


Occasional Notes


No. 1 An Independent Miscellany of Astronomy 27 June 2018

On 25 October last year I resigned my position on the Council of the British Astronomical Association, having served for twenty-six years as Curator of Instruments and Director of the Instruments and Imaging Section. In recent years I produced forty-six issues of *I&I News* and *Technical Tips*. I now continue with this independent publication, to be issued at irregular intervals, and an accompanying website (see link below) from where all of them can be downloaded.

I invite contributions on all aspects of practical astronomy: visual observing, imaging, photometry, spectroscopy, telescope construction and maintenance, restoration of classic instruments, observatories, and historical articles particularly relating to instruments. The first article presented here concerns some of my final work for the BAA.

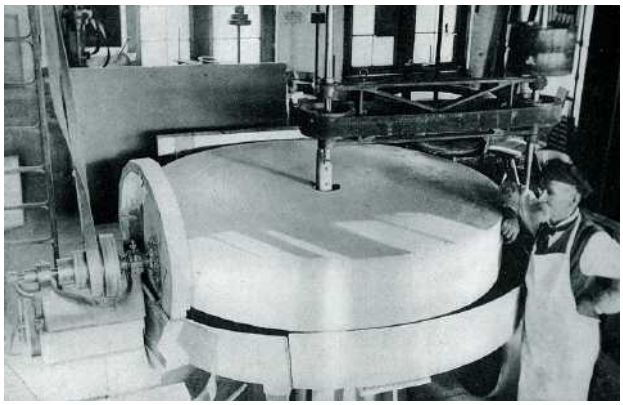
Bob Marriott

BAA instruments secured for posterity

In 2017, three BAA instruments were deposited in permanent collections. In *I&I News* New Series No. 29 (16 June) I included a brief account of instrument no. 1 (reproduced here); no. 3 is now in a museum; and no. 239 was the subject of my final report to the Council.

Instrument no. 1

Instrument no. 1 is a speculum-metal grating measuring 36 x 36 mm, with a ruled area 29 x 21 mm, and with a presentation inscription on three sides of the face: 'Ruled on Rowland's Engine. Johns Hopkins University, Baltimore, Md. U.S.A. 1890. Plate prepared at the Astronomical and Physical Instruments Works of J. A. Brashear, Allegheny, Pa., U.S.A., and presented by him to the British Astronomical Association. 14,438 lines to one in. 568 lines to mm. A.E. Decemb. 10, 1890'. From 1890 to 1951 it was used successively by John Evershed, Walter Maunder, Charles P. Butler, W. B. Wright, and L. Vizard. In 1952 it was loaned to a Member who by 1959 had disappeared, and it was eventually written off as lost. In 2004 I received a letter from that Member, informing me that he wanted to return it, and I recovered it on 24 September that year. This grating is not only an early example of a new technology; it is a tangible record of international recognition of the Association immediately it was founded. Historically, it is the Association's most important and valuable instrument. I recently prepared a box for it, with an account of its history and provenance, and it is now deposited in the Association's archive at Burlington House.



John Brashear in later years, at a machine in his factory in Pittsburg. The factory, built in 1886, was an important building in the history of Pittsburgh and was eventually listed in the National Register of Historic Places. In March 2015, however, one of the walls collapsed and the building was considered unsafe. During the demolition, a sealed brass box was discovered in the foundations. This time capsule was found to contain several dozen letters, documents, photographs, and other memorabilia, including a letter from Sir Howard Grubb, stating that he was pleased to sponsor Brashear's membership of the Association. Grubb served on the first Council.

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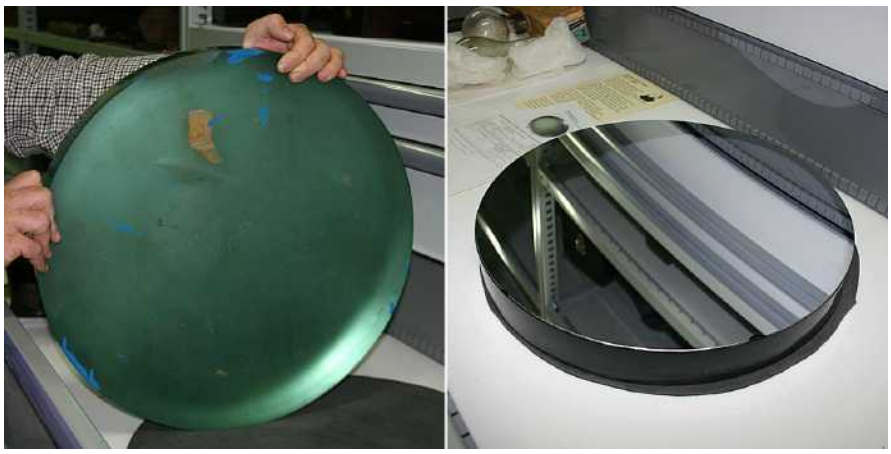
Instrument no. 3

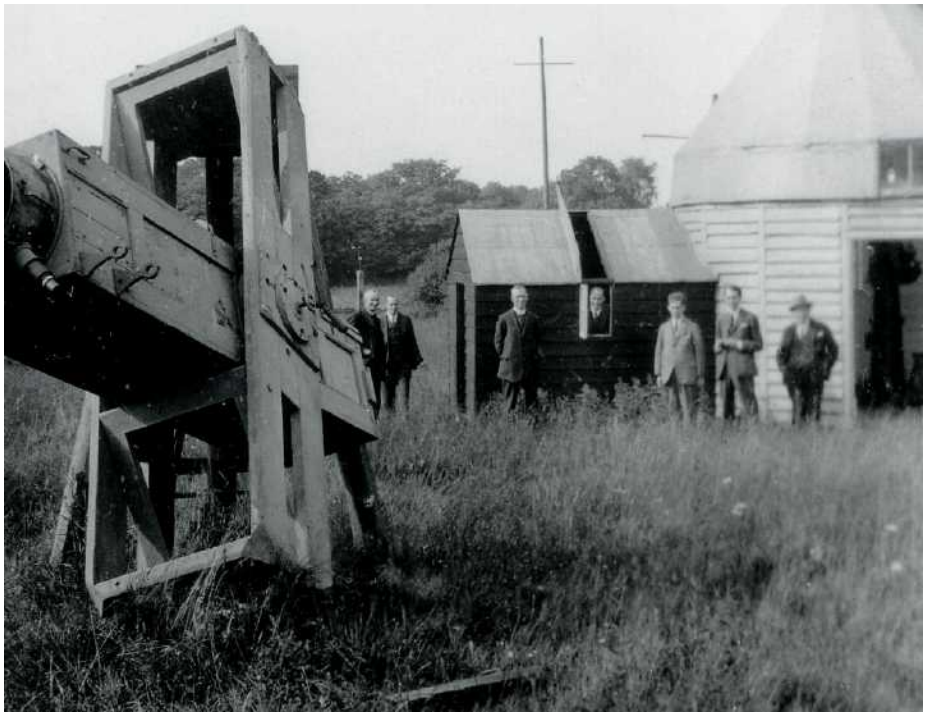
This 18-inch f/6.8 mirror was made by George Henry With, of Hereford, in 1877. In 1879 it was sold to the Rev J. Jevons Muschamp Perry, vicar of Alnwick, Northumberland, who made a tube and mount for it. George Calver, who tested the mirror, pronounced it to be an exceptionally fine example, and Perry considered it to be 'a magnificent specimen', while his observational results were 'quite sufficient to show me that the very high reputation of its excellent maker is worthily and proudly maintained by this mirror'. Their judgements were endorsed by Charles Piazzi Smyth, Astronomer Royal for Scotland, who after using the instrument told Perry that he 'could not expect any telescope, reflector or refractor, upon the same object, to do any better'. In 1882 the complete instrument was acquired by Nathaniel Green, who lived in St John's Wood – at that time still a semi-rural area north of Regent's Park, London. In 1894, Green advertised the mirror for sale at £100 (in current terms, approximately £10,000) but received no offers, and he therefore presented the complete instrument for installation in the proposed BAA observatory. Fund-raising for this project was a failure, however. The observatory never materialised, and the instrument was placed in storage. In 1905 it was placed on loan to J. M. Baikie, who returned it in 1910, and in 1917 it was placed on loan to the Rev Theodore Phillips, vicar of Headley, Surrey, who constructed a new tube and mount for it. After Phillips' death in 1942 the mirror was on loan to several Members until 2008, when it was loaned to Hereford City Museum for a special exhibition on T. W. Webb. After that, it was placed in storage.

Although this is a fine mirror (I used it during the late 1980s), it is of such historical importance that it would not have been prudent to risk damage or loss by placing it on loan again, and with its focus of 10 feet 2½ inches it is improbable that anyone would want to construct an instrument to accommodate it. Consequently, the Council accepted my proposal that it be presented to Hereford City Museum. At the beginning of August 2017 I visited the museum and spent the afternoon with one of the curators in the building in which are stored the collections not currently on display, and during that time I signed the document which officially transferred ownership of the mirror. In recent times the museum, which was founded in 1874, has suffered cuts in funding, but the curators and volunteers are determined that it will prevail, and they are extremely pleased with this gift. The mirror now resides less than half a mile from where it was made 141 years ago.

George Henry With (1827–1904)



The 18-inch mirror, carrying With's delicately engraved signature and a lengthy inscription in English, Latin, Greek, and Judaic.

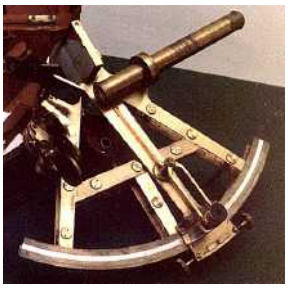


The 18-inch mirror incorporated in a massive timber tube on an English equatorial mount, at T. E. R. Phillips' observatory, Headley, *c*.1930. The conic-roofed building at right housed the 8-inch Cooke refractor bequeathed to the Royal Astronomical Society by William Coleman in 1911 and subsequently placed on loan to Phillips. This instrument eventually passed to Port Elizabeth Observatory, South Africa, and is now owned privately. A domed building (not in the photograph) housed the 12¼-inch Calver reflector which Phillips had purchased in 1907 and which was added to the BAA collection in 1946 (instrument no. 93). This photograph was taken during one of Phillip's summer gatherings, which were attended by many prominent amateur and professional astronomers.

Instrument no. 239

This 9¼-inch mirror was made by W. W. Slade (1860–1943) for Arthur Stanley Williams in 1917. Slade's name is not well known now, but among his contemporaries he had a considerable reputation for his high standard of work.

