

10^5 times that of ordinary viscosity for bottom velocities over 2 knots.

In the discussion which followed, *Dr. Jeffreys* remarked that observers had found that the maximum velocity occurred in rivers one-third of the depth down. *Prof. Lamb* commented on how the determination of the Earth's rigidity from tidal observations alone seemed to wax and wane periodically in popularity. *Prof. Proudman* stated, in answer to *Prof. Turner*, that the process of numerical integration in the case of the Red Sea could be done by a skilled computer in a day. *Prof. Proudman*, at the request of the Chairman, gave a *résumé* of the history of the determination of the Earth's rigidity from tidal observations: Lord Kelvin had first pointed out that a comparison of tidal observation and theory should give the Earth's yield, and that the fortnightly term seemed especially suitable. Proceeding on these lines, Darwin had found that the Earth was about as rigid as steel, but later had found that the theoretical fortnightly term in a frictionless ocean of uniform depth covering the whole globe was not an equilibrium tide. *Prof. Lamb* had given the dynamical reason for this, but Lord Rayleigh had pointed out that the objections were not valid for basins of uniform depth bounded by meridians. There was no guarantee, however, that the fortnightly term followed the equilibrium law, although the effect of friction was much more serious than had often been supposed, and might possibly restore the fortnightly tide to an equilibrium form.

But there were two other difficulties in the use of the fortnightly tide, viz. the uncertainty attached to the results of analysis of observations, and the fact that there was a shallow-water constituent of equal period.

The Red Sea seemed to present an opportunity for determining the Earth's rigidity by a method which, unlike that of the fortnightly term, was free from theoretical objections. What was needed was accurate data. Good harmonic constants ought to be obtained for two or three stations in the middle of the Red Sea.

The Greenwich Assistants during 250 Years.

THE celebration of the 250th anniversary of the founding of the Royal Observatory at Greenwich in the year now ending makes it perhaps not inopportune to collect some information about those who have helped the successive Astronomers Royal in their labours. This may be scarcely more than a list of names with brief personal facts about each, but a sketch of the growth of the staff from its small beginning may not be without interest.

Flamsteed entered into residence at the Royal Observatory on 1676 July 10 with his two servants, T. Smith and C. Denton, and in the same year a sum of £26 was allotted by Treasury

minute as annual salary for an Assistant—a labourer from the Tower to move the instruments, count the clock, and call Flamsteed at hours of the night when necessary. How this somewhat inadequate help was supplemented is to be learned from the well-known volume containing the autobiography and correspondence of Flamsteed compiled by Francis Baily, and to this we turn for the history of these early years.

There is mention of one Cuthbert, who was instructed to bring a bedstead from London for the two Bluecoat boys sent from Christ Church (*sic*) Hospital for Flamsteed to teach. There is evidence that Cuthbert helped with the instruments, and it may be that he was the “surly laborer” that Flamsteed speaks of, and the recipient of the moderate salary allowed by the Treasury. In a memorandum Flamsteed writes: “In the meantime wanting assistance, I took an ingenious young man to be my servant, and some young gentlemen to teach: I employed them in my night observations, to tell the clock, write for me, and such like things as I could trust them in, which saved the public the charge of a pair of necessary assistants and helped to bear the further unavoidable charge of an expensive habitation.” The exact date of this has not been found, but it appears to have been early in Flamsteed’s time. The ingenious young man may possibly have been Stafford, to be immediately mentioned. There is a list of names of Flamsteed’s pupils among his papers that will be referred to later, but the names of those who helped him other than his pupils are found, by turning over the pages of Baily’s volume, to have been: Abraham Sharp (1684), Stafford (d. 1688), A. Sharp (1688), Luke Leigh and three others (1696), Thomas Weston (1696–), J. Hodgson (1696–1702), I. Woolferman (1705), J. Crosthwait (1705–1719), Abraham Ryley, T. Witty (1705–1706). The dates, given in some cases, show approximately the times of their service. The status of these men varied somewhat, and on this point the following extract from a memorandum by Flamsteed written in October 1700 is illuminating:—

The laborer being paid by the Office of the Ordnance as well as myself, looked upon himself as the King’s servant; and being a person fit only for hand labour was rather a hindrance than a help to me, but always a certain charge. For I was forced to allow him diet or want his attendance when I had occasion for him, on his pretence of providing it. Till in the year 1694, the officers allowed me to name my own laborer: since which time I have named one of my own servants and received his pay for his maintenance: which is a favour I must ever acknowledge, and I valued it the more because it made me easy, and furnished me with an ingenious and tractable youth instead of a surly laborer.

