

SMITHSONIAN MISCELLANEOUS COLLECTIONS.

— 311 —

INDEX CATALOGUE

OF

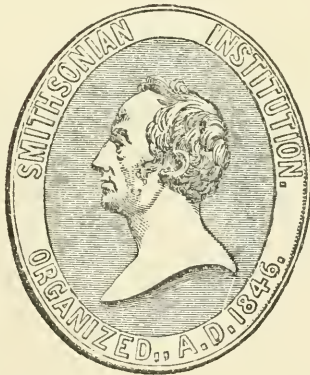
BOOKS AND MEMOIRS

RELATING TO

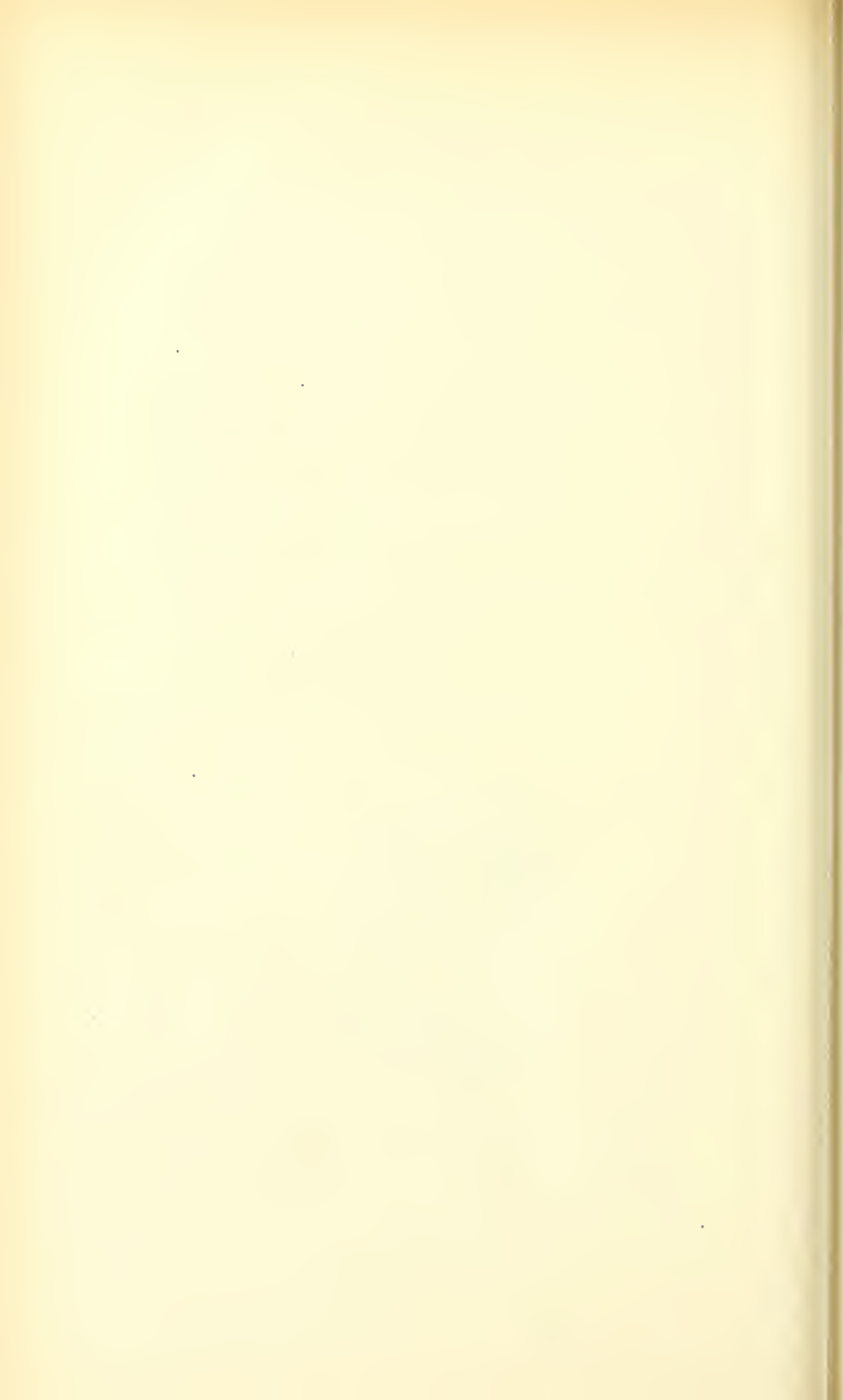
NEBULÆ AND CLUSTERS, ETC.,

BY

EDWARD S. HOLDEN.



WASHINGTON:  
SMITHSONIAN INSTITUTION.  
1877.



“For out of the olde feldis, as men saieþ,  
Comith all this newe corne, fro yere to yere,  
And out of olde bokis, in gode faieþ,  
Comith all this newe Science, that men lere.”

*The Assemble of Foules.—CHAUCER.*



## ADVERTISEMENT.



Whoever attempts the enlargement of the bounds of knowledge in any particular branch of science, in justice to himself, the public, and previous laborers in the same field, should make himself familiar with all that has been previously published on the subject. But information of this kind is so widely dispersed through the journals and transactions of learned societies of all parts of the civilized world, that index catalogues or references to authorities are of the utmost importance to the investigator. In consideration of this fact, the present work has been accepted for publication, after having received the approval of our collaborators in the line of astronomy.

JOSEPH HENRY,  
*Secretary Smithsonian Institution.*

WASHINGTON, *November, 1877.*

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## INTRODUCTION.

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The design of the following Catalogue is to give a full list of books and memoirs relating to Nebulæ and Clusters, and to include references to papers on allied subjects—as the Milky Way, the Nebular Hypothesis, etc., etc., which may serve to give as complete a knowledge as possible of the first two subjects. It was undertaken in 1874, for my own use, and has been steadily prosecuted until the present time; and I am induced to offer it for publication, by the hope that it may be found as useful to others as it has already been to myself. It is believed to be nearly complete, so far as the uses of the astronomer require. It is impossible, in a work of this kind, to insure its entire completeness, but it is hoped that few important papers are omitted. It is also beyond the limits of the plan to make an index for the bibliographer chiefly.

In reading upon any special subject there are several cases which may arise: *First*, having any given series of publications, as the *Philosophical Transactions*, for example, one may wish to know all that has been printed in that series on this particular subject. The present index has under the title of each publication a reference to all works on nebulæ and clusters contained in it. *Second*, one may wish to know all the works on the special subject which we owe to a particular author no matter where published; in the present index, under each author's name, is given a list of his writings on nebulæ, etc., arranged not chronologically, as in a work of more extended scope they should be, but by periodicals. All the papers of D'ARREST, for example, in the *Astronomische Nachrichten*, are to be found together, chronologically arranged, and so with papers in other journals. This form is convenient for an index of so special a nature as the one in question, par-

ticularly as difficulties frequently arise as to the date of a paper, which it is often hard to fix except by some arbitrary rule. If such a rule be once adopted it must be adhered to although it will often disarrange the true logical order of the papers. *Third*, the question may be to discover all the papers written on a special subject, no matter by what author. In the present case such a question might be to find the papers which have been written on a given nebula, or on the spectra of nebulae in general, or something allied to this. It is plain that in so new a subject great subdivision is not required, and I find by experience that all my own wants in this direction have been supplied by adding after the reference to each paper a note more or less extended, giving an indication of the purport of the paper. A slight familiarity with the writings of the various authorities will enable one readily to turn to the authors likely to have treated a given subject. Thus if the proper motion of nebulae was in question, the writings of OTTO STRUVE, D'ARREST, SCHOENFELD, VOGEL, SCHULTZ, SCHMIDT, RÜMKE, ARGELANDER, OPPOLZER, WINNECKE, etc., would naturally be first consulted, and so with other subjects.

One nebula, that in *Orion*, has received a vast amount of study, and I have added a special bibliography of this, as well as one referring to the Variable Nebulae.

Section IV consists of a reference-list to all published (and many unpublished) drawings of nebulae and clusters. Under this head many of the most extended memoirs will be again indexed, and nearly all the monographs, so that it supplements in a way the main index. That is if the memoirs on a certain nebula are sought for and no preliminary clue is at hand, (as to authors,) it will be well before looking through the whole list of author's names, to look for this nebula in the list of drawings. If it is found there, the references joined to it will indicate the principal papers on this object.

To facilitate the finding of nebulae I have given in this part of



the work a finding list of Sir WILLIAM HERSCHEL'S classes and numbers, as well as of MESSIER'S nebulæ—the identifications resting on the authority of Sir J. HERSCHEL.

The abstracts of Sir WILLIAM HERSCHEL'S papers I have made much more full than in other cases, in order to present, if possible, something like an adequate idea of the views of this great man on the subject which is peculiarly his own. This is the more necessary, as we have as yet no collection of his works which is generally available, (a want which it is hoped may be filled,) and as the earlier volumes of the *Philosophical Transactions* are now quite rare.\*

References to translations and reprints of important papers have frequently been included in order that such papers may be accessible to as many as possible in the native language of the reader.

Many popular and historical papers have been referred to which appeared in Reviews and Magazines, but it is not supposed that such references are by any means exhaustive of this part of the subject, nor does it seem desirable that they should be so, since they are largely repetitions one of another.

I have included (with some hesitation) a few references to the views of the ancients on the Milky Way, etc., which may be thought to render the Index more complete by presenting more fully the historical side of the subject; but in the main it refers to publications made between the epoch of the invention of the telescope and the present time.

It is to be noted that the references here made are always from a consultation of the original work, when this was accessible, and not by a transcription from any indices or general catalogues, like the Royal Society's *Catalogue of Scientific Papers* for example. These

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\* A complete collection of his separate papers exists at the Pulkowa Observatory, and also one in five volumes in the possession of his descendants in England, but in order to gain an acquaintance with them in general, it is necessary to examine no less than thirty-nine separate volumes of the *Philosophical Transactions*. Much unpublished and most precious material exists in manuscript.

have however been consulted in order to secure the necessary checks upon accuracy.

A considerable number of the works quoted are not to be obtained in the United States, and in many cases I have had only incomplete sets of periodicals at hand, which may explain possible omissions.

Following, I give a list of all works on special astronomical bibliography which are known to me, which may be of use to those consulting this Catalogue.

Among this list of works, the only one similar in purport to the present, is the work of my friend E. B. KNOBEL, Esq., F. R. A. S., etc. A careful comparison with § 4 of his work has assured me of the accuracy both of his list and of the present one as it stood in manuscript at the time of the publication of Mr. KNOBEL's paper.

The present Index is somewhat wider in scope than § 4 of Mr. KNOBEL'S, and it contains a special reference to the contents of each paper, which is not given in the other list. As the two works were done independently, each serves as a useful check upon the other.

#### LIST OF ASTRONOMICAL BIBLIOGRAPHIES.

BELGIAN ACADEMY OF SCIENCES: *Bibliographie Académique*. 1875. 8vo.

[This work contains, beside brief biographies of the various members of the Academy, a full list of those works of each member which have been printed in the publications of this Academy, as well as tolerably full lists of such works printed elsewhere.]

CARL, PH.: *Principien der Astronomischen Instrumentenkunde*, p. 161. [Literature of Micrometers.]

———: *Repertorium der Cometen-Astronomie*. 8vo. 1864.

[Contains references to observations, etc., of comets, and is very complete.]

DARBOUX and HOÜËL: *Bulletin des Sciences Mathématiques et Astronomiques*. Periodical. 8vo.

[Contains abstracts of, and criticisms upon, works and memoirs on Astronomy, Mathematics, etc.]

ENGELMANN, R.: *Literatur der Astronomische Nachrichten, etc.*, from BESSEL's *Abhandlungen*. 3 vols., 4°. 1876-7.

[There are now three volumes, 4°, of Indices to the *Astronomische Nachrichten*, which are very full, arranged both by authors and subjects, and issued periodically by the editors.] ENGELMANN's *Indices*, as below, are even more full for the special subjects treated.

Vol.	Page.	Subject.
I	83	[Comets.]
I	194	[Saturn and Saturn's Satellites.]
I	260	[Refraction.]
I	316	[Aberration, Nutation, and Precession.]
II	202	[Instruments.]
II	236	[Parallax of Stars.]
II	281	[Fundamental Stars, Star Catalogues, and Star Charts.]
II	325	[Proper Motion, Variable Proper Motion, Double Stars.]
II	404	[Mathematics.]
III	138	[Geodesy, Longitudes, Measurement of an Arc of Meridian.]
III	286	[Pendulums; Units of Mass, etc.; Terrestrial Refraction, etc.]
III	489	[Miscellaneous.]

KNOBEL, E. B.: *Reference Catalogue of Astronomical Papers and Researches*. 8vo. 1876. *Mon. Not. R. A. S.*, November.

LALANDE, J.: *Bibliographie Astronomique, etc.* 1803. See *C. T.*, 1806.

LONDON, ROYAL SOCIETY OF: *Catalogue of Scientific Papers*. [1800-1863.] 6 vols., 4°. 1867-1872.

POGGENDORF: *Bibliographisch-Literarisches Handwörterbuch zur Geschichte der Exacten Wissenschaften, etc.* 2 vols., 8vo. 1863.

REUSS, J. D.: *Repertorium Commentationum, etc.* Vol. V. *Astronomia*. 1804. 4°.

SCHIBEL, J. E.: *Astronomische Bibliographie*. 1st part, 1784; 2d part, 1786; 3d part, with Appendices to parts 1 and 2, 1789-1798. 8vo.

SCHUMACHER, H. C.: *Catalogue des Livres Composant la Bibliothèque de feu H. C. SCHUMACHER*. Part I. [Mathematics, Astronomy, etc.] 1855. 8vo. pp. 147. [Other valuable works of this class are frequently printed by various publishers.]

SOHNCKE, L. A.: *Bibliotheca Mathematica*. Verzeichniss der Bücher über Astronomie, etc., welche in Deutschland und dem Auslande vom Jahre 1830 bis 1854, erschienen sind. 1854. 8vo.

ST. PETERSBURG ACADEMY OF SCIENCES: *Tableau général Méthodique et Alphabétique des Matières contenues dans les Publications de l'Académie Impériale des Sciences de St. Petersbourg depuis sa fondation*. 1<sup>ère</sup> partie. *Langues étrangères*. 8vo. 1874.

- STRUVE, OTTO V.: *Catalogus Librorum in Bibliotheca Speculæ Pulcovensis.* 8vo. 1858.
- WEIDLER, J. F.: *Bibliographia Astronomica, etc.* 1755. 8vo.
- WELLER: *Cometen-Literatur in the Anzeiger für Kunde der Deutschen Vorzeit.* 1857. No. 10, p. 321; No. 11, p. 359.
- WOLF, R.: *Sonnenflecken Literatur in the Astronomische Mittheilungen.* ———; *Handbuch der Mathematik, Astronomie, etc.* 2 vols, 8vo. 1872.
- YOUNG, THOS.: *A Course of Lectures on Natural Philosophy.* 2 vols. 1807. 4°. Vol. ii, p. 87.

PRINCIPAL ABBREVIATIONS USED IN THE REFERENCES OF THE PRESENT WORK.\*

Abbreviation.	Work referred to.
<i>Am. Ass. Adv. Sci.</i>	Proceedings American Association for the Advancement of Science.
<i>Am. Jour. Sci.</i>	Silliman's American Journal Science and Arts.
<i>A. N.</i>	Astronomische Nachrichten.
<i>Ast. Jour.</i>	Gould's Astronomical Journal.
<i>B. A. A. S.</i>	Reports British Association for the Advancement of Science.
<i>Bern.</i>	Mitt. d. Naturforsch. Gesell. in Bern.
<i>B. J.</i>	Bode's [or Berliner] Jahrbuch.
<i>C. R.</i>	Comptes Rendus de l'Académie Royale des Sciences.
<i>C. T.</i>	Connaissance des Temps.
<i>Mem. A. A. S.</i>	Memoirs American Academy of Arts and Sciences. [Boston.]
<i>Mem. R. A. S.</i>	Memoirs of the Royal Astronomical Society.
<i>Mem. Soc. Spet. Ital.</i>	Memorie della Società degli Spettroscopisti Italiani.
<i>Mon. Not. R. A. S.</i>	Monthly Notices of the Royal Astronomical Society.
<i>M. M.</i>	Mélanges Mathématiques et Astronomiques.
<i>Paris.</i>	Histoire [ou Mémoires] de l'Académie Royale des Sciences.
<i>Phil. Mag.</i>	London, Edinburg and Dublin Philosophical Magazine.
<i>Proc. A. A. S.</i>	Proceedings American Academy of Arts and Sciences. [Boston.]
<i>Proc. R. S.</i>	Proceedings of the Royal Society of London.
<i>P. T.</i>	Philosophical Transactions of the Royal Society of London.
<i>p. t.</i>	Philosophical Transactions of the Royal Society of London—abridgment to 1800, by HUTTON.
<i>Quar. Jour. Sci.</i>	Quarterly Journal of Science.
<i>Sid. Mess.</i>	Mitchel's Siderial Messenger.
<i>V. J. S.</i>	Vierteljahrsschrift der Astron. Gesell. [Leipzig.]

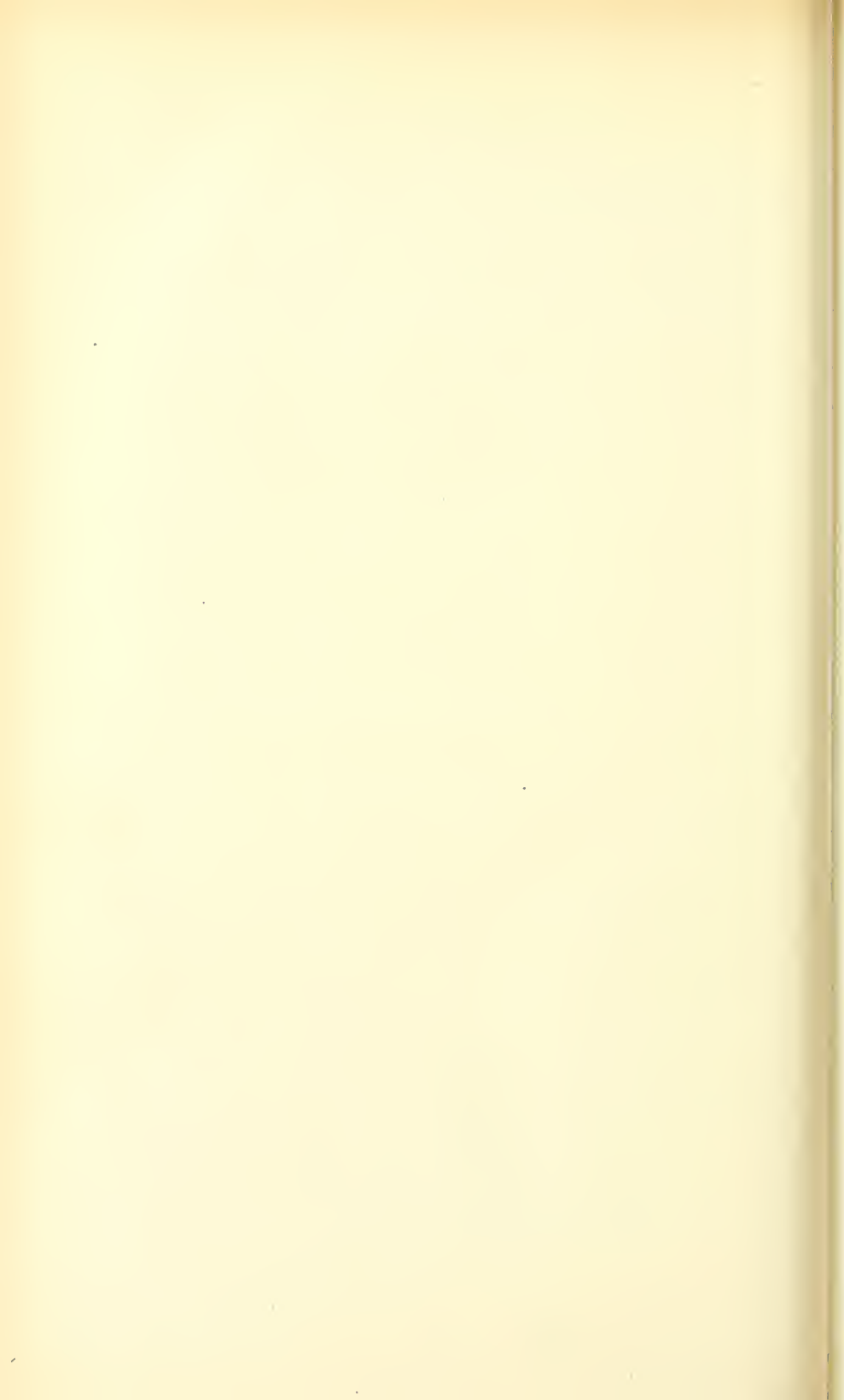
\*Those used and not given here will be easily understood.

It remains to state that in the main body of the Catalogue I have catalogued names commencing with LE or LA under L, as LALANDE, LAHIRE, etc. Names commencing with DE have not been placed under D, with the exception of D'ARREST, D'ABBADIE, etc. Names commencing with VON are not catalogued under V.

EDWARD S. HOLDEN.

U. S. NAVAL OBSERVATORY,

WASHINGTON, *January*, 1877.



I.

INDEX-CATALOGUE OF BOOKS AND MEMOIRS RELATING TO NEBULÆ, CLUSTERS, ETC.

[Alphabetically arranged by authors.]

- Abbe**: [Distribution of Nebulæ in space.] *Mon. Not. R. A. S.*, xxvii, p. 257.  
 ———: *Mon. Not. R. A. S.*, xxxv, p. 236, and *Am. Ass. Adv. Sci.*, 1870, p. 40. [The very much extended nebulae of HERSCHEL'S Catalogue.] See also *Am. Jour. Sci.*, 3d series, ix, p. 42.  
 ———: JOHNSON'S *Cyclopedia*, 4<sup>o</sup>, 1876, article *Nebula*, [succinct history.]
- Abbott**: *Mon. Not. R. A. S.*, xxiii, p. 32. [Cluster  $\kappa$  *Crucis*.]  
 ———: [Nebula surrounding  $\eta$  *Argûs*.] *Mon. Not. R. A. S.*, xxv, 192; xxviii, 200.  
 ———: *Mon. Not. R. A. S.*, ~~xxxi~~, pp. 226, 230, 231. [Nebula in *Argo*.]  
 ———: *Mon. Not. R. A. S.*, xxxii, p. 61. [Note on Nebula in *Argo*.]  
 ———: [Nebula surrounding  $\eta$  *Argûs*.] *Mon. Not. R. S. Tasmania*, 1870, p. 21, [2 sketches]; 1871, p. 17; 1872, p. 27.
- Abhandlung d. König. Sächs. Gesellschaft der Wissenschaften**: See *Sächs. Gesell. König. Abh.*

**Academy of Sciences, Paris**: *Histoire et Mémoires*.

<i>A. D.</i>	<i>Page.</i>	<i>Author.</i>	<i>A. D.</i>	<i>Page.</i>	<i>Author.</i>
Vol X. } 1666-9 }	117	{ La Hire.	1759	469	[Cheseux.]
		{ Cassini.	1759	453	Legentil.
1707	354	Maraldi.	1771	435	Messier.
1733	19	Fontaney.	1777	440	Messier.
1734	78	Maupertius.	1779	505	Jeurat.
1746	55	Maraldi.	1789	610	LeMonnier.
1755	194	Lacaille.	1807	206	Messier.

