Revised New General Catalogue and Index Catalogue

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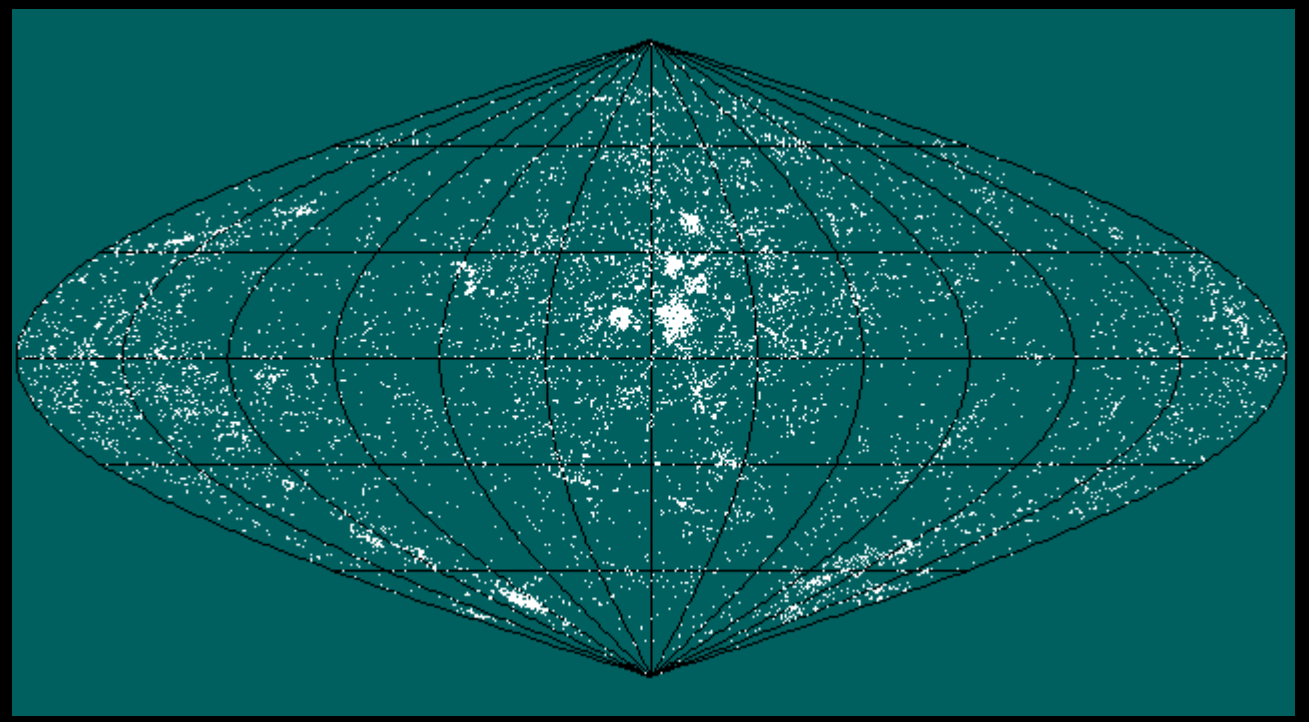
To my wife Gisela



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

Preface to the current version

There are new columns for redshift(z), distance (derived from z) and metric distance. All data are arranged in a single line. The amount of objects with status "not found" remains constant (2.3%).

The Revised NGC/IC gives the physical and identification data for each object. Additionally, the ***Historic NGC/IC*** is available, presenting the historical data for each object: discoverers, discovery dates, instruments and references in the original NGC and IC (see "NGC/IC" button). It is part of my comprehensive study about the history of the NGC. The results were published in August 2010 by Cambridge University Press: ***Observing and Cataloguing Nebulae and Star Clusters - From Herschel to Dreyer's New General Catalogue*** (see "Publications" button).

Unfortunally, I was forced in 2006 to remove all my data from the NGC/IC Project website. This is due to a conflict with the former webmaster Bob Erdman, who eventually has terminated his activities for the project in 2009. His "Historically Corrected NGC", first presented on the project website in April 2006, is a mere copy of my ***Historic NGC*** (Jan. 2006) which is evident by an overwhelming amount of facts. The necessary acknowledgment is still missing. Hopefully, a totally revised NGC/IC Project webseite will be launched this year. This offers a chance for a return of my NGC/IC data!

