

ELLIOTT'S ALGEBRA OF QUANTICS.

An Introduction to the Algebra of Quantics. By EDWIN BAILEY ELLIOTT, M.A., F.R.S. Oxford, Clarendon Press, 1895. 8vo, xiii + 423 pp.

No single book is likely soon to supersede Salmon's Higher Algebra, but it will be replaced gradually by a combination of others, each of narrower scope. Professor Elliott's book is likely to be one of these, and to become equally well known. So far as binary forms are concerned, it worthily signalizes the advance made by English investigators during the past quarter century. To the memoirs of French and German writers before Hilbert there has been ready access through the standard works of Clebsch, Gordan, and Deruyts. There was needed a manual which should introduce the student to the researches of Cayley and Sylvester since 1870, and of Franklin, Hammond, Forsyth, MacMahon, and others of the English school.

A cursory inspection of the book shows that its style is that of the lecture, and therefore easy for the reader. Topical headings are supplied to nearly all sections. Frequent openings are made for geometrical application or illustration; and every student will thank the author for the occasional explicit warnings against the most probable errors and misconceptions. As to the matter, of 415 pages all but 45 are given to binary quantics, although incidental references to forms in more than two variables occur throughout the introductory chapters. Eleven chapters (259 pages) treat questions pertaining to binary forms of all orders; four chapters (110 pages) are given to particular forms and systems, and a final chapter (45 pages) to ternary forms and particularly the cubic. Well-chosen examples, more than 350 in number, distributed through the book double its value.

The first four chapters are entitled: Principles and Direct Methods, Essential Qualities of Invariants, Essential Qualities of Covariants, Cogredient and Contragredient Quantities. The first defines invariants, and gives abundant elementary examples, eliminants, Jacobians, Hessians, discriminants, catalecticants, canonizants. In the second and third, homogeneity and isobarism are shown to be necessary properties. Concomitants of one quantic are made to yield joint concomitants of two or more by substituting for the quantic f a linear aggregate of the same order: $f + \lambda\varphi + \psi\mu$