During the 1880s, Stanley Williams introduced transit timings of Jovian features (enabling detailed monitoring of longitudes and currents) and assigned the names of Jupiter's belts and zones. All his observations were made with a 6½-inch reflector by Calver – no doubt acquired from the maker – and many of the results were published in his two-volume *Zenographical Fragments*. He also devoted much of his time to the study of variable stars, of which he made many photographic discoveries with a 5-inch Abney doublet by Grubb. He was a founder Member of the Association, a member of the Provisional Committee, a member of Council 1890–93, and an inspiration for the work of the Jupiter Section. He also published his work in *Monthly Notices of the Royal Astronomical Society*, and in 1923 was awarded the Hannah Jackson (née Gwilt) Gift and Medal.



Stanley Williams was also a keen yachtsman. In 1904 he was the first to complete a solo voyage to Lisbon and back, for which he probably used the 8-inch double-frame sextant by Troughton (above) which he had borrowed from the Royal Astronomical Society. This was formerly the property of Richard Sheepshanks (1794–1855), and was one of twenty instruments presented to the Association in 1956. In 1982 it was sold at Christie's.

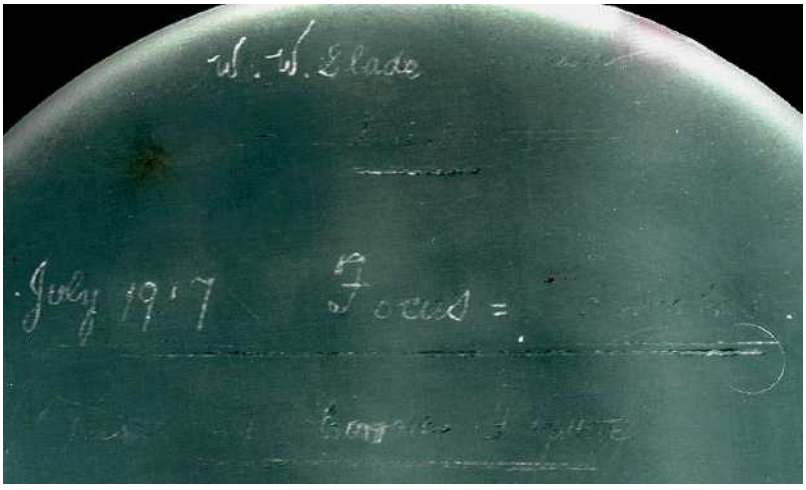
After retiring from his profession as a solicitor, Stanley Williams moved to St Mawes, Cornwall, where he lived a reclusive life on a barge, with his observatory on the jetty. He spent his last eighteenth months at Feock, near Truro, and after he died in 1938 T. E. R. Phillips wrote of him: 'His lonely life was spent in communion with Nature and consecrated to his studies, and it was fitting that, in accordance with his desire, his body should have been taken by steamer to a point off Falmouth a few miles from land and, following a short religious service, committed to the sea he loved in the presence of just a couple of friends.'

Stanley Williams bequeathed the Slade mirror, the Calver reflector, and the Grubb lens to the Royal Astronomical Society, and in 1956 the RAS presented them, with seventeen other instruments, to the Association. The Calver reflector, which Stanley Williams had used for more than fifty years, was placed on loan in 1958 and was lost by 1976, while in 1981 the Grubb photographic lens was sold to an anonymous buyer for a few pounds.

The Slade mirror was originally incorporated in an instrument with an equatorial mount, and was sequentially placed on loan to several Members. It is one of the many instruments which I traced and recovered soon after I was appointed Curator of Instruments in 1991, but only the mirror remained. At the meeting of Council on 25 October 2017 it was the subject of my final report as Director of the Instruments and Imaging Section, and it was then deposited in the Association's archive as an invaluable record of an important and influential founder Member.

St Mawes, Cornwall

Feock, Cornwall



Slade's inscription on the back of the mirror

Arthur Stanley Williams (1861–1938)

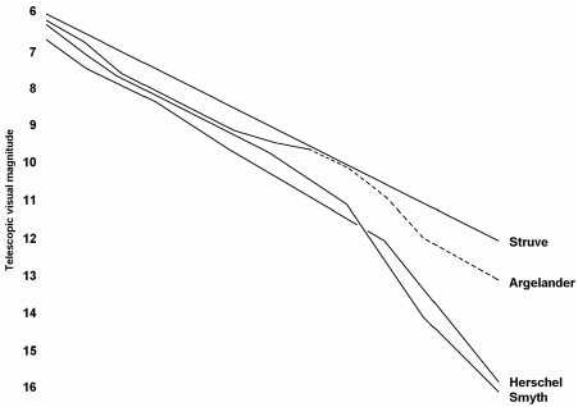
Sir John Herschel at the Cape of Good Hope

At the meeting of the BAA Historical Section at the Birmingham and Midland Institute on 25 November, Dr Allan Chapman presented an excellent talk on Sir John Herschel's four-year sojourn at the Cape of Good Hope. I had taken with me my copy of Herschel's book containing the results of his survey of the southern skies, published in 1847, and I was afforded the opportunity to speak about it as a brief addendum to Allan's talk.

The full title is *Results of Astronomical Observations made during the Years 1834, 5, 6, 7, 8, at the Cape of Good Hope; Being the Completion of a Telescopic Survey of the Whole Surface of the Visible Heavens, Commenced in 1825*. This is a large quarto volume of 472 pages, with an Introduction, chapters entitled 'Of the Nebulae of the Southern Hemisphere', 'Of the Double Stars of the Southern Hemisphere', 'Of Astrometry, or the Numerical Expression of the Apparent Magnitudes of the Stars', 'Of the Distribution of Stars, and of the Constitution of the Galaxy in the Southern Hemisphere', 'Observations of Halley's Comet, with Remarks on its Physical Condition, and that of Comets in General', 'Observations of the Satellites of Saturn', 'Observations of the Solar Spots', and an 'Appendix' with discussions of numerical magnitudes, levels and geodesic determination of observatories, solar radiation, and a catalogue of seventy-six ruby stars. The chapters include catalogues of about 2,300 nebulae and clusters and about 2,100 double stars observed with the 20-foot reflector – the majority of them newly discovered – and a catalogue of micrometrical measures of several hundred double stars made with the 7-foot equatorial refractor. The volume also contains eighteen plates: nine plates with fifty-nine drawings of nebulae and clusters – including large folding plates of the Orion nebula, η Argûs (η Carinae), and the Nubecula Major (Greater Magellanic Cloud) – a folding plate of the Milky Way from Centaurus to Monoceros, three plates with thirteen drawings of Halley's comet, a plate with thirteen drawings of sunspots, and three plates consisting of numbered zones in the northern and southern hemispheres, diagrams of the construction of the observatory housing the refractor, and the observatories and telescopes *in situ*. In addition, at the end of the text there is an illustration of the obelisk erected after the Herschels departed the Cape. The plates were engraved by James Basire – the fourth generation of a family of artists and engravers – whose grandfather had employed William Blake as an apprentice.

After returning from the Cape, Herschel spent nine years preparing the book. Publication was funded by Hugh Percy, 3rd Duke of Northumberland, who had funded the Northumberland refractor at Cambridge Observatory (below) when he was Chancellor of the university during the 1830s. He died in 1847, shortly before publication, and his brother Algernon succeeded him as 4th Duke. This copy of *Results* was originally presented to Ipswich Philosophical Society, founded in 1818 but inactive by 1855.

The following pages include mere fragments of this monumental work. Two particular points should be noted. First, in the nineteenth century, positions were often recorded with North Polar Distance rather than Declination. More important, however, is that at that time there were enormous differences in the recording of magnitudes. For example, Herschel's estimates with his 18-inch reflector extended to magnitude 20. In 1851, William Rutter Dawes



commented on the disparities in magnitude estimates by different observers, and soon afterwards, Norman Pogson introduced the magnitude scale that is still in use, though it was not generally adopted as the standard until the 1890s. In the late 1860s, George Knott compared magnitudes recorded by several observers and demonstrated that although visual magnitudes were consistent, telescopic magnitudes varied dramatically. The graph above is based on Knott's tabulated results. Earlier telescopic magnitude estimates should therefore be considered with caution.

RESULTS

OF

ASTRONOMICAL OBSERVATIONS

MADE DURING THE YEARS 1834, 5, 6, 7, 8,

AT THE CAPE OF GOOD HOPE;

BEING THE COMPLETION OF A TELESCOPIC SURVEY OF THE WHOLE SURFACE OF THE VISIBLE HEAVENS,

COMMENCED IN 1825.

BY

SIR JOHN F. W. HERSCHEL, BART., K.H.

M.A., D.C.L.; F.R.S. L. & E.; HON. M.R.I.A.; F.E.A.S.; F.G.S.; M.C.U.P.S.;

CORRESPONDENT OR HONORARY MEMBER OF THE IMPERIAL, ROYAL, AND NATIONAL ACADEMIES OF SCIENCES OF BERLIN, BRUSSELS, COPENHAGEN, GÖTTINGEN, HAARLEM, MASSACHUSETTS (U. S.), MODENA, NAPLES, PARIS, PETERSBURG, STOCKHOLM, TURIN, AND WASHINGTON (U. S.);

THE ITALIAN AND HELVETIC SOCIETIES;

THE ACADEMIES, INSTITUTES, ETC. OF ALBANY (U. S.), BOLOGNA, CATANIA (GIOENIAN), DIJON, LAUSANNE, NANTES, PADUA, PALERMO, ROME (DEI LINCEI), VENICE (ATHENÆUM), AND WILNA;

THE PHILOMATHIC SOCIETY OF PARIS; ASIATIC SOCIETY OF BENGAL;

SOUTH AFRICAN LITERARY AND PHILOSOPHICAL SOCIETY (C. G. H.); LITERARY AND HISTORICAL SOCIETY OF QUEBEC; HISTORICAL SOCIETY OF NEW YORK (U. S.);

ROYAL MEDICO-CHIRURGICAL SOCIETY, AND INSTITUTION OF CIVIL ENGINEERS, LONDON;

GEOGRAPHICAL SOCIETY OF BERLIN; ASTRONOMICAL AND METEOROLOGICAL SOCIETY OF BRITISH GUIANA;

ETC. ETC. ETC.

LONDON:
PUBLISHED BY SMITH, ELDER AND CO., CORNHILL.
1847.

TO

The Memory of

THE LATE

HUGH, DUKE OF NORTHUMBERLAND,

CHANCELLOR OF THE UNIVERSITY OF CAMBRIDGE,

THE ENLIGHTENED FRIEND

AND MUNIFICENT PATRON OF SCIENCE,

This Work

IS GRATEFULLY INSCRIBED

BY

THE AUTHOR.