Stafford is described by Baily as Flamsteed’s servant, but in another place as amanuensis, and Flamsteed writes that when he (Stafford) died in 1688 he *hired* Ab. Sharp, who had served him for six months four years earlier. It is not clear how the acquaintance between Flamsteed and Sharp arose, but it is

evident that their relations were closer than of master and servant. Luke Leigh was a "poor kinsman of Mr. Halley's," and of the three others associated with him in the above list one was an "ingenious youth, a relation of Sir Christopher Wren," the other two were residents in Derbyshire whose names have not come down to us. About the year 1696 these four were *hired* to compute at their homes, and did not live at Greenwich, the computation being the conversion of observed Right Ascension and Declination into latitude and longitude, which Baily suggests was quite unnecessary. Weston was an expert draughtsman. He was engaged, also in 1696, to make the maps of the constellations, but about 1704 he was described as being then expert in observing. J. Hodgson is mentioned in 1696 as "servant"; but he was certainly a man of some qualities, for he was elected to Fellowship of the Royal Society in 1703, and shortly afterwards became master of the mathematical school of Christ's Hospital. He married Flamsteed's niece, but Flamsteed writes his name Hodgson or Hudson indiscriminately, which seems curious. Baily appears to have no doubt but that the same person is meant. Isaac Wolferman and Joseph Crosthwait are described as Flamsteed's servants, who in 1705-1708 calculated stars in Hercules and Cassiopeia, "enlarged with the addition of many stars observed in the years 1705-8 by them and Mr. Ab. Ryley." The prefix to Ryley's name may be significant.

"He had a servant waited on him that was very good at numbers." This sentence in Baily's volume is apparently taken from the Flamsteed MS., and applies to the period 1695-1704. Baily adds, "no trace of the name of the servant is found." Perhaps the remark refers to Hodgson or to Wolferman. Ryley was evidently in a responsible position in 1713, for when Newton, Halley, and others made what was the first official inspection of the Observatory on August 13 of that year, Mr. Clark, whose name we do not find elsewhere, and Mr. Ryley attended them. Flamsteed did not do so, but it is recorded that he gave the Visitors a glass of wine. Crosthwait was at first called "my servant," "my man," or "Joseph," but about 1711 Flamsteed writes that he procured a couple of expert calculators (Mr. Ab. Ryley and Mr. Crosthwait), and later on Crosthwait is often referred to as "my amanuensis." He was undoubtedly one of the household, and was present at Flamsteed's deathbed*. He was afterwards instrumental with Abraham Sharp in printing and publishing the *Historia Cœlestis*, and in the end felt aggrieved with Mrs. Flamsteed for ungenerous treatment. T. Witty was a calculator engaged in 1705-6 for the preparation of what is known as the "spurious" or "corrupt"

* In a letter to Ab. Sharp, Flamsteed describes Crosthwait as a "Cumberland youth," and in Cudworth's 'Life of Sharp' it is suggested, but not established, that he was a descendant of an old family of that county.

edition. His salary (£30 a year) as well as that of Weston's was paid by the Royal Grant for that publication, and, as Flamsteed included charges for their board in the bill he sent to the referees, it is to be inferred that all lived in the Observatory. As to payment of servants and financial matters generally, Flamsteed, though not a very rich man, must have had a comfortable income in the last part of his life. His father died in 1688, which brought him an addition to his income, and his wife, whom he married in 1692, inherited a patrimony a few years later. Also the living at Burstow must have been of some value. In his early days at the Observatory, as has been said, Flamsteed took pupils, and there is a list of names of 140 pupils that he had between 1676 and 1709—many, if not all of them, belonging to families of rank destined for sea-service; and in connection with this the facts set out in the following paragraph may have some bearing.

