

universe would be an object of intuition, that is, would form a picture, at least to God. According to Einstein, we cannot say, speaking absolutely, that there is any picture even for God. The picture is only known as a function of the frame. That is, the things measured are only known through the measurings, and the measurings are bound up with the things they serve to measure. The understanding of this reciprocity makes it impossible to separate and consider apart what, for the convenience of language alone, we distinguish as frame and picture. Science goes in a kind of perpetual oscillation, with an ever-narrowing adaptation, from the measured to the measuring, from the measuring to the measured. Thus, considered from the point of view of the measuring, it is impossible by any physical means whatever to reveal a uniform movement of translation in which both the observer and all that he observes participate. Considered from the point of view of the measured, the velocity of light is the only velocity which is unchanged when we pass from one system of reference to another, and in the electromagnetic universe this velocity plays the rôle which infinite velocity formerly played in the mechanistic universe. The constancy of the velocity of light implies further an irreducible plurality of physical measurements of times, because the various groups of observers cannot make clocks from which they can detach themselves and compare them as instruments with one another. They are themselves the inhabitants of a clock, prisoners in their own time-measuring instrument, bound to its state whether they suppose it at rest or moving.

To most of us, however, whether our interest in the principle of relativity is scientific or philosophical, the greatest stumbling-block is probably the hypothesis of a finite universe. This seems a contradiction in thought and at least an unnecessary appendage of the principle. Prof. Brunschvicg shows us very clearly why the equations lead necessarily to this hypothesis, for they allow us to show that without it the total reduction of inertia to reciprocal action between masses is impossible.

The metaphysics which the new physics implies means therefore a complete revolution both in philosophy and science. As metaphysics it claims neither priority over science nor independence of it, not even the independence implied by Kant in the theory that the conditions of experience are *a priori*. This is not because metaphysics has learnt to be humble or to be resigned, but because in reality there is a contradiction in the very notion that by reflecting on science we can disengage certain antecedent conditions capable of enclosing all past and future knowledge in static schemes. On the side of positive science we have come to see that by the pure experimental method we

are not and cannot be brought into contact with elemental constituents of experience, whether material as Democritus conceived them, or intelligible as Plato conceived them, or sensible as Hume conceived them. The realities we are dealing with in physical science are statistical, so that all reflection on the results of experiment is, not an approach to the absolute, but a progress in the discovery of relativity. The early nineteenth-century ideal of a pure positive science perpetually progressive by means of a division of labour has given place in the twentieth century to a new and more subtle idea, the idea of a progress which is reflective.

(3) Prof. D. Nys's "La Notion d'espace" is a valuable book, but belongs to a different category from that of the two works we have mentioned. It is the fourth volume of his "Cosmologie ou Étude philosophique du monde inorganique," and is encyclopædic in its treatment of the subject. It includes in a general view of the various philosophical doctrines a very clear account of the recent theories with the criticisms upon them and is a model of careful compilation. It develops no original theory and is written from the point of view of neoscholasticism.

(4) Mr. Shann's short treatise on "The Evolution of Knowledge" is the work of one who knows how to think out a problem for himself. It deals with a different aspect of relativity from that of the physical principle, namely, with the nature of the vital need which has produced in man and some animals the function of knowing. All those friends of Mr. Shann who have received from him from time to time his excellent privately printed pamphlets, bound in the well-known scarlet wrapper, will welcome this published work.

H. WILDON CARR.

Ceremonial Exchange.

Argonauts of the Western Pacific: An Account of Native Enterprise and Adventure in the Archipelagoes of Melanesian New Guinea. By Dr. Bronislaw Malinowski. Pp. xxxii+527. (London: G. Routledge and Sons, Ltd., 1922.) 21s. net.

IN this volume Dr. Malinowski has given the first-fruits of his extended stay in the Trobriands, a group of islands off the south-east of New Guinea. A good deal of more or less desultory information, published in Government reports and elsewhere, has indicated that these islanders differ in some respects from their neighbours; Dr. Malinowski now shows how intimately they are all associated with one another, not merely by ordinary trade, but by a hitherto unrecorded and very remarkable system of ceremonial

exchange, known as Kula, with which this book is almost solely concerned.

