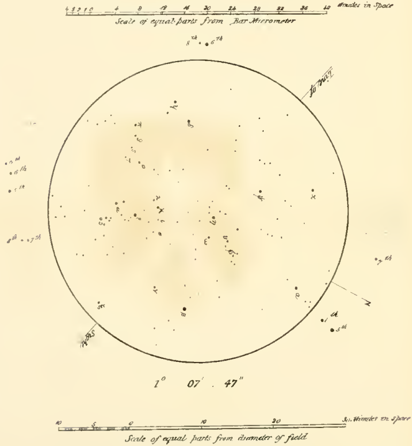
APPROXIMATE DISTANCES AND MAGNITUDES OF THE

PRINCIPAL STARS AND NEBULA SURROUNDING η ARGUS

TAKEN AT HOBART TOWN FEBY. 1871.



REFERENCE.

	Magnitude	Distance from η
α	6th	29′ 30″
β	6th	26′. 00″
γ	6½	32′ 00″
δ	6½	26′ 30″
ε	7th	22′ 30″
ζ	7th	31′ 20″
η	7th	—
θ	7½	16′. 15″
ι	7½	15′ 45″
κ	7½	16′ 10″
λ	7½	17′ 30
μ	8th	27′ 25″
ν	8th	26′ 30″
ξ	8th	40′ 00″
ο	8th	25′ 30″
π	8½	32′ 25″
ρ	8½	30′ 20″
σ	8½	29′ 15″
τ	8½	29 40″
υ	8½	08′ 20″
φ	8th	12′ 00″
χ	8½	26′ 40″
ψ	8½	13′. 50″
ω	8½	06′ 30″

η ARGUS AND ITS SURROUNDING NEBULA, &c.

By F. Abbott, F.R.A.S., &c.

Read at a meeting of the Royal Society of Tasmania, 9th May, 1871.

In the last paper I had the honour on bringing before the Society I referred to a correspondence which was then pending on the star η, and the attached nebula, in the constellation Argo-Navis. It will be fresh in the minds of many of the members of this Society that authorities, previously quoted, have confirmed the alterations which have been recorded in this object. E. B. Powell, Esq., of Madras, writing to the Royal Astronomical Society some observations on the binary star α Centauri, has a concluding note thus:—"I have to observe that to Mr. Abbott must be ascribed the first publication of the fact that η is no longer in the dense portion of the nebula, where it was seen by Sir John Herschel."—(*Vide Monthly Notices R.A.S., Vol.* 24, *p.* 172.)

It was in March, 1865, that I first pointed out the fluctuations in this object, through the Melbourne equatorial, to Mr. Ellery at the Observatory, when the star η was out of the nebula, and the altered figure of the dark space was filled with 12th magnitude stars, richly coloured as described in Monthly Notices R.A.S., Vol. 25, p. 192.

Notwithstanding this in connection with all other evidence, strong opposing influences have been brought to bear against the movements which have been observed, although it is well known to every astronomer that there is nothing stationary in the universe. The distance of such objects as the nebula about η Argus is in all cases so immensely great, their position in the sky often unfavourable, and convenient times for observing so far apart, that any alteration or physical change may for centuries remain unknown.

The late Sir William Herschel writes, and is followed by Sir John, thus: "Gravitation still further condensing and so absorbing the nebulous matter, each in its immediate neighbourhood might ultimately become stars, and the whole nebula finally take on the state of a cluster of stars," &c.—(*Vide Outlines of Astronomy, 5th edition, p.* 640.) Mr. Procter considers that an increased or decreased distance in space may account for the fluctuations.

The present object was observed and faithfully recorded by Sir John Herschel when stationed at the Cape of Good Hope in the year 1837. It is quite impossible to say what, if any, alterations may have taken place in the nebula before

that time, but it is certain that changes have taken place both in the star and in the nebula since 1854; and these fluctuations have been so great and unusual as to raise a doubt in the mind of Sir John Herschel as to their reality. This opinion, coming from such an authority, has influenced many others, who, notwithstanding all evidence, and without a single observation of their own, have refused to credit these recorded facts. Some also, who have but lately commenced observing, contrary to all scientific rule, ignore all previous observations made by others, in order to make an opening for their own.

