Thomas Lewis: A lifetime of double stars

David Wright

Thomas Lewis (1856–1927) was one of the great double star experts. A short biography and interpretation of his work is presented here.

Introduction

The history of double star astronomy has produced a long list of outstanding practitioners. The work of the Herschels, William and John, and of the Rev. W. R. Dawes for example, is legendary. So too are the contributions of Wilhelm and Otto Struve, and later those of R. G. Aitken.[1]

During the late nineteenth and early twentieth centuries, the name of Thomas Lewis could justly be counted amongst those of the first rank. However, little is known about him, as there exist but a few brief sketches of his achievements. These are scattered in the extensive literature of astronomy[2,3] and the present account represents the first attempt at bringing together the known facts. Thomas Lewis' work was acclaimed internationally during his own lifetime, a lifetime of double stars.

Early life

Thomas Lewis was born on 12 June 1856. He entered the Royal Hospital School at Greenwich, then under the charge of the Rev. James Hill, at the age of eleven. It is clear that the young boy must have displayed an aptitude for learning as three years later he became a pupil teacher. By December 1874, Lewis had enrolled as a student at the College for Training Naval Teachers. This qualified him for the profession of naval schoolmaster and led to his appointment in 1879 as Assistant Master in Devonport Dockyard School. An important career move, it was achieved only after Civil Service Examination, and marked a turning point in his life. Lewis did not remain in his new job very long but instead entered a further examination for appointment at the Royal Observatory Greenwich.

Superintendant of Time

The Civil Service Examination Lewis underwent, was particularly stringent on medical grounds. This was due to the previous incumbent, a Mr Lyn, having been retired due to ill-health in January 1880. The Victorian dictum of 'value for money' operated just as strongly at Greenwich as anywhere else, it would seem.

Lewis' first task was to take charge of the Meridian Circle reductions. This was during Sir George Airy's last year as Astronomer Royal (he retired in August 1881) and was typical of the 'bread and butter' work of the Observatory in those days.

Feelings among staff at Airy's retirement at the age of 80, were reported to have been cool. His career had been a magnificent but frequently despotic one,[4] and Greenwich was an institution ripe for subtle change. Sir W. H. M. Christie assumed the mantle of Astronomer Royal next, and continued in this capacity until 1910. Evidence of the shift in personnel management technique, can be seen when Lewis asked for the vacant post of Superintendant of the Time Department (previously held by George Criswick) towards the end of 1881.

During Airy's tenure, the vacancy would probably have been filled by a senior staff member, yet Lewis was given it after just a few months service. There can be no question that Lewis performed his duties other than with ability and tact. He supervised the Navy's chronometers for 35 years, until his own retirement on September 30th 1917. With a temperament suited to the balancing of scientific and business interests, Lewis was to become a much respected figure. Exciting times were in prospect when, by international agreement, the Greenwich meridian was chosen as the world's Prime Meridian in 1884.[5] It thus became the basis of the international Time Zone system.

The last seven years of his term saw Lewis under the command of Sir Frank Watson Dyson (Astronomer Royal from 1910 to 1933). Sir William McCrea has written of him: 'He (Dyson) was a man with great gifts and ample commonsense in using them; he was completely natural and unassuming in all his dealings'.[6] Lewis steered the Time Department through most of the Great War, an achievement in itself. By the end of 1917 for example, over 30 members of staff were away on War Service, with the resulting disruption to work.

Double star work

Double star astronomy in England during the nineteenth century, was characterised by the endeavours of Sir James South,[7] the Rev. W. R. Dawes, W. H. Maw, and G. M. Seabroke, to name but four. There were many other notables as well, including K. J. Tarrant and G. Knott.[8] Despite this blossoming of activity,

Fig. 1. Thomas Lewis (NMM Negative No: B1083Z).

between 1890 and 1914 the field was contracting in the amateur province and expanding in the professional. The embryonic British Astronomical Association established a Double Star Section in its first year, with K. J. Tarrant as Director. This post was held by G. M. Seabroke from 1892 to 1914 yet, during those 24 years, a maximum of only three members enrolled. Indeed during 1893 not a single member was to be found, apart from the Director himself. As Howard Kelly wrote in *The BAA: The First Fifty Years*,[9] 'after 24 year's endeavour to stimulate an interest in double stars, the lack of support, no doubt mainly due to want of suitable equipment, was more than discouraging, and the Section was discontinued in 1914'. On reflection this is surprising, since there were a greater number of filar micrometers in circulation then than are to be found nowadays. Cost was always high for these precision instruments, however, with a good filar costing around 15 guinneas (£15.75) in 1851. Nevertheless, there must have been quite a few available on the second-hand market by the turn of the century. Additionally there was a nucleus of experienced observers in the amateur ranks who could have undertaken this work seriously.

