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LIX.—*Historical Eloge of the Marquis De Laplace**.—By
M. Le BARON FOURIER.

THE name of Laplace has been heard in every part of the world where the sciences are honoured; but his memory could not receive a more worthy homage than the unanimous tribute of the admiration and sorrow of that illustrious body who shared in his labours and in his glory. He consecrated his life to the study of the grandest objects which can occupy the human mind.

The wonders of the heavens,—the lofty questions of natural philosophy,—the ingenious and profound combinations of mathematical analysis,—all the laws of the universe have been presented to his thoughts during more than sixty years, and his efforts have been crowned with immortal discoveries.

From the time of his first studies it was remarked that he possessed a prodigious memory: all the occupations of the mind were easy to him. He acquired rapidly a very extensive knowledge of the ancient languages, and he cultivated different branches of literature.—Every thing interests rising genius; every thing is capable of revealing it. His earliest success was in theological studies; and he treated with talent and with extraordinary sagacity the most difficult controversial questions.

We do not know by what fortunate event Laplace passed from the study of scholastics to that of the higher geometry. This last science, which scarcely admits of a divided attention, attracted and fixed his thoughts. Henceforth he abandoned himself without reserve to the impulse of his genius, and he was impressed with the conviction that a residence in the capital had now become necessary. D'Alembert was then in the zenith of his fame. It was he who informed the court of Turin that its Royal Academy possessed a geometer of the first order—Lagrange, who, without this noble testimony to his merits, might have remained long unknown. D'Alembert had announced to the king of Prussia that there was only one man in Europe who could replace at Berlin the illustrious Euler, who, having been recalled by the Russian government, had consented to return to St. Petersburg. I find in the unpublished letters possessed by the Institute of France the details of this glorious negotiation, which fixed the residence of Lagrange at Berlin.

* Pronounced at the public sitting of the Royal Academy of Sciences on the 15th June 1829.

It was about the same time that Laplace began that long career which was destined to become so illustrious.

He waited upon D'Alembert, preceded by numerous recommendations, which might have been considered as very powerful. But his attempts were vain, for he was not even introduced. He then addressed to him whose suffrage he solicited a very remarkable letter on the general principles of mechanics, of which M. Laplace has frequently quoted to me different fragments. It was impossible that a geometer like D'Alembert could fail to be struck with the singular profoundness of this composition. On the same day he invited the author of the letter, and thus addressed him:—"You see, Sir, that I hold recommendations as of very little value;—you have no occasion for them. You have made yourself better known;—this is sufficient for me: You are entitled to my support." In a few days he succeeded in getting Laplace nominated Professor of Mathematics in the Military School of Paris. From that moment, devoted wholly to the science which he had chosen, he gave to all his labours a fixed direction, from which he never deviated; for the unchangeable purpose of his mind has always been the principal feature of his genius. He already trenched upon the known limits of mathematical analysis;—he was versed in the most ingenious and powerful parts of this science; and there was none more capable than he of extending its domains. He had solved a leading question in theoretical astronomy. He formed the project of consecrating his efforts to this sublime science;—he was destined to perfect it, and was able to embrace it in all its extent. He thought deeply upon his glorious purpose; and he spent his whole life in accomplishing it, with a perseverance of which the history of the sciences presents perhaps no other example.

The immensity of the subject flattered the just pride of his genius. He undertook to compose the *Almagest* of his age. This memorial he has left us under the name of the *Mécanique Céleste*; and his immortal work surpasses that of Ptolemy as much as the modern analysis surpasses the *Elements of Euclid*.

Time, which is the only just dispenser of literary glory, and which sinks into oblivion contemporary mediocrity, perpetuates also the remembrance of great works. They alone convey to posterity the character of each succeeding age. The name of Laplace will thus live for ever;—but I hasten to add, that enlightened and impartial history will never separate his memory from that of the other successors of Newton. It will conjoin the illustrious names of D'Alembert, Clairaut, Euler,

Lagrange, and Laplace. I confine myself at present to the mere mention of the great geometers whom the sciences have lost, and whose researches had for their common object the perfection of physical astronomy.

