The single Notice is a long one by M. G. Bigourdan, "Les méthodes d'examen des miroirs et des objectifs." As is often the case in these appendices, both the older and the more modern methods are described, their mathematical bases are explained and applications to various instruments are made, so that the article practically constitutes a treatise on the subject in a form which can be read and understood without serious difficulty.

E. W. BROWN.

NOTES.

AT the meeting of the London mathematical society on March 11 the following papers were read: By E. W. HOBSON: "Some theorems in the theory of series of orthogonal functions"; by P. A. MACMAHON: "Investigations in the theory of the partition of numbers by a new method of partial fractions"; by R. L. HIPPISLEY: "Reciprocal and parallelogram linkages"; by J. R. WILSON: "A pseudo-sphere the equation of which is expressible in terms of elliptic functions"; by T. C. LEWIS: "Circles, spheres, etc., associated with a triangle, orthocentric tetrahedron, etc."

THE fifth ordinary meeting of the Edinburgh mathematical society for the session was held at the University of Glasgow on March 12. The following papers were read: By A. W. H. THOMPSON: "Solid geometry"; by G. D. C. STOKES: "A simple link apparatus for the mechanical solution of quadratic equations"; by F. TAVANI: "New formulae about the theory of the series of alternate sign."

BEGINNING with the April number, the staff of associate editors of the *Transactions of the American Mathematical Society* will include Professors A. B. COBLE and W. A. HURWITZ in place of Professors J. I. HUTCHINSON and MAX MASON, who have served since 1902 and 1911 respectively.

THE March number of the *Proceedings of the National Academy of Sciences* contains the following mathematical papers: "A note on functions of lines," by G. A. BLISS; "A classification of quadratic vector functions," by F. L. HITCHCOCK. The April number of the *Proceedings* contains:

"Groups possessing at least one set of independent generators composed of as many operators as there are prime factors in the order of the group," by G. A. MILLER; "The second derivatives of the extremal integral for a general class of problems of the calculus of variations," by ARNOLD DRESDEN; "Point sets and allied Cremona groups," by A. B. COBLE; "The straight lines on modular cubic surfaces," by L. E. DICKSON.

THE Theory of Functions of a Complex Variable, by E. J. TOWNSEND, is announced by Henry Holt and Company as in press and to appear in June.

THE Smith prizes of Cambridge University for 1915 have been awarded as follows: to H. GLAUERT, of Trinity College, for his essay "On the elliptical form of a rotating fluid as disturbed by a satellite," and to H. JEFFREYS, of St. John's College, for his essays "Certain hypotheses as to the internal structure of the earth and moon" and "On a possible distribution of meteors." The Rayleigh prize was awarded to J. PROUDMAN, of Trinity College, for his papers on tidal motion.

THE Adams prize commission announces as the subject of the prize competition for 1915–1916 the following:

"The course of evolution of the configurations possible for a rotating and gravitating mass, including the discussion of the stabilities of the various forms."

THE first award of the Ackermann-Teubner memorial prize in mathematics has been made, in accordance with the wish of the founder, to Professor FELIX KLEIN.

THE royal Venetian institute announces the following prize problem for 1917:

To make some notable extension to the theory of periodic solutions of differential systems. It is not always possible to profit by the classical method of Poincaré, that of varying the parameters in a known solution, or at least, only for small variations. When this method does not apply, the only concrete result concerning the condition of existence is the criterion of Whittaker. The most desirable investigation would be the elucidation of the law of distribution of the periodic solutions within the field of the general integral.

The competition is unrestricted. Memoirs should be written in Italian, French, English, or German, and submitted to the institute before December 31, 1917. The value of the prize is 3000 lire.

UNIVERSITY OF STRASSBURG.—The following courses in mathematics are being given during the present summer semester:—By Professor F. SCHUR: Differential geometry, three hours; Selected portions of projective geometry, two hours; Seminar, two hours.—By Professor G. FABER: Theory of functions of a complex variable, three hours; Partial differential equations, two hours; Seminar, two hours.—By Professor M. SIMON: Non-euclidean geometry, two hours.—By Professor J. WELLSTEIN: Differential and integral calculus, three hours; Mechanical integration, two hours.—By Professor L. v. MISES: Descriptive geometry, with exercises, three hours.—By Professor P. EPSTEIN: Analytic geometry of space, three hours; Introduction to determinants, two hours.—By Dr. A. SPEISER: Theory of numbers, two hours.—By Professor J. BAUSCHINGER: New methods in celestial mechanics, three hours.

