

He was elected a Fellow of the Royal Geographical Society in 1913.
He married in 1908 Miss Queenie Moyle of Chichester, whom he had known from childhood.

His death occurred at Ilford on 1922 December 9.

He was elected a Fellow of the Society on 1902 June 13.

Sir W. H. M. CHRISTIE, K.C.B., F.R.S.—Early in the year the Society lost by the death of Sir William Christie one of its oldest Fellows, for he was at the time the ninth in the list in order of date of election. His unobtrusive manner and personality and the fact that he had taken little active part in the affairs of the Society during the last ten years of his life caused him to be unfamiliar to the general body of present Fellows; but it may be said with truth that during the last fifty years no person has had more influence directly or indirectly on British astronomy. For forty years he was an official astronomer, and for twenty-nine of them the titular head of astronomy in England.

William Henry Mahoney Christie was the third son and the eldest child of the second marriage of Samuel Hunter Christie, F.R.S., Professor of Mathematics in the Royal Military Academy at Woolwich from 1838 to 1854, the author of many papers on magnetism, for whom the invention of the method of the bridge in electrical measurements is claimed. The second son of Samuel Christie, James Robert, who was also F.R.S. and on the staff of the Royal Military Academy as First Mathematical Master, was a Fellow of our Society and the author of a book on Practical Astronomy and other works.* The family was originally Scotch, the father of S. H. Christie having come to London in the eighteenth century. The subject of this memoir, whose mother was of an Irish family, whence came his third name, was born on 1845 October 1, and was educated at King's College School, London, and Trinity College, Cambridge, going up to the University in 1864. He was elected a Foundation Scholar of the College at Easter 1866, and achieved the position of fourth wrangler in the Mathematical Tripos of 1868, when the first three places were filled by Fletcher Moulton, G. H. Darwin, and Charles Smith, afterwards Master of Sidney Sussex College.

Christie sat for the Sheepshanks Exhibition in 1866, but was not successful, the exhibition being awarded in that year to Charles Niven, afterwards Professor of Natural Philosophy in the University of Aberdeen. Airy was one of the three examiners, and on the paper that he set, which was entirely on practical astronomy, Christie was undoubtedly first—showing an intimate knowledge of the adjustment and use of instruments, especially with Greenwich methods. Airy says in his Report: † “Christie is methodical, clear, and practical,” which were qualities that he retained throughout life. Another of the examiners wrote: “Christie is very clear and sensible in what he knows and a very satisfactory examinee.” But he failed in the paper set by Professor Cayley, which was wholly on Planetary and Lunar theory,

* See *Monthly Notices*, 40, 188.

† These Reports are preserved in the Record Room at Greenwich, and have been inspected by permission of the Astronomer Royal.—H.P.H.

and after careful consideration the examiners decided in favour of Niven, because he was "the man of most knowledge."