In order to give a just idea of their works, it would be necessary to compare them ; but the limits of a discourse like this oblige me to reserve a part of this discussion for the collection of our Memoirs.

Next to Euler, Lagrange contributed most to the foundation of mathematical analysis. In the writings of these two great geometers it has become a distinct science, the only one of the mathematical theories of which we can say that it is completely and rigorously demonstrated. Among all these theories, it alone is sufficient for its own purposes, while it illustrates all the rest; and it is so necessary to them, that without its aid they must have remained very imperfect.

Lagrange was destined to invent and to extend all the sciences of calculation. In whatever condition fortune had placed him, whether prince or peasant, he would have been a great geometer. This he would have become necessarily and without any effort—which cannot be said even of the most celebrated individuals who have excelled in this science.

If Lagrange had been the contemporary of Archimedes and Conon, he would have divided with them the glory of their most memorable discoveries. At Alexandria he would have been the rival of Diophantus.

The distinctive mark of his genius consists in the unity and grandeur of his views. He attached himself wholly to a simple though just and highly elevated thought. His principal work, the *Mécanique Analytique*, might be called Philosophical Mechanics, for it refers all the laws of equilibrium and motion to a single principle; and, what is not less admirable, it submits them to a single method of calculation of which he himself was the inventor. All his mathematical compositions are remarkable by their singular elegance, by symmetry of form, and generality of method, and, if we may so express it, by the perfection of his analytical style.

Lagrange was no less a philosopher than a great geometer. He has proved this in the whole course of his life, by the moderation of his desires, by his immoveable attachment to the general interests of humanity, by the noble simplicity of his manners, and the elevation of his character, and by the justness and profoundness of his scientific labours.

Laplace had received from nature all that force of genius which a great enterprise required. Not only has he united in his *Almagest* of the eighteenth century all that the mathematical
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and physical sciences had already invented, and which formed the foundation of astronomy, but he has added to this science capital discoveries of his own which had escaped all his predecessors. He has resolved, either by his own methods or by those of which Euler and Lagrange had pointed out the principles, questions the most important, and certainly the most difficult of all those which had been considered before his time. His perseverance triumphed over every obstacle. When his first efforts were not successful, he renewed them under the most ingenious and diversified forms.

In the motions of the moon, for example, there had been observed an acceleration, the cause of which philosophers were unable to discover. It had been ascribed to the resistance of an ethereal medium in which the celestial bodies moved. If this had been the case, the same cause affecting the orbits of the planets would have tended continually to disturb their primitive harmony. These stars would have been constantly disturbed in their course, and would have finally been precipitated upon the mass of the sun. It would have required the creating power to have been exerted anew in preventing or repairing the immense disorder which the lapse of time would have caused.

This cosmological question is undoubtedly the greatest which human intelligence can propose: It is now resolved. The first researches of Laplace on the immutability of the dimensions of the solar system, and his explanation of the secular equation of the moon, have led to this solution.

He at first inquired if the acceleration of the moon's motion could be explained by supposing that the action of gravity was not instantaneous, but subject to a successive transmission like that of light. By this means he succeeded in discovering its true cause. A new investigation then gave a better direction to his genius. On the 19th March 1787, he communicated to the Academy of Sciences a precise and unexpected solution of this great difficulty. He proved in the clearest manner that the observed acceleration is a necessary effect of universal gravitation.

This great discovery threw a new light on the most important points of the system of the world. The same theory, indeed, proved to him, that, if the action of gravitation on the stars was not instantaneous, we must suppose that it propagates itself more than fifty millions of times faster than light, whose velocity is well known to be 70,000 leagues in a second.

Hence he concluded from his theory of the lunar motions, that the medium in which the stars revolve does not oppose
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any sensible resistance to the motions of the planets; for this cause would particularly affect the motion of the moon, whereas it produces no perceptible effect.

