of Kapteyn's method to even greater distances. Here we find a careful résumé of Shapley's analysis of globular clusters which forms the basis of present-day views of the galactic structure. The extraordinary size of our own galactic system, as compared with distant spiral nebulae, is still a matter of great concern in modern astronomy. Sad experience has trained the scientist to be wary of introducing the term "exceptional" in his conceptions of the universe.

The closing chapter of "Kosmos" deals with "Relativity and Modern Theories" and gives an excellent summary of the contributions of Einstein and of the author with regard to the more theoretical aspects of the properties and distribution of matter and space. In conclusion, Dr. de Sitter remarks:

> Our conception of the structure of the universe bears all the marks of a transitory structure. It is not possible to predict how long our present views and interpretations will remain unaltered and how soon they will have to be replaced by perhaps very different ones, based on new observational data and new critical insight in their connection with other data. . . . By the use of mathematics, that most nearly perfect and most immaterial tool of the human mind, we try to transcend as much as possible the limitations imposed by our finiteness and materiality, and to penetrate ever nearer to the understanding of the mysterious unity of the Kosmos.

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Electric Clocks. By F. HOPE-JONES. xv + 259 pp.; 127 figs. London: N. A. G. Press, 1931. 12s. 6d.

EVER since the discovery of electromagnetism, nearly one hundred years ago, men have sought to find some way of time measurement. The author in this volume has made an exhaustive study of the evolution and development of devices which have been proposed for the improved measurement of time.

He has grouped his discussion about three heads, namely: (1) Independent self-contained clocks whose motive power is electrical; (2) synchronizing systems in which a signal is transmitted at regular intervals to correct the hands of independent clocks of all kinds; (3) electrical impulse dials, in which a master clock transmits impulses at minute, or half minute intervals, to propel the hands.

His descriptions are generally clear, but suffer in places by being too brief, or otherwise inadequate to convey the idea which he is trying to impart. Many of the figures also are too crude or too carelessly drawn to be readily understood by one who has not seen the mechanism. From a perusal of the work, one idea above all others emerges, namely, the astounding accuracy of the free pendulum and slave clock, to which the author contributed the remontoir, and W. H. Short the impulse mechanism, and the method of synchronizing the slave with the free pendulum. The performance of the Short clock has equalled if not exceeded the accuracy of the transit observations themselves.

It seems as though the author ought to have mentioned the application of the quartz-crystal controlled oscillator to time measurements. At the last reports on the performance of this device, it showed a constancy of one part in ten million over a period of some days.

The author mentions the Telechron system, by which a wheel work is actuated by a synchronous motor, operated on city service A. C. circuits, which are held to a constant frequency, but does not seem to know of the very extensive vogue which the system has attained in the United States. The convenience of obtaining a clock which requires no attention, and is accurate to four or five seconds, by merely plugging in on a house lighting circuit, seems likely to displace all other clocks for civil purposes. This, combined with the frequent distribution of time signals by radio, has changed the attitude of the whole world towards clocks.

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An Introduction to the Literature of Vertebrate Zoology. (Based Chiefly on the Titles in the Blacker Library of Zoology, the Emma Shearer Wood Library of Ornithology, the Bibliotheca Osleriana and Other Libraries of McGill University). By CASEY A. WOOD, xix, 643 pages, colored frontispiece. Oxford University Press, 1931. Price, 3 guineas.

IN the preparation of this work, Dr. Wood has rendered an important service to students of vertebrate zoology, who have been greatly in need of a systematic and comprehensive treatment of the literature of their field. An undertaking of this magnitude inevitably presents features for blame as well as for praise. As a bibliography of a large division of the field of zoology, it leaves much to be desired. It suffers from the limitation of having been compiled in the libraries of a single university. The entries vary in completeness from full citations to fragments, such as "Zooiasis. 1834–6? Leipzig." The treatment of periodical literature is extremely inadequate. Pamphlets are in many cases referred to simply as "author's reprints," with no indication of the original place of publication. But on the other hand the work possesses outstanding merits more than sufficient to compensate for its shortcomings Where else can one

discover in a few moments the title of an authoritative work on the birds of British Guiana or the fishes of Zanzibar?

