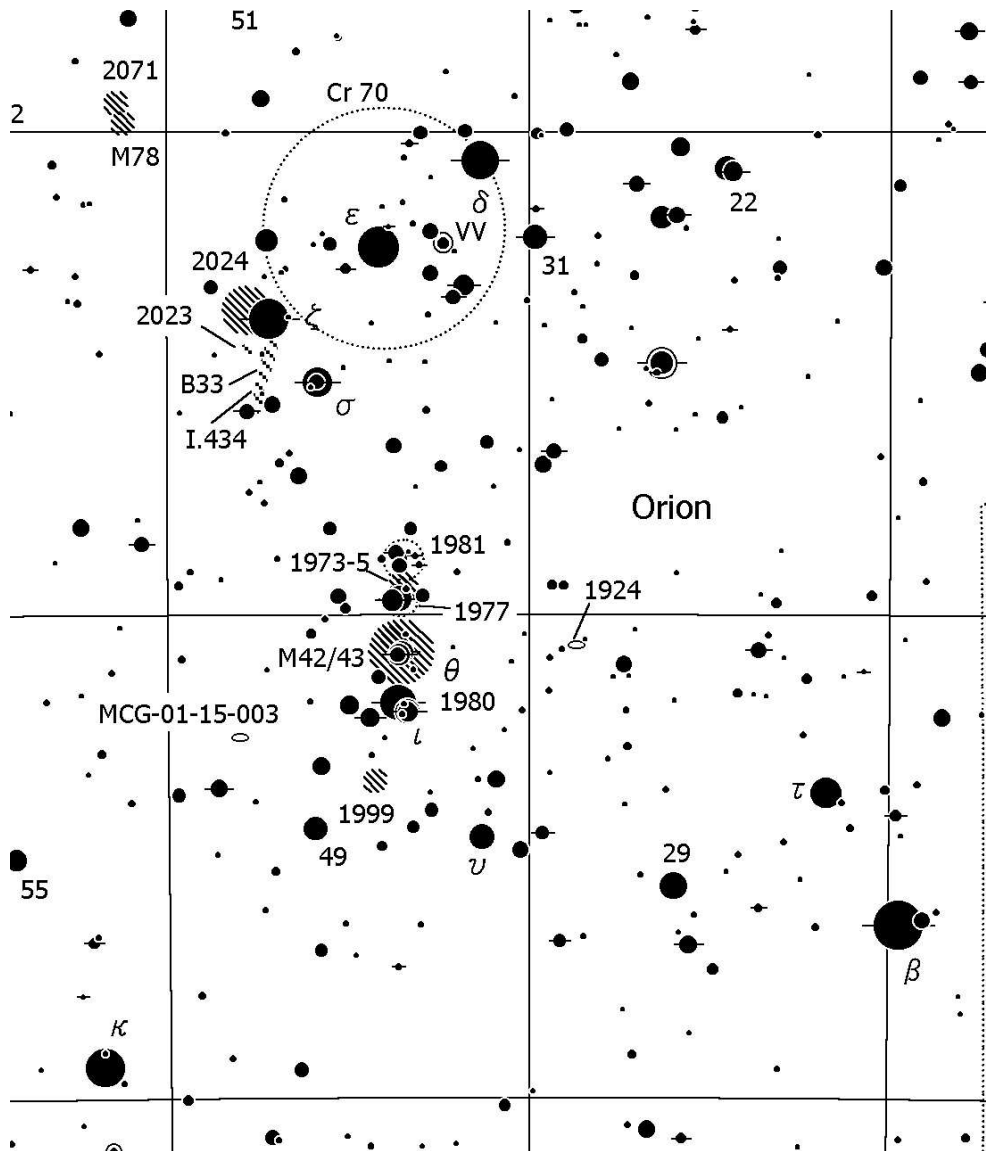


Taki's 8.5 Magnitude Star Atlas



Toshimi Taki

Revision -: January 7, 2006

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1. Introduction

After completing Taki's Star Atlas (introduced in *Sky & Telescope*, June 2005, p. 103), I planned a next project of star atlas. Using the same technique I developed for the earlier star atlas, I thought that it would be rather easy to produce a more detailed star atlas.

