

$\eta$  ARGUS.

ALTERATIONS WHICH HAVE TAKEN PLACE IN THE  
NEBULA, &c., SURROUNDING  $\eta$  ARGUS, FROM FEBRUARY,  
1871, TO FEBRUARY, 1872.

By F. ABBOTT, F.R.A.S., F.R.M.S.

(*Read 11th June, 1872.*)

If it were not for the certainty that many and important changes have of late years taken place in connection with the star  $\eta$  in Argo Navis, and the surrounding nebula, I should feel some diffidence in replying to the queries set forth by the late Sir John Herschel and the Astronomer Royal.

Sir John Herschel, when he wrote the Cape observations, expressed a desire, in different parts of the book, that any astronomer who followed him would carefully observe certain points in connection with nebulous matter, in order to ascertain if any such alterations as those referred to did take place. If Sir John, at the time he wrote, had thought the nebula inflexible, he certainly would not have expressed such a desire. Why, then, is this wish ignored? and against such observations as have been made on the nebula up to the present time, why has so much negative evidence been offered by astronomers who have not even seen the object? and who offer no inductive evidence to disprove the alterations, but from the evidence they have examined (what evidence?) have come to the conclusion that no change has taken place. This result was not arrived at by the Astronomer Royal after examining the evidence produced.

It is scarcely likely that Australian astronomers will relax observing so interesting an object, which they have the opportunity of seeing every fine night through the year, and of the changes in which much strong corroborating evidence is being adduced when only brought in comparison with the few casual observations made at Bangalore and Cordoba; or with any such reasoning as that offered by Mr. Procter, which must have been conceived by him since he wrote the article ("The Great Nebula in Argo") in Fraser's Magazine for December, 1868. This kind of reasoning reminds me of that fine double star  $\eta$  Coronæ first seen double by the late Dr. Herschel. Many a star-gazer has turned out on a bitterly cold night to inspect  $\eta$  Coronæ, and, being unable to divide it, arrived at the conclusion that no one had seen it double.

In a letter received from Mr. Severn, dated 29th June, 1870, the following passage occurs:—"Have you seen the tenth and new edition of the Outlines of Astronomy, in which it is

stated that no alteration has taken place in the star  $\eta$  or its surrounding nebula since Sir John Herschel was at the Cape." Was it here Mr. Severn changed his mind when he wrote to the Astronomer Royal?

In the English *Mechanic*, No. 352, December 23rd, 1871, an article from Mr. Procter appeared, in which (after using a not very scientific term) he states his belief that he has found out the cause of this imaginary discovery! After carefully examining the evidence adduced he found the result to be that Mr. Abbott's field was 1 degree 7 minutes in extent, while Sir John Herschel's drawing embraced a space of 28 minutes in polar distance, and 32 minutes in arc of right ascension, and this he considers to cause all the confusion. Mr. Procter is under a great mistake if he thinks that either the size of the telescope, or the diameter of the field will prevent the effect of any alterations, which may have taken place in the nebula, being seen. And this fact the most sceptical will soon have to admit; alterations in the object have been detected even with the naked eye. All my own observations and drawings have been made with the one telescope, and without reference to the Cape drawings, how does Mr. Procter account for this?

Lieutenant, now Captain Herschel in a letter to Sir J. F. Herschel thinks I must use low powers as I never mention the lemniscate; this is true, I do use a low power with large field and plenty of light for the drawings; but I saw the object with the large Melbourne reflector in June 1869, and was unable to detect the lemniscate of the late Sir J. Herschel. At that time the so called lemniscate as seen with my instrument had two openings, one at each end; shortly after three openings, next four, then five, and now six, as seen in the present drawing.

In the same letter Captain Herschel enquires, "is it rash to suspect that Mr. Abbott has mistaken the star  $\eta$ ." This question is answered in the notes and queries of the Astronomer Royal, for if I had mistaken the star it is clear that Captain Herschel had also mistaken it or the question asked by the Astronomer Royal "has Mr. Abbott copied Lieutenant Herschel's drawing of 1868?" would not apply. It was from nightly watching the reduction of this star that the rapid fluctuations in the nebula were observed.

Mr. La Sueur discovered great changes in the nebula on first applying the large Melbourne reflector to the object, and comparing it with Sir John Herschel's Cape drawing; and in following up his observations during his stay at the Observatory has left certain drawings, finished and unfinished,

which show unmistakably that frequent alterations were then going on in the object.

Since Mr. La Sueur left Melbourne the large telescope has been under the charge of Mr. Farie McGeorge whose careful research has brought more recent alterations to light, of which he has given drawings down to the present time.

Mr. H. C. Russell, B.A., of the Sydney Observatory, has produced a large drawing showing considerable changes in the object as seen with the Observatory telescope, which if I rightly remember, is a seven feet achromatic.

