Obituary.

PROF. H. A. LORENTZ, FOR. MEM. R.S.

HENDRIK ANTOON LORENTZ, whose death on Feb. 4 has already been recorded in our columns, was the subject of an article by Sir Joseph Larmor in NATURE of Jan. 6, 1923, when we had the privilege of reproducing his portrait in our Scientific Worthies series. Reference must be made to this article for a complete account of his scientific work and its significance in the progress of physics. It will suffice to state here that Lorentz was born at Arnheim, Holland, on July 18, 1853, and received his early training at the University of Leyden, where he became professor of theoretical physics in 1878. In 1902 he received the Nobel Prize for Physics; in 1905 he was elected a foreign member of the Royal Society; three years later he received its Rumford Medal, and in 1918 the Copley Medal. Such was his record; his personal qualities are described in the following brief messages with which we have been favoured.

EVERY student of the physical sciences knows the magnificent work of Lorentz: and his contributions have already been warmly and ably explained to the world. It may be justifiable to write a few words concerning the part that he played as a leader in international science, for that is less well known.

For many years Lorentz naturally and by general consent took the leading place in every European conference of physicists. He had won the affection and respect of men from all countries. He could use several languages fluently and accurately. He could grasp quickly the meaning of a speaker, and immediately on the termination of an address he could repeat its arguments and conclusions in such other languages as might be desirable, so that all present were kept in touch with one another. He never allowed a discussion to stray.

Nevertheless, even his great abilities and his sound judgment would not alone have made Lorentz the perfect president that he was. His success was due also to a wonderful and most attractive courtliness, to a humour that could express itself in not one language alone, and not least to the charm of a kindly and affectionate disposition. He was really beloved by all who sat under him. In his own field, and that no insignificant one, he was one of the forces that drew together men of different nations and brought them to a mutual understanding. W. H. BRAGG.

IN thinking of Prof. Lorentz one calls to mind, before all scientific achievements, his charming personality. A familiar figure at international and other conferences, speaking fluently several languages, he delighted everyone with his happy speeches and engaging simplicity of manner. There was no eccentricity of genius about him; he was just one of the simplest and most likeable of men. He must have wielded an immense influence, for he had come to occupy a unique place in the esteem of scientific men of all nations. Meeting him last autumn at the Conference at Como, I could see no sign of any failure of activity; and his mind was always young and able to enter with zest into the latest and most difficult advances of physics. In his long career he produced much work of the highest rank. The older work is now part of the commonplace matter of physics which we learn without thinking very much as to who originated it, and it is not easy to recollect at short notice the numerous developments that we owe to him. But his name recalls especially the Lorentz transformation, the culminating point of one phase of electrodynamic theory and the foundation stone of the next—relativity. I think it would be from about 1895 to 1902 that Lorentz and Larmor between them created a new chapter in electrodynamics. This development had two sides, one concerned with the effect of motion on all kinds of phenomena, and the other with the transition from Maxwell's continuous theory to the theory of electrons. I can well remember (as a student about 1905) how exciting was the escape from the old elastic solid ethers with their specific inductive capacities and other conventionalised conceptions to this new world of electrons. Lorentz's "Versuch einer Theorie" (the abbreviation is so familiar that one forgets there must have been some more of the title) alongside Larmor's "Æther and Matter" was the opening to the new physics; and what an opening it has proved! A. S. EDDINGTON.

MY own connexion with Lorentz, or rather with his works, goes back into a somewhat distant past. I took my degree at Cambridge in 1876, a few months after he had graduated at Leyden. A conversation with Stokes directed me to optics, Fresnel's wave surface, and the laws of double refraction as a first subject of investigation, and made me acquainted with Lorentz's dissertation on the reflection and refraction of light. From that time on I learnt to admire his work, and as the years passed on to recognise in him a master of physical science. Only some few weeks since I became possessed of the first volume of his lectures just published, and read again with increased feelings of regard and admiration some of that earlier work.