Presented by
Algernon
Duke of Northumberland.
to
The Ipswich
Philosophical Society.
with the Author's compliments.

M.17 = h. 2008. RA 18h 11m NPD 106º 15'

This very remarkable object is figured in my Northern Catalogue, but owing to the deficiency of micrometrical measures for laying down the stars, its form is far from accurately expressed in that representation. In particular the large horse-shoe-shaped arc which forms so striking and conspicuous an appendage to the bright oblique streak observed by Messier at its preceding termination, is there represented too much elongated in a vertical direction and as bearing altogether too large a proportion to that streak, and to the total magnitude of the object. The nebulous diffusion too, at the preceding end of that arc, forming the preceding angle and base line of the capital Greek omega (Ω) to which the general figure of the nebula has been likened, is now so little conspicuous as to induce a suspicion that some real change may have taken place in the relative brightness of this portion compared with the rest of the nebula; seeing that a figure of it made on the 25th of June, 1857 (on which occasion other details presently to be noticed were well seen, and for the first time distinctly delineated), expresses no such diffusion, but represents the arc as breaking off before it even attains fully to the group of small stars at the preceding angle of the Omega. Neither is the smaller of the two nebulous knots at its following angle close adjoining to the small star there situated so conspicuous as to have attracted particular notice either on that occasion, or on 13th August, 1835, when a pretty elaborate drawing was made of all the then known parts of the nebula, and a number of measures taken with the twenty-feet position micrometer with a view to the construction of a correct monograph of it.

Under these circumstances the arguments for a real change in the nebula might seem to have considerable weight. Nevertheless they are weakened or destroyed by a contrary testimony entitled to much reliance. Mr Mason, a young and ardent astronomer, a native of the United States of America, whose premature death is the more to be regretted, as he was (so far as I am aware) the only other recent observer who has given himself, with the assiduity which the subject requires, to the exact delineation of nebulae, and whose figures I find at all satisfactory, expressly states (Mem. American Phil. Soc. vol. vii. Art. xii, p. 177) that *both* the nebulous knots were well seen by himself and his coadjutor Mr Smith, on the 1st August, 1839, *i.e.* two years subsequent to the date of my last drawing. Mr. Mason also declares the upper and larger knot to be irresolvable by his telescope (a reflector of 12 inches aperture and 14 feet focal length constructed by himself). In this particular my observations of 1835 and 1837, so far agree that its resolvability is not mentioned in words or indicated in the diagrams made on those occasions. And, with respect to the diffusion of the nebula among the group of stars at the preceding angle and along the base-line of the Omega, it is represented as tolerably conspicuous in his figure – for which reason, and because it was decidedly noticed as a feature in my earlier observations, I have retained both it and the lesser knot in my present figure, considering the negative evidence of their having escaped delineation on those two nights as outweighed by the positive testimony in favour of their existence both at an earlier and a later epoch. Neither Mr. Mason however, nor any other observer. appears to have had the least suspicion of the existence of the fainter horse-shoe arc attached to the *following* extremity of Messier's streak. It was seen on both the nights in question, but only delineated in its true form and magnitude on the latter. It merits, however, a more particular attention than I was then able to bestow on it, as it is possible that yet other convolutions may exist. I should observe that the three stars which mark its extremity are *not* micrometrically laid down.

The stars visible in this nebula are for the most part too small to admit of their differences of RA and NPD being taken with the equatorial micrometer conveniently.

Accordingly only three or four have been so laid down. The more conspicuous of the remaining ones down to the 12th, and one or two of smaller magnitudes have been determined by triangulation from these by angles of position taken with the 20 feet position micrometer. Several of these angles were measured in England, the rest at the Cape, on the 13th August, 1835. No reason existing for preference, the means of all the observed positions belonging to the same pairs of stars were adopted, and the whole system of angles projected on a chart by means of a protractor. Thus from the equatoreally determined stars adopted as a basis of projection others were derived by the intersection of their directions, and from these again others, and so on; using always the best trigonometrical combinatons the respective cases would admit, and adjusting cases of discordant intersections as they arose, on an impartial consideration of their merits. (When a star is determined, in this mode of proceeding, by three or more intersecting lines which do not meet in a single point, bad trigonometrical combinations must be disregarded, and the centre of gravity of the intersections afforded by the good ones only taken.) From the stars laid down by triangulation, others depending only on eye-drafts were then inserted on the chart according to their configurations. Finally, the differences of RA and NPD of the stars of these two latter classes were read off from the chart by the aid of diagonal scales, and the whole entered in a catalogue; which done, the nebula was then worked in upon the chart as carefully as possible according to the united evidence of all the evidence of all the drawings and diagrams at any time procured of it or any of its parts.

The following is the Catalogue in question, in which the first column contains the number for future reference, the second, letters for more convenient citation, the third the magnitude assigned to the star on a comparison of all the observations neglecting half magnitudes below the 8th. The fourth column contains the difference of right ascension in seconds of time, and the fifth that of North Polar Distance in parts of the equatorial wire micrometer (1,000 parts = 4' 0".4) from the chief or Zero star, which in this case is the conspicuous star a little preceding the summit of the brighter horse-shoe. Lastly, the sixth column contains the classes to which the determinations of the stars belong in respect of probable precision; class I, containing stars determined by differences directly observed with the equatoreal; 2, stars projected by triangulation as above described; and 3, stars inserted from eye-drafts. Dots attached (:) denote want of precision.

[Catalogue of 44 stars, not included here]

30 (Bode) Doradûs = Lac 449. Neb = B. 1038 = Δ. 142 = h. 2941. RA 5h 40m NPD 159º 11'

This is one of the most singular and extraordinary objects which the heavens present, and derives no small addition to its intrinsic interest from its situation, which is among the thickest of the nebulae and clustering groups of the greater Nubecula, of whose total area it occupies about one five-hundredth part. For these reasons, as well as because its real nature has been completely misunderstood, and its magnified appearance so strangely misrepresented in the only figure which I am aware to have been made of it as to convey an entirely erroneous impression both of its form and structure; I have taken great pains to give as nearly as possible a perfect representation of it as it appeared in the twenty feet reflector on a great many occasions, but more especially on the 29th November, 1834, when a 'very careful drawing' was made of it by the eye alone, unaided by any micrometrical measures; and on the 21st and 22nd December, 1835, when the nebula was worked in from the telescope on a 'skeleton' previously prepared by an approximate reduction of the micrometrical measures of its principal stars, forming a chart, with a system of triangles, for its reception and for that of minute stars not susceptible of micrometric measurement, or not considered as of sufficient importance to be so measured. This is the only mode in which correct monographs can be executed of nebulae of this kind which consist of complicated windings and ill-defined members obliterated by the smallest illumination of the field of view; and to which the small stars, when very numerous, can be mapped down with tolerable precision.

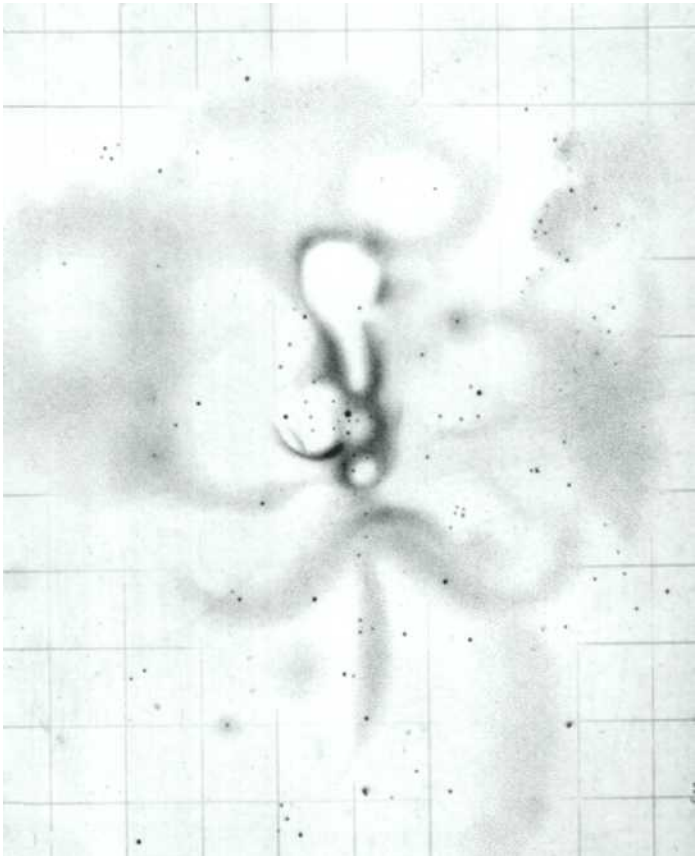
The following catalogue contains all the stars which I have been able distinctly to perceive within the area occupied by the nebula and nearly adjacent to it.

[Catalogue of 105 stars, not included here]

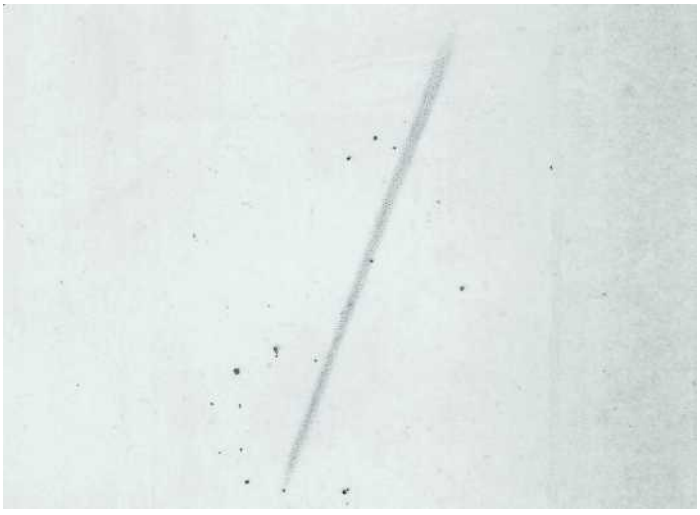
Owing to the convergence of the meridians so near the pole, they are laid down in the figure, and entered in the catalogue, not according to differences of RA and polar distance expressed as usual in time and in parts of the equatorial micrometer – but according to the values x and y of rectangular coordinates measured on the parallel and merdian passing through the central star, and both expressed in seconds of absolute angular measure.