After taking his degree Christie remained at Cambridge, occupied in teaching, and was elected a Fellow of his College in 1869 October. In 1870 June Mr. E. J. Stone, Chief Assistant at the Royal Observatory, Greenwich, was appointed to the position of H.M. Astronomer at the Cape of Good Hope, and left Greenwich in the following August. Airy selected Christie as Stone's successor, possibly because of his quality as shown in the Sheepshanks examination, and perhaps on account of his presumed hereditary talent. Christie joined the Staff of the Observatory in the autumn of that year, and quickly took up a position in the astronomical world. He joined our Society in 1871 January, was elected a Member of Council in 1872 February, and sat at the Council table in various capacities for forty years from that date, except in the year 1879-1880, when he stood off at his own wish. There is reason for thinking that Airy hoped Christie would take up the lunar theory as his special research, as it was Airy's at that time, but after making some study of Delaunay's papers and results, Christie abandoned the motion of the Moon as a line of work, and his early papers show that he was more interested in colour, spectroscopy, and optics generally. The first of these papers was, however, more of a mechanical nature, for it describes the now seemingly obvious paper-covered drum used until this day on the Greenwich Transit-Circle for recording the observation of declination of stars, invented by Christie in the year 1873. In that year a very important innovation in the work of the Royal Observatory was brought about by his influence, this being the addition of the systematic photography of the Solar surface, and the spectroscopic observation of the Sun and stars. The latter has not survived, but the recording of the positions of sunspots is one of the routine researches of the present day at Greenwich. Christie as Chief Assistant took occasional turns with the Transit-Circle and Altazimuth, the two principal instruments of the Observatory at that period, but examination of the papers communicated to the Society, indexed under the heading Royal Observatory, Greenwich, will show his special interest in the spectroscope, and in the latter half of the year 1877 a half-prism spectroscope, made on a new principle evolved by him, was brought into use. The instrument is described in the *Proceedings of the Royal Society*, No. 179, 1877, but briefly it may be said that the train is made up of half-prisms, each being the half of an isosceles prism cut in two by a plane perpendicular to the base, and gives an unusually large dispersion. The design has not been followed elsewhere, but the fact that it was constructed and brought into use is sufficient to show Christie's optical ingenuity and capability. The entries in the index to the *Monthly Notices* under his own name at this period are for the most part similarly of an optical nature. "On the Colour and Brightness of Stars as measured with a New Photometer" (1874 Jan.), is a paper which describes an instrument made for him by Browning, and includes a series of observations made with it. "On a New Form of Solar Eyepiece" (1876 January), relates to another instrument made to his design, whilst two papers on the appearance of Venus (1876 December and 1878 January) are contribu-

tions to a discussion then proceeding as to whether the solar light is reflected from Venus specularly; that is, as from a looking-glass, or whether it is scattered; and are based on actual observations of the planet made with polarising eyepiece and dark wedge. But though these were his favourite mental activities in these early years, it is not to be forgotten that he kept himself well in touch with the staple work of the Royal Observatory, as is shown by his discussion of the "Systematic Errors of the Greenwich North Polar Distances," to be found in vol. xlv of the *Memoirs*. He was during these ten years the trusted helper of Sir George Airy, conducting the routine of the Observatory with precision and skill, and held a place in our Society, which was then passing through a troublous period of internal faction, respected by all for his official position, his personal dignity, and his courtesy of manner. Not the least of his efforts outside his official work at this time was the establishment of the *Observatory Magazine*, which, with the encouragement of several friends, he initiated in the year 1877, and which has continued practically in the form that he devised under many successive Editors until the present time. Christie was sole Editor until 1881 October when, fearing lest this would interfere with his duties as Astronomer Royal, he offered the editorship to Mr. E. W. Maunder, and the two names appeared on the cover as joint Editors until the end of the year 1882, when Mr. Christie's connection with the *Magazine* ceased.

The retirement of Sir George Airy in 1881 August, and the consequent necessity for appointing a successor created considerable interest not only in astronomical circles but also among the larger public that keeps itself lightly in touch with scientific occurrences generally. The appointment of a new Astronomer Royal had not taken place for forty-six years, the name of Airy was fairly well known as that of a very learned man, and the circumstances of the science of astronomy had much changed, which all led to much speculation as to the next occupant of the exalted position. Many names were suggested, but a promotion from the staff apparently did not occur to people as a probable course, though it was obviously a suitable one, and the choice of the Crown—it is well known that Airy, Dr. Huggins, and Mr. Spottiswoode, then President of the Royal Society, were among the advisers—fell on Mr. Christie, who was unfeignedly surprised when he heard of his advancement. It was not an easy task to follow Airy in the superintendence of the Royal Observatory, for there was much that required alteration. Though the institution was rated as a shore department of the Admiralty, Airy took pride in keeping it distinct and different in its methods from the ordinary offices of the Civil Service. It was his pleasure to effect economies in small details and to rely on his own designs and ideas rather than to adopt the instruments and procedure of business establishments, the result being that in the year 1881 the visitor to Greenwich Observatory found himself in surroundings half a century out of date. It was a surprise to find that the excellent work on sun-spots and on earth magnetism emanated from wooden sheds, forty years old, and that the electrical batteries on which the transmission of the Greenwich time signal depended were in the