The professional scene was only slightly more promising by the start of the 1890s. True, the international effort on double stars was intense, but Greenwich did not even have a department assigned to this work when Lewis arrived. Permission was therefore readily granted, when he requested that the 12.8-inch refractor be re-mounted on the Lassell equatorial in the south grounds. This was to enable him to pursue double star measurements in his own time. It is important to remember, that the 'Great Equatoreal' (as the 12.8-inch was known) had seen first light 22 years before Lewis had made his first double star measures with it. The telescope's original programmes had consisted of the inspection of planetary disks, and the micrometry of asteroids.

Clearly there was a need for a cohesive double star department to be formulated at Greenwich. Although Lewis had made a 'small attempt' at binary star study in 1882, it was the erection of the 28-inch refractor on 1 October 1893, which influenced his work more than anything else. During the period 1882 to 1892, Lewis had observed with the transit circle, the old altazimuth, and the small equatorial, yet he was drawn more and more to double stars. He began to collect old measures, and was especially fascinated by the pairs in the 1837 catalogue of F. G. W. Struve.[10]

A prolific observer, Struve made 10 448 measures of 3112 pairs, including 2343 new discoveries. His immense work *Mensurae Micrometricae* set new standards by its clarity and thoroughness. Over the years Lewis assembled a 'mass of material' to use his own words, relating to the measures of Struve pairs. The fruition of this labour will be discussed later, when Lewis' published output is considered.

The 12.8-inch (Fig. 2) had been used only in 1893, with magnifications of $\times 285$ and $\times 412$, with a distinct preference for the latter. A total of 120 pairs were measured by Lewis with this instrument, generally over two or three nights. Professor Turner also contributed a few of these.

In September 1894 the 28-inch came into regular double star service and by November of the following year control of the telescope was passed by E. W. Maunder to Thomas Lewis. Maunder, a figure well remembered by BAA members for the role he played in the early story of the Association, relinquished control of the refractor as he wished to devote himself to heliographic reductions.

The magnificent 28-inch instrument was mounted on the equatorial which had previously carried the 12.8-inch refractor (Fig. 3). This was possible only because it had been constructed with massive proportion and