But to pass on. Lodge's paper on aberration problems aroused afresh the interest in the Michelson and Morley experiment of 1887; I think it was in June of 1893, when Fitzgerald was examining in the Natural Sciences Tripos along with J. J. Thomson, that he told us one evening in Thomson's rooms of his explanation of the difficulty—the brilliant baseless guess of an Irish genius we thought it at the time—he had given it in his lectures, he said, and then rather later we learnt of Lorentz's work and his paper in the *Transactions of the Amsterdam Academy of Sciences*. Little did we realise at that time all that was involved in the Lorentz transformation and his brilliant investigations into the laws of electromagnetism applied to moving media.

For me, however, much personal contact with Lorentz did not come until later; administrative work at the National Physical Laboratory severed in great measure my connexion with theoretical physics, but in 1922 I met him again at a meeting of the International Research Council at Brussels. The Council had been formed in 1919 to consist of allies and neutral nations replacing the former Association of Academies. Holland became a member at an early date, and Lorentz realised that, in many directions for the advancement of natural knowledge, the co-operation of the Central Powers was a matter of necessity. To this end he worked, feeling, as he wrote in 1925, that "the time had come to give as soon as possible to scientific effort that character of universality which, as a consequence of the nature of science, it ought to possess, believing that the action which he desired the Assembly to take would show a confidence in the future which could not fail to call forth a reciprocal feeling and assist in scattering the shadows darkening the life of nations."

Those of us who, in 1926, after the president, M. Emile Picard, had declared the proposal to invite Germany, Austria, Hungary, and Bulgaria to join the Council, to be carried by the unanimous votes of the 25 countries present, listened to his speech of thanks realised, if we had not known it before, that Lorentz was a great man, not only an eminent man of science, but also one who for his efforts in the cause of peace in science had fitly earned the gratitude of all who hold that on the growth of scientific knowledge depends the future welfare of mankind.

The International Research Council meets again in Brussels this summer. Is it a vain hope that at that meeting all nations may unite in doing honour to the memory of a man whose devotion to the cause of science has been so great, and whose work has proved a starting-point of one of the most marked advances of our time?

RICHARD GLAZEBROOK.

IN 1879, Maxwell was taken away in the prime of life, leaving behind him a mass of unfinished problems which seemed to call for the special genius of a Maxwell for their solution. It soon became clear that his mantle had fallen in a very special degree on the young Dutch mathematician who had just been appointed, at the early age of twenty-five, to the chair of theoretical physics at Leyden.

Lorentz took up in turn almost all the unfinished threads of Maxwell's work and carried them at least to the stage which Maxwell might have hoped to reach in a normal span of life, and often far beyond. He examined the effects of fine-grainedness of structure of media which Maxwell had treated as continuous; he took account of the mass of electrical charges which Maxwell had been content to neglect. These last investigations assumed great importance after the electron had been unearthed experimentally and established in its proper place in physics. Indeed, Lorentz's name is very specially associated with the mathematical theory of electrons, and his immediate explanation of the newly discovered Zeeman effect was one of his most sensational, although perhaps not one of his greatest, achievements. Whereas Maxwell had generally disregarded the effects of motion through the ether, Lorentz set to work to correlate the phenomena observable in systems at rest with those of systems in motion. He got so far as to show that the two sets of phenomena would be the same except for slight differences, imperceptible in practice, such as might be attributed to small (second-order) differences in clocks and measuring-rods. But this edifice needed for its consolidation a theory which ultimately came from other hands.

The aims of the two men were the same, but not their methods. Maxwell's science was an enchanted fairyland in which no one knew what magic would happen next. Lorentz's science was a workshop, in which tools of exquisite precision were fashioned with infinite care in view of all the world, and turned to their prearranged purposes; one almost seemed to see science growing according to plan.