The discussion of the motions of this planet is pregnant with remarkable consequences. We may conclude from it, for example, that the motion of rotation of the earth about its axis is invariable. The length of the day has not varied the 100dth part of a second for 2000 years. It is remarkable that an astronomer need not go out of his observatory to measure the distance of the earth from the sun. It would be sufficient to observe carefully the variations of the lunar motions, and from this he would deduce with certainty the distance required.

A still more striking consequence is that which relates to the figure of the earth; for the form even of the terrestrial globe is impressed on certain inequalities of the lunar orbit. These inequalities would not have taken place if the earth had been a perfect sphere. We may determine the compression at the poles of the globe by the observation of the lunar motions alone; and the results hence deduced agree with the real measures which have been obtained by the great trigonometrical surveys at the equator, in the northern regions, in India, and in different countries.

It is to Laplace that we especially owe this astonishing perfection of modern theories.

I cannot undertake to recount at present the series of his labours, and the discoveries to which they have led. The simple enumeration of them, however rapid it may be, would exceed the limits which I am obliged to prescribe to myself. Beside these researches on the secular equation of the moon, and the no less important and difficult discovery of the cause of the great inequalities of Jupiter and Saturn, we may mention those admirable theorems on the libration of the satellites of Jupiter. To these we may add his analytical inquiries respecting the tides,—a subject which he has pursued to an immense extent.

There is scarcely a point of physical astronomy of any importance that he did not study with the most profound attention; and he submitted to calculation most of the physical conditions which his predecessors had omitted. In the question already so complex, of the form and rotatory motion of the earth, he has considered the influence of the waters distributed between the continents, the compression of the interior strata, and the secular diminution of the dimensions of the globe.

Among all these researches we must particularly distinguish those

those which relate to the stability of great phænomena; for no object is more worthy of the meditation of philosophers. Hence it follows that those causes, either accidental or constant, which disturb the equilibrium of the ocean, are subject to limits which cannot be passed. The specific gravity of the sea being much less than that of the solid globe, it follows that the oscillations of the ocean are always comprehended between very narrow limits; which would not have happened if the fluid spread over the globe had been much heavier. Nature in general keeps in reserve conservative forces which are always present, and act the instant the disturbance commences, and with a force increasing with the necessity of calling in their assistance. This preservative power is found in every part of the universe. The form of the great planetary orbits, and their inclinations, vary in the course of ages, but these changes have their limits. The principal dimensions subsist, and this immense assemblage of celestial bodies oscillates round a mean condition of the system, towards which it is always drawn back. Every thing is arranged for order, perpetuity, and harmony.

In the primitive and liquid state of the terrestrial globe, the heaviest materials are placed near the centre, and this condition determines the stability of seas.

Whatever may be the physical cause of the formation of the planets, it has impressed on all these bodies a projectile motion in one direction round an immense globe; and from this the solar system derives its stability. Order is here kept up by the power of the central mass. It is not, therefore, left, as Newton himself and Euler had conjectured, to an adventitious force to repair or prevent the disturbance which time may have caused. It is the law of gravitation itself which regulates all things, which is sufficient for all things, and which everywhere maintains variety and order. Having once emanated from Supreme Wisdom, it presides from the beginning of time, and renders impossible every kind of disorder. Newton and Euler were not acquainted with all the perfections of the universe.

Whenever any doubt has been raised respecting the accuracy of the Newtonian law, and whenever any foreign cause has been proposed to explain apparent irregularities, the original law has always been verified after the most profound examination. The more accurate that astronomical observations have become, the more conformable have they been to theory. Of all geometers Laplace is the one who has examined most profoundly these great questions.