The first class of stars in this catalogue comprises those which have been determined by the combination of direct measures of differences of RA and NPD taken with the equatorial with angular measures of position taken with the 20 feet micrometer, or by such only of the latter description of measures as I consider on the whole, from their number and satisfactory coincidence of their results, equal in weight to such direct determinations. The second class contains stars determined by the projection of angles of position only but less numerous and accurate than those of class I, or in which angles of position not alone sufficient for determining the co-ordinates have been combined either with observed differencs of RA, or with distances obtained from configurations with stars of class I, capable of affording a considerable degree of exactness. Class 3, contains stars inserted on the 'skeleton' by the eye, and whose co-ordinates therefore will be more or less exact according to their situation, whether favourable or unfavourable for good configurations. Some of these which, owing either to the employment of a measured angle or to some other favourable circumstance, appear to claim a higher degree of confidence, are indicated by 2.3 in the column of classes.

The stars thus scattered over the area occupied by this nebula may or may not be systematically connected with it, either as an individual object, or as part of the vast and complex system which constitutes the Nubecula. In respect of their arrangement there is nothing to distinguish them from those which occupy the rest of the area covered by the nubecula, in which every variety of condensation



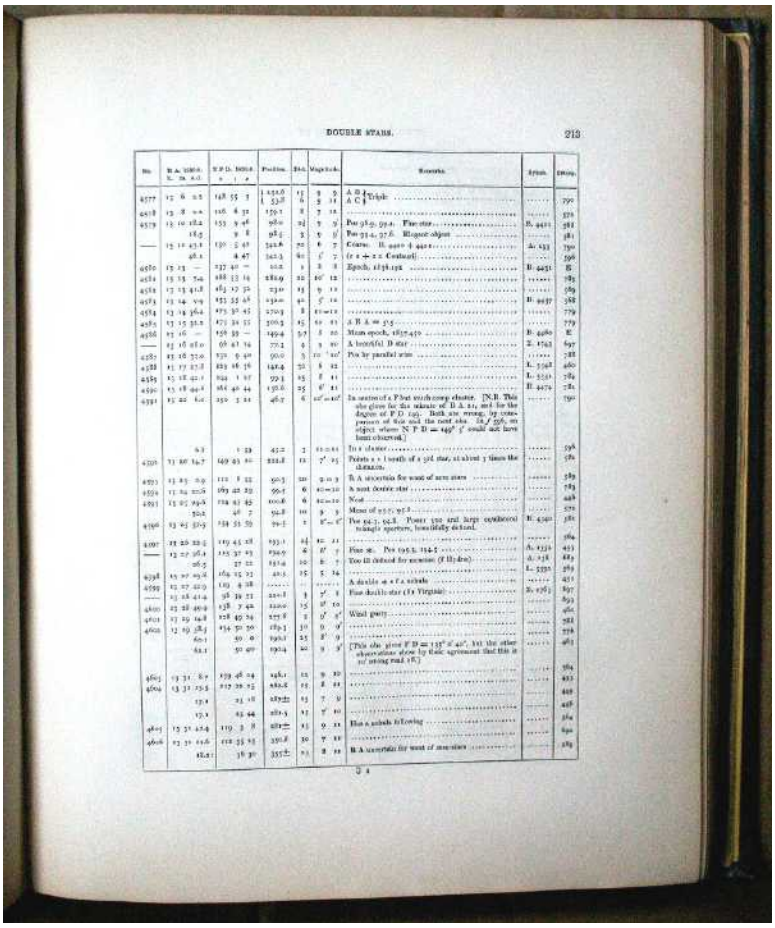
and mode of distribution is to be met with. The nebula itself (as seen in the 20 feet reflector) is of the milky or irresolvable kind – quite as free from any mottling or incipient stellar appearance as any other nebula which I can remember to have examined with that instrument. Its situation in the Nubecula is immediately adjacent to two large and rich clusters (h. 2922, and h. 2931). Mr. Dunlop remarks that 'the 30 Doradûs is surrounded by a number of nebulae of considerable magnitudes, 9 or 10 in number, with the 30 Doradûs in the centre, of which nebulae he gives a figured representation. For what object these can be intended I am quite at a loss to conjecture, unless they be the brighter portions of the nebulous convolutions seen without the connecting embranchments. But with this supposition their relative situations, intensities, and magnitudes in the figure alluded to, so far as I am able to judge, appear irreconcilable.



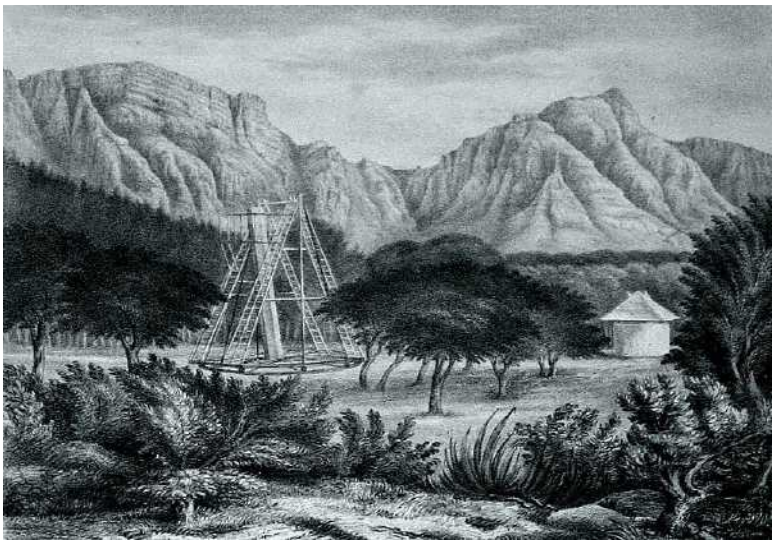
The remarkable object h. 3145 is by no means referable to this normal class. It is expressly described as brightest, not in the middle of its length, but at one end. Neither is its figure elliptical, but broader at the faint than at the bright extremity, the bounding lines being nearly rectilinear. It is a very faint and delicate object, and I regret not having obtained more than one observation of it.

The principal object kept in view during the progress of my southern sweeps was the discovery of new nebulae, and the determination, with some degree of precision, of the places of those already known. The detection and measurement of double stars was regarded as of subordinate interest, and allowed to interfere as litle as possible with the former inquiry. During sweeps, therefore, when nebulae were expected, little leisure was allowed for any minute examination of stars, especially on new ground. But in regions which had been once or twice well swept, or where nebulae were thinly scattered, or seemed to be altogether absent, stars down to the 6th or 7th magnitudes were (at least during the last two years over which the observations were continued) seldomly finally dismissed from the field of view till they had undergone the application of one or more of the diaphragms, whether circular or triangular (almost universally the latter), with or without increased magnifying powers, according to the state of the air. Of the defining and dividing power of the telescope under such circumstances, abundant proof has been afforded in the Catalogues of double stars observed with it in England, especially in the 4th, 5th, and 6th, after the mirrors had attained a degree of perfection which, though considerable, yet fell short, in my opinion, of that to which they were wrought subsequently.

To have executed a regular review of the southern heavens with the twenty-feet reflector, for the purpose of detecting close double stars, would have required at least two additional years, and probably more, since such reviews can only be carried on with effect in those states of the atmosphere when definition is perfect. Now in the hot season the opportunities are comparatively rare. The only mode of observation in which such a review is practicable with an instrument of this construction, is by carrying out the system of zone observations on the meridian with extensive prepared working lists of known stars.


DOUBLE STARS. 213

The building in which this instrument [refractor] was placed was circular, consisting of a wall 7 feet 8 inches high from the floor, with a recess on the north side for receiving the pier, and a door-way on the west. Its internal diameter was 9 feet 4 inches, and on the top was bedded a wooden circle of 4½ inches in thickness by 7 in breadth, supporting and held together (so as to break joints) by a cast-iron circular rail, the projection being destined to carry the rollers of the revolving roof; and forming, when laid down and screwed fast on its bed, a circle of 10 feet 6 inches diameter from summit to summit of the projecting part.



Cape Town as it would have appeared during the 1830s. Feldhausen – the residence of the Herschels from January 1834 (with three children) to March 1838 (with six children) – was located on the southern side (at right). This was the time of migration of Boers disillusioned with British colonial administration, taxation, restrictive laws, and recognition of equality between settlers and native inhabitants. This Great Trek led to the founding of the Transvaal, the Orange Free State, and the Natalia Republic.

The site of the reflector (*R*) was now easily ascertained by prolonging *ab* to a further distance, *bc* = 551.04 feet, and thence erecting a perpendicular, *CR* = 56.69 feet, to the centre of its foundation ring. The geodesical coordinates of this point, from the centre of the transit instrument at the observatory, were finally ascertained, by careful measurement on a chart laid down on a large scale from these data, to be 17,595 feet in the direction of the meridian to the south, and 5,190 feet in that of a parallel to the west of that centre. Its geographical situation was therefore in lat. 2' 53".55 south, and in long. 4s.11 to the west of the Cape Observatory. The record of its site is preserved on the spot by a granite column erected after our departure by the kindness of friends, to whom, as to the locality itself and to the colony, every member of my family had become, and will remain, attached by a thousand pleasing and grateful recollections of years spent in agreeable society, cheerful occupation, and unalloyed happiness.

The Herschels returned to England in March 1838, and in 1840 they moved to Collingwood, near Hawkhurst, Kent.

After the deaths of John Herschel in 1871 and his wife Margaret in 1884, the members of the family still living at Collingwood went their various ways. Francisca – who never married – returned to Observatory House, Slough, the old family home, where she was later joined by her widowed sisters Constance Anne Lubbock and Julia Mary Maclear. On 25 August 1922 – the centenary of the death of William Herschel – Observatory House was visited by several Fellows of the Royal Astronomical Society, including C. D. P. Davies and W. H. Steavenson.