In Hasted's '*History of Kent*'* a note on Greenwich Hospital and the attached School states as the origin of the latter that in 1715 certain sums were devoted to sending pensioners' sons to the school of Mr. John Weston, Assistant Astronomer Royal, who reported results in 1716 to the Commissioners. There may be a confusion of names or title, but it does not seem to be a very wild suggestion that Weston, who Flamsteed describes in one place as an "ingenious but sickly youth," left the Observatory and carried on Flamsteed's business of teaching, or, alternatively, that he was the son of a John Weston, who is described wrongly. Thomas Weston is depicted with Flamsteed by Thornhill on the ceiling of the Painted Hall. Weston's Academy lasted for many years in Greenwich, and to it many of the leading families in the neighbourhood sent their sons for education. There are copies to be seen of a drawing-book "for use in the Academy at Greenwich by Thomas Weston," *circa* 1740, the artistic merit of which makes it probable that it was prepared by the same hand that drew the constellation figures†.

Halley is said to have had no Assistant, which may be taken to mean that his helpers paid by the Treasury grant were of so little importance that their names have not survived. There is reason for thinking that he asked Crosthwait to return to the Observatory, but the latter shared the personal objection that Flamsteed had to his successor, and refused to do so. With Bradley we are on surer ground. He went to Greenwich in 1742, and very soon after he procured as his Assistant, John, the son of his eldest

* *Hundred of Blackheath*, Drake's Edition.

† It appears from Baily's '*Flamsteed*' that the figures of the constellations were first designed (1696) by Weston, "who had a faculty of drawing," but in 1703 and 1704 some of the maps of the constellations were anew delineated by P. Van Somer, "an excellent draughtsman, though in years." The engraving of the maps was done after Flamsteed's death, partly in London, by Vandergucht, who was rather dear, and Mynde, who was not so good, and partly in Holland, where they were very slow.

brother, who remained with him for fourteen years. John Bradley was born about 1728, so that he must have been quite a lad when he entered his uncle's service, but "he was an excellent pattern for his successors, and he had the advantage of the very best instruction and executed his great master's plans with unwearied diligence"*. The date of the last observation entered in his hand is September 1756, when he apparently went to sea for about ten years, and in 1767 was appointed second mathematica master of the Royal Naval Academy at Portsmouth under Mr. George Wiche, F.R.S., where he continued to make astronomical observations. He remained at the Academy until his death in 1794, when he was succeeded by his son James. He was sent by the Board of Longitude to the *Lizard* to observe the Transit of Venus in 1761, and during his stay he not only observed the Transit and determined the longitude of the place, but made several other useful observations. His successor was Charles Mason, who had a useful and varied career. He was chosen by the Council of the Royal Society as an observer of the Transit of Venus in 1761, and was instructed to go with Jeremiah Dixon—whose antecedents are not known to the writer, except that it is said he was born in a coal-mine—to Bencoolen, in Sumatra, in a ship of the Navy, the 'Sea-Horse.' But at that time we were at war with France and the 'Sea-Horse' engaged in action with a French frigate and returned to Plymouth somewhat damaged. Mason and Dixon at first refused to start again, but a sharp letter from the Royal Society caused them to change their minds, and they went in the 'Sea-Horse' to the Cape of Good Hope and observed the Transit from there†. We next hear of Mason being sent out, again with Dixon, to the United States by Lord Baltimore to lay down the boundary-line between Maryland and Pennsylvania. They did not complete this work, being stopped by Indian opposition in 1767; but the Mason and Dixon line was long famous as separating the Slave from the Free States, and is believed to be the origin of "Dixey-land," celebrated in song. Whilst in America, Mason and Dixon were commissioned by the Royal Society to measure a degree of latitude. On his return to England, Mason observed the Transit of Venus of 1769 from Cavan, in co. Donegal, by instruction of the Royal Society, and was later deputed by the same body to make a survey of various hills in Great Britain to find one suitable for what is now known as the Schiehallien experiment. After this he appears to have devoted himself, in part at least, to work of a computing kind. In the earliest issues of the *Nautical Almanac* the places of the Moon were formed from 'Mayer's Tables,' but a new edition of these tables, "improved by Chas. Mason" by comparison with Bradley's observations, appeared in 1787, and were used in preparing the *Almanac*. Mason died in Pennsylvania in 1787.

