

a course as B. O. Peirce and W. E. Byerly used to give at Harvard on harmonic analysis and potential function.

E. B. WILSON.

Annuaire pour l'An 1914 publié par le Bureau des Longitudes.
Paris, Gauthier-Villars. vii+502 pp., with four appendices.

THE most interesting article in the current *Annuaire* is one on the measurement of the day. In this M. G. Bigourdan has given a brief but sufficient summary of its early history and has carried it up to the present time, when the system of hour zones is fairly well established throughout the world. An interesting part of the story is his description of the efforts made in France to introduce the Greenwich meridian for the measurement of civil time and its final accomplishment in 1911. Two brief articles, one on the deformation of the images in telescopes by M. Hatt and the other on the seventeenth international geodetic congress by M. B. Baillaud, complete the "Notices."

Several revisions have been made in the astronomical portions, tending to bring the constants and descriptions up to date. But the mass of information contained in a small compass is too great for special mention here. The volume may perhaps be classified as the most complete travellers' guide to the physical universe which has hitherto been issued. There is even a slight tendency towards the inclusion of biological subjects in the tables of analyses of beers, wines, cereals, and the ashes of plants.

E. W. BROWN.

Les Actions à Distance. Par G. COMBEBIAC. *Scientia*
No. 30. Paris, Gauthier-Villars, 1910. 89 pp.

IN this issue of *Scientia*, M. Combebiac brings together the physical foundations of some of the hypotheses which have been advanced to explain action at a distance. In all of them, a fluid is postulated: the different ways in which motions may be set up in this fluid practically constitute the developments given in the volume.

The formulas of vectors and spherical harmonics are briefly set forth—too briefly we fear for anyone not familiar with them and their uses. Two chapters are respectively devoted to the pulsating spheres of Bjerknes and the oscillating spheres of Korn with special reference to the gravitational hypotheses

which have been deduced from their properties; and finally some three chapters to the well-known analogies between hydrodynamics and electromagnetism. One chapter is somewhat of a polemic on mechanical explanations of the phenomena of physics.

There are two fundamental difficulties which are always encountered in any attempt at mechanical or electrical explanations of gravitation. The first arises from the marvellous accuracy of the law: at the distance of the moon there can be no deviation from the well-known index 2 of the inverse square greater than one divided by a hundred million, and very probably the deviation is less than one tenth of this fraction. At one time Newcomb brought forward a larger deviation to explain the outstanding difference between theory and observation in the motion of the perihelion of Mercury, but abandoned it when the theory and observation of the moon showed that its adoption would require the explanation of a much larger error in the motion of the perigee of the moon. In fact, astronomers of the present day rarely invoke any such hypothesis to explain their difficulties.

The second difficulty arises from the apparently instantaneous propagation of gravitation. It has been computed that its velocity must be at least a million times that of light. In view of these facts one is tempted to wonder whether any of the ordinary mechanical explanations are possible, unless indeed it is a case where two effects counterbalance one another, as in the principle of relativity. It must be said in this connection that M. Combebiac emphasizes in his preface the fact that analogies and not explanations constitute the chief object he has in view. "Mais l'analogie," he says, "n'est elle pas l'un des plus efficaces moyens utilisés par l'esprit humain dans son effort d'adaptation au déterminisme naturel?" For this reason, the volume will be acceptable to all those who have puzzled their minds over this fascinating problem.

E. W. BROWN.

The Mechanics of the Earth's Atmosphere. A Collection of Translations (third). By CLEVELAND ABBE. Smithsonian Miscellaneous Collections, Vol. 51, No. 4.

THE plan adopted by Professor Abbe for forwarding the interests of meteorology by the republication of the more important memoirs has several advantages peculiar to this