To decide certain points of difference which are said to exist between the drawings made by Sir John Herschel, Lieut. Herschel, and myself respectively, referees have been appointed by the Council of the R.A.S. The present paper has relation to the observations made for, and the reply sent to, the referees, in answer to their queries on the points alluded to.

In carefully looking over the drawings taken at Bangalore by Lieut. Herschel, with the object, η Argus, 15° above the horizon, and also the *reversed* copy of Sir J. Herschel's, and on consideration of the discussion given with the drawings, I do not think that Lieut. Herschel's observations tend to disprove any one of the alterations which I have previously communicated to the Society. The present drawing, and the answers given to the referees, will, I think, render this clear.

The present observations have been made with the same instrument as the former ones, the object in the same position—approximately 80° above the horizon. The measures were taken with a bar micrometer by Cook and Sons, the bars being carefully traced in pencil on the drawing paper, in such a manner as to exactly fill the field of the telescope. All the stars visible were dotted down, the distances from η of the 6th, 7th, and 8th magnitude stars were lettered, measured, and catalogued from a scale of equal parts, after which the micrometer pencil lines were rubbed out, and the nebula inserted.

The first question put by the referees relates to a comparison of the positions of the principal stars and smaller groups as shown in my two drawings, which are said to have a sufficient general agreement with each other, considered as eye drafts, while they are irreconcilable with both Sir John's and Lieut. Herschel's configurations. A simple inspection of my drawing of 1870 with the reversed drawing of Sir John Herschel (*A.A., plate 4, in the Monthly Notices R.A.S.*) will show that the following principal stars hold a relative position considered as eye drafts, but not with the Cape Monograph as expressed

in the letter, D.D., C.C., (β), (κ), B.C., (E.), 522, 558, 640, 337, 383, 415, (γ), (λ), &c., &c. There are many other stars in my copy of 1870 that are not laid down in plate 4, pricked off from Lieutenant Herschel's drawing.

The other question of note refers to my "having placed within $11\frac{1}{2}$ (on the scale of my drawing of (η) five stars of magnitude at least equal to η, that is, the 7th magnitude, while in Sir J. Herschel's monograph only one star of that magnitude (marked C.) occurs within that distance;" and continues, "can you give any elucidation of the cause of the discrepancy?" also "if you would furnish some instrumental determination of the difference of R.A., and P.D., between η and other stars of equal magnitudes."

In my acknowledgment of this letter to Mr. William Huggins, F.R.S., &c., I mentioned that it was not my intention or desire to dispute either Sir John's or Lieutenant Herschel's configurations, but to call the attention of the astronomical world to the altered features of both the star and the nebula, with a view of obtaining a solution of the changes seen in this most remarkable object. I further stated that the above question was of a physical nature, and could only be answered as such.

On reference to my former papers it will be seen that mention is made, more than once, of the fact that the increase of stars of the same magnitude as η render it difficult to know that star from others, but by its position, and a marked difference in the *light*. The present drawing will show a still greater and more remarkable number of stars of a similar magnitude.

It is to this cause I have so frequently referred the increase of light, which I think is now clearly confirmed by a comparison of Lieutenant Herschel's description with that of Sir John. At one of the monthly meetings of the Society, Sir John Herschel considered the increase of light in the object, as recorded, very strange, and remarked "when I was at the Cape the nebula could not be seen at all with the naked eye." Lieutenant Herschel, when at Bangalore, compared the increased light, when the object was only 15° above the horizon, to that of Pleiades in Taurus.

Mr. Le Sueur, in his report on the Melbourne reflector, says "the nebula around η Argus has changed largely in shape since Sir J. Herschel was at the Cape. The star shines with the light of burning hydrogen," and in his opinion "has consumed the nebula."