hands of a small tradesman of the town. It was such things as these that Christie was called upon to remedy, and he did it steadily and carefully. The deal desks at which the computers worked were replaced by mahogany, and the officers and workmen of the General Post Office were called upon to put on a satisfactory footing and take over the telegraph wires and electrical apparatus internal and external. The first purely astronomical improvement Christie made related to the collimators of the Transit-Circle, which formerly rested on solid brick piers north and south of the instrument, and blocked out the view, so that observation of stars by reflexion at a greater distance than 40° from the zenith was prevented. Early in the year 1882 the piers were cut away and the collimators mounted as they are now, on upright arms turning on centres below, allowing them to be swung on one side when not in use, to extend the range of that class of observation. The extension and elaborations of the sun-spot record next came under Christie's consideration. At the beginning of this work in 1873 the photographs on which it depended showed an image of the sun 4 inches in diameter, but means were now adopted to double that size; a micrometer was designed and made for the measurement of these larger plates, and the co-operation of other observatories was sought to make the daily record complete. The valuable Greenwich record of positions of sun-spots and faculæ that has now been carried on with such completeness for nearly fifty years, projected and designed as to its details by Christie, is not the least of the items that stand to his credit.

It is needless to follow in detail the many alterations in procedure, the many improvements in structure and furnishing of the Royal Observatory that happened in the early years of his tenure of office as Astronomer Royal, though it may be well to record the short existence of a low building covered by the dome now surmounting the south observatory, in which the Lassell telescope was housed. Christie, on behalf of the Admiralty, accepted this telescope, being the one with which Hyperion was discovered in 1848, as a gift when it was offered by the Misses Lassell in 1883, thinking that a reflector of 2 feet aperture would be well suited for observation of faint satellites and comets beyond the power of the instrumental means then available. The instrument was set up in this building made for it in the south ground and much energy was spent in its installation. But in the end it was found unsuitable for any work involving measurement because of the instability of the mounting, and its use was finally abandoned. The necessity for a large telescope, however, remained present in Christie's mind and led to the procuring of a refracting telescope of 28-inch aperture to replace the Merz $12\frac{3}{4}$ -inch, that had been set up in the south-east tower of the Observatory about 1859. The planning of this objective was much to Christie's taste, for, as has been said, he had much optical talent. He consulted and had much correspondence with Sir George Stokes on the subject, and together they designed an objective of two lenses which, though normally suitable for visual observation, could by separation and reversal of one lens be made suitable for photography. The ingenuity shown in the design of the dome which covers this instrument calls for comment. The new telescope with object-glass of 28 feet focal

length is in the same building and on the mounting which formerly carried the smaller telescope, and it was necessary that the character of the dome should be enlarged, which was effected by giving it the shape of an involute of a circle, and the result to the eye is not inartistic. The construction of this object-glass, which was eventually made by the firm of Grubb from discs supplied by Messrs. Chance and mounted in 1893 July, was first mentioned in the Astronomer Royal's Report for 1886. In the same Report there is a foreshadowing of the addition of photography, other than solar, to the work of the Royal Observatory, for the suggestion is made that the Merz refractor might be adapted to photography by the addition of a correcting lens, but the suggestion was never realised; the needs of photography being otherwise provided for as will be shown later.