I decided that the next star atlas would be a substitute of Sky Atlas 2000.0, because Sky Atlas 2000.0 is too big (charts unfold to 21x16") for using at telescope. I like the format of Uranometria 2000. Smaller format is easier to be used at a telescope. Combination with my earlier star atlas will be a useful tool for deep sky observation. The same projection method and symbols are used in the both atlases. Of course, the new star atlas is free! You can download the star atlas at <http://www.asahi-net.or.jp/~zs3t-tk/>.

2. References

All the data used for the star atlas are available via Internet.

- [1] "SAO Star Catalog J2000 (SAO Staff 1966; USNO, ADC 1990)"
- [2] D. Hoffleit, W. H. Warren Jr., "The Bright Star Catalogue, 5th Revised Ed. (Preliminary Version)," *Astronomical Data Center, NSSDC/ADC* (1991)
- [3] D. Hoffleit, M. Saladyga and P. Wlasuk, "A Supplement to the Bright Star Catalogue," *Yale University Obs.* (1983)
- [4] A. C. Davenhall and S. K. Leggett, "A Catalogue of Constellation Boundary Data," (1990) --> There are some errors in the data.
- [5] "Saguaro Astronomy Club Database," Version 7.2, (2000)
- [6] "Charles Messier's Catalog of Nebulae and Star Clusters"
- [7] Patrick Moore and the Editors of *Sky & Telescope*, "The Caldwell Catalog: 109 Deep-Sky Delights for Backyard Observers," (1995)
- [8] "Herschel 400 List," *Astronomical League*
- [9] T. Taki, "Taki's Star Atlas," Available at <http://www.asahi-net.or.jp/~zs3t-tk/>.

3. Specification

- (1) Projection: Modified Transverse Mercator Projection
- (2) Number of Charts: 146 + 3
- (3) Scale: 8.4mm/degree \leftrightarrow Star Atlas 2000.0 Second Ed.: 8.2mm/degree
- (4) Chart Size: A4
- (5) Magnitude of Faintest Star: 8.5 (over 88,000 stars)
 \leftrightarrow Star Atlas 2000.0 Second Ed.: 8.5 (81,312 stars)
- (6) More than 2900 Deep Sky Objects \leftrightarrow Star Atlas 2000.0 Second Ed.: 2700 objects

Number of Bright Nebulae:	66	
Number of Dark Nebulae:	9	
Number of Open Clusters:	541	up to 10.0mag
Number of Asterisms:	2	
Number of Globular Clusters:	112	up to 12.0mag
Number of Planetary Nebulae:	167	up to 12.5mag
Number of Galaxies:	2025	up to 12.5mag
Number Super Nova Remnants:	5	
Number of Quasars:	1	

Total:	2928	

All Herschel 400 objects are plotted and the objects in Caldwell catalog are labeled.

4. Symbols

Figure 1 shows the symbols used in the star atlas.

Note that some of the large objects are depicted with thin line.

5. Chart ID

Chart ID	Right Ascension	Declination
1	0h to 24h	+83 to +90
2	22h to 24h	+62 to +83
3	20h to 22h	+62 to +83
4	18h to 20h	+62 to +83
5	16h to 18h	+62 to +83
6	14h to 16h	+62 to +83
7	12h to 14h	+62 to +83
8	10h to 12h	+62 to +83
9	8h to 10h	+62 to +83
10	6h to 8h	+62 to +83
11	4h to 6h	+62 to +83
12	2h to 4h	+62 to +83
13	0h to 2h	+62 to +83
14	23h to 24h	+37 to +62
15	22h to 23h	+37 to +62
16	21h to 22h	+37 to +62
17	20h to 21h	+37 to +62
18	19h to 20h	+37 to +62
19	18h to 19h	+37 to +62
20	17h to 18h	+37 to +62
21	16h to 17h	+37 to +62
22	15h to 16h	+37 to +62
23	14h to 15h	+37 to +62
24	13h to 14h	+37 to +62
25	12h to 13h	+37 to +62
26	11h to 12h	+37 to +62
27	10h to 11h	+37 to +62
28	9h to 10h	+37 to +62
29	8h to 9h	+37 to +62
30	7h to 8h	+37 to +62