We cannot affirm that it was his destiny to create a science entirely

entirely new, like Galileo and Archimedes; to give to mathematical doctrines principles original and of immense extent, like Descartes, Newton, and Leibnitz; or, like Newton, to be the first to transport himself into the heavens, and to extend to all the universe the terrestrial dynamics of Galileo; but Laplace was born to perfect every thing, to exhaust every thing, and to drive back every limit, in order to solve what might have appeared incapable of solution. He would have completed the science of the heavens, if that science could have been completed.

The same character appears in his researches on the analysis of probabilities,—a science quite modern and of immense extent; whose object, often misunderstood, has given rise to the most erroneous interpretations, but whose application will one day embrace every department of human knowledge,—a fortunate supplement to the imperfection of our nature.

This art originated from a fine and fertile idea of Pascal's: It was cultivated from its origin by Fermat and Huygens. A philosophical geometer, James Bernouilli, was its principal founder. A singularly happy discovery of Stirling, the researches of Euler, and particularly an ingenious and important idea due to Lagrange, have perfected this doctrine: It has been illustrated by the objections even of D'Alembert, and by the philosophical views of Condorcet: Laplace has united and fixed the principles of it. In his hands it has become a new science, submitted to a single analytical method, and of prodigious extent. Fertile in useful applications, it will one day throw a brilliant light over all the branches of natural philosophy. If we may here be permitted to express a personal opinion, we may add, that the solution of one of the principal questions, that which the illustrious author has treated in the 18th chapter of his work, does not appear to us exact; but, taken all in all, this work is one of the most precious monuments of his genius.

After having mentioned such brilliant discoveries, it would be useless to add, that Laplace belonged to all the great Academies of Europe.

I might also, and perhaps ought to, mention the high political dignities with which he was invested; but such an enumeration would only have an indirect reference to the object of this discourse. It is the great geometer whose memory we now celebrate. We have separated the immortal author of the *Mécanique Céleste* from all accidental facts which concern neither his glory nor his genius. Of what importance indeed is it to posterity, who will have so many other details to forget, to learn whether or not Laplace was for a short time the minister

minister of a great nation. What is of importance are the eternal truths which he discovered;—the immutable laws of the stability of the world, and not the rank which he occupied for a few years in the conservative senate.—What is of importance, and perhaps still more so even than his discoveries, is the example which he has left to all those who love the sciences, and the recollection of that incomparable perseverance which has sustained, directed, and crowned so many glorious efforts.

I shall omit, therefore, all the accidental circumstances and peculiarities which have no connection with the perfection of his works. But I will mention, that in the first body in the state the memory of Laplace was celebrated by an eloquent and friendly voice, which important services rendered to the historical sciences, to literature, and to the state, have for a long time illustrated*.

I shall particularly mention that literary solemnity which attracts the attention of the capital. The French Academy, uniting its suffrages to the acclamations of the country, considered that it would acquire a new glory by crowning† the triumphs of eloquence and of political virtue.

At the same time it chose to reply to the successor of Laplace, an illustrious academician‡, with more than one claim, who united in literature, in history, and in the public administration, every species of talent.

Laplace enjoyed an advantage which fortune does not always grant to great men. From his earliest youth he was justly appreciated by his illustrious friends. We have now before us unpublished letters, which exhibit all the zeal of D'Alembert to introduce him into the Military School of France, and to prepare for him, if it had been necessary, a better establishment at Berlin. The president Bochart de Saron caused his first works to be printed. All the testimonies of friendship which have been given to him recall great labours and great discoveries; but nothing could contribute more to the progress of the physical sciences than his relations with the illustrious Lavoisier, whose name, consecrated in the history of science, has become an eternal object of our sorrow and esteem.

These two celebrated men united their efforts. They undertook and finished very extensive researches in order to measure one of the most important elements of the physical theory of heat. About the same time, they also made a long series of experiments on the dilatation of solid substances. The

* M. Le Marquis Pastoret.

† M. Royer-Collard.