Academy of Sciences, Paris : *Comptes Rendus.*

<i>Volume.</i>	<i>Page.</i>	<i>Author.</i>	<i>Volume.</i>	<i>Page.</i>	<i>Author.</i>
XIII	449	De Vico.	LV	888	Chacornac.
"	450	Arago.	LVI	637	Chacornac.
XVII	190	De Vico.	LVIII	72	Goldschmidt.
XXIV	1021	Laugier.	LX	468	Faye.
XXVI	50	Arago.	"	543	Secchi.
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XXVIII	573	Laugier.	LXVI	306	[Chacornac.]
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XXXVII	874	Laugier.	LXIX	1519	{ Frankland.
XL	775	Dien.			{ Lockyer.
XLIV	1031	Porro.	LXXIII	825	Stephan.
"	1074	Le Verrier.	LXXIV	444	Stephan.
"	1075-1294	De Senarmont.	LXXVI	1073	Stephan.
"	1293-1295	Le Verrier.	LXXVII	1364	Stephan.
"	1279	Secchi.	LXXVIII	313	Stephan.
XLV	170	Secchi.	LXXXI	29	Wolf, C.
LIV	299	Le Verrier.	"	749	Planté.
"	1012	Le Verrier.	"	891	Tisserand.
LV	606	{ Le Verrier.	LXXXIII	328	Stephan.
"	751	{ Lassell.	LXXXIV	641	Stephan.
LV	792	{ Secchi.	"	705	Stephan.
		{ Le Verrier.			
		{ Schönfeld			

**Account of Several Nebulæ, etc. :** [HALLEY,] *P. T.*, xxix, p. 390.

**Adams, J. C. :** Address on presenting the gold medal of the R. A. S. to D'ARREST, February, 1875. *Mon. Not. R. A. S.*, xxxv, p. 265.

**Airy :** *Mon. Not.*, iii, p. 167. [The History and present state of our knowledge of Nebulæ.]

—— : *Mon. Not. R. A. S.*, xxxi, p. 233. [Nebula in *Argo*.]

—— : *Mem. R. A. S.*, ix, p. 303. [Address on delivering gold medal to Sir J. HERSCHEL.]

**Alexander, S. :** On the origin of the forms, etc., of Nebulæ. *Ast. Jour.*, Vol. II., p. 95, Nos. 36-44.

—— : *An. Jour. Sci.*, 2d series, xv, p. 300.

**Alphonso X. :** *Libros del Saber de Astronomia.* Vol I, p. 143, 4°.

**American Academy of Arts and Sciences :** *Memoirs.* Boston. 1818. Vol. III, p. 75. BOND, G. P.

—— : 1848. Vol. III, p. 87. BOND, W. C.

**American Academy of Arts and Sciences :** *Proceedings.* Boston. Vol I, pp. 165, 325, 342. BOND, W. C.

—— : 1862-3. Vol. VI, p. 177. BOND, G. P.



## American Journal of Science : [SILLIMAN'S.]

Series.	Vol.	Page.	Author.
1	XL	37	Mason.
1	XLIV	375	[De Vico.]
2	IV	427	Bond, W. C.
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2	XXXVIII	344	Trowbridge, D.
2	XXXIX	25	Trowbridge, D.
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2	"	46, 134, 276	Hinrichs.
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3	VIII	75	[Huggins.]
3	IX	42	Abbe.
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**Amer. Phil. Society Transactions :** Vol. VII, p. 165. MASON, E. P., and SMITH, H. L.

**American Ass. Adv. Science :** 1870. p. 40. ABBE.

**Amsterdam :** *Tijdsch. van Wiss. en Nat. Wetens.* Vol. I, [1348]. p. 7. KAISER, F.

**Angström :** *Recherches sur le spectre solaire*, p. 37. [Duplicity of lines in spectrum of nebulae.]

**Allgemeine Geog. Ephemeriden :** iv, p. 269. [OLBERS.]

**Arago :** *Astronomie Populaire*, vol. i, p. 495, etc.

— : *Analyse des Travaux de Sir WM. HERSCHEL.* *Ann. d. Bureau d. Long.* 1842, p. 410.

— : *C. R.*, xiii, p. 450. [Remarks on RONDONI'S drawing of nebula of Orion.]

— : *C. R.*, xxvi, p. 50. [BOND'S drawing of nebula of Orion.]

— : *Edinburg New Phil. Jour.* Vol. 33, p. 307.

**Aratus :** *Diosemeia*, ver. 160, [mentions *Præsepe*.]

**Argelander :** *Astronomische Beobachtungen zu Bonn.*, 4<sup>o</sup>., Vols. iii, iv, v. *Durchmusterung*. [Introductions contain data for determining the distribution of stars in space, of the milky way, etc.]

— : Maps in *Uranom. Nova.* give 19 nebulae, etc., visible to naked eye.

**Argelander:** Maps of *Durchmusterung* give 62 nebulae. [See LITTRON.]

——: *Rheinl. u. Westph. Sitzungsber.* xix, 1852, p. 79, [on a missing nebula.]

——: *A. N.*, lxxi, col. 287. [On an error in place of nebula in Bonn Zones—0°, No. 2436.] See PETERS, C. A. F.

**Astronomische Gesellschaft:** *Vierteljahrsschrift.*

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- : Königsberg Observations. Vol. 35. 1865. p. 193.  
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- : *A. N.*, lviii, col. 361. [On the variability of No. 548, Bonn Zone + 30°; and observations.]
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- : *A. N.*, lix, col. 271. [Identity of OLBERS' nebula of 1802 with one of HERSCHEL'S.]
- : [Discovery of a new star in the nebula 80 M.] *A. N.*, liii, col. 294. See *Mon. Not. R. A. S.*, xxi, p. 32.
- : [HIND'S missing nebula of 1852.] *Mon. Not. R. A. S.*, xxii, p. 150.
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- : [CYSAT knew of the nebula of *Orion*] *B. J.*, 1808, p. 122.
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 Bekannten,] *ib.* p. 70.  
 —: *B. J.*, 1782, p. 155, [list of new nebulae.]

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——: *A. A. S. Proc.*, i, p. 325. [Observations of h. 1357, h. 1376, h. 859, and nebula of Orion.]

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——: TEMPEL'S variable nebula in the *Pleiades*. Same vol., p. 125.

**Breen:** *A. N.*, xliii, col. 246. [Discovery of a nebula.]



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**Cacciadore** : Nébuleuse inconnue. *Zach.* 14, p. 409. 1826. [See *A. N.*, v, 121, 282, 425, and vii, 64.]

**Capocci** : *A. N.*, v, col. 427. [Observations.]

**Carpenter and Stone** : *Mon. Not. R. A. S.*, xxiv, p. 92. [On BOND'S drawing of nebula of *Orion*. See same volume, page 177.]

**Carrington** : *Mon. Not. R. A. S.*, xxvi, p. 65. [On KRUEGER'S observations of  $\lambda$  *Persei*.]



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———: *De Cometâ anni 1652-3*. [Nebulæ of *Andromeda* and *Orion*. Discovery of the fourth star in *Orion's* trapezium.]

———: Découverte de la lumière céleste qui paraît dans le Zodiaque. [Suspects nebulæ of *Andromeda* and *Orion* to be star clusters.] For the last two references see DELAMBRE, *Hist. de l'Ast. Moderne*, vol. ii, pp. 700, 709, 744.]

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———: *Bull. Internat. de l'Obs. de Paris*. 1863, April 28. [Variable nebula h. 1191.]

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———: *C. R.*, lxvi, p. 306. [Notice of a paper presented to the Academy of Sciences on the constitution of nebulæ.]

———: *A. N.*, lvii, col. 374. [Annular nebula of *Lyra*.] See *Les Mondes*, No. 9, p. 241.

———: [Missing nebula in *Coma Berenices*.] *Mon. Not. R. A. S.*, xxii, p. 277.

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———: *Memorie dell'Osservatorio*.

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**[Cysat]:** Der erste Entdecker des Orionsnebel — 1619. [R. WOLF, 1853.]

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**D'Abbadie:** *Mon. Not. R. A. S.*, xvii, p. 245. [PORRO's new star in trapezium of *Orion*.]

**Darquier:** Sur les étoiles doubles, etc., 1783. *Mem. Royal Ac. de Toulouse*, vol. ii. [Discovery of *Lyra* nebula = G. C. 4447.]

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— : *Siderum Nebulosorum Observ. Havnienses.* 1861-7. 4°.

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— : Resultate aus Beob. d. Nebelflecken, etc. 1856. *Abhand. d. k. Säch. Gesell. d. Wissenschaften*, vol. iii, p. 293.

— : *A. N.*, xxxiv, col. 269. [Discovery of a nebula.]

— : Einige Verbess. zu J. HERSCHEL's Nebelcatalog. 1855. *A. N.*, xli, col. 191.

— : Verz. von 50 Messierschen Nebelflecken, etc. 1855. *A. N.*, xlii, col. 193. [Remarks on variable nebulae.]

— : *A. N.*, lvi, col. 328. [HIND's variable nebula.]

— : *A. N.*, lvii, col. 337. [Proposal for a catalogue of nebulae; Double Nebulae; Variability; *Orion* Nebula; HIND's variable nebula; h's ditto in *Coma Ber.*; H. iv, 4; Missing Nebulae; Proper Motion.]

- D'Arrest:** *A. N.*, lvii, col. 341. [HIND'S variable nebula and *Nebula Orionis*.]
- : *A. N.*, lvii, col. 345. [Variability of H. iv, 4.]
- : *A. N.*, lviii, col. 1. [List of 50 double nebulae.]
- : *A. N.*, lviii, col. 155. [No. 580 zone + 30° of Bonn zones. Variable nebula.]
- : *A. N.*, lviii, col. 175. [List of nebulae in the Bonn zones.]
- : *A. N.*, lix, col. 13. [On the *Merope* Nebula in the Pleiades; also on a second nebula in this group.]
- : *A. N.*, lx, col. 377. [On CHACORNAC'S variable nebula near  $\xi$  *Tauri*; comet of 1792, II, etc.]
- : *A. N.*, lxii, col. 197. [Ueber den Nebel H. i, 118.]
- : *A. N.*, lxiii, col. 177. [Observations of some nebulae in Lord ROSSE'S "list of nebulae not found."]
- : *A. N.*, lxiii, col. 180. [List of 215 new nebulae.]
- : *A. N.*, lxiv, col. 125. [On MESSIER 49; disappearance of a nebula observed by SCHMIDT in this group.]
- : *A. N.*, lxv, col. 1. [Second list of new nebulae.]
- : *A. N.*, lxviii, col. 251. [Three missing nebulae.]
- : *A. N.*, lxx, col. 337. [LEFEBVRE'S drawing of *Orion* nebula.]
- : *A. N.*, lxxi, col. 143. [Nebula near HIND'S variable.]
- : *A. N.*, lxxix, col. 3. [Spectral lines of nebulae.]
- : *A. N.*, lxxix, col. 193. [Spectroscopic observations of two nebulae; G. C. 1532 = H. iv, 45, and G. C. 4373 = H. iv, 37; the parallax of H. iv, 37, is less than 0.07"; changes in spectrum of H. iv, 37.]
- : *A. N.*, lxxx, col. 189. [Spectra of nebulae. Gaseous nebulae belong to our system.]
- : [Notice of D'Arrest's catalogue of nebulae.] *Mon. Not. R. A. S.*, xxviii, p. 94.
- : *Ast. Jour.*, vol. 2, p. 130. [New Nebula,  $a = 285^{\circ} 58' 8.2''$   $\delta = + 0^{\circ} 46' 7.7''$  1852.0.]
- Dawes:** *Mon. Not. R. A. S.*, viii, p. 31. [Star in nebula of *Orion*.]
- Democritus:** See PLUTARCH *De Placit.* Lib. iii, cap. 1. [Views on the milky way.]
- De Morgan:** *Phil. Mag., L. E. D.*, 3d ser., vol. 22, p. 241. [Analysis of works of WRIGHT, of Durham.]
- Denning:** *A. N.*, lxxx, col. 299. [*Orion* nebula. Ten stars in and near the trapezium.] See SALTER.
- Derham:** Observations on nebulous stars. *P. T.*, 1733, p. 70, and *p. t.* vii, p. 602. [Catalogue of 16 Nebulae from HEVELIUS' *Prodromus*.]

- Dien** : See LE VERRIER. [New nebula.] *C. R.*, xl, p. 775.
- Doppelmayer** : *Himmelskarten*. Blatt. 26. [Figure of *nebula Orionis*, after HUYGHENS and PICARD.]
- Drew, John** : Atlas of nebulae and clusters, Southampton, [about] 1864, [I have never seen this work, but suppose it to have been similar to a series of charts made by him for the South Kensington Museum. These are none of them original.]
- Dreyer, J.** : *V. J. S.*, 1876, p. 69. [Review of SCHULTZ'S 500 nebulae.]
- : *V. J. S.*, 1876, p. 269. [Review of SCHENFELD, *Ast. Obs. Mannheim*, vol. ii ;] and same vol. p. 276. [Review of VOGEL, Leipzig observations, 1876.] [DREYER also notes that the *Merope* variable nebula is not seen in Lord ROSSE'S telescopes.]
- : *A. N.*, lxxxviii, col. 359. [Announcement of his proposed supplement to HERSCHEL'S general catalogue of nebulae.]
- : *Mon. Not. R. A. S.*, xxxvii, p. 427. [Identification of some of STEPHAN'S nebulae.]
- Dunér** : *A. N.*, lxxxviii, col. 251. [Discovery of a nebula.]
- Dunlop** : A catalogue of nebulae, etc., in the southern hemisphere. *P. T.* 1828, p. 113. [629 objects; figures of 27.] *Ed. Jour. Sci.*, x, p. 282.
- Durchmusterung, etc.** : [ARGELANDER.] The Maps have 62 nebulae and clusters. See LITTRON.

- Edinburgh Journal of Science** : Vol. x, p. 282. [DUNLOP.]
- Edinburgh New Phil. Journal** : Vol. xxxiii, p. 307. [ARAGO.]
- Edinburgh Review** : Vol. 88, p. 55. [Review of SIR JOHN HERSCHEL'S Survey of the Southern Heavens.]
- Ellery** : *Mon. Not. R. A. S.*, xxxiv, p. 269. [Note on  $\eta$  *Argus*.]
- Engelmann R.** : *Messungen 99 Doppelsternen*, etc., p. 147. [Variability of stars in *nebula Orionis*.]
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- Ennis** : Origin of the stars. 8vo.
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- 
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- Flammarion**: *Histoire du Ciel*. 8vo. Paris, 1872.
- Flamsteed**: [Discovered G. C. 428.] See BAILY's account of the Rev. JOHN FLAMSTEED, etc., catalogue. FLAMSTEED also observed M. 41 = G. C. 1454.
- Flaugergues, Honoré**: Observation qu'il y a au sud de la nébuleuse d'*Orion* une seconde nébuleuse, etc. *Mem. de l'Inst.*, i. [an VI,] [1798,] p. 106.  
[Simple mention of the existence of such a nebula, of oval figure and perfectly uniform brilliancy.]
- : Observations de la nébuleuse d'*Orion*. *C. T.*, 1802, [an XI,] p. 361.
- Fontaney**: *Hist. de l'Acad. des Sciences depuis 1686-99*, tome ii, p. 19, Paris, 1733. [Description of the Magellanic clouds in 1685.]
- Frankland and Lockyer**: *C. R.*, vol. lxxix, 1869, p. 1519. [Spectra of nebulae.]
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- 
- Galileo**: *Siderius nuntius*. Francof., 1610, p. 32. [GALILEO's opinion that nebulae are clusters of stars.] See KEPLER's *Dissertatio cum nuntio sidereo*, p. 39 in this connection.
- Gautier**: Recent researches on Nebulae, [history of,] condensed from *Bibliothèque Univ.*, 1862. *Am. Jour. Sci.*, 2d series, xxxv, p. 101, and xxxvii, p. 198. [See also *Smithsonian Report*, 1863, p. 299.]
- Gill**: [Stars within trapezium of *Orion* nebula.] *Mon. Not. R. A. S.*, xxvii, p. 315.
- Gilliss**: *Wash. Ast. Obs.*, 1863, p. 65. Catalogue of double stars, No. 82. [Changes in  $\gamma$  *Argûs*.]

- Gilliss**: *Wash. Ast. Obs.*, catalogue of southern stars, p. 17, No. 30. Observation of G. C. 193. [Difference of 1m. with h's R. A.]
- : *Ast. Jour.*, vol. ii, p. 178. [Errors in LACAILLE's catalogue of clusters; Nos. 3134, 3528, 3881, 4375, and 4449.]
- Glauchius**: *Theoria Viæ Laetææ*. 1663. 4°.
- Goldschmidt**: *C. R.*, lviii, 1864, i, p. 72. [Study of the *Pleiades*.]
- : *A. N.*, lix, col. 31. [*Nebula Orionis* and G. C. 2403.]
- Gore**: Southern stellar objects for small telescopes. London, 1877.
- [**Gould**:] *Mon. Not. R. A. S.*, xxxii, p. 178. [ $\eta$  *Argûs* nebula.]
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**Gould's Astronomical Journal:**

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I	47	Petersen.
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II	130	D'Arrest.
II	178	Gilliss.
III	71	{ Petersen.
		{ [Secchi.]
V	16	Peters, C. H. F.

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- Hahn, Von**: *B. J.*, 1797, p. 157. [Nebula of *Orion*.]
- : *B. J.*, 1797, p. 250. [Nebula of *Andromeda*.]
- . Gedanken über den Nebelfleck in *Orion*. *B. J.*, 1799, p. 235. [Suggests that this nebula may gradually concentrate into stars.]
- : Beob. u. Gedanken u. die Gegend des gestirnten Himmels beim nördl. Flügel der Jungfrau. *B. J.*, 1801, p. 178.
- : Ueber den planetarischen Nebelfleck bei  $\mu$  *Hydræ*. *B. J.*, 1802, p. 231. [Suggestions as to a means of detecting a motion of rotation in this nebula.]
- : Ueber *Mira Ceti* als Nebelsterne, Nebel der *Leyer* u. d. *Hydra*. *B. J.*, 1803, p. 106.
- : *B. J.*, 1807, p. 152. [Ueber die Stoffe im Weltraum, etc.]
- Hall, A.**: Catalogue of 151 stars in *Præsepe*. *Wash. Ast. Obs.*, 1867, appendix iv.

**Hall, Maxwell:** *Nature*. 1877. Jan. 11, p. 244. [Observations of the variable nebula near *Mcrope Pleiadum*; it was bright Oct. 20, 1876.]

**Halley:** *P. T.*, xxix, 1715, p. 390. [Catalogue of 6 nebulae.]

———: *P. T.*, 1720, p. 22.

**Harding:** Verz. der Nebelflecke, etc., von MESSIER, mit Berücksichtigung der HERSCHELSCHEN Cataloge. *Kleine Astron. Ephem.*, 1834.

———: Acht neue Nebelflecke. *B. J.*, 1827, p. 134.

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<i>Vol.</i>	<i>Page.</i>	<i>Author.</i>
I	lxvii	Bond, W. C.
I	265	Bond, W. C.
V	-----	Bond, G. P.
VIII	53	{ Winlock. { Trouvelot.
VIII	Part ii and Plates.	{ Bond, G. P. { Winlock. { Trouvelot.

[**Heis:**] His *Atlas Cœlestis* contains 6 nebulae visible to the naked eye.

[———:] [Is said to have made many drawings of nebulae. *Nature*, 1877, July 12, p. 213.]

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**Helmholtz:** *Am. Jour. Sci.*, 2d series, xxiv, p. 203. [Nebular hypothesis.]

**Herschel, Carolina:** Zone catalogue of nebulae reduced to 1800.0. Mss. in possession of Royal Society of London. See HERSCHEL'S general catalogue of nebulae, etc., p. 2. See also p. 6, [same work,] for an account of the various HERSCHEL Mss. at Burlington House.

**Herschel, J.:** Results of astronomical observations at the Cape of Good Hope. 4°. 1847. [Figures of sixty nebulae.]

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- : [On the fifth star of the trapezium of *Orion*.] *Mem. R. A. S.*, iii, p. 189. See also page 187. [HERSCHEL and RAMAGE.]
- : A list of test objects, etc. *Mem. R. A. S.*, viii, p. 21.
- : *Mem. R. A. S.*, vol. vi, p. 78. [Connection of double stars with nebulae.]
- : Observations on nebulae at the Cape of Good Hope. *Report B. A. A. S.*, 1838, part ii, p. 17.
- : *Report B. A. A. S.*, 1845, President's address. [General account of nebular science; belief that elliptical nebulae are in general stellar.]
- : *Bull. Sci. de l'Ac. Imp. de St. Pet.*, vol. iv, 1838, p. 238. [Letter to W. STRUVE on G. C. II. Observations.]
- : *A. N.*, xii, col. 274. [Observations at Cape of Good Hope.]
- : Account of nebulae observed at the Cape of Good Hope. *Mon. Not. R. A. S.*, iii, p. 75.
- : [Missing nebula in *Coma Berenices*.] *Mon. Not. R. A. S.*, xxii, p. 248.
- : [Nebula round  $\eta$  *Argus*.] *Mon. Not. R. A. S.*, xxviii, p. 225, and xxxi, p. 228.
- : [Nebula round  $\eta$  *Argus*.] [Spectra of southern nebulae.] *Mon. Not. R. A. S.*, xxix, p. 82; see p. 164.
- : Observations on 2307 nebulae, made at Slough. *P. T.*, 1833, p. 359. [Figures of 67.]
- : General catalogue of nebulae and clusters of stars. *P. T.*, 1864, p. 1. [5079 nebulae.]
- : Nebula of *Orion*. *Obs. C. G. H.*, p. 25, with plate.
- [———] : *Am. Jour. Sci.*, 2d series, v, p. 86.
- Herschel, Capt. J. :** *Mon. Not. R. A. S.*, vol. xxix, p. 82. [ $\eta$  *Argus*.]
- : *Mon. Not. R. A. S.*, xxxi, p. 235. [Nebula in *Argo*.]
- : Spectra of southern nebulae. *Proc. R. S.*, vol. xvi, 1867-8, pp. 417 and 451. [Contains observations of spectrum of *Orion* nebula.]
- : *Proc. R. S.*, xvii, 303.
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- : *Mem. R. A. S.* i, p. 167. Observations of M. 20=G. C. 4355.
- : *B. J.*, 1787, p. 213. [Letter to BODE, describing the contents of his memoir "On the Construction of the Heavens." 1785.]
- : Entdeckung [einiger] Nebelflecken, etc. *B. J.*, 1788, p. 238. [Translation from "On the Construction of the Heavens." 1785.]
- : Verz. von 1,000 neuen Nebelflecken. *B. J.*, 1791, p. 157.
- : Verz. von 1,000 neuen Nebelflecken. *B. J.*, 1794, p. 151.
- : Ueber die Anordnung des Weltgebäudes, [translated by FISCHER.] *B. J.*, 1794, pp. 213 and 226.
- : *B. J.*, 1795, p. 65.
- : Ueber die eigentlichen Nebelsterne. *B. J.*, 1801, p. 128, [translation from *P. T.*, 1791.]
- : On the power of penetrating into space by telescopes, [translated by IDELER.] *B. J.*, 1804, p. 231.
- : Ueber den Nebelfleck H. i. 7, etc. *B. J.*, 1805, p. 211. [Correction of an error in its place.]
- : Ueber den Bau des Himmels, [translated by IDELER.] *B. J.*, 1807, p. 113.
- : Verz. von 500 neuen Nebelflecken. *B. J.*, 1807, p. 129.
- : Ast. observations relating to the siderial part of the Heavens and its connection with the nebulous part, [translated by BRANDES.] *B. J.*, 1818, p. 97.
- : Einige merkwürdigen Stellen der Milchstrasse. *B. J.*, 1821, p. 149.