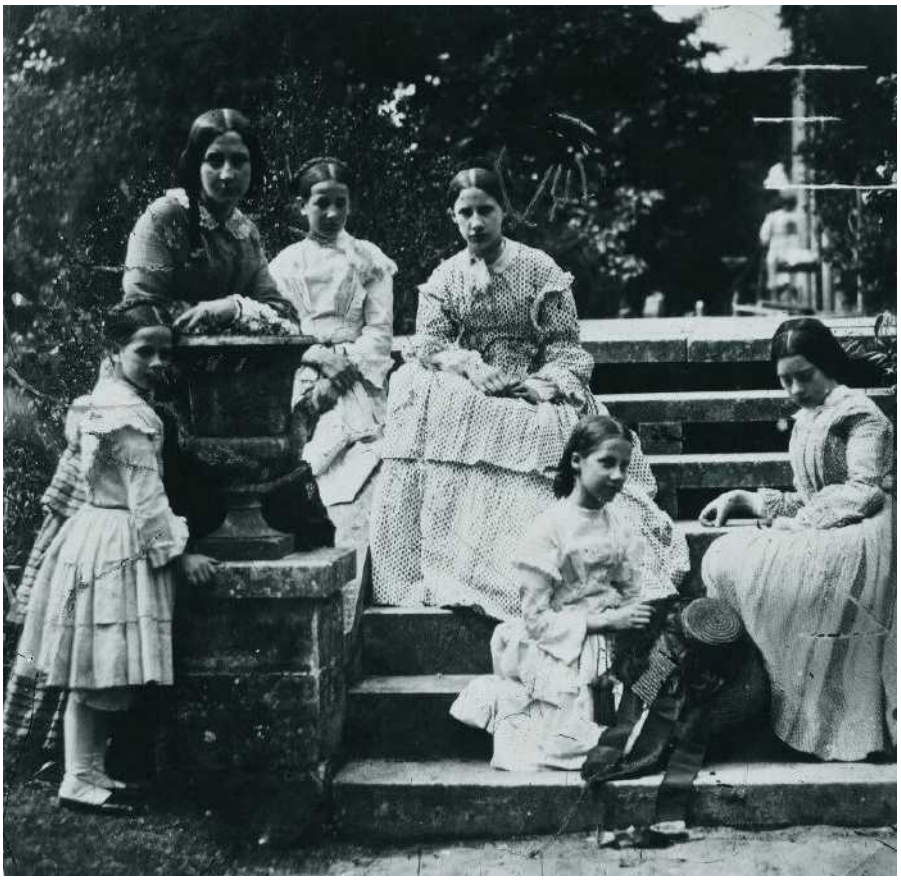
In June 1923, Davies and Steavenson returned to Observatory House in order to test one of the three 18¾-inch mirrors that John Herschel had used at the Cape. This was the only mirror remaining with the family, but it was not known whether it was No. I, No. II, or No. III, as recorded by Herschel. These mirrors were made of speculum metal – an alloy of copper and tin – decades before the advent of successful silver-on-glass mirrors (which I have termed 'The Silver-on-Glass Revolution').

At Feldhausen, close to the ocean, the mirrors tarnished very quickly due to the salty air. Therefore, constant maintenance was necessary, and the mirrors sometimes had to be exchanged and cleaned as frequently as every few weeks. With silver-on-glass, the silver coating can be replaced without affecting the figure, but the cleaning of speculum metal can involve an optical polish during which the figure must be carefully retained. Speculum metal is heavier than standard glass by a factor of about 3.3, so an 18¾-inch mirror would have weighed about 240 lbs (about 110 kg), compared with about 73 lbs (about 33 kg) for a glass mirror. However, Herschel had taken with him a mechanic, John Stone, who no doubt participated in much of the onerous work.

In 1992, Davies's granddaughter, Mrs Marian Deuchar, presented me with all of his astronomical letters, documents, and photographic plates. These include notebooks and records of his work on mirror-making, and correspondence and papers concerning several of his eclipse expeditions. He travelled to Algiers in 1900, Spain in 1905, and Paris in 1912, and prepared for an expedition to Russia to observe the eclipse of 21 August 1914. Finally, he was in Giggleswick, Yorkshire, to observe the eclipse of 29 June 1927. Some of these documents formed the basis of my articles '1927: a British eclipse' (BAA *Journal*, 1999) and 'C. D. P. Davies and the 1914 solar eclipse' (*I&I News*, NS No. 30, 2017). Other documents include Davies's correspondence with Francisca Herschel following the testing of the mirror, and plans for another visit. These are now presented here, after the photographs of ten of John and Margaret Herschel's twelve children. Davies's paper on the testing of the mirror is presented in its entirety, and is followed by one of Julia Margaret Cameron's superb portraits of John Herschel, taken at Collingwood in April 1867.

Feldhausen.
Photograph by Caroline Emilia Mary Hamilton-Gordon (née Herschel), 1898.

Collingwood.
In February this year I was at last able to visit this grand house. I am grateful to Ivan Walton for arranging this visit, and to Ann Pattihis, her husband Marios, and her mother, the current residents, for their hospitality.



Six of Herschel's nine daughters (and three sons), *c.*1860. *Left–right*: Constance Anne (1855–1939, married Sir Nevile Lubbock in 1881); Caroline Emilia Mary (1830–1909, Lady-in-Waiting to Queen Victoria, married General The Honourable Sir Alexander Hamilton-Gordon in 1852); Margaret Louisa (1834–1861, married Reginald Dykes Marshall in 1859); Isabella (1831–1893, not married); Francisca (1846–1932, not married); Mathilda Rose (1844–1914, married William Waterford, *c.*1874). (Photograph courtesy National Portrait Gallery.) John Herschel was aged 63 when Constance Anne was born. In a letter to Herschel dated 24 January 1865, William Rutter Dawes – a close friend of Herschel and his family for almost forty years – wrote of her with affection: 'Your account of Constance pleased me much. Dear child! May every blessing attend her, &, though her parents' "evening star", may she shine more & more brightly, & her setting be deferred till the middle of the next century! What will be the state of the world then? is a question so often put, which none can answer.' In 1933, Lady Constance Lubbock edited and published *The Herschel Chronicle*, on the lives and work of William and Caroline Herschel.

Two sons and two daughters, *c.*1860. *Left–right*: William James (1833–1917); Amelia (1841–1926, married Sir Thomas Francis Wade, Professor of Chinese at Cambridge University); Alexander Stewart (1836–1907); Julia Mary (1842–1933, married John Fiot Lee Pearse Maclear, Commander of HMS *Challenger*). (Photograph courtesy National Portrait Gallery.) The last of the Herschel family with that name was the Rev Sir John Charles William Herschel (1869–1950), son of (Sir) William James Herschel and Emma Hardcastle.

Francisca, *c.*1860

63 years later ...

Observatory House
Slough

Dear Mr. Davies

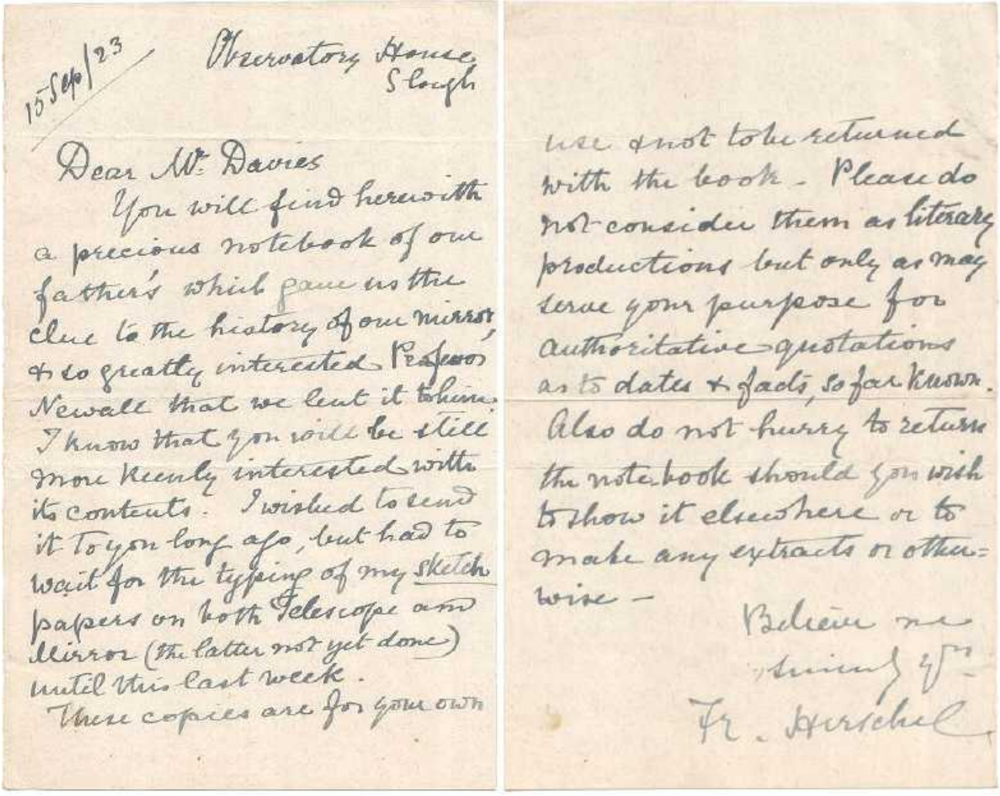
I thank you very much for your kind appreciation of what little help I have been able to afford you. Also for the pleasant news of a now possible visit from Mrs. Davies & yourself. We would be happy to receive you at lunch-time as these shortened days give but little chance of any sun-light later in the day -

For the present week and up till Thursday 27th) next week alas! our time will be fully occupied with upsetting and arranging our rooms for a Sale of Work (C.E.Z.M.S) which we have not had for many years here.

But all will be finished again & clear on the Friday following - or should any day suit you better in early October which the exception of Tuesday 2nd October - My sister & I both under-stand and sympathise with Mrs. Davies when the fiat goes forth that too much walking must be put a stop to.

With kind regards
Believe me
Yr very sincerly
J. Herschel

On 15 September 1923, Francisca sent Davies 'a precious notebook of our father's which gave us the clue to the history of our mirror', together with her typed notes on the mirrors and the telescope, including extracts from the notebook as 'authoritative quotations as to dates & facts, so far known.'



