THURSDAY, JANUARY 18, 1894.

HEINRICH HERTZ.

THE last day of 1893 witnessed the tragic death of Prof. Milnes Marshall on Scawfell: on the New Year's Day Prof. Heinrich R. Hertz passed away, and his death will be even more severely felt in many circles and more widely mourned. For some time he had not been in good health. Last winter a severe illness prevented him from discharging his professional duties: for some weeks he was confined to his bed, and fears were entertained that he might not recover. During the summer-semester he got better and was again able to lecture; a casual observer would scarcely have thought that there was anything wrong with him. He was in excellent spirits, and his friends hoped that the vacation would complete his restoration to health and strength. But with the returning winter there came a relapse. A chronic, and painful, disease of the nose spread to the neighbouring Highmore's cavity and gradually led to blood-poisoning. He was conscious to the last, and must have been aware that recovery was hopeless; but he bore his sufferings with the greatest patience and fortitude.

Hertz is best known through his magnificent series of researches on electric waves. He was led, somewhat indirectly, to these by a problem proposed in 1879 by the Berlin Academy of Sciences, viz. to establish experimentally a relation between electromagnetic forces and the dielectric polarisation of insulators. At this time Hertz was assistant in the Berlin Physical Institute, and his attention was directed to the problem by Prof. von Helmholtz. The oscillations of Leyden jars and of open induction-coils first attracted his attention; but he reluctantly came to the conclusion that any decided effect could scarcely be hoped for. Yet he kept the matter in mind; and certain experiments made a few years later—when he had become Professor of Physics at the Karlsruhe Polytechnic—led him to the production and examination of electric oscillations of very short period (about a hundred-millionth of a second). The paper "On very Rapid Electric Oscillations," which was published in 1887, was the first of a splendid series of researches which appeared in *Wiedemann's Annalen* between the years 1887 and 1890, and in which he showed, with ample experimental proof and illustration, that electromagnetic actions are propagated with finite velocity through space. These twelve epoch-making papers were afterwards republished—with an introductory chapter of singular interest and value, and a reprint of some observations on electric discharges made by von Bezold in 1870—under the title *Untersuchungen über die Ausbreitung der elektrischen Kraft.* (An English translation of this book, with a preface by Lord Kelvin, has just been published.)

As early as 1883, Prof. G. F. Fitzgerald read a paper at the Southport meeting of the British Association, "On the Energy Lost by Radiation from Alternating Currents," and at the same meeting pointed out that electromagnetic waves of as little as two metres wave-length, or even less, could be obtained by discharging an accumulator through a small resistance. In a paper on "The Theory of Lightning-Conductors," published in the *Phil. Mag.* in August, 1888, Dr. O. J. Lodge suggested that waves of 20 or 30 c.m. length from a small condenser might be concentrated upon some sensitive detector; that shorter waves still might be obtained by discarding the condenser and simply producing oscillations in a sphere or cylinder by giving it a succession of sparks; and that light-waves in all probability were only smaller editions of these. It was reserved for Hertz to discover, and apply with marvellous ingenuity, the necessary "detector," a resonating circuit with an air-gap, the resistance of which is broken down by well-timed impulses so that visible sparks are produced. It was only after this paper was written that Dr. Lodge read how Hertz had succeeded in detecting electromagnetic waves in free space, in investigating their reflection, and measuring their velocity; and at the end of a postcript to the same paper announcing the news there occurs the sentence: "The whole subject of electrical radiation seems working itself out splendidly." How amply this statement has been substantiated we now know.[1]

When his earlier papers on electric oscillations were written, Hertz was not aware of von Bezold's observations, nor that the subject was engaging the attention of physicists in Great Britain. He readily and gracefully acknowledged the value of the work done by others; and it is equally pleasant to recollect that, when he had attained the goal towards which others were striving, Profs. Oliver Lodge and Fitzgerald were foremost in announcing his success and in preparing the English-speaking world to appreciate the importance of the discoveries which he had made and might yet be expected to make. None, we may be sure, more deeply mourn the death of this brilliant investigator—in his thirty-seventh year—than those who have travelled along the same path, and can fully appreciate the value of his work.

