OBITUARY

W. M. H. Greaves

With the untimely death of Professor W. M. H. Greaves, F.R.S., at his home in Edinburgh on 1955 December 24, British astronomy has suffered a severe and unexpected blow. Foremost in Great Britain and indeed in the world as a pioneer in stellar spectrophotometry, Greaves was also an indefatigable worker for astronomy as a whole.

He was born in Barbados on 1897 September 10 and received his early education there, coming to Cambridge (St John's) in 1916 to read mathematics. Classed as a Wrangler in Part II of the Mathematical Tripos in 1919, he was awarded the Smith's Prize and the Tyson Medal in Astronomy. During his tenure of the Isaac Newton Studentship (1921-23) he spent some time at the Royal Observatory, Greenwich, as a voluntary worker. This was, whether he recognized it at the time or not, to determine his future career: for when Spencer Jones relinquished his Chief Assistantship at Greenwich to take up the post of H.M. Astronomer at the Cape, the then Astronomer Royal (Dyson) offered the vacancy to Greaves. Taking up the post in 1924, he remained at Greenwich for fourteen years, an uncommonly long term for a Chief Assistant; and not unnaturally he struck deeper roots than most of the distinguished band of young astronomers who have held that position. He relinquished it only in 1938 to become Astronomer Royal for Scotland and Professor of Astronomy in the University of Edinburgh, which joint post he held until his sudden death last Christmas Eve.

When Greaves came to Greenwich the spectrum of a star was chiefly of interest because of the lines it exhibited. Careful study of these was capable of yielding valuable information concerning the chemical composition and physical constitution of its outer layers, as well as such properties as its excitation temperature, its luminosity (whence its distance) and its radial velocity. The continuous spectrum, on the other hand, was regarded as little more than the background necessary for the formation of the absorption lines. In so far as it was studied, this had been largely done without dispersion, selection of different spectral regions being made by colour filters through which star images far from monochromatic were directly recorded. This kind of observation yielded the colour index, for long the only quantitative measure of a star's colour that was attempted. Useful though this quantity was, it offered and still offers great difficulties in interpretation, the numerical results depending on the telescope-filter combination used. It was Greaves, more than anyone else in Great Britain, who underlined the fundamental physical importance of the stellar continuum. His work made clear how detailed observations of it could be used to study the mechanism by which the energy created in the interior of a star escaped through its outer layers in the form of visible radiation. That in this process the lines were imprinted on the spectrum was to Greaves in his less guarded moments a secondary matter—a revealing detail but still only a detail.

First in the process of improving on the crude colour index for studying the continuum came the concept of the 'effective wavelength' of a star, already taking shape when Greaves began at Greenwich. A coarse parallel-wire grating put across the objective of a telescope produced slightly elongated first-order

spectra flanking the undeviated central image of each star in the field. Measures of these images, combined with a knowledge of the geometry of the grating-telescope combination, showed that their separation defined an effective wavelength characteristic of the energy distribution in the stellar continuum, i.e. of the colour of the star. Though a step forward from ordinary colour indices, these effective wavelengths turned out to be unexpectedly difficult to interpret and to be disappointingly insensitive to temperature differences. Greaves next turned to full-scale spectrophotometry, in which medium-dispersion spectrograms were examined wavelength by wavelength and the intensity distribution expressed in the form of a ' spectrophotometric gradient ', or ratio of intensity between any desired wavelength regions. This involved the sacrifice of mass results from all the stars in a given field, since with substantial dispersion only one spectrum could be obtained at a time; but patient work at Greenwich, first on the 30-inch Thompson reflector and then on the newly-presented 36-inch Yapp reflector, gradually built up results for a network of bright stars in the northern hemisphere. These still constitute the fundamental system of relative gradients. Meanwhile in order to calibrate them so as to be able to assign a colour temperature to any gradient, terrestrial sources of known temperature had to be compared with the stars. The range of temperature involved was of course extreme, and no great precision could be expected, but a scale of stellar temperatures was arrived at that has not even yet been superseded.

The concept of stellar gradient has been and is criticized as referring to a cosmic abstraction, namely a star whose spectrum is without line absorption. But the proof of the pudding is in the eating: even the critics must allow that the concept has been illuminating theoretically. Greaves himself said, in his Halley Lecture of 1945 (though in a somewhat different context):

> '. . . the observer is generally reduced to making what observations he can, and I think it is true to say that in a situation of this kind the observations he makes will generally turn out to be more or less what is required for the testing of . . . theory '.

However true this may be of astronomical observation in general, one may doubt whether the future will show that Greaves himself was groping in the dark as blindly as he pretended to be. It is true at any rate that, in steering stellar spectrophotometry in the direction he did, he showed that in astronomy intuition was worth at least as much in suggesting fruitful lines of advance as in other sciences.

Shortly after his translation north of the Border the outbreak of World War II put a temporary end to Greaves' spectrophotometric work. With the bombardment of London imperilling the national time service, the main time station was transferred to Abinger in Surrey (where it still is) and a reserve station was set up at Edinburgh. Much of the striking improvement in precision of the time signals achieved during the War originated with him. After hostilities ended he set to work with characteristic energy to rebuild his purely scientific work, and in the past few years the first-fruits of his reorganization of the Royal Observatory on Blackford Hill have begun to appear in the form of a series of papers on the continuous spectra of early-type stars. In this work photographic photometry (to which he had earlier contributed so much and to which he still adhered) has been greatly increased in accuracy by a striking new technique. Microphotometer traces of several spectrograms of the same star are combined so as to eliminate the worst effects of plate grain and so make possible

the detection of minor features that would otherwise be obscured. Suitably directed, this technique should have important applications, and it is good to know that Greaves had in recent years built up at Edinburgh a flourishing school of young astrophysicists who can be expected to apply it.

Greaves was a tireless worker for national and international astronomy. He brought a needed whiff of the subject to the British Association meetings as Secretary of Section A of the body from 1924 to 1931. Secretary of the Royal Astronomical Society from 1933 to 1939, he became its President in 1947; and as president of its Radio Astronomy Committee he had (one suspects) a great deal to do with that body's successful advocacy of the giant steerable paraboloid now nearing completion at Jodrell Bank. He served as President of Commission 25 (Photometry) of the International Astronomical Union from 1948 to 1955. But he was also a strong supporter of amateur astronomy. He joined the B.A.A. in 1924 and served on our own Council with few breaks from 1929 to 1938; and whilst at Greenwich was a regular attendant at and contributor to meetings of the Association.

Greaves married in 1927 Caroline Grace Kitto, who, together with their only son George, survives him.

In personal habits Greaves was the typical absent-minded professor of fiction. Many of his idiosyncrasies could and did exasperate: notably his habit of making clear, by returning in conversation to a topic long since dropped by the rest of the company, that he had been oblivious of all that had passed in the interval. It is a measure of the man that his little peculiarities, easily mistaken for rudeness on first acquaintance, soon grew to be recognized as part and parcel of a genial personality. Most men in his position would have made enemies; yet even amongst the many of us who had occasion at one time or another to disagree with him it would be difficult to find one who did not like him. British astronomy is immeasurably the poorer by his loss.—A.H.