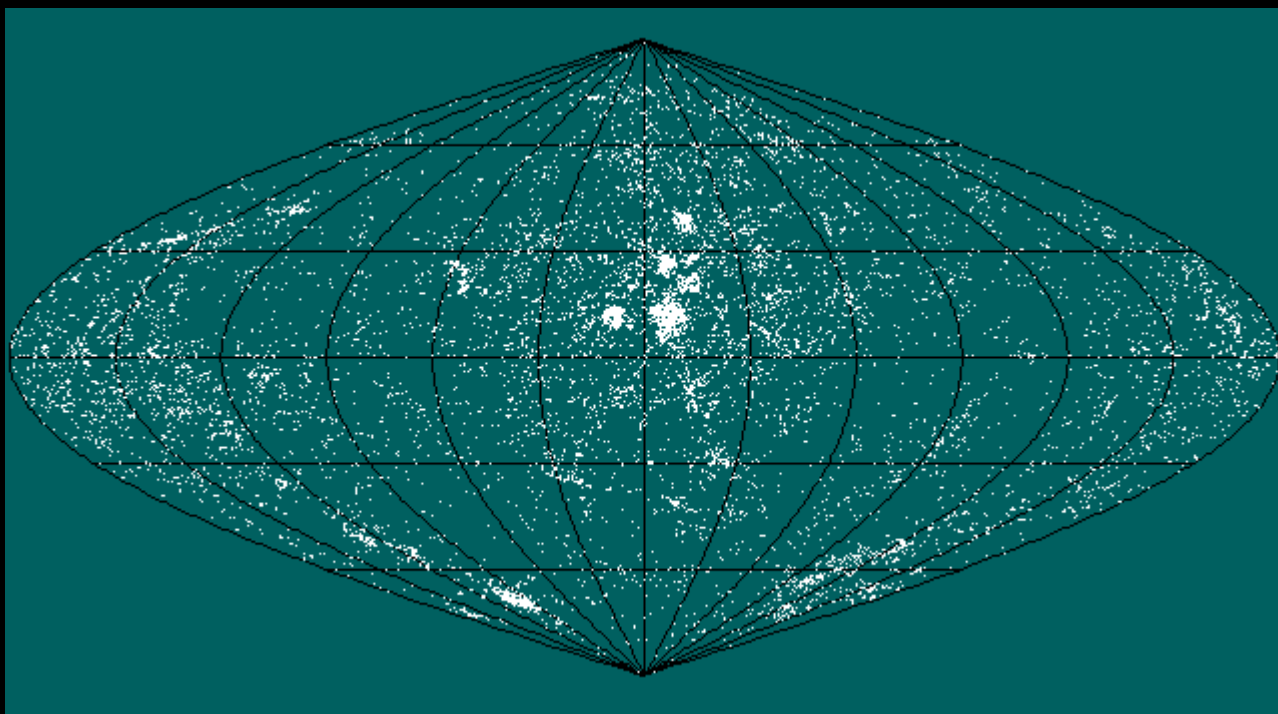


Revised New General Catalogue and Index Catalogue

Wolfgang Steinicke

Version: January 27, 2003

To my wife Gisela



Pot of all NGC and IC objects (equatorial system). The "clusters" seen are partly due to selection effects (see text)

The Revised New General Catalogue and Index Catalogue contains and describes all objects of the original NGC/IC compiled by Dreyer. In addition many new objects (named with extension letters) or companions are included, so the catalogues list exactly 14000 entries. All known data, cross identifications and individual names are presented. The problem of existence, quality of the data and of double or multiple entries is discussed. For all objects, except some large open clusters or galactic nebulae, precise positions are given. Some 12700 positions were determined using the Digital Sky Survey and RealSky, also many magnitudes, sizes and position angles. So a great amount of the presented data is new. The equinox is 2000.0.

Table of contents

Preface to the new edition

[1 Introduction](#)

[2 The NGC/IC Project](#)

[3 Content and structure of the catalogue](#)

[3.1 Overview](#)

[3.2 NGC/IC-numbers, extension letters and components](#)

[3.3 Status of identification](#)

[3.4 Coordinates and constellations](#)

[3.5 Magnitudes, sizes, position angle and type](#)

[3.6 Identifications and remarks](#)

[4 Literature](#)

[5 Revised New General Catalogue](#) (ASCII data)

[6 Revised Index Catalogue](#) (ASCII data)

Preface to the new version

Two years has passed since the publication of the last version of the *Revised New General Catalogue and Index Catalogue* in February 2001. These data are included e.g. in Guide 8.0, SkyMap Pro 7.0, Starry Night, Eye&Telescope, the SAC database and the database of the Losmandy mounting.

At the same time the *NGC/IC Project* (see chapter 2) has grown and new results came up. Outstandig are Harold Corwin's *Precice Position List* [6] and *NGC/IC Puzzle Solutions* [7] and the *Identity Survey of IC Galaxies* by Malcom Thomson [31]. Corwin's and Thomson's work has been carefully compared with my results. As usual some errors were found and corrected. The present database is in maximum agreement. The data were compared also with the new *Deep Sky Field Guide* of the Uranometria II, published in 2002. But not only the desktop activities contributed to the project, but also visual inspections, e.g. by Steve Gottlieb, helping to clear some critical cases.

The design of the catalogue has not essentially changed. The number of entries in my NGC/IC database has grown slightly from 13993 to 14000. The amount of objects with status "not found" is quite constant with 2.5%. We are

Wolfgang Steinicke, Umkirch

January 2003

1 Introduction

The present work contains all objects listed in Dreyer's [12] *New General Catalogue* (NGC), published in 1888 and its two supplements, the *Index Catalogue*, published in 1895 (IC I), and the *Second Index Catalogue*, published in 1908 (IC II). The NGC contains 7840 nonstellar objects, the IC I and IC II add another 1520 and 3866 objects, respectively.

The historic catalogues collect nonstellar objects, discovered by different observers over the centuries. The history of the NGC/IC is reviewed in detail by Corwin (NGC/IC Project) and Thomson [31]. The NGC and the IC I contain all objects found *visually* up to 1895, regardless of their magnitudes, sizes or various types. This naturally implies a great inhomogeneity. Modern catalogues, e.g. Nilson's UGC [20], are homogenous samples based on precise definitions. Nilson gives also a short survey of the history of catalogues of galaxies (UGC, p. 449). The IC II is of even greater inhomogeneity. The main reason is the advent of photography at the beginning of the century. Beside new nonstellar objects found visually up to 1908, Dreyer included all objects found on plates, taken e.g. by Max Wolf with the Bruce-Astrograph at Heidelberg Observatory. There are crowded "photographic areas" in the IC II, rivaling with real clusters (Virgo, Coma, Fornax; see front cover). A considerable amount of this faint objects (down to 18^{mag}) are not listed in any modern catalogue, being *unverified* for a long time.

Dreyer was aware, that his data contain many errors. He published lists of corrections. Later Reinmuth [25], Carlson [3] and others made corrections. Modern revisions of Dreyer's catalogues were published by Sulentic and Tiff (1977) and by Sinnott (1988). The *Revised New General Catalogue* (RNGC) by Sulentic and Tiff [29] is an attempt to update the NGC, listing all objects with 1975 positions. Sinnott [27] was the first (exactly 100 years) after Dreyer, who lists the complete NGC/IC with all 13226 objects. His *NGC 2000.0* gives positions for the equinox 2000.

My own work starts around 1981 with the compilation of the *Revised Index Catalogue*, a rather criminalistic work, done by scanning a printed version of Dixon's monumental "Master List" [11]. This sounds rather unscientific, but a digital approach was out of reach at that time. It soon becomes clear, that there is a large number of unverified objects and many misidentifications in the literature. A considerable number of IC-objects are identical to existing NGC-objects, and there are IC-objects which appear twice (or even multiple) in the IC. The confusion is due to the fact that the NGC and both IC parts are inhomogenous samples, covering the whole sky independently (sorted by right ascension).