15 Sep/23 Observatory House, Slough

Dear Mr Davies

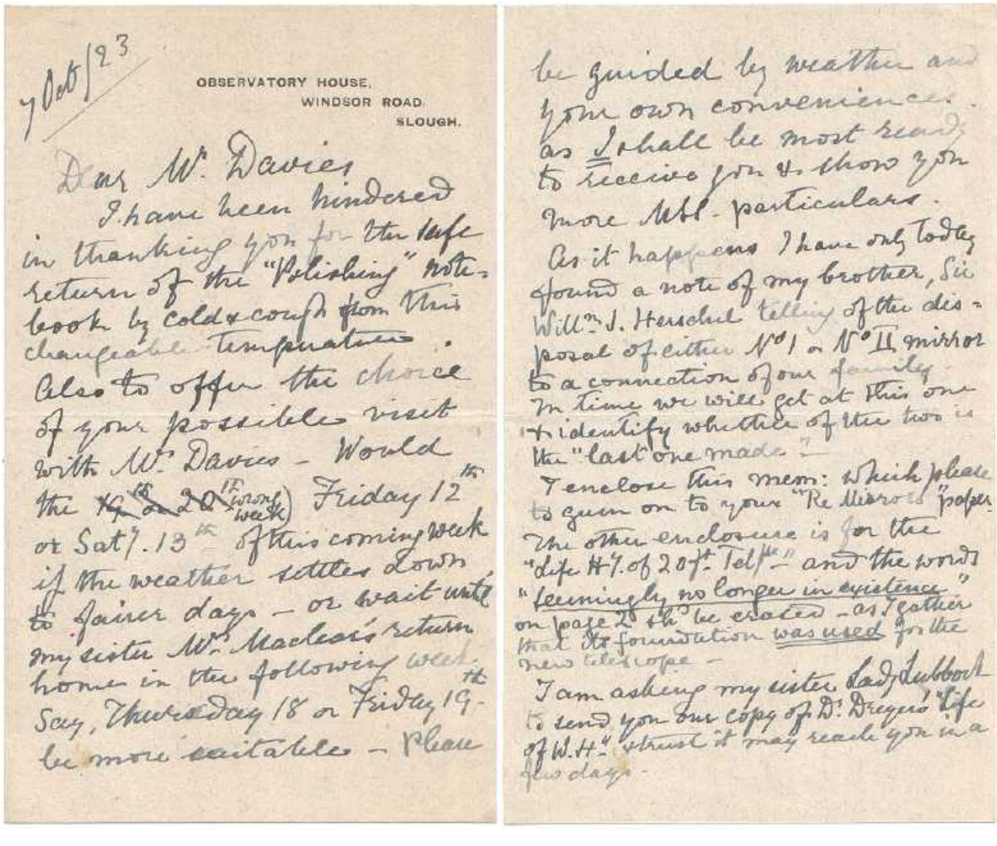
You will find herewith a precious notebook of our father's which gave us the clue to the history of our mirror, & so greatly interested Professor Newall that we lent it to him. I know that you will be still more keenly interested with its contents. I wished to send it to you long ago, but had to wait for the typing of my sketch papers on both Telescope and Mirror (the latter not yet done) until this last week.

These copies are for your own use & not to be returned with the book. Please do not consider them as literary productions but only as may serve your purpose for authoritative quotations as to dates & facts, so far known. Also do not hurry to return the notebook should you wish to show it elsewhere or to make any extracts or otherwise —

Believe me sincerely Yrs

Fr. Herschel

On 7 October she extended another invitation to Davies and his wife Jessie (*née* Mudge, great-great-granddaughter of the eighteenth-century horologist Thomas Mudge) to visit her later that month, when they would be able to meet her sister Mrs Maclear – Julia Mary Herschel (1842–1933), who in 1878 had married John Fiot Lee Pearse Maclear (1838–1907), son of Sir Thomas Maclear (HM Astronomer at the Cape Observatory), Commander of HMS *Challenger* during the Expedition of 1872–76, promoted to Vice Admiral in 1897 and Admiral in 1903. Concerning the fate of the mirrors, Francisca had 'only today found a note of my brother, Sir Willm. J. Herschel telling of the disposal of either No I or No II mirror to a connection of our family. In time we will get at this one and identify whither of the two is the "last one made" ... I am asking my sister Lady Lubbock to send you our copy of Dr Dreyer's "Life of W. H." & trust it may reach you in a few days.'



7 Oct/23

OBSERVATORY HOUSE,
WINDSOR ROAD
SLOUGH.

Dear Mr Davies

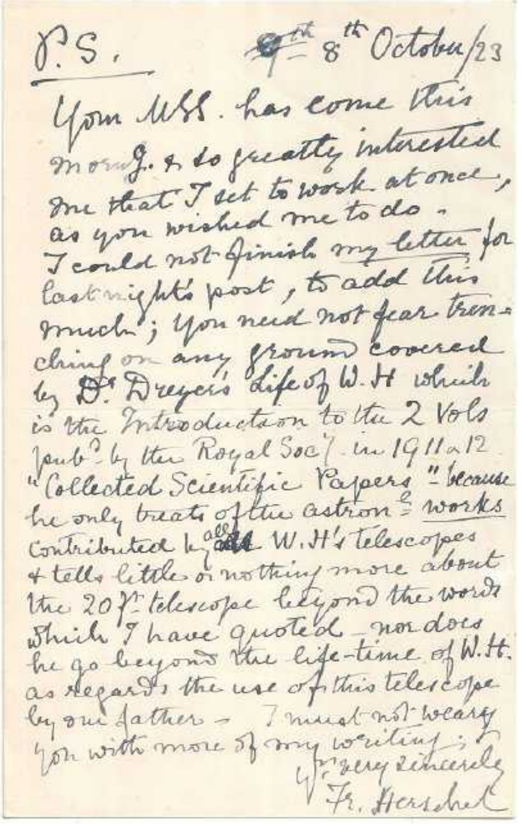
I have been hindered in thanking you for the safe return of the "Polishing" notebook by cold & cough from this changeable temperature. Also to offer the choice of your possible visit with Mrs Davies — Would the ~~[illegible]~~ (wrong week) Friday 12th or Saty. 13th of this coming week if the weather settles down to fairer days — or wait until my sister Mrs Maclear's return home in the following week. Say, Thursday 18 or Friday 19th be more suitable — Please be guided by weather and your own convenience. as I shall be most ready to receive you & show you more MS. particulars.

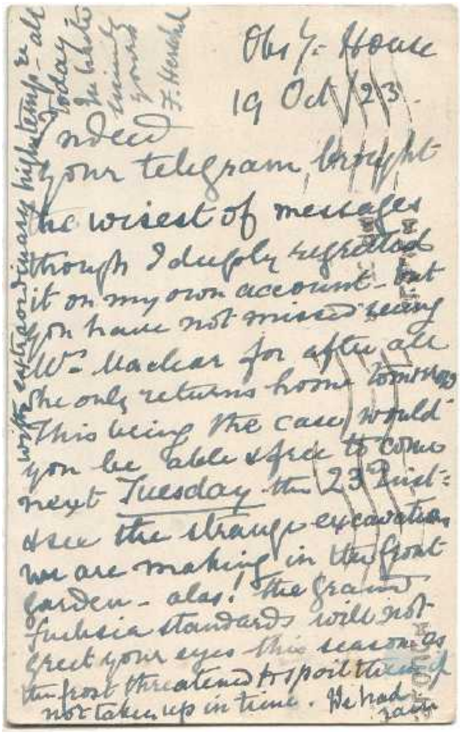
As it happens I have only today found a note of my brother, Sir Willm J. Herschel telling of the disposal of either No I or No II mirror to a connection of our family. In time we will get at this one & identify whither of the two is the "last one made".

I enclose this mem: which please to guide on to your "Re Mirrors" paper. The other enclosure is for the "Life H.Y. of 20ft. Telpe" and the words "seemingly no longer in existence" on page 20 to be erased — as I gather that its foundation was used for the new telescope —

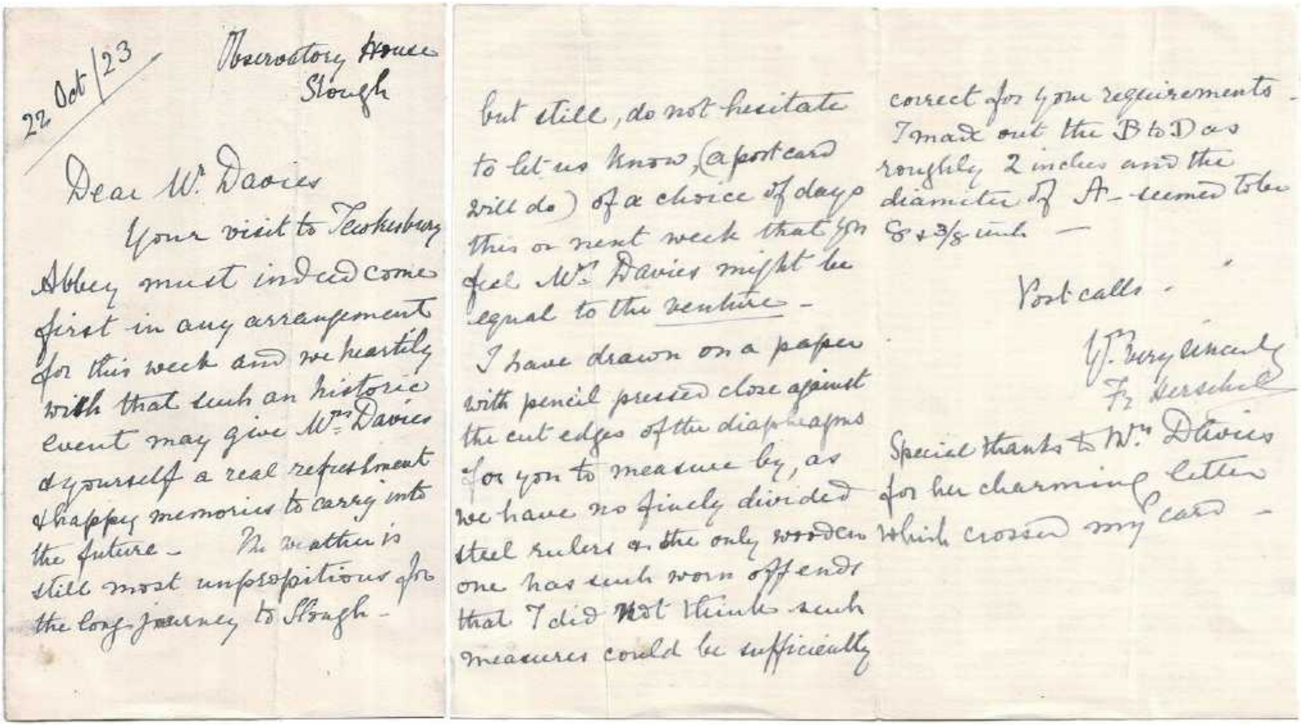
I am asking my sister Lady Lubbock to send you our copy of Dr Dreyer's "Life of W.H." & trust it may reach you in a few days.

As a postscript to this letter she added that she had received the draft of Davies's paper on the testing of the mirror which he was writing for the Royal Astronomical Society. Following a telegram from Davies postponing the visit due to adverse weather, Francisca replied that 23 October would be a convenient date for the visit, as Mrs Maclear would be at home. They would also be able to see 'the strange excavation we are making in the front garden.'


P.S. ~~9th~~ 8th October/23
Your MSS. has come this morng. & so greatly interested me that I set to work at once, as you wished me to do - I could not finish my letter for last night's post, to add this much; you need not fear trenching on any ground covered by Dr Dreyer's Life of W.H which is the Introduction to the 2 Vols pub^d by the Royal Soc^y in 1911 & 12 "Collected Scientific Papers" - because he only treats of the astron^l works contributed by all W.H's telescopes & tells little or nothing more about the 20 ft telescope beyond the words which I have quoted - nor does he go beyond the life-time of W.H. as regards the use of this telescope by our father - I must not weary you with more of my writing; Yrs very sincerely
Fr. Herschel


Obs^y House
19 Oct/23.
Indeed your telegram brought the wisest of messages though I deeply regretted it on my own account - but you have not missed seeing Mrs Maclear for after all she only returns home tomorrow. This being the case would you be able & free to come next Tuesday the 23 Inst: & see the strange excavation we are making in the front garden - alas! the grand fuchsia standards will not greet your eyes this season as the frost threatened to spoil them if not taken up in time. We had rain
F. Herschel

Unfortunately, the weather again prevented the visit, as by 22 October it was 'still most unpropitious for the long journey to Slough' from Fretherne, Gloucestershire. In the meantime, Francisca sent Davies some diagrams that she had prepared, together with additional measurements. (These diagrams remain with the collection of letters and other papers.)