It would perhaps be an exaggeration to say that the news of Hertz's discoveries (with his consequent appointment as successor to Clausius in the chair of Physics at Bonn) reached Germany by way of England. But at the time when these researches were undertaken Maxwell's theory does not appear to have been very widely known in Germany, and it is certain that its importance was not generally recognised. It seems that Hertz himself did not at first appreciate how rich and suggestive it was. But when he showed how worthily he could follow in the footsteps of Faraday and Maxwell, his work received instant and ample recognition in England. In December, 1890, he came over to England to receive the Rumford medal, which was conferred upon him by the Royal Society for his researches on electromagnetic radiation. He was delighted with the warm welcome which he received, and often spoke of it with obvious pleasure.

It might be thought that a world-wide reputation so rapidly attained would produce in a young man some feeling of elation and pride, and in his colleagues somewhat of envy. But Hertz's modesty was proof against the one, and his unvarying courtesy and ready recognition of the merits of his co-workers made the other well-nigh impossible. He was a most lovable man, and was never happier than in giving pleasure to others. He was always ready to show hospitality to scientific men from England and America who came to Bonn. Even under the restraint of a foreign tongue (he spoke and wrote English with considerable fluency) his conversation was charming. When entertaining friends he kept the learned professor well in the background, and his one desire was to make every guest feel at ease and happy. Many of his students will remember with pleasure certain trips to the Siebengeberge, and delightful evenings spent in his house in the Quantius-Strasse.

Absolutely devoid of any desire to pose before the public, Hertz yet showed on occasion that he could ably act as a popular exponent of experimental research. After the publication of his fascinating researches on electric radiation—its rectilinear propagation, reflection, refraction, and polarisation—he was invited to address the *Naturforscherversammlung* (which corresponds to our British Association) at Heidelberg, in 1889. He

[1] It may not be out of place to observe here that Hertz appears to have made a mistake in saying that Poincaré first pointed out the error of calculation in his important paper "On the Finite Velocity of Propagation of Electromagnetic Actions." (English edition, pp. 9, 15, 270.) It seems clear that Lodge (*Phil. Mag.* July, 1889) first drew attention to it.

chose as his subject "The Relations between Light and Electricity." The lecture, afterwards published by Strauss, of Bonn, attracted great attention in Germany, and rapidly passed through half a dozen editions; it deserves to be better known in England. To students of science it will be a pleasure—not unmixed with sadness—to know that shortly before his untimely death he completed the manuscript of a new work on "The Principles of Mechanics." This book is already being prepared for publication, and those who have learned to value the insight and originality of the gifted author will eagerly watch for its appearance. D. E. J.

PROF. DR. RUDOLF WOLF.

IN Prof. Dr. Rudolf Wolf astronomical science loses one of her most devoted servants, and his death will be deplored not only by his countrymen and the observatory which he has directed since its foundation, but by astronomers all over the civilised world.

The services which he has rendered to astronomical science have not been restricted to one branch, although his name is generally spoken of with reference to sunspots.

Born on July 7, 1816, at Fällanden, near Zurich, he attended in his youth the higher schools in the last-mentioned city, where he made the acquaintance of the astronomer Horner, and began his first studies in mathematics and astronomy. He then went to the Vienna University in order to study astronomy under Littrow, and later to Berlin, at which place and time were Encke and Poggendorf. The year 1838 saw him in his home again, and this time his opportunities for astronomical studies were few and far between, as he had little time to spare, owing to his having accepted the post of a teacher in mathematics and physics at the town "Realschule" in Berne. In the year 1844 he commenced lecturing at the university, and in 1852 he obtained his Doctor's degree from the Berne Faculty, the same year becoming a member of that body itself by being appointed an Ausserordentliche Professor. About this time Wolf busied himself with a series of fine pieces of mathematical work, some of which were published singly, and others in various "Fachblättern," and in this year (1852) he published his "Taschenbuch der Mathematik, Physik, Geodäsie und Astronomie," a book which, owing to its clearness of exposition, passed quickly through a series of editions. One of the last pieces of work at which he was employed before he was overtaken by his illness was the sixth edition of this small book. The year 1847 was a very important one in the life of Prof. Rudolf Wolf, for it was at this period that he was appointed to the directorship of the small observatory of Berne. It was there that he began his well-known series of observations on sunspots, which he carried on without intermission to the end of his life, and which in connection with previous observations led to such important results. Owing to his memorable discovery of the relation between sunspots and earth magnetism his name first became better known, and it was more especially on this account that he received his promotion and a professorship of mathematics at the Berne University. In the year 1855 we find him returning as Professor of Astronomy to the newly-founded Swiss Polytechnikum, and at the same time to the university in his "Vaterstadt," where at a later date (1864) he received the appointment as director of the newly-built observatory in which he worked with great zeal to the end of his life.