The volume, of quarto size, is divided into three parts. In the first of these, a running commentary of 146 pages on the history of the literature of vertebrate zoology from the time of Aristotle down to the present, the author has achieved the remarkable feat of being so interesting that one may open at any page and find himself immediately engrossed in the text. Dr. Wood has brought to his task a freshness of style and a conciseness of expression which must be the envy of all reviewers, as it is of the present writer. Such subjects are included as early Greek, Roman and Oriental zoologists, medieval writers on zoology, the Renaissance and its effect on zoological writings, the literature of comparative zoology, forerunners, contemporaries and successors of Linnaeus, animal painters and illustrators, zoological gardens and museums, travelogues of explorers, and other topics too numerous to mention. The reader who wishes to orient himself in the general literature of vertebrate zoology will find here a veritable treasure-house of information.

The second portion of the work consists of a classified index to authors of treatises on different groups of vertebrates and different geographical areas, so arranged that one may find in a moment a selected group of references on, say, the fishes of Europe or the mammals of South Africa.

Having located in this way the name of an author of a standard reference on the subject in question, one turns next to the third portion of the volume, which consists of a partially annotated catalogue of the titles on vertebrate zoology in the McGill University Libraries. Here he will find the detailed citation of the work he desires to consult, with, in many cases, a note regarding the nature of the treatise which may indicate its probable usefulness.

While the work is obviously of greater value to persons having access to the libraries of McGill University than to any one else, nevertheless its general utility is so great that no library of zoology can afford to be without it. Although he who consults the volume in quest of the literature dealing with his own particular specialty is likely to be disappointed by the omissions he will discover, on the other hand, any one wishing to become acquainted with the literature of a portion of the vertebrate field with which he is unfamiliar will bless Dr. Wood for the care and labor he has expended in smoothing the way.

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SOCIETIES AND MEETINGS

THE INTERNATIONAL CONGRESS OF MATHEMATICIANS, ZURICH, SEPTEMBER 4–12, 1932

IF any evidence were needed of the rapid development of mathematics in the last third of a century it might well be found in a study of the programs of the several sections of this Congress and of the number and nature of the papers read. In the early years of these quadrennial meetings four sections were considered sufficient; at present there are twice as many. At first the countries represented were chiefly European, the number of members from other continents being relatively small; but in this congress between 40 and 50 nations were represented and the attendance approximated 650 men and 200 women. Of the latter, several were on the mathematical staffs of various American colleges, most of the others being associate members incidentally visiting the congress. The United States and Canada were represented by between 65 and 70 mathematicians and about 25 associates, between 20 and 30 reports or papers being listed.

The congress was divided as usual into two kinds of meetings, six forenoons being occupied by general sessions, at which 22 lectures on new phases of advanced mathematics were given, and four afternoons being devoted to section meetings. There were eight of these sections as follows: I. Algebra and the Theory of Numbers; II. Analysis (three subsections); III. Geometry (two subsections); IV. Probability, Statistics, Insurance; V. Astronomy and Technical Mathematics; VI. Mechanics and Mathematical Physics; VII. Philosophy and History; VIII. Education.

The papers listed in the various sections, not all of which were read, numbered 268. Certain minor changes were made in the programs of the various sessions, and the lists given below are based chiefly upon the latest information supplied by the official bureau.

Each paper was written in one of the four international languages recognized by the congress—English, French, German and Italian. In general the contributors from countries speaking other languages (such as Holland, Russia, Greece, Portugal, the Balkan states, Scandinavia and South America) prepared their papers in French or in German. The fact, therefore, that an address was given in French, for example, does not signify that it was of French origin. There is some value, however, in observing the languages in which current mathematical investigations