22 Oct/23 Observatory House
Slough

Dear Mr Davies
Your visit to Tewkesbury Abbey must indeed come first in any arrangement for this week and we heartily wish that such an historic event may give Mrs Davies & yourself a real refreshment & happy memories to carry into the future - The weather is still most unpropitious for the long journey to Slough -

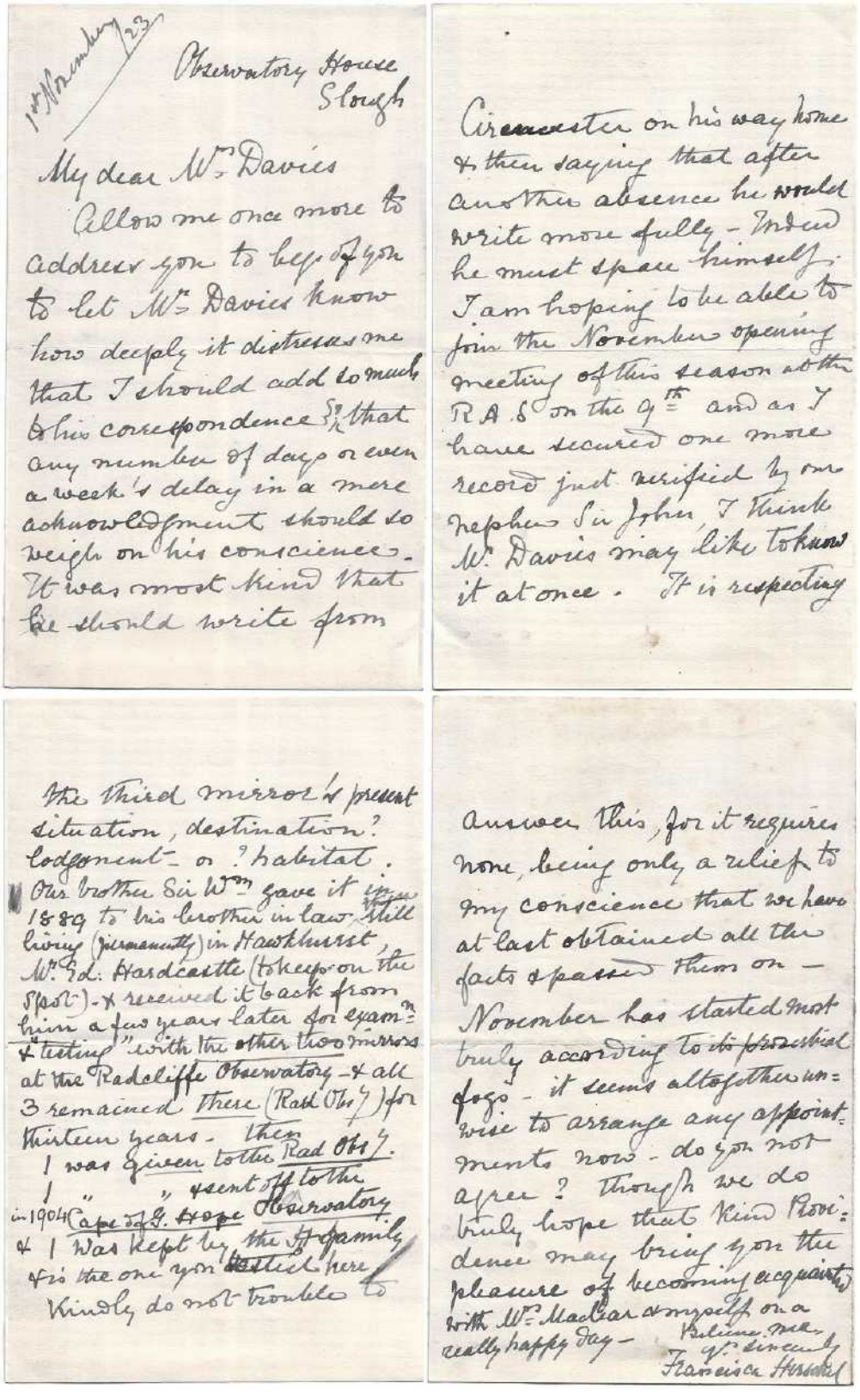
but still, do not hesitate to let us know, (a postcard will do) of a choice of days this or next week that you feel Mrs Davies might be equal to the venture -
I have drawn on a paper with pencil pressed close against the cut edges of the diaphragms for you to measure by, as we have no finely divided steel rulers & the only wooden one has such worn off ends that I did not think such measures could be sufficiently correct for your requirements - I made out the B to D as roughly 2 inches and the diameter of A - seemed to be 8 + 3/8 inch -

Post calls -

Yrs very sincerely
Fr Herschel

Special thanks to Mrs Davies for her charming letter which crossed my card -

By the beginning of November the intended visit had still not been possible. Francisca, however, in a letter to Mrs Davies, supplied additional information respecting 'the third mirror's present situation, destination? lodgement or ?habitat. Our brother Sir Wm. gave it in 1889 to his brother in law still living (permanently) in Hawkhurst, Mr Ed. Hardcastle (to keep on the spot) & received it back from him a few years later for examn. & "testing" with *the other two* mirrors at the Radcliffe Observatory [Oxford], and all 3 remained *there* (Rad Obsy) for thirteen years. Then, 1 was *given* to the Rad Obsy, 1 was given and sent off to the Cape of G. Hope Observatory in 1904, & 1 was kept by the H family & is the one you tested here.' This, she declared, was 'a relief to my conscience that we have at last obtained all the facts & passed them on.' Finally, 'we do truly hope that kind Providence may bring you the pleasure of becoming acquainted with Mrs Maclear and myself on a really happy day.'



1st November 23

Observatory House
Slough

My dear Mrs Davies

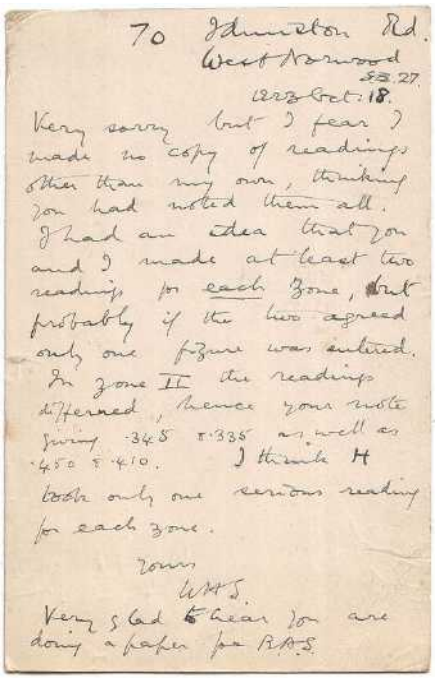
Allow me once more to address you to beg of you to let Mrs Davies know how deeply it distresses me that I should add so much to his correspondence Sir K that any number of days or even a week's delay in a mere acknowledgment should so weigh on his conscience. It was most kind that he should write from Circencester on his way home & then saying that after another absence he would write more fully - Indeed he must spare himself. I am hoping to be able to join the November opening meeting of this season at the R A S on the 9th and as I have secured one more record just rectified by our nephew Sir John I think Mrs Davies may like to know it at once. It is respecting the third mirror's present situation, destination? lodgement - or ? habitat. Our brother Sir Wm gave it in 1889 to his brother in law still living (permanently) in Hawkhurst, Mr Ed. Hardcastle (to keep on the spot) - & received it back from him a few years later for examn & "testing" with the other two mirrors at the Radcliffe Observatory - & all 3 remained there (Rad Obsy) for thirteen years - then

1 was given to the Rad Obsy.
1 " " sent off to the
in 1904 Cape of G. Hope Observatory
& 1 was kept by the H family
& is the one you tested here.

Kindly do not trouble to answer this, for it requires none, being only a relief to my conscience that we have at last obtained all the facts & passed them on -

November has started most truly according to its proverbial fogs - it seems altogether unwise to arrange any appointments now - do you not agree? though we do truly hope that Kind Providence may bring you the pleasure of becoming acquainted with Mrs Maclear & myself on a really happy day -

Believe me
Yrs sincerely
Francisca Herschel



70 Johnston Rd.
West Norwood
SE.27.
1923 Oct. 18.

Very sorry but I fear I made no copy of readings other than my own, thinking you had noted them all. I had an idea that you and I made at least two readings for each Zone, but probably if the two agreed only one figure was entered. In Zone II the readings differed, hence your note giving .345 & .335 as well as .450 & .410. I think H took only one serious reading for each Zone.

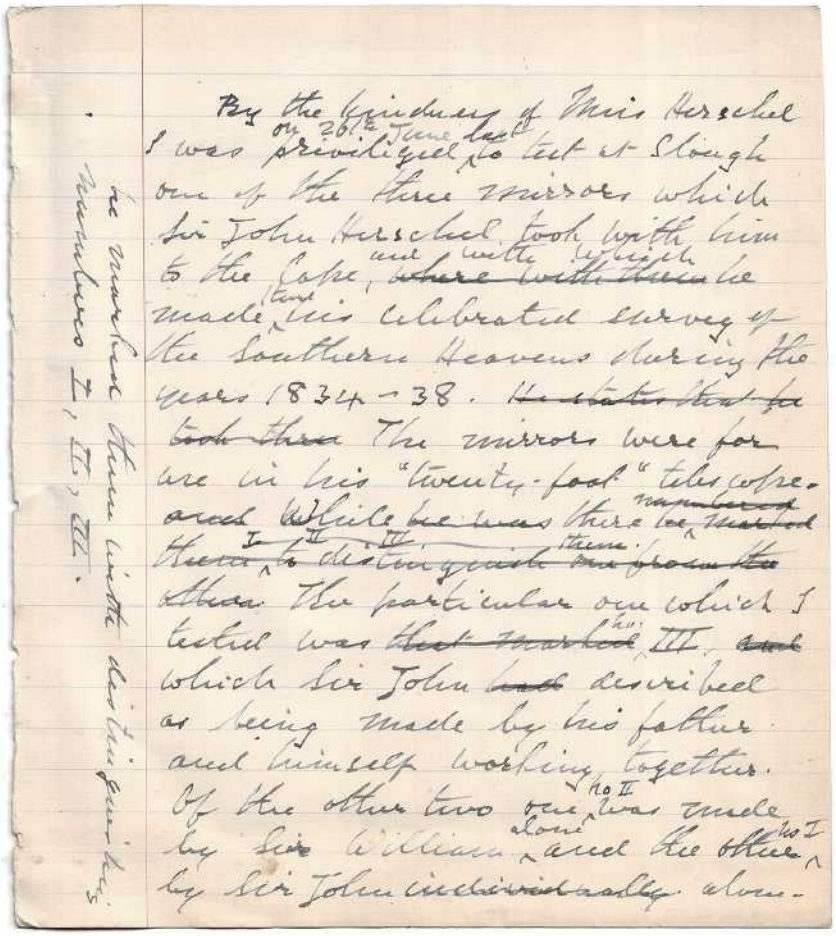
Yours
WHS.