Lorentz was beloved by all who had the honour of knowing him; the present writer can pay special tribute to his unfailing kindness and patience in discussing problems with men of a younger generation who had no conceivable claims on his time. Our admiration for his achievements is unbounded, but we will remember him mainly as our genial, kindly, and very human friend.

J. H. JEANS.

THERE is a remarkable unity, for the most part, in the work of Lorentz, converging as it does on the great purpose, to frame if possible a consistent theory of electricity and light and their mutual relations, and to clear up the obscurities inherent in these subjects, which are scarcely yet entirely dissipated. His studies on thermodynamics and radiation and gas theory may be recognised as all ancillary to the main purpose. To survey the titles alone of his published papers, in anything like a chronological sequence, is to recall the successive stages in a long endeavour which culminated in the theory of electrons and (in a restricted sense) of relativity. It is unfortunate from this point of view that the issue of his collected papers, begun in 1907, has not been continued. It was characteristic of the writer, though perhaps to be regretted on historical grounds, that he could not resist the very natural temptation, in a progressive subject, to revise and even to rewrite many of these by the light of further knowledge and reflection. It is to be hoped, in the interests of scientific history, that the publication will before long be continued and completed, as a fitting memorial of a great and effective genius.

The contents of the volume already published show that his interests were not wholly restricted to the speculations referred to, absorbing as these were. We find, for example, a paper on the turbulent flow of water in pipes. The theoretical work of Reynolds is here presented in a simplified form, and a novel attempt is made to find, on theoretical grounds, a limiting value of the 'critical velocity.' The paper was probably the first introduction of the matter to continental readers. We find, again, an elegant mathematical paper on viscous motion of fluids, in which a certain 'reciprocal theorem' is used to extend somewhat the range of soluble problems. There is also an interesting discussion of the Hertzian dynamics, which was attractive, no doubt, for the 'geodesic' principle on which it is based. Finally, we may mention an elegant article on the classification of crystal forms.

To British investigators, Lorentz was ever a most sympathetic figure. This was due partly to his mastery of our language, which made personal relations easy, partly to his keen admiration of the work of the great English leaders of his time (notably Maxwell), and above all to the transparent kindliness and charm of his character, with its strict integrity, and the engaging candour with which he always admitted and even emphasised such difficulties as he had not been able to surmount.

H. LAMB.

THE unexpected death of Prof. Lorentz, premature not in years but in intellect, removes from the world a gracious figure, that will stand in the range of succession of other past leaders—Volta, Davy, Ampère, Faraday, Hamilton, Stokes, Helmholtz, Kelvin, Kirchhoff, Maxwell, Rayleigh, Boltzmann, Willard Gibbs, Hertz, Poincaré—in the development of physical ideas, especially on the side of the consolidation of theory. The main characteristic which he exhibited, most prominently in recent years, has been great rapidity of assimilation, resulting in conciseness and clarity of exposition, over all the field of mathematical physics. This has always been a welcome feature to his colleagues in Great Britain, brought up, from the mode of their education, towards width of outlook. He was the ideal leader for an international congress, for he was the most learned and rapid of contemporary physicists. Of necessity, therefore, he took his knowledge from where he could most readily find it; and perhaps the work of the great originating minds of the British school was not so fully before him historically as it has been to their own countrymen—as indeed on occasion he has been the first to admit. When one considers his fifty years of scientific activity, absolutely in the front rank, the zest and power with which in recent years he has thrown himself into new phases of physical development, such as relativity and *quanta*, often problematical and perplexing to older modes of thought, have been most remarkable. He has been an outstanding ornament of the Dutch school, and of their historic university of Leyden: and when one looks around for his peers the name of Huygens is apt to rise to mind.

JOSEPH LARMOR.

THE concentrated power of the human mind is illustrated by the achievements of mathematical physicists more decisively than by any other pursuit. The miracle does not lie in the working out of equations, but in the dissection and recognition of the essential operations of natural law with such completeness and clarity that the construction of equations to represent the intrinsic forces at work becomes possible. The deduction of consequences then naturally follows, or can be left to time.

