

THURSDAY, NOVEMBER 20, 1913.

MODERN PHYSICAL IDEAS AND RESEARCHES.

- (1) *Modern Electrical Theory*. By Dr. N. R. Campbell. Second edition. Pp. xii + 400. (Cambridge: University Press, 1913.) Price 9s. net.
- (2) *Les Idées Modernes sur la Constitution de la Matière. Conférences Faites en 1912*. By E. Bauer, A. Blanc, E. Bloch, Mme. P. Curie, A. Debierne, and others. Pp. 370. (Paris: Gauthier-Villars, 1913.) Price 12 francs.
- (3) *Researches in Physical Optics, with especial reference to the Radiation of Electrons*. Part i. By Prof. R. W. Wood. Pp. vii + 134 + x plates. (New York: Columbia University Press, 1913.)

(1) **T**HE second edition of Dr. Norman Campbell's "Modern Electrical Theory," reviewed first in NATURE, May 28, 1908, is practically a new book. The work of Barkla and Bragg, and the theories of Einstein and Planck have rendered necessary a fresh treatment of part ii., dealing with radiation. The principle of relativity and Stark's work on valency alter completely part iii., which deals with electricity and matter, a field in which second thoughts have proved notoriously less ambitious than the first, whilst the first part, which deals with the electron theory proper, has also been entirely re-written.

It must have been a task of no ordinary magnitude to attempt to present to-day the changing theories of modern physics. Speaking of the subject of radiation, the author claims it is the best attempt in the English language to deal generally with the matter, because "so far as I know there is no other." Again, in the references to the literature at the end of chapter i., after a mention of Lorentz's "Theory of Electrons," we read: "I know of no other English treatise which can be recommended with confidence," and the remark will be generally endorsed.

The book deals with the whole of the large legitimate field of the electron theory, electro-magnetism, metallic and electrolytic conduction, optics, radiation, and the chemical as well as physical properties of matter. It is in welcome contrast to the earlier more or less popular presentations of the subject which have appeared in our language, in that as much attention is given to the failures as to the successes of the theory, and in that, in the absence of any experimental evidence of positive electricity apart from matter, it does not trespass unduly into the region which many people have been led to regard as the chief object

of the electron theory, the explanation of matter in terms of the electron.

Physical theories at the present moment are so shaky at the foundations that the doubt arises sometimes whether the superstructure is not being built up too rapidly. The difficulties, now ten years old, in reconciling the undulatory and corpuscular types of radiation in one theory, the hopeless confusion that prevails as to the necessity for the existence of an ether, and the modern discrete or quantum theory of energy, seem to call for a more drastic reconsideration than we find here of many of the simplest physical conceptions and their experimental basis. Take, for example, the view that has been universally held of the uniform propagation of radiation in all directions through space. There seems to be really no evidence for this. All that experiment and observation justify is its propagation between portions of space occupied by matter. Elsewhere it may not be propagated at all. Recent suggestions that it is propagated along "Faraday tubes" which, starting from the radiator, must necessarily end "somewhere," seem vaguely to imply something of the kind. But what a different complexion would be assumed by some of the larger generalisations of science, in the field, for example, of the maintenance of solar and cosmical energy, not to mention problems in wireless telegraphy connected with the curvature of the waves round the earth, and all of the topics dealt with in the present book, if it were frankly confessed at the outset that we are really in complete ignorance as to the answer to this simplest first question about the nature of radiation.

In the concluding chapters the author permits himself to wander beyond the strict boundary of his subject to discuss the principle of relativity and the changes in current ideas required from this new point of view. It is at least instructive to try to follow a British author attempting to reproduce these abstruse conceptions, which as yet scarcely anyone in this country professes to understand, or at least to appreciate. But the exposition is marred by too great an anxiety to defend the view from possible objections, and it cannot be said that the fundamental or primary significance of the principle is made out, or that it has been duly correlated with other physical conceptions. One remains in doubt whether, if not metaphysical, it is not of subjective rather than objective importance, a mathematical correction to render consistent observations in which the velocity of light enters, and which would be, if not actually false, at least inoperative were gravitational action, for example, instead of light em-

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ployed to transmit the intelligence of an event to a distant place.

