XLIX.

Catalogue of 500 new Nebulæ, nebulous Stars, planetary Nebulæ, and Clusters of Stars; with Remarks on the Construction of the Heavens.

[*Phil. Trans.*, 1802, pp. 477–528.]

Read July 1, 1802.

SINCE the publication of my former two catalogues of nebulæ, I have, in the continuation of my telescopic sweeps, met with a number of objects that will enrich our natural history, as it may be called, of the heavens. A catalogue of them will be found at the end of this paper, containing 500 new nebulæ, nebulous stars, planetary nebulæ, and clusters of stars. These objects have been arranged in eight classes, in conformity with the former catalogues, of which the present one is therefore a regular continuation. This renders it unnecessary to give any further explanation, either of the contents of its columns, or the abbreviations which have been used in the description of the objects.

It has hitherto been the chief employment of the physical astronomer, to search for new celestial objects, whatsoever might be their nature or condition; but our stock of materials is now so increased, that we should begin to arrange them more scientifically. The classification adopted in my catalogues, is little more than an arrangement of the objects for the convenience of the observer, and may be compared to the disposition of the books in a library, where the different sizes of the volumes is often more considered than their contents. But here, in dividing the different parts of which the sidereal heavens are composed into proper classes, I shall have to examine the nature of the various celestial objects that have been hitherto discovered, in order to arrange them in a manner most conformable to their construction. This will bring on some extensive considerations, which would be too long for the compass of a single paper; I shall therefore now only give an enumeration of the species that offer themselves already to our view, and leave a particular examination of the separate divisions, for some early future occasions.

In proceeding from the most simple to the more complex arrangements, several methods, taken from the known laws of gravitation, will be suggested, by which the various systems under consideration may be maintained; but here also we shall confine ourselves to a general review of the subject, as observation must furnish us first with the necessary data, to establish the application of any one of these methods on a proper foundation.

ENUMERATION OF THE PARTS THAT ENTER INTO THE CONSTRUCTION OF THE HEAVENS.

I. *Of insulated Stars.*

In beginning our proposed enumeration, it might be expected that the solar system would stand foremost in the list; whereas, by treating of insulated stars, we seem, as it were, to overlook one of the great component parts of the universe. It will, however, soon appear that this very system, magnificent as it is, can only rank as a single individual belonging to the species which we are going to consider.

By calling a star insulated, I do not mean to denote its being totally unconnected with all other stars or systems; for no one, by the laws of gravitation, can be intirely free from the influence of other celestial bodies. But, when stars are situated at such immense distances from each other as our sun, Arcturus, Capella, Lyra, Sirius, Canopus, Markab, Bellatrix, Menkar, Shedir, Algorah, Propus, and numberless others probably are, we may then look upon them as sufficiently out of the reach of mutual attractions, to deserve the name of insulated stars.

In order not to take this assertion for granted, without some examination, let us admit, as is highly probable, that the whole orbit of the earth's annual motion does not subtend more than an angle of one second of a degree, when seen from Sirius. In consequence of this, it appears by computation, that our sun and Sirius, if we suppose their masses to be equal, would not fall together in less than 33 millions of years, even though they were not impeded by many contrary attractions of other neighbouring insulated stars; and that, consequently, with the assistance of the opposite energies exerted by such surrounding stars, these two bodies may remain for millions of ages, in a state almost equal to undisturbed rest. A star thus situated may certainly deserve to be called insulated, since it does not immediately enter into connection with any neighbouring star; and it is therefore highly probable, that our sun is one of a great number that are in similar circumstances. To this may be added, that the stars we consider as insulated are also surrounded by a magnificent collection of innumerable stars, called the milky-way, which must occasion a very powerful balance of opposite attractions, to hold the intermediate stars in a state of rest. For, though our sun, and all the stars we see, may truly be said to be in the plane of the milky-way, yet I am now convinced, by a long inspection and continued examination of it, that the milky-way itself consists of stars very differently scattered from those which are immediately about us. But of this, more will be said on another occasion.

From the detached situation of insulated stars, it appears that they are capable of being the centres of extensive planetary systems. Of this we have a convincing proof in our sun, which, according to our classification, is one of these stars. Now, as we enjoy the advantage of being able to view the solar system in all its parts, by means of our telescopes, and are therefore sufficiently acquainted with it, there will be no occasion to enter into a detail of its construction.

The question will now arise, whether every insulated star be a sun like ours, attended with planets, satellites, and numerous comets? And here, as nothing appears against the supposition, we may from analogy admit the probability of it. But, were we to extend this argument to other sidereal constructions, or, still farther, to every star of the heavens, as has been done frequently, I should not only hesitate, but even think that, from what will be said of stars which enter into complicated sidereal systems, the contrary is far more likely to be the case; and that, probably, we can only look for solar systems among insulated stars.

II. *Of Binary sidereal Systems, or double Stars.*

The next part in the construction of the heavens, that offers itself to our consideration, is the union of two stars, that are formed together into one system, by the laws of attraction.

If a certain star should be situated at any, perhaps immense, distance behind another, and but very little deviating from the line in which we see the first, we should then have the appearance of a double star. But these stars, being totally unconnected, would not form a binary system. If, on the contrary, two stars should really be situated very near each other, and at the same time so far insulated as not to be materially affected by the attractions of neighbouring stars, they will then compose a separate system, and remain united by the bond of their own mutual gravitation towards each other. This should be called a real double star; and any two stars that are thus mutually connected, form the binary sidereal system which we are now to consider.

It is easy to prove, from the doctrine of gravitation, that two stars may be so connected together as to perform circles, or similar ellipses, round their common centre of gravity. In this case, they will always move in directions opposite and parallel to each other; and their system, if not destroyed by some foreign cause, will remain permanent.

Figure 1 (p. 205) represents two equal stars *a* and *b*, moving in one common circular orbit round the centre *o*, but in the opposite directions of *a t* and *b t*. In Fig. 2 we have a similar connection of the two stars *a b*; but, as they are of different magnitudes, or contain unequal quantities of matter, they will move in circular orbits of different dimensions round their common centre of gravity *o*. Fig. 3 represents equal, and Fig. 4 unequal stars, moving in similar elliptical orbits round a common centre; and, in all these cases, the directions of the tangents *t t*, in the places *a b*, where the stars are, will be opposite and parallel, as will be more fully explained hereafter.

These four orbits, simple as they are, open an extensive field for reflection, and, I may add, for calculation. They shew, even before we come to more complicated combinations, where the same will be confirmed, that there is an essential difference between the construction of solar and sidereal systems. In each solar system, we have a very ponderous attractive centre, by which all the planets, satellites, and comets are governed, and kept in their orbits. Sidereal systems take a greater scope: the stars of which they are composed move round an empty centre, to which they are nevertheless as firmly bound as the planets to their massy one. It is however not necessary here to enlarge on distinctions which will hereafter be strongly supported by facts, when clusters of stars come to be considered. I shall only add, that in the subordinate bodies of the solar system itself, we have already instances, in miniature, as it may be called, of the principle whereby the laws of attraction are applicable to the solution of the most complicated phenomena of the heavens, by means of revolutions round empty centres. For, although both the earth and its moon are retained in their orbits by the sun, yet their mutual subordinate system is such, that they perform secondary monthly revolutions round a centre without a body placed in it. The same indeed, though under very narrow limits, may be said of the sun and each planet itself.

That no insulated stars, of nearly an equal size and distance, can appear double to us, may be proved thus. Let Arcturus and Lyra be the stars: these, by the rule of insulation, which we must now suppose can only take place when their distance from each other is not less than that of Sirius from us, if very accurately placed, would be seen under an angle of 60 degrees from each other. They really are at about 59°. Now, in order to make these stars appear to us near enough to come under the denomination of a double star of the first class, we should remove the earth from them at least 41253 times farther than Sirius is from us. But the space-penetrating power of a 7-feet reflector, by which my observations on double stars have been made, cannot intitle us to see stars at such an immense distance; for, even the 40-feet telescope, as has been shewn,* can only reach stars of the 1342d magnitude. It follows, therefore, that these stars could not remain visible in a 7-feet reflector, if they were so far removed as to make their angular distance less than about $24\frac{1}{4}$ minutes; nor could even the 40-feet telescope, under the same circumstances of removal, shew them, unless they were to be seen at least $2\frac{1}{2}$ minutes asunder. Moreover, this calculation is made on a supposition that the stars of which a double star is composed, might be as small as any that can possibly be perceived; but if, on the contrary, they should still appear of a considerable size, it will then be so much the more evident that such stars cannot have any great real distance, and that, consequently, insulated stars cannot appear double, if they are

* See *Phil. Trans.* for 1800, Part I. page 83 [above, p. 50].

situated at equal distances from us. If, however, their arrangement should be such as has been mentioned before, then, one of them being far behind the other, an apparent double star may certainly be produced; but here the appearance of proximity would be deceptive; and the object so circumstanced could not be classed in the list of binary systems. However, as we must grant, that in particular situations stars apparently double may be composed of such as are insulated, it cannot be improper to consult calculation, in order to see whether it be likely that the 700 double stars I have given in two catalogues, as well as many more I have since collected, should be of that kind. Such an inquiry, though not very material to our present purpose, will hereafter be of use to us, when we come to consider more complicated systems. For, if it can be shown that the odds are very much against the casual production of double stars, the same argument will be still more forcible, when applied to treble, quadruple, or multiple compositions.

Let us take ζ Aquarii, for an instance of computation. This star is admitted, by FLAMSTEED, DE LA CAILLE, BRADLEY, and MAYER, to be of the 4th magnitude. The two stars that compose it being equal in brightness, each of them may be supposed to shine with half the light of the whole lustre. This, according to our way of reckoning magnitudes,* would make them $4m \times \sqrt{2} = 5\frac{2}{3}m$; that is, of between the 6th and 5th magnitude each. Now, the light we receive from a star being as the square of its diameter directly, and as the square of its distance inversely, if one of the stars of ζ Aquarii be farther off than the stars of between the 6th and 5th magnitude are from us, it must be so much larger in diameter, in order to give us an equal quantity of light. Let it be at the distance of the stars of the 7th magnitude; then its diameter will be to the diameter of the star which is nearest to us as 7 to $5\frac{2}{3}$, and its bulk as 1·885 to 1; which is almost double that of the nearest star. Then, putting the number of stars we call of between the 6th and 5th magnitude at 450, we shall have 686 of the 7th magnitude to combine with them, so that they may make up a double star of the first class, that is to say, that the two stars may not be more than 5″ asunder. The surface of the globe contains 34036131547 circular spaces, each of 5″ in diameter; so that each of the 686 stars will have 49615357 of these circles in which it might be placed; but, of all that number, a single one would only be the proper situation in which it could make up a double star with one of the 450 given stars. But these odds, which are above $75\frac{1}{2}$ millions to one against the composition of ζ Aquarii, are extremely increased by our foregoing calculation of the required size of the star, which must contain nearly double the mass allotted to other stars of the 7th magnitude; of which, therefore, none but this one can be proper for making up the required double star. If the stars of the 8th and 9th magnitudes, of which there will be 896 and 1134, should be taken in, by way of increasing the chance in favour of the supposed composition of our

* The expressions 2m, 3m, 4m, &c. stand for stars at the distance of 2, 3, 4, &c. times that of Sirius, supposed unity.

double star, the advantage intended to be obtained by the addition of numbers, will be completely counteracted by the requisite uncommon bulk of the star which is to serve the purpose; for, one of the 8th magnitude ought to be more than $2\frac{3}{4}$ times bigger than the rest; and, if the composition were made by a star of the 9th magnitude, no less than four times the bulk of the other star which is to enter the composition of the double star would answer the purpose of its required brightness. Hence therefore it is evident, that casual situations will not account for the multiplied phenomena of double stars, and that consequently their existence must be owing to the influence of some general law of nature; now, as the mutual gravitation of bodies towards each other is quite sufficient to account for the union of two stars, we are authorised to ascribe such combinations to that principle.

It will not be necessary to insist any further on arguments drawn from calculation, as I shall soon communicate a series of observations made on double stars, whereby it will be seen, that *many of them have actually changed their situation with regard to each other, in a progressive course, denoting a periodical revolution round each other; and that the motion of some of them is direct, while that of others is retrograde.* Should these observations be found sufficiently conclusive, we may already have their periodical times near enough to calculate, within a certain degree of approximation, the parallax and mutual distance of the stars which compose these systems, by measuring their orbits, which subtend a visible angle.

Before we leave the subject of binary systems, I should remark, that it evidently appears, that our sun does not enter into a combination with any other star, so as to form one of these systems with it. This could not take place without our immediately perceiving it; and, though we may have good reason to believe that our system is not perfectly at rest, yet the causes of its proper motion are more probably to be ascribed to some perturbations arising from the proper motion of neighbouring stars or systems, than to be placed to the account of a periodical revolution round some imaginary distant centre.

III. *Of more complicated sidereal Systems, or treble, quadruple, quintuple, and multiple Stars.*

Those who have admitted our arguments for the existence of real double stars, will easily advance a step farther, and allow that three stars may be connected in one mutual system of reciprocal attraction. And, as we have from theory pointed out, in figures 1, 2, 3, and 4, how two stars may be maintained in a binary system, we shall here shew that three stars may likewise be preserved in a permanent connection, by revolving in proper orbits about a common centre of motion.

In all cases where stars are supposed to move round an empty centre, in equal periodical times, it may be proved that an imaginary attractive force may be supposed to be lodged in that centre, which increases in a direct ratio of the distances. For since, in different circles, by the law of centripetal forces, the squares of the periodical times are as the radii divided by the central attractive forces, it follows, that when these periodical times are equal, the forces will be as the radii. Hence we conclude, that in any system of bodies, where the attractive forces of all the rest upon any one of them, when reduced to a direction as coming from the empty centre, can be shewn to be in a direct ratio of the distance of that body from the centre, the system may revolve together without perturbation, and remain permanently connected without a central body.

Hence may be proved, as has been mentioned before, that two stars will move round a hypothetical centre of attraction. For, let it be supposed that the empty centre *o*, in Fig. 1 and 3, is possessed of an attractive force, increasing in the direct ratio of the distances *oa* : *ob*. Then, since here *ao* and *bo* are equal, the hypothetical

Fig. 1.

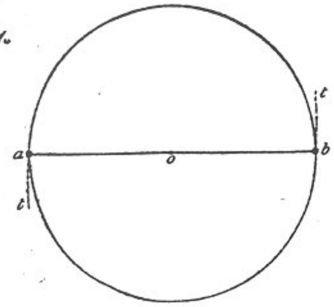


Fig. 2.

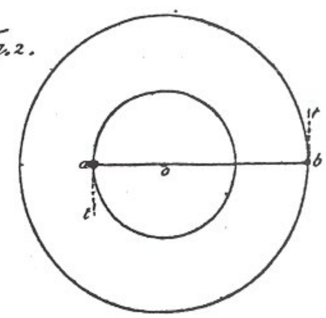


Fig. 3.

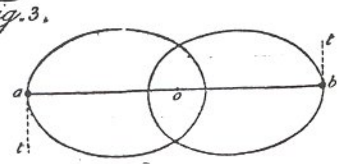
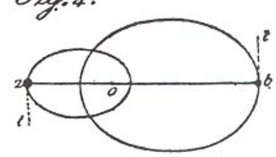


Fig. 4.



attractions will be equal, and the bodies will revolve in equal times. That this agrees with the general law of attraction, is proved thus. The real attraction of *b* upon *a* is $\frac{b}{ab^2}$; and that of *a* upon *b* is $\frac{a}{ab^2}$; and, since $b = a$, it will be $\frac{b}{ab^2} : \frac{a}{ab^2} ::$ $ao : bo$; which was required.

In Figures 2 and 4, when the stars *a* and *b* are unequal, and their distances from *o* also unequal, let $oa = n$, and $ob = m$; and let the mass of matter in $a = m$, and in $b = n$. Then the attraction of *b* on $a = \frac{b}{ab^2}$, will be to the attraction of *a* on $b = \frac{a}{ab^2}$, as $n : m$; which is again directly as $ao : bo$.