‡ M. Le Comte Daru.

works of Newton sufficiently show us the value which this great geometer attaches to the special study of the physical sciences. Laplace is of all his successors the one who has made the greatest use of his experimental method; he was almost as great a natural philosopher as he was a geometer. His researches on refractions, on capillary attraction, on barometrical measurements, on the statical properties of electricity, on the velocity of sound, on molecular action, and on the properties of gases, testify that there was nothing in the investigation of nature to which he was a stranger. He was particularly anxious about the perfection of instruments, and he caused to be constructed at his own expense, by a celebrated artist, a very valuable astronomical instrument, which he gave to the Observatory of France.

All kinds of phænomena were perfectly well known to him. He was connected by an old friendship with two celebrated chemists, whose discoveries have extended the boundaries of the arts and of chemical theory. History will unite the names of Berthollet and Chaptal to that of Laplace. It was his happiness to reunite them; and their meetings always had for their object and for their results the increase of those branches of knowledge, which are the most important and the most difficult to acquire.

The gardens of Berthollet at his house at Arcueil were not separated from those of Laplace. Great recollections and great sorrows have rendered this spot illustrious. It was there that Laplace received celebrated foreigners, men of powerful minds, from whom science had either obtained or expected some benefit, but especially those whom a sincere zeal attached to the sanctuary of the sciences. The one had begun their career,—the others were about to finish it. He received them with extreme politeness: He went even so far that he led those who did not know the extent of his genius, to believe that he might himself draw some advantage from their conversation.

In alluding to the mathematical works of Laplace, we have particularly noticed the depth of his researches, and the importance of his discoveries: but his works are distinguished also by another character which all readers have appreciated, —I mean the literary merit of his compositions. That which is entitled the *Système du Monde* is remarkable for the elegant simplicity of its style, and the purity of its language. There had previously been no example of this kind of composition; but we should form a very incorrect idea of the work, were we to expect to acquire a knowledge of the phænomena of the heavens in such productions. The suppression of the symbols of the language of calculation cannot contribute

bute to its perspicuity, and render the perusal of it more easy. The work is a perfectly regular exposition of the results of profound study: it is an ingenious epitome of the principal discoveries. The precision of its style, the choice of methods, the greatness of the subject, give a singular interest to this vast picture; but its real utility is to recall to geometers those theorems whose demonstrations were already known to them. It is properly speaking the contents of a mathematical treatise.

The purely historical works of Laplace have a different object. They present to geometers with admirable talent the progress of the human mind in the invention of the sciences. The most abstract theories have indeed an innate beauty of expression. It is this which strikes us in several of the treatises of Descartes, and in some of the pages of Galileo, of Newton, and Lagrange. Novelty of views, elevation of thought, and their connection with the grand objects of nature, fix the attention and fill the mind. It is sufficient that the style be pure, and have a noble simplicity. It is this kind of literature that Laplace has chosen, and it is certain that he has attained in it the first rank. If he writes the history of great astronomical discoveries, he becomes a model of elegance and precision. No leading fact ever escapes him: the expression is never obscure or ambiguous. Whatever he calls great is great in reality. Whatever he omits does not deserve to be cited.

M. Laplace retained to a very advanced age that extraordinary memory which he had exhibited from his earliest years; a precious gift, which, though it is not genius, is that which serves to acquire and preserve it. He had not cultivated the fine arts, but he appreciated them. He was fond of Italian music and of the poetry of Racine, and he often took delight in quoting from memory different passages of this great poet. The works of Raphael adorned his apartments, and they were found beside the portraits of Descartes, Francis Vieta, Newton, Galileo and Euler.

Laplace had always accustomed himself to a very light diet, and he diminished the quantity of it continually, and even to an excessive degree. His very delicate sight required constant care, and he succeeded in preserving it without any alteration. These cares about himself had only one object, that of reserving all his time and all his strength for the labours of his mind. He lived for the sciences, and the sciences have rendered his memory immortal.

He had contracted the habit of excessive application to study, so injurious to health, though so necessary to profound inquiries; but he did not experience from it any inconvenience till during the two last years of his life.