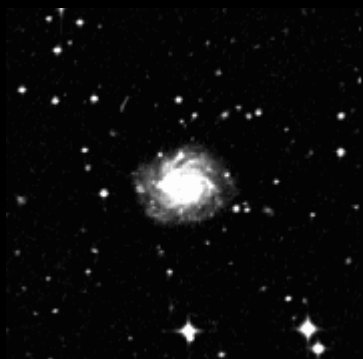
During the revision of the IC, it becomes evident, that the same work has to be done for the 7840 NGC-objects. The confusion found in the IC is also present in the NGC and there are disturbing correlations between both catalogues.

Beside the contributions from the NGC/IC Project, which is described in the next chapter, identifications of NGC/IC-objects are based on various sources (described in chapter 3), charts and photos. All objects were visually inspected with RealSky [23] or the Digital Sky Survey [24]. For galaxies the major datasets were consulted, e.g. PGC/LEDA [21], UGC [20], MCG [33], CGCG [34], RC3 [10] and NED, the *Nasa/IPAC Extragalactic Database* and the new DSFG [8]. A number of bright NGC- and IC-galaxies is illustrated in the *Carnegie Atlas of Galaxies* by Sandage and Bedke [26], which includes all objects listed in the Shapley-Ames catalogue.

The result presented here is not comparable to the work of Sulentic and Tiff or of Sinnott, which often failed to clear a confusing case or even totally missed it. Both datasets contain many errors. Examples are given in Steve Gottlieb's *Corrections to the RNGC* [14] and in Fig. 1. Another one is IC 4274. The NGC 2000.0 gives Decl=-25°, but this must be Decl=-65°, leading to the identity IC 4274 = NGC 5189.

The new catalogue contains all available data and cross identifications. Missing or inaccurate data for galaxies (magnitude, size, position angle) were completed. Chapter 3 describes the content and structure of the catalogue and explains the columns (fields). Chapter 4 lists the literature, and the chapters 5 and 6 are the main parts: the data.

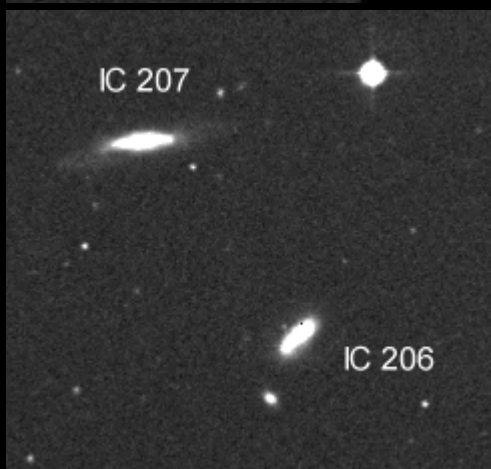
Fig. 1 - Examples of identified objects.



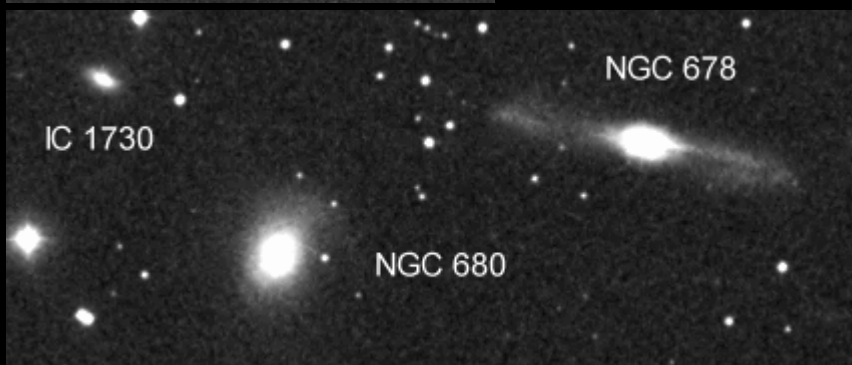
NGC 6993 - The object is declared as "not found" in the RNGC and so the type is "-" in Sinnott's book. But actually NGC 6993 is a bright Sc galaxy (13.8 mag) in Capricornus.



IC 252 - Sinnott does not identify the object (type "blank"), but actually this is a pretty bright double galaxy with a total magnitude of 15.5 mag, located in Cetus. The object is not listed in the PGC or in any other catalogue! The south following lenticular galaxy is "anonymous".



IC 206/207 - Sinnott does not identify both objects (type "blank"). Actually this is a rather "prominent" pair of bright galaxies in Cetus with magnitudes 13.1 mag and 12.8 mag. The (known) identifications are IC 206 = MCG -1-6-53 = PGC 8238 and IC 207 = MCG -1-6-54 = PGC 8251.



NGC 678 - This case is based on an identification problem mentioned in the *Carnegie Atlas of Galaxies* [26], panel 152. The coordinates of the edge-on galaxy named A0147+21 were incorrect, so this interesting object (noted by Allan Sandage) could not be found again. I identified it with NGC 678 = UGC 1280, a bright galaxy (13.3mag) in Aries, accompanied by NGC 680 and IC 1730.

The aim of the NGC/IC project, headed by Dr. Harold G. Corwin jr. (Pasadena/USA), is to clean the historical NGC and IC. All investigations start from the historical data, e.g. the observer's publications. Dreyer's data are often not consistent. There are puzzles (see e.g. [7], [31]), which are hard to solve, or will never be solved, because the historical data are too poor (e.g. the IC 919 group in Ursa Major in the center of galaxy cluster Abell 1783). An example of a solved problem (by Harold Corwin) is NGC 3518, which position was found to be in error by 1h in right ascension, leading to the final identity NGC 3518 = NGC 3110 = NGC 3122.

The present work has been done as part of the project, to get accurate positions and to fill large gaps in the data. Up to now, core team members have presented major contributions to the problem of the NGC/IC identities. Most famous are Malcolm Thomson's *Identity Survey of IC Galaxies* [31], Harold Corwin's *Precise Position List* [6] and *NGC/IC Puzzle Solutions* [7], and Steve Gottlieb's *Corrections to the RNGC* [14]. Over the last years I checked all objects. Many errors were found by me and others. E.g. IC 3400, listed as a 16.2 mag galaxy, is actually a star of 10^{mag}! It is often useful to inspect critical cases by visual observations, as Steve Gottlieb does to simulate the historic situation. In spite of using digital tools like CCD, Internet and CD-ROM in astronomy, the value of visual observing is still high - particularly for the NGC/IC cleaning process! The DSS is often helpful, but it can cause wrong results. Due to the fact, that the photographic and visual magnitudes of nonstellar objects differ and also that the optical image of diffuse objects looks quite different through a telescope or on a photo.

Although the team member's approaches do not totally agree, most identifications are confirmed within the group. But some still vary and this supports many valuable discussions, leading (perhaps) to a final result!

3 Content and structure of the catalogues

3.1 Overview

The present work consists of two parts: the *Revised New General Catalogue*, listing all 7840 NGC-objects and the *Revised Index Catalogue*, listing all 5386 IC-objects (the first and final objects are shown in Fig. 2 and 3).