In addition to analytical power, H. A. Lorentz had an exceptionally clear perception of the essentials of a physical process, and was able to state them with novel precision. He had thus the rare and enviable power of dealing with elementary and familiar facts in such a way as to interest advanced experts; for he could display unexpected connexions, and disentangle unforeseen contradictions, even in subjects which have long been taught superficially to first-year students. In this illuminating and clarifying power he has been likened to the late Lord Rayleigh, and the comparison is just. The difference was that Lorentz was a professor with worshipful students who took down and published some of his lectures, whereas Rayleigh had for the most part to range over the field of physical science by himself. Both clarified everything they touched. The way in which Lorentz's work dovetailed into, and often heralded, some of the modern developments—a search for invariants and the like,—his thorough grasp of the knowledge of his time, and his many steps over the border into new territory, have been dealt with in NATURE of Jan. 6, 1923, by a master mind: the only defect being that Larmor's own precursory or simultaneous contributions, which enabled him to appreciate so quickly the work of Lorentz, have been slurred over or ignored in that appreciative article.

In the past, too much of Lorentz's work has been partially buried in the *Archives Néerlandaises*, or has been made known only through lecture notes. A collection of his papers for English-speaking countries would be a great help; they might serve to recall attention to the physical bearing of some of the recondite speculations and revolutionary methods of treatment now in vogue, and help to re-establish connexion with much that has gone before.

Where so much has been done, it may seem trivial to pick out a single instance of Lorentz's scientific insight, but I was personally concerned in verifying the Zeeman dissection of spectrum lines by a magnetic field, at an early stage ("Year-book of the Royal Society for 1897," **98**, p. 119), and could appreciate the almost contemporaneous electron-orbit precessional theory of Lorentz. It is well known that he anticipated or predicted a number of subsidiary details, about polarisation and the like, which were forthwith abundantly verified by observation.

I had the pleasure of entertaining Prof. and Mme. Lorentz at Edgbaston on the occasion of the conferment of an honorary degree, and they became our valued friends. With his scientific or philosophic outlook I found myself in close sympathy.

OLIVER LODGE.

I CANNOT pretend to write any appreciation of Lorentz's scientific work. I have only known him as chairman of a small international body of which I am a member, the committee set up by the League of Nations to provide the machinery of international co-operation, when required, in questions of science, arts, and letters. It is generally known as the C.I.C. or Committee of Intellectual Co-operation.

The first chairman was the philosopher Bergson, a swift and subtle thinker, a man of infinite accomplishments, accustomed to the great world, and a speaker of distinguished eloquence, equally at home in French and English. When Bergson retired, it seemed almost impossible to fill his place, until someone—I have been told it was his pupil Einstein—suggested the name of Lorentz. He was not at the time a member of the committee, but as soon as he came among us he impressed all his colleagues as the right man. He had not the brilliance or the diplomatic power of Bergson; but his patience and courtesy, his imperturbable fair-mindedness, his transparent simplicity and good-will, together with his great scientific eminence and his easy command of English, French, and German, gave him at once the entire confidence and affection of the committee. He had the advantage, of course, of coming from a neutral country; he had no old enmities to forget, and his own devotion to the cause of international appeasement and common sense was so obvious that one never spoke of it. It could be taken for granted.

All the multifarious undertakings of the committee come before the chairman, and Lorentz had to arrange for the consideration of problems of bibliography, of art, and even of law, as well as of science proper. He never failed in lucidity and never lost patience. But above all he enabled his literary colleagues to understand and appreciate the noble simplicity of a great mind genuinely devoted to science. GILBERT MURRAY.