The data of my ***Revised New General Catalogue and Index Catalogue*** are used by Mathematica, TheSky, Guide, SkyMapPro, Starry Night, Eye&Telescope, the SAC database and the database of the Losmandy mounting.

Wolfgang Steinicke, Umkirch

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1 Introduction

The present work contains all objetcs 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. For a comprehesive history of the NGC, see my latest book.

The historic catalogues collect nonstellar objects, discovered by different observers over the centuries. The history of the NGC/IC is reviewed in detail in my recent book "**Observing and Cataloguing of Nebulae and Star Clusters**". It is based on my "Historic NGC/IC" datasets. 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 Tifft (1977) and by Sinnott (1988). The *Revised New General Catalogue* (RNGC) by Sulentic and Tifft [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).

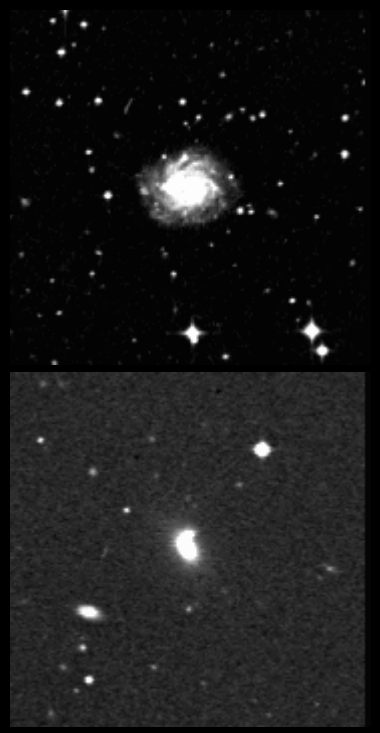
During the revision of the IC, it becomes evident that the same work has to be done for the 7840 NGC-objects. The confusion found in the IC is also present in the NGC and there are disturbing interferences between both catalogues.

Beside the contributions form the NGC/IC Project, which is desribed 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 & Tifft or Sinnott, which often failed to clear a confusing case or even totally missed it. Both datasets contain may errors. Examples are given in Steve Gottlieb's *Corretions 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.

My 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.

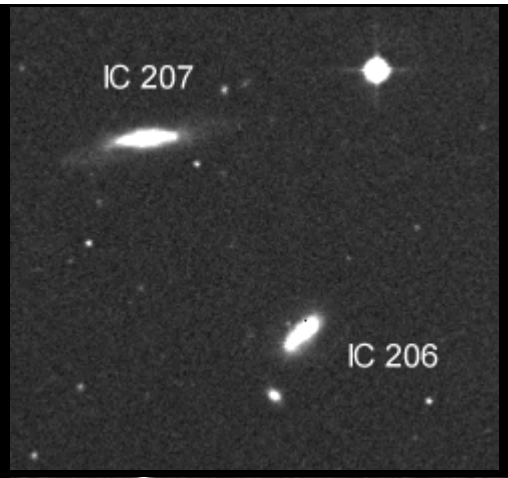
Fig. 1 - Examples of identified objects.

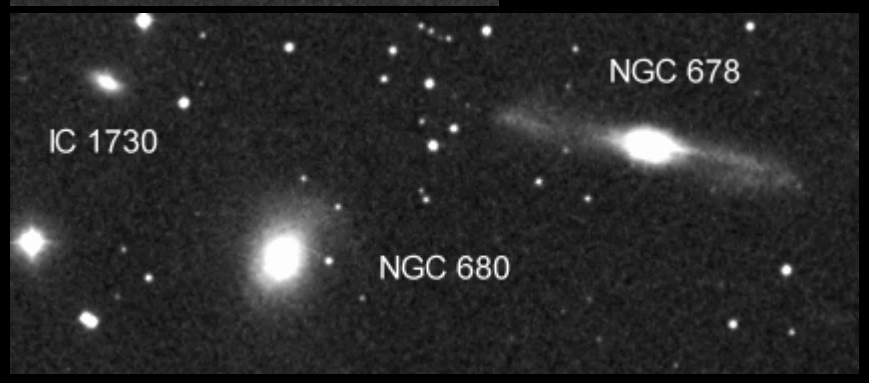


NGC 6993 - The object is declared as "not found" in the RNGC and so the type is "-" in Sinnott's book. But actually NGC 6993 is a bright Sc galaxy (13.8 mag) in Capricornus.