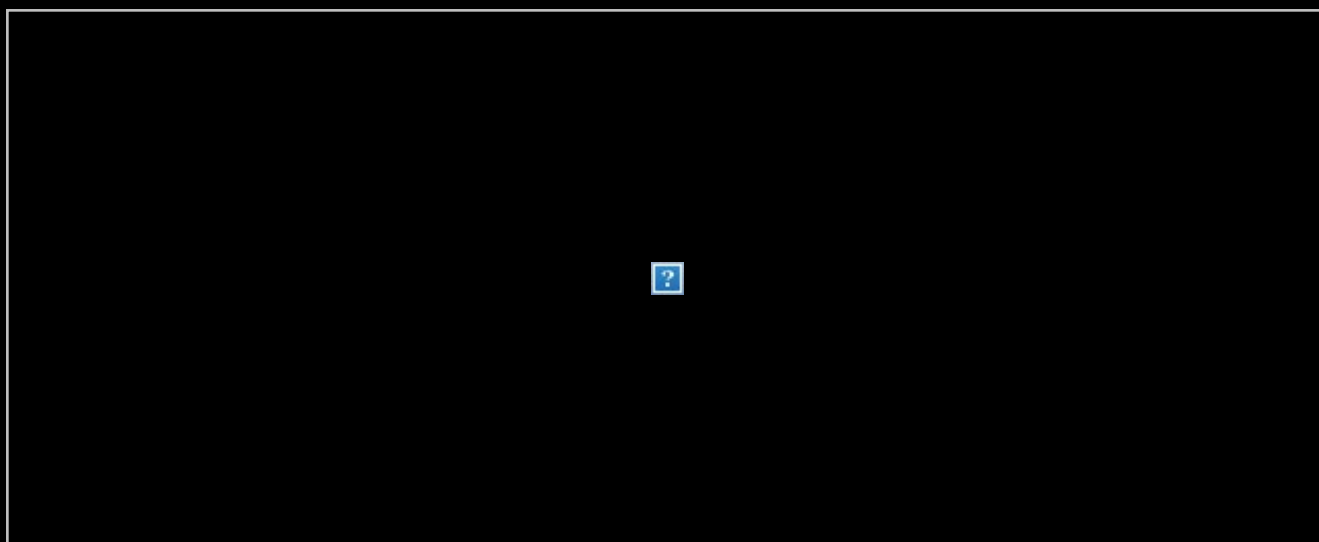


Fig. 2 - The first entries are located in Pegasus: the „classical" pair of galaxies NGC 1 / NGC 2, and IC 1, a pair of stars.

Both parts use the same arrangement of columns (fields). The catalogue fields are listed in Tab. 1, discussed in detail in the following sections. Due to the confusion in the original NGC/IC it should be better to talk about *entries* (or identities), rather than *objects*. Many entries in the NGC/IC cannot be found or are *non-existent*, the classical example is NGC 7088, called "Baxendell's unphotographable nebula". The number of *existing* objects in both catalogues is smaller than the number of entries. A fact which is often ignored by modern computer-telescope databases, used to punch-in the desired object for automatic positioning. In the case of NGC 7088 you will see a blank field, in other cases (see below) you will run into confusion.

Tab. 1 - Explanation of the catalogue fields

Field	Explanation
NGC, IC	NGC- or IC-number. Some objects have an <i>extension letter</i> (A,B,C,...).
C	Components. If two or more <i>different</i> objects use the <i>same</i> NGC- or IC-number, these are numbered as components (1,2,3,...). This is also applied for objects associated with the main entry.
D	Dreyer Object. A * marks, that this is the object which is ment in Dreyer's catalogue (many objects with extension letters are not in the original NGC/IC).
X	Second Line. If more then one line is used for an object (if the space for identifications is not sufficient) the lines are counted (1,2) here.
S	Status. Status of the identification (see Tab. 2)
P	Precision. Flag for high precision position
CON	Constellation
alpha, delta	Right ascension, declination. Equinox J2000.0
Bmag	Photographic (blue) magnitude
Vmag	Visual magnitude
SB	Surface brightness
a, b	Larger/smaller diameter ("). If only one value (a) is given, this refers to the maximum size.
PA	Position angle (°). The position angle is only relevant for galaxies, and given if possible.
Type	Type of object
PGC	PGC-number. Object listed in the <i>Catalog of Principle Galaxies</i> [22]
ID1, ID2, ID3	Identifications
Remarks	Additional information

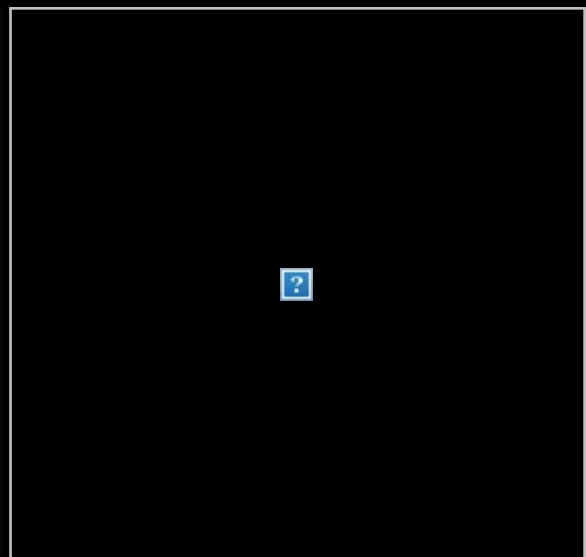
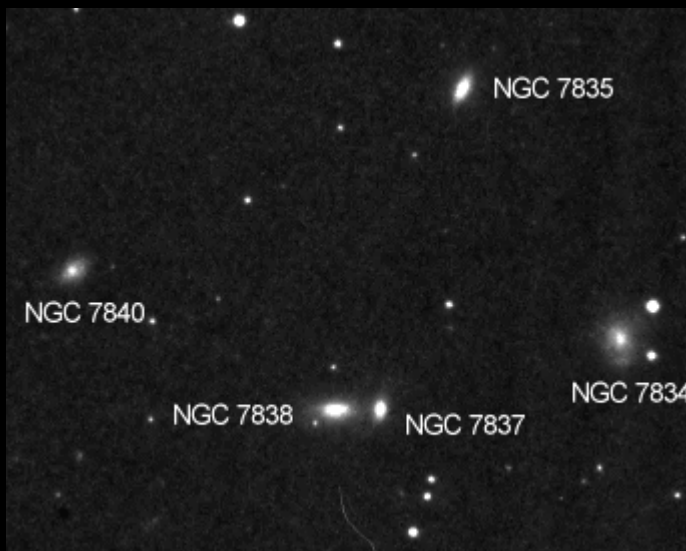


Fig. 3 - The final entries in the catalogues are located in Pisces: NGC 7840 in a small group of NGC-galaxies (all found at Malta by Albert Marth), and the galaxy IC 5386, which is identical to NGC 7832 (seen by Swift and Howe and discovered earlier by William Herschel).

3.2 NGC/IC-numbers, extension letters and components

The catalogues are sorted by NGC- and IC-number respectively (taking into account the extension letters). The NGC2000.0 sorts the objects by right ascension, but this is rather awkward, because the precision of the coordinates listed there is rather poor.

There is a considerable number of double/multiple identifications: one object has different NGC- or IC-numbers

(or both). Examples are the southern galaxy IC 2624 = NGC 3497 = NGC 3525 = NGC 3528 in the constellation Crater or "Barnard's galaxy" NGC 6822 = IC 4895. All these *internal* identifications are given in the catalogues.

Even more trouble results from the use of extension letters (e.g. IC 3481A), which were introduced during the last decades to denote new objects in the vicinity, not listed in the original catalogues. In a few cases an original entry is split into two or more names with different extensions, such as NGC 61 in Cetus, which is now NGC 61A *and* NGC 61B (both are galaxies), or the galaxies in Seyfert's Sextett (NGC 6027A to NGC 6027E = VV 115; the diffuse extension north-west of NGC 6027B was thought by Seyfert to be a sixth galaxy).

In some cases the original name is retained, but extension letters are added to denote fainter objects in the vicinity, e.g. NGC 3250, a galaxy in Antila which is surrounded by 5 companions named NGC 3250A thru NGC 3250E. In one case the extension letter denotes a direction: the "S" in NGC 2175S means "south", denoting a small open cluster south of the open cluster NGC 2175.

The field C is used to distinguish individual components. Double or multiple systems are split into different components, all with individual data. If extension letters are present, two or more entries are possible, e.g. NGC 78 with C=1 (=NGC 78A), NGC 78 with C=2 (=NGC 78B) and the entries for NGC 78A and NGC 78B itself.