ALL physicists, young and old, realise and appreciate the importance of Lorentz's work. Those who are old enough to be his contemporaries, who read his papers as they appeared, or rather as they were translated, who know the views prevalent before they came out and the changes they produced, can perhaps realise more easily than the younger men the effect of his work and the magnitude of the influence it has had on the progress of science. This feeling will be especially acute in those who more than fifty years ago were convinced of the truth of Maxwell's theory of light and interested in its development, for Lorentz was the first pioneer of Maxwell's theory.

Lorentz's first work, a dissertation for the doctor's degree in 1875, was an application of Maxwell's theory to the problem of the reflection and refraction of light by dielectrics and also by metals. This, so far as my knowledge goes, was the first application of Maxwell's theory other than those made by Maxwell himself. This was followed by a still more important paper on the relation between the refractive index and the density of bodies; this was the first application of Maxwell's theory to a medium consisting of discrete molecules which could be polarised by electric forces. We have in the same connexion his great memoirs, "La Théorie électromagnétique de Maxwell et son application aux corps mouvants" (1892) and "Versuch einer Theorie der elektrischen und optischen Erscheinungen in bewegten Körpern" (1895), the second of these being the beginning of the great subject of relativity.

There is no space here to discuss Lorentz's work in any detail; it covered so much ground and his papers throw so much light on the state of scientific opinion when they were written that an edition of collected papers, which it is to be hoped will be one of the ways in which his memory will be commemorated, would supply invaluable material for the history of physics during the past half-century.

Lorentz's services to science were not confined to his own researches; he was an admirable expositor in many languages. Those who heard him give in 1923 the Rede Lecture in Cambridge on Maxwell's electromagnetic theory will remember that without any notes he spoke for an hour in perfect English, never hesitating for a word. In addition to expressing his own ideas clearly, he was remarkably quick at understanding the ideas of other people, and often, though he might not agree with them, put them more clearly than their author. These qualities, combined with unfailing courtesy and kindliness, made him unrivalled as the chairman at a scientific conference. He was, I should think, the most cosmopolitan man of science that ever lived. He travelled widely in many countries, and there can be but few universities either in the Old World or the New in which he had not lectured and inspired and encouraged both teachers and students, and stimulated them to undertake further investigations. Besides his own researches, great as these are, science owes to him many others of which he was directly or indirectly the begetter. J. J. THOMSON.

THE news of Prof. Lorentz's death will be heard with deep regret by many friends in England and Scotland who had come under the influence of his remarkable personal charm, and admired him for his grace, sincerity, and kindliness, no less than for his great scientific achievements.

Lorentz's fame will, I think, ultimately rest chiefly on his electron-theory and all that followed from it. The essential characteristics of this theory were that all electric, magnetic, and optical phenomena were supposed to be due to the presence or motion of individual electric charges, constituting the link between ponderable matter on one hand, and the ether on the other. Matter and ether were supposed not to interact directly, and to be capable of influencing each other only through the mediation of electrons: moreover, the electrons were assumed not to interact directly (as they had been supposed to do in the older electron-theories), and to be capable of influencing each other only through the mediation of the ether. The ether itself was conceived to be at rest everywhere and at all times, whereas in the earlier theories it had been regarded as entangled with the particles of bodies, and carried along with these when they move: Lorentz's ether was, in fact, merely space endowed with certain properties. The general plan of the investigation was to reduce all the complicated cases of electric and magnetic action, *e.g.* the properties of dielectrics, metallic conduction, metallic reflection, the Hall effect, etc., to one simple and fundamental case, in which the field contained only free ether with electrons at rest or moving in it.