31	6h to 7h	+37 to +62
32	5h to 6h	+37 to +62
33	4h to 5h	+37 to +62
34	3h to 4h	+37 to +62
35	2h to 3h	+37 to +62
36	1h to 2h	+37 to +62
37	0h to 1h	+37 to +62

38	23h to 24h	+12 to +37
39	22h to 23h	+12 to +37
40	21h to 22h	+12 to +37
41	20h to 21h	+12 to +37
42	19h to 20h	+12 to +37
43	18h to 19h	+12 to +37
44	17h to 18h	+12 to +37
45	16h to 17h	+12 to +37
46	15h to 16h	+12 to +37
47	14h to 15h	+12 to +37
48	13h to 14h	+12 to +37
49	12h to 13h	+12 to +37

50	11h to 12h	+12 to +37
51	10h to 11h	+12 to +37
52	9h to 10h	+12 to +37
53	8h to 9h	+12 to +37
54	7h to 8h	+12 to +37
55	6h to 7h	+12 to +37
56	5h to 6h	+12 to +37
57	4h to 5h	+12 to +37
58	3h to 4h	+12 to +37
59	2h to 3h	+12 to +37
60	1h to 2h	+12 to +37
61	0h to 1h	+12 to +37

62	23h to 24h	-12 to +12
63	22h to 23h	-12 to +12

64	21h to 22h	-12 to +12
65	20h to 21h	-12 to +12
66	19h to 20h	-12 to +12
67	18h to 19h	-12 to +12
68	17h to 18h	-12 to +12
69	16h to 17h	-12 to +12
70	15h to 16h	-12 to +12
71	14h to 15h	-12 to +12
72	13h to 14h	-12 to +12
73	12h to 13h	-12 to +12

74	11h to 12h	-12 to +12
75	10h to 11h	-12 to +12
76	9h to 10h	-12 to +12
77	8h to 9h	-12 to +12
78	7h to 8h	-12 to +12
79	6h to 7h	-12 to +12
80	5h to 6h	-12 to +12
81	4h to 5h	-12 to +12
82	3h to 4h	-12 to +12
83	2h to 3h	-12 to +12
84	1h to 2h	-12 to +12
85	0h to 1h	-12 to +12

86	23h to 24h	-37 to -12
87	22h to 23h	-37 to -12
88	21h to 22h	-37 to -12
89	20h to 21h	-37 to -12
90	19h to 20h	-37 to -12
91	18h to 19h	-37 to -12
92	17h to 18h	-37 to -12
93	16h to 17h	-37 to -12
94	15h to 16h	-37 to -12
95	14h to 15h	-37 to -12
96	13h to 14h	-37 to -12
97	12h to 13h	-37 to -12

98	11h to 12h	-37 to -12
99	10h to 11h	-37 to -12
100	9h to 10h	-37 to -12
101	8h to 9h	-37 to -12
102	7h to 8h	-37 to -12
103	6h to 7h	-37 to -12
104	5h to 6h	-37 to -12
105	4h to 5h	-37 to -12
106	3h to 4h	-37 to -12
107	2h to 3h	-37 to -12
108	1h to 2h	-37 to -12
109	0h to 1h	-37 to -12

110	23h to 24h	-62 to -37
111	22h to 23h	-62 to -37
112	21h to 22h	-62 to -37
113	20h to 21h	-62 to -37
114	19h to 20h	-62 to -37
115	18h to 19h	-62 to -37
116	17h to 18h	-62 to -37
117	16h to 17h	-62 to -37
118	15h to 16h	-62 to -37
119	14h to 15h	-62 to -37
120	13h to 14h	-62 to -37
121	12h to 13h	-62 to -37