I proceed now to explain a combination of three bodies, moving round a centre of hypothetical attraction. Fig. 5 contains a single orbit, wherein three equal bodies *a b c*, placed at equal distances, may revolve permanently. For, the real attraction of *b* on *a* will be expressed by $\frac{a}{ab^2}$; but this, reduced to the direction *ao*, will be only $\frac{b \cdot by}{ab^3}$; for, the attraction in the direction *ba* is to that in the direction *by*, parallel to *ao*, as $\frac{b}{ab^2}$ to $\frac{b \,.\, by}{ab^3}$. The attraction also of *c* on *a* is equal to that of *b* on *a*; therefore the whole attraction on *a*, in a direction towards *o*, will be expressed by $\frac{2b \,.\, by}{ab^3}$ In the same manner we prove, that the attraction of *a* and *c* on *b*, in the direction *bo*, is $\frac{2a \,.\, by}{ab^3}$; and that of *a* and *b* on *c*, in the direction *co*, is $\frac{2c \,.\, by}{ab^3}$. Hence, *a b* and *c* being equal, the attractions in the directions *ao*, *bo* and *co* will also be equal; and, consequently, in the direct ratio of these distances. Or rather, the hypothetical

Fig. 5.

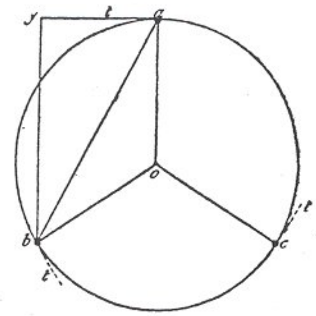


Fig. 6.

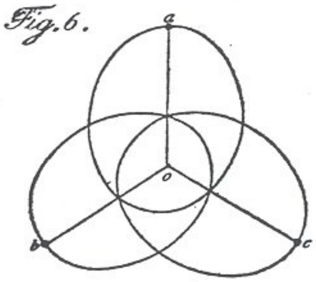


Fig. 7.

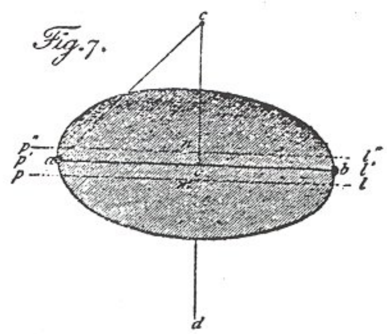
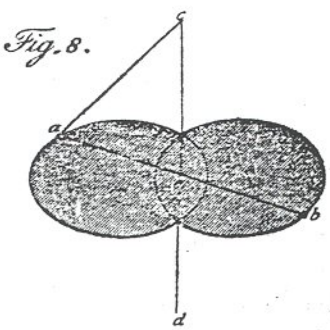


Fig. 8.



attractions being equal, it proves that, in order to revolve permanently, *a b* and *c* must be equal to each other.

Instead of moving in one circular orbit, the three stars may revolve in three equal ellipses, round their common centre of gravity, as in Fig. 6. And here we should remark, that this centre of gravity will be situated in the common focus *o*, of the three ellipses; and that the absolute attraction towards that focus, will vary in the inverse ratio of the squares of the distances of any one of the stars from that centre, while the relative attractions remain in the direct ratio of their several distances from the same centre. This will be more fully explained, when we come to consider the motion of four stars.

A very singular straight-lined orbit, if so it may be called, may also exist in the following manner. If *a* and *b*, Fig. 7, are two large equal stars, which are connected together by their mutual gravitation towards each other, and have such projectile motions as would cause them to move in a circular orbit about their common centre of gravity, then may a third small star *c*, situated in a line drawn through *o*, and at rectangles to the plane described by the stars *a b*, fall freely from rest, with a gradually acquired motion to *o*; then, passing through the plane of the orbit of the two stars, it will proceed, but with a gradually retarded motion, to a second point of rest *d*; and, in this manner, the star *c* may continue to oscillate between *c* and *d*, in a straight line, passing from *c*, through the centre *o*, to *d*, and back again to *c*.

In order to see the possibility and permanency of this connection the better, let *o* be the centre of gravity of the three bodies, when the oscillating body is at *c*; then, supposing the bodies *a* and *b* to be at that moment in the plane *pl*, and admitting *m* to represent a body equal in mass to the two bodies *a b*, *o* will be the common centre of gravity of *m* and *c*. Then, by the force of attraction, the body *c* and the fictitious body *m* will meet in *o*; that is to say, the plane *pl*, of the bodies *a b*, will now be at *p'l'*. The fictitious body *m* may then be conceived to move on till it comes to *n*, while the body *c* goes to *d*; or, which is the same, the plane of the bodies *a b* will now be in the position *p''l''*, as much beyond the centre of gravity *o*, as it was on the opposite side *m*. By this time, both the fictitious body *m*, now at *n*, and the real body *c*, now at *d*, have lost their motion in opposite directions, and begin to approach to their common centre of gravity *o*, in which they will meet a second time. It is evident that the orbit of the two large stars will suffer considerable perturbations, not only in its plane, but also in its curvature, which will not remain strictly circular; the construction of the system, however, is such as to contain a sufficient compensation for every disturbing force, and will consequently be in its nature permanent.

In order to add an oscillating star, it is not necessary that the two large stars should be so situated as to move in a circular orbit, without the oscillating star. In Fig. 8, the stars *a* and *b* may have such projectile forces given them as would cause them to describe equal ellipses, of any degree of excentricity. If now the small star *c* be added, the perturbations will undoubtedly affect not only the plane of the orbits of the stars, but also their figures, which will become irregular moveable ovals. The extent also of the oscillations of the star *c* will be affected; and will sometimes exceed the limits *c d*, and sometimes fall short of them. All these varieties may easily be deduced from what has been already said, when Fig. 7 was considered. It is however very evident, that this system also must be permanent; since not only the centre of gravity *o* will always be at rest, but *ao*, whatever may be the perturbations arising from the situation of *c*, will still remain equal to *bo*.

It should be remarked, that the vibratory motion of the star *c* will differ much from a cometary orbit, even though the latter should be compressed into an evanescent ellipsis. For, while the former extends itself over the diameter of a globe in which it may be supposed to be inscribed, the hypothetical attractive force being supposed to be placed in its centre, the cometary orbit will only describe a radius of the same globe, on account of its requiring a solid attractive centre.

After what has been said, it will hardly be necessary to add, that with the assistance of any proper one of the combinations pointed out in the four last figures, the appearance of every treble star may be completely explained; especially when the different inclinations of the orbits of the stars, to the line of sight, are taken into consideration.

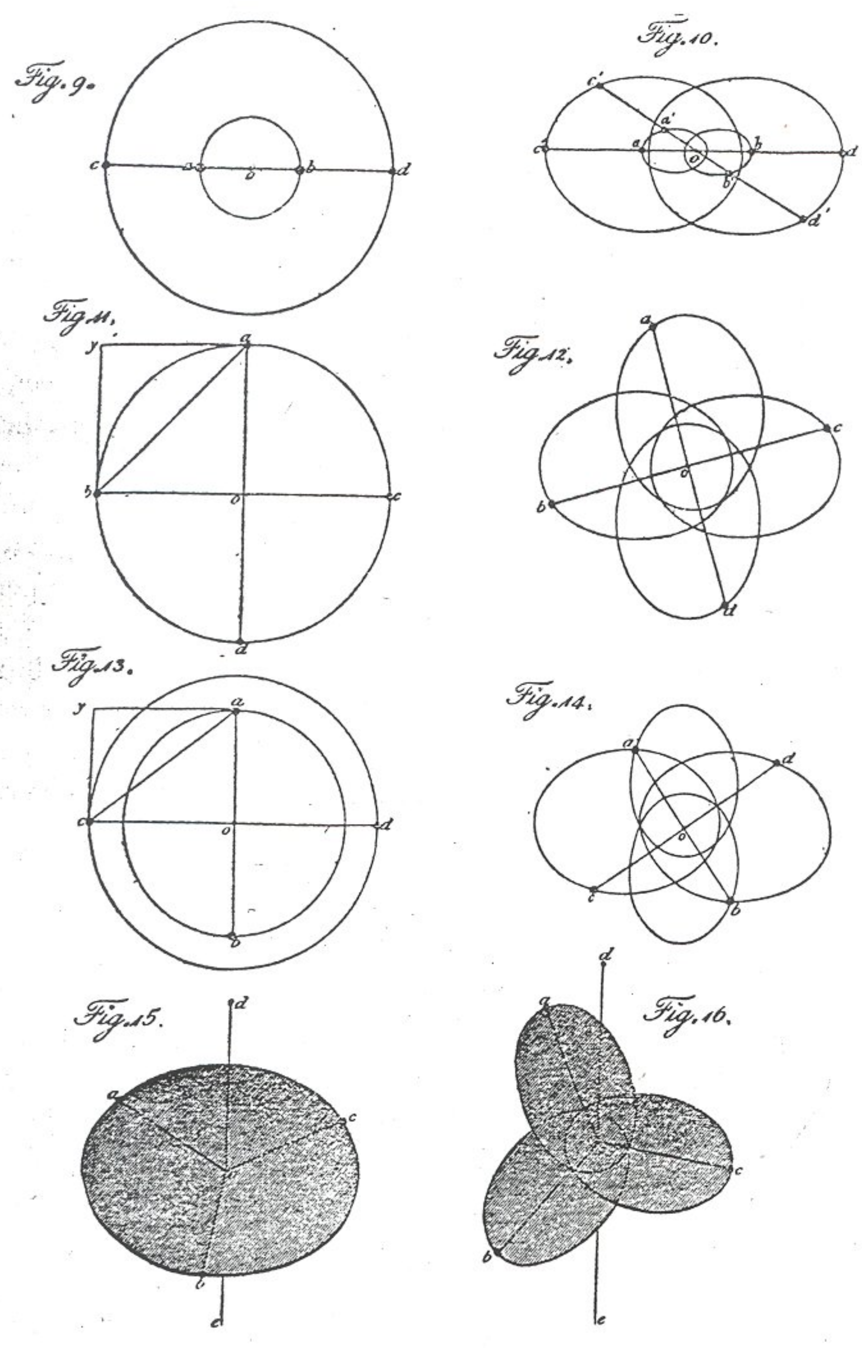
If we admit of treble stars, we can have no reason to oppose more complicated connections; and, in order to form an idea how the laws of gravitation may easily support such systems, I have joined some additional delineations. A very short explanation of them will be sufficient.

Fig. 9 represents four stars, *a b c* and *d*, arranged in a line; *a* being equal to *b*, and *c* equal to *d*. Then, if $ao = bo$, and $co = do$, the centre of gravity will be in *o*; and, with a proper adjustment of projectile forces, the four stars will revolve in two circular orbits round their common centre. By calculating in the manner already pointed out, it will be found, that when, for instance, $ao = 1$, $co = 3$, and $c = d = 1$, then the mass of matter in $a = b$, will be required to be equal to 1·3492.

It is not necessary that the projectile force of the four stars should be such as will occasion them to revolve in circles. The system will be equally permanent when they describe similar ellipses about the common centre of gravity, which will also be the common focus of the four ellipses. In Fig. 10, the stars *a b c d*, revolving in ellipses that are similar, will always describe, at the same time, equal angles in each ellipsis about the centre of hypothetical attraction; and, when they are removed from *a b c d* to *a′ b′ c′ d′*, they will still be situated in a straight line, and at the same proportionate distances from each other as before. By this it appears, as we have already observed, that the absolute hypothetical force in the situation *a′ b′ c′ d′*, compared to what it was when the stars were at *a b c d*, is inversely as the squares of the distances; but that its comparative exertion on the stars, in their present situation, is still in a direct ratio of their distances from the centre *o*, just as it was when they were at *a b c d*; or, to express the same perhaps more clearly, the force exerted on *a′*, is to that which was exerted on *a* as $\frac{1}{\overline{a'o}|^2} : \frac{1}{\overline{ao}|^2}$. But the force exerted on *a* is to that exerted on *c*, in our present instance, as $ao = 1$ to $co = 3$; and still remains in the same ratio when the stars are at *a′* and *c′*; for the exertion will here be likewise as $a'o = 1$ to $c'o = 3$.

Fig. 11 represents four stars in one circular orbit; and its calculation is so simple, that, after what has been said of Fig. 5, I need only remark that the stars may be of any size, provided their masses of matter are equal to each other.

It is also evident, that the projectile motion of four equal stars is not confined to that particular adjustment which will make them revolve in a circle. It will be sufficient, in order to produce a permanent system, if the stars *a b c d*, in Fig. 12, are impressed with such projectile forces as will make them describe equal ellipses round the common centre *o*. And, as the same method of calculation which has



been explained with Figs. 6 and 10 may here be used, it will not be necessary to enter into particulars.

Fig. 13 represents four stars, placed so that, with properly adjusted projectile forces, they may revolve in equal times, and in two different circles, round their common centre of gravity *o*. If $ao = bo = 4$, $co = do = 5$, and $c = d = 1$, then will the mass of matter in $a = b$, required for the purpose, be 1·5136. This arrangement, remarkable as it may appear, cannot be made in all situations; for instance, if the distance $ao = bo$ were assumed equal to 1, that of $co = do$ being 2, it would be impossible to find such quantities of matter in *a* and *b* as would unite the four stars into one system.

As we have shewn how the arrangements in Fig. 10 may be derived from that of Fig. 9, so it will equally appear, that four stars may revolve in different but similar ellipses round their common centre, as in Fig. 14. For here the four stars, when placed at *a b c d*, are exactly in the situation represented in Fig. 13; but, on account of different projectile forces, they revolve, not as before in concentric circles, but in similar elliptical orbits.

Fig. 15 represents three stars, *a b c*, in the situation of Fig. 5, to which a small oscillating star, *d*, is added. The addition of such a star to Fig. 1, has been sufficiently explained in Fig. 7; and, what has been remarked there, may easily be applied to our present figure. As the fictitious body *m*, in Fig. 7, was made to represent the stars *a* and *b*, it will now stand for the three stars *a b* and *c*. If we suppose these stars to be of an equal magnitude in both figures, the centre of gravity *o*, of the three stars, will not be so far from *m* and *n* as in Fig. 7; and the perturbations will be proportionally lessened.

Fig. 16 gives the situation of three stars, *a b c*, moving in equal elliptical orbits about their common focus *o*, while the star *d* performs oscillations between *d* and *e*. What has been said in explaining Fig. 8, will be sufficient to shew, that the present arrangement is equally to be admitted among the constructions of sidereal systems that may be permanent.

We have before remarked, that any appearance of treble stars might be explained, by admitting the combinations pointed out in Figs. 5, 6, 7, and 8; and it must be equally obvious, that quadruple systems, under what shape soever they may shew themselves, whether in straight lines, squares, trapezia, or any other seemingly the most irregular configurations, will readily find a solution from one or other of the arrangements of the eight last figures.

More numerous combinations of stars may still take place, by admitting simple and regular perturbations; for then all sorts of erratic orbits of multiple flexures may have a permanent existence. But, as it would lead me too far, to apply calculation to them, I forbear entering upon the subject at present.

Before I proceed, it will be proper to remark, that it may possibly occur to many, who are not much acquainted with the arrangement of the numberless stars of the heavens, that what has been said may all be mere useless surmise; and that, possibly, there may not be the least occasion for any such speculations upon the subject. To this, however, it may be answered, that such combinations as I have mentioned, are not the inventions of fancy: they have an actual existence; and, were it necessary, I could point them out by thousands. There is not a single night when, in passing over the zones of the heavens by sweeping, I do not meet with numerous collections of double, treble, quadruple, quintuple, and multiple stars, apparently insulated from other groups, and probably joined in some small sidereal system of their own. I do not imagine that I have pointed out the actual manner in which they are held together; but it will always be a desirable step towards information, if the possibility of such unions, in many different ways, can be laid before us; and, very probably, those who have more leisure to consider the different combinations of central forces, than a practical astronomer can have, may easily enlarge on what has been laid down in the foregoing paragraphs.