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 (13.3 mag) in Aries, accompanied by NGC 680 and IC 1730.

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2 The NGC/IC Project

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 publifications. 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 hictorical 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 usefull to inspect critical cases by visual observations, as Steve Gottlieb does to simulate the historical 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 helpfull, 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!

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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 smaler 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 columns

Columne	Explanation
N	**Catalogue N = N (NGC) or N = I (IC)**
NI	**catalogue number** . Some objects have an *extension letter* (A,B,C,...).
A	**Extension letter:** A, B, C...
C	**Components**. If two or more *different* objects use the *same* 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).
S	**Status**. Status of the identification (see Tab. 2)
P	**Precision.** Flag for high precision position
CON	**Constellation**
RH, RM, RS	**Right ascension**. Equinox J2000.0
V, DG, DM, DS	**Declination**. Equinox J2000.0
Bmag	**Photographic (blue) magnitude**
Vmag	**Visual magnitude**
B-V	**Difference of visual and blue magnitude**
SB	**Surface brightness (mag/arcmin2)**
X, Y	**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**

z	**Redshift (from NED or LEDA)**
D(z)	**Distance derived from z (Mpc)**
MD	**Metric Distance (Mpc); from NED**
PGC	**PGC-number**. Object listed in the *Catalog of Principle Galaxies* [22]
ID1 - ID11	**Identifications; the last non-empty field contains remarks (if any)**

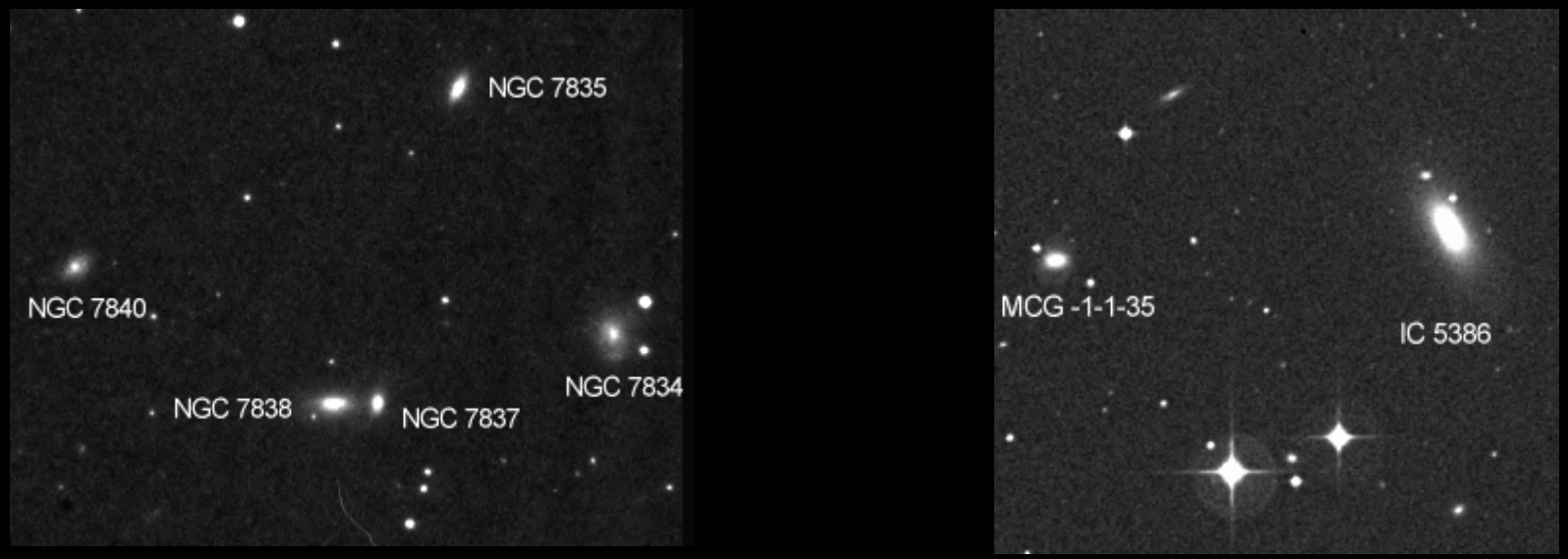

Fig. 3 - The final entries in the catalogues are located in Pisces: NGC 7840 in a small group of NGC-galaxies (all found at Malta by Albert Marth), and the galaxy IC 5386, which is identical to NGC 7832 (seen by Swift and Howe and discovered earlier by William Herschel).

