

improvement in the rendering into English of the matter already employed. In the direction of chemico-botanical research there is great room for investigation, and a text-book embracing the knowledge already acquired, and information on points in connection with the chemistry of vegetable physiology, would render such a work of interest not only to the scientific chemist or botanist, but also to the general reader. Baron von Mueller's translation forms an excellent nucleus for such a work, and should a future edition of the book be required, we should hope to find it enlarged in such directions.

J. M. T.

#### GEOGRAPHICAL ASTRONOMY

*Abriss der praktischen Astronomie, vorzüglich in ihrer Anwendung auf geographische Ortsbestimmung.* Von Dr. A. Sawitsch, nach der zweiten russischen Original-Ausgabe. Neu herausgegeben von Dr. C. F. W. Peters. (Leipzig, 1879.)

AS may be inferred from the title of this work, the astronomical reader will not find it to be a general treatise on the practical branches of the science, but one confined to the theory and uses of instruments, and explanation of methods employed at the present day in the determinations of geographical positions. As such the name of its author, Dr. A. Sawitsch, the well-known Professor of Astronomy in the Imperial University of St. Petersburg, will give the work high recommendation in the estimation of the student. The two volumes of the original edition are now incorporated in one, and such modifications as have been rendered necessary by the introduction of new or improved forms of instruments, and refinements of observation and reduction have been introduced in a great measure by the author himself. In the opening chapter we have explanations of the various methods of reckoning time, and the transformation of one into another; the reduction of mean into apparent places, the calculation of refraction and parallax, and the influence of the earth's compression upon the geocentric co-ordinates of points upon the surface, with remarks upon angular measures in general, and upon the astronomical telescope and its adjustment, the microscopes, verniers, level, &c. In the first section, the author treats of the transit instrument, and enters into the various adjustments to which it is subjected, and also describes in some detail the universal instrument of Piston and Martins, and the errors of division to which instruments for angular measures may be liable. The second section is devoted to the determination of latitude and time by measure of zenith distance, of time from corresponding altitudes, &c. The third section enters more fully into the uses and theory of the transit instrument, and likewise describes Bessel's method for the determination of latitude thereby, supplying practical rules and an example. The next section treats of the determination of azimuth, and of the influence of diurnal aberration on the polar co-ordinates of a star. The fifth section contains a valuable outline of the various methods applicable to the determination of terrestrial longitude, including the telegraphic method, the transportation of chronometers, and longitude by observations of eclipses, especially those of the sun, and by lunar occultations.

The reference to the utility of eclipses for longitude-determination leads to an important chapter on Hansen's method for the calculation of the general circumstances of these phenomena upon the earth's surface, and the methods followed by Dr. Zech, in his researches on the historical eclipses; and, as a numerical example, the formulæ are applied to the computation of the circumstances of the total solar eclipse of August 18, 1887, to which frequent reference has been made in astronomical treatises. The data are founded upon the lunar tables of Hansen and the solar tables of Leverrier. Further, we have a discussion on moon-culminators in their application to longitudes, with notices on the methods of Nicolai and Struve, and a fully-worked-out example. The sixth section relates to the reduction of the longitude, latitude, and azimuth of a place to another, both accurately and approximately, and the determination of the distance of points on the terrestrial spheroid, of which the geographical positions are given. There are two supplementary chapters: the one bearing upon reflection-instruments, and of course entering at length into the use of the sextant; the other treating of interpolation, with special reference to the formulæ of Bessel and Hansen.

In the language in which this work originally appeared it would be almost a sealed book in Western Europe. The excellent translation into a language of which every scientific student should, in these days, possess a knowledge, now placed in our hands by Dr. Peters, will be, without doubt, a welcome addition to his means of instruction on an important branch of practical astronomy.

#### OUR BOOK SHELF

*A Treatise on Dynamics of a Particle, with numerous Examples.* By P. G. Tait and the late W. J. Steele. Fourth Edition. (London: Macmillan and Co., 1878.)

THE bibliography of this revised text-book is—a first edition in 1856, 304 pages; a second edition in 1865, 363 pages; a third edition in 1871, 428 pages; and the present edition of 407 pages. There are slight alterations in the disposition and amount of the matter in this edition, caps. x. and xi. of the third are put into cap. ix., caps. v. and vi. are contained in cap. v. of the fourth. The position of some of the exercises has been changed. The main features remain unaltered. The revision has had the advantage of Prof. Greenhill's supervision, who has verified (and corrected where necessary) the Examples and has freely introduced the use of Elliptic Functions. There is no need of any commendation for a text-book so well-known. We are, however, very much disposed to think that had Prof. Tait composed the work at a later date than he did, it would have differed somewhat from its present form and have approximated more closely to the Natural Philosophy brought out under the joint editorship of Sir William Thomson and himself. The author justly complains that "several sections in which some novelties appear have been translated almost *letter for letter* and transferred, without the slightest allusion to their source, to the pages of a German work. Several other books have obviously been similarly treated. It is well that this should be known, as the English authors might otherwise come to be supposed to have adopted these passages *simpliciter* from the German."

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