IV. *Of clustering Stars, and the Milky-way.*

From quadruple, quintuple, and multiple stars, we are naturally led to a consideration of the vast collections of small stars that are profusely scattered over the milky-way. On a very slight examination, it will appear that this immense starry aggregation is by no means uniform. The stars of which it is composed are very unequally scattered, and shew evident marks of clustering together into many separate allotments. By referring to some one of these clustering collections in the heavens, what will be said of them will be much better understood, than if we were to treat of them merely in a general way. Let us take the space between β and γ Cygni for an example, in which the stars are clustering with a kind of division between them, so that we may suppose them to be clustering towards two different regions. By a computation, founded on observations which ascertain the number of stars in different fields of view, it appears that our space between β and γ, taking an average breadth of about five degrees of it, contains more than 331 thousand stars; and, admitting them to be clustering two different ways, we have 165 thousand for each clustering collection. Now, as a more particular account of the milky-way will be the subject of a separate paper, I shall only observe, that the above mentioned milky appearances deserve the name of clustering collections, as they are certainly brighter about the middle, and fainter near their undefined borders. For, in my sweeps of the heavens, it has been fully ascertained, that the brightness of the milky-way arises only from stars; and that their compression increases in proportion to the brightness of the milky-way.

We may indeed partly ascribe the increase, both of brightness and of apparent compression, to a greater depth of the space which contains these stars; but this will equally tend to shew their clustering condition: for, since the increase of brightness is gradual, the space containing the clustering stars must tend to a spherical form, if the gradual increase of brightness is to be explained by the situation of the stars.

V. *Of Groups of Stars.*

From clustering stars there is but a short transition to groups of stars; they are, however, sufficiently distinct to deserve a separate notice. A group is a collection of closely, and almost equally compressed stars, of any figure or outline;

it contains no particular condensation that might point out the seat of an hypothetical central force; and is sufficiently separated from neighbouring stars to shew that it makes a peculiar system of its own. It must be remembered, that its being a separate system does not exclude it from the action or influence of other systems. We are to understand this with the same reserve that has been pointed out, when we explained what we called insulated stars.

The construction of groups of stars is perhaps, of all the objects in the heavens, the most difficult to explain; much less can we now enter into a detail of the numerous observations I have already made upon this object. I therefore proceed in my enumeration.

VI. *Of Clusters of Stars.*

These are certainly the most magnificent objects that can be seen in the heavens. They are totally different from mere groups of stars, in their beautiful and artificial arrangement: their form is generally round; and the compression of the stars shews a gradual, and pretty sudden accumulation towards the centre, where, aided by the depth of the cluster, which we can have no doubt is of a globular form, the condensation is such, that the stars are sufficiently compressed to produce a mottled lustre, nearly amounting to the semblance of a nucleus. A centre of attraction is so strongly indicated, by all the circumstances of the appearance of the cluster, that we cannot doubt a single moment of its existence, either in a state of real solidity, or in that of an empty centre, possessed of an hypothetical force, arising from the joint exertion of the numerous stars that enter into the composition of the cluster.

The number of observations I have to give relating to this article, in which my telescopes, especially those of high space-penetrating power, have been of the greatest service, of course can find no room in this enumeration.

VII. *Of Nebulæ.*

These curious objects, which, on account of their great distance, can only be seen by instruments of great space-penetrating power, are perhaps all to be resolved into the three last mentioned species. Clustering collections of stars, for instance, may easily be supposed sufficiently removed to present us with the appearance of a nebula of any shape, which, like the real object of which it is the miniature, will seem to be gradually brighter in the middle. Groups of stars also may, by distance, assume the semblance of nebulous patches; and real clusters of stars, for the same reason, when their composition is beyond the reach of our most powerful instruments to resolve them, will appear like round nebulæ that are gradually much brighter in the middle. On this occasion I must remark, that with instruments of high space-penetrating powers, such as my 40-feet telescope, nebulæ are the objects that may be perceived at the greatest distance. Clustering collections of stars, much less than those we have mentioned before, may easily contain 50000 of them; and, as that number has been chosen for an instance of calculating the distance at which one of the most remote objects might be still visible,* I shall take notice of an evident consequence attending the result of the computation; which is, that a telescope with a power of penetrating into space, like my 40-feet one, has also, as it may be called, a power of penetrating into time past. To explain this, we must consider that, from the known velocity of light, it may be proved, that when we look at Sirius, the rays which enter the eye cannot have been less than 6 years and $4\frac{1}{2}$ months coming from that star to the observer. Hence it follows, that when we see an object of the calculated distance at which one of these very remote nebulæ may still be perceived, the rays of light which convey its image to the eye, must have been more than nineteen hundred and ten thousand, that is, almost two millions of years on their way; and that, consequently, so many years ago, this object must already have had an existence in the sidereal heavens, in order to send out those rays by which we now perceive it.

VIII. *Of Stars with Burs, or Stellar Nebulæ.*

Situated as we are, at an immense distance from the remote parts of the heavens, it is not in the power of telescopes to resolve many phenomena we can but just perceive, which, could we have a nearer view of them, might probably shew themselves as objects that have long been known to us. A stellar nebula, perhaps, may be a real cluster of stars, the whole light of which is gathered so nearly into one point, as to leave but just enough of the light of the cluster visible to produce the appearance of burs. This, however, admits of a doubt.

IX. *Of milky Nebulosity.*

The phenomenon of milky nebulosity is certainly of a most interesting nature: it is probably of two different kinds; one of them being deceptive, namely, such as arises from widely extended regions of closely connected clustering stars, contiguous to each other, like the collections that construct our milky-way. The other, on the contrary, being real, and possibly at no very great distance from us. The changes I have observed in the great milky nebulosity of Orion, 23 years ago, and which have also been noticed by other astronomers, cannot permit us to look upon this phenomenon as arising from immensely distant regions of fixed stars. Even HUYGENS, the discoverer of it, was already of opinion that, in viewing it, we saw, as it were, through an opening into a region of light.† Much more would he be convinced now, when changes in its shape and lustre have been seen, that its light is not, like that of the milky-way, composed of stars. To attempt even a guess at what this light may be, would be presumptuous. If it should be surmised, for instance, that this nebulosity is of the nature of the zodiacal light, we should then

* See *Phil. Trans.* for 1800, page 83 [above, p. 51].

† See *Systema Saturnium*, page 8 and 9.

be obliged to admit the existence of an effect without its cause. An idea of its phosphorical condition, is not more philosophical, unless we could shew from what source of phosphorical matter, such immeasurable tracts of luminous phenomena could draw their existence, and permanency; for, though minute changes have been observed, yet a general resemblance, allowing for the difference of telescopes, is still to be perceived in the great nebulosity of Orion, even since the time of its first discovery.

X. *Of nebulous Stars.*

The nature of these remarkable objects is enveloped in much obscurity. It will probably require ages of observations, before we can be enabled to form a proper estimate of their condition. That stars should have visible atmospheres, of such an extent as those of which I have given the situation in this and my former catalogues, is truly surprising, unless we attribute to such atmospheres, the quality of self-luminous milky nebulosity. We can have no reason to doubt of the starry nature of the central point; for, in no respect whatever does its appearance differ from that of a star of an equal magnitude; but, when the great distance of such stars is taken into consideration, the real extent of the surrounding nebulosity is truly wonderful. A very curious one of this kind will be found in the 4th class, No. 69, of the annexed catalogue.

XI. *Planetary Nebulæ.*

This seems to be a species of bodies that demands a particular attention. To investigate the planetary nature of these nebulæ, is not an easy undertaking. If we admit them to contain a great mass of matter, such as that of which our sun is composed, and that they are, like the sun, surrounded by dense luminous clouds, it appears evidently that the intrinsic brightness of these clouds must be far inferior to those of the sun. A part of the sun's disk, equal to a circle of 15″ in diameter, would far exceed the greatest lustre of the full moon; whereas, the light of a planetary nebula, of an equal size, is hardly equal to that of a star of the 8th or 9th magnitude. If, on the other hand, we should suppose them to be groups, or clusters of stars, at a distance sufficiently great to reduce them to so small an apparent diameter, we shall be at a loss to account for their uniform light, if clusters; or for their circular forms, if mere groups of stars.

Perhaps they may be rather allied to nebulous stars. For, should the planetary nebulæ with lucid centres, of which the next article will give an account, be an intermediate step between planetary nebulæ and nebulous stars, the appearances of these different species, when all the individuals of them are fully examined, might throw a considerable light upon the subject.

XII. *Of planetary Nebulæ with Centres.*

In my second catalogue of nebulæ, a single instance of a planetary nebula with a bright central point was mentioned; and, in the annexed one, No. 73 of the 4th class, is another of very nearly the same diameter, which has also a lucid, though not quite so regular a centre. From several particularities observed in their construction, it would seem as if they were related to nebulous stars. If we might suppose that a gradual condensation of the nebulosity about a nebulous star could take place, this would be one of them, in a very advanced state of compression, A further discussion of this point, however, must be reserved to a future opportunity.

Catalogue of 500 additional new Nebulæ, and Clusters cf Stars.

First Class. Bright Nebulæ.

I.	1788.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
216	Dec. 3	22 Ursæ	*p*	13 52	*s*	3 4	2	*v*B. *p*L. *i*F. *r*. *mb*M. Towards the *sf*, within the nebulosity, is a *v*S. *st*.	2787
217	27	54 Persei	*f*	9 25	*n*	0 46	2	*c*B. *c*L. *mb*M. Stands nearly in the center of a trapezium.	1579
218	31	63 Aurigæ	*f*	26 43	*s*	0 20	1	*c*B. R. *vgmb*M. about 3′ *d*.	2419
	1789								
219	Mar. 23	55 Ursæ	*f*	5 33	*n*	0 36	1	*v*B. *c*L. *i*F. *vgmb*M.	3665
220	Apr. 12	64 (γ) Ursæ	*p*	43 59	*s*	0 20	2	*c*B. *m*E. 70° *np sf*. 3 or 4′ *l*, 2′ *b*.	3549
221	—	— —	*p*	21 41	*s*	0 37	2	*c*B. R. *vgmb*M, 4 or 5′ *d*.	3718
222	—	— —	*p*	20 20	*s*	0 35	2	*c*B. *i*E. near mer. *gb*M. 2′ *l*.	3729
223	—	— —	*f*	6 4	*s*	2 45	2	*v*B. *m*E. *np sf*. BN. 5′ *l*. 1½′ *b*.	4026
224	—	1 Canum	*p*	9 19	*s*	3 10	2	*c*B. *p*L. *m*E. SN.	4085
225	—	— —	*p*	8 31	*s*	0 46	2	*v*B. *p*L. B*r*N. just *f* a *cst*.	4102
226	14	64 (γ) Ursæ	*p*	33 32	*s*	0 34	1	*c*B. R. SB*r*N and *v*F chev. 4′ *d*.	3631
227	—	— —	*p*	15 28	*n*	2 37	2	*c*B. *c*L. *i*F. *r*. *vgb*M. 3′ *l*. 2′ *b*.	3780
228	—	— —	*p*	5 20	*n*	2 24	2	*v*B. *v*B*i*N. and F. bran. 1½′ *l*. ¾′ *b*.	3898
229	—	— —	*f*	3 46	*n*	1 47	1	The 2d of 2. *v*B. R. *vgb*M. See II. 791.	3998
230	—	83 Ursæ	*f*	20 24	*n*	0 27	2	*c*B. S. E. *sp nf*. *c*BN. and F bran.	5422
231	—	— —	*f*	24 34	*n*	0 10	2	*c*B. *p*S. *i*R.	5473
232	—	— —	*f*	27 7	*n*	0 16	1	The 2d of 2. *c*B. S. R. *vgmb*M. See III. 791.	5485
233	17	44 Ursæ	*f*	1 14	*s*	0 16	2	*c*B. E. 30° *sp nf*. *r*. *mb*M. 3′ *l*. 1½′ *b*.	3448
234	—	74 Ursæ	*f*	1 31	*s*	0 28	2	*c*B. S. *l*E. Just *p* a *p*L *st*.	4500
235	—	12 (ι) Draconis	*p*	66 52	*s*	2 3	2	*c*B. *i*F *vgmb*M. 7′ *l*, 5′ *b*.	5585
236	—	— —	*p*	59 56	*s*	2 13	3	*v*B. S. *i*R. B*ir*N. *vgmb*M.	5631
237	—	— —	*p*	54 10	*s*	0 52	1	B. *i* oval. *vgmb*M.	5678
238	24	69 Ursæ Hev.	*f*	27 55	*s*	0 32	2	*c*B. *p*L. *i*R *vgmb*M.	5376
239	—	— —	*f*	28 10	*s*	0 17	3	*c*B. *p*L. E. *mb*M.	5379
240	—	— —	*f*	28 34	*s*	0 17	2	*c*B. *p*L. E. SBN.	5389

I.	1790.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
241	Feb. 17	19 (ξ) Hyd. Crat.	*p*	14 43	*s*	0 57	1	*c*B. E. 70° *np sf*. *vgb*M 7′ *l*, 4′ *b*. within a parallelogram.	3621
242	Mar. 17	15 (*f*) Ursæ	*p*	15 40	*s*	0 21	1	*v*B. LB*r*N. with *v*F chev.	2681
243	—	77 (ε) Ursæ	*f*	1 47	*n*	2 25	1	*c*B. S. R. *gb*M.	4814
244	18	39 Ursæ	*f*	36 44	*n*	0 40	2	*c*B. R. *vgmb*M. 1½′ *d*.	3619
245	—	— —	*f*	39 27	*n*	1 58	3	*v*B. *c*L. R. *vgb*M.	3642
246	—	66 Ursæ	*p*	29 19	*n*	0 20	2	*c*B. *p*L. E.	3683*
247	—	— —	*p*	28 13	*n*	2 0	2	*v*B. *p*L. *l*E. near par. *mb*M.	3690
248	—	— —	*p*	7 5	*n*	2 52	2	*c*B. *p*L. *i*F.	3894
249	19	17 Ursæ	*p*	9 0	*n*	3 43	2	*c*B. E. near par. *er*. *b*M. 4′ *l*, 2′ *b*. I suppose, with a higher power and longer attention, the stars would become visible.	2742
250	—	— —	*p*	4 47	*n*	3 17	1	*v*B. *c*L. *l*E. LBNM.	2768
251	—	76 Ursæ	*p*	50 48	*s*	2 3	1	*v*B. perfectly R. BN and F chev. *vgb*M. 1½′ *d*.	3945
252	—	— —	*p*	41 11	*s*	0 34	1	*v*B. *c*L. R.	4041
253	—	— —	*p*	41 46	*s*	0 51	1	*v*B. *v*L. E.	4036
254	—	— —	*p*	1 47	*s*	1 8	1	*e*B. E. par. 5′ *l*. all over equally B. except just on the edges.	4605
255	—	69 Ursæ Hev.	*f*	19 26	*n*	1 1	1	*v*B. BENM. 3′ *l*. ½′ b.	5308
256	—	— —	*f*	21 33	*n*	0 13	1	*v*B. *p*L. *i*F. suddenly *mb*M.	5322
257	Oct. 9	12 Eridani	*f*	16 58	*s*	1 58	1	*c*B. *i*R *vgmb*M. 1½′ *d*.	1344
258	Dec. 28	47 (λ) Persei	*p*	3 41	*n*	1 0	1	*v*B. *i*F. *r*. *b*M. 5′ *l*. 4′ *b*. A *p*L star in it towards the *f* side, but unconnected.	1491
259	1791. Mar. 7	17 Hydræ Crat	*f*	18 31	*n*	0 27	1	*c*B. *p*L. *l*E. *gb*M. The brightness takes up a large space of it.	3923
260	Apr. 2	23 (*h*) Ursæ	*p*	1 49	*s*	0 34	1	*v*B. *v*S. *i*R. *mb*M.	2880
261	1793 Feb. 4	38 of the *Con-nois.*	*f*	3 7	*s*	1 35	1	*v*B. *i*R. *vgb*M. 5′ *d*. Seems to have 1 or 2 stars in the middle, or an *i*N; the chev. diminishes *vg*.	1931
262	Apr. 6	1 (λ) Draconis	*p*	2 6	*s*	2 41	1	*c*B. *v*S. *i*F. N. with *v*F chev.	3682*
263	—	4 Draconis	*p*	22 48	*s*	0 23	1	*c*B. *l*E. *b*M.	4128
264	7	— —	*p*	14 18	*n*	1 36	1	*c*B. S. *b*M.	4250*
265	8	37 Ursæ	*p*	16 16	*n*	1 5	1	*c*B. S. *i*R. *vgmb*M.	3182
266	—	— —	*p*	13 35	*s*	0 11	1	*c*B. *p*L. *i*F. *gb*M.	3206
267	—	39 Ursæ	*f*	11 21	*s*	0 10	1	*c*B. *p*L. *i*R. 1¼′ *d*. The greatest part of it almost equally B.	3445
268	—	— —	*f*	12 46	*s*	0 4	1	*v*B. *v*S. R. Stellar.	3458
269	—	— —	*f*	18 1	*n*	0 29	1	*c*B. R. 1′ *d*. just *n* of a S*st*.	3488
270	—	— —	*f*	35 36	*n*	1 42	2	*v*B. *c*L. E. par. SN. E par.	3610
271	—	— —	*f*	35 54	*n*	0 55	1	*v*B. *c*L. E. *mb*M.	3613*