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 vincinity, 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 east (!) of the emission nebula 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 13957 (see Tab. 2).

Not all objects in the catalogue are in Deyer'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 for NGC: 7051 = 89.9 %, for IC: 4140 = 76.9 %).

Tab. 2 - Explanation of the field *S* and number of entries in the Revised NGC and IC (13226 objects from original catalogue + 731 added objects = 13957).

S	Explanation	NGC	%	Add	IC	%	Add
1	Galaxy	6022	76.8	465	3972	73.7	149
2	Galactic nebula, Supernova remnant	147	1.9		86	1.6	4
3	Planetary nebula	94	1.2		36	0.7	
4	Open cluster	673	8.6	3	38	0.7	
5	Globular cluster	115	1.5		8	0.1	
6	Part of other object (e.g. bright HII region of a galaxy)	30	0.4	1	23	0.4	
7	Object already in the NGC- or IC	262	3.3	78	76	1.4	5
8	IC-object already in the NGC			24	268	5.0	2
9	Star(s)	403	5.1		672	12.5	
10	Not found	94	1.2		207	3.8	
	Sum	**7840**		**571**	**5386**		**160**

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. Naturally the "object", e.g. NGC/IC-Number, discovered later, gets the "7". The order for NGC entries is based on the "Historic NGC", presenting the discovery dates.

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 191A (S=8) is identical to IC 1563 (S=1).

Entries with S=9 are single stars, pairs (e.g. the famous pair of stars IC 1 (Fig. 2) in Pegasus; see Fig. 2), trios, groups (asterisms) or clouds of stars. For most single stars a magnitude is given; for the brightest there is a designation (e.g. SAO). Among the record holders (see Tab. 3) is Alpha CVn = NGC 4530. John Herschel suspected some nebulosity around it, which does not exist. Fig. 4 shows the case of the asterism NGC 7005 in Aquarius, discovered by d'Arrest.

Tab. 3 - The brightest stars in the NGC (the record holder in the IC is the 6.5 mag star IC 1851).

Object	Star	Magnitude (V)
NGC 771	50 Cas	4.0
NGC 4530	Alpha 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 301 cases (2.3%) 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 - From left to right: NGC 7005, an asterism in Aquarius (s=9; type: *Grp); IC 5126 in Aquarius (at the nominal position there is no nonstellar object); IC 5126 is a confirmed galaxy at a different position.

3.4 Coordinates and constellation

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 comparision 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.