122	11h to 12h	-62 to -37
123	10h to 11h	-62 to -37
124	9h to 10h	-62 to -37
125	8h to 9h	-62 to -37
126	7h to 8h	-62 to -37
127	6h to 7h	-62 to -37
128	5h to 6h	-62 to -37
129	4h to 5h	-62 to -37
130	3h to 4h	-62 to -37

131	2h to 3h	-62 to -37
132	1h to 2h	-62 to -37
133	0h to 1h	-62 to -37

134	22h to 24h	-83 to -62
135	20h to 22h	-83 to -62
136	18h to 20h	-83 to -62
137	16h to 18h	-83 to -62
138	14h to 16h	-83 to -62
139	12h to 14h	-83 to -62
140	10h to 12h	-83 to -62
141	8h to 10h	-83 to -62
142	6h to 8h	-83 to -62
143	4h to 6h	-83 to -62
144	2h to 4h	-83 to -62
145	0h to 2h	-83 to -62
146	0h to 24h	-90 to -83

A1	Coma/Virgo Border
A2	Central Region of Orion
A3	Eta Carinae and Vicinity

6. Deep Sky Object List

Deep Sky Object List (sorted with Chart ID and sorted with object name) is prepared. Deep Sky Object List in MS-Excel is also available at <http://www.asahi-net.or.jp/~zs3t-tk/>.

Basic data (position, type, class, magnitude, size, and NGC description) of deep sky objects is based on Saguario Astronomy Club Database version 7.2, dated Aug. 5, 2000. The database is compiled by the Saguario Astronomy Club (pronounced sa-war-oh) in Arizona, U.S.A.

I selected deep sky objects for the star atlas considering the specification described in Section 2. Specification. I also include the all objects in the following catalogs. The list identifies the catalogs in which each object is included.

- Messier Objects
- Caldwell Objects

- The TAAS 200 Observing List
- The RASC's Finest N.G.C. Objects List
- Herschel 400 Objects
- Best Objects in the New General Catalog

The list also identifies the objects in "A catalog of deep-sky objects in 'Visual Astronomy of the Deep Sky'" and Herschel -II list.

6.1 Introduction of Deep Sky Object Catalogs

The information is obtained in the related websites.

6.1.1 Messier Catalog

Catalog of 109 deep sky objects by Charles Messier.

6.1.2 Caldwell Catalog

A list of 109 non-Messier objects prepared by Sir Patrick Caldwell-Moore. The list includes interesting objects in the whole sky.

Following is the introduction by Sir Patrick Caldwell-Moore.

"The idea of the Caldwell Catalogue came to me one night, after I had been observing the Moon (my own subject) and had looked casually at the Perseus Sword-Handle. This has no Messier number. (Messier catalogued nebulae as 'objects to avoid' during his comet searches, and in any case limited himself to the northern part of the sky.) There are many Messier clubs. Why not draw up a catalogue of bright nebular objects omitted by Messier?

I did so - and more or less on the spur of the moment, sent it off to Sky and Telescope. To my surprise it caught on, and by now everyone seems to use the Caldwell numbers. I could not use M numbers, because Messier and Moore begin with M - but my proper name is hyphenated (Caldwell-Moore), so I used C."

6.1.3 Best Objects in the New General Catalog

Catalog compiled by A.J. Crayon and Steve Coe, Version 1.0, dated January 4, 1990.

This list includes 110 NGC objects.

"This list is used by members of the Saguaro Astronomy Club of Phoenix, AZ. for the Best of the NGC achievement award."

6.1.4 Catalog of deep-sky objects in "Visual Astronomy of the Deep Sky", by Roger N. Clark

This catalog includes 611 deep sky objects.

Roger N. Clark writes:

"This appendix lists the 611 deep-sky objects that, in the author's opinion, are the most interesting for amateur astronomers. The list represents a search of the literature for objects that are both interesting to observe and also have photographs widely available.