The exchange takes place between partners who may reside in the same island, but for the most part in different islands. The Kula articles of value are shell-necklaces of a special type and armlets made of *Conus* shell. The former always travel N.-E.-S.-W., *i.e.* clockwise, and the latter in the contrary direction, but other articles of value may be implicated in the transactions in a subsidiary manner. The islands mainly concerned in Kula are those between Nada and the Trobriands, the Amphletts, part of the southern d'Entrecasteaux and the Tubetube group. The real Kula necklaces and the arm-shells have various worth, and highly valued ones have individual names, and their wanderings are followed with interest. The ownership, or rather trusteeship, of each object is temporary, and ranges from a few minutes to one year or possibly two, but a man who retains an object beyond a year is regarded as a mean person. The exchange is by the natives sharply differentiated from barter, as no haggling takes place. An equivalent gift is always expected, but cannot be demanded or enforced, the only punishment for failing in this being loss of esteem. If at any time an equivalent gift cannot be bestowed, intermediate gifts will smooth the way till the real repayment takes place. Meanness is the most despised vice, and generosity the essence of goodness. *Noblesse oblige* is in reality the social norm regulating their conduct. This does not mean that people are always satisfied and that there are no squabbles nor even feuds about the transactions. It is obvious that however much a man may want to give a good equivalent for the object received, he may not be able to do so; and then, as there is always a keen competition to be the most generous giver, a man who has received less than he gave will not keep his grievance to himself but will brag about his own generosity and compare it with his partner's meanness; the other resents it, and the quarrel is ready to break out. All the preparatory activities, as well as those connected with the voyages and the ceremonies of exchange, are permeated by magic, as indeed is the whole economic life of the people.

The most important character of Kula is the mental attitude of the natives towards it. The objects of the Kula are neither used nor regarded as currency, as they are never used as a medium of exchange or as a measure of wealth; they serve merely to be owned and displayed and then exchanged. It is through being the means of arousing envy and conferring social distinction and renown that these objects attain their high value and form one of the leading interests in native life. The ceremonial attached to the act of giving and the manner of carrying and handling shows distinctly that they are

not mere merchandise, but something that confers dignity on a man, that exalts him, and which he therefore treats with veneration and affection. Nothing of the same kind has been described elsewhere, but something analogous may be discovered now that attention has been directed to it. The potlatch of British Columbia, for example, is worth reconsidering in the light of this book.

Dr. Malinowski has not confined himself to a mere detailed description of Kula, but he has endeavoured, apparently with great success, to explain its psychological significance. Kula so pervades the life, thought, and emotion of the people concerned in it that it seems in some respects to fulfil functions which are characteristic of many religions, but with magic supplying the place of spiritual powers. The system might almost be termed the Kula cult, as Dr. Malinowski seems to hint; but he distinctly states that the natives worship nothing.

The inter-insular Kula requires seaworthy canoes, and Dr. Malinowski describes how these are made, and the series of magical rites which accompany every stage in their manufacture, equipment, and sailing. The smaller fishing canoes are owned by one man, but the sea-going canoe is constructed by a group of people; it is owned, used, and enjoyed communally, and this according to definite rules, all of which are described with careful detail and psychological insight. To the natives a canoe of this type is a marvellous achievement, a thing of beauty, and an object permeated by magic. "He has spun a tradition around it, he adorns it with his best carvings, he colours and decorates it. It is associated with journeys by sail, full of threatening dangers, of living hopes and desires to which he gives expression in song and story. In short, in the tradition of the natives, in their customs, in their behaviour, and in their direct statements, there can be found the deep love, the admiration, the specific attachment as to something alive and personal, so characteristic of the sailor's attitude towards his craft."

An outstanding merit of this book is that it is a well-considered study in ethnographical method; indeed the author's remarks on field-work will prove of great value for the guidance of future workers. A large number of magical formulæ and oral texts is given in the native language and in translation, which provides unusual documentary evidence of exceptional value for the elucidation of native psychology. The book is well illustrated and of reasonable cost, for which the publishers are to be thanked. Mr. Robert Mond and others, by their liberality, have enabled these investigations to be made, and they have the satisfaction of knowing that they have afforded an

opportunity for a young student to produce a work of absolutely first-class value. It is to be hoped that Dr. Malinowski will be able to publish in full the remainder of his material, which, judging from this sample, will mark a distinct progress in ethnographical research and interpretation. A. C. HADDON.