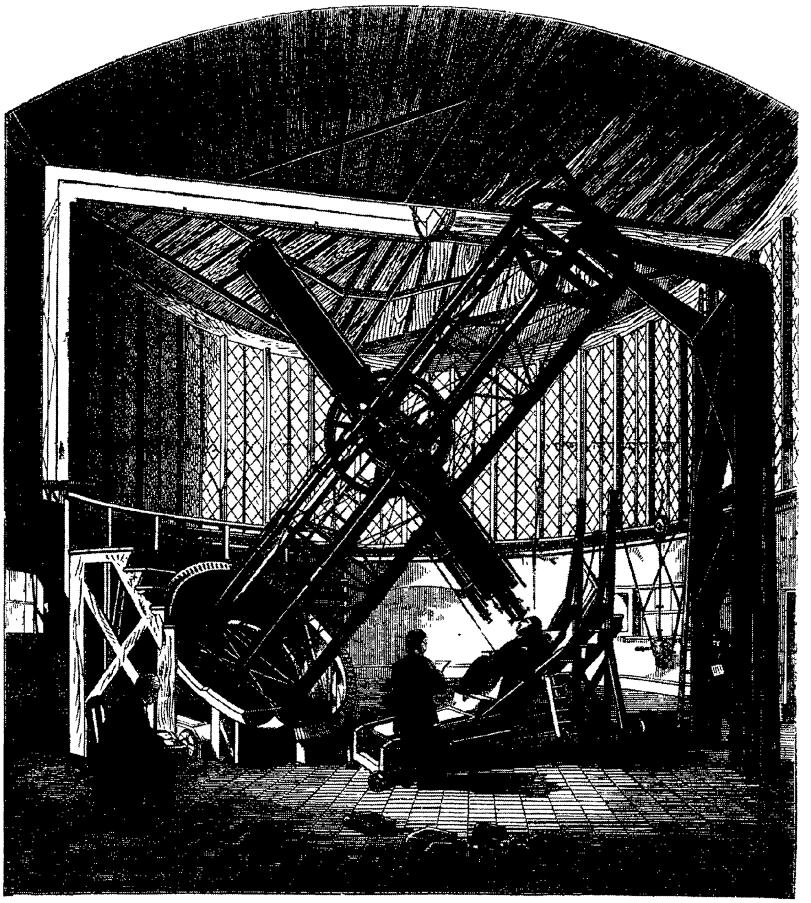

Fig. 2. The Great Equatorial, Royal Observatory, Greenwich (NMM Negative No: B8285).

solid principles. With this telescope in his hands, Lewis was well aware that he and his colleagues could match the best international refractors of the day. Results were produced to an exquisite standard on a near production line basis, with 645 pairs being measured in a single year. Because of its formidable resolving power, the 28-inch was capable of dividing a double star whose components were separated by 0.17 arc seconds. The present author has given a detailed appraisal of the 28-inch elsewhere.[11]

Lewis encouraged other members of staff to the 'Onion' dome in the evenings (as the building which houses the 28-inch is called). Sir Frank Dyson writing in 1921 remarked that, 'For the first few years Mr. Lewis did almost the whole of the observing himself'. Indeed he drew up the programme of work, based upon the pairs in the Struve catalogue mentioned earlier. They were further supplemented by other interesting pairs which had been discovered, or which demanded attention. There are some that bear Lewis' name, and nine that of W. B. Bowyer. Bowyer took a prominent part in the research. Joining Lewis at the eyepiece in 1895, he observed on three nights a week between the years 1902 and 1914. Fig. 4 shows both men at work around 1899. The smoking cap which Lewis is wearing was popular with professional and amateur then, as was the Egyptian Fez. Neither had a brim or peak, so they were practical. The Struves always sported a velvet cap with gold thread around when observing, the number of gold threads indicating the wearer's generation. Wilhelm was of the first.[12]

Table 1. Double star observers who used the 28-inch refractor at Greenwich from 1893 to 1919 and whose work forms the basis of the Greenwich double star observations during those years.

Observer	*Dates of service with the 28-inch up to 1919*
W. Bowyer	1895–1915
W. Bryant	1897–1903 1906–1919
S. Chapman	1910–1914
S. Eddington	1910–1913
H. Furner	1902–1919
J. Jackson	1919
H. Jones	1913–1915
T. Lewis	1893–1911

Table 1 shows the complete rota of observers for the period 1893 to 1919. W. Bryant undertook regular duties from 1897 to 1903 and again from 1906 onwards. Professor Chapman and Professor Eddington also made a considerable number of observations. Lewis himself ceased observing in 1911. During the 1914–1918 War, R. Jonckheere, Director of the Lille Observatory, took over most of the observing.

A Golden Age in professional double star work in England, came to an end in 1919. In that year the