In compiling this catalog, the first step was to check that an object might be seen through average amateur telescopes. Then I searched for those that might show some features. Many objects within range of small telescopes were left out because they are so near the limits that most would just look like another fuzzy patch. The present list has many of these (depending on your telescope size and sky quality), but many others clearly show significant detail and have much text devoted to them in books like Burnham's *Celestial Handbook*."

Codes:

"An asterisk (*) means the object is discussed in the book and a drawing and photograph are presented in Chapter 7. An S indicates the object is a star cluster with star magnitudes given in Appendix B Of *Visual Astronomy of the Deep Sky*. Exclamation points indicate the object is an especially fine-looking one, with four (!!!!) being the most spectacular visually."

6.1.5 Herschel 400

Following is the introduction by Paul Jones.

"For many years, Amateur Astronomers have enjoyed the challenge and excitement provided by the Messier Club of deep-sky objects. The 110 or so objects in the Messier Catalog introduced the observer to the importance of careful observing and record keeping. Upon completion of this project, however, the amateur was left somewhat in a void. He or she wanted to further the quest for deep-sky objects, but outside of the vast New General Catalog, there was no organized program that would provide that next vital step upward. With this idea in mind, the formation of the Herschel Club began."

"It started over four years ago, when several members of the Ancient City Astronomy Club in St. Augustine, Florida, who had recently completed the Messier Club noticed a letter in *Sky & Telescope* magazine from James Mullaney of Pittsburgh, Pennsylvania. Mr. Mullaney alerted amateurs to the William Herschel Catalog of deep-sky objects, and suggested this would be a

good project to get into after completion of the Messier Lists. He went on to say that Herschel's listings could be found in the original New General Catalog by Johann Dreyer, available from the Royal Astronomical Society in England.”

“The New General Catalog was a compilation of several deep-sky catalogs circa 1880; it contained almost 8,000 objects of which 2,477 of these objects were observed by William Herschel. Ancient City Astronomy Club (A. C. A. C.) members began the difficult process of separating his objects, which used a rather unique classification system with eight sub-categories; each individual object was placed into a particular subcategory. These subcategories are:

Class I - Bright Nebulae;

Class II - Faint Nebulae;

Class III - Very Faint Nebulae;

Class IV - Planetary Nebulae;

Class V - Very Large Nebulae;

Class VI - Very Compressed and Rich Clusters of Stars;

Class VII - Compressed Clusters of Small and Large Stars;

Class VIII - Coarsely Scattered Clusters of Stars.

“It was soon discovered that a vast majority of Herschel's objects were in Class II and III, faint and very faint nebulae, with magnitudes fainter than thirteen, beyond the reach of many amateur telescopes. We of the A.C.A.C. decided that the proposed Herschel Club should consist of enough objects to present a distinct challenge, yet still be within range of amateurs who possessed only modest equipment and were affected by moderate light-pollution problems. After considerable study, we set 400 as the best number of objects to comprise the Herschel Club. Our main references through this process were the Atlas of the Heavens and Atlas of the Heavens Catalog by Antonin Becvar. These two volumes are readily available to the amateur astronomer and contained all the positions, magnitudes and other pertinent data used in this manual.”

6.1.6 Herschel-II

“August 1997 saw a new addition to the Astronomical League's roster of certificate observing programs -- the Herschel II developed by the Rose City Astronomers of Portland, Oregon. Consisting of 400 of the 2,478 deep sky objects catalogued by William Herschel in the late 1700's, the Herschel II is the next level observing project after the Ancient City Astronomers'

Herschel 400 program. The Herschel II observing program is an advanced level project focused on improving observers' technical skills by taking thorough field notes and developing accurate technical object descriptions."

6.1.7 The RASC's Finest N.G.C. Objects List

The Royal Astronomical Society of Canada (RASC) compiled a list of 110 deep sky objects.

"The Royal Astronomical Society of Canada (RASC) has published this list in their yearly Observer's Handbook which is edited by Roy L. Bishop. The Finest N.G.C. Objects List was compiled by Alan Dyer; it is arranged sorted by seasons and constellations."