### Abstracts of Sir William Herschel's Memoirs in the Philosophical Transactions.

*A.D. Vol. P.*

- 1784 74 437 *Account of some observations tending to investigate the Construction of the Heavens.*
- 438 Resolution of the milky way.
- 439 Number of stars visible in field of the 20-foot telescope.
- 440 Examination of MESSIER's nebulae.
- 442 Arrangement of nebulae and clusters in *strata*, sometimes of great length.
- 443 Sun near the centre of the milky way.
- 445 Star gauging defined.
- 446 Table of results of star gauging from 15<sup>h</sup> 10<sup>m</sup> to 16<sup>h</sup> 37<sup>m</sup> R. A. and from 92° to 94° N. P. D., and 11<sup>h</sup> 16<sup>m</sup> to 14<sup>h</sup> 30<sup>m</sup> and 78° to 80° N. P. D.

## Herschel, W.: ABSTRACTS OF MEMOIRS—Continued.

A D. Vol. P.

- 1784 74 448 The solar motion explained by the situation of the sun in the milky way.
- 448 Local distribution of nebulae—nebulae surrounded by spaces vacant of stars.
- 449 Strata of *Cancer* and *Coma Berenices* described.  
With this memoir is a plate of figures of nebulae. Plate xvii, fig. 1, M. 98; 2, M. 53; 3, H., ij, 28, [resolvable;] 4, H., i, 18; 5, H., iii, 15; 6, H., iv, 5; 7, H., iv, 2; 8, H., iv, 3; 9, 10; 11, H., i, 13; 12, 13, 14, 15?  
Also Plate xviii, construction of the heavens—cloven disc.
- 1785 75 213 *On the Construction of the Heavens.*
- 214 Theoretical view of the formation of nebulae.  
*Form I.* Condensation of neighboring stars about a central and larger star: globular forms.
- 215 *Form II.* Condensation of neighboring stars about a nucleus of contiguous stars: condensed irregular forms.  
*Form III.* Condensation about a stream of stars, producing a form coarsely similar to the prototype: extended, branching, compound forms.
- 216 *Form IV.* Compound forms derived from the mutual attraction of clusters.  
*V.* Vacancies will then arise in the surrounding space.  
Objection to the above views; they tend to show a gradual destruction of the universe. Response, that space is infinite and that the occasional destruction of one star may operate to give life to the rest.
- 217 Optical appearances to an observer within a nebula of the third form.
- 219 Results of observation—star gauges.
- 221–240 Gauges throughout the 24<sup>h</sup> in R. A. Results given in detail.
- 241 The stars being supposed to be nearly equally scattered, and their number in a field of view of known angular diameter being given, to determine the length of the visual ray. Solution of the problem.
- 243 Another solution.
- 244 Proof that the sun is situated in a compound nebula of Form III.
- 253 Section of our sidereal system.
- 254 Origin of nebulous strata.
- 256 M. 80 and M. 4 on the edges of vacancies.
- 257 Phenomena at the Poles of our nebula.

## Herschel, W.: ABSTRACTS OF MEMOIRS—Continued.

- A.D. Vol. P.
- 1785 75 258 Enumeration of very compound nebulae or milky way.  
Ten described, including that of *Orion* and *Andromeda*.
- 263 Account of nebula of *Lyra*. G. C., 4447.  
Planetary nebulae. Observations of G. C., 4628, 4964,  
4572, 4565, 826, 2102, 4302.  
The accompanying plate gives a figure of a section of the  
milky way.
- 1786 76 457 *Catalogue of one thousand New Nebulae and Clusters of  
Stars*.  
Description of sweeping telescope; Newtonian; 20 feet  
focus, 18.7 in. aperture, power 157, field 15' 4".
- 458 Description of the method of sweeping.
- 464 Probable errors of the places given by the sweeps before  
1783, Dec. 13,  $\Delta\alpha = 1^m$ ,  $\Delta\delta 8'-10'$ , during 1784  $\Delta\alpha$   
 $< 30^s$ ,  $\Delta\delta < 5'$ .  
Till 1785, September 24,  $\Delta\alpha < 12^s$ ,  $\Delta\delta < 4'$ .  
After 1786, April,  $\Delta\alpha < 6^s$ ,  $\Delta\delta < 2'$ .
- 466 Definition of *classes* of nebulae and clusters.
- 467 A map of positions of nebulae was made for identification.
- 469 Explanation of a short method of describing appearance of  
nebulae by letters.
- 471 Catalogue:  

Class I	No. 1 to No. 93
II	No. 1 to No. 402
III	No. 1 to No. 376
IV	No. 1 to No. 29
V	No. 1 to No. 24
VI	No. 1 to No. 19
VII	No. 1 to No. 17
VIII	No. 1 to No. 40
- 498 Notes to special nebulae.
- 1789 79 212 *Catalogue of a second thousand of New Nebulae and Clusters  
of Stars; with a few introductory Remarks on the Con-  
struction of the Heavens*.
- 213 A telescope has power to penetrate into space. Proof that  
every star is a sun shining by its native brightness.
- 214 Systems of stars—globular clusters and definition of a cluster.
- 216 Admitting that a cluster is real, not apparent, the stars com-  
posing it are about of equal magnitude.
- 217 At the same distance from the centre an equal scattering  
takes place.  
These clusters are of a globular form.
- 218 They are more condensed at the centre than at the surface.

## Herschel, W. : ABSTRACTS OF MEMOIRS—Continued.

A.D. Vol. P.

- 1789 79 219 Form I of nebulae, [*P. T.*, 1785, p. 214,] is thus shown to exist in the heavens.  
Such clusters are subject to central powers.
- 220 The idea of other central forces [than that of gravity] in the construction of the sidereal heavens, was given in certain mathematical papers delivered to the Phil. Soc. of Bath, [and is yet entertained.]
- 221 Not only were *round* nebulae and clusters formed by central powers, but likewise every cluster of stars or nebula that shows a gradual condensation, or increasing brightness towards a centre.
- 222 This theory of central power is fully established on grounds [of observation] which cannot be overturned.
- 223 Clusters can be found of 10' diameter with a certain degree of compression and stars of a certain magnitude, and smaller clusters of 4' 3' 2' in diameter, with smaller stars and greater compression, and so on through resolvable nebulae by imperceptible steps, to the smallest and faintest [and most distant] nebulae.
- 224 Other clusters there are, which lead to the belief that either they are more compressed or are composed of larger stars. Spherical clusters are probably not more different in size among themselves than different individuals of plants of the same species. As it has been shown that the spherical figure of a cluster of stars is owing to central powers, it follows that those clusters which, *cæteris paribus*, are the most complete in this figure, must have been the longest exposed to the action of these causes.
- 225 The maturity of a sidereal system may thus be judged from the disposition of the component parts.  
Planetary nebulae may be looked on as very aged.
- 226 Though we cannot see any individual nebula pass through all its stages of life, we can select particular ones in each peculiar stage.
- 226 Catalogue :  

Class I	No. 94	to	No. 215
II	No. 403	to	No. 768
III	No. 377	to	No. 747
IV	No. 30	to	No. 58
V	No. 25	to	No. 44
VI	No. 20	to	No. 35
VII	No. 18	to	No. 55
VIII	No. 41	to	No. 78
- 255 Notes.

## Herschel, W.: ABSTRACTS OF MEMOIRS—Continued.

- | A. D. | Vol. | P.    |   |
|-------|------|-------|---|
| 1791  | 81   | 71    | <i>On Nebulous Stars properly so called.</i><br>The name nebulous stars incorrectly used in former times.   |
|       |      | 72    | Nebulæ can be selected so that an insensible gradation shall take place from a coarse cluster like the <i>Pleiades</i> down to a milky nebulosity like that in <i>Orion</i> , every intermediate step being represented. This tends to confirm the hypothesis that all are composed of stars more or less remote.   |
|       |      | 73    | A comparison of the two <i>extremes</i> of the series, as a coarse cluster and a nebulous star, indicates, however, that <i>the nebulosity about the star is not of a starry nature.</i>  |
|       |      | 74    | Summary of the reason which led to the belief that all nebulæ were clusters more or less remote.<br>Basis for the ideas of <i>connection</i> and <i>disjunction</i> of stars and nebulæ.  |
|       |      | 75-77 | Particular examples of such supposed conjunctions and disassociations.<br>The trapezium of <i>Orion</i> is unconnected with the nebula.   |
|       |      | 78-82 | Notes of observations on nebulous stars and consideration of the relation of the nucleus to the envelope in each case.  |
|       |      | 83    | Considering II, iv 69, [= G. C. 810,] as a typical nebulous star, and supposing the nucleus and chevelure to be connected, we may, 1st, suppose the whole to be of stars, in which case either the nucleus is enormously larger than other stars of its stellar magnitude or the envelope is composed of stars indefinitely small; or, 2d, we must admit that the star is <i>involved in a shining fluid of a nature totally unknown to us.</i> |
|       |      | 84    | The <i>telescopic milky way</i> is probably composed of this shining fluid, which must commence somewhere about the range of the stars of the 7th magnitude, and extend to the regions of the 9th, 10th, 11th, and 12th.  |
|       |      | 85    | The shining fluid might exist independently of stars. The light of this fluid is no kind of reflection from the star in the centre. If this matter is self-luminous, it seems more fit to produce a star by its condensation than to depend on the star for its existence.  |
|       |      | 86    | List of diffused nebulosities and planetary nebulæ; both better accounted for by the hypothesis of a shining fluid than by supposing them to be distant stars.<br><i>Regeneration of stars</i> from planetary nebulæ.   |
|       |      | 87    | How far the light-corpuscles emitted from millions of suns may be concerned in this shining fluid it is not neces-  |

## Herschel, W.: ABSTRACTS OF MEMOIRS—Continued.

- | <i>A.D.</i> | <i>Vol.</i> | <i>P.</i> |   |
|-------------|-------------|-----------|---|
| 1791        | 81          | 88        | sary to inquire—we need not know the origin of the luminous matter whose existence is rendered evident by means of nebulous stars.  |
| 1795        | 85          | 46        | <i>On the Nature and Construction of the Sun and Fixed Stars.</i>   |
|             |             | 69        | Speculations on the Satellites of Fixed Stars; the mutual distance of the component stars of condensed clusters, and on the distances of the clusters themselves, etc.  |
|             |             | 70        | Star gauges. $19^h.6$ to $20^h.2$ ; N. P. D. = $73^\circ.9$ .   |
| 1796        | 86          | 166       | <i>Method of observing the Changes that happen to the Fixed stars, etc.</i>   |
| 1800        | 90          | 49        | <i>On the power of penetrating into Space by telescopes, etc.</i>   |
|             |             | 63        | Relative distance from the earth of cluster in <i>Perscus</i> and other clusters.   |
|             |             | 70–78     | Observations in detail of several nebulæ, each with various telescopes.   |
| 1802        | 92          | 477       | <i>Catalogue of 500 new Nebulæ, Nebulous Stars, Planetary Nebulæ and Clusters of Stars; with remarks on the Construction of the Heavens.</i>  |
|             |             |           | After a sufficient number of celestial objects is found, there is a necessity for a scientific classification. The former classification was only for the convenience of the observer.                                  |
|             |             | 478       | Enumeration of the parts that enter into the construction of the heavens.   |
|             |             |           | I. <i>Of insulated stars.</i>   |
|             |             | 479       | Notion of an insulated star—our sun is one.   |
|             |             | 480       | The milky way consists of stars very differently scattered from those which are immediately about us.   |
|             |             |           | II. <i>Of Binary Siderial Systems or Double Stars.</i>  |
|             |             | 480–485   | Theoretical notions of such systems.  |
|             |             | 486       | Many of them have already changed their situation with regard to each other in a progressive course, denoting a periodical revolution round each other.   |
|             |             |           | Our sun does not belong to such a system.   |
|             |             |           | III. <i>Of more complicated Siderial Systems, or triple, quadruple, quintuple, and multiple stars.</i>  |
|             |             | 487       | Theorem as to the permanent connection of revolving stars, when the forces acting on any one of them reduced to a direction as coming from the empty centre, are in the direct ratio of the distances from that centre. |



## Herschel, W.: ABSTRACTS OF MEMOIRS—Continued.

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- 1802 92 437-495 Hypothetical examples of such connections.
- 495 IV. *Of Clustering Stars and the Milky Way.*  
Marks of clustering in the milky way. Example of the stars between  $\beta$  and  $\zeta$  Cygni.
- 496 "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 show 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.* Definition.
- 497 VI. *Of clusters of Stars.* Definition.
- VII. *Of Nebulæ.* Perhaps they are all to be resolved into the three last-mentioned species.
- 498 Power of a telescope to penetrate not only space but time [past.]
- 499 VIII. *Of Stars with Burs or Stellar Nebulæ.*  
IX. *Of Milky Nebulosity.*  
Probably of two kinds. 1st, apparent, which is formed by distant ["widely-extended"] clustering stars, and, 2d, real, and possibly at no very great distance from us. The nebula of *Orion* of this latter kind.
- 500 X. *Of Nebulous Stars.*
- 501 XI. *Of Planetary Nebulæ.*  
Perhaps they are allied to nebulous stars.
- XII. *Of Planetary Nebulæ with Centres.*
- 503 Catalogue.
- |         |         |    |         |
|---------|---------|----|---------|
| Class I | No. 216 | to | No. 288 |
| II      | No. 769 | to | No. 907 |
| III     | No. 748 | to | No. 978 |
| IV      | No. 52  | to | No. 78  |
| V       | No. 45  | to | No. 52  |
| VI      | No. 36  | to | No. 42  |
| VII     | No. 56  | to | No. 67  |
| VIII    | No. 79  | to | No. 88  |

- 1811 101 269 *Astronomical Observations relating to the Construction of the Heavens, arranged for the purpose of a critical examination, the result of which appears to throw some new light on the Organization of the Celestial bodies.*

[The following analysis is by HERSCHEL himself.]

## Herschel, W. : ABSTRACTS OF MEMOIRS—Continued.

A.D. Vol. P.

- 1811 101 272 Diffused nebulosity exists in great abundance.
- 275 Observations of more than one hundred and fifty square degrees of it.
- 277 Its abundance exceeds all imagination.  
Nebulous matter consists of substances that give out light, which may have many other properties.
- 278-281 Nebulous diffusions contain both milky nebulosity, and such as from its faint appearance may be mistaken for resolvable.
- 278-279 The range of its visibility is confined to very moderate limits.
- 280 The purpose for which such great abundance of nebulosity may exist, deserves investigation.
- 282 Either greater depth or greater compression of the nebulous matter may occasion greater brightness.
- 284 Condensation will best account for greater brightness.  
The condensation of the nebulous matter ascribed to gravitation.
- 285 When a nebula has more than one preponderating seat of attracting matter, it will probably in time be divided.  
This conception is supported by the appearance of double nebulae.
- 286 Their double appearance can be no deception.  
Their nebulosity is derived from one common stock.
- 290 This opinion is supported by the remarkable situation of nebulae.
- 292 Which may be seen in Mr. BODE's *Atlas Cœlestis*.
- 293-296 The real form of the nebulous matter of which nebulae are composed may be inferred from their figure.
- 299 The form of the nebulous matter of round nebulae is globular.  
This form is caused by gravitation.
- 302 The central brightness of nebulae points out the seat of attraction.  
The effect of attraction on the form of the nebulous matter depends on its original expansion, on the time of the action and on the quantity of the attracting matter.
- 305 III different stages of condensation pointed out.
- 306 Comets may be highly condensed nebulae.
- 307 Progressive condensation takes place.
- 308 Concentric brightness as well as globular form indicates the general gravitation of the nebulous matter.  
Progressive condensation may be seen in the formation of nuclei.



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- 1811 101 309-310 Nebulous matter is probably capable of being consolidated; the act of shining proves it to have chemical properties.  
It will stop light, and is partly opaque.
- 311 Queries relating to the subsidence of the nebulous matter, the zodiacal light, and the cause of rotatory motion.
- 313 Some part of the nebulous matter is probably elastic.
- 313 The uniform light of nuclei, and of much condensed nebulae, proves that the nebulous matter is considerably opaque.
- 314 When the nebulous matter assumes hardness, the progress of condensation will be impeded.
- 315 Three indications of the compression of the nebulous matter.  
Planetary appearance arises from superficial lustre.
- 316 High degree of condensation of the nebulous matter.  
A still higher degree of condensation.
- 318 In common good telescopes planetary nebulae cannot be distinguished from stars.  
Perhaps they may in the end be so condensed as actually to become stars.
- 319 The nebulous matter in a cubical space of 10' will admit of a condensation of two trillion and 208 thousand billion times before it can go into the compass of a globe of the diameter of our sun.  
Planetary nebulae have a rotatory motion on their axes.  
The original eccentricity of the nebulous matter of a nebula may be the physical cause of the rotatory motion of celestial bodies.
- 320 The nebulous star in *Orion* is fictitious.
- 321 Two out of three nebulous stars in *Orion* have lost their former nebulous appearance.  
Their fictitious appearance was owing to a dispersion of their light in passing through nebulous matter.
- 322 The faintest appearance of the nebulosity in *Orion* is perhaps not further from us than the stars of the third or second magnitude; the brightest part is therefore probably not so far.
- 323 In thirty-seven years the nebulosity of this nebula has undergone great changes, and much greater since the time of HUYGHENS.
- 324 Nebulae are not permanent celestial bodies.
- 325 Additional proof of the opacity of the nebulous matter.

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- 1811 101 325 Very distant nebulosities which cannot be seen in a state of diffusion may become visible when condensed into separate nebulæ.
- 327 Conversion of planetary into bright stellar nebulæ, into stars with burs, or stars with haziness.
- 329 Conversion of more distant ones into faint stellar nebulæ, into stars with burs or with faint ebevelure.  
When it is doubtful whether an object is a star or a nebula, it may be verified by an increase of magnifying power.
- 330 When the object is very like a star it becomes difficult to ascertain whether it is a star or a nebula.  
When we cannot ascertain whether the doubtful object is a star or a nebula, of which several instances are given, the similitude is as great as any we can expect; for were it greater there could be no doubt.
- 1814 104 243 *Astronomical Observations relating to the Siderial part of the Heavens and its Connection with the Nebulous part; arranged for the purpose of a critical examination.*  
In the memoir on the nebulous part of the heavens [P. T. 1811] I have endeavored to show the probability of a very gradual conversion of the nebulous matter into the siderial appearance.
- 249 I. *Of stars in remarkable situations in regard to Nebulæ.*  
Surmise that nebulæ may have considerable proper motions. Necessity of caution in such conclusions. Five stars in such situations.
- 250 II. *Of two stars with nebulosity between them.*  
19 instances of such connection are given; in the memoir of 1811, 139 double nebulæ joined by nebulosity were noted.
- 251 Should we not surmise that possibly these stars had formerly been highly condensed nebulæ like those that had been mentioned, and were now by gradually increasing condensation turned into small stars; and may not the nebulosity still remaining show their nebulous origin? Also we have over 700\* double stars free from nebulosity, many of which are probably at no great real distance from us, it seems as if we had these double objects in three different successive conditions. 1st, as nebulæ; next as stars with remaining nebulosity; and lastly, as stars completely free from nebulous appearance.

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[\* 10,000 or more in 1876. As comparatively few are nebulous, either our system is in an advanced state or the order here given is exceptional.]

## Herschel, W. : ABSTRACTS OF MEMOIRS—Continued.

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1814 104 251 III. *Of Stars with nebulousness of various shapes attached to them.*

252 Fourteen such objects noted.

Now, if we admit a contact between these nebulae and the stars, it deserves to be remarked that stars in the situation of these fourteen cannot have been formed from their adjoining nebulousness; for a gradual condensation of the nebulous matter would have been central; whereas the stars are at the extremity of the nebulae. Their connection is then due to some motion either of the star or of the nebulae. If the nebulousness should subside into the star, it would give an idea of the *growth* of a star.

253 IV. *Of stars with nebulous branches.*

Three cases noted of a connection between stars and nebulae and reference made to *P. T.*, 1811, pp. 301–311, for further examples.

254 V. *Of nebulous stars.*

Thirteen are noted—see also *P. T.*, 1791, p. 71.

255 Nebulous stars are not only connected with a nebulousness, which, from its great regularity, might be taken for an atmosphere, but also with the luminous appearances belonging to the nebulous matter which is so widely expanded in various regions of the heavens.

What has been said of the gradual condensation of the nebulous matter in the case of extended nebulae, is supported by a much greater number of nebulousness in a spherical form. [See *P. T.*, 1811, pp. 301–8.] 322 cases are there mentioned, in which the fact of the gradual condensation is rendered so evident as not to admit of a doubt.

256 Nebulous stars only differ from round nebulae containing a nucleus, in the degree of condensation.

257 VI. *Of Stars connected with extensive windings of nebulousness.*

Three cases noted.

The nebulousness which has been shown to be connected with stars, may be fully proved to be of the same nature as the general mass of nebulous matter.

Stars of this class are in a condition of growth.

257 Possibility that stars were originally formed by a condensation of the nebulous matter.

We may conceive both the generation and growth of stars to be the legitimate effects of the law of gravitation, to

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which the nebulous matter is proved by observation to be subject.

1814 104 257 VII. *Of small patches consisting of Stars mixed with nebulosity.*

Thirty-seven cases noted.

The connection may be only apparent—admitting it to be real :

1st, it may happen that the nebulosity still mixed with the stars is some remaining unsubsidied part of that from which they were formed ; or, 2d, the union of stars and nebulosity may have been affected by the motion of either the stars or the nebulosity.

258 Such motions do take place. Nebulæ are subject to great changes in their appearance, as the nebula of *Orion*. [*P. T.*, 1811, p. 320.]

259 Every nebulosity which is carried into the region of a small patch of stars will probably be gradually arrested and absorbed by them, and the *growth of stars* thus continued.

VIII. *Of objects of an ambiguous construction.*

Clusters of stars at a great distance may assume a nebulous appearance. [*P. T.*, 1811, p. 270.]

Telescopes of gradually increasing space-penetrating powers show certain objects successively as nebulæ, mixtures of nebulosity and stars, and as true clusters ; other objects, so viewed, increase in brightness, and the nebulosity becomes more uniformly united and of a milky appearance, and these are purely nebulous.

260 Definition of *ambiguous* objects, their classification and examples. Seventy-one such noted in four classes.

*Class 1.* Seven objects, which may be supposed to consist of stars, but where observations leave it doubtful.

261 *Class 2.* Twenty-six objects of round or nearly round figure. The round figure of these show them to be *globular*. They must either be in a condensed state purely nebulous, or else if consisting of stars, they must be in an advanced order of compression, and only appear nebulous on account of their very great distance from us.

A middle state between the progressive condensation of a globular nebula and a cluster of stars can have no existence, because a globular nebulosity when condensed can only produce a single star. A globular cluster may, however, intercept a mass of nebulous matter in motion,

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- in which case the nebulosity must soon assume the form of the cluster, and will finally be absorbed by it.
- Class 3. Twenty-six easily resolvable objects.
- Class 4. Twelve objects, probably clusters.
- 1814 104 262 IX. *Of the siderial part of the Heavens.*  
Intimate connection between the nebulous and siderial condition.
- 263 Stars of first magnitude. [See *P. T.*, 1785, p. 68.]
- 264 Prismatic analysis of the light of *Sirius,  $\alpha$  Orionis, Procyon, Arcturus, Aldebaran and  $\alpha$  Lyræ.\**
- 265 X. *Of the aggregation of stars.*  
Star-gauges prove that the stars are not equally distributed over the celestial regions.  
*Forming* clusters. This tendency to clustering is chiefly visible in places extremely rich in stars. Its greatest effects will then be in and near the milky way.
- 266 The twenty objects referred to are not given as instances of the actual formation of clusters, but merely to draw attention to a seemingly aggregating arrangement. Fifteen of these are in the milky way and five are near it.
- 266 XI. *Of irregular clusters.*  
Clusters in very rich parts of the heavens are generally of irregular form and imperfectly collected. One hundred
- 1267 and twelve such objects are referred to; eighty of size not noted, fifty-three of these in the milky way, eighteen near it, nine at a distance from it. Also thirty-two irregular clusters from 2' to 30' in diameter; of these twenty-two are in the milky way and ten near it.
- 267 The great number of clusters in these two collections is not only an indication that they owe their origin to a clustering power residing in the centre; but the still remaining irregularity of their arrangement additionally proves that the action of the clustering power has not been exerted long enough to produce a more artificial construction.
- 268 XII. *Of clusters variously extended and compressed.*  
Fifteen extended clusters named; twelve in the milky way, three near it. Their descriptions show that the power which has drawn the stars together has acted under different circumstances in the several cases.