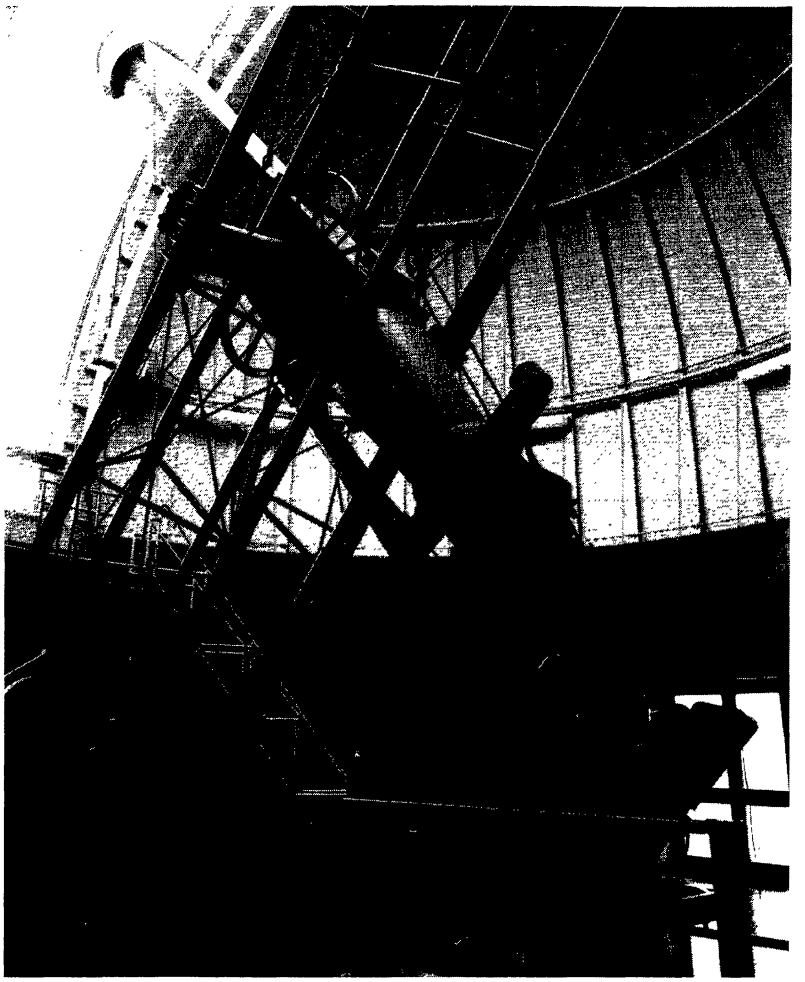

Fig. 3. The 28-inch Refractor in use in Dome F Herstmonceux (NMM Negative No: B619).

telescope was only used for a few months by regular members of staff. The bearings and pivots were found to be badly worn and needed replacement. August 1919 completed the quarter century of binary star research and left Greenwich a fine double star department.

The Greenwich double star results which followed in the years 1919 to 1940 are in marked contrast.[13] It is clear that only a few hundred measures per year were made. This is not an adverse judgement on the observers, rather it is an indication of the lean years which the field was beginning to enter professionally during the inter-war period. It is probably true to say that it was the changing trends in astrophysics, and the exciting new discoveries being made that promoted the declining interest in binaries.

Those who continued to examine double stars at Greenwich, included L. S. T. Symms, whose reputation became well known, and Richard v. d. R. Woolley, later an excellent Astronomer Royal (and Sir Richard). Survivors from the Lewis years were, W. W. Bryant, H. Furner, and J. Jackson. The names of G. Simmonow and R. G. Aitken appear, and they were obviously paying short visits. By the middle of 1939 observing had stopped.

Lewis would no doubt have approved of the revival of activity in the late 1950s to early 1970s, whilst the telescope was at Herstmonceux. The successors to Lewis then being, L. S. T. Symms, Sir Richard Woolley, M. P. Candy, and R. W. Argyle.

Observing technique

A double star measurement is of great value if carefully made.[14] Assuming there are sufficient measures taken over a span of years, an orbit can be computed and the masses of the stars deduced. This explains the long-term nature of the work and why, despite being of fundamental importance, it has become somewhat unfashionable. Suitably equipped amateurs can and do play an important role here.

A double star measure today is taken in the same manner as Lewis would have done, and it is interesting to examine the procedure. A filar micrometer in use today on the 28-inch is shown in Fig. 5. The principle is well known, and involves measuring the position angle of the fainter component with respect to the brighter, in degrees and minutes of arc. The separation between the two stars is then taken in seconds of arc. Fig. 6 shows the viewing geometry. Generally, pairs are measured over three or four nights and the mean taken. Lewis's own preference was to observe a pair on about three