I.	1796.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
272	Mar. 4	Georgian planet	*p*	0 53	*n*	0 6	2	*c*B. S. *i*R. BN. *mb*M. This nebula was seen at 9^h 27′, sidereal time; the telescope being out of the meridian, the estimations may be a little faulty.	3332*
273	1797 Nov. 22	A double star	*f*	5 45	*s*	0 39	3	*v*B. *v*L. E. near par. The determining star follows 5 Draconis Hevelii 13′ 54″ in time, and is 0° 23′ more south.	4589
274	—	— —	*f*	10 13	*s*	0 24	3	*c*B. *v*S. *i*R. *b*M.	4648
275	Dec. 10	5 Dracon. Hev.	*f*	1 32	*n*	0 12	2	*c*B. S. R.	4291
276	—	— —	*f*	2 45	*n*	0 12	2	*c*B. *c*L. *i*F. *l*E. *mb*M.	4319
277	—	— —	*f*	6 20	*n*	0 20	2	*v*B. *c*L. *l*E. *mb*M.	4386
278	12	— —	*p*	11 5	*s*	0 15	1	*c*B. *c*L. *i*R. *mb*M.	4133*
279	—	— —	*p*	10 28	*n*	1 38	2	*c*B. *c*L. *l*E. *b*M.	4127*
280	—	16 (ζ) Ursæ min.	*f*	51 33	*n*	0 3	3	*v*B. *c*L. *l*E. *lb*M. The greatest brightness confined to a small point.	6217
281	1798 Dec. 9	τ Apps. Sculps. L. C. 95	*p*	1 47	*n*	0 27	1	*c*B. E. *np sf*. NM. 6′ *l*. 1½′ *b*.	613
282	1801 Apr. 2	Star 6·7 m. [B. 1446]	*p*	55 17:	*s*	1 10	1	*c*B. *p*L. *i*F.	2977*
283	—	— —	*p*	15 42:	*s*	1 31	1	*c*B. *c*L. *er*.	3183*
284	—	208 (N) Camelop. of BODE's Cat.	*p*	85 18:	*s*	0 23	1	*c*B. *v*S. *i*F.	3329*
285	Nov. 8	24 (*d*) Ursæ	*f*	13 14	*s*	1 53	1	*v*B. *v*L. E. *np sf*. 6′ *l*. 2′ *b*.	2976
286	—	— —	*f*	30 0	*s*	1 8	1	*v*B. *c*L. R. *vgmb*M. On the north-following side there is a F ray interrupting the roundness.	3077
287	Dec. 7	1 (λ) Draconis	*p*	4 37	*n*	1 13	1	*c*B. *m*E. *np sf*. *mb*M. 3′ *l*, 1′ *b*.	3735
288	1802 Sept. 26	184 Camelopar. of BODE's Cat.	*p*	11 58	*s*	2 34	1	*v*B. *c*L. *l*E. suddenly *mb*M.	2655

Second Class. Faint Nebulæ.

II.	1789.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
769	Feb. 22	81 (*g*) Geminor.	*p*	37 58	*n*	0 4	1	*p*B. *p*L. *i*R. *er*. *b*M.	2339
770	—	62 Ursæ	*p*	13 44	*s*	2 15	1	*p*B. *p*L. R. *lb*M.	3687
771	Mar. 20	26 (χ) Virginis	*p*	7 0	*n*	0 26	2	*p*B. *c*L. *i*F. *er*. *mb*M. 4 or 5′ *d*.	4504
772	—	— —	*f*	3 9	*n*	0 57	2	F. S. E.	4626

II.	1789.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
773	Mar. 20	26 (χ) Virginis	f	3 5	n	1 1	2	F. S. E. bM.	4628
774	—	— —	f	6 27	n	0 55	2	pB. S. iR. mbM.	4671
775	23	55 Ursæ	f	3 31	s	0 25	1	pB. cL. lE. vgmbM.	3652
776	—	26 (χ) Virginis	p	8 19	s	0 4	1	F. vL. er.	4487
777	—	— —	f	17 15	n	1 9	1	F. S. R. bM.	4813
778	—	— —	f	21 12	n	1 54	1	F. S. sf. a double star.	4888
779	—	— —	f	22 44	n	0 14	1	F. S.	4925
780	26	46 (γ) Hydræ	f	1 22	s	1 14	1	F. R. r. vglbM. 4′ d.	5085
781	Apr. 12	1 Canum	p	10 55	s	0 53	2	A pS. st. involved in nebulosity of no great extent; the st. does not seem to belong to it.	4068*
782	14	64 (γ) Ursæ	p	31 7	n	0 7	1	pB. S. R. vgmbM. just f a Sst.	3656
783	—	— —	p	18 40	n	0 50	1	pB. pL. bM.	3738
784	—	— —	p	17 41	n	0 37	1	pB. cL. lE. 3′ l.	3756
785	—	— —	p	7 3	n	2 18	1	pB. S. lE.	3888
786	—	— —	p	3 31	n	1 39	1	F. E.	3913
787	—	— —	p	3 2	n	1 27	1	Two nebulæ; the 1st pB. S.	3916
788				3 7		1 24		The 2d pB. S.	3921
789	—	— —	f	1 35	n	1 38	1	Two nebulæ; the 1st pB. E.	3972
790								The 2d F. S.	3977
791	—	— —	f	3 24	n	1 48	1	The 1st of 2. pB. S. E. See I. 229.	3990
792	—	1 Canum	p	3 12	n	2 47	1	F. S. R. bM.	4172
793	—	— —	p	0 57	n	2 36	2	F. pL. iF. bM.	4198
794	—	77 (ε) Ursæ	p	11 32	s	0 49	2	F. S.	4644*
795	—	— —	p	8 25	s	1 13	2	pB. vS. mbM.	4675*
796	—	— —	p	7 20	s	1 25	2	pB. cS. lE. BrN.	4686*
797	—	81 Ursæ	p	3 33	s	2 18	2	pF. pS. R. vgbM.	5201*
798	—	83 Ursæ	f	0 49	n	1 1	1	pB. E. 1½′ l, ½′ b.	5278*
799	—	— —	f	21 27	n	1 7	2	pB. cL. E.	5443*
800	—	— —	f	25 7	n	1 2	1	pB. S.	5475*
801	—	— —	f	27 27	n	0 23	1	F. cL.	5486*
802	17	71 Ursæ	p	15 20	n	1 33	1	F. S. E.	4149*
803	—	— —	p	13 57	n	0 59	2	F. S. R.	4161*
804	—	— —	p	5 43	s	0 3	1	pB. pL. iF.	4271*
805	—	— —	p	4 41	n	1 20	1	The 2d of 2. pB. pL. mbM. See III. 798.	4290*
806	—	— —	p	2 13	n	1 42	1	pB	4335*
807	—	12 (ι) Draconis	p	55 48	n	0 42	1	pB. E. mer. 1½′ l, ¾′ b.	5667*
808	24	Neb. II., 756	p	24 16	n	0 41	1	pB. S. iF. er. mixed with some pL. stars, which may perhaps belong to it.	5687*
809	—	— —	p	15 5	s	0 26	1	F. S. E.	5751*
810	—	21 (μ) Draconis	p	46 31	n	3 23	1	pF. pS. lE.	6125*
811	—	— —	p	44 9	n	0 50	1	pB. iR. vgvlbM.	6143
812	—	— —	f	10 4	n	2 55	1	F. S. R. vglbM.	6338
813	26	5 Canum	p	10 53	s	0 50	1	pB. S. lE.	4187
814	—	7 Canum	f	20 24	n	1 20	1	F. S. vsmbM.	4732

II.	1789.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
815	Apr. 26	82 Ursæ	*p*	31 48	*s*	0 52	1	F. *v*S. Stellar.	4987
816	—	— —	*p*	26 52	*s*	1 36	1	F. S. *i*R. *vgmb*M.	5040
817	—	— —	*p*	3 42	*s*	1 40	1	*p*B. S. R. *vgb*M.	5250
818	—	12 Drac. Hev.	*p*	40 16	*n*	0 33	1	*p*F. *c*S. R. *vgb*M.	5881*
819	1790 Mar. 8	13 (λ) Hyd. Crat.	*p*	11 58	*n*	0 31	1	*p*F. *p*L. *i*F. *b*M.	3571
820	10	65 Aurigæ	*f*	7 22	*n*	0 1	1	*p*B. S. Stellar.	2387
821	—	70 Geminorum	*p*	1 43	*n*	0 12	1	*p*B. *c*S. *r*. *p* a *cst*.	2415
822	17	27 Lyncis	*p*	25 42	*n*	0 41	1	*p*F. R. *r*. *vgb*M.	2426
823	—	15 (*f*) Ursæ	*p*	12 10	*s*	0 18	1	*p*B. S. R. *mb*M.	2693
824	—	26 Ursæ	*f*	139 17	*s*	0 1	1	*p*B. *m*E. 6′ *l*, 2′ *b*.	3917*
825	—	— —	*f*	139 40	*s*	1 44	1	*p*B. S. *i*F. *b*M.	3922*
826	—	77 (ε) Ursæ	*f*	28 0	*n*	1 42	1	F. S. E.	5109
827	—	— —	*f*	69 19	*n*	3 27	1	*p*B. S. *i*F. *mb*M.	5430*
828	18	17 Ursæ	*p*	6 25	*s*	2 57	1	*p*B. S. *vgmb*M.	2756
829	—	66 Ursæ	*p*	31 14	*n*	1 9	2	F. E. *np sf*. *er*. 1½′ *l*.	3669
830	—	— —	*p*	15 23	*s*	0 20	1	*p*B. E.	3804
831	—	— —	*p*	11 44	*n*	1 22	1	*p*B. *v*S. *l*E.	3838
832	—	— —	*p*	6 53	*n*	2 52	2	*p*B. *p*L. R. The nebulosity of this runs into that of I. 248.	3895
833	—	— —	*p*	1 1	*n*	1 46	1	F. S.	3958
834	19	17 Ursæ	*p*	11 34	*n*	3 10	1	*p*F. *p*S. *i*F. *er*.	2726
835	—	29 (υ) Ursæ	*f*	5 11	*n*	0 15	2	F. S. E. near par.	3043
836	—	76 Ursæ	*p*	70 41	*s*	0 53	1	F. S. R. *r*. almost of equal light throughout.	3725
837	—	— —	*p*	66 54	*s*	1 0	1	*p*B. *l*E.	3762
838	—	— —	*p*	66 15	*s*	3 9	1	*p*B. S.	3770
839	—	— —	*p*	63 0	*s*	2 28	1	*p*B. *c*S. R. *mb*M.	3796
840	—	— —	*p*	47 30	*s*	2 16	1	F. S. *b*M.	3978
841	—	69 Ursæ Hev.	*f*	4 24	*n*	2 46	2	The 1st of 2. *p*B. S. *i*F.	5216
842	—	— —	*f*	4 35	*n*	2 50	2	The 2d of 2. *p*B. *p*L. *i*F.	5218
843	—	— —	*f*	26 40	*n*	0 42	1	F. S.	5370
844	—	— —	*f*	27 43	*s*	0 29	1	*p*B. *c*L.	3795
845	20	50 (α) Ursæ	*f*	22 41	*n*	1 44	3	*p*B. *p*L. *i*R. *b*M.	3668
846	—	76 Ursæ	*p*	23 9	*n*	3 13	1	*p*B. *m*E. *sp nf*. BN. 5′ *l*, ½′ *b*.	4256
847	—	— —	*p*	19 1	*n*	3 8	1	*p*B. S. *l*E.	4332
848	—	— —	*p*	14 21	*n*	2 8	1	F. *i*F. *b*M. Stellar.	4441
849	—	— —	*p*	9 7	*n*	1 15	1	*p*B. *v*S. *l*E. SN.	4521
850	—	— —	*p*	7 16	*n*	0 48	1	*p*B. *p*L. *i*R. *r*. *vgb*M.	4545
851	Oct. 9	72 Pegasi	*f*	18 3	*s*	0 6	2	*p*F. *p*L. *i*R. *lb*M. *sp*. a *v*S*st*.	7773
852	—	σ Fornacis L. C. 285	*p*	4 15	*s*	0 34	1	F. *p*L. *i*R. *gb*M.	1425
853	Nov. 26	29 (π) Androm.	*p*	25 48	*s*	0 24	1	F. S. E. near mer.	29
854	Dec. 25	44 Piscium	*f*	3 49	*n*	0 56	1	*p*B. *v*S. R. *vgmb*M. pretty well defined on the margin.	128
855	—	—	*f*	4 44	*n*	0 10	2	*p*B. *c*L. *i*R. *r*. *vgb*M. *sp*. *v*S*st*.	132

II.	1790.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
856	Dec. 25	44 Piscium	*f*	13 52	*n*	1 8	1	F. S. *vgb*M.	194
857	—	— —	*f*	13 52	*n*	0 53	1	F. S. *vgb*M.	198
858	—	— —	*f*	14 10	*n*	0 58	1	*p*B. S. *vgb*M.	200
859	—	98 (μ) Piscium	*f*	20 28	*n*	0 1	1	*p*B. S. E. near par. *sp*. a S*st*.	693
860	28	MAYER's Zod. Cat. No. 18	*p*	5 48	*n*	0 39	1	*p*F. *v*S. *vgb*M.	196
861	—	57 Aurigæ	*f*	17 30	*n*	1 54	1	*p*B. *p*L. *i*F. *gb*M.	2320
862	—	— —	*f*	23 5	*n*	1 29	1	F. *p*L.	2332?*
863	29	63 (δ) Piscium	*p*	0 39	*n*	0 44	1	*p*L. *l*E. *r*. *gb*M.	257
	1791								
864	Mar. 7	17 Hyd. Crat.	*f*	16 46	*s*	0 1	1	*p*B. S. R. *vgmb*M. almost resembling a N.	3904
865 } 866 }	—	— —	*f*	34 2	*s*	0 31	1	Two nebulæ, both F. S. R. *b*M. and nearly in the same par.	4105 4106
867	April 2	73 Ursæ	*p*	14 8	*s*	1 12	1	*p*B. *v*S. Stellar.	4194
868 } 869 }	3	14 (τ) Ursæ	*f*	11 8	*n*	0 47	1	Two nebulæ, the 1st F. S. *i*F, the 2d F. *p*L. E. The place is that of the second, the other precedes it about 30^s and is nearly in the same parallel.	2814* 2820
870	—	35 Ursæ	*f*	2 50	*s*	0 36	1	F. S. *i*R. Almost of equal light throughout.	3259
871	—	— —	*f*	3 37	*s*	0 52	1	F. *v*S. *mb*M.	3266
872	—	— —	*f*	21 30	*n*	0 11	1	F. *c*L. *i*R.	3394*
873	May 6	13 (γ) Ursæ min.	*f*	37 53	*s*	1 17	1	F. R. *b*M. 1′ *d*.	6048
874	24	37 (ξ) Bootis	*f*	34 48	*s*	1 12	1	*p*B. *p*L. *i*R. *vgmb*M.	5928
875	30	25 Herculis	*f*	3 10	*n*	2 12	1	*p*B. S. *l*E. *vgmb*M.	6166
	1792								
876	Apr. 20	22 (*f*) Bootis	*p*	15 58	*n*	0 26	1	*p*B. *v*S.	5492
877	—	— —	*p*	13 27	*n*	1 21	1	*p*B. *p*L. *i*F.	5513
878	Sept. 16	3 Cephei Hev.	*p*	29 15	*s*	0 25	1	*p*B. *i*F. *b*M. contains 2 stars.	6824*
	1793								
879	Apr. 6	1 (λ) Draconis	*p*	9 49	*s*	2 5	1	*p*B. S. R. *b*M.	3622*
880	—	— —	*p*	7 44	*n*	0 6	2	F. S. *l*E. *sp nf*. but near mer. *gb*M.	3654
881	7	4 Draconis	*p*	45 43	*n*	0 12	1	F. *m*E. *np sf*. but near par. about 1½′ *l*.	3879*
882	8	37 Ursæ	*p*	10 40	*n*	1 3	1	*p*B. *p*L. *l*E. *b*M.	3225
883	—	— —	*p*	8 36	*n*	0 8	1	F. S. R. *b*M.	3238
884	—	39 Ursæ	*f*	22 42	*s*	0 37	1	F. S. R. *b*M.	3517
885	—	— —	*f*	37 41	*n*	0 42	1	F. S. *l*E. *np sf*.	3625
886	—	— —	*f*	44 5	*s*	0 2	1	*p*B. *i*F.	3674
887	9	42 Ursæ	*f*	2 41	*n*	1 56	1	F. *p*L. *i*F. *b*M.	3435
888	—	— —	*f*	7 21	*n*	0 11	1	F. S. R. *b*M.	3470
889	May 12	19 Bootis Hev.	*p*	26 45	*n*	0 20	1	*p*B. *p*L. R. just foll. a S*st*.	5374
890	—	— —	*p*	13 20	*n*	0 33	1	*p*B. *p*L. *i*R.	5491
891	—	— —	*f*	6 44	*n*	0 8	1	*p*B. *p*L. *l*E. BM.	5652

