

displaced by pressure. He worked with W. G. Duffield on the spectrum emitted by silver in a carbon-tube furnace (*Ap. J.*, 28, 371). In 1910 he was elected to a Research Fellowship at Manchester; and continuing the work which Duffield had so successfully inaugurated, he studied the effect of pressure on the arc spectra of titanium (*Proc. R.S.*, 83, 414) and of vanadium (*Ap. J.*, 34, 21), and also on the widening of the hydrogen lines (*Ap. J.*, 34, 299). In 1912 he went to Cambridge, and carried out further researches in the astrophysical department of the observatory. He had there studied the widening of the hydrogen lines under different conditions of electrical excitation in the spark spectrum (*Ap. J.*, 34, 299), and had begun work on the displacement of lines in the sun's spectrum. He joined the expedition to the Crimea to observe the total eclipse of the sun in 1914 August. On his return to his native land he got a commission in the Engineers, and was soon afterwards, in 1915, attached to the Italian Navy in scientific work, to which he devoted himself at Venice until the end of the war. A life of great promise was cut short by his death on 1919 March 17.

He was elected a Fellow of the Society on 1913 January 10.

H. F. N.

FATHER WALTER SIDGREAVES, S.J., died at Stonyhurst College on 1919 June 12, after a lingering illness borne with exemplary patience, at the ripe age of 82 years. He was born 1837 October 4, the second son of Edward Sidgreaves, of Grimsargh, near Preston, Lancashire. He came to Stonyhurst as a boy in 1848, and, after completing his school course, joined the Society of Jesus on 1855 September 7. He returned to Stonyhurst in 1857, to the seminary attached to the College, and remained there until 1861, when he had completed his literary and philosophical studies. He then taught for seven years at the College: in 1862-65, chemistry and mathematics; and in 1866-68, mathematics.

In the period 1863-68 he acted as director of the observatory while Father Perry was engaged in his theological studies. Father Perry had succeeded Father Weld in the direction of the establishment in 1860. The observatory, which was founded in 1838, was primarily intended as a meteorological station, and the readings of the usual instruments have been continuously recorded since that date. The year 1866 marked an interesting period in the development of the Meteorological Office, for in that year its functions were transferred from the Board of Trade to a Committee of the Royal Society. This was followed by the establishment of seven observatories of recording instruments of uniform pattern to provide material for the scientific study of the weather. Stonyhurst was chosen as one of the seven stations, and Father Sidgreaves installed the photographic barograph and thermograph, the anemometer and the rain gauge. The experiment terminated in 1884, when the weather service was reorganised on a different system.

In the year 1858 Sir Edward Sabine, who was then making

a magnetic survey of England, chose Stonyhurst as one of his observing stations. The next year Father Weld, who had purchased a set of instruments for the observation of the absolute values of the magnetic elements, commenced these records at Stonyhurst. But it was Father Sidgreaves who in 1863 inaugurated the regular series of monthly determinations of the magnetic elements, which have been continued uninterruptedly since that date. For the last twenty years also he had taken most of the observations himself. His very last observation, made when he could scarcely walk to the observatory, was of the magnetic dip on 1919 May 3. His pluck was indomitable.

In 1866, still during his first directorship of the observatory, he installed and adjusted in a specially constructed subterranean chamber the set of self-recording photographic magnetographs, generously presented to the observatory by the Royal Society. In connection with his interest in terrestrial magnetism he accompanied Father Perry, and with him made a magnetic survey of the west and east of France, during his long vacations, when he was studying theology, in the years 1868-69.

One of the most important papers which he published (*Mem., R.A.S.*, 54, 85) was "On the Connection between Sun-spots and Earth-magnetic Storms." It contains a discussion, based on a very great number of measures of the areas of sun-spots from the long series of drawings accumulated at Stonyhurst, and of the ranges in the magnetic elements from the photographic records, as to the precise nature of the connection between sun-spot area and terrestrial magnetic disturbance. The study covers the period 1881-1898. The conclusion he arrived at was that the connection was not one of direct cause and effect. He further suggested that both the spots on the sun and the magnetic storms on earth were due to clouds of electrified particles which existed between the sun and the earth.