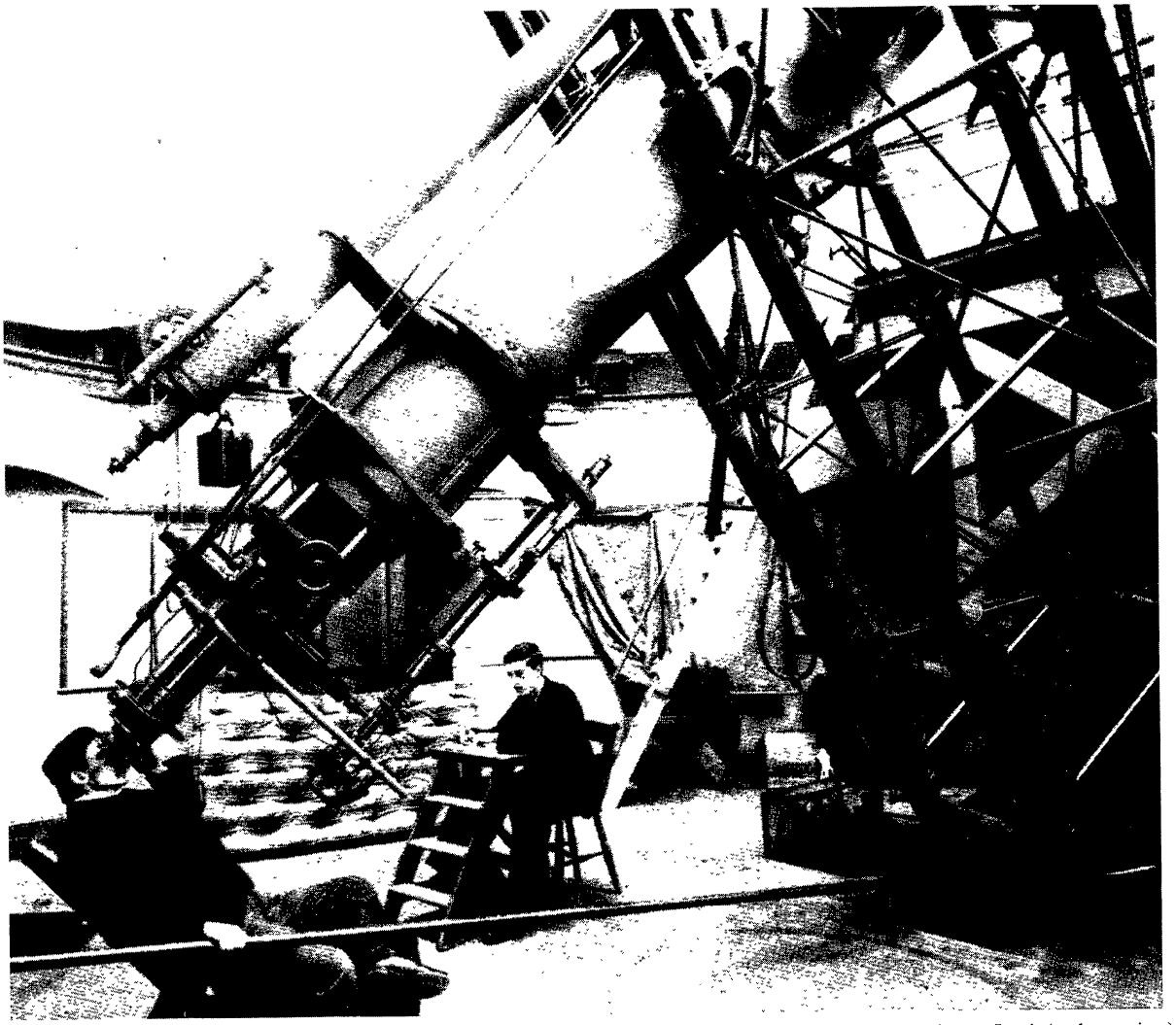

Fig. 4 (above). Thomas Lewis (at the eyepiece) and W. Bowyer taking notes at the 28-inch, *c.* 1899 (NMM Negative No: B5698/c Reproduced by courtesy of the National Maritime Museum and the Royal Greenwich Observatory).

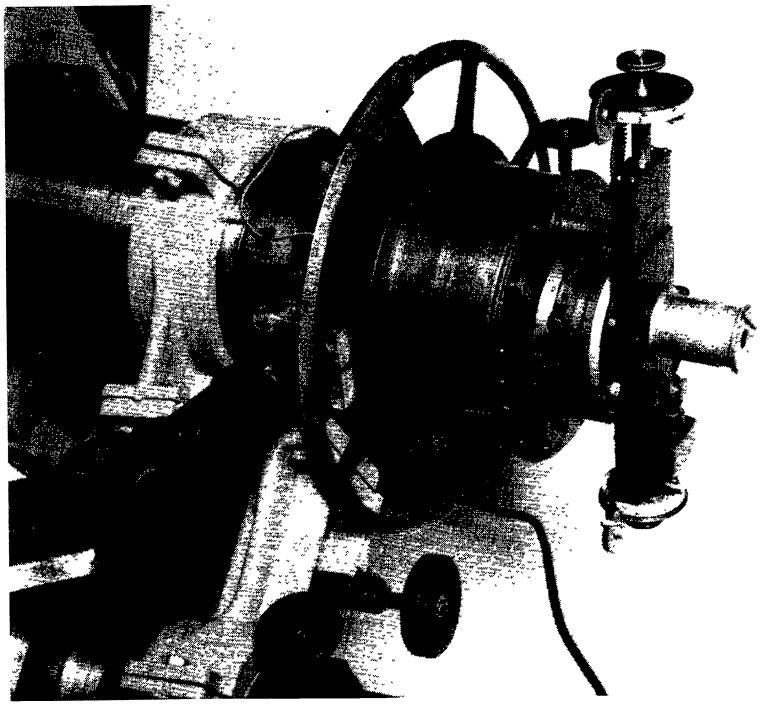

Fig. 5 (left). Bifilar micrometer attached to the 28-inch Refractor (NMM Negative No: C2947).