* *Vide* Rigaud's 'Works and Correspondence of Bradley.'

† Weld's 'History of the Royal Society,' vol. ii.

Bradley had some help from one, Gael Morris, who in one place is called Assistant Astronomer Royal, but this help appears to have been in reducing lunar observations, and not to have been done actually at the Observatory, and perhaps without pecuniary recompense.

When Mason left Greenwich to proceed on his Transit of Venus expedition, his place as regular Assistant was taken by Charles Green, who was in charge of the Observatory and made the observations during the last few months of Bradley's life, which were spent in Gloucestershire. He was Assistant throughout Bliss's short reign, and carried on during the months until Maskelyne took charge early in 1765. His observations are published under his own name in the same volume with those of Bliss. He went with Maskelyne to Barbados in 1764 to test Harrison's Chronometer. Green appears to have left the Observatory immediately after Maskelyne's arrival early in 1765, for Joseph Dymond was appointed Assistant on Lady Day of that year. He (Green) was chosen by the Royal Society to observe the Transit of Venus of June 1769, and went with Lieutenant (afterwards Captain) James Cook to the Pacific in the 'Endeavour.' This is generally called Cook's First Voyage, and Cook naturally had command of the ship; but the astronomical observation of the Transit and its concomitants, the determination of the latitude and longitude of the place of observation, which was the main but not exclusive object of the expedition, was chiefly in the hands of Green, who received two hundred guineas from the Royal Society, whereas Cook had one hundred. The Transit was observed well, so far as weather-conditions were concerned, but Maskelyne, who reduced the observations for position, was not very well satisfied with them*. Green died on the homeward voyage from scurvy, as did many others of the party. In Admiral Wharton's book on this voyage it is said that the fatality occurred because Green took no care of his health, but lived in such a manner as to promote the disorders he had on him.

The names of Maskelyne's Assistants are given in a list in an article by Mr. Thos. Lindsay published in the *Transactions of the Astronomical and Physical Society of Toronto* for 1898. The list is said to have been taken directly from Maskelyne's note-books, to which Mr. Lindsay had access, and that it was apparently compiled with care, but there appear to be some inconsistencies with other information. The list is as follows:—

Joseph Dymond, Lady Day, 1765; William Bayly, 1766 November 14; Reuben Burrow, Lady Day, 1771; John Hellins, Michaelmas, 1773; George Gilpin, Lady Day, 1776; Joseph Linly, 1781 July 30; Thomas Horrox, 1786 Sept. 29; Robert Gooch, 1786 Dec. 9; Geo. Plowman, 1787 Jan. 5;

* *Phil. Trans.* vol. lxi. p. 397.

Wm. Malachy Hitchens, 1787 Feb. 10; John Brinkley, 1787 June 23 and 1788 Jan. 27; John Burnstead, 1787 Oct. 16; Joshua Moore, 1787 Dec. 11; Wm. Garrard, 1788 March 25; Wm. Smith, 1789 July 1; John Crossley, 1789 July 16; Benedict Chapman, 1792 April 1; Joshua Garnett, 1793 July 1; David Kinnebrook, 1794 May 23; Thos. Evans, 1796 Feb. 12; Wm. Garrard, 1798 July 1; John Crossley, 1798 July 21; Robert Wallace, 1798 Sept. 22; Francis Nisbet, 1798 Oct. 17; and Thomas Ferminger, 1799 Dec. 17, *who stayed until Maskelyne's death in 1811.*