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[\*I believe that these experiments of HERSCHEL'S have been hitherto overlooked, at least I have seen no mention of them in historical works.]

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- 1814 104 269 XIII. *Of clusters of stars of a peculiar description.*  
Six such objects named : One in the milky way, three near it, two at a distance from it.
- 271 XIV. *Of differently compressed clusters of stars.*  
I have hitherto only considered the arrangement of stars in clusters with a view to point out whether they are drawn together by a clustering power in the same manner as the nebulous matter has been proved to be condensed by a gravitating principle ; but in the forty-one clusters of the following two collections we shall see that it is one and the same power uniformly exerted which first condensed nebulous matter into stars and afterwards draws them together into clusters, and which by a continuance of its action, gradually increases the compression of the stars which form the clusters. The first collection has thirty-three considerably compressed clusters, seventeen in the milky way, fifteen near it, and one at a distance. The second collection contains eight clusters, highly compressed, five in the milky way, two near it, and one at a distance.
- 272 XV. *Of the gradual concentration and insulation of clusters of stars.*  
The existence of a clustering power is nowhere so visibly pointed out as in the thirty-nine clusters given in the following collection : Twenty-one of these are in the milky way, seven near it, and eleven at a distance.
- 273 XVI. *Of globular clusters of stars.*  
Fourteen such objects noted : One in the milky way, four near it, and nine at a distance from it.
- 274-7 [Detailed accounts from observing books of M. 72 ; M. 2 ; M. 5 ; M. 56 ; M. 80 ; M. 13 ; M. 3 ; M. 15 ; M. 79 ; M. 19 ; M. 53.]
- 278 XVII. *Of more dis'ant globular clusters of stars.*  
The following eleven objects are so like those of the foregoing collection that I have called them miniatures of the former. Five of these are in the milky way, one near it, and five at a distance. Detailed descriptions given.
- 279 I have supposed the clusters of this class to be at a greater distance from us than those of the preceding collection, because the stars of which they are composed are more minute than those of the clusters of which I have called them miniatures ; their compression is also closer, and the size of the whole is much contracted, all of which



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particulars are readily explained by admitting them to be more distant. This argument, however, does not extend so far as to exclude a real difference which there may be in different clusters, not only in the size, but also in the number and arrangement of the stars.

XVIII. *Of still more distant globular clusters of stars.*

- 1814 104 280 It has frequently happened that I saw three objects in succession, the first of which was a brilliant globular cluster of stars, the second a miniature of the former in which the stars could just be perceived, and the third in every respect a similar miniature of the second, as the second was of the first, but in which the stars, though suspected, were no longer to be distinguished. Five such objects given, all in the milky way.

XIX. *Of a recurrence of the ambiguous limit of observation.*

- 281 It has already been shown [VIII] that in passing from faint nebosity to the suspected sidereal condition we cannot avoid meeting with ambiguous objects, and the same critical situation will again occur, when, from the distinctly sidereal appearance, we endeavor to penetrate gradually further into space.

The effects of clustering power have been gradually traced from the first indication of clustering stars through irregular as well as through more artificially arranged clusters up to the beautiful globular form.

The extended views I have taken in this and in my former papers of the various parts that enter into the construction of the heavens have prepared the way for a final investigation of the universal arrangement of all these celestial bodies in space. The *scale* is still wanting by which distances are to be measured.

- 282 XX. *Of the breaking up of the Milky Way.*

Its whitish tinge has been proved by star-gauges to arise from accumulated stars. It does not now consist of equally scattered stars.

- 283 One hundred and fifty-seven instances have been given of clusters situated within the milky way. Sixty-eight more are in the borders. Now, since the stars of the milky way are permanently exposed to the action of a power whereby they are irresistably drawn into groups, we may be certain that from mere clustering stars they will be gradually compressed through successive stages of accumulation till they come up to what may be called

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the ripening period of the globular form, and total insulation; from which it is evident that the milky way must be finally broken up and cease to be a stratum of scattered stars.

- 1814 104 284 The state into which the incessant action of the clustering power has brought it at present is a kind of chronometer that may be used to measure the time of its past and future existence; and although we do not know the rate of going of this mysterious chronometer, it is nevertheless certain that since the breaking up of the milky way affords a proof that it cannot last forever, it equally bears witness that its past duration cannot be admitted to be infinite.

This paper is accompanied by Plate IX, p. 284, with 17 figures.

Fig. 1 = H. v, 46.	10 = H. iii, 697.
2 = H. iii, 67.	11 = H. ii, 101.
3 = H. ii, 706.	12 = H. ii, 500.
4 = H. i, 143.	13 = H. viii, 44.
5 = H. iv, 4.	14 = H. viii, 4.
6 = H. iv, 35.	15 = H. vi, 36.
7 = H. iv, 42.	16 = H. vi, 5.
8 = H. iv, 69.	17 = M. 72.
9 = H. iv, 33.	

- 1817 107 302 *Astronomical Observations and Experiments tending to investigate the Local Arrangement of the Celestial Bodies in Space and to determine the Extent and Condition of the Milky Way.*

The construction of the heavens can only be known when we have the situation of each body defined by its three dimensions. Of these three the ordinary catalogues give but two, leaving the distance or profundity undetermined.

- 303 The method of parallaxes has given the distance of the sun, planets, etc. The parallax of the stars has also received attention. With regard to more distant objects, as small stars, compressed clusters, and nebulae, these methods are of no avail.

I. *Of the local situation of the stars of the Heavens.*

- 304 It is evident that we cannot mean to affirm that the stars of the fifth, sixth, and seventh magnitudes are really smaller than those of the first, second, or third, and that we must ascribe the cause of the difference in the apparent magnitudes of the stars to a difference in their relative distances from us. - On account of the great number



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of stars in each class we must also allow that the stars of each succeeding magnitude beginning with the first, are, one with another, further from us than those of the magnitude immediately preceding. The relative magnitudes give only relative distances, and can afford no information as to the real distances at which the stars are placed.

II. *Of a standard by which the relative arrangement of the stars may be examined.*

A standard of reference for the arrangement of the stars may be had by comparing their distribution to a certain properly modified equality of scattering. The equality which I propose does not require that the stars should be at equal distances from each other, nor is it necessary that all those of the same nominal magnitude should be equally distant from us.

1817 107 305 It consists in allotting a certain equal portion of space to every star, in consequence of which we may calculate how many stars any given extent of space may contain. This arrangement is explained by means of a figure. Plate XV, Fig. 1.

306 III. *Comparison of the order of magnitudes with the order of distances.*

Comparison of the order of distances by the foregoing scheme with the magnitudes assigned in BODE'S catalogue of 14,144 stars.

308 The result of this comparison is, that if the order of magnitudes could indicate the distance of the stars, it would denote at first a gradual, and afterwards a very abrupt, condensation of them; but that, considering the principle on which the stars are classed, their arrangement into magnitudes can only apply to certain relative distances, and show that, taking the stars of each class, one with another, those of the succeeding magnitudes are farther from us than the stars of the preceding order.

IV. *Of a criterion for ascertaining the profundity or local situation of celestial objects in space.*

309 It will be admitted that those stars, the light of which we can experimentally prove to be  $\frac{1}{4}$ ,  $\frac{1}{9}$ ,  $\frac{1}{16}$ -----of the light of any certain star of the first magnitude must be 2, 3, 4-----times as far from us as the standard star, provided the condition of the stars should come up to the supposed mean state of diameter and lustre of the standard star.

V. *Of the equalization of star light.*

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- Star gauging gave rise to an investigation of the space-penetrating power of telescopes.
- 1817 107 310 Finding that this might be calculated with reference to the extent of the same power of which the unassisted eye was capable, there always remained a desideratum of some sure method by which this last might be ascertained.
- Description of experimental apparatus.
- 311 Method of limiting apertures.
- 313 VI. *Of the extent of natural vision.*
- 313-8 Experiments on stars.
- 318 The distances of clusters cannot be ascertained by the method of equalizing star-light.
- VII. *Of the extent of telescopic vision.*
- 319 Experiments which go to show that the diameter of the pupil of the human eye is not more than 0.21 inch, and greater than 0.17 when observing with a telescope. It may be assumed 0.2 inch.
- 320 VIII. *Application of the extent of natural and telescopic vision to the probable arrangement of the celestial bodies in space.*
- We shall be able to say that a distant celestial object is so far from us, provided the stars of which it is composed are of a size and lustre equal to the size and lustre of such stars as *Sirius*, *Arcturus*, etc.
- 321 The stars of the tenth, eleventh, and twelfth order of distances are not only more compressed than those in the neighborhood of the sun, but, moreover, their compression in different parts of the heavens must be very unequal.
- IX. *Of the construction and extent of the milky way.*
- 322 General description of it.
- The sun is within its plane, for to an observer in latitude 60°, when at 100° R. A. the milky way is in the east, it will at the same time be in the west at 280°; while in its meridional situation it will pass through *Cassiopeia* in the Zenith and through the constellation of the Cross in the Nadir.
- 323-4 Examination of the cluster in the Sword Handle of *Percus*, with various space-penetrating powers.
- 325 [Beside the 863 gauges published in *P. T.*, 1785, p. 221, above 400 more have been taken in various parts of the heavens.]
- 326 The twenty-foot telescope cannot fathom the profundity of the milky way.

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- 1817 107 326 If the stars of the 5th, 6th, and 7th magnitudes cannot be supposed to be gradually of a smaller physical size and brightness than those of the 1st, 2d, and 3d, how much less can a supposition be admitted that would require that the stars, which, by a long series of gauging powers, have been proved to make their gradual telescopic appearance should also be gradually of a different construction with regard to physical size and brightness from those which we see with the naked eye?
- 327 The telescopic breadth of the milky way considerably exceeds the extent which, in our maps, is assigned to it.
- 328-30 Observations—sweeps—which confirm this.
- 330 X. *Concluding Remarks.*  
What has been said of the extent and condition of the milky way in my papers on the construction of the heavens, with the addition of this attempt to give a more correct idea of its profundity in space, will nearly contain all the general knowledge we can ever have of this magnificent collection of stars.
- 331 Our sun with all the stars we can see with the eye are deeply immersed in the milky way, and form a component part of it.
- 1818 108 429 *Astronomical observations and experiments, selected for the purpose of ascertaining the relative distances of clusters of stars, and of investigating how far the power of our telescopes may be expected to reach into space when directed to ambiguous celestial objects.*  
The method of equalization of star light will show the relative distances of stars; from this a method was explained in *P. T.*, 1817, by which means the profundity in space of every object consisting of stars can be ascertained as far as the light of the telescope suffices. This method may be used to ascertain the profundity of globular and other clusters.
- 430 I. *Of the distance of globular and other clusters of stars.*  
General principles to guide in such observations.
- 431 II. *A series of observations of clusters of stars from which the order of their profundity in space is determined.*
- 431-51 Observations of H. vi, 7, 9, 10, 11, 12, 17, 20, 26, 35, 38, 41, 63, and of M. 1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15, 19, 22, 30, 33, 34, 35, 53, 55, 56, 57, 62, 67, 68, 69, 71, 72, 74, 75, 77, 79, 80, 92, 97.
- 451 III. *Of a method to represent the profundity of celestial objects in space by a diagram.*

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- 1818 108 470 Fig. 1, Plate xxi, represents such a method applied to the foregoing objects.
- 460 IV. *Of ambiguous celestial objects.*  
An object is often ambiguous when viewed with insufficient optical means, and its nature may be known by increasing this means. Objects ambiguous to the naked eye become known with the 20-foot telescope, and so on.
- 462 V. *The milky way, at the profundity beyond which the gauging powers of our instruments cannot reach, is not an ambiguous object.*
- 463 We may conclude that when our gauges will no longer resolve the milky way into stars it is not because it is ambiguous, but because it is fathomless.
- 463 VI. *Of the assumed semblance of clusters of stars when seen through telescopes that have not light and power sufficient to show their nature and construction.*
- 464 Observations of various clusters in telescopes of various sizes.
- 465 Two different principles, the *nebulous* and the *siderial*, have been observed in the celestial spaces.  
Distinguishing characteristics of each.
- 466 It seems highly probable that some of the cometic, many of the planetary, and a considerable number of the stellar nebulæ, are clusters of stars in disguise.
- VII. *Of the extent of the power of our telescopes to reach into space when they are directed to ambiguous celestial objects.*  
The method of equalizing the light of stars may be applied so as to give an estimate of the extent of this power.  
When the united light of a cluster of stars is visible to the [naked] eye, there will be a certain maximum of distance to which the same cluster might be removed, so as still to remain visible in a telescope of a given space-penetrating power; and if the distance of the cluster can be ascertained by the gauging power of any instrument, that will just show the stars of it, the order of the profundity at which this cluster could still be seen as an ambiguous object may be ascertained by the space-penetrating power of the telescope through which it is observed.
- 467-8 Examples of this method.

- Hevelius:** *Prodromus Astronomiæ*, 1690. [Has a catalogue of sixteen nebulae and clusters.]
- [———:] Discovered M. 40.
- Hind:** *A. N.*, xxiii, col. 356. [Discovery of nebula.]
- : *A. N.*, xxx, col. 257. [Discovery of nebula.]
- : *A. N.*, xxxv, col. 371. [Discovery of a variable nebula,  $a = 4^h 11^m 50^s$ ,  $\delta = +19^\circ 8'$ .]
- : *Mon. Not. R. A. S.*, x, p. 141. [Discovery of a nebula.]
- : *Mon. Not. R. A. S.*, xii, p. 208. [Notice of a new nebula discovered.]
- : [Variable nebula in *Taurus*.] *Mon. Not.*, xxiv, p. 65.
- : *C. R.*, 1850, i, p. 358. [Discovery of a nebula,  $12^h 0^m 33^s + 66^\circ 0' 30''$ . 1850.0.]
- : *Am. Jour. Sci.*, 2d series, xxxiii, p. 436. [Variable nebula in *Taurus*.]
- : *Nature* 1876, p. 545, [CHACORNAC'S variable nebula.]
- Hinrichs:** *Am. Jour. Sci.*, 2d series, xxxix, pp. 46, 134, and 276. [Nebular hypothesis.]
- Hipparchus:** [Discovered G. C. 512, 521, 1681.] See SCHULTZ, *A. N.*, lxvii, col. 4.
- Holden:** Report Sec'y of the U. S. Navy, 1875, p. 75. [Report on TROUVELOT'S drawings of nebulae.]
- : On the nebula of *Lyra* = M. 57. *Mon. Not. R. A. S.*, xxxvi, p. 61.
- : *Mon. Not.*, vol. xxxvii, p. 231. [List of Drawings of nebula of *Orion*.] See *A. N.*, lxxxix, col. 135.
- : On supposed changes in the nebula M. 17 = G. C. 4403, etc., [with plates.] *Am. Jour. Sci.*, 1876, May, vol. xi, page 341, 3d series.
- : On the proper motion of G. C. 4355. *Am. Jour. Sci.*, 1877, Dec.
- Homer:** *Odyssey*, lib. v, verse 270. [First mention of the *Pleiades*.]
- Hooke:** *Micrographia*, fol. London, 1665, p. 242. [Discovery of 4th and 5th stars in *Orion* trapezium?]
- Horner:** *Die Milchstrasse des südlich. Himmels u. die kapschen Wolken*. 1804. *ZACH. Monat. Corr.*, vol. 10, p. 220, [has a plate.]
- Hoseman:** *Discursus de viâ lacteâ*. 1665. 4°.
- Huggins:** A discourse on spectrum analysis applied to the heavenly bodies, 8°, Nottingham, 1866. [With photographs of drawings, etc., p. 29 *et seq.*] German translation by KLINKERFUES.

- Huggins**: On the spectrum of the great nebula in *Orion*. *Proc. R. S.*, xiv, p. 39.  
 ———: *Proc. R. S.*, xv, 1866, p. 7. [Spectra of nebulae. Remarks.]  
 ———: On the spectrum of the great nebula in *Orion*, etc. *Proc. R. S.*, vol. xx, 1872, p. 379.  
 ———: On the motions of some of the nebulae towards or from the earth. [G. C. 1179, 4234, 4373, 4390, 4447, 4510, 4964.] *Proc. R. S.*, vol. xxii, 1873, p. 251. See *V. J. S.*, 1873, p. 218.  
 ———: On the spectra of some of the nebulae. *P. T.*, 1864, p. 437. See *L. E. D. Phil. Mag.*, 1866, p. 523.  
 ———: Further observations on the spectra of some of the nebulae, with a mode of determining the brightness of these bodies. *P. T.*, 1866, p. 381. See *L. E. D. Phil. Mag.*, 1866, p. 475.  
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- : *C. R.*, xvii, p. 190. [Drawings of the nebula in *Heracles* and of two in *Ursa Major*.]
- Victoria, Royal Society Transactions**: x, 11, 23, LESUEUR; x, pp. 71-106, McGEORGE.
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- : ——— von  $\delta = 9^{\circ} 30'$  zu  $15^{\circ} 30'$ . Jena, 1870. 8°.
- : *Positionen-Bestimmungen von Nebelflecken*, etc., zwischen  $\delta = 9^{\circ} 30'$  und  $\delta = + 15^{\circ} 30'$ ; extracted from Leipzig observations; vol. i, 1876. 4°. [Contains 2 plates.]
- : *Bothkamp Obs.*, i, p. 56. [Spectra of several nebulae.]
- : *A. N.*, lxx, col. 161. [Places of 100 nebulae; 1865.0.]
- : *A. N.*, lxxi, col. 45. [Comparison of above places with D'ARREST's positions.]
- : *A. N.*, lxxviii, col. 245. [Spectra of nebulae G. C. 1179, 4230, 4234, 4373, 4390, 4447, 4510, 4532, 4572, 4628.]
- : *V. J. S.*, 1867, p. 193; 1874, p. 57; 1876, p. 276.

- Washington Astronomical Observations:** 1867, HALL. 1868, pp. 17, 65, GILLISS.
- Waters, S.:** [Note on distribution of resolvable, etc., nebulæ.] *Mon. Not. R. A. S.*, xxxiii, p. 406.
- : Distribution of clusters and nebulæ [with chart.] *Mon. Not. R. A. S.*, xxxiii, p. 558.
- Webb:** Celestial objects for common telescopes, 3d edition, London, 1873. 8vo. [Contains some original observations on nebulæ not accessible elsewhere.]
- : *Mon. Not. R. A. S.*, xxvi, p. 208. [Notice of his drawing of *Orion* nebula.]
- : *Intellectual Observer*, vols. 2, 4, 5, 6, 7, 8, 9, 10, 11, and 12, [ditto. ditto.] Vol. 12, p. 258, has a history of the nebula of *Orion*.
- Weisse:** *Positiones Mediæ Stellarum Fixarum*, etc., [— 15°, + 15°] preface by F. G. W. STRUVE. [Distribution of stars, etc.]
- : *Positiones Mediæ Stellarum Fixarum*, etc., [+ 15°, + 45°] preface by O. v. STRUVE. [Distribution of stars, milky way, etc.]
- Westminster Review:** Vol. xiv, p. 185. HERBERT SPENCER. Vol. xxv, p. 390.
- Winlock:** Astronomical engravings from Observatory of Harvard College, 35 plates, 1875. 4°. Collected in *Annals H. C. Obs'y*, vol. viii. [Contains plates by TROUVELOT of nebula *Orionis*, (2) G. C. 4447, nebula of *Andromeda*, G. C. 4250, G. C. 4294, G. C. 4532, G. C. 4355, etc.]
- : *Harv. Coll. Obs'y Annals*, viii, p. 53.
- Winnecke:** *V. J. S.*, 1872, p. 58.; 1875, p. 297, Ueber die Strassburger Beob. der Nebelflecke. [Observations; allusion is made to an unpublished series of observations with the Bonn heliometer in 1857–8.]
- : *V. J. S.*, 1877, p. 82. [120 different nebulæ have been compared with one or more neighboring stars at Strassburg up to 1877.]
- : *A. N.*, xlv, col. 247. [Discovery of a nebula; remarks on suspected proper motions.]
- : *A. N.*, vol. li, col. 383, beilage zu No. 1224. [Observation of P. NOËL's on the star  $\eta$  *Argûs*. See also the Amsterdam reprint of *Paris Mem.*, vol. 6, 1685–89.]
- : *A. N.*, lvii, col. 207. [HIND's variable nebula observed.]
- : *A. N.*, lix, col. 65. [Merope nebula and nebula No. 548, Bonn zone + 30°.]
- : *Mon. Not. R. A. S.*, xxiv, p. 7. [Nebula of *Orion*.]
- : Ueber d. Nebelfleck des *Orions*. *M. M.*, iii, p. 499. *Bull. de l'Acad. Imp.*, vii, p. 18.

- Wolf, C.:** Description du groupe des Pléiades et mesures micrométriques des positions, etc., *C. R.*, 1875, July 5, vol. lxxxi, p. 29. [The catalogue contains 499 stars; also there is given an account of TEMPEL's variable nebula.] See also *Bull. Intern. de l'Obs. de Paris*, 1875, Nos. 223-4.
- Wolf, R.:** J. B. CYSAT von Luzern. Bern, 1853. [CYSAT the discoverer of the nebula of *Orion*.]  
 ———: *A. N.*, xxxviii, col. 109. [CYSAT.]
- Wollaston, F.:** A specimen of a general astronomical catalogue. London, 1789, *folio*. [Catalogues of nebulae reduced to 1790.0.]
- Wright, Thos.:** [of Durham:] Theory of the Universe. London. 4° 1750. [Theoretical considerations on the formation of the universe, etc., the milky way, etc.] See also *Phil. Mag.*, 3d series, vol. 22, p. 241. DEMORGAN, and *Hamburgische freie Urtheile*, 1751, for synopses, etc., of WRIGHT's ideas.
- 
- Young:** Natural Philosophy, edition, 1807. ii, p. 324. 4°. [Catalogue of works on nebulae.]
- 
- Zach:** *Corr. Ast.*, xiv, 410. [On CACCIATORE's new nebula.]
- Zach's:** *Correspondance Astronomique*, vol. xiv, p. 410.  
 ———: *Monatliche Correspondenz*, vol. x, p. 220.
- Zöllner:** *V. J. S.*, 1867, p. 116. [Review of HUGGINS, *P. T.*, 1868, p. 529.]

## II.

### LIST OF THE MORE IMPORTANT BOOKS AND MEMOIRS RELATING TO THE NEBULA OF ORION.

[Arranged alphabetically by Authors.]