nights. To increase the speed of measuring, Lewis moved the position angle circle of the micrometer by hand, although a slow motion was fitted. The graduations could then be read to the nearest minute of arc, which was typical of the micrometers built at that time. The screw constant of the micrometer (i.e. what one revolution of the micrometer's screw equals in arc seconds, or part of an arc second), was found by observing transits of the stars 2 Ursae Minoris, Bradley 402, and Piazzi 2.60 by Lewis and Dyson on 27 December 1894. It was typical of Dyson to interest himself in the instrumentation and its performance.[15]

Published material

The clearest indication of the rising quality of Lewis' work, is found by examining his published output. H. P. Hollis, a friend and colleague, writing the obituary of Lewis,[16] said that his 1890 paper, on 'Historical Instruments at Greenwich', 'embodied careful research'. This was soon followed by a contribution to *Monthly Notices of the Royal Astronomical Society* in June 1891, on 'The Orbit of 36 Andromedae'. Without doubt, his greatest work was the 1906 *Memoir* published by the RAS entitled: 'Measures of the Double Stars contained in the *Mensurae Micrometricae* of F. G. W. Struve'.[17] Lewis had collected a large quantity of measures of these pairs, produced by 107 observers including his own determinations of 419 of the 3112 pairs.

Sir Frank Dyson, then Astronomer Royal for Scotland, encouraged Lewis to prepare the monograph for submission to the Council of the RAS who then sanctioned its publication. A thick but compact document, it bears the hallmarks of the master hand. The debt to Struve is acknowledged and the *Memoir* is a model of sound judgement and organization. It is extremely easy to use and the modern double star observer will find it a hand, if weighty, reference work. It is enhanced by manuscripts provided by the Senate of the University of Cambridge and others.

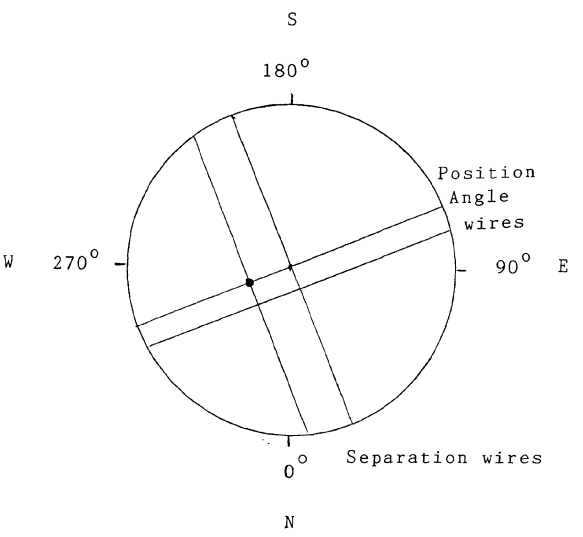

Fig. 6. Viewing geometry of double star measurement (author's drawing). The fainter component is always measured with respect to the brighter. In this example the position angle (p.a.) is about 112°.

The Introduction contains a brief history of the subject, and his extensive acquaintance with double star literature is evident. It is a keynote of his writing, that full credit is paid to other workers, including his colleagues at Greenwich. The measures referenced extend from Sir William Herschel's values in the eighteenth century, up to the early 1900s.

In 1907 Lewis was awarded the Lalande Prize of the Paris Academy of Sciences for this work – international recognition well deserved.

A compendium of the Greenwich double star observations made between 1893 and 1919, already referred to, was printed by His Majesties' Stationery Office in 1921 at the cost of £1.5s.0d.[18] Herein lay the results of the Greenwich observers divided into four sections. A useful introduction by Sir Frank Dyson, giving instrumental data and a resumé of the observing programme, commenced the work. The following two sections were on the results, one recounted the means up to 1910 (for the individual observations had been published annually up to then), followed by all the measurements taken from 1910 to 1919. Pairs of special note had small case histories given about them and, finally, 25 binaries were selected and orbit diagrams drawn up. The completion of this volume after Lewis had retired must have afforded him much satisfaction.