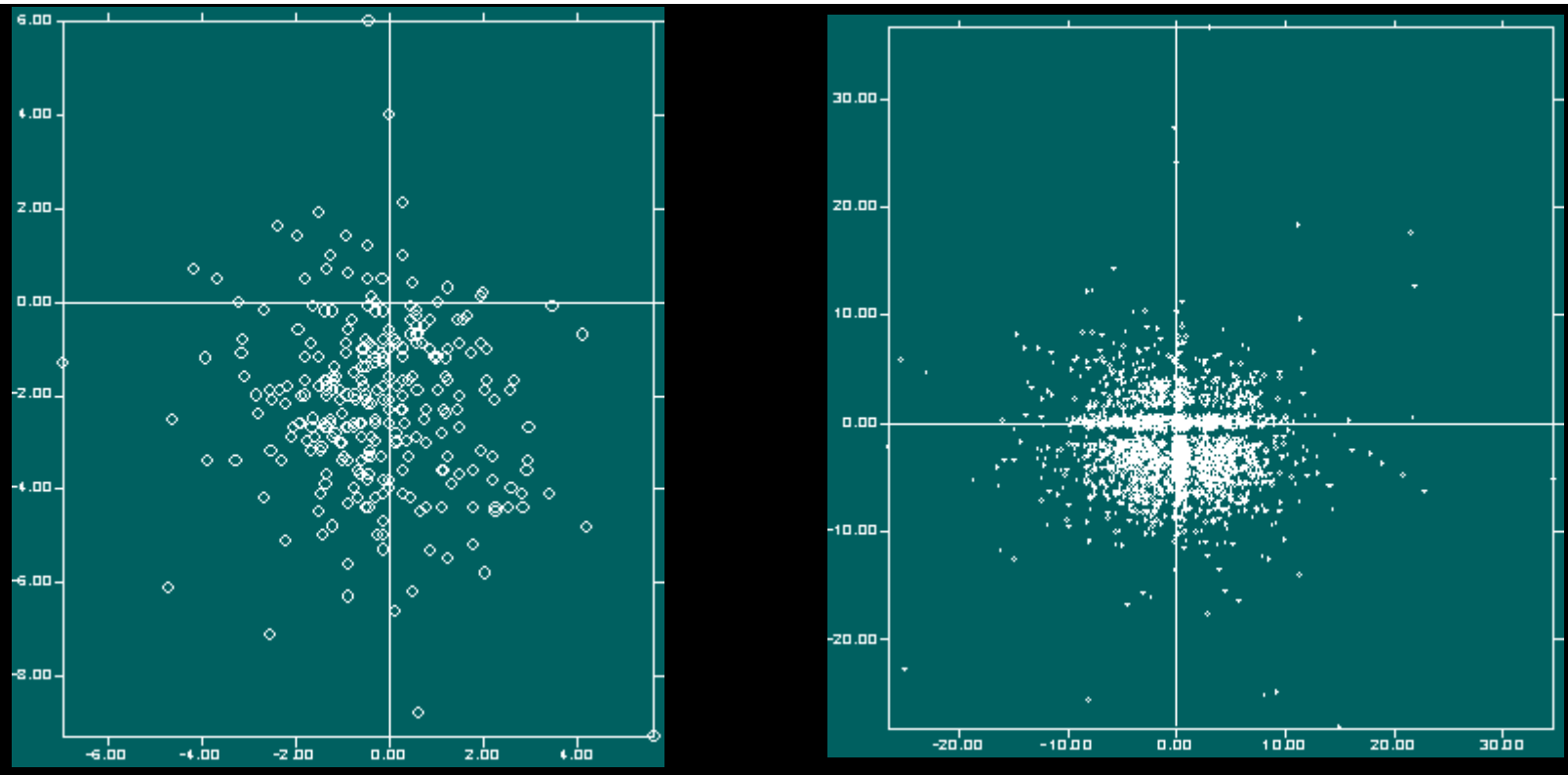

Fig. 5 - Coordinate differences in arcsec between this catalogue (RealSky measurements) and the GSC (left) and ESO/Uppsala (right).

The constellation is calculated from the borders given by the IAU. Most of the 7840 NGC objects are located in Virgo (678), only 4 NGCs are in Chamaeleon and Equuleus. Most of the 5386 IC objects are located in Coma Berenices (687), no IC is in Circinus and Crux. The following table shows the numbers for all constellations.

Con	NGC	IC	Sum		Con	NGC	IC	Sum
AND	154	46	200		LAC	26	12	38
ANT	49	43	92		LEO	385	441	826
APS	8	20	28		LEP	32	29	61
AQL	40	8	48		LIB	57	19	76
AQR	142	123	265		LMI	63	49	112
ARA	16	9	25		LUP	18	11	29
ARI	81	66	147		LYN	100	36	136
AUR	25	15	40		LYR	33	5	38
BOO	264	230	494		MEN	72	12	84
CAE	16	7	23		MIC	11	19	30
CAM	45	29	74		MON	58	9	67
CAP	27	30	57		MUS	6	4	10
CAR	40	14	54		NOR	14	2	16
CAS	41	17	58		OCT	7	8	15
CEN	138	60	198		OPH	42	21	63
CEP	36	10	46		ORI	65	29	94
CET	409	240	649		PAV	49	231	280
CHA	4	3	7		PEG	319	114	433
CIR	5		5		PER	95	60	155
CMA	38	8	46		PHE	40	20	60
CMI	19	6	25		PIC	20	1	21