- Arago** : *C. R.*, xiii, p. 450. [Remarks on RONDONI's drawing.]  
 — : *C. R.*, xxvi, p. 50, [BOND's drawing.]
- 
- Barneby** : *Mon. Not. R. A. S.*, vol. xxxiv, p. 248. [Variability of 6th star in trapezium.]
- Bessel** : *B. J.*, 1808, p. 122. [CYSAT knew of the nebula of *Orion*.]
- Bode** : *Anleitung z. Kenntniss des Gestirnten Himmels*, p. 166, Plate 1, p. 556. [Two drawings.]  
 — : *Himmelskarten*, Tafel 30. [Drawing.]
- Bond, G. P.** : *Annals Harvard College Observatory*, vol. v, 1867. [With two steel engravings and two charts.] 4°.  
 — : *Mon. Not. R. A. S.*, xxi, p. 203. [Spiral structure.]
- Bond, G. P. and W. C.** : *Mon. Not. R. A. S.*, xxiv, p. 177.
- Bond, W. C.** : Description of the nebula about  $\theta$  *Orionis*. *Mem. Am. Ac. Arts and Sciences*, vol. iii, [1848,] p. 87. [With steel engraving.]  
 — : *Proc. Am. Ac. Arts and Sciences*, i, p. 325. [Observations.]  
 — : Same volume, p. 342. [Resolvability of nebula of *Orion*.] See also *Am. Jour. Sci.*, 2d series, iv, p. 427.
- 
- Carpenter and Stone** : *Mon. Not. R. A. S.*, xxiv, p. 92. [On G. P. BOND's drawing.]
- Cassini, J. D.** : De Cometa Anni 1652-3. [Discovery of the 4th star in *Orion's* trapezium, etc.]  
 — : Découverte de la lumière céleste qui paraît dans le Zodiaque. [Suspects nebula of *Orion* to be a star cluster.] See DELAMBRE. *Hist. de l'Astr. Mod.*, vol. ii, pp. 700, 709, 744.
- Cysat** : CYSAT, der erste Entdecker des *Orions*-Nebel. [1619.] [R. WOLF, 1853.]  
 — : *Mathemata astronomica de loco cometæ qui sub finem anni 1618*, etc,



- D'Abbadie**: *Mon. Not. R. A. S.*, xvii, p. 245. [PORRO's new star in trapezium.]
- D'Arrest**: *Undersøgelse over de nebulose Stjerner*, etc. 1872. 4°. [With drawing of the nebula and detailed memoir.]
- : *A. N.*, lvii, col. 341.
- : *A. N.*, lxx, col. 337. [Notice of LEFEBVRE's drawing.]
- Dawes**: *Mon. Not. R. A. S.*, viii, p. 31. [New star.]
- Denning**: *A. N.*, lxxx, col. 299. [Ten stars in and near trapezium.] See **SALTER**.
- De Vico**: *Mem. Oss. Coll. Romano*, 1839, p. 31, plates i and ii. [Drawing; new stars in trapezium.]
- : Same, 1840-41, p. 22. [Plate by **RONDONI**.]
- : *C. R.*, xiii, p. 449. [Note on **RONDONI**'s drawing.]
- Doppelmayer**: *Himmels-Karten*, Blatt. 26.
- 
- Engelmann, R.**: *Messungen 90 Doppelsternen*, etc., p. 147. [Variability of stars.]
- 
- Faye**: *C. R.*, vol. lx, 1865, i, p. 468. [Remarks on **SECCHI**'s observation of the spectrum of the nebula in *Orion*.]
- Flaugergues**: *C. T.*, 1802, [An xi,] p. 361. [Observations.]
- : *Mem. de l'Institut*, i, [An vi,] 1798, p. 106.
- 
- Gill**: *Mon. Not. R. A. S.*, xxvii, p. 315. [Stars within the trapezium of *Orion*.]
- Goldschmidt**: *A. N.*, lix, col. 31.
- 
- Hahn, Von**: *B. J.*, 1797, p. 157; *B. J.*, 1799, p. 235.
- Herschel, J.**: *Results of Astronomical Observations at the Cape of Good Hope*, p. 25. [With a plate.]
- : *Account*, etc., of the nebula of *Orion*. *Mem. R. A. S.*, vol. ii, p. 487. [With plates.]
- : *Mem. R. A. S.*, vol. iii, p. 189. [Fifth star of the trapezium.] See also same vol., p. 187.
- Herschel, Capt. J.**: *Proc. R. S.*, vol. xvi, [1867-8,] pp. 417, 451. [Observations of spectrum.]

- Herschel, W. :** MSS. in possession of Royal Society, London. [Unpublished observations.]
- : refers to the nebula of *Orion* in *P. T.*, 1785, p. 258; 1789, p. 249; 1791, pp. 72, 75, 77; 1811, pp. 276, 320; 1814, p. 258.
- Holden :** *Mon. Not. R. A. S.*, vol. xxxvii, p. 231.
- : Washington Astronomical Obs., 1874, plate vi, fig. 4.
- Hooke :** *Micrographia*, London, 1665, p. 242. [Discovery of the 4th and 5th stars in trapezium.]
- Huggins :** On the spectrum of the great nebula in *Orion*. *Proc. R. S.*, xiv, 1864, p. 39.
- : Ditto, ditto. *Proc. R. S.*, xx, 1872, p. 379.
- : Ditto, ditto. *Proc. R. S.*, xxii, 1873, p. 251.
- : *Mon. Not. R. A. S.*, xxvi, p. 71. [Nine stars in trapezium.]
- : *Am. Jour. Sci.*, 3d series, v, p. 75.
- : *P. T.*, 1863, p. 541. [Spectrum.]
- Huyghens :** *Systema Saturnium*. 4°. 1659. [Drawing.] See KAISER.

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- Kaiser, F. :** *Amster. Tijdsch. v. Wiss. en Nat. Wetens*, i, 1848, p. 7. [HUYGHEN'S drawing, 1694.]
- : *De Sterrenhemel*, vol. ii, plate 3, pp. 533, 542. [Original drawing.]

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- Lalande :** *Astronomie*, i, p. 272. [With a figure, MAIRAN'S.]
- Lamont :** *Ueber die Nebelflecken*. Munich, 1837. 4°. [With a plate.]
- Laplace :** *Exposition de la Systême du Monde*, p. 452. [Opinion that nebulae change.]
- Lassell, W. :** Observations of the nebula of *Orion*, etc. *Mem. R. A. S.*, xxiii, [1854,] p. 53. [Plate.]
- : *Proc. R. S.*, xvi, p. 322. [Measurements of stars.]
- : *A. N.*, xxxv, col. 383.
- : *Mon. Not. R. A. S.*, xiv, p. 74.
- : *Mon. Not. R. A. S.*, xvii, p. 68. [Relative visibility of 5th and 6th star in trapezium.]
- : *Mon. Not. R. A. S.*, xxii, p. 164. [New star in trapezium.]
- : *Mon. Not. R. A. S.*, xxix, p. 165.
- Lefebvre :** *ROZIER Obs. sur la Physique*, xxii, 1783, p. 34. [With drawing.]

- Legentil**: Remarques sur les Etoiles nébuleuses. *Hist. de l'Ac. Roy. des Sciences*, 1759, p. 453, [with several figures.]
- LeSueur**: *Proc. R. S.*, xviii, pp. 1, 242. [Spectrum.]  
 ———: *Proc. R. S.*, xix, p. 18. [Spectrum.]
- LeVerrier**: *C. R.*, vol. xlv, 1859, pp. 1074, 1293-5. [PORRO'S new star in nebula of *Orion*.]
- Liaponoff**: See STRUVE.  
 ———: *Mon. Not. R. A. S.*, vol. xxiii, p. 228. [Review of his memoir.]
- Long**: *Astronomy*, vol. i, p. 321, plate 67, fig. 96. [Observations and drawing.]
- 
- Mairan**: *Traité de l'Aurore Borcale*, [p. 249; nebula *Orionis* varies in shape; date of PICARD'S drawing given as 1673, March 20. MAIRAN'S drawing, (fig. xxvii,) 1727-1733.]
- Messier**: *Nébuleuse d'Orion*. *Hist. de l'Acad. R. des Sciences*, 1771, pp. 435, 458. [Drawing.]
- 
- Nichol**: *System of the world*, 1846, p. 55. [Lord Rosse's observations.]
- 
- Pond**: On an appearance hitherto unnoticed in the nebula of *Orion*. *Mem. R. A. S.*, iii, 1826, p. 93. [Recession of the nebula from the stars.] [See also same volume, p. 187, for an observation of J. HERSCHEL and RAMAGE on this point.]
- Porro**: *Mem. dell'Osserv. Coll. Romano*, 1856-7, p. 3. [Discovery of a new star in trapezium.]  
 ———: *A. N.*, xlvi, col. 171. [Same.]  
 ———: *C. R.*, xlv, p. 1031. [Same.]
- 
- Robinson**: *Nature*, vol. xv, p. 292. [Note on the resolvability of the central part of nebula *Orionis*.]
- Rondoni**: See DEVICO.
- Rosse\***: Account of observations on nebula of *Orion*, 1848-1867, *P. T.*, 1868, part i, p. 57. [Plates.] For a review of this, see O. STRUVE in *V. J. S.*, 1870, p. 25.  
 ———: *Mon. Not. R. A. S.*, xxix, p. 165.

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\* Fourth Earl of Rosse.

- Salter**: *A. N.*, lxxx, col. 299. [Ten stars in and near trapezium.]
- Schroeter**: *Aphroditographische Fragmente*, p. 248. [Has a chart and memoir.]
- : *Beiträge zu den neuesten astron. Entdeckungen*, vol. iii, p. 449. [With figures.]
- : *B. J.*, 1797, p. 198. [Observations.]
- : *B. J.*, 1801, p. 128. [Changes in nebula of *Orion*.]
- Secchi**: *Mem. dell'Oss. Coll. Romano*, 1852-55, p. 80, and Plate v. [Drawing.]
- : *Mem. dell'Oss. Coll. Romano*, 1856-7, p. 3. [New star in trapezium.]
- : *Bull. Meteor. d. Coll. Romano*, 1865, January.
- : *Acc. d. Nuovo Cimento*, serie 2<sup>a</sup>, vol. v-vi, 1872, p. 20. [The solar Corona is brighter than the nebula of *Orion*.]
- : *Atti dell'Ac. d. N. Lincei*, Anno xxv, sess. iv, 1872, p. 49. [Spectrum.] See also, Anno vii, p. 88.
- : Sulla grande nebulosa di Theta *Orione*. 1868. 4<sup>o</sup>. *Mem. Ital. Soc. Firenze*, vol. i. [Memoir; drawing; spectrum.]
- : *A. N.*, xlv, col. 60. [Sketch of nebula of *Orion*.]
- : *Mon. Not. R. A. S.*, vol. xviii, p. 8.
- : *Mon. Not. R. A. S.*, xxv, p. 153. [Spectrum.]
- : *Mon. Not. R. A. S.*, vol. xxviii, p. 162; xxix, p. 165.
- : *C. R.*, xlv, p. 1279, and xlv, p. 170. [PORRO'S new star.]
- : *C. R.*, lx, p. 543. [Spectrum.] See also p. 468.
- : *C. R.*, lxv, p. 63.
- : *C. R.*, lxvi, p. 643. 1868. [Spectrum, etc.]
- : *Sugli Spettri Prismatici*. Mem., i, ii, iii.
- Senarmont**: *C. R.*, xlv, pp. 1075, 1294. [PORRO'S new star.]
- Smith**: *Opticks*. 4<sup>o</sup>. [HUYGHENS' drawing.]
- Stone, E. J., and Carpenter**: *Mon. Not. R. A. S.*, xxiv, p. 92. [On G. P. BOND'S drawing of nebula of *Orion*.]
- Struve, O.**: Observations de la grande nébuleuse d'*Orion*, avec 4 planches. *Mem. de l'Acad. Imp. des Sciences de St. Petersbourg*, tome v, No. 4, 1862. See *M. M.*, ii, p. 517. [Abstract of above memoir.]
- : *Bull. de la Classe Phys.-Math. de l'Acad. Imp. de St. Petersbourg* xvi, 1853, col. 113.
- : *M. M.*, iii, p. 535. [Observations at Malta.]
- : *M. M.*, iii, p. 550. [Variability of nebula of *Orion*.]
- : *Mon. Not. R. A. S.*, xvii, p. 225. [Stars.]

**Struve, O.:** *V. J. S.*, 1870, p. 25. [Review of the Memoir of Lord Rosse.]

**Struve, W.:** Rapport sur les observations de LIAPONOFF sur la nébuleuse d'Orion. *Bull. de la Classe Phys.-Math.*, vol. xii, p. 316, and *Mélanges Math.*, ii, p. 45.

——: *Catal. Nov. Stell. Duplic.*, 1827, p. xiv. [Discovery of 5th star in trapezium.]

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**Tempel:** *A. N.*, lviii, col. 240. [Drawing.]

——: *A. N.*, lxxx, col. 29. [Trapezium.]

——: Unpublished drawing, made in 1876.

**Tisserand:** *Bull. Inter. Obs. Paris*, 1876, No. 119, also *C. R.*, lxxxi, April 17, p. 891.

**Trouvelot:** *Annals Harv. Coll. Obs'y*, vol. viii. [Drawing.]

——: *Wash. Ast. Obs.*, 1874, Appendix I, plate vi, fig. 4. [Drawing.]

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**Vico:** See DE VICO.

**Vogel, H. C.:** *A. N.*, lxxviii, col. 245. [Spectrum.]

**Von Hahn:** *B. J.*, 1797, p. 157.

——: *B. J.*, 1799, p. 235.

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**Webb:** *Intellectual Observer*, vol. xii, p. 258. [History.]

——: *Mon. Not. R. A. S.*, xxvi, p. 208. [Account of his drawings and observations.]

**Winlock:** *Astronomical Engravings from the Observatory of Harvard College*, plate 24. [Drawing of central part, by TROUVELOT.] See *Annals Harv. Coll. Obs.*, vol. viii.

**Winnecke:** *Mélanges Math.*, iii, p. 499, and *Bull. de l'Ac. Imp.*, vii, p. 18.

——: *Mon. Not. R. A. S.*, xxiv, p. 7. [New stars.]

**Wolf, R.:** *J. B. Cysar von Luzern*, 1853.

——: *A. N.*, xxxviii, col. 109.

### III.

#### LIST OF BOOKS AND MEMOIRS RELATING TO VARIABLE NEBULÆ.

[Arranged alphabetically by Authors.]

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**Abbott:** *Mon. Not. R. A. S.*, xxv, 192; xxviii, 200; xxxi, 226, 230, 231; xxxii, 61. [Nebula in *Argo*.]

———: *Mon. Not. R. S. Tasmania*; 1870, p. 21; 1871, p. 17; 1872, p. 27. [Same.]

**Airy:** *Mon. Not. R. A. S.*, xxxi, p. 233. [Same.]

**Auwers:** *A. N.*, lviii, col. 361. [On the variability of No. 548, Bonn zone + 30°.]

———: *Mon. Not. R. A. S.*, xxii, p. 150. [HIND'S missing nebula of 1852.]

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**Bredichin:** *Annales de l'Observatoire de Moscou*, ii, p. 125. [TEMPEL'S nebula in the *Pleiades*.]

**Bulliadus:** *P. T.*, 1667, p. 459; *p. t.*, i, p. 162. [The nebula of *Andromeda* became invisible to the naked eye in February and March, 1667.]

**Burton:** *Mon. Not. R. A. S.*, xxxvi, p. 69. [Nebula in *Argo*.]

**Butillon:** *C. R.*, 1848, xxvii, pp. 112, 188. [Proper motion of M. 92.]

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**Cassini:** *Elémens d'Astronomie*, 1740, 4<sup>o</sup>, p. 77. [*Andromeda* nebula.]

**Chacornac:** *Bull. Inter. de l'Obs. de Paris*, 1863, April 28. [1191 h.]

———: *Nébuleuse variable de  $\xi$  Taureau*. *C. R.*, lvi, 1863, p. 637.

———: *National Almanac*, [U. S.], 8vo, 1864, p. 36. [Notice of discovery of his variable nebula.]

———: *Mon. Not. R. A. S.*, xxii, p. 277. [Missing nebula in *Coma Berenices*.]

- D'Arrest**: *A. N.*, xlii, col. 193.  
 ———: *A. N.*, lvi, col. 328. [HIND's variable nebula.]  
 ———: *A. N.*, lvii, col. 337. [HIND's variable nebula and others.]  
 ———: *A. N.*, lviii, col. 155. [Discovery of a second variable nebula in *Taurus*.]  
 ———: *A. N.*, lix, col. 13. [*Merope* nebula.]  
 ———: *A. N.*, lx, col. 377. [On CHACORNAC's variable nebula near  $\epsilon$  *Tauri*.]  
 ———: *A. N.*, lxiv, col. 125. [Disappearance of a nebula.]  
 ———: *A. N.*, lxviii, col. 251. [Three missing nebulae.]  
 ———: *A. N.*, lxxi, col. 143. [HIND's variable nebula.]  
 ———: *A. N.*, lxxix, col. 193. [Changes in spectrum of H. iv, 37.]
- Dreyer**: *V. J. S.*, 1876, p. 269. [*Merope* nebula not seen in Lord ROSSE's telescopes.] See ROSSE in *Nature*, vol. xv, p. 397.

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**Ellery**: *Mon. Not. R. A. S.*, xxxiv, p. 269. [Nebula in *Argo*.]

**Engelmann, R.**: *Messungen 90 Doppelsternen, etc.*, p. 147. [Variability of stars in nebula *Orionis*.]

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**Gould**: *Mon. Not. R. A. S.*, xxxii, p. 178. [Nebula in *Argo*.]

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**Hall, Maxwell**: *Nature*, 1877, p. 244, [Jan. 11.] [*Merope* nebula.]

**Herschel, J.**: *Mon. Not. R. A. S.*, xxii, p. 248. [Missing nebula in *Coma Berenices*.]

———: *Mon. Not. R. A. S.*, xxviii, p. 225; xxix, pp. 82, 164, 228. [Nebula in *Argo*.]

———: The *General Catalogue of Nebulae and Clusters of Stars, P. T.*, 1864, has [pp. 14-40] notes on various nebulae, from which the following in regard to variable nebulae has been extracted. A few additions have been made from other sources:

I. Variable nebulae, [*brightness*].—G. C. 768, [TEMPEL]; 839, [HIND]; 1792; 2197?? [ *$\eta$  Argus*]; 2211, [VOGEL]; 2319; 2405; 3079; 3254; 3311; 3858??; 3977; 4016; 4173?; 4415, [TUTTLE]; 4473, [HIND]; 4922.

II. Variable nebulae, [*proper motion*].—G. C. 2501; 3138, 3588. 4051-2 binary? See ROSSE, *P. T.*, 1861, p. 704. G. C. 4403??, G. C. 4355, [HOLDEN].

III. Variable nebulae, [*possible comets*].—G. C. 573, 614, 1696, 2094, 2846, 3550.



**Herschel, Capt. J.:** *Mon. Not. R. A. S.*, vol. xxix, p. 82; xxxi, p. 235. [Nebula in *Argo*.]

**Hind:** *Am. Jour. Sci.*, 2d series, xxxiii, p. 436. [His variable nebula in *Taurus*.]

———: *Nature*, 1876, Oct. 19, p. 545. [CHACORNAC'S variable nebula.]

———: *Mon. Not. R. A. S.*, xxiv, p. 65. [Variable nebula in *Taurus*.]

———: *A. N.*, xxxv, col. 371. [Discovery of a variable nebula,  $\alpha = 4^{\text{h}} 11^{\text{m}} 50^{\text{s}}$ ;  $\delta = +19^{\circ} 8'$ .]

———: *Nature*, 1876, p. 545. [CHACORNAC'S variable nebula.]

**Holden:** On supposed changes in M. 17 = G. C. 4403. *Am. Jour. Sci.*, 3d series, xi, p. 341.

———: On the proper motion of G. C. 4355. *Am. Jour. Sci.*, 1877, Dec.

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**Key:** [45, II. iv, *Geminorum*.] *Mon. Not. R. A. S.*, xxviii, p. 154.

**Knott:** [45, II. iv, *Geminorum*.] *Mon. Not. R. A. S.*, xxv, pp. 62, 191.

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**Le Sueur:** *Scientific Opinion*, vol. iii, p. 250. [Nebula in *Argo*.]

———: *Trans. R. S. Victoria*, x, pp. 11-23. [Nebula in *Argo*.]

**Le Verrier:** *C. R.*, vol. liv, 1862; p. 299. [HIND'S variable nebula.]

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**Mairan:** *Traité de l'Aurore Boréale*, p. 248. [Nebula of *Orion* varies in shape.]

**McGeorge:** *Proc. R. S. Victoria*, x, pp. 71, 106. [ $\eta$  *Argús*.]

**Melbourne Obs'y:** Report of Board of Visitors, 1875. [ $\eta$  *Argús*.]

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**Petersen:** *Ast. Jour.*, i, p. 47. [HIND'S nebula.]

**Pogson:** *Mon. Not. R. A. S.*, xxi, p. 32. [Changes in 80 M.]

**Pons and De Zach:** *Corres. Astron.*, vol. xiv, p. 410. [Changes in nebulae.]

**Powell, E. B.:** *Mon. Not. R. A. S.*, xxiv, p. 171. [Nebula in *Argo*.]

**Proctor:** *Mon. Not. R. A. S.*, xxxiii, p. 14. [Nebula in *Argo*.]

- Robinson**: *B. A. A. S.*, 1869, p. 20; *Nature*, vol. vi, p. 8. [Nebula in *Argo*.]
- Reesse**: *Nature*, vol. xv, [1877,] p. 397. [TEMPEL'S variable nebula near *Merope*.]
- Russell**: Observations on the stars and nebula about  $\eta$  *Argús*. 8vo. Sydney, 1871.
- : *Mon. Not. R. A. S.*, xxxii, p. 22. [Nebula in *Argo*.]
- 

- Schmidt, J. F.**: *A. N.*, lv, col. 91. [New variable nebula.]
- : *A. N.*, lvii, col. 243. [Variability of No. 6 Bonn zones and HIND'S variable nebula.]
- : *A. N.*, lviii, col. 253. [TEMPEL'S variable nebula.]
- : *A. N.*, lxxv, col. 261. [M. 8 contains a variable star.]
- : *A. N.*, lxxviii, col. 199. [S. *Coronæ* nebulous?]
- : *A. N.*, lxxxviii, col. 233. [Connection of variable stars with nebulae.]
- Schroeter**: *B. J.*, 1801, p. 128. [Announces changes in nebulae of *Orion* and *Lyra*.]
- Schönfeld**: *A. N.*, lviii, col. 355. [On variability of nebula No. 548 Bonn zone + 30°.]
- Schultz**: *A. N.*, lxxv, col. 315. [Remarks on variable nebulae. G. C. 1707, 4760.]
- Severn**: *Mon. Not. R. A. S.*, xxx, p. 180. [Nebula in *Argo*.]
- Struve, O.**: *M. M.*, iii, p. 550. [Variability of *Orion* nebula.]
- : *Mon. Not. R. A. S.*, xxii, p. 242. [Nebula in *Taurus*.]
- 

- Trouvelot**: TEMPEL'S variable nebula near *Merope*. [Unpublished paper read to *Am. Ac. A. and S.*, in 1876.]
- Tebbutt**: *Mon. Not. R. A. S.*, xxxi, p. 210. [Nebula in *Argo*.]
- Tempel**: *A. N.*, liv, col. 286. [Discovery of a variable nebula.]
- : *A. N.*, lxxxvi, col. 67. [*Merope* variable nebula.]
- : *A. N.*, xc, col. 355. [On 8 MESSIER.]
- : *Pub. del R. Oss. Milano*, No. 5, plate ii. [*Merope* variable nebula.]

**Winnecke**: *A. N.*, li, col. 383. [Noël's observation of  $\eta$  *Argús*.]

——: *A. N.*, lvii, col. 207. [Hind's variable nebula.]

——: *A. N.*, lix, col. 65. [*Merope* nebula and nebula No. 548 Bonn zone + 30°.]

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**Wolf, C.**: *C. R.*, 1875, July 5, vol. lxxxi, p. 29. [Tempel's variable nebula.]