The dates are those of entry into the Observatory, and in almost every case the date of leaving, given in the list, coincides with that of the next entry. The two dates attached to Brinkley's name have a peculiar significance. Brinkley was Senior Wrangler in 1788, and it seems, if the Tripos examination was then held in January, that he must have come to Greenwich at the end of his third year at Cambridge and worked there until the middle of the next October term. Apparently he went up to Cambridge on 1787 Nov. 9 (the date is recorded), sat for the Tripos, took his degree, and then came back to Greenwich. Brinkley was of Caius College, and he left Greenwich finally to take up an appointment there. In 1792 he was made Andrews Professor of Astronomy at Dublin, a competitor for the post being John Hellins, fourth in the above list. Maskelyne's letter recommending Brinkley for the post, which was rather severe on Hellins, has already been published in this Magazine*. It seems that Hellins was, or became, a clergyman, and a treatise by him on mathematical subjects is extant. Of the others early in the list, Dymond was sent to Hudson Bay by the Royal Society to observe the Transit of Venus of 1769. Bayly went to the North Cape for the same purpose, and afterwards as astronomer with Captain Cook on his second and third voyages. He succeeded Witchell as Principal of the Academy at Portsmouth. Burrow helped Maskelyne in the Schiehallien experiments, and subsequently went to India, where he did important work for the Trigonometrical Survey and contributed several mathematical papers to the *Asiatic Records*†. George Gilpin was Assistant Secretary of the Royal Society from 1785 to 1810. Malachy Hitchens, in the list, was the third son of the Rev. Malachy Hitchens, a life-long friend of Maskelyne, who was "comparer" of the *Nautical Almanac*. The matter of finance connected with these gentlemen is to be gathered from the following Memorial of the Astronomer Royal to the Right Honourable the Lords Commissioners of His Majesty's Treasury:—

That your Memorialist (agreeable to the original institution of the Royal Observatory in the year 1676) is allowed by Government only £26 per annum

* Vol. xxxiv. p. 397

† See Markham's *Memoir of the Indian Surveys*.

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for maintaining an Assistant, which allowance is totally inadequate for the purpose, and that your Memorialist has been obliged to increase it to £60 out of his own pocket.

That notwithstanding this, when by the instructions of your Memorialist the Assistant becomes capable of being useful to him, he finds his labour underpaid and leaves him. That this has repeatedly been the case, to the great inconvenience as well as expense of your Memorialist, and to the obvious detriment of the service of the Institution. That my present Assistant is now about to leave on this account only.

That in the time of the Astronomer Royal who preceded your Memorialist very considerable perquisites arose to the Assistants for showing the Observatory to strangers. But that upon his appointment to be His Majesty's Astronomical Observer in the year 1765 he was strictly forbidden under His Majesty's Sign Manual to suffer any money to be taken for showing the Royal Observatory, which injunction has been punctually obeyed.

That your Memorialist hopes from the facts above mentioned that your Lordships will think it reasonable that an augmentation should be made to the salary of the Assistant, which augmentation your Memorialist conceives should not be less than £70 a year.

March 7, 1771.

A letter supporting this was sent by the President and Council of the Royal Society, Visitors of the Royal Observatory, and on 1771 May 16 the Lords of the Treasury agreed that an additional salary of £70 a year should be given to the Assistant on the understanding that the Astronomer Royal should not suffer any money to be taken for showing the Observatory (*Treasury Minute Book*, No. 41, p. 143).

