Ralph Allen Sampson, M.A., D.Sc., LL.D., F.R.S.

RALPH ALLEN SAMPSON was born at Skull, County Cork, on June 25, 1866. When he was five the family moved to Liverpool, and it was at the Liverpool Institute that he received his early education. He eventually entered St John's College, Cambridge, as a sizar, and graduated as third Wrangler in the Mathematical Tripos of 1888. In the following year he gained the first Smith's Prize and was elected a Fellow of St John's. At this time he held a Lectureship in Mathematics at King's College, London, and was engaged in hydrodynamical research.

In 1890 he returned to Cambridge as the first holder of the newly founded Isaac Newton Studentship in Astronomy and Physical Optics. He worked in astronomical spectroscopy with H. F. Newall, and in 1893 he published a paper of 62 pages entitled "On the Rotation and Mechanical State of the Sun." This paper is historically interesting as it advanced for the first time the hypothesis of radiative equilibrium, a hypothesis which has since dominated the theory of the interior of a star. On several occasions during Sampson's career he put forward suggestions which subsequently were followed up by others and proved to be of first-class importance. He possessed the adventuring spirit of the pioneer, combined with a tremendous capacity for work. It naturally happened that on occasions he embarked on a line of research which eventually proved fruitless, and his remarkable patience and persistence would lead him to continue work in a particular direction long after a point had been reached at which other investigators would have given up the struggle. It was this same patience and capacity for work which saw him through the research on the theory of Jupiter's inner satellites, for which he was awarded the Gold Medal of the Royal Astronomical Society in 1928.

In 1893 Sampson was elected to the Chair of Mathematics in the Durham College of Science at Newcastle-on-Tyne, and in 1895 he removed to Durham itself as Professor of Mathematics. It was during his Durham days that he carried out the heavy but congenial task of editing the unpublished manuscripts of John Couch Adams, the co-discoverer of Neptune, who had been Sampson's teacher. And it was at Durham that the work on the theory of the Four Great Satellites of Jupiter was commenced. He formed the project of basing the elements of the orbits entirely on the Harvard photometric observations of the eclipses of the satellites, and from a careful discussion of these observations he deduced fresh elements by comparison with existing theory. He then found that there were substantial discrepancies when the individual observations

were compared with the theory using the new elements, and Sampson undertook the heavy task of working out the dynamical theory afresh. This work was completed by the time he left Durham in 1910 and tables based on the new theory were published. It was not, however, until 1920 that the new theory itself was printed, and in the intervening period the whole work was revised and a few omissions were found and tabulated. But in spite of the refinements introduced, substantial discrepancies still remained when comparison was made with observation, and it has been since shown by De Sitter that, contrary to expectation, the Harvard photometric observations of the eclipses were affected by rather serious systematic errors, and that consequently it is unadvisable to derive elements from eclipse observations alone. But Sampson's research remains as a necessary stage in our efforts to obtain a really satisfactory theory of Jupiter's Galilean Satellites. These satellites form a very stable system which is of special dynamical interest on account of the commensurabilities of the periods of revolution of the three inner ones.

In December 1910 Sampson was appointed Astronomer Royal for Scotland and Professor of Astronomy in the University of Edinburgh in succession to F. W. Dyson. During his tenure of office he took a great interest in problems connected with the accurate measurement of time, and it was largely due to his co-operation in testing the first free pendulum clock devised by W. H. Shortt that this type of clock, in its developed form, is now part of the standard equipment of so many observatories. In 1921 Sampson published an important paper in the *Monthly Notices of the Royal Astronomical Society* on clock errors and wireless time-signals, in which he called attention to the serious discrepancies between time observations at different observatories. There can be no doubt that this paper greatly stimulated the interest of astronomers in the problem of time determination, which is of fundamental importance in certain aspects of astronomical and geophysical research. In consequence of the attention which has, as a result of Sampson's stimulation, been lavished on the problem, and of the appearance of the free pendulum type of clock, the discordances have now been greatly reduced.

A very striking example of Sampson's pioneering instinct is to be found in the work carried out at Edinburgh on the distribution of energy in the continuous spectra of stars. Sampson was interested in photometric research, and during the war years of 1914–1918 he instructed E. A. Baker to embark on photo-electric experiments. At this time the idea was to fit a cell on a telescope and obtain direct readings of stellar magnitudes (as has indeed been done by other workers), but the aim of the research changed and the result was the construction of a photo-

electric photometer designed to measure the densities of star images on photographic plates. Then came the idea of applying the instrument to the measurement of images of stellar spectra. More research by Baker followed on the intensity-density relationship of photographic emulsions, and finally a spectrophotometric programme was commenced which yielded what have since become known as colour temperatures of stars, although Sampson used the term "effective temperature," which is now reserved to denote a different concept. The stress was now laid on the methods of photographic spectrophotometry as worked out by Sampson and Baker, and the photo-electric photometer took its place as an accessory instrument for measuring the densities of the spectra. The methods employed have since been copied and extended by other workers, and modifications in Sampson's original pioneer scheme were only to be expected. But any subsequent modifications and improvements do not alter the fact that other workers in this field were inspired by Sampson's researches, and they know that their work is the logical continuation of the lead given at Edinburgh.

In the Edinburgh colour temperature work the spectra were photographed with a 6-inch photo-visual to which an objective prism was attached. The exposures were necessarily long and the programme was limited to stars brighter than the third magnitude. It had been obvious for some time that the observatory required extensive re-equipment, and in 1927 Sampson was able to announce that plans had been sanctioned for the erection of a 36-inch reflecting telescope and the acquisition of a new camera employing a 10-inch Cooke Triplet lens. Provision was also made for a modern spectrograph to be attached to the 36-inch reflector and for other accessories. The new equipment was finally completed and installed in 1932.

Sampson's active career was now approaching its close. He continued in the direction of the observatory until 1937, when ill-health hastened his retirement. For some months he travelled abroad, but eventually settled in the south of England, and on November 7, 1939, he died at Bath, being survived by his widow, a son and four daughters.

The Gold Medal of the Royal Astronomical Society was awarded to Sampson in 1928 for his work on Jupiter's Satellites. He was awarded the Keith Prize of the Royal Society of Edinburgh for the period 1919–1921. He served on the Council of the Royal Society of Edinburgh during the periods 1912–1915 and 1919–1921, was Vice-President 1915–1918 and 1933–1936, Secretary to Ordinary Meetings 1922–1923, and General Secretary of the Society 1923–1933.

See also *Obituary Notices of Fellows of the Royal Society*, vol. iii, No. 8, 1940, pp. 221–226

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https://doi.org/10.1017/S0370164600020502 Published online by Cambridge University Press