The Observatory Magazine

The Observatory was founded in 1877 by Sir W. H. M. Christie, and remains in Sir William McCrea's estimation 'the most human of all professional scientific journals'.[19] This publication printed the majority of his articles. Nine of them were also available as a slim volume entitled *Double Star Astronomy* produced in 1908.[20] This was essentially a much expanded version of the introduction to the 1906 *Memoir*. The topics of real and apparent orbits were dealt with, as was personal equation, masses of binary stars, and the poles of double star orbits. The rapidly advancing field of photography was not neglected either. It is interesting to note that, in 1897, the 28-inch refractor secured 'some good results' on dry collodion plates. Exposures ranged from 1 to 30 seconds, and each plate bore a number of star images from which the best could be used for measurement.

The paper most associated with Lewis, aside from the 1906 *Memoir* was his 1913 study 'On the magnifying powers used by double star observers'.[21] Here there is analysis of magnifications used on telescopes from a 3.8-inch of the Rev. W. R. Dawes, to the Lick 36-inch refractor. This publication is still regarded as essential reading for aspirant double star observers, containing as it does a pragmatic approach to an oft disputed subject. Lewis commented, for example, 'There is one

interesting personality not often mentioned, viz., when an observer becomes quite used to his instrument and various eyepieces, he gradually develops a preference for one particular eyepiece, and will use it under almost all conditions – and to advantage. Some of this prejudice is doubtless due to comfort in placing the eye'. In an age when professional astronomy still relied quite strongly on using the eye as the light detector, such remarks merited close attention. Lewis concluded with a formula:

$$\text{magnifying power} = 140\sqrt{A}$$

where A is the diameter of the aperture in inches. He wrote that it 'may safely be taken as representing the concensus of opinion among experienced observers in their choice of the best magnification for a given telescope; and it may, therefore, be useful as a guide to others in selecting the eyepieces which best suit their particular telescope'.

H. P. Hollis summarized his friend Lewis' writing for *The Observatory* in these terms: 'In each series of years there will be found articles by him of considerable value'.[22] Indeed, Lewis became involved in the editorship of the magazine for a total of nineteen years.

E. W. Maunder had asked Downing and Lewis to join him as joint editors in 1884. This arrangement continued until 1888. By 1893 Lewis had entered a similar alliance, this time with Hollis and Turner, although this triumvirate lasted for just a year. From 1898 through to 1912, the task of editorship was divided equally between Lewis and Hollis.

One of Lewis' ambitions had been to edit the magazine, so this was amply fulfilled. Another was to serve as Secretary of the Royal Astronomical Society, which he duly did from 1905 to 1908. Hollis wrote of Lewis: 'Lewis was a man who had definite aims in life, and these he pursued unswervingly'. This was the key to his character.

A character sketch

Essentially a serious individual, Lewis did however enjoy organizing and playing for the Royal Observatory Hockey Club. A further relaxation was a yacht he purchased for weekend use, as he possessed a natural love of the sea.

His chief interest out of working hours appeared to have been his involvement with freemasonry. 'Prominent in the craft at Greenwich', Lewis was Master of the Royal Naval College from 1901 to 1902. He was First Principal of the Trafalgar Chapter in 1904, and acted as Treasurer of the Chapter between 1906 and 1919.

In 1907 he married at the age of 51, and had a daughter. A son was also born, but unfortunately died in infancy. Both wife and daughter were destined to survive him. The last ten years of his retirement were spent at Wivenhoe in Essex, where he died in June 1927. At his burial, Sir Frank Dyson attended with W. B. Bowyer and P. Melotte of the Royal Observatory. J. E. Evans a Headmaster of the Royal Hospital School and a life long friend together with P. Melotte represented the Masonic bodies with whom Lewis was connected.

Conclusion

The Greenwich observations of double stars, fully deserve the praise they have received since their publication over seventy years ago. Their success reflects to the credit of Thomas Lewis who inspired the work.

Nowadays this demanding field of observation is almost entirely in the hands of amateurs in this country but all who study these objects owe a debt to Lewis.

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Address: 524 Coulsdon Road, Caterham, Surrey CR3 5QQ

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