At the monthly meeting of the Royal Society of Victoria, held on the 13th March, 1871, Mr. Fairie McGeorge, who has now charge of the reflecting telescope at the Melbourne Obser-

vatory, read a paper in which he referred to some observations made with that instrument on the star η Argus, and the nebula; and stated "that the object had evidently undergone great changes since Mr. Le Sueur made his sketches of it. It was now beyond a doubt that enormous physical changes were still taking place."

The catalogue accompanying my present drawing, made for the referees, and laid on the table, will show that there are now in the same field two stars of the 6th, two $6\frac{1}{2}$, three 7th, four $7\frac{1}{2}$, four 8th, and nine of the $8\frac{1}{2}$ magnitude, and it is literally crowded with others of from the $8\frac{1}{2}$ to the 12th magnitude. Those lying outside the field and occupying an area of about $1\frac{1}{2}°$, have their magnitudes attached. The small cluster I take to be Sir. J. Herschel's 3276, described as "a fine, bright, rich, not very large cluster," if so it is now a beautiful cluster of richly coloured stars, quite equal to κ Crucis.

It is almost impossible to define the boundary of the nebula, as it appears to be gradually fading away, and is not so distinct in outline as formerly.

The finest nights have always been selected for observing, and no delineation of the object has ever been given, but what was an accurate representation of its appearance through the telescope.

The following is an extract from a letter addressed by Mr. Severn, of Melbourne, to the Astronomer Royal, and printed in the Monthly Notices, Royal Astronomical Society, for April, 1870:—"I may say that I cannot confirm the new position given to η Argus in respect to the nebula. I have watched it for 14 years, and it is just where it was; of course much less brilliant."

A letter dated 21st June in the same year, which I received from Mr. Severn contains the following passage:—"My present motive is to draw your attention to the injustice *done* you in the η Argus business; I have of course read all your letters in the Monthly Notices of the R.A.S. on the subject. *You must* not allow the *Spectator*, or Mr. Le Sueur, or any other man to deprive *you* of your discovery; *you* have at least done, and *that* years ago, what the 4ft. Cassegranians and Mr. Le Sueur *are* claiming as their discovery. *I can't* stand this, and therefore if you don't defend yourself, by writing to our papers, *I must*. I send you a *Leader* with my paper in it, also another *re* η."

On reading these two extracts, which are dated about the same time, it will appear that the writer must have very suddenly changed his mind.

In June, 1869, I visited Melbourne for the purpose of seeing the new large reflecting telescope, and must confess to being

much surprised on seeing the object η Argus in such a small field with so large an instrument. Mr. Le Sueur thought at the time that he saw a faint shadow of a lemniscate; and what I saw was a dark path across the nebula, not unlike that portion of Eridanus, occupied by 188 and 198 l. C. and not far from the star Achernar. The object was only seen between passing clouds, and although the best speculum was in the instrument at the time the definition was not good.

In June, 1862, I brought before this Society a copy of the drawing made from observations on that beautiful cluster of coloured stars known as κ Crucis, the original drawing, &c., of which was at the time remitted to the Royal Astronomical Society, with notes on the variation of both colour and position when compared as eye draft, with Sir John Herschel's observations made at the Cape of Good Hope. *(Vide Monthly Notices, R.A.S., Vol. 23, p. 32.)*

As the instrument used at the Cape was in every respect different from the one used in Hobart Town, and the effect of colour varying, as it does, so much in different persons, I discontinued observing to allow time for other changes to become known, and have now waited nearly nine years, in order to compare the object with the previous drawing by the same optical means. Sir John Herschel estimated this cluster to be formed of from 50 to 100 stars; in the drawing of 1862, a copy of which now lies on the table, there were laid down 75 stars to which the colour of each was given. It is now known that certain alterations have taken place since 1862, but a series of cloudy nights has prevented the possibility of preparing a sequent to the former drawing in time for the present meeting.