6.1.8 The TAAS 200 Observing List

"The Albuquerque Astronomical Society (TAAS) has created TAAS 200, a list of 'the best 200 non Messier objects easily visible from central New Mexico' (objects north of declination -48). This list was intended for intermediately experienced and equipped observers."

6.2 Information of Deep Sky Objects

The deep sky object list shows following information. Information in Tables 1 through 5 is taken from Reference [5].

- Object Name: See Table 1.
- Type: See Table 2.
- Constellation: See Table 3.
- Position in Equatorial Coordinate (Epoch 2000)
- Magnitude (Number only: visual magnitude, Number + p: photographic magnitude)
- Apparent Size in arc-minute (m) or arc-second (s)
- Position Angle (P.A.) for galaxy major axis
- Class: See Table 4.
- NGC Visual Description: See Table 5.
- Chart ID

7. About the Author

I, Toshimi Taki, live in a small city near Nagoya in Japan. I am an Aircraft Structure Engineer by profession.




I have been an amateur astronomer for over 30 years. I am a member of Oriental Astronomical Association, which is the oldest amateur astronomy club in Japan. I am interested in telescope

making and visual observation of deep sky objects. I wrote three articles in Sky and Telescope on telescope making.












E-mail Address: zs3t-tk@asahi-net.or.jp

Website: <http://www.asahi-net.or.jp/~zs3t-tk/>

Stars

Common Stars	Multiple Stars	Variable Stars
		

Deep Sky Objects

		Galaxies
		Bright Nebulae
		Dark Nebulae
		Planetary Nebulae
		Supernova Remnant
		Open Clusters
		Globular Clusters
		Quasars

Abbreviations**Stars**

Greek Letter: Bayer Letter

Number only: Flamsteed Number

Deep Sky Objects

Number only: NGC, New General Catalog of Nebulae & Clusters of Stars

Biur: Biurakan (open clusters)

Blanco: (open clusters)

Bochum: (open clusters)

C: Caldwell Catalog

Cr: Collinder (open clusters)

Fein: Feinstejn (open clusters)

Harvard: (open clusters)

Hogg: (open clusters)

I.: IC, 1st and 2nd Index Catalogs to the NGC

Lynga: (open clusters)

M: Messier Catalog (all types of objects)

Mel: Melotte (open clusters)

Pismis: (open clusters)

PK: Perek & Kohoutek (planetary nebulae)

Ru: Ruprecht (open clusters)

Sh: Sharpless (bright nebulae)

Steph: Stephenson (open clusters)

Stock: (open clusters)

Tr: Trumpler (open clusters)

Figure 1. Symbols

Table 1 (1/3). Abbreviations for Object Name

Abell	George Abell (planetary nebulae and galaxy clusters)
ADS	Aitken Double Star catalog
AM	Arp-Madore (globular clusters)
Antalova	(open clusters)
Ap	Apriamasvili (planetary nebulae)
Arp	Halton Arp (interacting galaxies)
Bark	Barkhatova (open clusters)
B	Barnard (dark nebulae)
Basel	(open clusters)
BD	Bonner Durchmusterung (stars)
Berk	Berkeley (open clusters)
Be	Bernes (dark nebulae)
Biur	Biurakan (open clusters)
Blanco	(open clusters)
Bochum	(open clusters)
Ced	Cederblad (bright nebulae)
Cr	Collinder (open clusters)
Czernik	(open clusters)
DDO	David Dunlap Observatory (dwarf galaxies)
Do	Dolidze (open clusters)
DoDz	Dolidze-Dzimselejsvili (open clusters)
Dun	Dunlop (globular clusters)
Fein	Feinstein (open clusters)
Frolov	(open clusters)
Gum	(bright nebulae)
H	William Herschel (globular clusters)
Haffner	(open clusters)
Harvard	(open clusters)
He	Henize (planetary nebulae)
Hogg	(open clusters)
HP	Haute Provence (globular clusters)
Hu	Humason (planetary nebulae)