The *good quality* of an instrument best suited for showing minute changes in nebulous matter is more important than its size. *Light, definition, and penetration*, will show *depth and outline* most distinctly. Two dissimilar instruments will seldom shew configurations of nebulous matter alike. Powell and Leyland's 1-16th immersion lens, and Tolles' 1-6th ditto, will resolve Noberts' 19th band on his new test plate, when many superior instruments and higher powers have failed to do so. This difference in size and magnifying power does not prove that Noberts' 19th band is irresolvable—nor does the size and magnifying power of the telescope prove that the Nebula around  $\eta$  does not fluctuate.

Sir J. Herschel did not wish to longer endorse the theory of the concretion of nebulous matter into isolated stars; this, however, is not without its supporters. M. Delaunay, *Cours Elémentaire d'Astronomie*, 4th Edition,—“In adopting the idea of Herschel concerning the progressive condensation of nebulae, and their transformation into stars, and applying these ideas to our planetary system, Laplace arrived at the most satisfactory mode of explaining their formation. “*Exposition du système du Monde.*”

Mr. Procter releases himself by a correction given in *Nature*, for October 19th, 1871, page 487, from longer considering that the fluctuations may be accounted for by an increased or decreased distance in space, but that the object is nearer than it was formerly supposed to be.

Another opinion offered is that of Mr. La Sueur, while observing the object with the Melbourne reflector. “The star  $\eta$  now shines with a light different from other stars in the field, and more the colour of burning hydrogen,” and, Mr. La Sueur thought, “had consumed the nebula.”

How were the small coloured stars, seen lying on the dark ground of the sky along with  $\eta$  produced?—M. N., vol. 24, page 5. They must either have been concreted from the nebula as it drifted away, or by underlying it became visible with the telescope when the nebulous matter was removed.

Mr. Powell, of Madras, does not seem to have observed

these minute coloured stars, when informing the Royal Astronomical Society that  $\eta$  was out of the Nebula and in the dark space. They were seen here and at the Melbourne Observatory.

No communication, excepting my own, has appeared in reference to  $\eta$  having been seen some months later in quite a different portion of the Nebula, after it had left the dark ground of the sky. This is one amongst other changes which has certainly been misconstrued, as very shortly after the account of it reached England a statement appeared in the *Quarterly* and other journals to the effect that the star  $\eta$  remained in the thick of the nebula—where it was in the Cape drawing—which was not true.

Owing to a continuation of dry and hot weather, followed by wet and cloudy nights through the month of February and part of March, the present drawing was not completed until the object had reached near the zenith, consequently for checking and completing it, a total reflecting prism by Cook and Sons, with an orthoscopic eye-piece by Ross, was used. With this adoption no sensible difference could occur, as both the size of the field and the definition were much the same as in the case of the other drawings.

The same means for ascertaining the distance of the stars, as adopted in 1871, were again used on the present occasion. The bars of a Cook and Sons Micrometer were traced on the drawing paper so as to just fill the field of the telescope. The value of each bar of the micrometer is sixteen seconds of time. The stars were then pricked down on the paper and the distance of each ascertained by the lines traced from the bar micrometer, which is then taken out of the telescope, and the original eye-piece inserted to finish the drawing. By these means, little or no sensible error can, I apprehend, occur.

The cardinal points have been omitted in the present drawing, and the meridian line only approximately inserted. The telescope used being a refractor, the drawing will require reversion to bring the object into its true position.

It will be found, on comparison with former drawings, more especially with that of 1871, that although considerable alterations have taken place in the position of the stars surrounding  $\eta$  Argus, still sufficient similarity exists to allow of their identification, as, for instance, in the case with the four stars convex to  $\eta$  (alluded to by Professor Airey).

The four stars marked  $\delta$ ,  $\gamma$ ,  $\epsilon$ , and  $\xi$ , the small adjacent ones marked  $\eta$ ,  $\rho$ ,  $s$ ,  $\tau$ ,  $\chi$ ,  $\psi$ , and the small stars immediately surrounding  $\eta$ , though agreeing very closely with the drawing



of 1871, have but little agreement with Sir J. Herschel's monograph.

It will also be observed that a very considerable increasing the number of stars has taken place, there being now visible in the field of the telescope one hundred and seventy of the 7th, 8th, and 9th magnitude, as compared with one hundred and thirty-four in the drawing of last year.

The boundary of the dark space has now six openings, as shown in the drawing, but is gradually becoming less distinct.

For the purpose of seeing the original lemniscate, eyepieces of 60, 80, and 130 powers were used, but without avail.

[In the present drawing, the term "line of sight" has been omitted, some exception having been taken to it, but I find it is still in use — *Fraser's Magazine* for January, 1872. The term occurs twice in Mr. Procter's article, "New Survey of the Northern Heavens," page 91.]