The included entries with extension letters and different components rise the number of objects, while the internal identifications lowers it. The net number (which is by now impossible to calculate) of "real" objects in both catalogues - not regarding the question of existence here - is considerable lower than 13226 (the sum of the original NGC- and IC-entries). The total number of entries in the Revised NGC/ IC is 13993 (see Tab. 2).

Not all objects in the catalogue are in Deyér's original NGC/IC. To assign the identity a * is used in column D.

3.3 Status of identification

The field S describes the status of identification, as explained in Tab. 2. Objects with S=1 to 5 are the *very* NGC/IC objects (sum: 7540 = 89.3 %, 4310 = 77.6 %).

Tab. 2 - Explanation of the field *S* and number of entries in the Revised NGC and IC.

S	Explanation	NGC	%	IC	%
1	Galaxy	6495	76.9	4125	74.3
2	Galactic nebula, Supernova remnant	140	1.7	102	1.8
3	Planetary nebula	96	1.1	36	0.7
4	Open cluster	690	8.2	39	0.7
5	Globular cluster	118	1.4	8	0.1
6	Part of galaxy (e.g. bright HII regions)	28	0.3	22	0.4
7	Object already in the NGC- or IC	360	4.3	86	1.5
8	IC-object already in the NGC	22	0.3	253	4.6
9	Star(s)	383	4.5	633	11.4
10	Not found	115	1.4	249	4.5
	Sum	8447		5553	

Objects with S=6 are parts (often bright HII regions) of a large galaxy. Examples are NGC 588, NGC 592, NGC 595 and NGC 604, which are HII regions in M 33 = NGC 598 or IC 3550, 3551, 3552, 3555 and 3563, which are parts of NGC 4559. One could assign these objects a status S=7, which I did not.

If an NGC (or IC) object appears twice or more in the NGC (or IC), all entries with higher NGC (or IC) number carry a status S=7, e.g. NGC 34 (S=7), which is the same as NGC 17 (S=1). All data for these entries are equal. There is a curious example in the IC, which I call the "Swift-Barnard battle" near Algol: the objects involved are IC 290, 292, 293, 294, 295 and 296, all observed by Swift, and IC 1883, 1884, 1887, 1888 and 1889, all observed

by Barnard. Following Corwin [6], the identities are: IC 290 = IC 1884, IC 292 = IC 1887, IC 293 = IC 1888 and IC 294 = IC 296 = IC 1889 which might be also identical to IC 295, further IC 1883 = NGC 1212 (for different view see [31]).

Status S=8 is given for crossover identities bewteen NGC and IC; in the last example: IC 1883 (S=8) and NGC 1212 (S=1). The reverse case is only applied, if the NGC object does not belong to the original set, e.g. NGC 161A (S=8) is identical to IC 1563 (S=1).

Entries with S=9 are stars, e.g. the famous pair of stars IC 1 (Fig. 2) in Pegasus. One of the brightest stars in the NGC (see Tab. 3) is CVn = NGC 4530. John Herschel suspected some nebulosity around it, which does not exist. S=9 applies also for star groups (asterisms), which are different from real clusters (with S=4). Fig. 4 shows the case of IC 5268 in Lacerta. The IC description is "B, S" (bright, small); Sinnott does not identify the object (type "blank"). Actually this is an asterism with 6 stars involved, too poor to be an Open Cluster or not physically related.

Tab. 3 - The brightest stars in the NGC (the brightest star in the IC is IC 3408 with mag 9.5).

Object	Star	Magnitude (V)
NGC 771	50 Cas	4.0
NGC 4530	CVn	4.3
NGC 2542	19 Pup	4.7
NGC 2142	3 Mon	5.0

Entries with S=10 are not found. Tab. 2 shows, that this applies only to 364 cases (2.6%) in the NGC/IC. Calling these entries "non existent", as the RNGC often does, may be correct. But in some cases, the object could exists at another place, due to observing errors or errors in compiling the NGC/IC. IC 5126 (Fig. 4) in Aquarius is an example. Sinnott does not identify this object (type "blank"). The IC description reads "vF, vS, R, between 2 st 14", which assigns a very faint, very small, round object located between 2 stars of 14^mag. The position is marked with a "+", but there is no object, it exists nearly 1° south.

It is also incorrect to declare the nearest anonymous object as the missing one. As already mentioned, critical cases - also those already "fixed" in the literature - should be carefully investigated with the help of the historical sources. The NGC/IC Project is working on all these "puzzles".



Fig. 4 - Top: IC 5268, an asterism in Lacerta (s=9; type: *Grp). Bottom left: IC 5126 in Aquarius; at the nominal position there is no nonstellar object. Bottom Right: IC 5126 is a confirmed galaxy at a different position (identification by Harold Corwin, as noted by Malcom Thomson [31]).

The coordinates are given for the modern equinox 2000.0 (the most northern and southern objects are shown in Fig. 6). The positions for objects with status S=1,6,7,8,9 or 10 are determined with RealSky [23] or DSS [24]. Normally the center of brightness or morphology is used. For large objects (galaxies, star groups or clusters) the center is not well defined. In case of double stars with comparable brightness the geometric center is measured, otherwise the position of the brighter component is given. A total of 12632 accurate positions were measured, flagged by '1' in the field P. Coordinates for globular clusters are from Harris [15]. For planetary nebulae precise coordinates were determined by Brian Skiff [28]. Coordinates for "diffuse" objects like gaseous nebulae or open clusters are adapted from various sources.

With RealSky positions can be measured to an accuracy of 1-2". The result was compared with the Lick Northern Proper Motion Survey Galaxy Calalogue (NPM1G) [18], the new list of MCG positions from Corwin [5], with the GSC and the ESO data [19]. The comparison with the GSC was made by Steve Gottlieb, finding a systematic shift of 2.5" towards the south (Fig. 5 left), due to an internal "problem" of the RealSky software. This shift was corrected.

The comparison with the ESO/Uppsala positions is the first global check of Laubert's measurements in the late 70's (Fig. 5 right). The average values of the absolute differences are 3.8" in Rect and 3.5" in Decl. The center of the cloud is at (+0.2",-2.0"), the shift is also present here! It is also noticable, but with a lower value of 1.5" in the differences RealSky-NPM1G. It seems to me, that the positions determined with the Digital Sky Survey are better.