## IV.

### LIST OF FIGURED NEBULÆ.

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A large portion of the following list of drawings of nebulae is taken from Sir JOHN HERSCHEL'S "General Catalogue of Nebulae and Clusters of Stars," p. 40, *Phil. Trans.*, 1864, part i. It has been attempted *first* to correct his list, which as printed, contains many errors,\* and *second* to bring it up to the present time as far as possible. In an attempt of this kind there are necessarily many omissions, and the writer solicits corrections and additions to the list. By the courtesy of Mr. LASSELL, Mr. E. B. KNOBEL, Dr. H. C. VOGEL, Mr. ELLERY, Rev. T. W. WEBB, Dr. DOBERCK and others, I have been able to include in this list a reference to some important drawings which are not yet "published;" in particular a long and valuable series of photographs of star-clusters by Dr. RUTHERFURD, which I have given separately, as well as a great number of southern star-clusters photographed by Dr. B. A. GOULD, and a list of drawings by M. TROUVELOT.

The references to the works cited are given below: it is to be noted that the drawings of DUNLOP are omitted for reasons given by Sir JOHN HERSCHEL, (*op. cit.*, p. 40,) as are those in the *Philosophical Transactions*, by Sir WM. HERSCHEL. For similar reason the drawings in SMYTH'S Celestial Cycle are omitted.

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\* In HERSCHEL'S list the references to his drawings of 1833 are to the plates in his own paper, beginning with plate i. In the *Phil. Trans.* for 1833, HERSCHEL'S plate i. is plate ix. I have, however, seen a separate copy of this paper in which the steel plates were numbered from i. on; it has seemed best to refer to them as they stand in the complete volumes.

## LIST OF ABBREVIATIONS EMPLOYED.

Abbreviations.	Works Cited.	Authors.
P. T., 33.	Philosophical Transactions, 1833-----	J. HERSCHEL
P. T., 44.	“ “ 1844-----	LORD ROSSE.
P. T., 50.	“ “ 1850-----	“
P. T., 61.	“ “ 1861-----	“
P. T., 68.	“ “ 1868-----	“
C. G. II.	Results of Astronomical Observations at the Cape of Good Hope.	J. HERSCHEL.
R. di.	Wood-cut diagrams in P. T., 61. [Only those are referred to which express some feature not elsewhere depicted by the author.]	LORD ROSSE.
B. A. A.	{ American Academy Arts and Sciences, vol. } iii, n. s.	W. C. BOND. G. P. BOND.
M. A. A.	{ Transactions American Philosophical So- } ciety, vol. vii.	MASON and SMITH.
D'Arr.	De instrumento magno æquetoreo, etc. 1861.	D'ARREST.
D'Arr. <sup>2</sup>	Sid. Nebul. Obs. Havnienses, 1867 -----	“
D'Arr. <sup>3</sup>	Undersøgelse over de nebulose Stjerner, etc.	“
Lam.	Vorlesung u. die Nebelflecken, 1837-----	LAMONT.
Lam. <sup>2</sup>	Ann d. k. k. Stw. b. München, vol. xvii. --	“
Secchi.	Mem. dell'Oss. Coll. Romano, 1852-55, etc.---	SECCHI.
Lass.	Memoirs R. A. S., vol. xxiii-----	LASSELL.
Lass. <sup>2</sup>	“ “ “ xxxvi-----	“
Lass. <sup>3</sup>	Lithographs privately distributed. <i>Mon. Not. R. A. S.</i> , vol. xxi, p. 52.	“
Lass. <sup>4</sup>	Drawings unpublished, but kindly communicated by the author.	“
H. C.	{ Astronomical Engravings' from the Ob- } servatory of Harvard College.	WINLOCK and TROUVELOT.
Washington.	Washington Ast. Obs., 1874, Appendix I.--- }	HOLDEN and TROUVELOT.
Vogel.	{ Beob. von Nebelflecken. Leipzig, 1867. A } few copies of this work contained pho- tographs.	H. C. VOGEL.
Vogel. <sup>2</sup>	Leipzig Observations, vol. i, 1876-----	“
Vogel. <sup>3</sup>	Bothkamp Observations, vol. iv, 1877-----	“

LIST OF ABBREVIATIONS—*Continued.*

<i>Abbreviations.</i>	<i>Works Cited.</i>	<i>Authors.</i>
Knobel.	{ Drawings mostly of clusters, as yet unpublished, but kindly communicated by the author. }	KNOBEL
Melbourne	{ Astronomical observations at Melbourne, yet unpublished, but kindly communicated by R. J. L. ELLERY, esquire. }	ELLERY. TURNER. MCGEORGE.
Le Sueur.	Proc. R. S., 1870 -----	LE SUEUR.
Trouvelot.	{ Drawings of nebulae, as yet unpublished, but kindly communicated by the author. }	TROUVELOT.



## LIST OF FIGURED NEBULÆ.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
27	C. G. H.	IV	8	Melbourne.	
31	P. T., 61.	XXV	1		
52	C. G. H.	III	1		
67	C. G. H.	VI	19	Melbourne.	
105-6	} B. A. A.	Opp. p. 86	-----	-----	<i>Andromeda.</i>
116-7			Messier.	Opp. p. 213	
	Rondoni.		-----	-----	Hist. de l'Ac. R. des Sciences, 1806. Mem. dell'Oss. Coll. Romano, 1840-1.
	H. C.	XXXIII			
138	P. T., 33.	XIV	52		
	Lass. <sup>2</sup>	I	1		
169	C. G. H.	V	10	Melbourne.	
187	C. G. H.	IV	6	Melbourne.	
298	P. T., 33.	XIII	38		
303	R. di.				
352	P. T., 50.	XXXVI	5		
	P. T., 61.	XXVI	10		
	Vogel. <sup>3</sup>	XIV			
372	R. di.			Knobel.	
409	P. T., 33.	XIV	58		
412	P. T., 61.	XXV	2		
521	Krueger.	I			Fenn. Soc. Sci. Acta, vol 8, p. 55.
527	P. T., 33.	X	28		
	R. di.				
544	D'Arr.	II	7		
560	P. T., 61.	XXV	3		
567	C. G. H.	VI	14	Melbourne.	
572	P. T., 61.	XXV	4		
575	P. T., 33.	XIV	56	Trouvelot.	
	P. T., 61.	XXV	5		
584	Pihl.	I		Knobel.	Mon. Not. R. A. S., vol. 28, p. 247, and vol. 29, p. 329.
600	P. T., 61.	XXV	6		
	Lass. <sup>2</sup>	I	2		
604	Lass. <sup>2</sup>	I	3		
705	C. G. H.	VI	17	Melbourne.	
709				Melbourne.	
731	C. G. H.	IV	1	Melbourne.	
768	Tempel.	11			Pub. del R. Oss. Milano No. 5. <i>Var.</i>
810	P. T., 33.	X	31		
	P. T., 61.	XXV	7		
822	C. G. H.	V	11	Melbourne.	
823	C. G. H.	V	11	Melbourne.	

## LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
826	D'Arr.	II	9		
	Lass.	II	4		
	Lass. <sup>2</sup>	I	4		
853	P. T., 61.	XXV	8		
888	P. T., 61.	XXV	9	Melbourne.	
905	Vogel. <sup>2</sup>	II			
979	C. G. H.	III	3	Melbourne.	
980	C. G. H.	III	3		
981	C. G. H.	III	3		
987	C. G. H.	III	3		
1057	C. G. H.	VI	11	Melbourne.	
1082	C. G. H.	III	6		
1084	C. G. H.	III	6		
1085	C. G. H.	III	6		
1086	C. G. H.	III	6		
1089	C. G. H.	III	6		
1090	C. G. H.	III	6		
1119				Knobel.	
1135	C. G. H.	III	2		
1137	P. T., 33.	XIII	49		
	Vogel. <sup>3</sup>	14			
1140	C. G. H.	III	2		
1141	C. G. H.	III	2		
1142	C. G. H.	III	2		
1143	C. G. H.	III	2		
1156	C. G. H.	IV	7	Melbourne.	
1157	P. T., 33.	XVI	81		
	Lass. <sup>2</sup>	II	6		
	Vogel. <sup>3</sup>	14			
	P. T., 44.	XVIII	81		
	R. di.				
	D'Arr.	II	4		
	Secchi.	IV	8		
	Lass.	II	1		
	Vogel.	I	1		
1163	C. G. H.	IV	7		
1164	C. G. H.	IV	7		
1165	C. G. H.	VI	20	Melbourne.	
1168	C. G. H.	VI	20		
1171	C. G. H.	VI	20		
1174	C. G. H.	IV	7		
1175	C. G. H.	VI	20		
1176	C. G. H.	IV	7		
1177	C. G. H.	IV	7		

## LIST OF FIGURED NEBULÆ—Continued.

## DRAWINGS OF THE NEBULA OF ORION = G. C. 1179.

<i>Observer.</i>	<i>Date.</i>	<i>Place where Published.</i>
Huyghens.	1656	Systema Saturnium, p. 8.
Picard.	1673	Hist. de l'Acad. Royale des Sciences, 1759, p. 470, fig. 5. <i>Date</i> from <i>Traité de l'Aurore Boréale</i> , [Mairan,] p. 248.
Huyghens.	1694	Amsterdam Tijdsch. v. Wiss. en Nat. Wetens., vol. i, 1848.
Mairan.	1731	Traité de l'Aurore Boréale, p. 248.
Long.	1742	Astronomy, p. 321, plate 67, fig. 96.
LeGentil.	1758	Hist. de l'Acad. R. des Sci., 1759, p. 470, figs. 2 and 6.
Messier.	1771	Hist. de l'Acad. R. des Sci., 1771, p. 460.
W. Herschel.	1774	Phil. Trans., 1811, p. 320. [Unpublished description and observations in Ms. in possession of the Royal Society, London.]
Lefebvre.	1779	Obs. sur la Physique, vol. xxii, p. 34, fig. 3, plate i.
Schræter.	1794	Aphroditographische Fragmente, p. 248.
Schræter.	1797-8	Beiträge z. d. neuesten Astron. Entdeck. iii, p. 149, [4 figures.]
Bode.	?	Anleit. z. Kenntniss d. Gest. Himmels, p. 166, and plate 1. [See also Himmelskarten, Tafel 30.]
J. Herschel.	1824	Mem. R. A. S., vol. ii, 1826, p. 487.
J. Herschel.	1837	Obs. Cape of Good Hope, p. 25, plate viii.
Lamont.	1837	Ueber d. Nebelflecken, p. 29, fig. xi. [A pencil original of this is in the possession of Col. COOPER, of Markree; dated February, 1839.]
DeVico.	1839	Mem. Oss. Coll. Romano, 1839, plates i and ii.
Rondoni.	1841	Mem. Oss. Coll. Romano, 1841, p. 24.
Lassell.	1847	Nichol's Architecture of the Heavens. [Separate copies of this were printed.] p. 106, plate x.
W. C. Bond.	1848	Mem. Amer. Acad'y, iii, p. 87. A revised copy of this drawing is given in <i>Annals Harv. Coll. Obs'y</i> , vol. v., p. 174; and this is probably the most authentic.
Liapouff.	{ 1847 }	Mem. Imp. Ac. de St. Petersbourg, vol. v, 1862.
Struve.	{ 1851 }	
Lassell.	1854	Mem. R. A. S., xxiii, p. 53, plate i.
Secchi.	1862	Ast. Nach., vol. xlv, col. 60.
Tempel.	1862	Ast. Nach., vol. lviii, col. 240.
G. P. Bond.	1865	Annals Harv. Coll. Obs'y, vol. v. plate i. [Reprinted in <i>Ast. Engravings Harv. Coll. Obs'y</i> , 1874. See <i>Annals H. C. Obs'y</i> , vol. viii.]
Rosse.	1867	Phil. Trans., 1868, p. 57.
Secchi.	1868	Firenze Ital. Soc. Mem., 3d ser., i, part 2.
D'Arrest.	1872	Undersøgelse over de neb. Stjerner. 1874.
Winlock.	} 1874	{ <i>Ast. Engravings from H. C. Obs'y</i> .
Trouvelot.		{ <i>Annals Harv. Coll. Obs'y</i> , vol. viii.
Holden.	} 1876	
Trouvelot.		Wash. Ast. Obs., 1874, Appendix I, plate vi, fig. 4.

LIST OF FIGURED NEBULÆ—Continued.  
NEBULA OF ORION—*Unpublished Drawings.*

Observer.	Date.	Place where reference is to be found.
Flaugergues.	1802	In <i>C. T.</i> , 1802, [an xi,] p. 362, it is noted that such a drawing was deposited with the <i>Bureau des Longitudes</i> .
Pond.	1826	In <i>Mem. R. A. S.</i> , iii, p. 94, it is noted that such a drawing was to be sent to the Royal Astron. Soc. Made at Naples? Letter of Dr. C. H. F. Peters.
Cooper.	1847?	Oil painting made at Starfield, and now in possession of the Royal Ast. Soc'y. [A copy of this is at the residence of Mr. Lassell, Ray Lodge, Maidenhead.]
Lassell.	1847	Oil painting in possession of Royal Astronomical Society; copied in <i>Mem. R. A. S.</i> , vol. xxiii.
Hippesley. }		
Schmidt.	1860-75	2 drawings; another is [1877] in progress.
Lassell.	1862	See Proc. R. S., vol. xvi, p. 322.
Webb.	1863	See Mon. Not. R. A. S.; vol. xxvi, p. 208.
Webb.	1866	Kindly communicated by the author.
Bird.	1866	Kindly communicated by the Rev. T. W. Webb.
Tempel.	1876	Part of an unpublished series of Drawings of nebulae. A copy of this is in possession of the Royal Astronomical Society.

G. C. No.	Work Cited.	Plate.	Fig.	Unpublished drawings.	Remarks.
1180	C. G. H.	II	3		
1183	C. G. H.	II	3		
	P. T., 50.	XXXVIII	16		
	Lass.	II	3		
1185	C. G. H.	VIII	1		
	B. A. A.	Opp. p. 96.			
	Lass.	I	1		
1225	D'Arr.	II	2		
	Lass. <sup>2</sup>	I	8		
	Secchi.	IV	12		
	Lass.	II	2		
1226	D'Arr.	II	10		
1233	C. G. H.	III	5		
1235	C. G. H.	III	5		
1238	C. G. H.	III	5		
1243	C. G. H.	III	5		
1248	C. G. H.	IV	9	Melbourne.	
1249	C. G. H.	IV	9		
1258	C. G. H.	IV	9		
1259	C. G. H.	IV	9		
1260	C. G. H.	IV	9		
1265	C. G. H.	IV	9		
1266	C. G. H.	IV	9		
1267	P. T., 33. R. di.	XII	36		

## LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
1269	C. G. H.	II	4	Melbourne.	Two figures.
1276	C. G. H.	III	4		
1277	C. G. H.	III	4		
1278	C. G. H.	III	4		
1279	C. G. H.	III	4		
1281	C. G. H.	III	4		
1282	C. G. H.	III	4		
1283	C. G. H.	III	4		
1361	Vogel. <sup>2</sup>	II			
1419	R. di.				
1425	P. T., 61.	XXVII	11		
	Vogel. <sup>2</sup>	I	1		
1437	P. T., 33.	XIV	64		
	P. T., 50.	XXXVII	10		
	Secchi.	IV	6		
	Lass.	II	8		
	Vogel.	XVI	2		
1467	P. T., 33.	XVI	91		
1477	P. T., 61.	XXVII	12	Melbourne.	
1477-8	Le Sueur.				Proc. R.S., xix, p. 19.
1511	C. G. H.	IV	4		
	Lass. <sup>2</sup>	II	9	Melbourne.	
1519	P. T., 33.	XV	72		
	P. T., 50.	XXXVII	6		
	Lass. <sup>2</sup>	I	10		
	Secchi.	IV	15		
1519 }	Lass.	II	9		
1520 }					
1532	P. T., 50.	XXXVIII	15		
	Lass.	II	6		
	Lass. <sup>2</sup>	I	11		
	H. C. Key.				Mon. Not. R. A. S., xxviii, p. 155.
	Secchi.	IV	13		
	Vogel.	I	3		
1565	P. T., 50.	XXXVIII	12		
	Secchi.	IV	11		
	Lass.	II	5		
	Lass.	II	7		
1567	Secchi.	IV	14		
1677	C. G. H.	VI	12		
1677 ?				Melbourne.	
1721	P. T., 33.	XIV	61		
	Lam.	I	8		
1728	P. T., 33.	XIV	65		
1745	C. G. H.	V	12	Melbourne.	
1801	C. G. H.	V	8	Melbourne.	
1861 }	P. T., 33.	XV	70		
1863 }					
	Lass. <sup>2</sup>	II	12		
	Vogel.	I	4		

## LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
1950				Knobel.	
2003	C. G. H.	V	9		
2017	C. G. H.	VI	9		
	Lass.	II	10	Melbourne.	
	Lass. <sup>2</sup>	III	13		
	Secchi.	IV	16		
2053	P. T., 50.	XXXVI	3		
	P. T., 61.	XXVII	13	Melbourne.	
2058	P. T., 61.	XXVII	14		
2063	C. G. H.	VI	2	Melbourne.	
2067	C. G. H.	IV	3	Melbourne.	
2102	C. G. H.	VI	5		
	Lass.	II	11	Melbourne.	
	Lass. <sup>2</sup>	III	14		
	Secchi.	IV	5		
2158	P. T., 33.	XIII	40		
2197	C. G. H.	IX	1	Melbourne.	<i>η Argús.</i> Many small figures of this exist which are not here recorded.
	McGeorge.				Trans. R. S. Victoria, vol. x, p. 110, figs. 1-6.
2216	P. T., 61.	XXVII	15		
2217	P. T., 61.	XXVII	15		
2333	C. G. H.	IV	10	Melbourne.	
2336	C. G. H.	IV	10		
2337	C. G. H.	IV	10		
2338	C. G. H.	IV	10		
2340	C. G. H.	IV	10		
2342	C. G. H.	IV	10		
2343	P. T., 33.	X	32		
	P. T., 50.	XXXVII	11		
2347	Vogel <sup>2</sup>	I	2		
2373	P. T., 33	XIV	53		
	P. T., 50.	XXXVII	7		
	Lass. <sup>2</sup>	III	15		
	Vogel. <sup>2</sup>	I	4		
	Lam.	I	6		
2377	P. T., 33.	XIV	54		
	P. T., 61.	XXVII	16		
	Vogel. <sup>2</sup>	I	5		
2378	P. T., 33.	XIV	51		
	Vogel. <sup>2</sup>	I	3		
2379	R. di.				
2445	R. di.				
2486	P. T., 33.	XV	79		
2488	P. T., 33.	XV	79		
2559	R. di.				
2581				Melbourne.	

## LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
2597	R. di.				
2606	P. T., 61.	XXVII	17		
2670	P. T., 61.	XXVII	18		
2671	P. T., 61.	XXVII	18		
2680	P. T., 61.	XXVII	19		
2733	R. di.				
2756	P. T., 61.	XXVII	20		
2760	P. T., 61.	XXVII	20		
2804	P. T., 33.	XV	71		
2806	P. T., 33.	XIV	59		
	Vogel. <sup>2</sup>	I	7		
2807	P. T., 50.	XXXVII	8		
2838	P. T., 50.	XXXV	2		
	Lass. <sup>2</sup>	IV	16		
	Vogel. <sup>2</sup>	I	8		
2841	P. T., 33.	XIV	55		
2870	P. T., 61.	XXVII	21		
2878	P. T., 33.	XV	69		
2884	P. T., 61.	XXVII	21		
2890	Lass. <sup>2</sup>	III	17		
2910	P. T., 33.	XIV	57		
2950	P. T., 61.	XXVII	22		
2958	P. T., 33.	XV	68		
2962	P. T., 33.	XV	68		
2972	R. di.				
3025	Lass. <sup>2</sup>	IV	19		
3028	Lass. <sup>2</sup>	IV	18		
3041	P. T., 61.	XXVII	23		
3042	P. T., 61.	XXVII	23		
3049	Lass. <sup>2</sup>	IV	20		
	Vogel. <sup>2</sup>	I	9		
3085	P. T., 61.	XXVIII	24		
3101	P. T., 33.	XVI	83		
3106	P. T., 33.	XII	37		
	Lass. <sup>2</sup>	V	21		
3108	P. T., 33.	XV	78		
3109	P. T., 33.	XV	78		
3113	P. T., 33.	XIV	66		
3132	P. T., 33.	XIV	50		
	Lass. <sup>2</sup>	V	22		
3151	P. T., 61.	XXVIII	25		
3152	P. T., 61.	XXVIII	25		
3155	Lass. <sup>2</sup>	V	23		
3165	P. T., 33.	XV	76		
	P. T., 50.	XXXVII	9		
	Lass. <sup>2</sup>	V	24		
3167					
3178					
3180	P. T., 33.	XV	74	Melbourne.	
3182	P. T., 33.	XV	74		
3183					
3189	P. T., 33.	XV	75	Melbourne.	

