terrestrial magnetism when the earth is considered as a sphere and as a spheroid. The last two sections contain the numerical calculations. At the end are maps drawn from the numerical results for every 5° of latitude and every 10° of longitude. The agreement with observation is stated by the editor to be very satisfactory.

In conclusion, the reader will gather from the rough indications here given that the volume is not a mere compilation of incomplete fragments. Whatever he may think about the value of collections of published papers, and in particular of Volume I of Adams's works, it will be immediately apparent that Volume II is at least on the same footing as any other book containing original and previously unpublished scientific work, and its possession by scientific libraries will be as much a necessity as is that of the best known journals and treatises.

ERNEST W. BROWN.

NOTICE SUR M. HERMITE.

PAR M. C. JORDAN.

ADDRESS DELIVERED AT THE MEETING OF THE PARIS ACADEMY OF SCIENCES, JANUARY 21, 1901.

THE French school of mathematics loses in the person of M. Hermite its head and master.

It would be rash to undertake to analyze in haste and under the stress of keen emotion the long series of his works which have thrown so much lustre on the second half of the nineteenth century. Such an undertaking calls for more time and calmer feelings. Addressing then to our venerated confrère the last farewell, which his modesty forbade pronouncing at his grave, we limit ourselves here to pointing out, in broad lines and as far as memory permits, some of the discoveries which we owe to him.

In 1843, M. Hermite entered the Ecole Polytechnique at the age of twenty years. At the suggestion of Liouville, he wrote to Jacobi communicating the results which he had obtained relative to the division of abelian functions, then but little known. The illustrious German geometer, who was occupied at the time with the editing of his works, did not hesitate to give the letter of his young correspondent a place beside his own investigations. He wrote to him a little later: "Do not be troubled, Monsieur, if some of

your discoveries are to be found in my former researches. As you commenced where I finish, there is necessarily a small sphere of contact. In the future, if you honor me with your communications, I only shall have to learn."

The prediction of the great geometer was not long in being fulfilled. In the four letters which follow and which Jacobi has also preserved for us, M. Hermite proposed first to generalize the theory of continuous functions; but he shortly found himself led to vaster problems in the arithmetical theory of forms, where he soon obtained admirable results. At the very beginning of his works he points out several methods for reducing quadratic forms in any number of indeterminates. A little later the introduction of continuous variables leads him to the discovery of deeper lying truths.

He gives the complete solution of the problem of the arithmetical equivalence of general quadratic forms or of forms decomposable into linear factors; he determines the transformations of these forms into themselves; he demonstrates, in a manner altogether novel and purely arithmetical, the celebrated theorems of Sturm and Cauchy on the separation of the roots of algebraic equations. He introduces the fertile notion of quadratic forms with conjugate variables, and deduces from their theory a new demonstration of the beautiful theorem of Jacobi on the number of decompositions of a number into four squares. He arrives finally at the remarkable proposition that the roots of all algebraic equations having integral coefficients and the same discriminant can be expressed by a limited number of distinct irrationalities.

The algebraic study of forms is also the object of his meditations. The notion of invariant which dominates this theory had remained a little confused until the day when Cayley threw it into full light in the celebrated memoir dated 1845. Cayley, Sylvester, and Hermite divided the new domain which opened before them. Their works are so interlaced in this fraternal rivalry that it would be difficult and hardly desirable to distinguish with precision the part done by each in their common work. It seems, however, that we can attribute in particular to M. Hermite the law of reciprocity, the discovery of associated covariants, that of skew invariants, and the formation of the complete system of covariants of cubic and biquadratic forms and of invariants of the form of the fifth order.

These important researches in arithmetic and algebra did not satisfy his activity; he pursued at the same time his

studies on transcendants. In a series of memorable investigations he solved the problem of the transformation of hyperelliptic functions, and from the developments in series of the elliptic functions he deduced important formulæ relative to the number of classes of quadratic forms.

He laid the foundations of the theory of modular functions at the same time and solved in its details the difficult question of their transformation, thus giving far in advance a model for those who have elaborated and generalized this theory in our day.

The impression produced on geometers by the ensemble of these works is reflected very well in a picturesque phrase which we received at that time from the lips of Lamé: "To read the memoirs of M. Hermite makes one's flesh creep."

In 1856, at the age of thirty-four years, M. Hermite entered the Institute; in 1862 a chair was created for him at the Ecole Normale; a little later he became professor also at the Ecole Polytechnique and at the Sorbonne.