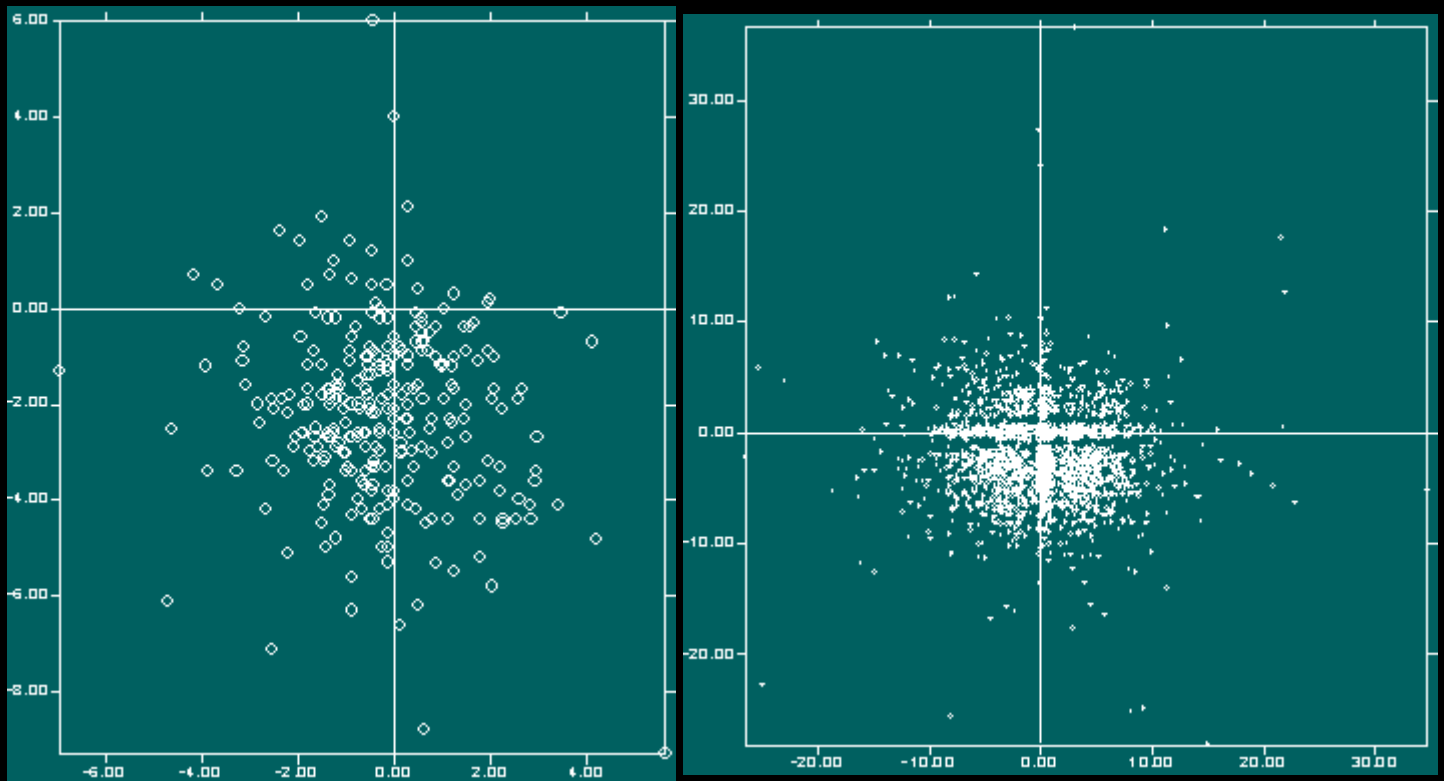


Fig. 5 - Coordinate differences in arcsec between this catalogue (RealSky measurements) and the GSC (left) and ESO/Uppsala (right).

The constellation is calculated from the borders given by the IAU. Most NGCs are located in Virgo (675), only 4 NGCs are in Chamaeleon and Equuleus. Most ICs are located in Coma (690), no IC is in Circinus or Crux.

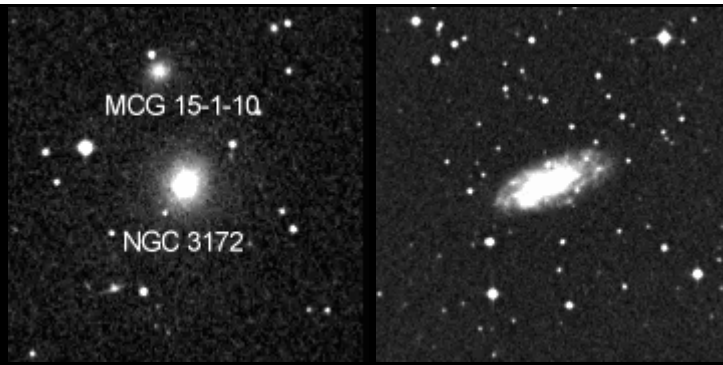


Fig. 6 - The most northern and most southern entries in the catalogues are both galaxies: NGC 3172 in Ursa Minor ("Polarisima borealis") and NGC 2573 in Octans ("Polarissima australis").

3.5 Magnitudes, size, position angle and type

The data for magnitudes, sizes, position angles and types for NGC/IC-objects are incomplete in the literature. Using RealSky and DSS gaps were filled.

The magnitudes listed in the field Bmag are photographic (blue), based on plate inspections/measurements (ZWG, MCG, ESO, DSS and RealSky). The faintest object is shown in Fig. 7. One new source is the NPM1G [18] which gives precise positions and magnitudes. In some cases the magnitudes between PGC, UGC and NPM1G differ by more than 2^{mag} (the rms-error between PGC and NPM1G is 1.0 mag; mostly the PGC lists the brighter magnitude). In case of a galaxy with compact core and diffuse halo the difference to NPM1G is comprehensible (due to the digital plate measuring process), otherwise the reason is unclear. Examples are IC 983: PGC 12.5 mag, UGC 14.3 mag, NPM1G 14.7 mag or NGC 3074: PGC 13.4 mag, UGC 14.8 mag, NPM1G 16.0 mag.

The magnitudes listed in the field Vmag are visual. If these - in the case of galaxies - are not given in the literature (e.g. the RC3 [10]), Vmag is calculated using the type of the galaxy as described e.g. in the DSFG [8].

The magnitude listed in the field SB is the calculated surface brightness for galaxies (see the RC3 [10] or the DSFG [8]).

The data for sizes and position angles, particularly in the IC, are very incomplete (fields a, b and PA). The data given here (together with magnitude estimates) come from inspection of the DSS and RealSky. There are no gaps remaining. The value for "a" gives 0.01' resolution because some planetaries are very small (Fig. 7). If only one the greater diameter is given, it refers to the maximum size. There is a curiosity concerning the PA in the PGC for MCG galaxies which are neither in the UGC nor in the ESO catalogue: many PA values must be mirrored at 90°. E.g. NGC 4626: the PGC gives PA = 145° but the correct value is PA = 35°, or take NGC 779 (20° to 160°). This was also noticed by Karachentsev [17].

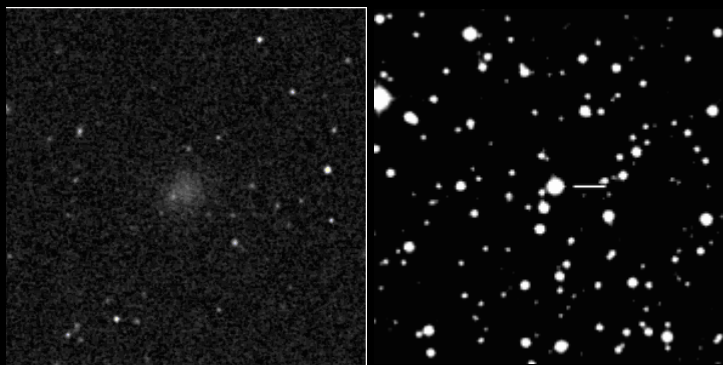


Fig. 7 - Magnitude (Bmag) and sizes: among the faintest objects is the dwarf galaxy IC 4107 (left), discovered by Wolf, in Coma Berenices with 18.5mag (the brightest object is the open cluster IC 2602 with 1^m.9, the "Southern Pleiades" in Carina). Some planetaries are very small, e.g. NGC 6833 in Cygnus (right) with only 1" in diameter (largest object: NGC 292, the Small Magellanic Cloud, with 319' x 205').

The field Type (see Tab. 4) corresponds to the status and gives further informations. The most complex type information is given for galaxies (e.g. the Hubble type), mainly adapted from UGC, ESO and PGC or determined by own estimation. Generally types differ between various sources. There is a special type for ring galaxies, following Thompson [30]. Types for open clusters are included according to Trümpler's classification. For globular clusters the concentration class (I...XII) is given.

Tab. 4 - Abbreviations used in the field type

Type	Explanation
*, *2,...,*Grp	Star, double star,...,star group (asterism)
C, D, E, I, P, S	Galaxy: compact, dwarf, elliptical, irregular, peculiar, spiral (d=dwarf, B=bar, R=ring, M=mixed); other letters: from Hubble type or its extensions
R..., PRG	Ring galaxy (see [30]), Polar ring galaxy
GxyP	Part of galaxy (e.g. bright HII region)
OCL	Open cluster (if no Trümpler class is available)
GCL	Globular cluster (if no concentration class is available)
DN, EN, RN, PN	Nebula: dark, emission, reflection, planetary
SNR	Supernova remnant
NF	Not found

3.6 Identifications and remarks

The fields ID1, ID2 and ID3 contain cross identifications. If the space is not sufficient, the field Remarks contains additional identifications or a second line (indicated by X=2) is used. The PGC-number is listed in the field PGC (LEDA-numbers are listed as PGC-numbers; numbers > 73197).