G. C. No. 2786;  
Vogel<sup>2</sup>, plate i,  
fig 6.



## LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
3190	P. T., 61.	XXVIII	26		
3240	P. T., 61.	XXVIII	27		
3249	R. di.				
3258	P. T., 33.	XIII	41		
	Lass. <sup>2</sup>	V	25		
3275	C. G. H.	I	2		
3278	P. T., 33.	XVI	84		
3321	P. T., 33.	X	27		
	Lass. <sup>2</sup>	VI	26		
3340	P. T., 33.	XIV	62		
3342	Vogel. <sup>2</sup>	I	10		
3356	P. T., 33.	XIV	67		
3511	P. T., 61.	XXVIII	28		
3525	C. G. H.	IV	2	Melbourne.	
3531	C. G. H.	V	7		
3570	C. G. H.	VI	1		
	Le Sueur.	I		Melbourne.	
3572	P. T., 33.	X	25		
	P. T., 50.	XXXV	1		
	Lass. <sup>2</sup>	VI	27		
	Vogel.	I	5		
	R. di.				
3606	C. G. H.	IV	5		
	Lass. <sup>2</sup>	VII	28	Melbourne.	
3607				Melbourne.	
3614	P. T., 33.	XIII	39		
	Lass. <sup>2</sup>	VII	29		
3615	P. T., 61.	XXVIII	29		
	Vogel. <sup>2</sup>	I	11		
	C. G. H.	VI	15		
3651				Melbourne.	
3661 ?				Melbourne.	
3706	C. G. H.	VI	10		
3717	P. T., 61.	XXVIII	30		
3750	R. di.				
3766	P. T., 61.	XXIX	35		
3770	P. T., 61.	XXIX	35		
3778	P. T., 61.	XXIX	35		
3779	P. T., 61.	XXIX	35		
3928				Melbourne.	
4040	Vogel. <sup>2</sup>	II			
4051 }	P. T., 33.	XV	77		
4052 }					
	P. T., 61.	XXVIII	31		
4058	P. T., 50.	XXXVII	8	Trouvelot.	
4066	C. G. H.	VI	8	Melbourne.	
4083	P. T., 33.	XVI	87		
4087	R. di.				
4118	P. T., 33.	XVI	89		
4125	C. G. H.	VI	7	Melbourne.	
4160	P. T., 61.	XXVIII	32		
4224	C. G. H.	V	4		

## LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
4229	C. G. H.	V	6		
4230	P. T., 33.	XVI	86		
	P. T., 61.	XXVIII	33		
	H. C.	25			
4234	Lam.	I	1		
	Vogel. <sup>3</sup>	14			
4261	C. G. H.	VI	13		
4276				Melbourne.	
4284	C. G. H.	VI	6	Melbourne.	
4290	C. G. H.	VI	3	Melbourne.	
	Lass. <sup>2</sup>	VII	30		
4294	H. C.	25			
4302	C. G. H.	VI	4	Melbourne.	
4305	C. G. H.	VI	18		
	C. G. H.	V	1		
4335	C. G. H.	V	5		
4342	C. G. H.	V	2	Trouvelot.	
4343	P. T., 33.	XIII	42		
	Lass. <sup>2</sup>	VII	31		
4355	P. T., 33.	XVI	80		
	Lass.				Mem. R. A. S., vol. xxxiii, p. 121.
	Lass. <sup>2</sup>	VIII	32		
	C. G. H.	II	2		
	M. A. A.	IV	1		
	H. C.	32			
4361	C. G. H.	I	1	Trouvelot.	
4373	Vogel. <sup>3</sup>	14		Trouvelot.	
4375	C. G. H.	VI	16	Melbourne.	
4390	Vogel. <sup>3</sup>	14			
	Secchi.	IV	3		
4395	P. T., 33.	X	30		
4403	P. T., 33.	XII	35	Trouvelot.	
	Lass. <sup>2</sup>	VII	33		
	Wash'n.	VI	3		
	Holden.				Am. Jour. Sci., 1876, May, p. 341.
	C. G. H.	II	1		
	Lam.	I	10	Melbourne.	
	M. A. A.	VI	1		
	Le Sueur.	I	1		Proc. R. S., 1870.
4419	Struve.	I	2332		Catalogus Novus.
4427	Lam.	I	9		
	Helmert.	I and II			Publications of the Hamburg Observatory, vol. i.
4447	P. T., 33.	X	29		Lyra.
	P. T., 44.	XIX	29		
	Vogel. <sup>3</sup>	14			
	Wash'n.	VI	2		
	Lass. <sup>3</sup>				

## LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
4447	H. C.	34			
	D'Arr.	II	5		
4487	Lam.	I	7		
	Lass. <sup>2</sup>	IX	34		
	Vogel. <sup>3</sup>	14			
4510	P. T., 33.	XIII	46	-----	Dumb-bell nebula.
	Secchi.	IV	1		
	D'Arr.	II	3		
	Vogel.	I	7		
	Vogel. <sup>3</sup>	14			
	Lam.	I	2		
4514	P. T., 33.	XIII	43	Trouvelot.	
	Secchi.	IV	7		
4520				Knobel.	
4532	P. T., 33.	X	26		
	P. T., 44.	XIX	26		
	P. T., 50.	XXXVIII	17		
	P. T., 61.	XXXI	43		
	Lass. <sup>2</sup>	IX	35		
	Lass. <sup>3</sup>				
	Vogel.	I	6		
	Secchi.	IV	10		
	Smyth.	p. 290		-----	Spec. Hartwell.
	D'Arr.	II	8		
	H. C.	35			
4565	P. T., 33.	XIII	48		
4572	P. T., 33.	XIII	47		
	P. T., 44.	XIX	47		
	P. T., 61.	XXVIII	34		
	Lass. <sup>2</sup>	IX	36		
	Lam.	I	5		
	Vogel. <sup>3</sup>	14			
4594	P. T., 61.	XXX	36		
4600	P. T., 33.	XI	33		
4616	P. T., 33.	XI	34		
	M. A. A.	VII	1		
4618	P. T., 33.	XVI	82		
	M. A. A.	VII	1		
4627	P. T., 61.	XXX	37		
4628	P. T., 33.	XIII	44		
	P. T., 50.	XXXVIII	14		
	Lass. <sup>2</sup>	X	37	-----	Also figured in Proc. R. S., vol. xii, p. 269.
	Vogel. <sup>3</sup>	14			
	D'Arr.	II	1		
	Secchi.	IV	2		
	Lam.	I	4		
4670				Knobel.	
4678	P. T., 33.	XVI	88		
	P. T., 44.	XVIII	88	Knobel.	

## LIST OF FIGURED NEBULÆ—Continued.

<i>G. C. No.</i>	<i>Work Cited.</i>	<i>Plate.</i>	<i>Fig.</i>	<i>Unpublished drawings.</i>	<i>Remarks.</i>
4687	P. T., 33.	XVI	90		
	Secchi.	IV	9		
4729	C. G. H.	IV	11	Melbourne.	
4730	C. G. H.	IV	11		
4731	C. G. H.	IV	11		
4733	C. G. H.	IV	11		
4734	P. T., 61.	XXX	38		
4764	Vogel.	I	8		
4815	P. T., 61.	XXX	39	Trouvelot.	
4876	P. T., 33.	XV	73		
4877	P. T., 33.	XV	73		
4886-7	Vogel. <sup>2</sup>	I	12		
4892	P. T., 33.	XVI	63		
	P. T., 50.	XXXVI	4		
	D'Arr.	II	6		
4950	P. T., 33.	XIV	60		
4964	P. T., 33.	XIII	45		
	P. T., 50.	XXXVIII	13		
	P. T., 61.	XXX	40		
	Lass. <sup>2</sup>	X	38		
	Secchi.	IV	4		
	Lam.	I	3		
4971	P. T., 33.	XVI	85		
	P. T., 61.	XXX	41		
5046	P. T., 61.	XXX	42		

## LIST OF FIGURED NEBULÆ—Continued.

Following are given lists of photographs of clusters and double stars which are as yet unpublished. These lists are intended to facilitate comparisons between work done by different observers. The data were furnished by the observers themselves.

## LIST OF PHOTOGRAPHS OF STAR GROUPS AND CLUSTERS.

By Dr. L. M. RUTHERFORD.

The "number of stars" is the number of *measurable* stars on the photographic plates, which include a field of about  $1^{\circ} 50'$ .

<i>Central Star of Group.</i>	<i>Number of measurable stars.</i>
$\beta$ Cygni -----	36
$a = 20^{\text{h}} 38^{\text{m}}$ -----	} 40
$\delta = + 35^{\circ} 8'$ -----	
21 Cygni -----	75
B. A. C. 6986 -----	75
27 Cygni -----	70
34 Cygni -----	130
37 Cygni -----	150
58 Cygni -----	40
59 Cygni -----	80
61 Cygni -----	48
$a = 19^{\text{h}} 38^{\text{m}}$ -----	} 50
$\delta = + 40^{\circ} 0'$ -----	
$a = 19^{\text{h}} 38^{\text{m}} \delta = + 27^{\circ} 7'$ -----	65
$a = 20^{\text{h}} 0^{\text{m}} \delta = + 31^{\circ} 53'$ -----	100
$\theta$ Orionis -----	60
Præsepe -----	30
12 Comæ Berenices -----	10
$\gamma$ Cassiopiæ -----	38
$\mu$ Cassiopiæ -----	48
B. A. C. 8033 -----	24
Perseus -----	90
B. A. C. 723 -----	12
Pleiades -----	56
40 Eridani -----	8
$\theta$ Urs. Majoris -----	7
B. A. C. 4010 -----	10
Arcturus -----	11
41 Serpentis -----	7
44 Boötis -----	4
72 Herculis -----	7
70 Ophiuchi -----	8
20 Vulpeculæ -----	36

## LIST OF FIGURED NEBULÆ—Continued.

LIST OF STAR CLUSTERS PHOTOGRAPHED AT THE NATIONAL OBSERVATORY AT CORDOBA, ARGENTINE REPUBLIC. [1875-6.]

[Under the direction of Dr. B. A. GOULD.]

Lac. 1023.	fol. d <i>Velorum</i> .	$\zeta$ <i>Lupi</i> .
$\chi$ <i>Fornacis</i> .	Lac. 4145.	Lac. 6612.
Pleiades.	<i>n.f.</i> $\eta$ <i>Carinæ</i> .	Lac. 6697.
Lac. 1339.	Lac. 4270.	Dunlop 326.
$\theta$ <i>Orionis</i> .	Lac. 4310.	Dunlop 360.
<i>c</i> <i>Orionis</i> .	Lac. 4375.	22 <i>Scorpii</i> .
P. vi, 233.	$t_2$ <i>Carinæ</i> .	Lac. 7017.
$\circ$ <i>Canis Maj.</i>	$\theta$ <i>Carinæ</i> .	$\zeta$ <i>Scorpii</i> .
Lac. 2553.	$\eta$ <i>Carinæ</i> .	Br. 5891.
Lac. 2581.	Lac. 4479.	Lac. 7038.
Lac. 2638.	Br. 3346.	Lac. 7099.
Lac. 2766.	$x$ <i>Carinæ</i> .	Lac. 7345.
Lal. 14868.	$y$ <i>Carinæ</i> .	Lac. 7382 = M. 6.
d <i>Puppis</i> .	Lac. 4809.	Lac. 7478 = M. 7.
<i>c</i> <i>Puppis</i> .	Lac. 4816.	9 <i>Sagittariæ</i> .
Lac. 3134.	Lac. 4821.	M. 16.
$\gamma$ <i>Velorum</i> .	Lac. 5006.	M. 23.
Lac. 3195.	Lac. 5279.	Arg. Uran. <i>Sag.</i> 11.
r <i>Puppis</i> .	$\kappa$ <i>Crucis</i> .	$\kappa$ <i>Telescopii</i> .
$\circ$ <i>Velorum</i> .	Lac. 5659.	Lac. 8357.
Lac. 3466.	Lac. 5818.	<i>Sagittarius</i> 20 <sup>h</sup> 20 <sup>m</sup> ; 48° 50'

UNPUBLISHED DRAWINGS OF NEBULÆ, BY L. TROUVELOT, CAMBRIDGE, MASS.

G. C. 575	G. C. 1823	G. C. 4341 ?
768	2318 ?	4342 ?
801 ?	2343 ?	4358 ?
858	2560	4361
859	2735 ?	4373
1179	2798 ?	4380 ?
1227 ?	3142 ?	4400
1541	4058 ?	4403
1691 ?	4124 ?	4412 ?
1719	4127 ?	4514
1771	4244	4815

NOTE.—Those nebulae marked “?” are not finally identified, as the observing telescope is unprovided with circles. They are, in all cases, very near to the place of the nebula which is drawn.

V.

INDEX TO SIR WILLIAM HERSCHEL'S CATALOGUES  
OF NEBULÆ AND CLUSTERS.

[The identifications rest on the authority of Sir JOHN HERSCHEL.]

CLASS I.

[BRIGHT NEBULÆ.]

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
1	591	33	2734	66	1777
2	1771	34	3615	67	2616
3	2038	35	2806	68	3337
4	2041	36	3095	69	3358
5	2396	37	3096	70	3900
6	3702	38	3075	71	4024
7	3146	39	3227	72	2112
8	3228	40	3383	73	2755
9	2776	41	3254	74	2832
10	3176	42	3430	75	2851
11	2758	43	3132	76	2881
12	2942	44	4314	77	2972
13	2301	45	4279	78	1909
14	3166	46	4295	79	2024
15	3198	47	4441	80	2182
16	3273	48	4296	81	2178
17	2203	49	4359	82	2566
18	2207	50	4404	83	3043
19	2752	51	4412	84	3249
20	2405	52	4625	85	3441
21	2499	53	4815	86	2104
22	2925	54 *	214	87	2274
23	3008	55	4892	88	2287
24	3134	56	1861	89	2836
25	3274	57	1863	90	2855
26	2179	58	746	91	3001
27	2229	59	1780	92	3101
28 <sup>1</sup>	2991	60	709	93	3300
28 <sup>2</sup>	2994	61	1904	94	2501
29	2347	62	418	95	2804
30	2921	63	589	96	3437
31	3075	64	604	97	3459
32	3110	65	2917	98	3637

\*This is not I 54 of the *Phil. Trans.*, but a nebula subsequently inserted by Sir WILLIAM HERSCHEL.



## CLASS I — BRIGHT NEBULÆ — Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
99	3843	148	4097	199	2066
100	342	149	4293	200	1713
101	470	150	4331	201	2245
102	574	151	307	202	2604
103	{ 4585	152	487	203	2597
	{ 4586	153	536	204	1684
104	4933	154	549	205	1823
105	431	155	778	206	2708
106	692	156	575	207	2711
107	752	157	396	208	2761
108	263	158	866	209	2811
109	645	159	158	210	2910
110	4998	160	3092	211	3305
111	5000	161	3012	212	3011
112	463	162	3342	213	3002
113	1811	163	2008	214	3783
114	1896	164	2145	215	4058
115	1944	165	2756	216	1781
116	2216	166	2924	217	853
117	2217	167	1778	218	1548
118	{ 2233	168	2052	219	2404
	{ 2236 ?	169	2750	220	2317
119	3103	170	3645	221	2443
120	2554	171	3984	222	2447
121	2663	172	2238	223	2660
122	888	173	2600	224	2707
123	2915	174	2687	225	2717
124	3122	175	2796	226	2379
125	3125	176	3189	227	2476
126	3987	177	3190	228	2564
127	4026	178	3151	229	2637
128	4045	179	3152	230	3749
129	3229	180	3652	231	3782
130	3397	181	3723	232	3794
131	2411	182	3964	233	2248
132	1835	183	3990	234	3048
133	3262	184	3977	235	3856
134	3292	185	3899	236	3897
135	3293	186	3574	237	3934
136	3294	187	3716	238	3715
137	1837	188	3942	239	3720
138	3477	189	3935	240	3726
139	2878	190	3731	241	2371
140	3243	191	3730	242	1711
141	3311	192	4627	243	3315
142	3197	193	386	244	2369
143	3356	194	2413	245	2387
144	3346	195	2723	246	2421
145	3850	196	2745	247	2425
146	3851	197	3041	248	2560
147	4275	198	3042	249	1750

## CLASS I.—BRIGHT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
250	1765	263	2738	276	2888
251	2602	264	2835	277	2948
252	2672	265	2051	278	2742
253	2668	266	2073	279	2737
254	3142	267	2245	280	4236
255	3662	268	2257	281	361
256	3671	269	2275	282	1906
257	714	270	2360	283	2081
258	793	271	2362	284	2218
259	2586	272	2170	285	1905
260	1848	273	3127	286	1982
261	1137	274	3181	287	2452
262	2420	275	2868	288	1691

## CLASS II.

## [FAINT NEBULÆ.]

1	4739	31	3130	60	2734
2	4900	32	2888	61	2871
3	78	33	2386	62	2875
4	351	34	2971	63	2885
5	581	35	3009	64	2929
6	573	36	3045	65	2987
7	860	37	3076	66	3052
8	858	38	3169	67	3077
9	859	39	3196	68	3105
10	5039	40	1869	69	3144
11	2824	41	2211	70	3171
12	3184	42	2315	71	3193
13	2434	43	2034	72	3225
14	2730	44	2058	73	3256
15	3118	45	2061	74	3274
16	2258		{ 2149	75	3278
17	2821	46	{ 2150 ?	76	4122
18	3020	47	2243	77	2175
19	3147	48	1707	78	2193
20	3174	49	2352	79	3927
21	3302	50	2358	80	1704
22	3506	51	2359	81	2195
23	2978	52	2376	82	2254
24	3285	53	2390	83	2757
25	3539	54	2427	84	2894
26	3004	55	2957	85	2891
27	3923	56	3003	86	2903
28	2088	57	1839		{ 2943 ?
29	2089	58	1840	87	{ 2951
30	2382	59	1975	88	2966

## CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
89	2981	140	2847	191	3377
90	3003	141	2893	192	4055
91	3038	142	2899	193	3486
92	3053	143	2904	194	3838
93	3067	144	2926	195	4269
94	3084	145	2982	196	3954
95	3240	146	2986	197	4374
96	4116	147	3082	198	4371
97	4139	148	3148	199	4357
98	1956	149	3157	200	4364
99	2201	150	3910	201	4389
100	2273	151	4178	202	4527
101	2276	152	2428	203	4632
102	2350	153	2507	204	4407
103	2488	154	2510	205	4414
104	2541	155	2979	206	4607
105	2768	156	2999	207	4760
106	2783	157	3019	208	{ 5003 ?
107	2799	158	3068		{ 5004
108	2802	159	2419	209	111
109	2814	160	2423	210	176
110	2845	161	2490	211	560
111	2874	162	2621	212	4883
112	2877	163	2787	213	5011
113	2977	164	2794	214	167
114	3030	165	2795	215	202
115	3025	166	2848	216	203
116	3029	167	2955	217	206
117	3026	168	2956	218	212
118	3950	169	2974	219	221
119	3084	170	2983	220	222
120	3093	171	2984	221	442
121	3010	172	2988	222	455
122	3013	173	2993	223	469
123	3028	174	3013	224	218
124	3031	175	3081	225	526
125	3173	176	3171	226	4971
126	3187	177	3869	227	5049
127	3192	178	4111	228	399
128	3219	179	4112	229	402
129	3450	180	3005	230	5020
130	4105	181	3214	231	5022
131	2231	182	3221	232	5038
132	2626	183	3131	233	4821
133	2777	184	3140	234	4824
134	2791	185	3421	235	4919
135	2805	186	3287	236	4928
136	2813	187	3297	237	554 ?
137	2812	188	3390	238	571
138	2943	189	3418	239	634 ?
139	2842	190	3373	240	5046

## CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
241	29	292	1043	343	3099
242	4973	293	1992	344	3266
243	29	294	2611	345	3298
244	4991	295	2658	346	3324
245	125	296	2661	347	2107
246	516	297	3614	348	2168
247	4734	298	3251	349	2433
248	4790	299	3338	350	2437
249	4880	300	3355	351	2446
250	4939	301	3420	352	2473
251	4879	302	1596	353	2765
252	298	303	1640	354	2803
253	390	304	1477	355	3006
254	620	305	2011	356	3446
255	5005	306	3660	357	3903
256	5006	307	3673	358	2131
257	47	308	3685	359	2134
258	651	309	3750	360	2204
259	1653	310	3751	361	2220
260	1872	311	1913	362	2227
261	4705	312	3482	363	2230
262	734	313	3491	364	2251
263	743	314	3527	365	2293
264	1335	315	1660	366	2295
265	1384	316	1519	367	2439
266	1674	317	1520	368	2649
267	759	318	1670	369	2655
268	1981	319	1676	370	2719
269	2341	320	2001	371	2743
270	430	321	2744	372	2771
271	448	322	2855	373	2781
272	449	323	2858	374	2790
273	601	324	2887	375	2800
274	626	325	3074	376	2854
275	1898	326	3207	377	2859
276	2675	327	3495	378	2882
277	2696	328	3524	379	2931
278	551	329	3891	380	3100
279	805	330	3914	381	3222
280	1721	331	3875	382	3303
281	1730	332	4034	383	3314
282	363	333	1969	384	3319
283	377	334	1971	385	3336
284	582	335	2221	386	3333
285	647	336	2298	387	3331
286	654	337	2325	388	3344
287	688	338	2380	389	3347
288	738	339	2426	390	3353
289	1096	340	2487	381	3351
290	726	341	2511	392	3364
291	762	342	2575	393	3368

## CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
394	3369	445	130	496	2823
395	3385	446	154	497	2989
396	3391	447	239	498	3020
397	3396	448	322	499	3040
398	3400	449	323	500	3080
399	4113	450	4876	501	406
400	4090	451	4877	502	636
401	4106	452	107	503	643
402	4180	453	4851	504	648
403	2603	454	4925	505	1796
404	2664	455	758	506	1865
405	2762	456	760	507	2291
406	2901	457	908	508	2665
407	3104	458	773	509	2679
408	2563	459	777	510	3461
409	2784	460	781	511	3465
410	3083	461	304	512	3469
411	3154	462	315	513	3473
412	3242	463	326	514	877
413	3395	464	836	515	886
414	3444	465	606	516	943
415	3692	466	605	517	3361
416	3754	467	4921	518	2817
417	3756	468	5029	519	2819
418	3826	469	4792	520	1763
419	3833	470	624	521	2361
420	3880	471	69	522	887
421	3917	472	141	523	895
422	3933	473	353	524	876
423	3948	474	515	525	890
424	3687	475	644	526	900
425	4135	476	4807	527	920
426	4601	477	4833	528	924
427	4605	478	74	529	1739
428	4808	479	95	530	2941
429	4906	480	114	531	3032
430	4909	481	404	532	3164
431	4932	482	495	533	3655
432	4997	483	497	534	3704
433	185	484	498	535	3283
434	190	485	499	536	3330
435	474	486	504	537	3432
436	518	487	547	538	3985
437	520	488	586	539	4021
438	529	489	543	540	4033
439	4936	490	1768	541	4039
440	4940	491	1899	542	4038
441	4946	492	1973	543	4047
442	4831	493	2232	544	4050
443	4849	494	2235	545	4061
444	122	495	1864	546	1845

## CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
547	1847	597	772	648	3951
548	2739	598	4834	649	3959
549	3318	599	4746	650	4077
550	2383	600	4950	651	4104
551	2384	601	613	652	4204
552	2449	602	616	653	3526
553	2557	603	674	654	4110
554	1612	604	488	655	4126
555	1854	605	494	656	4129
556	1882	606	4768	657	4147
557	1736	607	637	658	1718
558	3191	608	641	659	3159
559	3288	609	136	660	3160
560	3299	610	391	661	3188
561	3381	611	395	662	3233
562	2441	612	403	663	3402
563	3320	613	506	664	3452
564	1774	614	1449	665	3505
565	2205	615	1448	666	3520
566	3487	616	1562	667	3537
567	3503	617	410	668	3644
568	2852 ?	618	414	669	3669
569	2857 ?	619	627	670	3682
570	2862 ?	620	635	671	3701
571	{ 2856 ?	621	145	672	3743
	{ 2865 ?	622	238	673	3876
572	2876	623	2609	674	3896
573	2857	624	1914	675	3952
574	3926	625	2911	676	4008
575	3956	626	2355	677	4010
576	3999	627	1634	678	4071
577	3138	628	2886	679	3565
578	3231	629	3026	680	3566
579	3445	630	3017	681	3947
580	3902	631	3056	682	3971
581	3904	632	3133	683	4013
582	3946	633	592	684	4057
583	4145	634	1646	685	3675
584	4246	635	2401	686	3686
585	4056	636	3135	687	3806
586	4333	637	3445	688	3656
587	4325	638	3620	689	3576
588	394	639	2030	690	4202
589	397	640	2035	691	3761
590	4884	641	2173	692	3789
591	7	642	2760	693	3790
592	576	643	3195	694	3870
593	747	644	3341	695	3920
594	774	645	3365	696	3931
595	4738	646	3511	697	3689
596	426	647	4265	698	3718

## CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's</i> <i>No.</i>	<i>Gen. Cat.</i> <i>No.</i>	<i>Herschel's</i> <i>No.</i>	<i>Gen. Cat.</i> <i>No.</i>	<i>Herschel's</i> <i>No.</i>	<i>Gen. Cat.</i> <i>No.</i>
699	3740	750	3011	799	3758
700	3953	751	4051	800	3784
701	4231	752	4052	801	3795
702	4850	753	4218	802	2754
703	145	754	3854	803	2764
704	638	755	4062	804	2853
705	4827	756	{ 4025	805	2866
706	4907		{ 4029 ?	806	2897
707	90	757	4064	807	3925
708	1788	758	4082	808	3940
709	2353	759	4087	809	3991
710	3693	760	4085	810	4185
711	3665	761	4114	811	4192
712	3674	762	4115	812	4291
713	3688	763	4074	813	2782
714	3693	764	4128	814	3255
715	3694	765	4130	815	3424
716	3710	766	4131	816	3462
717	1924	767	4292	817	3617
718	2225	768	847	818	4065
719	1633	769	1496	819	2330
720	2069	770	2424	820	1529
721	2072	771	3054	821	1546
722	2074	772	3161	822	1554
723	2556	773	3162	823	1720
724	2624	774	3202	824	2583
725	2657	775	2394	825	2587
726	1626	776	3036	826	3512
727	1689	777	3316	827	3752
728	2339	778	3350	828	1759
729	2363	779	3371	829	2408
730	2445	780	3492	830	2494
731	2471	781	2692	831	2520
732	2477	782	2397	832	2561
733	2652	783	2454	833	2612
734	1486	784	2461	834	1742
735	1489	785	2555	835	1957
736	1497	786	2576	836	2444
737	2498	787	2578	837	2465
738	2559	788	2584	838	2472
739	2562	789	2618	839	2485
740	2590	790	2619	840	2627
741	2676	791	2634	841	3590
742	2834	792	2770	842	3592
743	2945	793	2792	843	3709
744	3150	794 <sup>1</sup>	3177	844	3714
745	2166	794 <sup>2</sup>	3179	845	2407
746	3448	795	3216	846	2839
747	2749	796	3224	847	2895
748	2807	797	3578	848	2998
749	2950	798	3639	849	3069



## CLASS II.—FAINT NEBULÆ—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
850	3089	870	2117	890	3799
851	5024	871	2125	891	3913
852	764	872	2215	892	3921
853	14	873	4158	893	3932
854	62	874	4102	894	3937
855	66	875	4208	895	3624
856	98	876	3800	896	3625
857	97	877	3809	897	4761
858	104	878	4513	898	2004
859	412	879	2372	899	3672
860	101	880	2395	900	660
861	1482	881	2547	901	4308
862	1491	882	2087	902	4383
863	143	883	2098	903	1970
864	2570	884	2299	904	2302
865	2720	885	2375	905	2460
866	2721	886	2415	906	4109
867	2788	887	2242	907	4417
868	1797	888	2265	908	1690
869	1798	889	3712	909	1972

## CLASS III.

[VERY FAINT NEBULÆ.]