It may be true that it is impossible to conceive of a body moving relatively to an observer with velocity greater than that of light. But we can, and do, work with β -particles of radium, and we can imagine two of these expelled in opposite directions from a source of radium at rest relatively to the earth, and therefore, in ordinary parlance, having a velocity relatively to one another nearly twice that of light. This, of course, in no way questions or minimises the importance of the principle of the great German mathematical physicist in its own field, but science is ever sceptical of restrictions which it is told must necessarily and for all time limit its power of disentangling the phenomenon from the appearance of the phenomenon. In any case the author deserves success in thus including in this conscientious review of modern electrical theory some of the modern conceptions which are at once the most foreign to our habits of thought and the most difficult to appreciate at their true worth. Successful the volume undoubtedly is in its purpose of providing serious students acquainted with the older physics an introduction to the newer theories.

(2) This collection of ten lectures by as many authorities treats in simple and clear fashion with some of the special departments of physical science now most to the fore. Brownian movement, the subject of high vacua or ultra-rarefied gases, and the relations between matter and the ether are the only three topics which can claim even thirty years of history. Three more deal with the electron in one or other aspect—electro-magnetic dynamics, the electronic theory of metals, and ionisation by collision and the electric spark—and two with radioactivity, the radiations of the radioactive substances, and their successive transformations. Lastly, two of the newest conceptions, the quantum theory of energy and the magneton theory, complete the volume, which will prove as useful and interesting as earlier publications on similar lines by the Société française de Physique.

(3) The third volume is a collection of some of the most interesting and beautiful discoveries of Prof. R. W. Wood, issued by the Columbia University under the E. K. Adams fund for physical research. They include the notable contributions to resonance spectra and radiations, first with iodine, then from mercury vapour, which have enabled the vapour arising from a cold surface of mercury to be photographed, and going on to experiments with heat waves of more than 0.1 mm. wave-length, analogous to those with Herzian waves, in which a "dew" of condensed mercury

globules deposited on quartz was employed for the resonator. This in turn leads to some extraordinary, still incomplete, observations on the electric conductivity of ruled silvered glass gratings, in spite of the complete severance of the silver film by the diamond.

Lastly must be mentioned some attempts to photograph the lunar surface through screens transmitting only yellow, violet, and ultra-violet light respectively. These photographs reveal the presence of a remarkable deposit round the crater of Aristarchus which very probably may be sulphur, and foreshadow a method for carrying out a limited petrological survey of the lunar surface. It is a pity that the volume does not appear to be for sale, for many no doubt would be glad to secure this well-illustrated collection of modern experimental researches by one of its greatest masters.

FREDERICK SODDY.

THE THRESHOLD OF SCIENCE—AND BEYOND.

- (1) *Zoology*. By Prof. E. Brucker. Pp. xiii + 219. (London: Constable and Co., Ltd., 1913.) Price 2s. net.
- (2) *Some Secrets of Nature*. Short Studies in Field and Wood. With an introduction by W. J. P. Burton. Pp. xiv + 144 + plates. (London: Methuen and Co., Ltd., n.d.) Price 1s. 6d.
- (3) *The Romance of Nature*. Studies of the Earth and its Life. With a preface by the Rev. A. Thornley. Pp. xix + 164 + x plates. (London: Methuen and Co., Ltd., n.d.) Price 2s.
- (4) *In the Lap of the Lammermoors*. By W. McConachie. Pp. xii + 315. (Edinburgh and London: William Blackwood and Sons, 1913.) Price 5s. net.

(1) **O**NE of the many ways of beginning the study of zoology is to take a survey of the whole animal kingdom, working from the simple to the complex, never going very deeply into anything, but using now this, now that, to illustrate a principle. That is what Prof. Brucker has done, and it is a feat to have done it so clearly and in such simple language. If the reader, young or old, is able to touch and handle, as well as read about, even a tenth of the creatures discussed, he will have got far across the threshold of the science—to use the phrase which gives its name to this new series. To our thinking there is far too much in the book for an introduction, but that is largely a matter of opinion, and it is doubtless what students say of most courses of elementary instruction which their professors after much thought on the subject decide to deliver. Be this as it may, the author of this little book is evi-