All abbreviations are explained in Tab. 5 (see [13] for more details). For the 14000 entries 41928 different identifications are given, coming from 79 catalogues. From these one can see, to which classes the object belongs (e.g. cluster membership, morphology, spectral properties). Some of the problems resulting from these identifications were already discussed, other cases are mentioned below.

Some objects have common names in other catalogues, e.g. galaxies which are members of an interacting group (ARP 317 contains the galaxies NGC 3623, NGC 3627 and NGC 3628). Vice versa there are double entries in one catalogue, e.g. NGC 3627 = ARP 16 = ARP 317. The name ARP 16 refers to the fact, that the galaxy itself is peculiar. The reason why some galaxies have up to three different ZWG-designations, e.g. NGC 1544 = ZWG 361.11 = ZWG 362.4 = ZWG 370.1A (the two polar fields are designated A and B), is due to overlapping Palomar Sky Survey fields inspected individually by Zwicky.

Another example is the galaxy IC1502 = UGC 12105 = UGC 12706 = MCG 12-1-1 = MCG 13-1-2 = ZWG 344.3 = ZWG 359.5 in Cepheus. The object lies on the edge of two MCG-declination zones (at Decl = +75°) and in two different Zwicky-fields, so Vorontsov-Velyaminov and Zwicky included it twice in their catalogues. The double entry in the UGC is probably due to a writing error. UGC 12105 has Rect = 22 34.1 (there is no galaxy at that position) and UGC 12706 (the *real* IC 1502) has Rect = 23 34.1. UGC 12105 ought to be omitted, but is included here to clarify the situation.

Tab. 5 - Abbreviations from 79 catalogues used in the fields ID1, ID2, ID3 and Remarks. NGC and IC are not included, PGC is included for completeness. N counts the total occurrences in both catalogues (if N=1 the object is given).

ID	Explanation	N
A	Anonymous galaxy form RC2 [9]	23

Abell	Planetary nebula	3
AM	Arp & Madore (southern peculiar galaxy)	784
ARAK	Arakelian (galaxy)	202
ARP	Atlas of Peculiar Galaxies [2]	220
BCL	Boulesteix cluster (HII region in M33)	8
Berkeley	Open cluster	2
Bochum	Open cluster; NGC 2409= Bochum 4	1
3C	Third Cambridge Catalogue of Radio Sources	22
CED	Cederblad (diffuse galactic nebula)	70
CGMW	Catalogue of Galaxies Behind the Milky Way	14
COU	Coutès (Halpha emission nebula)	2
DCL	Dickens, Currie, Lucey (galaxy in centaurus custer)	69
DDO	David Dunlop Observatory (dwarf galaxy)	32
DFOT	Doi, Fugugita, Okamura, Tarusawa (galaxy in Coma cluster)	9
DG	Dorschner & Görtler (reflection nebula)	6
Djargovsky	Globular cluster; NGC 6540 = Djargovsky 3	1
DRCG	Dressler Cluster of Galaxies (galaxis in different clusters)	264
ESO	ESO/Uppsala Survey of the ESO(B)-Atlas [19]; format: first number = field, second number = object in field. If the format contains no letters, the object is a galaxy, otherwise letters are used for special types: RN=reflection nebula (e.g. ESO 123-RN7), SC=star cluster, EN=emission nebula, PN=planetary nebula, *N=star(s) in nebula, N*=nebula and star	3035
FAIR	Fairall (compact and bright nucleus galaxy)	114
Fath	Nebula; Fath 703 = NGC 5892	1
FCC	Fornax Cluster Catalogue	42
FGC	Flat Galaxy Catalogue (the extension ist FGCE; the addendum is refered by a following 'A') [17]	122
GCL	Globular Cluster; from the Catalogue of Star Clusters and Associations	107
HARO	Galaxy with UV excess	15
Henize	Planetary nebula; NGC 5408 = Henize 959	1
HCG	Hickson compact group of galaxies	130
Holmberg	Dwarf galaxy; Holmberg VI = NGC 1325A	1
IRAS	IRAS catalogue of infrared sources	3392
J	Jonkheere; J 475 = NGC 6741 (planetary nebula)	1
KARA	Karachentseva (isolated galaxy)	229
KAZ	Kazayan (emission line galaxy)	80
KCPG	Karachentsev isolated pair of galaxies	504
KDWG	Karachentsev dwarf galaxy	3
Keeler	Galaxy; NGC 5866A = Keeler 690	1
KUG	Kiso UV galaxy	677
LBN	Lynds Bright Nebula (emission nebula)	99
LDN	Lynds Dark Nebula; LDN 1653 = NGC 2313	1
LT	L. Thompson [30] (ring galaxy)	2
Lund	Open cluster	2
M	Messier; M 110 = NGC 205 is included, M 40 and M 45 are not; all other , except M 25 = IC 4725, are in the NGC	107
MCG	Morphological Catalogue of Galaxies [33]; first number = declination zone (+15 to -6, "+" sign is omitted), second number = field in zone (by right ascension), third number = galaxy in field.	7600
Mel	Melotte (open cluster); Mel 15 = IC 1805	1
MK	Markarian (galaxy with UV continuum)	281
OCL	Open Cluster; from the Catalogue of Star Clusters and Associations	382
New	Galaxy (Shapley-Ames); New 2 = NGC 4507	1
NPM1G	Lick Northern Proper Motion Survey Galaxy Catalogue [18]; Format: declination zone (°) + number	1698

Pal	Palomar (globular cluster)	3
PGC	Catalog of Principal Galaxies [22]	9862
PHL	Palomar-Haro-Luyten (blue star or galaxy); PHL 1226 = IC 1746	1
PK	Perek & Kohoutek (planetary nebula) [1]; format: galactic coordinates	132
PRC	Polar ring galaxy	43
RB	Rood & Baum (galaxy in Coma cluster)	7
Reinmuth	Galaxy; Reinmuth 80 = NGC 4517A	1
Reiz	Galaxy (this identification is given only if no other identification is available)	36
Ruprecht	Open cluster (Ruprecht 166 = NGC 5120)	1
SBS	Second Byurakan Survey (UV excess objects)	3
SG	Shain & Gaze (emission nebula)	3
Sh2	Sharpless (emission nebula)	18
Shkh	Shakhbazian (compact galaxy in compact group)	2
SS	Struve & Straka (galactic nebula); SS 20 = IC 2067	1
1SZ, 2SZ	Southern Zwicky compact galaxies (2 lists)	6
Todd	Todd (galaxy); found during his „Telescopic Search for the Trans-Neptunian Planet“, AN <u>113</u> , 153 (1885); some new identifications were found by Klaus Wenzel	21
TOL	Tololo (emission line galaxy)	9
UGC	Uppsala General Catalogue of Galaxies [20]	4013
UGCA	Catalogue of Selected Non-UGC Galaxies [21]	170
UM	University of Michigan (emission line galaxy)	28
URA	Uranova (stellar ring); URA 50 = IC 1311	1
VCC	Virgo Cluster Catalog (galaxy)	527
vdB-Hagen	Van den Bergh-Hagen (open cluster); VdB-Hagen 208 = NGC 6256	2
VDB	Van den Bergh (reflection nebula); VDB 66 = NGC 2149	1
VMT	Van den Bergh, Marschner & Terzian (supernova remnant); VMT 9 = IC 443	1
VV	Vorontsov-Velyaminov (interacting galaxy) [33]	320
WAS	Wasilewski (emission line galaxy)	17
Z	Galaxy listed in the Catalogue of Selected Compact Galaxies and of Post-Eruptive Galaxies [35] only by 1950-coordinates, which are appended.	22
ZH	Zwicky-Humason (galaxy in Abell 194); IC 1693 = ZH 32	1
ZWG	Zwicky's Catalogue of Galaxies and of Clusters of Galaxies [34]; the designation CGCG is also in use (with '-' instead of our '.'); Format: first number = field, second number = galaxy in field	6131
1ZW..7ZW	Catalogue of Selected Compact Galaxies and of Post-Eruptive Galaxies [35], based on 7 lists	154
8ZW	Eighth List of Compact Galaxies [36]	29
Sum		41928

Some objects are misclassified due to their catalogue membership. The planetary nebula IC 3568 is listed in the Uppsala General Catalogue of Galaxies (UGC 7731 = PGC 41662). Visually it is difficult to decide, if the object is a compact galaxy (a typical example is Abell 76) or a small planetary nebula with high surface brightness, e.g. NGC 2242, which was listed by Zwicky as a galaxy (ZWG 205.5). All three examples are shown in Fig. 8 below.