In the Report for the next year, 1887, the plans for the first enlargement and extension of the buildings of the Observatory, which formed such a prominent feature of Christie's control, were set out. The Admiralty had sanctioned and made provision in the estimates for a considerable alteration and extension of the rooms used as computing rooms, lower and upper, built by Bradley, which would take in his old quadrant pier, and on this would be placed the 6-inch Cooke refractor, for occasional observations and to carry the photoheliograph. The advantage of thus concentrating the work of the Observatory in the old building was pointed out, from which it appears that Christie at that time did not contemplate the splendid building, which is the main observatory to-day, in the south grounds. This came later, and was built piecemeal in the years 1891 to 1899, section being added to section as money was supplied for the purpose by the Treasury in response to the Astronomer Royal's tactful demands. It is curious to think that this grew out of an original scheme for a storehouse or museum to house various portable instruments that was to be attached to the Lassell building, mentioned in the Report for 1889. The scheme for placing the Cooke Equatorial on the upward extension of the quadrant pier, proposed in 1887, was also modified when the Astrographic Chart was initiated, and the telescope to be used for that work at Greenwich was set up in that place. In 1894 Sir Henry Thompson made his noble gift of £5000 to the Observatory to provide a photographic telescope, and the acceptance of this offer gave a reason for the destruction of the Lassell building erected in 1884 and the re-erection of the dome on the central tower of the new building—the Physical Observatory, as it was then called. The building of this went on steadily but slowly, and at the same time extensions, projected by Christie, were going on in other directions. The construction of a new Altazimuth or Universal Transit-Circle was proposed in 1892, the observations with which would be treated in an ingenious manner according to formulæ to be found in a paper by Christie in the *Monthly Notices* of May of that year (1892). This instrument was made by Messrs. Troughton & Simms, and the building to house it erected in 1894 and 1895. In the years immediately following this the Observatory domain was increased by the addition of an enclosure in the park on the east side of the Observatory, at a distance of between 300 and 400 yards, as the site for a Magnetic

Pavilion to contain the instruments used for determination of absolute values of the magnetic elements. This was completed and the instruments installed in 1898 September. It will be readily understood that this decade was a busy period in Christie's life. The consideration of details of these instruments and consultation with Government departments as to the new buildings, left little time for individual astronomical work. In one Report he complains that he could never find leisure to complete the optical calculations for a photographic corrector to be applied to large visual instruments, such as has been already mentioned, as he would like to have done. His time was largely occupied in drafting long letters, many of which were written in his own hand, to the instrument makers and to the Admiralty and Treasury. Simultaneously the normal work of the Observatory was going on. The observations with the Transit-Circle were increasing; the chronometer work was expanding, and the Astrographic Chart and Catalogue were proceeding, and though these things were largely in the hands of his Chief Assistant and Assistants, he exercised meticulous supervision over all, even to such small details as to the position of shelves to carry chronometers or the making of cupboards to hold photographs.

Besides, and perhaps beyond the material changes in building and equipment that Christie wrought, the changes in the staff and the manner of their selection must be mentioned, though the subject must be touched on lightly. In the early history of Greenwich Observatory the Assistants of the Astronomer Royal were undoubtedly men drawn to the work by natural inclination, content with small reward, and if one may judge from Maskelyne's treatment of the luckless Kinnebrook wholly at the mercy of their chief, who might discharge them for such a venial offence as a difference of personal equation. Their selection lay wholly with the Astronomer Royal until in the year 1872 the appointment of Assistants passed into the hands of the Civil Service Commissioners, who made selection in the usual way by examination, the salary offered and the examination being of such type as might attract men with university degrees of minor merit—but the conditions did not attract largely. On several occasions when appointments were offered it was difficult to secure candidates, and experience showed that the work at Greenwich, being largely of a mechanical nature, was efficiently done by those who had been apprenticed to the "trade," so that Christie reverted more or less to an earlier method of forming the staff, and temporary computers passed into a class of established computers, which has now become Assistants. A change was made also in connection with the higher office of Chief Assistant. Airy had from the beginning an Adjutant. First, the Rev. Robert Main, then Mr. E. J. Stone, and afterwards, as we have seen, Mr. Christie; gentlemen whom he chose for their mathematical attainments, nominally that they might help him if need be in his researches, or in any detail of the Observatory work in which such talent was required, but who actually helped him by taking responsible charge of the routine work of the establishment. Christie when holding the office had influenced Airy to establish a "Physical Department" represented by the sun-spot work, and with this the study of Earth-magnetism might fittingly be associated. Since the work of