As with meteorology and with terrestrial magnetism, so too with astronomy the main equipment of the observatory is due to Father Sidgreaves. In 1867 the 4-inch refractor, which was the first instrument systematically used by Father Secchi when he resided at Stonyhurst during the revolutionary troubles in Italy in 1848, was replaced by an 8-inch refractor. This again, during Father Sidgreaves' second directorship of the observatory, 1890-1919, was furnished with a 15-inch object-glass as a memorial to Father Perry, subscribed for by his friends.

After the completion of his theological studies and his ordination as priest in 1871, Father Sidgreaves returned to Stonyhurst in 1873, when he acted as assistant to Father Perry, and accompanied him on the British Government expedition to observe the transit of Venus at Kerguelen Island on 1874 December 9. The astronomers were conveyed from the Cape of Good Hope to the desolate island which was to be their abode from 1874 October 8 to 1875 February 27 in H.M.S. *Volage*, which was propelled by steam helped by sails. They experienced a succession of heavy

gales, the seas on several occasions coming clear over the bulwarks and submerging the guns. Father Perry used to declare that Father Sidgreaves, who worked in snow and sleet and violent winds, was magnificent. He set up all the instruments, took most of the magnetic observations, and contributed greatly to the success of the expedition. He again accompanied Father Perry, in the year 1882, to observe the second transit of Venus at Nos Vey, Madagascar, the astronomers being assisted on this occasion by the officers and crew of H.M.S. *Fawn*.

On the death of Father Perry, on board H.M.S. *Comus* during the total solar eclipse expedition to Cayenne of 1889 December, Father Sidgreaves resumed the charge of the Stonyhurst Observatory. At that time he was superior of the scholasticate, 1881 to 1893, at St. Mary's Hall, Stonyhurst, a kind and gentle superior beloved by all his subjects. To this office, from the year 1883, he joined that of professor of experimental physics, which he taught for twenty-two years. As a professor he was remarkably up to date, by no means antiquated or stereotyped. Every new discovery was illustrated in his lectures, which were intended to make the future priests conversant with the trend of the scientific thought of the day. His manipulative skill in performing experiments was remarkable. By nature his mind was sceptical, and it took a great deal of unimpeachable observational data to convince him.

Father Sidgreaves' original researches in astronomy are contained in many papers published in scientific periodicals, but more especially in the *Monthly Notices* of the R.A.S. In solar physics, one of the chief studies he made was of a long series of photographs of the violet rays of calcium in the sun's spectrum. For this purpose he took hundreds of photographs of the H and K region of the spectrum in the general light of the sun with the fine Hilger spectrograph which had been acquired by Father Perry. The result was to prove that the sun is akin to that class of stars which show both bright and dark lines in their spectra, and is itself spectroscopically a variable star. Contrary to the usually accepted theory he held also, from a study of the series of Stonyhurst drawings, that the umbræ of sun-spots are elevations and not depressions below the sun's luminous envelope or surface.

But he will be chiefly remembered for his researches on the spectra of stars. Working with instruments of greatly inferior power to those possessed by many observatories, spectrographs which he had designed himself, he obtained a long series of very beautiful spectra. He was a most painstaking, methodical, and accurate observer. This photographic work was awarded a gold medal at the St. Louis Exposition of 1904, and a grand-prix in the Franco-British Exhibition of 1908.

His memoir on the "Spectrum of Nova Aurigæ," 1892 (*Memoirs, R.A.S.*, 51, 29), contains a long list of bright and dark lines measured in the spectrum of the star, and is a very valuable contribution to our knowledge of the constitution of new stars.

Nova Aurigæ was the first new star the spectrum of which was photographed, and Father Sidgreaves was one of the first observers to obtain such photographs. He recognised the similarity between the spectrum of the star and that of the solar chromosphere. He was equally successful with his photographs of the new star in Perseus, 1901, and more particularly demonstrated the change in the spectrum which sympathetically accompanied its alternations in luminosity when it had attained a magnitude about 4.57.