II.	1793.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
892	May 12	19 Bootis Hev.	*f*	7 44	*n*	0 24	1	F. S. E. near mer.	5661
893	—	— —	*f*	9 37	*s*	0 22	1	*p*B. S. *i*F.	5674
894	—	— —	*f*	10 46	*s*	0 31	1	F. S.	5679
895	13	93 (τ) Virginis	*p*	21 54	*s*	0 40	1	F. S. *i*R.	5257
896	—	— —	*p*	21 49	*s*	0 40	1	F. S. *i*R.	5258
897	Sept. 6	53 Aquarii	*p*	16 29	*n*	0 7	1	*p*B. *l*E. *r*. 1½′ *l*. 1¼′ *b*.	7218
898	1794 Mar. 22	Georgian planet	*f*	¾°	*n*	½	1	By coarse estimation. F. 3′ north of a *p*L. red *st*. This nebula was seen at 8ʰ 49′, sidereal time, the telescope being out of the meridian.	3107
899	1797 Dec. 20	4 (*b*) Ursæ min.	*p*	26 13	*s*	0 40	1	F. S. E. near mer. 1′ *l*.	5323
900	1798 Dec. 10	18 (ε) Eridani	*p*	20 53	*s*	1 5	1	F. E. *sp nf*. near par. 3′ *l*, 1′ *b*.	1247
901	1799 June 29	93 Herculis	*p*	27 30	*s*	0 11	1	F. S. *i*F. *er*. 2′ *l*.	6389
902	—	— —	*f*	7 47	*n*	0 49	1	F. *p*L. R. *vgb*M. 3½′ *d*.	6555
903	1801 Apr. 2	Star 6·7 m. [B. 1446]	*p*	41 21:	*s*	0 6	1	F. *p*L. *r*.	.. *
904	—	— —	*f*	29 49:	*s*	0 25	1	F. *p*L. *lb*M.	.. *
905	—	— —	*f*	61 5:	*s*	0 49	1	*p*B. *p*L.	.. *
906	Nov. 28	11 (α) Draconis	*f*	86 13	*n*	0 8	1	F. S. *l*E. *sp nf*. *vglb*M.	5949
907	1802 June 26	2 (μ) Lyræ	*f*	5 21	*n*	0 18	1	F. S. *i*F.	6646
908	Sept. 30	Ursæ 24 Bode	*f*	6 59	*n*	0 9	1	*p*B. *p*L. *er*. I believe I see some of the stars. *i*F.	2650*
909	—	27 Ursæ	*f*	20 3	*s*	0 5	1	F. *p*L. R.	3066*
910	1791 Mar. 24	73 Ursæ	*f*	15 44	*s*	0 48	1	F. S.	4646*

Third Class. Very faint Nebulæ.

III.	1788.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
748	Dec. 3	43 Camelop.	*f*	35 5	*n*	0 29	1	*v*F. *v*S. has a *v*F. branch *nf*.	2366
749	—	22 Ursæ	*p*	12 45	*s*	0 24	1	*c*F. *v*S.	2810
750	31	63 Aurigæ	*f*	48 58	*n*	0 43	1	*v*F. S. R. *lb*M.	2493
751	—	38 Lyncis	*f*	25 15	*s*	0 30	2	*e*F. S.	2965*
752	1789 Feb. 22	16 (ζ) Cancri	*p*	4 19	*n*	0 8	1	*e*F. *l*E. *s* of a *v*S*st*.	2530
753	—	33 (η) Cancri	*p*	8 11	*s*	0 4	1	*v*F. S. R. *vlb*M.	2582*
754	24	6 Corvi	*p*	17 33	*s*	1 43	1	*e*F. *v*S. R.	4087
755	Mar. 20	26 (χ) Virginis	*p*	13 3	*n*	0 20	1	Two nebulæ, both *v*F. *v*S.	4403
756								E. within 1½′ of each other.	4404

III.	1789.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
757	Mar. 20	26 (χ) Virginis	*p*	5 25	*n*	0 38	2	2 *v*S. stars involved in *v*F. nebulosity of no great extent.	4520
758 }	23	— —	*f*	20 55	*n*	1 53	1	Two nebulæ, both *v*F. *v*S.	4878
759 }									4879
760	—	— —	*f*	23 47	*s*	0 9	1	*c*F. *v*S. R.	4928
761	—	— —	*f*	24 55	*n*	0 18	1	*v*F. S.	4942
762	—	102 (υ') Virginis	*p*	11 30	*n*	0 36	1	*v*F. *v*S.	5478
763	—	105 (φ) Virginis	*p*	1 1	*s*	0 1	1	*e*F. S.	5618
764	26	9 (β) Corvi	*p*	4 55	*n*	0 15	1	*c*F. *p*S. R. Stellar.	4462
765	—	45 (ψ) Hydræ	*p*	1 35	*s*	0 53	1	*v*F. *p*L. *i*F.	4970
766	—	— —	*f*	0 39	*s*	0 16	1	*v*F. *v*S.	4993
767	Apr. 12	64 (γ) Ursæ	*p*	78 24	*s*	3 45	1	*v*F. *p*S. *i*E.	3298
768	—	— —	*p*	30 48	*s*	0 49	2	*v*F. *v*S. Stellar.	3657
769	—	— —	*p*	1 40	*s*	1 44	1	*c*F. S.	3931*
770	14	— —	*p*	39 32	*n*	2 2	1	*v*F. *v*S. Stellar.	3594
771	—	— —	*p*	19 37	*n*	1 8	1	*e*F. S. *i*E. On account of the brightness of 179 Ursæ maj. of BODE's Cat. which was in the field of view with it, I had nearly overlooked it.	3733
772	—	— —	*p*	19 2	*n*	1 16	1	*v*F. Stellar.	3737
773	—	— —	*p*	14 0	*n*	2 32	1	*c*F. *p*S. *l*E. just *f* a *v*S*st*.	3804*
774	—	— —	*p*	10 37	*s*	0 58	2	*v*F. S.	3824*
775	—	— —	*p*	10 17	*s*	1 1	1	*v*F. *v*S.	3829
776	—	— —	*p*	9 33	*n*	2 12	1	*e*F. *p*L. *l*E, time inaccurate. Left doubtful.	3850*
777	—	1 Canum	*p*	1 54	*s*	0 33	1	*e*F. S. Stellar.	4181
778	—	77 (ε) Ursæ	*p*	9 10	*s*	1 4	2	*c*F. S. *l*E. *i*F.	4669*
779	—	— —	*f*	11 36	*n*	0 20	2	*v*F. S.	4964*
780	—	— —	*f*	12 37	*s*	0 19	1	*c*F. S.	4977*
781 }	—	— —	*f*	12 44	*s*	2 20	1	Two nebulæ. Both *v*F. S. Place is that of 2nd, the other is 3' or 4' *sp*.	4973*
782 }									4974*
783	—	— —	*f*	12 33	*s*	2 28	1	*v*F. S. E.	4967*
784	—	81 Ursæ	*p*	7 6	*n*	0 9	1	*c*F. S. *i*R.	5164
785	—	83 Ursæ	*f*	4 34	*n*	0 37	1	2 *e*F. *st*. with nebulosity.	5294
786	—	— —	*f*	14 3	*s*	0 22	1	*v*F. *v*S. Stellar.	5368
787	—	— —	*f*	22 27	*s*	0 28	1	*v*F. *v*S.	5447
788	—	— —	*f*	23 47	*s*	0 24	1	*v*F. *v*S.	5461
789	—	— —	*f*	23 54	*s*	0 22	1	*v*F. *v*S.	5462
790	—	— —	*f*	25 23	*s*	0 17	1	*v*F. *p*L.	5477
791	—							The 1st of 2. *v*F. S. 3' or 4' dist. from I. 232.	5484*
792	17	44 Ursæ	*p*	2 11	*n*	0 50	1	*v*F. S. E. 20° *sp nf*. *er*.	3398
793	—	48 (β) Ursæ	*f*	1 25	*s*	0 10	1	*v*F. *v*S. Stellar. The brightness of β Ursæ is so considerable, that it requires much attention to perceive this nebula.	3499

III.	1789.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
794	Apr. 17	71 Ursæ	*p*	22 30	*n*	1 8	1	*c*F. S. ver. 300.	4054*
795	—	— —	*p*	16 8	*n*	2 5	2	*v*F. S. *i*F. *r*.	4141
796	—	— —	*p*	11 23	*n*	2 52	1	*e*F.	4195
797	—	— —	*p*	10 56	*n*	3 11	2	*e*F. S.	4199*
798	—	— —	*p*	5 4	*n*	1 20	1	The 1st of 2. *c*F. *l*E. *i*F. See II. 805.	4284
799	—	— —	*p*	1 12	*n*	1 36	1	*v*F. *v*S.	4358
800 }	—	— —	*p*	1 9	*n*	1 37	1	Two, both *c*F. *c*S. R.	4362*
801 }									4364*
802	—	74 Ursæ	*f*	4 54	*n*	0 30	2	The 1st of 2. *v*F. S. *l*E. See III. 807.	4547
803	—	69 Ursæ Hev.	*f*	9 33	*s*	2 53	2	Suspected *e*F. *v*S.	5255*
804	—	— —	*f*	46 59	*s*	2 18	2	*e*F. S. E. *r*.	5526
805	—	— —	*f*	48 9	*s*	0 1	3	*e*F. *v*S. R. Stellar.	5540
806	—	12 (ι) Draconis	*p*	34 20	*n*	0 8	1	*v*F. *v*S. *l*E.	5777
807	24	74 Ursæ	*f*	5 26	*n*	0 34	1	The 2d of 2. *e*F. S. E. differently from III. 802.	4549
808	—	69 Ursæ Hev.	*p*	7 35	*s*	2 19	1	*c*F. S. E.	5109*
809	—	— —	*f*	27 7	*s*	1 25	1	*v*F. *v*S.	5372
810	—	— —	*f*	30 44	*s*	0 13	1	*c*F. *v*S. R.	5402
811	—	Neb. II. 756	*f*	0 32	*n*	0 2	1	*v*F. S. E.	5821
812	—	21 (μ) Draconis	*p*	55 20	*n*	3 18	1	*v*F. *v*S. *l*E.	6088*
813	—	— —	*p*	36 1	*n*	1 14	1	*v*F. *v*S. *i*R.	6182
814	26	5 Canum	*p*	15 0	*n*	0 32	1	*v*F. S. *er*.	4142
815	—	7 Canum	*f*	18 48	*s*	0 22	1	S. Stellar.	4707
816	—	— —	*f*	25 11	*n*	1 33	1	*e*F. S. *l*E.	4801
817	—	— —	*f*	26 43	*n*	0 45	1	*c*F. S. *i*F.	4834
818	—	— —	*f*	33 4	*s*	1 7	1	*c*F. S. R. *vglb*M.	4932
819	—	82 Ursæ	*p*	32 15	*s*	2 12	1	*v*F.	4998
820	—	— —	*p*	29 17	*s*	2 48	1	2*v*S stars at less than 1′ *d*. with *v*F. nebulosity between them.	5009
821	—	— —	*p*	12 59	*s*	0 7	1	*c*F. Stellar.	5163*
822	—	— —	*p*	6 23	*s*	1 25	1	*c*F. *p*S. *i*R. *lb*M.	5225
823	—	— —	*p*	5 5	*s*	1 18	1	*c*F. *p*L. R. *vlb*M.	5238
	1790								
824	Mar. 8	7 (*a*) Hyd. Crat.	*f*	7 26	*s*	1 9	1	*v*F. *v*S. *i*R. *glb*M.	3528*
825	10	39 Lyncis	*p*	12 53	*s*	1 31	1	*v*F. S. R. *b*M. *s* of a S*st*.	2746
826	—	— —	*p*	5 55	*s*	1 56	1	*v*F. S. *r*.	2780
827	—	— —	*f*	2 11	*s*	1 29	1	*e*F. *v*S. *sf* a *v*S*st*.	2840
828	—	Hyd. L. C. 1039	*p*	2 1	*s*	1 11	2	*e*F. *p*S. R. *vgb*M. Stellar. just *p* a *v*S*st*.	3885
829	17	27 Lyncis	*p*	23 49	*n*	1 30	1	*e*F. *v*S. R. *b*M.	2431
830	—	— —	*p*	10 40	*n*	1 19	1	*c*F. *p*S. *b*M.	2474
831	—	15 (*f*) Ursæ	*p*	12 8	*n*	0 23	1	*v*F. *v*S.	2692
832	—	— —	*f*	9 39	*n*	0 57	1	*v*F. S. *l*E.	2800
833	—	26 Ursæ	*f*	134 3	*s*	1 43	1	*v*F. *v*S.	3870
834	—	74 Ursæ	*f*	2 4	*s*	1 56	1	*e*F. S. *i*F.	4511
835	—	77 Ursæ	*f*	82 37	*n*	1 52	1	*e*F. S. E. but nearly R.	5526*

