It is essentially a work for those who are already somewhat familiar with the subject, and to whom the general information given at the beginning will serve as a useful reminder of the progressive steps by which our present knowledge has been attained. On p. 35, however, the author is in error in attributing the first X-ray tube with slanting anticathode to Mr. A. A. Campbell Swinton instead of to Sir Herbert Jackson, who, in fact, actually made it with his own hands.

After referring to the construction of "gas" tubes and their mode of regulation, we reach the section of the work dealing with the hot cathode device due to Lilienfeld and Coolidge. It is here that the value of the book is most apparent, for the author has brought together much valuable information which was previously scattered, and therefore only accessible with difficulty. The applications of the hot cathode idea are considered in detail, and the modification of the usual radiographic type of tube to suit the special requirements of the laboratory is explained and illustrated. We thus have the advantage of studying the design of the modern tubes employed in X-ray spectroscopy, with full notes of the difficulties to be met with in their use and the means of overcoming them, written by one who is himself an accomplished experimenter. Incidentally, since most of these tubes require to be continually exhausted of gas while in action, the author refers to the latest pumping methods, and gives an interesting description of a tube with liquid anticathode and also of one with a gaseous target.

The medical radiologist is, of course, gaining valuable data from the purely physical work on absorption and scattering of X-rays under various conditions, as well as from the study of the energy distribution in X-ray spectra, and he is also beginning to realise the desirability of utilising for his work a type of electrical plant that will provide a constant current at a pressure of, say, 200,000 volts. Apparatus of this kind was first set up in the United States for careful physical work on X-ray spectra, and a modification of the plan then adopted, and due largely to Dr. Dauvillier himself, is now being developed in France. Germany, too, is actively manufacturing constant current high voltage plant for X-ray work. The author has therefore wisely devoted a whole chapter to this important matter.

With regard to protection, there is no mention of the recommendations of the X-ray and Radium Protection Committee which were issued in 1921, and the author is perhaps too definite (p. 114) in referring to what he considers a safe minimum radiation intensity. It is felt by many that we are not yet quite sure as to the biological effects of exposure to a very feeble radiation over long periods of time continuously.

The book deals towards the end with the vexed question of X-ray measurement, a subject to which Dr. Dauvillier has himself made some notable contributions. Finally, there are brief references to medical, industrial, or other applications of X-rays.

We recommend this work to all physicists who are engaged upon researches in which a technical knowledge of the subject is indispensable. It is clearly written, well arranged, and fully illustrated. Its use would be still further enhanced, however, by the provision of a more adequate index, or at least the revision of the existing "table des matières," where in several instances the page numbers do not agree with the references in the text.

C. E. S. P.

The New Principia.

Principia Mathematica. By Prof. Alfred North Whitehead and Bertrand Russell. Second edition. Vol. 1. Pp. xlvi + 674. (Cambridge: At the University Press, 1925.) 42*s.* net.

THE great achievement of the authors of "Principia Mathematica" is to have deduced mathematics by strict symbolic reasoning from a small number of logical propositions. This was previously attempted