CNC	117	220	337		PSA	38	17	55
COL	17	8	25		PSC	301	172	473
COM	298	687	985		PUP	57	7	64
CRA	5	3	8		PYX	12	1	13
CRB	37	17	54		RET	11	25	36
CRT	87	32	119		SCL	61	36	97
CRU	8		8		SCO	51	15	66
CRV	35	17	52		SCT	13	3	16
CVN	212	278	490		SER	76	73	149
CYG	70	24	94		SEX	66	41	107
DEL	22	7	29		SGE	6	2	8
DOR	299	38	337		SGR	84	41	125
DRA	301	55	356		TAU	48	42	90
EQU	4	11	15		TEL	28	87	115
ERI	327	110	437		TRA	6	4	10
FOR	67	42	109		TRI	82	38	120
GEM	67	47	114		TUC	62	62	124
GRU	48	29	77		UMA	409	101	510
HER	214	96	310		UMI	36	18	54
HOR	25	66	91		VEL	36	5	41
HYA	227	136	363		VIR	678	502	1180
HYI	11	2	13		VOL	9	1	10
IND	43	45	88		VUL	20	6	26

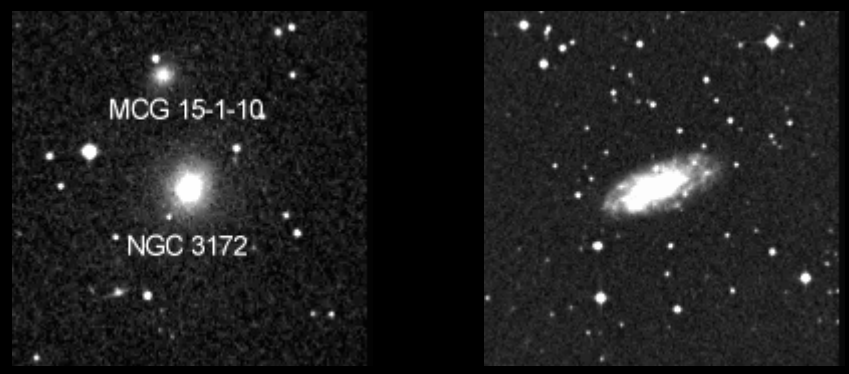

Fig. 6 - The most northern and most southern entries in the catalogues are both galaxies: NGC 3172 in Ursa Minor ("Polarisima borealis") and NGC 2573 in Octans ("Polarissima australis").

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 (CGCG, 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 magniude 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 graeter 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].

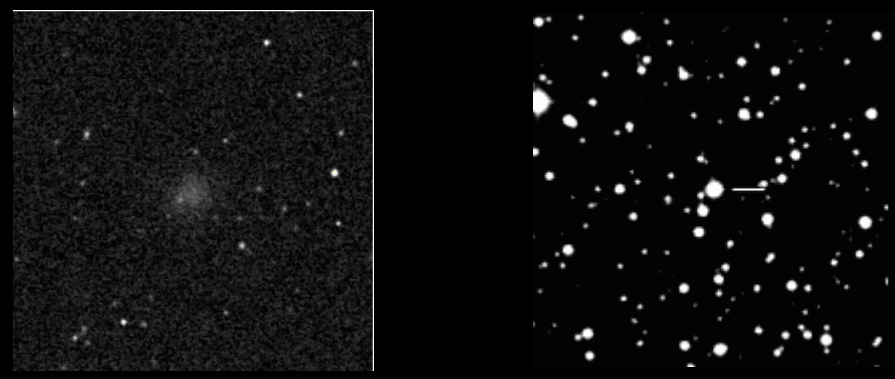

Fig. 7 - Magnitude (Bmag) and sizes: among the faintest objects is the dwarf galaxy IC 4107 (left), discovered by Wolf, in Coma Berenices with 18.5mag (the brightest object is the open cluster IC 2602 with $1^m.9$, the "Southern Pleiades" in Carina). Some planetaries are very small, e.g. NGC 6833 in 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 detemined 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 14002 entries 39096 different identifications are given, coming from 82 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 CGCG-designations, e.g. NGC 1544 = CGCG 361-11 = CGCG 362-4 = CGCG 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 = CGCG 344-3 = CGCG 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 82 catalogues used in the fields ID1 to ID11. NGC and IC are not included; PGC (LEDA) is included for completeness. N counts the total occurances in both catalogues (if N=1 the object is given).