the Observatory was then developing along two diverging lines it appeared to him that the office of Chief Assistant should be duplicated, and that there should be an officer of this class for each branch. The attitude of resistance of the staff to this, or rather to the method of appointment of the Chief Assistant, which is wholly in the hands of the Astronomer Royal, has been hinted at in another place (*Observatory*, 45, 78), where it is contended that by selecting these officers from outside the staff, the science of astronomy is enriched by talent and genius which would otherwise find its way elsewhere, and the argument has much weight and is supported by experience. Christie carried his point in spite of some internal opposition in addition to the normal objection to increase of staff and expenditure from the controlling offices of the Admiralty and Treasury. Much of his time was spent on official interviews and correspondence on these matters, which, looking back from the present-day point of view, was certainly not wasted effort, noting the effect it has had on astronomy, though it brought him no personal reputation as an astronomer.

Though many items may be omitted in this brief sketch of the activities of Sir William Christie in these twenty-nine years, the part that he took in the establishment of Greenwich as the prime meridian of the World, and in the matter of the reform of the time-system generally should not be forgotten. He was the representative of Great Britain at the meeting of the International Geodetic Association at Rome in 1883 when Mr. Sandford Fleming's proposal for the introduction of a universal day based on the Greenwich meridian was discussed. He was not one of the representatives at the conference at Washington in the following year, where it was resolved to recommend the adoption of the meridian of Greenwich as the zero of longitude, and the Greenwich civil day, beginning at Greenwich midnight and reckoned from 0 to 24 hours, as the standard of time-reckoning, but he had given his support freely and whole-heartedly to these proposals and there is little doubt but that this had much effect. At his instigation the Board of Visitors in 1885 recommended almost unanimously that the day in the British Nautical Almanac should be arranged for the year 1891 to begin at Greenwich midnight so as to agree with civil reckoning. As we know this recommendation is not being carried out until nearly forty years after it was proposed, but Christie took the responsibility of making this unification of the day in certain departments of the observatory work at the beginning of 1885, and on January 1 of that year the hour hand of the public clock at the Observatory gate was put forward by twelve hours.

His co-operation was often sought for the determination of differences of longitude from Greenwich, and for this purpose a Transit Pavilion was built in 1891 in the front court on Bradley's meridian, which was used occasionally by members of his staff and by visiting astronomers and geodesists. The arc Greenwich-Paris was measured three times under his direction (the first time was before the erection of this building), the longitude of Montreal was determined in 1892 in co-operation with Professor McLeod of the M'Gill University, the Astronomer Royal consenting to take part in the work on condition that the longitude of

Waterville near Valentia in Ireland was determined, since this was near the western end of the European longitude arc on the parallel of 52° N. This was followed a few years later by determination of the longitude of Killorglin, whereby the fixation of the astronomical position of this western end for which Greenwich had taken the responsibility some forty years earlier was satisfactorily completed. Christie took no personal share in these observations, but merely organised. He was a good and careful observer judging by his work when he was chief assistant, but after he became Astronomer Royal he observed no more except on one special occasion of a solar eclipse in 1882 May, which was seen in partial phase from Greenwich, and on the later occasions when he went with members of his staff on eclipse expeditions: to Japan in 1896, when the sky was completely overcast during totality; to Sahdol in India in 1898; to Ovar in Portugal in 1900; and to Sfax in Tunisia in 1905. "He observes too much," he was once heard to say in half cynical comment on the methods of one who like himself was the chief of an important national observatory, which apparently expressed his views on the duty of an Astronomer Royal in this respect.