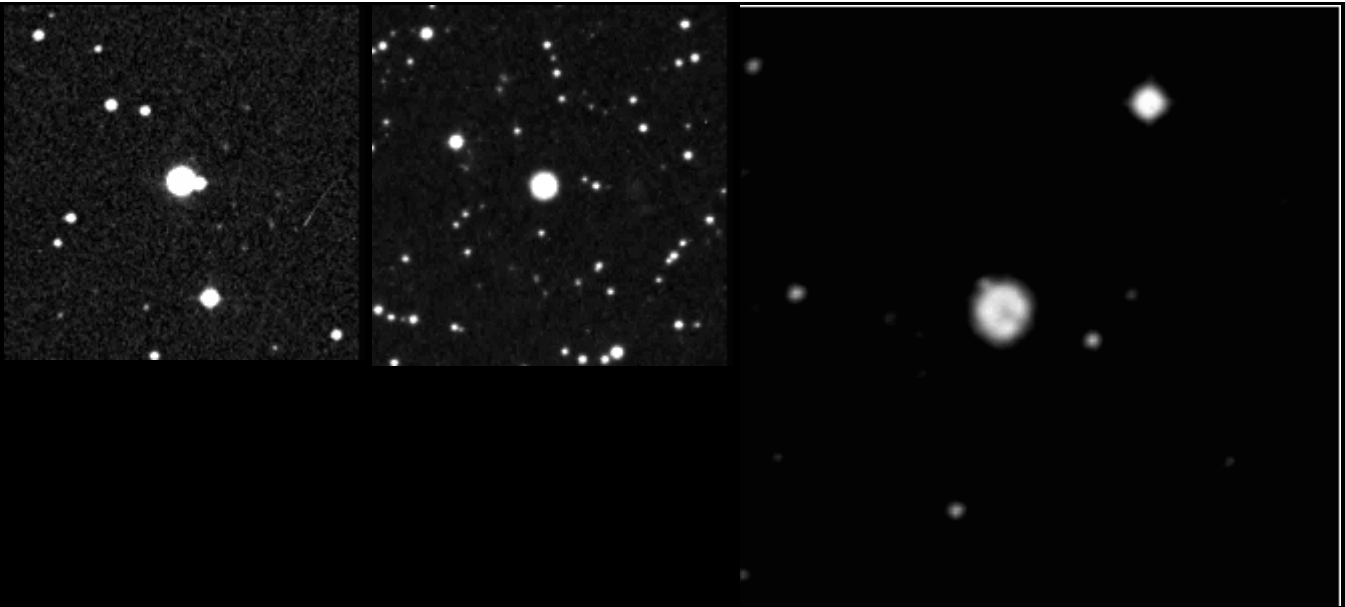


Fig. 8 - Classification problems. Left: IC 3568 = UGC 7731 (planetary in Camelopardalis), center: NGC 2242 = ZWG 205.5 (planetary in Auriga), right: Abell 76 (compact galaxy in Aquarius).

The field Remarks contains additional identifications and information. In case of a planetary nebula the magnitude of the central star (if known) is given [1]. The field presents also all known *individual names* for single or multiple objects (see also [16]). In Tab. 6 these names are listed, together with the corresponding object(s). In one case I have created a new name: IC 5173, which I named "Southern Integral-sign", as it looks like the northern "Integral-sign", UGC 3697 (Fig. 9). Unlike UGC 3697, which is a warped galaxy, IC 5173 is a double galaxy (AM 2210-693). Tidal interaction disturbs the larger (left) one. The smaller component is called IC 5173A = ESO 76-IG8A.

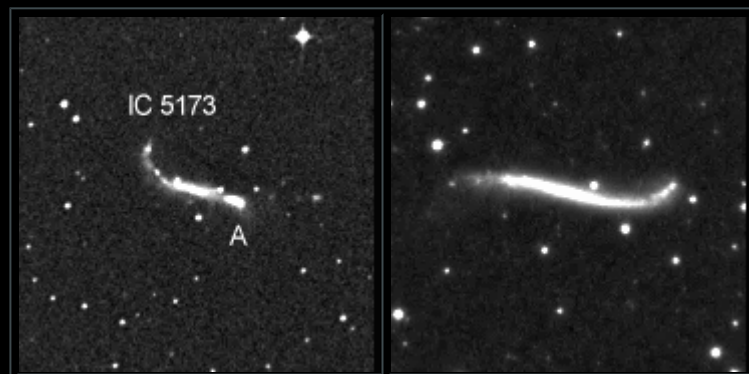


Fig. 9 - The Southern and Northern Integral-signs: IC 5173 = AM 2210-693 in Indus (left) and UGC 3697 in Camelopardalis (see explanation above).

Tab. 6 - List of names used in the catalogues (field *Remarks*)

Name	Identification
Andromeda nebula	NGC 224 = M 31
Antennae	NGC 4038, NGC 4039
Atom for peace galaxy	NGC 7252
Barnard's galaxy	NGC 6822 = IC 4895
Baxendell's nebula	NGC 7088
Bear Claw nebula	NGC 2537
Beehive cluster	NGC 2632 = M 44
Black Eye galaxy	NGC 4826 = M 64

Blinking planetary	NGC 6826
Blue flash nebula	NGC 6905
Blue planetary	NGC 3918
Blue snowball	NGC 7662
Bode's nebulae	NGC 3031 = M 81, NGC 3034 = M 82
Box nebula	NGC 6309
Bubble nebula	NGC 7635
Bug nebula	NGC 6302
Butterfly nebula	IC 2220
Butterly cluster	NGC 6405 = M 6
California nebula	NGC 1499
Carafe group	NGC 1595, NGC 1598 with ESO 202-G23 ("carafe")
Cat eye nebula	NGC 6543
Centaurus A	NGC 5128
Cetus A	NGC 1068
Chi Persei	NGC 884
Christmas Tree cluster	NGC 2264
Cocoon nebula	IC 5146
Coddington nebula	IC 2574
Conus nebula	NGC 2264
Copeland Septett	NGC 3745, NGC 3746, NGC 3748, NGC 3750, NGC 3751, NGC 3753, NGC 3754
Crab nebula	NGC 1952 = M 1
Crescent nebula	NGC 6888
Delle caustiche	NGC 6603 = M 24
Double cluster	NGC 869, NGC 884
Dumbbell nebula	NGC 6853 = M 27
Eagle nebula	NGC 6611 = M 16
Eight-burst planetary	NGC 3132
Epsilon Orionis nebula	NGC 1990
Eskimo nebula	NGC 2392
Eta Carinae nebula	NGC 3372
Flaming Star nebula	IC 405
Flame nebula	NGC 2024
Fornax A	NGC 1316
Gamma Cas nebula	IC 59, IC 63
Gamma Cyg nebula	IC 1318
Gem cluster	NGC 3293
Ghost of Jupiter	NGC 3242
Grus Quartett	NGC 7552, NGC 7582, NGC 7590, NGC 7599
h Persei	NGC 869
Helix	NGC 2865
Helix nebula	NGC 7293
Hercules cluster	NGC 6205 = M 13
Herschel's ray	NGC 2736
Hind's variable nebula	NGC 1555
Horsehead nebula	IC 434
Hubble's variable nebula	NGC 2261
Intergalactic Wanderer	NGC 2419
Jewel Box	NGC 4755