III.	1790.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
836	Mar. 18	17 Ursæ	*p*	79 17	*s*	0 33	1	*v*F. *v*S. may be a patch of stars.	2469
837	—	— —	*p*	75 32	*s*	0 40	1	*e*F. *v*S.	2488
838	—	— —	*p*	75 10	*s*	0 15	1	*e*F. *v*S.	2497
839	—	— —	*p*	72 22	*s*	3 40	1	*e*F. *v*S.	2497
840	—	— —	*p*	63 56	*s*	1 28	1	*c*F. *c*S.	2505*
841	—	— —	*p*	16 9	*s*	1 9	1	*v*F. S.	2534*
842	—	43 Ursæ	*p*	5 8	*s*	0 39	1	*v*F. *v*S. R.	2710
843	—	66 Ursæ	*p*	19 23	*n*	1 52	1	*v*F. Stellar. *np* a S*st*.	3353*
844	—	— —	*p*	16 1	*n*	2 2	1	*v*F. S. *m*E.	3757
845	—	69 (δ) Ursæ	*p*	4 55	*n*	1 17	1	*v*F. S. E. in the par.	3795
846	19	20 Ursæ	*f*	7 53	*s*	2 23	1	*c*F. S. *m*E. very narrow.	4154*
847	—	76 Ursæ	*p*	67 53	*s*	2 50	1	*e*F. *v*S. *i*F.	2870
848	—	69 Ursæ Hev.	*p*	19 5	*n*	2 13	1	*v*F. *v*S.	3740
849	—	— —	*f*	23 53	*s*	0 8	1	*v*F. *v*S.	5007*
850	20	76 Ursæ	*p*	26 56	*n*	3 17	1	*v*F. *p*S.	5342
851	—	— —	*p*	25 25	*n*	0 43	1	*e*F. S. *i*F.	4210
852	—	— —	*p*	16 38	*n*	2 12	1	*v*F. Stellar, *nf* a S triangle of B*st*.	4238
853	Apr. 1	30 (φ) Ursæ	*f*	8 55	*n*	1 35	1	*v*F. S. *vgl*bM.	4391
854	Oct. 9	72 Pegasi	*f*	15 8	*s*	0 23	2	2 *v*S close *st*. with nebulosity between.	3073
855 } 856	—	— —	*f*	27 15	*n*	0 3::	1	Two nebulæ, both *e*F. Stellar. dist. 1′ from 30° *sp* to *nf*.	7760 7805 7806
857	—	σ Fornacis L. C. 285	*p*	12 30	*s*	1 54	1	*v*F. S. *i*F. *lb*M.	1366
858	10	6 Pegasi	*p*	24 40	*n*	0 43	1	*e*F. *p*L. *i*R. *vlb*M. requires great attention to be seen.	7046
859	—	— —	*p*	7 56	*n*	0 17	1	*c*F. *v*S. *i*R. *mb*M. near a *v*S*st*.	7081
860	Nov. 2	72 Pegasi	*p*	5 19	*n*	1 7	1	*v*F. S. *lb*M.	7680
861	—	— —	*f*	37 50	*s*	0 17	1	*e*F. S.	39
862	8	1 Lacertæ Hev.	*p*	3 17	*n*	1 19	1	*e*F. *p*L. *i*R. *r*.	7223
863	—	— —	*f*	3 9	*n*	0 48	1	*v*F. *v*S. *mb*M.	7248
864	—	— —	*f*	4 37	*n*	0 50	1	*v*F. S. *m*E. 75° *np sf*. *b*M.	7250
865	13	26 Aurigæ	*p*	1 9	*n*	1 31	1	*v*F. *v*S. R. *b*M.	1985
866	26	29 (π) Androm.	*p*	27 37	*s*	0 20	1	*v*F. *v*S. The *np* corner of a square.	13
867	Dec. 6	MAYER'S Zod. Cat. 20	*p*	49 19	*s*	1 39	1	*e*F. *p*S. *i*R. *lb*M.	7797
868	—	— —	*p*	39 35	*s*	0 42	1	*e*F. *p*S. *i*F.	12
869	25	44 Piscium	*f*	3 25	*n*	0 55	1	*v*F. *v*S. *b*M. *p*. and in the field with II. 854. *nf*. 2. S*st*.	125
870	—	— —	*f*	12 48	*n*	0 49	1	*v*F. S. *i*R. *vgb*M.	182
871	28	MAYER'S Zod. Cat. 18	*p*	8 1	*n*	1 44	1	*v*F. S. R. *vgb*M.	173
872	—	— —	*p*	5 52	*n*	0 41	1	*v*F. *v*S. *b*M.	192
873	—	— —	*p*	5 32	*n*	0 39	1	*e*F. *c*L. In the field with the foregoing, and with II. 860	201
874	—	57 Aurigæ	*f*	17 56	*n*	1 50	1	*v*F. *v*S. *l*E.	2322

III.	1790.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
875	Dec. 28	57 Aurigæ	*f*	21 42	*s*	0 7	1	*v*F. *v*S.	2329
876	29	51 Piscium	*f*	5 44	*n*	1 43	1	*v*F. *p*L. *i*R. *sf* a S*st* which is partly involved in the nebulosity.	180
	1791								
877	Feb. 23	26 Hydræ	*p*	73 56	*n*	0 22	1	*v*F. *i*R. *r*. 2′*d*. almost of equal light throughout.	2525
878	Apr. 2	14 (τ) Ursæ	*f*	9 14	*n*	0 38	2	*v*F. *c*L. R. *mb*M. near 5′ *d*.	2805
879	—	73 Ursæ	*p*	2 39	*s*	1 12	1	*c*F. S. *i*F.	4384
880	—	— —	*f*	8 13	*s*	1 26	1	*e*F. S.	4566
881	3	35 Ursæ	*f*	21 51	*n*	0 13	1	*v*F. S.	3392
882	May 6	9 Ursæ min.	*p*	34 52	*s*	2 0	1	*v*F. *p*L. R. *b*M.	5671*
883	—	13 (γ) Ursæ min.	*f*	42 41	*s*	1 36	1	*e*F. *v*S. ver. 300.	6071*
884	—	— —	*f*	44 51	*s*	2 22	1	*v*F. *v*S. with 300 *c*L.	6079*
885	24	37 (ξ) Bootis	*p*	3 44	*s*	0 35	1	*e*F. *v*S. E. near par.	5760
886 }	26	7 Serpentis	*p*	15 32	*n*	0 20	1	Two nebulæ, both *e*F. *v*S. the *p* is the most *n*. dist. 1½′.	5851
887 }									5852
888	27	19 (ξ) Coronæ	*p*	6 41	*n*	1 7	1	*e*F. *v*S. R. with 300 *p*L.	6103
889	28	17 (σ) Coronæ	*p*	2 1	*s*	0 52	1	*v*F. S. R. *vglb*M.	6089
890	—	20 (ν′) Coronæ	*f*	8 9	*n*	1 20	1	*v*F. *p*L. *l*E. *lb*M.	6177
891	30	25 Herculis	*p*	3 41	*n*	0 37	1	*e*F. *v*S. R. *lb*M.	6129
892	—	— —	*p*	2 5	*s*	0 9	1	*e*F. S. *b*M.	6142
893	—	44 (η) Herculis	*p*	6 26	*n*	0 8	1	*e*F. *v*S. *i*F. ver. 300.	6195
	1792								
894	Apr. 20	22 (*f*) Bootis	*f*	12 29	*n*	1 15	1	*v*F. *v*S.	5702
895	—	— —	*f*	12 55	*n*	0 47	1	*v*F. *v*S.	5710
896	—	— —	*f*	16 45	*s*	0 25	1	*e*F. S. *vlb*M.	5737
	1793								
897 }	Feb. 4	34 (θ) Gemin.	*p*	1 33	*s*	0 31	1	Two nebulæ. The most *n*. and *p*. *e*F. S. The other *e*F. *v*S. dist. 4′.	2290
898 }									2289
899	—	— —	*f*	15 18	*n*	1 17	1	*v*F. S. nearly R. *b*M.	2333
900 }	—	— —	*f*	36 21	*n*	0 9	1	Two nebulæ just preceding III. 703. Both *e*F.	2385
901 }									2388
902	Mar. 8	18 Navis	*f*	10 36	*n*	0 32	1	*v*F. *l*E. *r*. *b*M.	2578
903	Apr. 6	4 Draconis	*p*	30 43	*n*	0 10	1	*e*F. S. *i*F. *vlb*M.	4034
904	—	— —	*p*	23 25	*n*	0 24	1	*e*F. *v*S. E. mer.	4120
905	7	— —	*p*	37 3	*n*	0 8	1	*e*F. *v*S. ver. 300.	3961
906	—	6 Draconis	*f*	12 31	*n*	1 8	1	*v*F. E. 2′ *l*, ½′ *b*.	4693
907	—	— —	*f*	16 26	*n*	1 35	1	*v*F. E. *np sf*. 1½′ *l*, ½′ *b*.	4749*
908	—	— —	*f*	23 36	*n*	0 10	1	*e*F. *v*S. *i*R. *vlb*M.	4857
909	—	— —	*f*	39 10	*n*	0 35	1	*v*F. *v*S. R.	5034*
910	8	37 Ursæ	*p*	15 47	*n*	0 19	1	*v*F. *p*L. *i*F. *r*. some of the stars visible.	3188
911	—	— —	*p*	11 47	*s*	0 5	1	*v*F. *c*L. *i*F.	3220
912	—	— —	*f*	0 59	*n*	1 27	1	*e*F. *v*S. ver. 300.	3284*
913	—	39 Ursæ	*f*	8 14	*n*	1 14	1	*v*F. *v*S.	3408
914	—	— —	*f*	10 29	*s*	0 2	1	*v*F. S. *l*E.	3440
915	—	— —	*f*	25 35	*n*	0 3	1	*v*F. S.	3530

III.	1793.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
916	Apr. 9	42 Ursæ	*p*	48 48	*n*	0 39	1	*e*F. *v*S. Stellar near a S*st*.	3102
917	} —	— —	*p*	15 19	*s*	0 44	1	Two nebulæ.	3286
918	}			15 10		0 47		Both *v*F. *p*S. R. *lb*M.	3288
919	—	— —	*p*	0 1	*n*	2 2	1	*v*F. *v*S. near a *v*S*st*.	3407
920	—	— —	*f*	19 23	*n*	2 1	1	*e*F. *v*S. E. near mer.	3543
921	—	— —	*f*	24 11	*n*	1 22	1	*e*F. *p*L. E.	3589
922	—	— —	*f*	35 14	*n*	1 11	1	*v*F. *v*S. 2*v*S. stars in it.	3671
923	May 5	Hydr. L. C. 1179	*p*	1 25	*n*	0 5	1	*v*F. *v*S. R. *lb*M.	5328
924	—	6 Hydræ conti	*f*	11 2	*s*	1 27	1	*e*F. S. *r*. ver. 300.	5592
925	12	64 Virginis	*f*	1 18	*n*	1 10	1	*c*F. S.	5118
926	—	— —	*f*	13 5	*n*	1 17	1	*v*F. S. *sp* a *c*B*st*.	5224
927	—	19 Bootis Hev.	*p*	0 20	*n*	0 44	1	*v*F. S.	5599
928	13	93 (τ) Virgin.	*p*	26 17	*s*	0 5	1	*v*F. S.	5227
929	—	— —	*p*	9 25	*n*	0 35	1	*v*F. S. E. mer.	5331
930	Sept. 6	53 Aquarii	*p*	27 19	*n*	0 18	1	*e*F. ver. 300.	7165
931	—	— —	*p*	12 23	*s*	0 19	1	*e*F. S. *i*R.	7230
932	—	— —	*p*	8 50	*n*	1 11	1	*e*F. S. *l*E. *s* of a S*st*. to which it seems almost to be attached, but is free from it. The star is the 1st of 3, making a S triangle.	7246
933	—	— —	*p*	6 7	*n*	0 58	1	*v*F. S. R. *b*M.	7251
934	1794 Apr. 1	Georgian planet	*p*	0 16	*s*	0 2	1	*v*F. This nebula was seen at $9^h\ 45'$, sidereal time, the telescope being out of the meridian.	3080
935	19	12 (δ) Hydræ crateris	*f*	15 11	*n*	0 40	1	*e*F. S. *b*M.	3734
936	Oct. 15	5 (*a*) Cephei	*f*	7 54	*n*	0 16	1	*v*F. *er*.	7076
937	1797 Nov. 22	Neb. I. 274	*f*	25 3	*n*	0 53	1	*v*F. S. *i*R. *b*M.	4954*
938	Dec. 10	A double st*	*p*	9 5	*n*	0 10	1	*e*F. *p*L. *i*F. *See I. 273.	4363
939	—	— —	*f*	4 0	*s*	0 35	1	*e*F. S.	4572
940	12	5 Dracon. Hev.	*p*	32 24	*s*	0 49	1	*v*F. S. R. *b*M.	3890*
941	—	— —	*p*	8 21	*n*	0 57	1	*v*F. *p*S. 2 S *nf* stars make a triangle with it.	4159
942	—	— —	*f*	4 16	*n*	0 59	1	*e*F. E. near mer. ver. 300.	4331
943	} —	5 (*a*) Ursæ mi.	*f*	46 2	*s*	0 28	1	Two nebulæ.	5909
944	}							Both *v*F. *v*S. *r*. dist. 1½′ par.	5912
945	—	35 Draconis	*p*	47 10	*s*	1 17	1	*v*F. S. E. *n* of a S*st*.	6324
946	20	4 (*b*) Ursæ mi.	*p*	29 31	*n*	1 57	1	*v*F. *v*S. R.	5295*
947	—	— —	*p*	14 39	*n*	0 42	1	*v*F. *c*L. *i*F. *vlb*M. *s* of a *p*B. *st*.	5452
948	—	— —	*f*	2 20	*n*	1 3	1	*e*F. *v*S. E. near mer.	5547
949	—	— —	*f*	14 44	*n*	2 29	1	*e*F. S. *l*E. near par.	5640*
950	—	— —	*f*	24 18	*n*	1 13	1	*v*F. S. *r*. It is preceded by a S. patch of *st*. which appears almost like this nebula, but more resolved.	5712

III.	1797.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
951	Dec. 20	4 Cephei of BODE's Cat.	*p*	21 18	*s*	1 25	1	*e*F. S. better with 320.	6331
	1798								
952 953	Dec. 9	2 (π^{1}) Orionis	*p*	10 20	*s*	1 34	1	Two nebulæ within 1′ of each other; mer. Both *v*F. *v*S.	1633 1634
954	10	8 Ceti	*f*	17 5	*s*	1 15	1	*e*F. S.	163*
955	—	21 Ceti	*p*	3 46	*n*	0 4	1	*c*F. *v*S. *i*R.	270
956	—	18 (ε) Eridani	*p*	15 21	*s*	0 53	1	*v*F. *v*S. 2 or 3′ *n* of 2 S*st*.	1284
	1799								
957 958	June 29	93 Herculis	*p*	3 59	*n*	1 37	1	Two; both *v*F. *v*S; place that of the *f* one, *p* one about 4′ more *s* and 5 or 6ˢ *p*.	6500 6501
959	Dec. 19	16 Eridani	*f*	6 37	*n*	0 26	1	The 2d of 2 *v*F. *v*S. 1½′ *sf* I. 60. I.C.	324*
960	—	19 Eridani	*f*	1 19	*n*	1 13	1	*v*F. *v*S. ver. 300.	1362
961	—	— —	*f*	2 43	*n*	0 46	1	*v*F. *v*S.	1377
962	—	— —	*f*	20 51	*n*	1 15	1	*v*F. *v*S. *sp*. 2*p*B*st*.	1482
	1801								
963	Apr. 2	Star 6·7 m. [B. 1446]	*p*	59 37:	*n*	0 17	1	*e*F. S. *i*F.	..*
964	—	— —	*p*	21 56	*s*	1 32	1	*c*F. S. Stellar. ver. 300. just *p*. a S*st*.	3144*
965	—	— —	*p*	19 24	*s*	1 23	1	*v*F. *v*S.	3155*
966	—	— 8 m [P. IX. 112]	*f*	31 14:	*s*	0 11	1	*v*F. *v*S.	..*
967 968	—	— 6·7 m [B. 1446]	*f*	25 48:	*s*	0 19	1	Two nebulæ. The 1st *v*F. S. The 2d *nf* the 1st *e*F. *v*S.	3465* ..*
969	—	— —	*f*	60 27	*s*	1 6	1	*e*F. S.	..*
970	—	208 (N) Camel. of BODE's Cat.	*p*	24 19:	*n*	0 28	1	*v*F. *p*L. *r*.	..*
971	—	Star 6·7 m. [B. 1446]	*f*	77 24	*s*	0 58	1	*e*F. *v*S. R.	3890*
972	Nov. 28	50 (α) Ursæ	*p*	4 54	*s*	0 10	1	*v*F. *v*S. R. *b*M.	3471
973	Dec. 6	16 (ζ) Ursæ mi.	*f*	14 15	*n*	1 8	1	*v*F. S. *l*E. mer. *r*.	6068
	1802								
974 975	Jan. 1	22 (ε) Ursæ mi.	*p*	10 49	*n*	0 37	1	Two nebulæ; the preceding *c*F. S. *b*M. the foll. *v*F. *v*S. it follows the 1st a few seconds, and is about 3′ more north. The place is that of the first.	6251 6252
976	May 21	2 (η) Coronæ	*p*	26 50	*n*	0 2	1	*e*F. S. *i*F.	5789
977	Sept. 26	186 P. Camelo. of BODE's Cat.	*f*	9 49	*s*	1 33	1	*e*F. *v*S. 300 confir.	2908*
978	—	— —	*f*	33 19	*s*	0 58	1	*e*F. *p*L. *l*E. *vlb*M. just *n* of 2 S*st* that are nearly in the parallel.	3057*

III.	1802.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
979 980 981	Sept. 26	191 Camelop. Bo.	*p*	7 44	*s*	0 38	1	Three, the place is that of the last. Two last *v*F*v*S, *p* one stellar; all in a line, about 1′ dist. from each other, *p* one most *n*, about 2′ more than the last.	3210* 3212* 3215*
982 983	30	24 Ursæ Bode	*f*	3 19	*n*	2 39	1	Two, the place is that of the last, the other about 42ˢ *p*. 6′ *n*; *p* one stellar, S* 1′ *f*; *f* one *v*F. S.	2629* 2641*
984	1784 Nov. 17	86 Pegasi	*p*	3 14	*s*	0 24	1	Suspected, 240 shewed 2 S*st*	7810*
985	1791 Mar. 24	73 Ursæ	*f*	20 11	*s*	1 17	1	*e*F. *p*S.	4695*

Fourth Class. Planetary Nebulæ,

Stars with Burs, with milky Chevelures, with short Rays, remarkable Shapes, &c.

