

inserting the calendar for 1911 and an article on the determination of the orbits of planets and comets.

The part devoted to physics starts with a most excellent article by Willy Wien, of Würzburg, which is almost popular in nature and yet so fundamental in treatment as to be worth many a perusal. The various fields of physics are covered by articles and many tables of constants and coefficients, admirable for reference, are included. Fundamental principles expressed in mathematical language abound. In fact, throughout the book the authors, owing to the lack of space, cannot elaborate much.

An article on radioactivity by Greinacher, of Zurich, is of the same character as the one on relativity by Willy Wien.

Several articles on chemical subjects are included; the fields of technology touched upon are those dealing with the theory and design of electrical machinery. All are treated from the viewpoint of the mathematics in the case.

Of the special articles we mention the obituary notice of the late Minkowski by Hilbert and Weyl, of Göttingen, and the article on the present tendencies in the teaching of mathematics in Germany by Lietzmann, of Barmen.

For both the fields of mathematics and physics fairly complete lists of journals, proceedings, recent books, and firms dealing in apparatus are given at the end of the book. A mortuary record for 1909–1910 and a list of teachers in the Hochschulen of Germany are added. Of course, a complete index closes the volume.

ERNEST W. PONZER.

Non-Euclidean Geometry. A critical and historical study of its development. By R. BONOLA. Authorized English translation with additional appendices by H. S. CARSLAW. With an introduction by F. ENRIQUES. Chicago, Open Court Publishing Co., 1912. xii + 268 pp.

THE recent untimely death of Professor Bonola lends unusual interest to this book. In a review of the original Italian edition which appeared in the BULLETIN in 1910 I spoke of the desirability of having "an English edition of so valuable and interesting a work." This want is now well supplied by Professor Carslaw's translation. In a new appendix (the fifth) the translator has also materially improved the book by adding a discussion of a subject which seemed con-

spicuous by its absence from the original, namely, the Klein-Poincaré representation of a non-euclidean plane on a euclidean plane by means of a system of circles orthogonal to a given circle.

In another new appendix (the fourth), the author shows very neatly how to construct projective geometry on the basis of Lobachefskian metrical geometry by adjoining ideal points, lines and planes. This meaning of the word "ideal" is sanctioned by common usage. In the fifth appendix, however, the term "ideal line" is used in a totally different sense, namely, for a circle which images or represents a straight line. This "double entendre" seems perhaps a trifle unfortunate. The translator has produced a very readable and satisfactory English version of the best historical introduction we have to the elements of non-euclidean geometry.

ARTHUR RANUM.

Dr. George Bruce Halsted—Géométrie Rationnelle, Traité élémentaire de la Science de l'Espace—Traduction Française par PAUL BARBARIN, avec une préface de C. A. LAISANT. Paris, Gauthier-Villars, 1911. iv + 296 pp.

FROM the time of Farrar and Bowditch a number of French mathematical works have been translated into English, but although several American mathematicians have had their works translated into German, to Dr. Halsted belongs the honor of being the first to be translated into French. Novelties in geometry appeal to the French—witness their creations in connection with the geometry of the triangle, nomography, geometrography, anallagmatic curves and surfaces, and how Méray's somewhat radical work is coming to its own. As could, then, be almost predicted, when the first edition of Professor Halsted's book appeared in 1904 under the title "Rational Geometry, a Text-Book for the Science of Space based on Hilbert's Foundations," it was sympathetically received in France. Barbarin, already well known by his writings on non-euclidean geometry, wrote among other notices (of the first and second editions of Dr. Halsted's book) a ten-page review for Darboux's *Bulletin*.*

In Germany the work was not received so whole-heartedly and Dehn's somewhat vigorously expressed criticisms† (di-

* Sér. 2, vol. 31 (1907), p. 309-319.

† *Jahresbericht der Deutschen Mathematiker-Vereinigung*, Nov., 1904, vol. 13, p. 592-596.