Kappa Crucis cluster	NGC 4755
Keenan's System	NGC 5216, NGC 5218
Kidney Bean Galaxy	NGC 4774
Lagoon nebula	NGC 6523 = M 8
Little Dumbbell	NGC 650/51 = M 76
Little Gem	NGC 6818
Markarian chain	NGC 4374, NGC 4406, NGC 4435, NGC 4438, NGC 4458, NGC 4461, NGC 4473, NGC 4477
Miniature Spiral	NGC 3928
Mirach's ghost	NGC 404
Nubecula minor	NGC 262 = SMC
North America nebula	NGC 7000
Omega Centauri	NGC 5139
Omega nebula	NGC 6618 = M 17
Omikron Velorum cluster	IC 2391
Orion nebula	NGC 1976 = M 42
Owl nebula	NGC 3587 = M 97
Pancake	NGC 2686
Papillon	IC 708
Pelican nebula	IC 5067, IC 5070
Perseus A	NGC 1275
Pinwheel galaxy	NGC 598 = M 33
Pleiades nebula (Maia)	NGC 1432
Pleiades nebula (Merope)	NGC 1435
Polarissima australis	NGC 2573
Polarissima borealis	NGC 3172
Praesepe	NGC 2632 = M 44
Ptolemy's cluster	NGC 6475
Rho Ophiuchi nebula	IC 4604
Ring nebula	NGC 6720 = M 57
Running Chicken nebula	IC 2944
Rosette nebula	NGC 2237, NGC 2238, NGC 2239, NGC 2246
Saturn nebula	NGC 7009
Sculptor galaxy	NGC 253
Seyfert Sextett	NGC 6027 (A-E)
Siamese Twins	NGC 4567, NGC 4568
Silver dollar	NGC 253
Small Magellanic cloud	NGC 292
Sombrero galaxy	NGC 4594 = M 104
Southern Integral-sign	IC 5173
Southern Pleiades	IC 2602
Spindle	NGC 2686
Spindle galaxy	NGC 3115
Starqueen nebula	IC 4703 (in M 16)
Stephan's Quintett	NGC 7317, NGC 7318A, NGC 7318B, NGC 7319, NGC 7320
Struve's Lost nebula	NGC 1554
Sunflower galaxy	NGC 5055 = M 63
Taurus A	NGC 1952 = M 1
Tarantula nebula	NGC 2070 = 30 Dor
The Box	NGC 4169, NGC 4173, NGC 4174, NGC 4175

The Eyes	NGC 4435, NGC 4438
The Mice	NGC 4676A, NGC 4676B
Toby Jug nebula	IC 2220
Triangulum galaxy	NGC 598 = M 33
Trifid nebula	NGC 6514 = M 20
Ursa Major A	NGC 3034 = M 82
Veil nebula	NGC 6960, NGC 6992, NGC 6995
Virgo A	NGC 4486 = M 87
Whirlpool galaxy	NGC 5194/95 = M 51
Wild Duck cluster	NGC 6705 = M 11
Witch Head nebula	IC 2118
Zwicky's Triplet	IC 3481, IC 3481A, IC 3483
47 Tucanae	NGC 104

4 Literature

[1] Acker, A., et al., Strasbourg-ESO Catalogue of Planetary Nebulae, München 1990; see also: Catalogue of the Central Stars of True and Possible Planetary Nebulae, Strasbourg 1982

[2] Arp, H. C., Atlas of Peculiar Galaxies, Pasadena 1966 (see also: Astrophys. J. Suppl. 14, 1 (1966))

[3] Carlson, D., Some Corrections to Dreyer's Catalogues of Nebulae and Clusters, Astrophys. J. 91 350 (1940)

[4] Corwin, H. G., de Vaucouleurs, A., de Vaucouleurs, G., Southern Galaxy Catalogue, Austin 1985

[5] Corwin, H. G., et al., Accurate Positions for MCG Galaxies, PASP 110, 779 (1998)

[6] Corwin, H. G., Precise Position List, NGC/IC Project, October 2002

[7] Corwin, H. G., NGC/IC Puzzle Solutions, NGC/IC Project, October 2002

[8] Cragin, M., Bonanno, E., Deep Sky Field Guide, Willmann Bell 2001

[9] de Vaucouleurs, G., de Vaucouleurs, A., Corwin, H.C., Second Reference Catalogue of Bright Galaxies, New York 1991

[10] de Vaucouleurs, G., et al., Third Reference Catalogue of Bright Galaxies, New York 1991

[11] Dixon, R. S., Sonneborn, G., A Master List of Nonstellar Optical Astronomical Objects, Ohio State Univ. Press 1980

[12] Dreyer, J. L. E., New General Catalogue, Index Catalogue, Second Index Catalogue, London 1962

[13] Lortet, M.-C., Borde, S., Ochsenbein, F., Astron. Astrophys. Suppl. 107, 193 (1994)

[14] Gottlieb, S., Corrections to the RNGC, NGC/IC Project 1998

[15] Harris W. E., Astron. J. 112, 1487 (1996)

[16] Hirshfeld, A., Sinnott, R. W., Sky Catalogue 2000.0, Vol. 2, Cambridge, Mass. 1985

[17] Karachentsev I. D. et al., Astron. Nachr. 314, 97 (1993)

[18] Klemola A. R., Hanson R. B., Jones B. F., Astron. J. 94, 501 (1987)

[19] Lauberts, A., The ESO/Uppsala Survey of the ESO(B)-Atlas, München 1982

- [20] Nilson, P., Uppsala General Catalogue of Galaxies, Uppsala 1973
- [21] Nilson, P., Catalogue of Selected Non-UGC Galaxies, Uppsala 1974
- [22] Paturel, G., et al., Catalogue of Principal Galaxies, LEDA 2000
- [23] RealSky, Astronomical Society of the Pacific, San Francisco, 1996, 1997
- [24] The Digized Sky Survey (102 CD-ROM version), Space Telescope Science Institute, 1993
- [25] Reinmuth, K., Die Herschel-Nebel, Veröff. Sternwarte Heidelberg, Bd. 9, 1926
- [26] Sandage, A., Bedke, J., The Carnegie Atlas of Galaxies, Washington D.C. 1994
- [27] Sinnott, R. W., NGC 2000.0, Cambridge University Press, Cambridge, Mass. 1988
- [28] Skiff, B., Precise Positions for the NGC/IC Planetary Nebulae, Flagstaff, Arizona 1996
- [29] Sulentic, J. W., Tifft, W. G., Revised New General Catalogue of Nonstellar Astronomical Objects, Tuscon 1977
- [30] Thompson, L. A ., Astrophys. J. 211, 684 (1977)
- [31] Thomson, M. J., Identity Survey of IC Galaxies, NGC/IC Project 2000
- [32] Vorontsov-Velyaminov, B. A., Atlas and Catalogue of Interacting Galaxies, Part I, Moscow 1959 (for Part II see: Astron. Astrophys. Suppl. 28, 1 (1977))
- [33] Vorontsov-Velyaminov, B. A., Arkhipova, V. P., Morphological Catalogue of Galaxies, Vol. I-IV, Moskow 1962-1968; (see also: Kogoshvili, N. G., Merged Catalogue of Galaxies, Bul. Abastumani Astr. Obs. 46, 133 (1975))
- [34] Zwicky, F., et al., Catalogue of Galaxies and of Clusters of Galaxies, Vol. 1-6, Pasadena 1963-68
- [35] Zwicky, F., Zwicky, M. A., Catalogue of Selected Compact Galaxies and of Post-Eruptive Galaxies, Zürich 1971
- [36] Zwicky, F., Sargent, W. L. W., Kowal C. T., Eighth List of Compact Galaxies, Astron. J. 80, 545 (1975)