At this epoch the course of instruction, it must be said, was hardly up to date. The great discoveries by which Gauss, Abel, Jacobi, and Cauchy had transformed the science during half a century were passed over in silence, as if they were of interest only to the initiated few. M. Hermite cast them boldly into the public domain. This happy audacity has borne its fruits. Witness our young and brilliant school of geometers; they were all students of Hermite, and owe a great deal of their success to his lectures and kindly encouragement.

His peaceful realm was not confined to our borders. M. Hermite kept up correspondence throughout learned Europe, and young talent anywhere could count on his counsel and support. Neither the duties of instruction nor even the afflictions of age could do injury to the fertility of his mind. In fact, from this second period date a great number of beautiful works which yield precedence in no way to the works of his youth. However, an appreciable evolution took place in the object of his investigations. Arithmetic and algebra which had predominated up to this time gave way to the integral calculus.

The transition is made by a celebrated memoir on the equation of the fifth degree, whose solution he gives by means of elliptic functions. Then follow the researches on interpolation, on new methods of developing functions in series of polynomials, on the discontinuities of definite integrals which depend on a parameter, etc.

In the theory of elliptic functions M. Hermite discovered a fundamental formula which permits their decomposition into simple elements, and consequently their integration. He was the first to study doubly periodic functions of the second species.

We arrive finally at the memoir on the exponential function, worthily crowning his long researches on the developments in continued fractions. He made clear that the number e is transcendental. Lindemann has since established that the number π is also transcendental. The solution of the problem of the quadrature of the circle, so vainly sought throughout all the centuries, is therefore demonstrated to be impossible.

We can legitimately claim for M. Hermite a share in this beautiful result, because it has been attained by following the process which he employed for the exponential. But one would give a very incomplete idea of the rôle of great minds by measuring them exclusively by the new truths which they have explicitly enunciated. The methods which they have bequeathed to their successors, leaving to their care the application of these methods to new problems perhaps unanticipated by themselves, constitute another part, sometimes the principal part, of their glory, as the example of Leibnitz shows.

For almost a century we have labored to develop the fertile germs which Gauss and Cauchy have sown in their writings; it will be the same with Hermite. Behold two examples to prove it:

The remarkable group of substitutions which he encountered in his researches on the transformation of abelian functions serves as the essential element for the solution of a problem altogether different, the resolution of equations by radicals. It appears again in the discussion of the second variation of definite integrals.

The quadratic forms having conjugate variables are the indispensable fundament of investigations in the reduction of the most general forms with real and complex coefficients.

M. Hermite loved science for its own sake and was but little occupied with its applications; these came spontaneously and by superaddition. To Lamé's equation, whose integration constitutes the last of his great works, he attached quite a series of problems in mechanics: rotation of a solid, determination of the elastic curve, oscillations of the conical pendulum.

To form a correct idea of the place occupied by M. Hermite in the mathematical world, one should have taken

part with us in the memorable fêtes of his jubilee in 1892. All his friends, his disciples, his admirers shared in this impressive ceremony ; all the learned societies of Europe sent either addresses or delegates.

The same year saw the jubilee of Pasteur. To-day Pasteur and Hermite are no more ; there remains for us only the souvenir of their examples and their works, but these are sufficient to immortalize their memory.

Permit us in concluding to express a wish in behalf of the section of geometry. The work of Hermite is very scattered; in addition to the principal memoirs, it contains many letters and short notes disposed here and there ; but all bear la griffe du lion. The Academy would honor itself and render a great service to geometers by undertaking the publication of the complete works of Charles Hermite.

NOTES.

THE committee in charge of the colloquium to be held in August in connection with the summer meeting of the AMERICAN MATHEMATICAL SOCIETY is now able to announce that Professor OSKAR BOLZA has consented to give a course of lectures on "The calculus of variations, in particular Weierstrass's discoveries."

THE ninth regular meeting of the Chicago Section of the AMERICAN MATHEMATICAL SOCIETY will be held at the University of Chicago, on Saturday, April 6, 1901, the first session opening at 10 o'clock A. M., in the Ryerson Physical Laboratory. The Christmas meeting will be held at Northwestern University, Evanston, Ill., on Friday and Saturday, December 27 and 28. Titles, abstracts, and time requirements of papers to be read at the April meeting should be in the hands of the Secretary of the Section, for the use of the programme committee, not later than March 20.

THE January number (volume 23, number 1) of the *American Journal of Mathematics* contains the following papers: "Die Typen der linearen Complexe rationaler Curven in R_r," by S. KANTOR ; "Transformations of systems of linear differential equations," by E. J. WILCZYNSKI ; "Distribution of the ternary linear homogeneous substitutions in a Galois field into complete sets of conjugate substitutions," by L. E. DICKSON ; "Distribution of the quaternary linear homogeneous substitutions in a Galois