Table 1 (2/3). Abbreviations for Object Name

IC	1st and 2nd Index Catalogs to the NGC (All types of objects except dark nebulae)
Isk	Iskudarian (open clusters)
J	Jonckheere (planetary nebulae)
K	Kohoutek (planetary nebulae)
King	(open clusters)
Kr	Krasnogorskaja (planetary nebulae)
Lac	Lacaille (globular clusters)
Loden	(open clusters)
LDN	Lynds (dark nebulae)
Lynga	(open clusters)
M	Messier (all types of objects except dark nebula)
MCG	Morphological Catalog of Galaxies
Me	Merrill (planetary nebulae)
Mrk	Markarian (open clusters and galaxies)
Mel	Melotte (open clusters)
M1 thru M4	Minkowski (planetary nebulae)
NGC	New General Catalog of Nebulae & Clusters of Stars. (All types of objects except dark nebulae)
Pal	Palomar (globular clusters)
PC	Peimbert and Costero (planetary nebulae)
Pismis	(open clusters)
PK	Perek & Kohoutek (planetary nebulae)
RCW	Rodgers, Campbell, & Whiteoak (bright nebulae)
Roslund	(open clusters)
Ru	Ruprecht (open clusters)
Sa	Sandqvist (dark nebulae)
Sher	(open clusters)
Sh	Sharpless (bright nebulae)
SL	Sandqvist & Lindroos (dark nebulae)
SL	Shapley & Lindsay (clusters in LMC)
Steph	Stephenson (open clusters)
Stock	(open clusters)

Table 1 (3/3). Abbreviations for Object Name

Ter	Terzan (globular clusters)
Tombaugh	(open clusters)
Ton	Tonantzintla (globular clusters)
Tr	Trumpler (open clusters)
UA	Catalog of selected Non-UGC galaxies
UGC	Uppsala General Catalog (galaxies)
UKS	United Kingdom Schmidt (globular clusters)
Upgren	(open clusters)
VV	Vorontsov-Velyaminov (interacting galaxies)
VdB	van den Bergh (open clusters, bright nebulae)
VdBH	van den Bergh & Herbst (bright nebulae)
vdB-Ha	van den Bergh-Hagen (open clusters)
Vy	Vyssotsky (planetary nebulae)
Waterloo	(open clusters)
Westr	Westerlund (open clusters)
Zw	Zwicky (galaxies)

Table 2. Object Type

ASTER	Asterism
BRTNB	Bright Nebula
CL+NB	Cluster with Nebulosity
DRKNB	Dark Nebula
GALCL	Galaxy cluster
GALXY	Galaxy
GLOCL	Globular Cluster
GX+DN	Diffuse Nebula in a Galaxy
GX+GC	Globular Cluster in a Galaxy
G+C+N	Cluster with Nebulosity in a Galaxy
LMCCN	Cluster with Nebulosity in the LMC
LMCDN	Diffuse Nebula in the LMC
LMCGC	Globular Cluster in the LMC
LMCOC	Open cluster in the LMC
NONEX	Nonexistent
OPNCL	Open Cluster
PLNNB	Planetary Nebula
SMCCN	Cluster with Nebulosity in the SMC
SMCDN	Diffuse Nebula in the SMC
SMCGC	Globular Cluster in the SMC
SMCOC	Open cluster in the SMC
SNREM	Supernova Remnant
QUASR	Quasar
#STAR	# Stars (#=1, 2, 3, 4, 5, etc.)