The date of this Memorial seems to be inconsistent with the remark that the Assistants had "repeatedly" left; for if the above list is complete and correct, Dymond had been the only Assistant who had completed his service before the Memorial was written; but it may be surmised that there had been others whose names are not given. Possibly during Dymond's absence on the Transit of Venus expedition there had been substitutes. Of the other Assistants in the list, one who has particular interest for us is David Kinnebrook, a "martyr of the science." The manner and reason of his martyrdom will be learned from the following extract from 'Maskelyne's Observations,' vol. iii. p. 339, at the end of the transit observations of the year 1795. Maskelyne writes:—

I think it necessary to mention that my Assistant, Mr. David Kinnebrook, who had observed the transits of the stars and planets very well in agreement with me all the year 1794, and for the greater part of the present year, began from the beginning of August last to set them down half a second of time later than he should do according to my observations; and in January of the succeeding year, 1796, he increased his error to 3/10ths of a second. As he had unfortunately continued a long time in this error before I noticed it, and did not seem to me ever likely to get over it and return to a right method of observing, therefore, though with reluctance, as he was a diligent and useful Assistant to me in other respects, I parted with him.

It does not seem to have occurred to Maskelyne that it might have been he who had changed his habit; but, though Maskelyne

is generally described as being of a gentle and retiring disposition, in his dealings with others he seems frequently to have been rather arbitrary. It may be added that it was not until nearly thirty years later, when Bessel, Argelander, Struve, and Walbeck showed differences of this kind, that Personal Equation was recognized in astronomy*.

Evans, who succeeded Kinnebrook, stayed rather more than two years, and then left to take charge of the observatory of Mr. Larkin at the top of Point Hill, Greenwich, in the house now used as a social club. The last name in the list again presents a difficulty, for it is said that Thomas Ferminger (afterwards Dr.) joined the Observatory in December 1799 and remained until Maskelyne's death in 1811. But it is recorded in the *Monthly Notices* † that Thomas Taylor, the father of H. G. Taylor, Director of the Madras Observatory, was appointed Assistant to Maskelyne about the year 1805. He remained on the Observatory staff until the retirement of Pond, so that Ferminger could not have been sole Assistant. The writer has some reason for thinking that Dr. Ferminger had charge of an observatory in the West of England, but this knowledge is vague. Mr. Lindsay, who appears to have access to considerable information about him, says that Dr. Thistelton Dyer, formerly Director of Kew Gardens, was a grandson of Dr. Ferminger. Thomas Taylor was Pond's only Assistant for more than ten years, but in the early part of the year 1822 the Council of the Royal Society, being anxious to increase the output at Greenwich, urged the Lords of the Admiralty ‡ to take steps for the continuance of the observations during the whole of the twenty-four hours, and in consequence the number of Assistants was gradually increased to six. Taylor is named as First Assistant. His son, H. Glanville Taylor, who had been engaged as a supernumerary in 1820, was placed on the permanent establishment in August 1822 and remained until he was appointed to Madras in 1830. Others were Thomas Henry Belville, William Richardson, Thomas Ellis, W. Rogerson, and F. W. Sinms. Belville was a relative of Pond, and in the Observatory went by the name of Mr. "Henry." It was he who established the private business of taking Greenwich Time to London, for the benefit of chronometer-makers, that was carried on by his family and descendants for many years. Richardson was a remarkable man. He was a North-countryman and had been a blacksmith. He was awarded the Gold Medal of the Royal Astronomical Society in 1830, but left the Observatory under disgraceful circumstances that cannot even be hinted at. Thomas Ellis (who entered in 1825) was also a North-countryman, and was the father of William Ellis, to be spoken of later.

* *Phil. Mag.* vol. lxiv. July, 1824.

† Vol. ix. p. 62.

‡ The control of the Royal Observatory passed from the Board of Ordnance to the Board of Admiralty about 1818.

F. W. Simms was a member of the family of instrument-makers, and was, in fact, the brother of William Simms, who was partner with Troughton. When Airy accepted the office of Astronomer Royal in 1835, he made it a condition that the First Assistant should be removed, which was done, and, as Simms also resigned, Airy began his reign with four members of his predecessor's staff.