IV.	1789.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
59	Mar. 23	55 Ursæ	*f*	4 51	*n*	0 23	1	*c*B. S. R. BN. The N is considerably well defined, and the chevelure *v*F.	3658
60	Apr. 12	36 Ursæ	*f*	8 37	*s*	2 28	2	*v*B. R. Planetary, but very ill defined. The indistinctness on the edges is sufficiently extensive to make this a step between planetary neb. and those which are described *vsmb*M.	3310
61	—	64 (γ) Ursæ	*f*	3 56	*s*	0 19	2	*c*B. B*r*N with *v*FE branches about 30° *np sf*. 7 or 8′ *l*, 4 or 5′ *b*.	3992
62	14	— —	*f*	2 27	*n*	1 25	1	*c*B. quite R. A large place in the middle is nearly of an equal brightness. Towards the margin it is less bright.	3982
63	24	69 Ursæ Hev.	*f*	1 24	*s*	1 33	1	*c*B. *c*L. *i*R. *er*. *vgmb*M. 4′ diam. I suppose, with a higher power, I might have seen the stars.	5204
64	1790 Mar. 4	6 Navis	*p*	7 41	*s*	1 2	2	A beautiful planetary nebula, of a considerable degree of brightness; not very well defined, about 12 or 15″ diam.	2440

IV.	1790.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
65	Mar. 5	28 Monocerotis	*p*	51 49	*n*	0 26	1	A pretty considerable star, 9 or 10m. visibly affected with *v*F. nebulosity, of very little extent all around. A power of 300 shewed the same, but gave a little more extent to the nebulosity. The 22d Moncerotis was quite free from nebulosity.	2346*
66	18	17 Ursæ	*p*	16 29	*s*	3 6	1	A small star with a *p*B. fan-shaped nebula. The star is on the *p* side of the diverging chevelure, and seems to be connected with it.	2701
67	—	66 Ursæ	*p*	0 39	*n*	1 55	1	*p*B. *p*L. R. The greatest part of it equally B, then fading away *p* suddenly; between 2 and 3′ diam.	3963
68	19	44 Lyncis	*p*	4 15	*n*	1 44	1	*v*B. S. exactly R. BNM. and *v*F. chev. *vg*. joining to the N. In a lower situation the chev. might not be visible, and this neb. would then appear like an ill defined planetary one.	2950
69	Nov. 13	{ 26 Aurigæ { or 31 Hevelii	*p* *f*	88 24 24 59	*s* *s*	0 11 1 26	1	A most singular phenomenon; A *st* 8m. with a faint luminous atmosphere of a circular form, about 3′ in diam. The star is perfectly in the centre, and the atmosphere is so diluted, faint, and equal throughout, that there can be no surmise of its consisting of stars, nor can there be a doubt of the evident connection between the atmosphere and the star. Another star, not much less in brightness, and in the same field with the above, was perfectly free from any such appearance.	1514
70	1791 May 6	6 Draconis	*f*	50 27	*n*	0 27	2	*c*B. R. almost equally B throughout, resembling a very ill defined planetary neb. about ½′ diam.	5144

IV.	1791.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C
71	May 24	37 (ξ) Bootis	*f*	16 5	*s*	0 44	1	A star 7·6m. enveloped in extensive milky nebulosity. Another star 7m. is perfectly free from such appearance.	5856
72	1792 Sept. 15	34 Cygni	*p*	5 10	*n*	0 23	1	A double star of the 8th magnitude, with a faint south-preceding milky ray joining to it, 8′ *l*, and 1½′ broad.	6888
73	1793 Sept. 6	16 (*c*′) Cygni	*f*	2 51	*s*	0 1	1	A bright point, a little extended, like two points close to one another; as bright as a star of the 8·9 magnitude, surrounded by a very bright milky nebulosity suddenly terminated, having the appearance of a planetary nebula with a lucid centre; the border however is not very well defined. It is perfectly round, and I suppose about half a minute in diam. It is of a middle species, between the planetary nebulæ and nebulous stars, and is a beautiful phenomenon.	6826
74	1794 Oct. 18	7 Cephei	*p*	24 57	*n*	1 22	1	A star 7m. very much affected with nebulosity, which more than fills the field. It seems to extend to at least a degree all around; smaller stars, such as 9 or 10m. of which there are many, are perfectly free from this appearance. A star 7·8m. is perfectly free from this appearance.	7023
75	—	7 Cephei	*f*	14 40	*s*	0 46	2	Three stars about 9m. involved in nebulosity. The whole takes up a space of about 1½′ diam. other stars of the same size are free from nebulosity.	7129
76	1798 Sept. 9	3 (η) Cephei	*p*	10 31	*s*	1 36	1	*c*F. *v*L. *i*F. a sort of BNM. The nebulosity 6 or 7′. The N seems to consist of stars, the nebulosity is of the milky kind. It is a pretty object.	6946

IV.	1798.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
77	Dec. 19	16 Eridani	*f*	4 56	*n*	0 14	1	A star about 9 or 10m. with a nebulous ray to the south-preceding side. The ray is about $1\frac{1}{2}'$ long. The star may not be connected with it.	1325
78	Nov. 8	8 Ursæ min. of BODE's Cat.	*p*	25 0	*n*	0 12	1	*c*B. R. about $1\frac{1}{2}'$ diam. Somewhat approaching to a planetary nebula, with a strong hazy border. = M82. See J. Herschel, Cape Obs.	4750
79									

Fifth Class. Very large Nebulæ.

V.	1789.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
45	Apr. 12	64 (γ) Ursæ	*f*	0 9	*s*	1 23	2	*c*B. *i*F. E. mer. LBN. with F. branches 7 or 8′ *l*, 5 or 6′ *b*.	3953
46	17	48 (β) Ursæ	*f*	10 4	*s*	0 41	2	*v*B. *m*E. *r*. 10′ *l*, 2′ *b*. There is an unconnected pretty bright star in the middle.	3556
47	1790 Apr. 1	30 (φ) Ursæ	*f*	10 9	*n*	1 39	1	*v*B. *m*E. *np sf*. *vgmb*M. 8′ *l*, 2′ *b*.	3079
48	Oct. 9	ι Fornacis L. C. 182	*f*	8 7	*s*	0 2	1	*v*B. E. 75° *np sf*. 8′ long. A very bright nucleus, confined to a small part, or about 1′ diam.	1097
49	Dec. 28	41 Persei Hev.	*f*	22 0	*n*	0 15	1	6 or 7 small stars, with faint nebulosity between them, of considerable extent, and of an irregular figure.	1624
50	1793 Mar. 4	ε Pixidis Na. L. C. 831	*f*	35 26	*s*	0 43	1	*v*F. *v*S. *l*E. 15° *sp nf*. *lb*M. 8′ *l*, 5 or 6′ *b*.	2997
51	Apr. 6	4 Draconis	*p*	14 48	*n*	0 20	2	*v*F. *m*E. 70° *np sf*. About 25′ *l*, and losing itself imperceptibly, about 6 or 7′ broad.	4236
52	Nov. 28	50 (α) Ursæ	*p*	17 49	*n*	1 30	1	*c*B. E. mer. *vgb*M. About 5′ *l*. and 3′ broad; the nebulosity seems to be of the milky kind; it loses itself imperceptibly all around. The whole breadth of the sweep seems to be affected with very faint nebulosity.	3359

Sixth Class. Very compressed and rich Clusters of Stars.

Additional Abbreviations. } cl. *Cluster*, com. *compressed*, sc. *scattered*, co. *coarsely*.

VI.	1790.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
36	Mar. 4	6 Navis	*p*	8 45	*s*	1 55	2	A *v*. com. cl. of S, and some L*st*. E near mer. The most compressed part is about 8′ *l*, and 2′ *l*. with many scattered to a considerable distance.	2432
37	1791 Feb. 23	26 Hydræ	*p*	79 30	*n*	1 0	1	A *v*. com. and very rich cl. of stars. The stars are of 2 sizes, some considerably L. and the rest next to invisible. The com. part 5 or 6′ in diam.	2506
38	Aug. 25	50 (γ) Aquilæ	*p*	14 50	*s*	1 18	1	*c*B. S. *i*F. *er*. Some of the *st*. are visible.	6804
39	1793 Mar. 3	ξ Pixidis Naut. L. C. 777	*p*	20 39	*s*	0 19	2	A cl. of L*st*. considerably rich *i*R. above 15′ diam.	2571
40	May 12	53 (ν) Serpentis	*p*	48 17	*n*	0 2	1	A very beautiful *e* com. cl. of *st*. extremely rich, 5 or 6′ in diam. gradually more compressed towards the centre.	6171
41	1797 Dec. 12	35 Draconis	*p*	22 6	*s*	1 7	1	R. *r*. about 3′ diam. *vgb*M. I suppose it to be a cluster of stars extremely compressed. 300 confirms the supposition, and shews a few of the stars ; it must be immensely rich.	6412
42	1798 Sept. 9	3 (η) Cephei	*p*	13 26	*s*	1 6	1	A beautiful compressed cl. of S*st*. extr. rich, of an *i*F. The preceding part of it is round, and branching out on the following side, both towards the *n*. and towards the *s*. 8 or 9′ in diam.	6939

Seventh Class. Pretty much compressed Clusters of large or small Stars.

VII.	1788.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
56	Dec. 16	11 (β) Cassiop.	*p*	9 57	*n*	2 6	1	A *p*. com. cl. of S*st*. of several sizes, cons. rich. E. near par. 5 or 6′ *l*.	7790
57	31	40 Aurigæ	*f*	8 28	*n*	1 25	1	A compressed cl. of *v*S. stars *i*F. 6′ diam. consid. rich.	2192

VII.	1790.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
58	Mar. 4	6 Navis	*f*	5 18	*s*	0 29	1	A *p*. com. and rich cl. of S stars *i*R. 7 or 8′ diam.	2479
59	Sept. 11	18 (δ) Cygni	*f*	18 38	*s*	1 4	1	A *v*. rich cl. of L*st*. considerably compressed, above 15′ diam. by the size of the *st*. it is situated in the milky-way, towards us.	6866
60	Dec. 28	47 (λ) Persei	*f*	3 30	*s*	0 50	1	A L. cl. of *c*L. *st*. *p*. com. and very rich. *i*R. 7′ diam.	1513
61	—	41 Persei Hev.	*p*	3 8	*n*	0 56	1	A beautiful cl. of L*st*. *v* rich, and considerably com. about 15′ diam.	1528
62	1791 Aug. 21	19 Aquilæ	*p*	0 26	*s*	1 24	1	A S. *p*. com. cl. of stars not very rich.	6756
63	1793 Mar. 3	ζ Pixidis Naut. L. C. 777	*p*	2 25	*s*	0 24	2	A L. cl. of scattered S*st*. *i*F. considerably rich.	2627
64	4	— —	*p*	20 55	*s*	1 9	1	A L. cl. of *st*. of a middling size. *i*E. considerably rich. The stars are chiefly in rows.	2567
65	8	2 Navis	*p*	16 10	*n*	0 38	1	A S. cl. of *v*S *st*. considerably rich and compressed.	2401
66	1794 Oct. 18	7 Cephei	*f*	16 45	*s*	1 7	2	A cl. of cons. com. *v*S. and L. stars about 12′ diam. considerably rich.	7142
67	1799 Jan. 30	15 (π′) Canis	*f*	42 33	*s*	0 14	2	A cl. of com. stars, considerably rich.	2421

Eighth Class. Coarsely scattered Clusters of Stars.

VIII.	1788.	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
79	Dec. 16	11 (β) Cassiop	*f*	20 35	*n*	1 5	1	A coarsely sc. cl. of L*st*. mixed with smaller ones, not very rich.	129
80	18	1 Camelopar.	*p*	41 36	*s*	1 29	1	A cl. of S. stars, containing one large one, 10; 9m. 2 or 3′ diam. not rich.	1444
81	1789 July 18	5 Vulpeculæ	*p*	2 46	*n*	2 4	1	A sc. cl. of *c*L. *st*. *i*F. pretty rich, above 15′ in extent.	6793
82	1790 Sept. 11	57 Cygni	*f*	1 0	*n*	0 52	1	A L. cl. of *p*S. stars of several sizes.	6989
83	30	51 Cygni	*p*	25 24	*s*	0 1	1	A cl. of sc. stars, above 15′ diam. pretty rich, joining to the milky-way, or a projecting part of it.	6895

VIII.	1790	Stars.		M. S.		D. M.	Ob.	Description.	N.G.C.
84	Dec. 28	33 (α) Persei	*f*	9 14	*n*	1 36	1	A cl. of S*st*. not very rich.	1348
85	—	41 Persei Hev.	*f*	2 42	*s*	0 2	1	A coarsely sc. cl. of L*st*. pretty rich.	1545
	1792								
86	Sept. 15	34 Cygni	*p*	9 43	*n*	0 15	1	A coarsely sc. cl. of L. stars, of a right-angled triangular shape.	6874
	1793								
87	Mar. 8	2 Navis	*p*	7 10	*s*	0 15	1	A small cl. of S. stars, not very rich.	2425
	1799								
88	Dec. 28	46 (ξ) Persei	*p*	27 13	*n*	1 29	2	A cl. of coarsely sc. L*st*. about 15′ diam.	1342

[*Notes to the Third Catalogue of Nebulæ.*

I. 246. Second obs., Sw. 1038, Apr. 8, 1793, 39 Ursæ, f. $44^m\ 5^s$, s. 0° 2′. Both these obs. give the P.D. 4′ or 5′ too small. In the first (Sw. 951) there is at the end a note to the effect that the line was contracted by moisture, 16′ by the quadrant at beginning and end. In Sw. 1038 is I. 271, the P.D. of which is also 5′ too small. Yet the zero is the same by three stars, but they are all at the beginning of the sweep.

I. 262. R.A. is 92^s too great. Probably a reduction to the meridian has been forgotten, as in the case of II. 879 and several stars. Other nebulæ in this sweep (1036) are all right, viz. II. 880, I. 263 and V. 51.

I. 264. R.A. is 60^s too small, which is apparently caused by a reduction to the meridian of -63^s.

I. 271. See I. 246.

I. 272. Second obs., Mar. 9., 1796, $10^h\ 41^m$ S.T. "The neb. of March 4 is about 7′ or 8′ s. of the Geor. Planet and a few degrees more p. in position than the second satellite, which almost points to it." The P.D. from the first obs. is 6′ too small. As the P.D. of Uranus on March 9 was 79° 41′·0, the P.D. of the neb. on that day comes out about 8′ greater than on March 4, and is much nearer the truth.