The chief work which Prof. Wolf set himself to do was to obtain a continuous record of the spots on the solar surface; this led him later to examine older observations, and finally to compare their periods with those obtained from magnetic observations. As an astronomical observer Prof. Wolf was most diligent. Besides busying himself with observations of many different kinds, he made a point of regularly watching the sun's surface. For fifty years, it is said, he did not allow a single day, in which the sun was at all visible, to pass without observing its surface with one of the observatory instruments, or with a small pocket telescope he carried about with him for that purpose. The importance of Prof. Wolf's work will be gathered from the following brief historical sketch.

In 1851 Lamont, the Scotch director of the Munich Observatory, in reviewing the magnetic observations made at Göttingen and Munich from 1835-50, perceived that they gave indications of a period of $10\frac{1}{3}$ years. Sabine, in the following winter, ignorant of Lamont's conclusion, undertook a similar examination with very different data, and found that there was a maximum of violence and frequency about every 10 years; he it was, also, who first noted the coincidence between this result and Schwabe's sunspot period. The memoir containing this remarkable communication was presented to the Royal Society March 18, and read May 6, 1852; but on the 31st July following, Prof. Rudolf Wolf at Berne, and on the 18th August, Alfred Gautier at Sion, both announced similar conclusions, arrived at quite separately and independently. Prof. Wolf's work began then in real earnest, and he corrected Schwabe's decennial period to one a little larger than eleven (11·11), and pointed out the better agreement in the ebb and flow of magnetic change than Lamont's $10\frac{1}{3}$ year cycles. So minute and exact were his inquiries that by 1859 he found that very considerable fluctuations on either side of the mean period, which he had previously deduced, were noticeable; for might not two maxima rise to sixteen and a half years, or sink below seven and a half years? Prof. Wolf pointed out later (1861) that the shortest periods brought the most acute crises, and *vice versâ*; he it was, also, who suggested the idea of a longer sunspot period ($55\frac{1}{2}$ years).

Among other branches of astronomy to which Prof. Wolf turned his attention may be mentioned that of variable stars. It was in 1852 that he pointed out the striking resemblance between sunspot curves (representing frequency) and curves representing the changing luminous intensity of many variable stars. Auroræ, too, received Prof. Wolf's attention, and it was in the same year that, as he was examining Vogel's collection of Zürich chronicles for evidence to connect the weather with sunspots, he was led to associate luminous manifestations with solar disturbances. He also interested himself with regard to the announcement of the discovery of Vulcan, and collected all information of recorded appearances (?) of what were thought to be intra-Mercurian planets.

From his youth up, Prof. Wolf had a great liking for historical study, and was as familiar with the history of his science as he was with the special branch which he made his own. For several years he collected and brought together a great amount of "quellenmaterial," which was published in the form of his "Geschichte der Astronomie." Perhaps his "Handbuch der Astronomie" may be said to be his best work, for there his thorough knowledge of his science and his cleverness had complete scope. The matter in this book is treated with both scientific accuracy and literary ability, and is a wonderful instance of his still youthful capacity for work.

Towards the end of November last the first sign of illness showed itself, and during the first few days of December quickly developed, resulting in his death on December 6, at the age of 77.

Wholly devoted to the science which he loved, and a large contributor to astronomical knowledge, his name will be handed down to posterity. When the principles played with to-day are thoroughly perfected at some future date, and we can produce perfect pictures of all solar phenomena on a single plate, our future astronomers will