1	1185 ??	23	2303	45	3560
2	511	24	1990	46	3561
3	2662	25	2047	47	3825
4	1884	26	3078	48	3988
5	2177	27	2356	49	1688
6	3228	28	2423	50	1696
7	1618	29	2469	51	1942
8	1857	30	2493	52	1945
9	3582	31	2908	53	2026
10	3583	32	3798	54	2147
11	3746	33	4157	55	2148
12	3849	34	1912	56	3744
13	3117	35	2531	57	3759
14	3889	36	2534	58	3780
15	2389	37	2691	59	3791
16	2391	38	2923	60	1752
17	2970	39	2967	61	1773
18	3055	40	3033	62	1786
19	1540	41	3039	63	1787
20	2240	42	3046	64	1825
21	2277	43	3143	65	2014
22	2289	44	3180	66	2153

## CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
67	2267	118	3488	169	297
68	2736	119	3510	170	319
69	3051	120	3873	171	325
70	3277	121	3864	172	328
71	3562	122	3866	173	329
72	3616	123	4262	174	362
73	4152	124	4266	175	401
74	4167	125	3732	176	443
75	2282	126	3908	177	542
76	2366	127	3955	178	631
77	2669	128	3958	179	416
78	3065	129	4000	180	4809
79	2323	130	4002	181	4915
80	2448	131	4016	182	4926
81	2474	132	3901	183	25
82	3272	133	3982	184	4899
83	3348	134	3818	185	4923
84	3529	135	3863	186	4930
85	3596	136	3877	187	4981
86	3595	137	4303	188	4984
87	3597	138	4076	189	4999
88	2234	139	4081	190	5057
89	2328	140	4161	191	189
90	2580	141	4573	192	419
91	2833	142	4582	193	453
92	2872	143	4444	194	667
93	2873	144	4536	195	684
94	2907	145	4653	196	701
95	2905	146	4996	197	700
96	2906	147	9	198	571
97	2922	148	53	199	628
98	3126	149	124	200	109
99	3584	150	355	201	513
100	3605	151	484	202	4890
101	3608	152	572	203	4898
102	2517	153	149	204	135
103	2544	154	230	205	258
104	2542	155	229	206	267
105	3136	156	272	207	478
106	3291	157	278	208	483
107	2187	158	2-9	209	4646
108	2237	159	294	210	4886
109	2481	160	295	211	4887
110	3857	161	568	212	4961
111	2310	162	564	213	4980
112	2417	163	598	214	466
113	2577	164	653	215	471
114	2980	165	4741	216	4845
115	3538	166	4823	217	4846
116	4067	167	299	218	4953
117	3485	168	301	219	4598

## CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
220	4903	270	1287	321	2568
221	4920	271	1452	322	2601
222	4922	272	1962	323	2641
223	86	273	1976	324	2646
223	83 ??	274	2628	325	2648
224	535	275	1761	326	2716
225	1321	276	1860	327	2753
226	4966	277	1918	328	3201
227	493	278	1919	329	3204
228	585	279	2667	330	2980
229	587	280	3250	331	2129
230	4888	281	3276	332	2268
231	5025	282	3483	333	2364
232	5026	283	3936	334	2368
233	5028	284	2504	335	2392
234	1662	285	3708	336	2393
235	1680	286	3777	337	2409
236	1762	287	3786	338	2497
237	4811	288	1648	339	2502
238	4924	289	1911	340	2516
239	540	290	2610	341	2574
240	1182	291	1756	342	2605
241	1271	292	1665	343	2629
242	1799	293	1974	344	2643
243	4871	294	1709	345	2644
244	113	295	1779	346	3416
245	640	296	1785	347	3844
246	724	297	1856	348	2064
247	749	298	1873	349	2123
248	765	299	2850	350	2304
249	771	300	2861	351	2319
250	263	301	3044	352	2320
251	269	302	3063	353	2440
252	276	303	3401	354	2645 ?
253	303	304	3405	355	2704
254	1958	305	3436	356	2740
255	2028	306	3475	357	2741
256	1641	307	3476	358	2769
257	1675	308	3481	359	2772
258	2700	309	3484	360	2773
259	503	310	3930	361	2954
260	509	311	4022	362	3027
261	546	312	4037	363	3354
262	652	313	4146	364	3372
263	753	314	4174	365	3419
264	1740	315	1895	366	3433
265	441	316	2111	367	3458
266	440	317	2176	368	3514
267	1274	318	2190	369	3618
268	998	319	3888	370	3628
269	1196	320	2500	371	4143

## CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
372	2551	423	3668	474	541
373	3998	424	3246	475	583
374	4092	425	3603	476	79
375	2495	426	4975	477	160
376	2506	427	5010	478	1996
377	2527	428	30	479	1578
378	2533	429	156	480	2829
379	2589	430	155	481	2913
380	2599	431	344	482	2973
381	2608	432	354	483	3018
382	2710	433	475	484	3037
383	2713	434	570	485	129
384	2714	435	4933	486	523
385	2537	436	5047	487	725
386	2535	437	5013	488	1829
387	2543	438	4965	489	3279
388	2552	439	159	490	837
389	2596	440	254	491	2674
390	2678	441	332	492	2976
391	2694	442	333	493	3090
392	2693	443	661	494	3175
393	2697	444	690	495	3123
394	2699	445	704	496	3259
395	2701	446	727	497	2241
396	2702	447	1130	498	2279
397	2797	448	1308	499	812
398	3215	449	611	500	997
399	2766	450	615	501	911
400	2712	451	745	502	915
401	3423	452	4718	503	955
402	3533	453	981	504	3129
403	3534	454	366	505	3619
404	3540	455	602	506	3696
405	3545	456	19	507	3579
406	3577	457	510	508	3978
407	3598	458	4780	509	3137
408	3601	459	408	510	1308
409	3610	460	435	511	4042
410	3630	461	10	512	1617
411	3735	462	608	513	1870
412	3737	463	151	514	3232
413	3757	464	459	515	3260
414	3822	465	4870	516	3284
415	3852	466	5036	517	3289
416	3859	467	76	518	2023
417	3860	468	465	519	1887
418	3865	469	630	520	1833
419	3884	470	4904	521	1907
420	3938	471	368	522	2228
421	3664	472	562	523	3212
422	3915	473	4952	524	3230

## CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
525	3282	576	4868	627	1820
526	3295	577	268	628	1826
527	1900	578	646	629	1831
528	1908	579	4989	630	1832
529	2346	580	623	631	2097
230	2402	581	579	632	2263
531	2406	582	607	633	3498
532	2429	583	472	634	4119
533	2726	584	590	635	4136
534	2774	585	872	636	4137
535	2846	586	873	637	4160
536	3244	587	851	638	4195
537	3267	588	893	639	4198
538	3301	589	903	640	4212
539	3499	590	1160	641	4214
540	1737	591	656	642	3567
541	1891	592	234	643	3581
542	1978	593	237	644	3814
543	3218	594	281	645	3911
544	3280	595	100	646	4151
545	3449	596	1985	647	1760
546	3721	597	1875	648	2916
547	3725	598	2292	649	3454
548	3304	599	1661	650	3501
549	3677	600	1963	651	3548
550	3970	601	1968	652	3568
551	3836	602	3113	653	3753
552	3839	603	3167	654	3422
553	4164	604	501	655	3435
554	4004	605	1614	656	3587
555	4377	606	1642	657	3979
556	313	607	1645	658	3980
557	569	608	1751	659	4069
558	4896	609	2482	660	4078
559	733	610	3238	661	4098
560	327	611	3248	662	3186
561	409	612	2607	663	3200
562	422	613	3332	664	3220
563	427	614	3352	665	3680
564	420	615	2154	666	3723
565	421	616	2591	667	3736
566	481	617	2659	668	3872
567	496	618	3286	669	3447
568	691	619	3507	670	3468
569	756	620	3612	671	3963
570	533	621	3659	672	3559
571	537	622	4156	673	3623
572	565	623	4182	674	3804
573	566	624	4188	675	3965
574	686	625	1729	676	3812
575	687	626	1758	677	3890

## CLASS III. — VERY FAINT NEBULÆ—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
678	4015	729	2953	780	3414
679	4019	730	4222	781	3410
680	4201	731	3827	782	3411
681	3658	732	3831	783	3406
682	3700	733	3867	784	3553
683	3739	734	3871	785	3649
684	3741	735	4248	786	3707
685	3810	736	4063	787	{ 3766
686	3981	737	4080		{ 3760 ?
687	3992	738	4134	788	{ 3778
688	4177	739	4149		{ 3773 ?
689	4257	740	4190		{ 3774 ?
690	3994	741	4328	789	{ 3779
691	4012	742	4462	790	3787
692	4728	743	4487	791	3793
693	4737	744	4507	792	2219
694	718	745	4866	793	2283
695	531	746	1501	794	2682
696	4706	747	1167	795	2746
697	2779	748	1515	796	2789
698	3683	749	1795	797	2793
699	3695	750	1604	798	2860
700	2165	751	1897	799	2914
701	2199	752	1625	800	2918
702	2837	753	1657	801	2920
703	1528	754	2706	802	3091
704	2060	755	2963	803	3622
705	2269	756	2964	804	3820
706	2349	757	3070	805	3829
707	2631	758	3345	806	4006
708	2729	759	3346	807	3094
709	1607	760	3374	808	3509
710	1631	761	3384	809	3711
711	1639	762	3788	810	3738
712	1714	763	3886	811	4028
713	1836	764	3014	812	4171
714	1833	765	3408	813	4219
715	2571	766	3428	814	2747
716	2585	767	2146	815	3235
717	2715	768	2398	816	3306
718	2808	769	2592	817	3326
719	2827	770	2348	818	3376
720	2828	771	2450	819	3431
721	3261	772	2453	820	3440
722	3236	773	2483	821	3552
723	2334	774	2509	822	3599
724	3494	775	2513	823	3609
725	2830	776	2532	824	2281
726	2864	777	2778	825	1754
727	4247	778	3206	826	1776
728	4267	779	3403	827	1822



## CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
828	2553	878	1790	928	3600
829	1558	879	2947	929	3678
830	1591	880	3107	930	4723
831	1719	881	2213	931	4767
832	1789	882	3929	932	4775
833	2539	883	4165	933	4779
834	3061	884	4168	934	1984
835	3820	885	3995	935	2451
836	1590	886	4048	936	4669
837	1600	887	4049	937	3409
838	1606	888	4176	938	2919
839	1610	889	4172	939	3112
840	1628	890	4215	940	2558
841	1731	891	4186	941	2763
842	2185	892	4191	942	2898
843	2463	893	4226	943	4089
844	2484	894	3957	944	4091
845	2759	895	3961	945	4282
846	1844	896	3983	946	3650
847	2455	897	1458	947	3765
848	3438	898	1457	948	3837
849	3684	899	1493	949	3907
850	2801	900	1530	950	3963
851	2826	901	1531	951	4286
852	2952	902	1654	952	884
853	1977	903	2666	953	885
854	5015	904	2731	954	81
855	5042	905	2615	955	153
856	5043	906	3223	956	676
857	732	907	3268	957	4348
858	4650	908	3339	958	4349
859	4672	909	3460	959	708
860	4972	910	2056	960	730
861	18	911	2082	961	740
862	4764	912	2138	962	787
863	4776	913	2224	963	1883
864	4778	914	2244	964	2045
865	1188	915	2307	965	2062
866	5	916	1998	966	2065
867	5037	917	2140	967	} 2284
868	4	918	2142	968	
869	59	919	2223	969	2458
870	89	920	2314	970	2567
871	84	921	2344	971	2598
872	96	922	2410	972	2266
873	102	923	3676	973	4163
874	1481	924	3861	974	4253
875	1489	925	3516	975	4425
876	88	926	3588	976	4011
877	1623	927	3868	977	1866



## CLASS III.—VERY FAINT NEBULÆ—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
978	1966	981	2079	983	1682
979	2077	982	1679	984	5044
980	2078				

## CLASS IV.

[PLANETARY NEBULÆ: STARS WITH BURS, WITH MILKY  
CHEVELURE, WITH SHORT RAYS, REMARKABLE  
SHAPES, Etc.]

1	4628	28 <sup>1</sup>	2670	54	2748
2	1437	28 <sup>2</sup>	2671	55	1629
3	1425	29	2255	56	2650
4	2403	30	3340	57	4274
5	3066	31	4802	58	20
6	2231	32	932	59	2400
7	2290	33	1202	60	2158
8	3108	34	1225	61	2635
9	3109	35	1672	62	2620
10	2099	36	1270	63	3575
11	4302	37	4373	64	1567
12	4378	38	1373	65	1500
13	4565	39	1565	66	1728
14	4479	40	3307	67	2613
15	12	41	4355	68	1888
16	4572	42	400	69	810
17	664	43	639	70	3536
18	4964	44	1359	71	4053
19	1362	45	1532	72	4561
20	1375	46	3801	73	4514
21	1170	47	3366	74	4634
22	1589	48	1999	75	4702
23	544	49	3808	76	4594
24	1226	50	4244	77	705
25	1487	51	4510	78	3270
26	826	52	4947	79	1950
27	2102	53	801		

## CLASS V.

[VERY LARGE NEBULÆ.]

<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>	<i>Herschel's No.</i>	<i>Gen. Cat. No.</i>
1	138	19	527	36	106
2	3085	20	132	37	4621 ?
3	3363	21	1511	38	1116
4	2733	22	3557	39	2294
5	2867	23	1947	40	2296
6	3648	24	3106	41	2831
7	2180	25	131	42	3165
8	2378	26	1931	43	2841
9	4363	27	1440	44	1541
10	4355	28	1227	45	2606
11	4355	29 <sup>1</sup>	2958	46	2318
12	4355	29 <sup>2</sup>	2962	47	1983
13	4368	30	1180	48	610
14	4616	31	1183	49	879
15	4600	32	1005	50	1923
16	31	33	1115	51	2825
17	352	34	1193	52	2189
18	105	35	—		

## CLASS VI.

[VERY COMPRESSED AND RICH CLUSTERS OF STARS.]

1	1549	15	4433	29	4774
2	1467	16	4521 ?	30	5031
3	1444	17	1351	31	392
4	1964	18	1471	32	4676
5	1383	19	4075	33	512
6	1508 ?	20	162	34	521
7	3472	21	1442	35	68
8	3967	22	1637	36	1559
9	3776	23	4416	37	1611
10	4193	24	4648	38	4499
11	4268	25	658	39	1651
12	4270	26	871	40	4211
13	4335	27	1465	41	4321
14	4998	28	1435	42	4590

## CLASS VII.

[PRETTY MUCH COMPRESSED CLUSTERS OF LARGE OR SMALL STARS.]

Height: m.	Gen. Cat. No.	Height: m.	Gen. Cat. No.	Height: m.	Gen. Cat. No.
1010	1010	1010	1010	1010	1010
1011	1011	1011	1011	1011	1011
1012	1012	1012	1012	1012	1012
1013	1013	1013	1013	1013	1013
1014	1014	1014	1014	1014	1014
1015	1015	1015	1015	1015	1015
1016	1016	1016	1016	1016	1016
1017	1017	1017	1017	1017	1017
1018	1018	1018	1018	1018	1018
1019	1019	1019	1019	1019	1019
1020	1020	1020	1020	1020	1020
1021	1021	1021	1021	1021	1021
1022	1022	1022	1022	1022	1022
1023	1023	1023	1023	1023	1023
1024	1024	1024	1024	1024	1024
1025	1025	1025	1025	1025	1025
1026	1026	1026	1026	1026	1026
1027	1027	1027	1027	1027	1027
1028	1028	1028	1028	1028	1028
1029	1029	1029	1029	1029	1029
1030	1030	1030	1030	1030	1030
1031	1031	1031	1031	1031	1031
1032	1032	1032	1032	1032	1032
1033	1033	1033	1033	1033	1033
1034	1034	1034	1034	1034	1034
1035	1035	1035	1035	1035	1035
1036	1036	1036	1036	1036	1036
1037	1037	1037	1037	1037	1037
1038	1038	1038	1038	1038	1038
1039	1039	1039	1039	1039	1039
1040	1040	1040	1040	1040	1040
1041	1041	1041	1041	1041	1041
1042	1042	1042	1042	1042	1042
1043	1043	1043	1043	1043	1043
1044	1044	1044	1044	1044	1044
1045	1045	1045	1045	1045	1045
1046	1046	1046	1046	1046	1046
1047	1047	1047	1047	1047	1047
1048	1048	1048	1048	1048	1048
1049	1049	1049	1049	1049	1049
1050	1050	1050	1050	1050	1050

## CLASS VIII.

[COARSELY SCATTERED CLUSTERS OF STARS.]

1051	1051	1051	1051	1051	1051
1052	1052	1052	1052	1052	1052
1053	1053	1053	1053	1053	1053
1054	1054	1054	1054	1054	1054
1055	1055	1055	1055	1055	1055
1056	1056	1056	1056	1056	1056
1057	1057	1057	1057	1057	1057
1058	1058	1058	1058	1058	1058
1059	1059	1059	1059	1059	1059
1060	1060	1060	1060	1060	1060
1061	1061	1061	1061	1061	1061
1062	1062	1062	1062	1062	1062
1063	1063	1063	1063	1063	1063
1064	1064	1064	1064	1064	1064
1065	1065	1065	1065	1065	1065
1066	1066	1066	1066	1066	1066
1067	1067	1067	1067	1067	1067
1068	1068	1068	1068	1068	1068
1069	1069	1069	1069	1069	1069
1070	1070	1070	1070	1070	1070
1071	1071	1071	1071	1071	1071
1072	1072	1072	1072	1072	1072
1073	1073	1073	1073	1073	1073
1074	1074	1074	1074	1074	1074
1075	1075	1075	1075	1075	1075
1076	1076	1076	1076	1076	1076
1077	1077	1077	1077	1077	1077
1078	1078	1078	1078	1078	1078
1079	1079	1079	1079	1079	1079
1080	1080	1080	1080	1080	1080
1081	1081	1081	1081	1081	1081
1082	1082	1082	1082	1082	1082
1083	1083	1083	1083	1083	1083
1084	1084	1084	1084	1084	1084
1085	1085	1085	1085	1085	1085
1086	1086	1086	1086	1086	1086
1087	1087	1087	1087	1087	1087
1088	1088	1088	1088	1088	1088
1089	1089	1089	1089	1089	1089
1090	1090	1090	1090	1090	1090
1091	1091	1091	1091	1091	1091
1092	1092	1092	1092	1092	1092
1093	1093	1093	1093	1093	1093
1094	1094	1094	1094	1094	1094
1095	1095	1095	1095	1095	1095
1096	1096	1096	1096	1096	1096
1097	1097	1097	1097	1097	1097
1098	1098	1098	1098	1098	1098
1099	1099	1099	1099	1099	1099
1100	1100	1100	1100	1100	1100

## CLASS VIII.—COARSELY SCATTERED CLUSTERS OF STARS—Continued.

<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.	<i>Herschel's</i> No.	<i>Gen. Cat.</i> No.
39	1466	56	4575	73	4515
40	1490	57	4638	74	4640
41	1015	58	4620	75	4773
42	1199	59	907	76	4615
43	970	60	1473	77	4842
44	1533	61	995	78	120
45	1510	62	4960	79	63
46	1557	63	4771	80	775
47	1556	64	204	81	4493
48	1436	65	389	82	4613
49	1421	66	578	83	4566
50	1430	67	4719	84	720
51	1469	68	1323	85	831
52	1544	69	4976	86	4551
53	4353	70	855	87	1553
54	4385	71	1451	88	717
55	4396	72	4410		

# VI.

## INDEX TO MESSIER'S CATALOGUE OF NEBULÆ, Etc.

<i>Messier's No</i>	<i>Gen. Cat. No.</i>	<i>Messier's No.</i>	<i>Gen. Cat. No</i>	<i>Messier's No</i>	<i>Gen. Cat. No.</i>
1	1157	36	1166	71	4520
2	4678	37	1295	72	4608
3	3636	38	1119	73	4617
4	4183	39	4681	74	372
5	4083	40	—	75	4543
6	4318	41	1454	76	385
7	4340	42	1179	77	600
8	4361	43	1185	78	1267
9	4287	44	1681 *	79	1112
10	4256	45	The <i>Pleiades</i> .	80	4173
11	4437	46	1564	81	} 1949 1953
12	4238	47	1594		
13	4230	48	—	82	1950
14	4315	49	3021	83	3606
15	4670	50	1483	84	2930
16	4400	51	3572	85	2946
17	4403	52	4957	86	2961
18	4401	53	3453	87	3035
19	4264	54	4442	88	3049
20	4355	55	4503	89	3097
21	4367	56	4485	90	3111
22	4424	57	4447	91	3120 ?
23	4346	58	3121	92	4294
24	4397	59	3155	93	1571
25	—	60	3182	94	3258
26	4432	61	2878	95	2184
27	4532	62	4261	96	2194
28	4406	63	3474	97	2343
29	4576	64	3321	98	2786
30	4687	65	2373	99	2838
31	116	66	2377	100	2890
32	117	67	1712	101	3770
33	352	68	3128	102	—
34	584	69	4411	103	341
35	1360	70	4428		

[\* *Præscpe* ]

## NOTE.

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Since the preceding pages were in type I have received, through the kindness of Mr. E. B. KNOBEL, the following additions, etc., which mostly refer to works not accessible to me.

<i>Page.</i>	<i>Author.</i>	<i>Correction.</i>
7	BAILY -----	Chart of the <i>Pleiades</i> in "Astronomical Tables and Remarks for the year 1822." London, 1822.
8	BODE-----	Description et Connoissance générale des Constellations. Berlin, 1801. [Contains catalogue of 1,802 nebulae and 212 clusters.]
8	BODE-----	Catalogue * * * de 5505 Etoiles. Berlin, 1805. [Contains catalogue of 372 nebulae and clusters.]
11	CATUREGLI ---	Catalogue of stars in the <i>Pleiades</i> . <i>Bologna Ephem. Mot. Coelest</i> , 1823-1828. Appendix.
44	LE MONNIER ..	Recueil de Tables Astronomiques, vol. i, pp. 203 and 205. [Catalogues of stars in the <i>Hyades</i> and <i>Pleiades</i> .]
49	PIAZZI -----	Catalogue of stars in the <i>Pleiades</i> . <i>B. J.</i> , 1817, p. 223. Chart.
55	SECCHI -----	<i>Mem. Coll. Romano</i> , 1863-'66. [Contains observations of several nebulae and clusters, with drawings.]
60	ULUGH-BEIGH -	HYDE's Commentary, p. 20. [Cluster in <i>Perseus</i> .]