Among other stars of which he published spectroscopic studies were β Lyræ, α Ceti, and γ Cassiopeiæ. These papers are illustrated by some beautiful reproductions from his original photographs, in particular the plate which shows the connecting star links between Secchi's Type II. and Type III., and by valuable detailed descriptions, accompanied by tables of wave-lengths of the particular stars studied. He has left hundreds of plates of the spectra of the brighter stars, which await measurement and discussion. In the case of β Lyræ he broached an ingenious theory on the cause of the variability in its light which he expounded in a lecture delivered before the Royal Institution in 1904. (*Proc. R.I.*, 1904.)

The character of Father Sidgreaves exhibited many of the traits of the typical Lancashire man. He was very tenacious of purpose, and very orderly and methodical in his work. In advancing years he became very deaf, and he made his deafness an excuse for shunning public appearances, which were naturally distasteful to him. He was happiest when he was working in his observatory, and in this work he was indefatigable. For the last nine years he had practically given up astronomical work with the exception of the time service, but terrestrial magnetic work he kept in his own hands until the very end. When we remember that, during his directorship of the observatory, he joined with his astronomical work the office of Superior of a large community and a professorship of physics, it is certainly remarkable that he was able to accomplish so much, although he possessed a very strong and hardy constitution.

He was one of the most kindly and gentle of men, most charitable in his judgments of others, and most courteous and urbane to all with whom he came in contact. He was revered by his own brethren in religious life as a model of exactness. "A good old man. His memory will remain treasured by all of us who knew him," writes the Astronomer Royal, and this verdict may well serve as his epitaph. He lies buried at Stonyhurst, with which college by far the greater part of his long life had been identified, as boy and man, and which he loved and served so faithfully.

He served for several years on the Council. He also acted for a term of years as President of the North-Western Branch of the British Astronomical Association at Manchester, and for two years as the director of its solar spectroscopic section.

He was elected a Fellow of the Society on 1891 January 9.

A. L. C.

CHARLES STEVENS was born at Dalston in 1852, and died at Ipswich on 1918 December 1.

In 1900 he entered the General Post Office, Secretary's branch, where he held an appointment for many years.

In 1906 he left London to take up duties as postmaster at Peterborough, where he remained three years, before going on to Ipswich. He retired in 1914.

He was twice married, and had two daughters and one son, who at present holds an appointment in the Indian Civil Service.

Apart from his official duties, he was most interested in music and astronomy.

He was elected a Fellow of the Society on 1899 February 10.

CHARLES THOMAS WHITMELL was born at Leeds on 1849 July 10, his father holding an appointment in the Leeds branch of the Bank of England. He attended the Leeds Grammar School, where he won a prize for Inorganic Chemistry in 1864. He received a letter of encouragement from Faraday about that time which he carefully preserved. At the age of nineteen he gained the degree of B.Sc. at London University. A year later he went to Cambridge, having obtained a Scholarship in Natural Science at Trinity College, Cambridge. In 1872 he was tenth Senior Optime in the Mathematical Tripos and first in the First Class in the Natural Science Tripos. He remained for some years taking pupils and giving University Extension Lectures. For two years he was a master at Tonbridge School. In 1879 he commenced the principal professional work of his life, being appointed Inspector of Schools under the Board of Education; his field of work was at Sheffield for a short time, then at Cardiff, where he remained till 1897; he was then transferred to his birthplace, Leeds, and remained here for the rest of his life, retiring, however, from his professional work in 1910. He was held in the highest respect and esteem by all the teachers of the schools which he visited for his courtesy, considerateness, and charm of manner.

His love for nature and science remained throughout his life. He found opportunities for travel in the Alps, Norway, United States, etc. Many notes made on these occasions were incorporated in his useful handbook on colour, published in 1888. Phenomena of colour greatly interested him, and he wrote several notes in explanation of the green flash at sunset, the white appearance of the moon in daylight, etc. He had in his house a variety of apparatus for producing curious colour effects. In astronomy also his bent lay in the direction of calculating unusual or unexpected phenomena. The transit of the half-lit moon over the half-lit earth as seen from Mars may be mentioned, also the fact that some of Jupiter's satellites can produce three total eclipses at the same conjunction to a point on the planet's surface. His series of "View Point" papers brought out many relations of this kind, and are very instructive.