Pure and Applied Electricity.

- (1) *Einführung in die Theorie der Elektrizität und des Magnetismus. Zum Gebrauch bei Vorträgen, sowie zum Selbstunterricht.* Von Prof. Dr. Max Planck. Pp. v+208. (Leipzig: S. Hirzel, 1922.) 42 marks.
- (2) *Elettrotecnica elementare con numerosi problemi.* By A. Occhialini. Vol. 1: *Magnetismo—Elettrostatica—Elettrochimica—Elettrodinamica—Elettromagnetismo—Induzione elettromagnetica.* Pp. v+344. (Firenze: Felice Le Monnier, n.d.) n.p.
- (3) *Installations électriques industrielles: choix du matériel.* Par R. Cabaud. Pp. 316. (Paris: J.-B. Baillière et Fils, 1922.) 10 francs.

THE first of these three books discusses the groundwork of the theory of electricity, the next discusses the experimental laws and their laboratory applications, and the third is a severely practical work for the commercial electrician. They are all introductions to the subject, but they are intended for very different classes of readers.

(1) Dr. Max Planck's work is philosophical, and presupposes a knowledge of mathematics and of the mathematical theory of electricity which is possessed by few. The foundations on which the ordinary mathematical equations rest are examined, and particular stress is laid on the units in which they are measured. The Gaussian, the electrostatic, and the electromagnetic systems of units are considered. The work will be very welcome to the pure theorist and will increase his confidence in the soundness of the physical basis of the mathematical theory. The clear distinction made between magnetic force and magnetic induction is very convincing. The experimenter will find little that is directly helpful to him in this book, but he will appreciate, however, the author's method of getting the capacity of an ellipsoid and the deductions that can be made from it.

(2) The second work under notice is very similar to the standard English books on experimental electricity and magnetism. The author's descriptions of the main phenomena are very clear, and the numerous examples given are instructive. A very full discussion is given of the problem of a number of batteries of different electromotive forces and resistances in parallel with one another. A thorough knowledge of this

problem is a great help to students when they come to the corresponding problems of dynamos or alternators running in parallel with one another. The definition given of the temperature coefficient of metals, however, is not sufficiently accurate for modern requirements. The rating of a dynamo depends on its temperature after a run at full load, and the temperature of the coils is computed from their measured resistance and a knowledge of the temperature coefficient of copper. As the problem is one of great commercial importance it is necessary to distinguish between the temperature coefficient of the volume resistivity, the mass resistivity, and the constant mass resistance. These are all different and vary with the lower of the two temperatures considered. The approximate formulæ for the self-induction of a coil are given, but we think that their limitations should have been stated.

(3) M. Cabaud's book is very general and can be appreciated only by a technical expert. It presupposes a thorough knowledge of practical electrical engineering. In the first section of the book a general discussion is given of the kind of electric machine required to do special work; for example, whether a direct-current or an alternating-current machine will be the more useful. In the latter case also the question of whether it is to be single phase or polyphase is considered. The efficiency of the machine, its heating under load, the electric strength of the insulating wrappings, etc., have all to be considered. In the second section the characteristics of the machines, whether rotating or stationary, are described. In the last section the usefulness of the various characteristics are discussed, and the important question of the best guarantees that should be demanded from the manufacturers is considered.

The Petroleum Industry.

- (1) *Encyclopédie Scientifique: Bibliothèque de géologie et de minéralogie appliquées: Les Gisements de pétrole.* Par Jean Chautard. Pp. viii+viii+330. (Paris: Gaston Doin, 1922.) 14 fr.
- (2) *The Oil Encyclopedia.* By Marcel Mitzakis. Pp. xvi+551. (London: Chapman and Hall, Ltd., 1922.) 21s. net.
- (3) *The Economics of Petroleum.* By Joseph E. Pogue. Pp. ix+375. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1921.) 33s. net.

THE "Encyclopédie Scientifique" constitutes a comparatively new departure in French technical literature, and has for its scope the ultimate publication of some thousand volumes dealing with the various phases of pure and applied science. M. Jean Chautard's