One of Airy's earliest acts as Astronomer Royal was to appoint as his First Assistant Mr. Robert Main, of Queen's College, Cambridge *, who had been Sixth Wrangler in 1834, the first of a long series of distinguished mathematicians who have held the post. It is not proposed to make any summary of Mr. Main's astronomical work here, but it may be mentioned in passing that it is due to him that Sunday is—in part, at least—a day of rest at Greenwich. Formerly the observers with the Transit and with the Mural Circle pursued their avocation on Sunday as on weekdays, but Mr. Main, who was in Holy Orders, pointed out that this was inconsistent with the tenets of the Church, and induced Airy to forego the Sunday observations except those of the Moon, which were specially important. There is a legend that for some weeks following this alteration of practice the sky was remarkably unfavourable for observing except on the Sundays, which were specially fine nights, and Airy was inclined to regret his decision. Besides his First † Assistant, Airy, early in his reign at Greenwich, added to his staff many who, owing to considerations of space, can be scarcely more than named here, but of whom much might be written. Glaisher, who had charge of the newly-formed Magnetic and Meteorological Department and earned world-wide fame as a meteorologist; William Ellis, who succeeded him after many years and became renowned for his investigation of the Sun-spot and Earth-magnetism problems; Edwin Dunkin, who began as Junior Computer and ended his career as Chief Assistant, President of the Royal Astronomical Society, and Fellow of the Royal Society, as, indeed, were the two previously mentioned; the Breen family, consisting of a father and three sons; Charles Todd, who became Postmaster-General of Australia; Lynn, Criswick, Nash, and others. It would be superfluous to allocate these gentlemen to the departments to which they were attached, but, besides the two main branches (the Astronomical and the Magnetic and Meteorological), there were separate computing departments dealing with the reduction of Lunar and Planetary Observations of past years, in which Juniors worked and from which they were often transferred elsewhere. Moreover, several of them served for a term at the Cambridge University Observatory, which

* [The opportunity is taken to point out a mistake in a note on page 486, vol. xxxvi. It is there stated that Mr. Main was of St. John's College. For this mistake and a consequent erroneous sentence the present writer is solely responsible. Main of John's was Senior Wrangler in 1838.—H. P. H.]

† The title "Chief" Assistant was not introduced until much later; probably Christie was the first "Chief."

in those years might have been looked on as an annexe to Greenwich, so much were the personnel intermingled. It may be mentioned in passing that in a local directory of the year 1852, Mr. Main is described as Assistant at the Royal Observatory, Belville and H. Breen, the eldest of the three brothers, as Assistant Astronomers, whilst Thomas Ellis, J. W. Breen, and Edwin Dunkin, who were near neighbours on Maidenstone Hill, were called "Observers," which may have been an indication of rank. When Mr. Main was appointed Radcliffe Observer at Oxford, the post of First Assistant was offered to E. J. Routh, afterwards famous as a "coach" at Cambridge, who spent a short time at Greenwich to see if the work was to his liking; and, though he did not find the post suitable, he found other attractions, for he married Miss Hilda Airy, daughter of the Astronomer Royal, in 1864.

The post was actually filled by the appointment of Mr. E. J. Stone, but of him and his successors we do not propose to write, these being too near the present epoch. It may be added, in conclusion, that the appointment of Assistants other than Chief Assistants passed into the hands of the Civil Service Commissioners, who selected by open examination, and that A. M. W. Downing was the first who entered (1873) under this new regime, and that there have been subsequent changes in the detail of appointments.

H. P. HOLLIS.

CORRESPONDENCE.

To the Editors of 'The Observatory.'

The Absorption of Radiation inside a Planetary Nebula.

GENTLEMEN,—

Prof. Milne in his letter (*The Observatory*, Oct. 25) points out the contradiction between the theory of a detached shell of gas supported by radiation pressure, developed in my recent paper (*A. N.* ccxxv.), and some results of modern astrophysics. The necessary condition for the existence of such a shell in a steady state is that the mean coefficient of absorption (K) must decrease through the thickness of the nebular shell as we pass from its internal boundary to its external boundary, but the physics of the atom demands that K must increase to a certain value and afterwards decrease.

The discrepancy between the results of "macroscopic" and "microscopic" analysis noted above is, as we know, not unique. It exists also in the domain of stellar physics under the form of disagreement between "observed" and theoretical stellar ab-