UNIVERSITY OF CHICAGO.—The following courses are announced for the summer quarter of 1915.—All courses are five hours a week.—By Professor E. H. MOORE: Synthetic projective geometry (first term); General analysis (first term).—By Professor A. C. LUNN: Theory of functions; Theory of relativity.—By Professor G. A. BLISS: Definite integrals; Calculus of variations.—By Professor W. D. MACMILLAN: Differential equations; Celestial mechanics.—By Professor A. DRESDEN: Analytic projective geometry (second term); Determinants and solid analytic geometry.—By Professor J. W. A. YOUNG: Differential calculus; Theory of numbers.—By Professor R. D. CARMICHAEL: Integral calculus; Differential equations (second term).—By Professor E. J. WILCZYNSKI: Projective differential geometry.—By Professor F. R. MOULTON: Theory of rotating bodies.

COLUMBIA UNIVERSITY.—Summer session, July 6 to August 13.—By Professor JAMES MACLAY: Higher algebra; Functions of a complex variable.—By Professor EDWARD KASNER: Theory of geometric constructions; Differential geometry.—By Professor W. B. FITE: Projective geometry; Differential equations.

THE following advanced courses in mathematics are announced for the academic year 1915–1916.

COLUMBIA UNIVERSITY.—By Professor T. S. FISKE: Differential equations, four hours, second half-year.—By Professor F. N. COLE: Theory of groups, three hours, second half-year.—By Professor C. J. KEYSER: Modern theories in geometry, four hours; Mathematics, three hours.—By Professor D. E. SMITH: History of mathematics, four hours.—By Professor JAMES MACLAY: Elliptic functions, four hours, first half-year; Applications of elliptic functions, two hours, second half-year.—By Professor EDWARD KASNER: Differential equations, four hours, first half-year; Seminar in differential geometry, two hours.—By Professor W. B. FITE: Infinite series, three hours, first half-year.—By Professor H. E. HAWKES: Differential geometry of curves, three hours, first half-year.

CORNELL UNIVERSITY.—By Professor J. MCMAHON: Theory of probabilities, three hours.—By Professor J. H. TANNER: Algebraic equations, three hours.—By Professor V. SNYDER: Geometry on an algebraic surface, three hours.—By Professor F. R. SHARPE: Vector analysis, three hours.—By Professor D. C. GILLESPIE: Projective geometry, three hours.—By Dr. C. F. CRAIG: Advanced analysis, three hours.—By Dr. F. W. OWENS: Differential equations, with applications, three hours.—By Dr. J. V. MCKELVEY: Mathematical pedagogy, three hours.—By Professor W. A. HURWITZ: Integral equations, three hours.—By Dr. L. L. SILVERMAN: Coordinate geometry, three hours.—By Dr. J. SLEPIAN: Mechanics, three hours.

HARVARD UNIVERSITY.—All courses meet three times a week throughout the year, except those marked *, which meet for half a year.—By Professor W. F. OSGOOD: Introduction to potential functions and Laplace's equation*; Elastic vibrations, Fourier's series, and Bessel's functions*; Theory of functions of several complex variables.—By Professor M. BÔCHER: Modern geometry and modern algebra; Theory of functions.—By Professor C. L. BOUTON: Differential equations and Lie's theory of continuous groups.—By Professor J. L. COOLIDGE: Subject-matter of elementary mathematics*; Probability*; Projective geometry*; Non-Euclidean geometry*.—By Professor H. N. DAVIS: Second course in dy-

namics.—By Professor G. D. BIRKHOFF: Infinite series and products*; Problem of three bodies.—By Dr. D. JACKSON: Advanced calculus; Theory of numbers*.—By Dr. G. M. GREEN: Differential geometry of curves and surfaces*; Projective differential geometry*.—By Dr. E. KIRCHER: Properties of polynomials, and invariants*; Algebraic numbers*.—By Dr. G. A. PFEIFFER: Linear partial differential equations of the second order*; Conformal transformations*.

Professor BIRKHOFF and Dr. JACKSON will conduct a fortnightly seminar in analysis.

Courses of research are also offered by Professor OSGOOD in the theory of functions, by Professor BÔCHER in analysis and algebra, by Professor BOUTON in the theory of point transformations, by Professor COOLIDGE in geometry, by Professor BIRKHOFF in differential equations, by Dr. JACKSON in the theory of functions of a real variable, and by Dr. GREEN in differential geometry.