I. 278, 279. *P.T.* has followed Sw. 1068. But the P.D.'s seem to have been interchanged, as the obs. makes the f. one 1° 53′ n. of the p. one instead of *vice versâ*. In Sw. 1074, Dec. 20, 1797, only I. 279 was seen, 4 Drac. Hev., p. $4^m\ 38^s$, s. 0° 46′, which is correct.

I. 282, 283, 284. The three brightest of the fifteen nebulæ observed by H. in Sw. 1096, April 2, 1801. He referred them all to "208 (N) Camelop. of BODE's Cat.," which is 4 H. Draconis = B. 1634.

The following four stars were observed :—

$9^h\ 37^m\ 24^s$	11° 9′	* 8 m.	[G. 1561 = P. IX. 112, magn. 6·3]	
10 28 40	13 22	* 6·7 m	[B. 1446 =	G. 1650, magn. 4·6]
12 6 22	11 57	* 7 m	[B. 1633 =	F. 2024, magn. 6·2]
12 6 38	11 49	* 6 m	[B. 1634 =	G. 1859, magn. 4·6].

To most of the transits corrections to centre of field have been applied, which adds to the uncertainty of the resulting places due to the small Polar Distance. All the objects have been identified on plates taken at Greenwich in 1911 (*M.N.* vol. 71, p. 509), the places for 1860 being—

I. 282	$9^h\ 29^m\ 42^s$	14° 30′·5	
I. 283	10 9 42	15 7·4	= N.G.C. 3183, d'A.
I. 284	10 32 44	12 27·6	= N.G.C. 3329, h. 733, d'A.

See below, under II. 903–905 and III. 963–971.

II. 781. Also observed in Sw. 929, Apr. 26, 1789, 5 Canum, p. $20^m\ 31^s$, n. 1° 0′, in good accordance with the first obs. No modern obs. known.

II. 794, 795, 796; III. 778–783. These groups were observed in Sw. 921 (Apr. 14 1789) and in Sw. 1001 (Mar. 24, 1791). In the former there are four stars, 77 (ε), 79 (ξ), 81 and 83 Ursæ maj. There is *not* any error in the obs. of P.D. of 77 Ursæ (as asserted by h. in G.C. p. 31); it agrees perfectly with the others, though the transit seems to require a correction of $+20^s$. All the details in *P.T.* are from Sw. 921, and the places derived from them by Auwers are distinctly better than those from Sw. 1001. But h. is right in thinking that the two observations supposed to belong to II. 794 refer to different objects. The second one has here been called II. 910. What put him out was probably that he did not know of N.G.C. 4669 (d'A.) which is =III. 778. The R.A.'s of the second group are very inaccurate, but there are five objects within 72^s. In Sw. 1001 there are three stars, Harv. 4038, 73 Ursæ and G. 1903; in the last there is an error of 1^m. In the following table the places are for 1860.

	Sweep 921, Auwers.		Sweep 1001.		Modern Observations.		Observer.
II. 794	$12^h\ 36^m\ 26^s$	34° 6′	....		$12^h\ 36^m\ 19^s$	34° 4′·7	d'A.
II. 910	....		$12^h\ 36^m\ 18^s$	34° 18′	36 27	34 22·5	d'A.
III. 778	12 38 46	34 21	12 38 55	34 25	38 23	34 21·9	d'A.
II. 795	12 39 31	34 30	....		39 10	34 29·5	d'A.
II. 796	12 40 36	34 42	12 40 6	34 37	40 20	34 42·3	d'A.
III. 985	....		12 40 42	34 47	41 14	34 51·5	d'A.
III. 779	12 59 18	32 57	....		59 28	32 56·0	h. 1532
III. 781	13 0 16:	35 39:	....		59 32	35 33·9	{ Rümker Howe
III. 783	13 0 18	35 45	....		59 36	35 40·6	h. 1533
III. 782	13 0 30	35 37	....		59 56	35 35·4	Rümker
III. 780	13 0 19	33 36	....		13 0 9	33 34	Bigourdan

II. 797. There must be an error of about 100^s in the transit. A second obs. in Sw. 929, Apr. 26, 1789, 82 Ursæ p. $10^m\ 36^s$, n. 0° 12′ agrees perfectly with Bigourdan ($13^h\ 23^m\ 34^s$, 36° 10′·5 for 1860).

II. 801. This is 14^s f., 6′ n. of I. 232. A second obs. supposed to be of it (Sw. 1003, Apr. 2, 1791) belongs to I. 232.

II. 803. Second obs., Sw. 951, Mar. 18, 1790, 69 δ Ursæ p. $3^m\ 52^s$, n. 0° 44′, agrees perfectly with the first.

II. 810. Not found four times by Bigourdan. In the sweep (928) it comes between III. 812 and II. 811, both of which are nearly correct. It is no doubt =N.G.C. 6127 (Swift IV.) with an error of 20′ in P.D., that read off being 31° 59′ instead of 31° 39′, the true Δ P.D. being 3° 43′.

II. 818. R.A. in G.C. and N.G.C. is 2^m too great (therefore not found by Bigourdan). The comp. star is "12 Drac. Hev. Woll. Cat.," *i.e.* G. 2280; G. 2182 was also observed and both agree. The neb. is probably =I.C. 1100 (Swift IX.), vF. pS. lE.

II. 824. Is =h. 994; C. H. and Auwers both agree with h's place.

II. 825. Is identical with III. 716 (*q.v.* in Second Cat.).

II. 827. In Sw. 948 (the last one that night) there was no Flamsteed star, for which reason 77 Ursæ was taken from the previous sweep. In Sw. 948, II. 827 was $5^m\ 34^s$ f., 10′ s. of I. 238, and $21^m\ 19^s$ f., 2° 10′ n. of G. 2013.

II. 862. Identification difficult, as it is one of a group. In Sw. 990, 57 Aurigæ is the only comparison star and the neb. is 2^s p., 2′ n. of II. 736. Auwers gives for 1860 $7^h\ 0^m\ 8^s$, 39° 37′ It is probably one of Kobold's nebulæ in the I.C.

II. 868. Not seen by d'A., and h. only observed the f. one (II. 869).

II. 872. Is 21^s p., 2′ s. of III. 881, while h. gives it as 24^s f., 2′ s. of it. $H-h=-53^s$. Sweep (1004) examined.

II. 878. P.D. is 5′ too great (* D.M. +56°·2331, $12^m\ 35^s$ f., 34′ n., gives 2′ less) owing to a change in the P.D. cord noted in the sweep.

II. 879. Sw. 1036, the only one that night (Apr. 6, 1793); the stars disagree badly in R.A. The resulting R.A. of the neb. is $1^m\ 47^s$ too great. There is a * 7m. $10^m\ 25^s$ p., 3′ s. of the neb., which must be +68°·632, but though right in P.D., it gives the R.A. 35^s too small. Something has been erased in the transit column between this star and the neb. II. 880 comes next, the place being correct; then comes I. 262 (*q.v.*).

II. 881. Not found by d'A. and Bigourdan. Sweep examined.

II. 903, 904, 905. See above, under I. 282. The Greenwich places are, for 1860—

9^h	42^m	10^s	$13°$	$28'·7$
10	52	43	14	8·0
11	23	46	14	36·0

II. 908. Omitted in the *P.T.*

II. 909. Omitted in the *P.T.* "Three, the place is that of the last, which is F. pL. R. The sp. one eF. vS., about 1′ more south and 1 F. =20″ preceding [*i.e.* 20^s]. The np. one pB., stellar, about 3′ more north than that of which the place is taken and 1·5 F. =30″ preceding." These three are N.G.C. 3063 =II. 333, 3065 =II. 334, and 3066 =II. 909.

II. 910. See above, under II. 794.

III. 751. Place is from the second obs. in Sw. 908, Feb. 22, 1789. It agrees well with the first (Sw. 902), * 7 [Lund 4808], p. 20^m 18^s, s. 1° 52′. The R.A. of h. (one obs.) is $\frac{1}{2}^m$ less.

III. 753. Sw. 907. R.A. is 37^s too small; so is the R.A. of the only other neb. in this short sweep (a second obs. of III. 606). "Extremely windy," and clock error from 33 Cancri differs 35^s from that of the previous sweep.

III. 769. Not found by Bigourdan.

III. 773. This is certainly =II. 830 (40^s f. the place of III. 773) which has a * 13 on the p. edge. In the sweep (920) III. 773 is 1^m 28^s f. I. 227.

III. 774. A second obs. in Sw. 946, Mar. 17, 1790, has * 6m. [G. 1807], f. 5^m 17^s, n. 2° 11′.

III. 776. Not found by Bigourdan.

III. 778–783. See above, under II. 794.

III. 791. The description is ambiguous: "Two, cB. R. vgmbM., has another p. vF. R. S., nearly in the mer. 3′ or 4′ dist. prec.," with a note added afterwards to the word "mer.": "By the description it should be perhaps nearly in the parallel." In a second obs. of April 2, 1791, H. saw only I. 232. Bigourdan has a neb. 4^s f. II. 801 on the parallel, but 3′ or 4′ p. I. 232 neither he nor d'A. saw any neb.

III. 794. Not found by Bigourdan.

III. 797. Also observed in Sw. 953, Mar. 19, 1790, 76 Ursæ p. 27^m 59^s, s. 2° 50′, or I. 253, f. 13^m 47^s, s. 1° 59′. This agrees well with the place of Bigourdan, which is =N.G.C. -37^s +4′.

III. 800–801. Very probably the word "two" refers to III. 799 and III. 800, as nobody seems to have seen three nebulæ in the place.

III. 803. Observed twice. Sw. 924, Apr. 17, 1789, "eF. vS. I was too late to verify with 300. I had, however, a single glimpse which seemed to confirm it. 12 ι Draconis p. 1^h 50^m 41^s, s. 1° 32′." Sw. 926, Apr. 24, 1789. Suspected eF. vS., but may be a deception, probably 2 S. close stars. 69 Ursæ Hev. Woll. Cat. [=G. 2002] f. 9^m 33^s, s. 2° 53′." In Sw. 924 it is 3^m 19^s p., 4′ s. of a star 6m. which is G. 2030; this gives for 1860 13^h 31^m 57^s, 32° 8′·8, or 1^m less than the result from 926. G. C. has taken the mean of the two, and Bigourdan could not see anything in that place.

III. 808. Is no doubt identical with II. 826, both observed once only and in different sweeps.

III. 812. In the sweep (928) there is a nearer star, G. 2296, f. 13^m 6^s, n. 2° 40′.

III. 821. According to the sweep (929) it is 1^m 7^s p., 1′ n. of the star L.L. 24969 (+53°·1622). Not seen by Bigourdan.

III. 824. There is an error of reduction of 6^m in the G.C. and the nebula is identical with h. 3316.

III. 835. Is =III. 804.

III. 839. A nearer comparison star is G. 1429, p. 20^m 8^s, n. 0° 12′.

III. 840. The P.D. is 9′ too great, probably caused by an error of 10′ in reading off the quadrant.

III. 842. R.A. is 40^s too great. Reduction to centre of field -40^s, evidently underestimated.

III. 845. Not found by Bigourdan.

III. 848. A better star is G. 1965, p. 23^s, s. 0° 4′.

III. 882. A better star is G. 2091, f. 16^m 20′, n. 0° 13′, which agrees perfectly with Bigourdan's place (14^h 25^m 39^s, 19° 40′·8), while that derived from 9 Ursæ is 44^s out.

III. 883. G. 2091 is nearer in P.D.; in the sweep (1005) the neb. f. 1^h 54^m 53^s, n. 0° 38′, which gives for 1860 16^h 2^m 45^s, 19° 8′ in good agreement with Bigourdan.

III. 884. In the same sweep as III. 883, and its R.A. is also nearly 1^m too great. The neb. followed same star G. 2091, 1^h 57^m 3^s, s. 8′, which gives 16^h 5^m 4^s, 19° 54′, agreeing well with Bigourdan.

III. 907. Bigourdan's R.A. is 1^m 13^s greater. In the sweep (1037) there is not any star nearer in P.D. than 6 Draconis, but I. 264 is 35^m 26^s p., 47′ s. of III. 907, which gives 12^h 45^m 36^s, 17° 38′, much nearer to B.'s place.

III. 909. In same sweep. Bigourdan's R.A. is 1^m greater than that of Auwers. IV. 70 followed 11^m 17^s, 8′ s., which gives 13^h 7^m 47^s, 18° 38′ or Auwers $+36^s+1'$.

III. 912. Not found by Bigourdan. In the sweep (1038) it precedes III. 913 16^m 0^s, 5′ north, so it is no doubt identical with either III. 917 or 918, which were observed the following night (Sw. 1039) without any mention of III. 912.

III. 937. In the sweep (1064) the observation of I. 274 seems to be inaccurate, but III. 937 is between two well determined stars (Kasan 2331 and 2388).

	* 6·7, f. 8^m 52^s, s.	2′.
	* 7·8, p. 25 40, s.	31.
These give respectively,	12^h 58^m 29^s	13° 52′
	58 4	49

and III. 937 is therefore =h. 1527.

III. 940. This is the same as III. 971. R.A. in N.G.C. is 1^m too small (clerical error).

III. 946. A better star is G. 2066, p. 11^m 6^s n. 30′, which gives 13^h 39^m 35^s, 9° 49′, agreeing much better with Bigourdan's place, 13^h 38^m 49^s, 9° 50′.

III. 949. A better star is Kasan 2528, p. 16^m 8^s, n. 30′, which gives 14^h 25^m 17^s, 9° 15′, differing nearly 2^m from the place in N.G.C., in which Bigourdan twice searched in vain.

III. 954. R.A. 28^s too great. Doubtless a correction to centre of field was forgotten.

III. 959. This is I.C. 324, 11^s f., 1′·2 south of I. 60. N.G.C. 1331 to be struck out. The place given by H. no doubt refers to I. 60.

III. 963–971. See above, under I. 282. The places from the Greenwich plates are, for 1860 :—

III. 963	9^h	23^m	17^s	13°	3′·6	
964	10	3	7	15	5·4	=N.G.C. 3144, d'A.
965	10	5	18	14	57·5	3155, h. 676, d'A.
966	10	0	16	11	29·6	
967	10	48	56	14	3·6	3465, h. 795, d'A.
968	10	51	23	14	2·9	
969	11	23	46	14	51·0	
970	11	34	19	11	51·0	
971	11	41	26	14	55·2	3890, III. 940, d'A.

III. 977. In the sweep (1111) is G. 1562, p. 5^m 0^s, n. 34′, which gives 9^h 25^m 48^s, 9° 39′, agreeing much better with Bigourdan's place.

III. 978. Not found by Bigourdan. The place is sufficiently correct, as appears from the star B. 1439 = G. 1643, p. 33^m 41^s, s. 13′, which gives for 1860 9^h 48^m 31^s, 8° 59′.

III. 979, 980, 981. These are not given in the *P.T.* The R.A. of N.G.C. 3210 requires a correction of $+1^m$; d'A. observed the 2nd and 3rd, Bigourdan all three.

III. 982, 983. Not in the *P.T.* In the Cape Observations, where h. gives these "omitted nebulæ," ΔP.D. is misprinted 2° 30′, and the P.D. of Auwers is therefore 9′ too great. Bigourdan's places ($\Delta\alpha=48^s$) agree well with H's. d'Arrest's R.A. of III. 983, adopted in the N.G.C., to be diminished by 1^m (one obs.).

III. 984. Not in *P.T.* The place is correct, the two stars are np. distant 0′·5 and 1′·5.

III. 985. See above, under II. 794.

IV. 65. Sweep 935. There was some uncertainty as to whether the P.D. was 90° or 91°. A star 6·5 m. following 2^m 29^s, 1° 20′ n., was supposed to be 22 Monocerotis, but the observed P.D. of this star must be 1° wrong, as the "P.D. piece" was immediately afterwards set from 88° 50′ to 89° 48′, "supposing it to have been set upon the wrong degree or changed by some accident." Then comes a star 7·8 m. 20^m 3^s f., 1° 2′ s. of the neb., which agrees with D.M. −1°·1738, and the P.D. of the neb. is 90° and not 91°, as stated in the *Phil. Trans.*, 1791, p. 82.

J. L. E. D.]