ID	Explanation	N
A	Anonymous galaxy form RC2 [9]	21
Abell	Planetary nebula	4
AM	Arp & Madore (southern peculiar galaxy)	782
ARAK	Arakelian (galaxy)	200
ARP	Atlas of Peculiar Galaxies [2]	217
BCL	Boulesteix cluster (HII region in M33)	7
Berkeley	Open cluster	2
Bigourdan	Non-stellar object; Bigourdan 298 = NGC 4411-2	1
Bochum	Open cluster; Bochum 4 = NGC 2409	1
3C	Third Cambridge Catalogue of Radio Sources	22
CED	Cederblad (diffuse galactic nebula)	70
CGCG	Zwicky's Catalogue of Galaxies and of Clusters of Galaxies [34]; format: first number = field, second number = galaxy in field	6129
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)	10
Djorgovsky	Globular cluster; Djorgovsky 3 = NGC 6540	1
DRCG	Dressler Cluster of Galaxies (galaxis in different clusters)	260
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	3029
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	106
HARO	Galaxy with UV excess	15
HCG	Hickson compact group of galaxies	130
Henize	Planetary nebula; Henize 959 = NGC 5408	1
Holmberg	Dwarf galaxy; Holmberg VI = NGC 1325A	1
IRAS	IRAS catalogue of infrared sources	3391
J	Jonkheere (planetary nebula); J 475 = NGC 6741	1
KARA	Karachentseva (isolated galaxy)	229
KAZ	Kazayan (emission line galaxy)	83
KCPG	Karachentsev isolated pair of galaxies	505
KDWG	Karachentsev dwarf galaxy	3
Keeler	Galaxy; Keeler 690 = NGC 5866A	1
KUG	Kiso UV galaxy	672
LBN	Lynds Bright Nebula (emission nebula)	101
LDN	Lynds Dark Nebula; LDN 1653 = NGC 2313	1
LT	L. Thompson [30] (ring galaxy)	2
Lund	Open cluster; Lud 1182 = NGC 2175S	1
M	Messier; M 110 = NGC 205 is included, M 40 and M 45 are not; all other , except M 24 = IC 4715 and M 25 = IC 4725, are in the NGC	108
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.	7624
Mel	Melotte (open cluster); Mel 15 = IC 1805	1
Min	Minkowski (planetary nebula); Min 2-57 = NGC 896	1
MK	Markarian (galaxy with UV continuum)	277
New	Galaxy (Shapley-Ames)	2
NPM1G	Lick Northern Proper Motion Survey Galaxy Catalogue [18]; Format: declination zone (°) + number	1705
OCL	Open Cluster; from the Catalogue of Star Clusters and Associations	382
Pal	Palomar (gobular cluster)	2
PGC (LEDA)	Catalog of Principal Galaxies [22]; continued by "Lyon Extragalactic Database" (LEDA)	10381
PHL	Palomar-Haro-Luyten (blue star or galaxy); PHL 1226 = IC 1746	1
PK	Perek & Kohoutek (planetary nebula) [1]; format: galactic coordinates	134
PRC	Polar ring galaxy	43
RB	Rood & Baum (galaxy in Coma cluster)	6
Reinmuth	Galaxy; Reinmuth 80 = NGC 4517A	1
Reiz	Galaxy (this identification is given only if no other identification is available)	35
Ruprecht	Open cluster	2
SBS	Second Byurakan Survey (UV excess objects)	3
SG	Shain & Gaze (emission nebula)	3
Sh2	Sharpless (emission nebula)	19
Shkh	Shakhbazian (compact galaxy in compact group)	2
SS	Struve & Straka (galactic nebula)	2
1SZ, 2SZ	Southern Zwicky compact galaxies (2 lists)	6
Todd	Todd (galaxy); found during his „Telescopic Search for the Trans-Neptunian Planet", AN 113, 153 (1885); some new identifications were found by Klaus Wenzel	22
TOL	Tololo (emission line galaxy)	9
UGC	Uppsala General Catalogue of Galaxies [20]	4012