The theory was remarkably successful, unifying and simplifying everything, and, in particular, reconciling the electromagnetic equations with Fresnel's law of the propagation of light in moving bodies. But it was, in its original form, incompetent to explain the negative result of the Michelson-Morley experiment: to meet this difficulty, the additional hypothesis of the Fitzgerald contraction was adopted in 1892: and in 1895 Lorentz made another advance on the road to relativity by introducing the idea of 'local time.' Larmor in 1900 extended the analysis so as to include small quantities of the second order, and thereby discovered the connexion of Lorentz's theory of local time with FitzGerald's contraction: and in 1903 Lorentz went further still and obtained the exact transformation which is known by his name and is the basis of the theory of special relativity. The principle of relativity itself was first clearly enunciated in the following year by Lorentz and Poincaré, especially in the latter's address delivered in September 1904 before the International Congress of Arts and Science at St. Louis. To the subsequent development of the subject Lorentz made important contributions, though perhaps none so epoch-making as his great discoveries of the period 1892–1904.

E. T. WHITTAKER.

News and Views.

THE Bill for the Stabilisation of Easter was advanced a stage in the House of Commons on Feb. 17, when, on the motion of Captain Bourne, seconded by Mr. Withers, it was read a second time. Following the suggestion of the League of Nations special committee of inquiry, the proposed date for Easter is the Sunday after the second Saturday in April, the purpose of this provision being (1) to make the festival coincide as nearly as possible with what appears to be the actual date of the event commemorated, and (2) to avoid the clashing of Passion Sunday with the Feast of the Annunciation (as actually happens this year when Easter falls on the second Sunday). Some of the speakers opposing the Bill urged that meteorological conditions are apt to be unfavourable at the period named, but such objections must be completely outweighed by a consideration of the historical grounds on which the proposed date has been chosen and the fact that Easter is a festival for all countries. A point which emerged clearly in the course of the debate is that the promoters of the Bill have no desire to override the ecclesiastical authorities. The Bill itself provides that it shall not come into operation without an order in Council, so as to give an opportunity for arrangement with the Churches, and the Home Secretary, in supporting the Bill, remarked that its promoters were willing to strengthen this safeguard by inserting a further clause under which such an order shall not be made without a resolution by Parliament in its favour. The Bill was actually a response to the desire of the ecclesiastical authorities for assurance that the stabilisation of the festival is demanded, and the Home Secretary said that its acceptance would be regarded as an instruction to set to work on the requisite negotiations. Sir H. Slesser, who had moved the rejection of the Bill, then withdrew his motion.

As regards the meteorological side to the problem of choosing the best period for a fixed Easter in April, statistics show that there is a slight general tendency over Great Britain as a whole for more rain to fall as the month grows older. This is due, no doubt, to the fact that the heating effect of the sun, and consequently the average temperature of the lower layers of the atmosphere during the middle of the day, is increasing rather rapidly, in consequence of which convectional rain of the type of the thunder shower becomes more common. This tendency is, however, too small to be of much practical importance. Some meteorologists believe that a sudden set-back of temperature is particularly liable to take place at certain fixed times in the spring and early summer, but even if this belief can be justified statistically—a matter of some doubt—the regularity of recurrence of these set-backs is not sufficient for the effect to be worth taking into account. That abrupt changes from summer warmth to winter cold do take place in most years at least once between the beginning of April and the end of May, is a matter of common knowledge, but it seems probable that this effect is associated with a marked annual variation in the frequency of occurrence of anticyclones over Greenland. The northerly or north-easterly winds that bring the cold weather normally descend to temperate latitudes along the eastern margins of such anticyclones; the maximum frequency is reached in May, and although a gradual increase takes place in the course of April, which gives the early part of the month some slight advantage, this is more than outweighed later by the greatly increased length of the day, and by the fact that not only does the earth then receive more heat and light from the sun, but also a higher proportion of the ultra-violet radiation, without which no holiday can be regarded as ideal from the point of view of health.

THE Galton Lecture delivered on the anniversary of Sir Francis Galton's birthday is an annual feature of the Eugenics Society. The lecturer this year was Dr. C. J. Bond, of Leicester, who chose as his subject "The Distribution of Natural Capacity in the Population and the Need for a National Stocktaking." Though it cannot be said that Dr. Bond introduced his audience to any new ideas, yet he gave forceful expression to several well-established ones at present