JOHNS HOPKINS UNIVERSITY.—By Professor F. MORLEY: Higher geometry, three hours (first half year); Vector analysis, three hours (second half year); Seminar, one hour.—By Professor A. B. COBLE: Algebraic functions, two hours.—By Professor A. COHEN: Advanced differential equations, two hours; Theory of functions, two hours.

PRINCETON UNIVERSITY.—By Professor H. B. FINE: Algebraic functions, three hours.—By Professor L. P. EISENHART: Mechanics, three hours (first term); Projective geometry, three hours (second term).—By Professor O. VEBLEN: Theory of sets of points, three hours; Coordinate geometry, three hours; Advanced analysis, three hours.—By Professor E. P. ADAMS: Electricity and magnetism, three hours; Analytic mechanics, three hours.—By Professor T. H. GRONWALL: Conformal representation, three hours; Differential equations and advanced calculus, three hours.—By Mr. J. W. ALEXANDER: Birational transformations, three hours (first term).—By Mr. A. A. BENNETT: Elliptic functions, three hours (second term).—By Dr. H. GALAJIKIAN: Differential equations of mathematical physics, three hours (first term).

YALE UNIVERSITY.—By Professor J. PIERPONT: Theory of functions of a complex variable, three hours; Modern analytic

geometry, three hours; Modern higher geometry, three hours.—By Professor P. F. SMITH: Continuous groups of transformations, three hours.—By Professor E. W. BROWN: Advanced calculus, three hours; Statics and dynamics, three hours; Advanced dynamics, three hours.—By Professor W. R. LONGLEY: Potential theory and harmonic analysis, three hours; Integral equations, three hours.—By Professor W. A. WILSON: Theory of functions of real variables, three hours.—By Dr. D. D. LEIB: Advanced algebra, three hours.—By Dr. G. M. CONWELL and Dr. H. F. MACNEISH: Differential geometry, three hours.—By Dr. E. J. MILES: Calculus of variations, three hours; Advanced calculus of variations, three hours.

THE *Jahresbericht der Deutschen Mathematiker-Vereinigung* notes the following extraordinary series of anniversaries of German professors of mathematics: M. NOETHER, of Erlangen, and A. WANGERIN, of Halle, celebrated their seventieth birthdays on September 24, and November 18, 1914, respectively. The eightieth birthday of E. SELLING, of Munich, fell on November 5, and the eighty-fifth birthday of M. CANTOR, of Heidelberg, on August 23. H. A. SCHWARZ, of Berlin, and J. THOMAE, of Jena, passed the fiftieth anniversary of their doctorates on August 6, and Professor E. LAMPE, of Berlin, on December 21.

PROFESSOR H. S. WHITE, of Vassar College, has been elected a member of the National academy of sciences.

PROFESSORS J. A. MILLER, of Swarthmore College, and W. F. OSGOOD, of Harvard University, have been elected members of the American philosophical society.

PROFESSOR T. S. FISKE has been appointed administrative head of the department of mathematics at Columbia University, succeeding Professor C. J. KEYSER, who has been relieved of administrative duties at his own request.

AT the University of Oklahoma Professor F. C. KENT has resigned and Dr. H. C. GOSSARD has been appointed instructor in mathematics.

AT the University of Michigan Professor L. C. KARPINSKI has been promoted to a junior professorship of mathematics.

AT the Massachusetts institute of technology, Dr. H. B. PHILLIPS has been promoted to an assistant professorship of mathematics.

MR. C. H. YEATON has been appointed instructor in mathematics at Dartmouth College.

AT Princeton University Dr. H. GALAJIKIAN has been appointed instructor in mathematics.—Mr. H. L. BARUCH has been appointed assistant in mathematics.

THE many friends of Professors KLEIN and RUNGE, of Göttingen, will be deeply grieved to learn of the death on the battlefield of the former's youngest son-in-law and the latter's younger son.

PROFESSOR F. A. SHERMAN, who held the chair of mathematics at Dartmouth College from 1871 to 1911, died February 25 at the age of seventy-four years.

PROFESSOR A. E. HAYNES, who retired from his professorship of mathematics at the University of Minnesota in 1911 after eighteen years service, died on March 12 at the age of sixty-six years.

BOOK catalogues: W. Heffer and Sons, Cambridge, England, catalogue 132, including about 800 titles in mathematics, physics, and engineering.—Galloway and Porter, Cambridge, England, catalogue 76, short list of mathematical books, 75 titles.—R. W. Lull, 84 Hanover Street, Manchester, N. H., list of 68 titles.