Very glad to hear you are doing a paper for R.A.S.

On 18 October, Steavenson replied to Davies's request for confirmation of some of the measures, noting that he was 'very glad to hear you are doing a paper for RAS'.

C. D. P. Davies

W. H. Steavenson



By the kindness of Miss Herschel on 26th June last I was privileged to test at Slough one of the three mirrors which Sir John Herschel took with him to the Cape, and with them he made his celebrated survey of the Southern Heavens during the years 1834–38. The mirrors were for use in his "twenty-foot" telescope and while he was there he numbered them I, II, III. The particular one which I tested was No. III, which Sir John described as being made by his father and himself working together. Of the other two one was made by Sir William alone and the other by Sir John individually alone.

The first page of Davies's manuscript of his paper, published in November 1923.

Herschel's 18¾-inch speculum (the '20 ft')

C. D. P. Davies

Monthly Notices of the Royal Astronomical Society, 84 (1923), 23–6

By the kindness of Miss Herschel I was privileged on June 26 last to test at Slough one of the three mirrors which Sir John Herschel took with him to the Cape, and with which he made there his celebrated observations of the southern heavens during the years 1834–38. The mirrors were 'for use' in his '20-ft. telescope'. While there he marked them with distinguishing Nos. I, II, III.

The particular one which I tested, identified later by the finding of the small figure '3' on its edge, was therefore No. III, which Sir John described as having been made by his father and himself working together. Of the other two, No. II was made by Sir William alone, and the remaining one, No. I, by Sir John alone.

Before giving the results of the testing of No. III it may prove interesting to give a brief outline of its history, as gathered from the various allusions to it in the Notes and Memoranda. From the fact that it was made by Sir William and Sir John working in conjunction, its date of origin can be fixed within fairly narrow limits.

Sir John Herschel was not born until 1792, and it is scarcely likely that he would be associated with his father in such a task as the grinding and figuring of a large mirror before the age of sixteen years or thereabouts. This brings us to 1808. Sir William died in 1822. We thus get a clear and definite limit on either side. From a rather hurried perusal of Sir William's record (MS) of grinding and polishing work in the year 1818, and from the fact that in two instances, and apparently in these two only, he used the plural pronoun 'we', both entries referring to the same mirror, it seems highly probable that by the 'we' are meant Sir William and his son, and that the mirror on which they were at work was the one now in question. This would be when Sir John was twenty-six years of age – a highly probable period for work of this sort.

In the Notes kindly supplied to me the first actual mention of the telescope of which our mirror, if not then, at least later on, formed part, occurs in Sir John Herschel's diary under date 1820 December 15, where he says that he occupied the morning in 'repairing the 20 ft'. The instrument was set on the Moon in the evening, and in a subsequent note it is stated that it continued in use throughout the succeeding year (1821). It was again put in order on 1822 April 1.

Then comes a long interval, and it is not until 1833 August 1 that we find mention of it once more. That mention is most brief and most interesting, viz, 'Packing the 20 ft'. He sailed for the Cape on November 13, and with him went our mirror packed, as stated in the 'Cape Register of goods shipped', in an elm box.

At the Cape, which he reached on 1834 January 16, the mirrors seem to have preserved their efficiency for some months. But in August he says that his 'two best' mirrors were so tarnished as to be useless. By the 'two best' he evidently means No. I, which he made himself, which was the most recent, and which he more often than not calls the 'long-focussed one,' and our No. III, usually called the 'short-focussed one'. He therefore fitted up his 'polishing apparatus', and in his subsequent Notes we find descriptions more or less full of the polishing of mirror No. III. Of these the following is a brief résumé.

'1834 September 9. Polished it. On trial on the following night (10th); it proved very successful.' In the course of his note he gives us to understand that the mirror on some former occasion had not been improved by an attempt to clean its surface with citric acid.

It was again polished on 1834 December 8, and successively early in January, in the middle of June, and again in the middle of December 1835. It was polished yet again in 1836 November, and once more on 1837 April 12; his description of the result of the last being: 'The polish was fine, and remarkably free from scratches, but the deeper tarnish spots were not quite effaced.' The tarnish spots were apparently caused by the citric acid treatment.

In March 1838, Sir John sailed from the Cape, reaching England in May, the 20-ft telescope having, as has been truly stated, 'triumphantly accomplished the noble task for which it had been constructed.' So far as is known this telescope was never erected again, being taken in 1840 from Slough to Hawkhurst, where its tube lay through one vicissitude after another – including the death of Sir John Herschel in 1871, that of his widow in 1884, and even the departure of the family in 1888 – until 1921, when it was reclaimed and brought back to its old home at Slough, our mirror, with all the other 'belongings', having been brought back thither in the previous year (1920). It was kindly placed on view for the visit of Fellows of the Society and others on 1922 August 25, the centenary of the death of Sir William Herschel.

It is always very delightful to find others interested in the Foucault test. In testing the mirror at Slough I had the pleasure of the presence of the Rev Sir John Herschel and also of Dr Steavenson, both of whom were keenly interested in the process throughout, and whose independent measures of the zones afforded me the great satisfaction of being in practical accordance with my own, the three sets of measures being mutually corroborative, and thus affording strong presumption of their accuracy.

In describing the testing it should be stated that the exact diameter of the mirror is 18.75 inches, the extra ⅜ inch all round being doubtless designed to afford a clear aperture of 18 inches, avoiding all risk of irregularities at or near to the edge. Had I known at the time that there had ever been 'tarnish spots' on its surface, as shown by Sir John's notes at the Cape, I should have looked with especial care for any traces of them. As my impression was that the surface was in excellent condition I feel that it may safely be taken for granted that the spots had been practically obliterated.

The mirror, being very heavy, was not removed from its box, the box, with the mirror in it, being set up and secured in the position required. Diaphragms were employed with zones having radii of 8.875 inches, 8.125 inches, 5.375 inches, and 2.5 inches. The first of these (A) exposed a zone of the mirror from a radius of 8.375 inches to the extreme edge. The other three, numbered I, II, III respectively, exposed each of them a zone 2 inches broad, the mean or central radius of the zones being as given above.

The radius of curvature (R) of the mirror measured exactly 40 ft, making the length of the principal focus precisely 20 ft, in full accordance with the name always given to it by its owner.

In the formula $a = r^2/R$, we thus get R = 480, while for the values of r_2 we get

A	78.765
I	66.015
II	28.890
III	6.250

And for *a*

A	0.164
I	0.137
II	0.060
III	0.013

Taking *a* as zero for A, and reckoning therefrom *towards* the mirror, we get the following values of *a*:

A	0.000
I	0.027
II	0.104
III	0.151

Or, in the event of irregularity at the extreme edge of the mirror causing uncertainty or difficulty in fixing the exact focus of the outermost zone, taking *a* as zero in I, we have

A	–0.027
I	0.000
II	0.077
III	0.124

The actual measures are as follows:

A	–0.125
I	0.000
II	0.410
III	0.550

Or, if preferred, reducing these same measures to the zero of A:

A	0.000
I	0.125
II	0.535
III	0.675

The measures taken by Rev Sir John Herschel and Dr Steavenson are:

	Herschel	Steavenson
A	0.185	–0.125
I	0.000	0.000
II	0.400	0.450
III	0.495	0.550

both of which sets will be seen to be in practical accordance with my own measures, the greatest difference in any two readings of the same zone being that between Sir John's readings of A and III and those of Dr Steavenson and myself, viz. $^3/_{50}$ of an inch – not a very striking difference in a length of 40 ft.

At first sight it may seem that the measures indicate a rather serious departure from the perfect parabolic curve. Of course, the curve is deeper than theory indicates, that is to say, the mirror is hyperbolic. But when it is borne in mind that in the days when it was made, the principle of testing at the centre of curvature was unknown, and that even when tested by this more recent and minutely accurate method the greatest difference of focal length amounts to no more than 0.426 inch; and when it is further remembered that testing at the principal focus was the only test at the disposal of the men of that day, and that such test was only one quarter as powerful as the Foucault test, that is, that the error, so far as they could read it, and, we may add, so far as concerns the actual use of the mirror, amounted to just about $^1/_{10}$ of an inch, it is impossible not to be filled with admiration for their work.

But this is not all. As yet I have spoken only of the zonal testing. The other portion of the Foucault test, that in which the appearance of the mirror is judged as a whole, in contradistinction to its piecemeal examination zone by zone, that generally known as the 'shadow' test, reveals in the case of this historic speculum a remarkable regularity of curvature throughout. There is a complete absence of rings, sudden gradations, mounds, or pools, the shadow coming on and going off with the motion to or fro of the shutter just as it should do. Altogether the mirror is a grand specimen of the work of the two great men who produced it, and is one more proof, if such were needed, of the sureness and soundness of the foundations on which rest the undying reputations of Sir William and Sir John Herschel.

Sir John Herschel, aged 75. One of several photographs of him by the renowned photographer Julia Margaret Cameron, who lived in Freshwater, Isle of Wight. The inscription reads: 'From Life, taken at his own residence, Collingwood, April 1867, Julia Margaret Cameron.' In 1869, Cameron presented an album of seventy-four photographs taken between 1864 and 1869 to her daughter, Julia Hay Norman, and son-in-law, Charles Norman, in gratitude at their having introduced her to photography by giving her her first camera. The title of the album is *Mrs. Cameron's Photographs from the Life*, though it is usually known as The Norman Album. The dedicatory inscription reads: 'To the givers of my camera I dedicate/give these works of this camera, with all gratitude for the inexhaustible pleasure to me, & to hundreds, which has resulted from the gift. Freshwater Bay, Isle of Wight, 1869 Sep 9.'