At the commencement of the disease by which he was cut off, there was observed with alarm a moment of delirium. The sciences still occupied his mind. He spoke with an unwonted ardour of the motions of the planets, and afterwards of a physical experiment, which he said was a capital one; and he announced to the persons whom he believed to be present, that he would soon discuss these questions in the Academy. His strength gradually failed. His physician*, who deserved all his confidence, both from his superior talents and the care which friendship alone could have inspired, watched near his bed; and M. Bouvard, his fellow-labourer and his friend, never left him for a single moment.

Surrounded with a beloved family,—under the eyes of a wife whose tenderness had assisted in supporting the necessary ills of life, whose amenity and elegance had shown him the value of domestic happiness, he received from his son, the present Marquis de Laplace, the strongest proofs of the warmest affection.

He evinced his deep gratitude for the marks of interest which the King and the Dauphin had repeatedly exhibited.

Those who were present at his last moments reminded him of his titles to glory, and of his most brilliant discoveries. He replied, "What we know is little, and what we are ignorant of is immense." This was at least the meaning of his last words, which were articulated with difficulty. We have often heard him express the same thought, and almost in the same terms. He grew weaker and weaker, but without suffering pain.

His last hour had arrived: the powerful genius which had for a long time animated him, separated from its mortal coil, and returned to the heavens.

The name of Laplace honoured one of our provinces already so fertile in great men,—ancient Normandy. He was born on the 23d March 1749, and he died in the 78th year of his age, on the 5th May 1827, at nine o'clock in the morning. Shall I remind you of that gloomy sadness which brooded over this place like a cloud when the fatal intelligence was announced to you? It was on the day and even at the hour of your usual meetings. Each of you preserved a mournful silence; each felt the sad blow with which the sciences were struck. All eyes were fixed on that place which he had so long occupied among you. One thought only filled your minds; every other meditation became impossible. You separated under the influence of an unanimous resolution, and for this single time your usual labours were interrupted.

* M. Magendie.

It is doubtless great—it is glorious—it is worthy of a powerful nation to decree high honours to the memory of its celebrated men. In the country of Newton the ministers of state desired that the mortal remains of this great man should be solemnly deposited among the tombs of its monarchs. France and Europe have offered to the memory of Laplace an expression of their sorrow, less pompous no doubt, but perhaps more touching and more sincere.

He has received an unusual homage;—he has received it from his countrymen in the bosom of a learned body, who could alone appreciate all his genius. The voice of science in tears was heard in every part of the world where philosophy had penetrated. We have now before us an extensive correspondence from every part of Germany, England, Italy, and New Holland—from the English possessions in India, and from the two Americas—and we find in it the same expressions of admiration and sorrow. This universal grief of the sciences, so nobly and so freely expressed, has in it no less truth than the funeral pomp of Westminster Abbey.

Permit me, before closing this discourse, to repeat a reflection which presented itself when I was enumerating in this place the great discoveries of Herschel, but which applies more directly to Laplace.

Your successors will see accomplished those great phenomena whose laws he has discovered. They will observe in the lunar motions the changes which he has predicted, and of which he was alone able to assign the cause. The continued observation of the satellites of Jupiter will perpetuate the memory of the inventor of the theorems which regulate their course. The great inequalities of Jupiter and Saturn pursuing their long periods, and giving to these planets new situations, will recall without ceasing one of the most astonishing discoveries. These are the titles to true glory which nothing can extinguish. The spectacle of the heavens will be changed; but at these distant epochs the glory of the inventor will ever subsist; the traces of his genius bear the stamp of immortality.

I have thus presented to you some features of an illustrious life consecrated to the glory of the sciences. May your recollection supply the defects of accents so feeble! May the voices of the nation—may that of the world at large, be raised to celebrate the benefactors of nations—the only homage worthy of those who, like Laplace, have been able to extend the domains of thought—to attest to man the dignity of his being, by unveiling to his eyes all the majesty of the heavens!