Table 3. Constellation Names and Abbreviations

Andromeda	And	Equuleus	Equ	Pyxis	Pyx
Antlia	Ant	Eridanus	Eri	Reticulum	Ret
Apus	Aps	Fornax	For	Sagitta	Sge
Aquarius	Aqr	Gemini	Gem	Sagittarius	Sgr
Aquila	Aql	Grus	Gru	Scorpius	Sco
Ara	Ara	Hercules	Her	Sculptor	Scl
Aries	Ari	Horologium	Hor	Scutum	Sct
Auriga	Aur	Hydra	Hya	Serpens	Ser
Bootes	Boo	Hydrus	Hyi	Sextans	Sex
Caelum	Cae	Indus	Ind	Taurus	Tau
Camelopardalis	Cam	Lacerta	Lac	Telescopium	Tel
Cancer	Cnc	Leo	Leo	Triangulum	Tri
Canes Venatici	CVn	Leo Minor	LMi	Triangulum Australe	TrA
Canis Major	CMA	Lepus	Lep	Tucana	Tuc
Canis Minor	CMi	Libra	Lib	Ursa Major	UMa
Capricornus	Cap	Lupus	Lup	Ursa Minor	UMi
Carina	Car	Lynx	Lyn	Vela	Vel
Cassiopeia	Cas	Lyra	Lyr	Virgo	Vir
Centaurus	Cen	Mensa	Men	Volans	Vol
Cepheus	Cep	Microscopium	Mic	Vulpecula	Vul
Cetus	Cet	Monoceros	Mon		
Chamaeleon	Cha	Musca	Mus		
Circinus	Cir	Norma	Nor		
Columba	Col	Octans	Oct		
Coma Berenices	Com	Ophiuchus	Oph		
Corona Australis	CrA	Orion	Ori		
Corona Borealis	CrB	Pavo	Pav		
Corvus	Crv	Pegasus	Peg		
Crater	Crt	Perseus	Per		
Crux	Cru	Phoenix	Phe		
Cygnus	Cyg	Pictor	Pic		
Delphinus	Del	Pisces	Psc		
Dorado	Dor	Piscis Australis	PsA		
Draco	Dra	Puppis	Pup		

Table 4. Class**1. Open Clusters ----Trumpler type for open clusters-----****(1) Concentration**

- I. Detached, strong concentration toward the center
- II. Detached, weak concentration toward the center
- III. Detached, no concentration toward the center
- IV. Not well detached from surrounding star field

(2) Range in brightness

- 1. Small range
- 2. Moderate range
- 3. Large range

(3) Richness

- p Poor (<50 stars)
- m Moderately rich (50-100 stars)
- r Rich (>100 stars)

(3) Nebulosity

An "n" following the Trumpler type denotes nebulosity in cluster

2. Globular Clusters ----Shapley-Sawyer concentration rating for globular clusters---**(1) Concentration**

The values range from 1 to 12, smaller numbers are more concentrated clusters.

3. Planetary Nebulae ----Vorontsov-Velyaminov type for planetary nebulae-----

- 1. Stellar
- 2. Smooth disk (a, brighter center; b, uniform brightness; c, traces of ring structure)
- 3. Irregular disk (a, very irregular brightness distribution; b, traces of ring structure)
- 4. Ring structure
- 5. Irregular form similar to diffuse nebula
- 6. Anomalous form, no regular structure

Some very complex forms may combine two types.

4. Galaxies -----Hubble type for galaxies-----

- E elliptical, E0 is roundest to E7 is flattest
subgroups; 'd' is dwarf, 'c' is supergiant, 'D' has diffuse halo
- S Spiral, 'a' has tightly wound arms, 'b' has moderately wound arms and 'c' has loosely wound arms
- SB Spiral with central bar
- Ir Irregular

Table 5. NGC Visual Description

!	remarkable object	neb	nebula, nebulosity
!!	very remarkable object	nf	north following
11m	11th magnitude	np	north preceding
8...	8th mag and fainter	p	pretty (before F,B,L,S)
9...13	9th to 13th magnitude	p	preceding
am	among	P	poor
att	attached	P w	paired with
B	bright	R	round
b	brighter	r	not well resolved
bet	between	Ri	rich
C	compressed	rr	partially resolved
c	considerably	rrr	well resolved
Cl	cluster	S	small
D	double	s	suddenly
def	defined	s	south
deg	degrees	sc	scattered
diam	diameter	sf	south following
dif	diffuse	sp	south preceding
E	elongated	st	star or stellar
e	extremely	susp	suspected
er	easily resolved	v	very
F	faint	var	variable
f	following		
g	gradually		
iF	irregular figure		
inv	involved		
irr	irregular		
L	large		
l	little		
M	middle		
m	much		
mag	magnitude		
n	north		
N	nucleus		