To close with some personal details, Christie married, in 1881, Violette Mary, daughter of Sir Alfred Hickman, Bart., a well-known ironmaster in the Midlands, and sometime member for Wolverhampton in the House of Commons. Mrs. Christie died in 1888, leaving two sons, the younger of whom died in early childhood, the elder, Capt. H. A. H. Christie (Yeomanry), Barrister-at-law, is a Fellow of our Society. He received the distinction of Companion of the Bath on the occasion of Queen Victoria's Diamond Jubilee in 1897 and Knighthood followed on 1904 November 9. The degree of Doctor of Science was conferred on him by Oxford University on 1902 June 24, and he was the recipient of honours from many foreign learned Societies. He was elected to Fellowship of the Royal Society in 1881, and served on the Council and as a Vice-President for various periods. He gave up his position as Astronomer Royal on his sixty-fifth birthday, 1910 October 1, and retired to a country home, first at Warlingham, and afterwards at Downe in Kent, keeping himself in touch, however, with the progress of astronomy. Yachting had been a recreation with him, and in the later years of his life in the winter months he made a voyage to some place of congenial climate. In February 1921 he visited Professor W. H. Pickering at Mandeville, Jamaica, and there had the opportunity of making some remarkable observations of the Moon that he communicated to the Society in April of that year. He seemed to be in his usual health—remembering his advanced age—on the day of the Meeting of the Society in January last, and spoke of a projected voyage to Morocco, for which he started on the following Friday, January 20. The manner of the end will be learned from the following extracts from the log of the P. and O. Steamship *Morea* :—

"January 22, 1922, 4^h 30^m p.m. Surgeon reported death of Sir William Christie, 1st saloon passenger. Cause of death, Gastric Hæmorrhage.

"January 23, 1922, 11^h 45^m, Slow. 11^h 46^m, Stopped, and committed

to the deep the body of the late Sir William Christie. $11^h 49^m$, Full ahead. Lat. $40^\circ 3' 5''$ N. Long. $9^\circ 20'$ W."

He was elected a Fellow of the Society on 1871 January 13. He was Secretary from 1880 February until 1882 February, President 1888–1890.

An engraved portrait from a painting by Jacomb Hood hangs in the Meeting Room.

H. P. H.

EDMOND HERBERT GROVE-HILLS, Colonel R.E., who died on October 2 at his residence, 1 Campden Hill, London, W., was born 1864 August 1. His father, Herbert A. Hills of High-Head Castle, Cumberland, had been Judge of the Court of Appeal in Egypt, and his mother was a daughter of Sir William Grove. Edmond Hills was educated at Winchester and at the Royal Military Academy, whence he passed out as senior cadet of his term in 1884 with a commission in the Royal Engineers. For the next two years he was at the School of Military Engineering at Chatham, and he went to Gibraltar in 1887, obtaining his Captaincy in 1893. Amid other scientific pursuits of his corps he became expert in photography; and his photographs of the solar spectrum at the eclipse of 1893 attracted attention. He had gone with Sir Ed. Thorpe to Fundium, in Senegal, W. Africa, to observe the eclipse of the sun of April 16 in that year, and taking two slit-spectroscopes he obtained successful photographs of the spectrum of the prominence and corona, the former showing the hydrogen lines up to H_ϵ . In the following year, 1894, he communicated, in the *Memoirs* of the Society, an account of a method for obtaining longitudes in survey work from photographs of the moon. His interests in solar physics developed, and he went to Japan for the eclipse in 1896, but cloudy weather prevented observation. In India in 1898 he was more fortunate, and obtained excellent photographs of the "flash" spectrum demonstrating that the chromospheric spectrum was not an exact bright reversal of the ordinary Fraunhofer spectrum. For many years he was secretary of the Joint Permanent Eclipse Committee. His spectroscopic equipment was lent by him to observers of subsequent eclipses, and was afterwards presented to the Cambridge University Observatory.

In 1896 Hills was appointed Instructor in Chemistry and Photography at the School of Military Engineering at Chatham, and held the post until 1899, when he took charge of the Geographical Section of the General Staff at the War Office, continuing the work throughout the Boer War. Under his influence the staff of the Geographical Section of the Intelligence Department of the War Office was enlarged.

His other main scientific interest was the science of geodesy, both in theory and in the field. He organised and improved several State surveys; in time he became associated with Sir David Gill in his promotion of the triangulation of South Africa and in the scheme of a Cape to Cairo meridian measurement. He reported officially on the Canadian surveys; and devoted a Presidential Address to the section of Geography at the British Association in 1908 to a discussion of correlation of the surveys of the Empire. Arising from local connec-