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	Van den Bergh (reflection nebula);	4
vdB-Hagen	Van den Bergh-Hagen (open cluster)	2
VMT	Van den Bergh, Marschner, Terzian (supernova remnant); VMT 9 = IC 443	1
VV	Vorontsov-Velyaminov (interacting galaxy) [33]	322
WAS	Wasilewski (emission line galaxy)	17
Westerlund	Open cluster; Westerlund 2 = NGC 3247	1
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); ZH 32 = IC 1693	1
1ZW..7ZW	Catalogue of Selected Compact Galaxies and of Post-Eruptive Galaxies [35], based on 7 lists	183
8ZW	Eighth List of Compact Galaxies [36]	28
Sum		**42494**

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 (CGCG 205-5). All three examples are shown in Fig. 8 below.

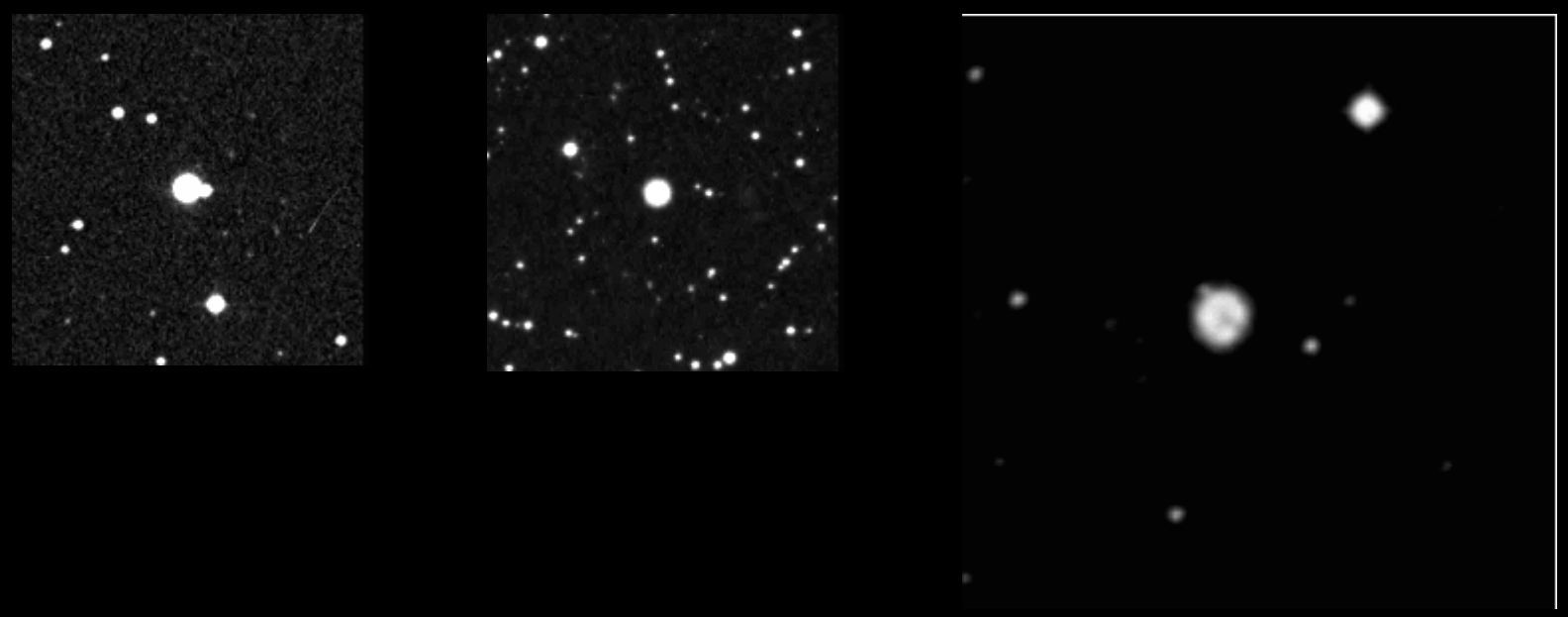

Fig. 8 - Classification problems. Left: IC 3568 = UGC 7731 (planetary in Camelopardalis), center: NGC 2242 = CGCG 205-5 (planetary in Auriga), right: Abell 76 (compact galaxy in Aquarius).

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 disturbes the larger (left) one. The smaller component is called IC 5173A = ESO 76-IG8A.

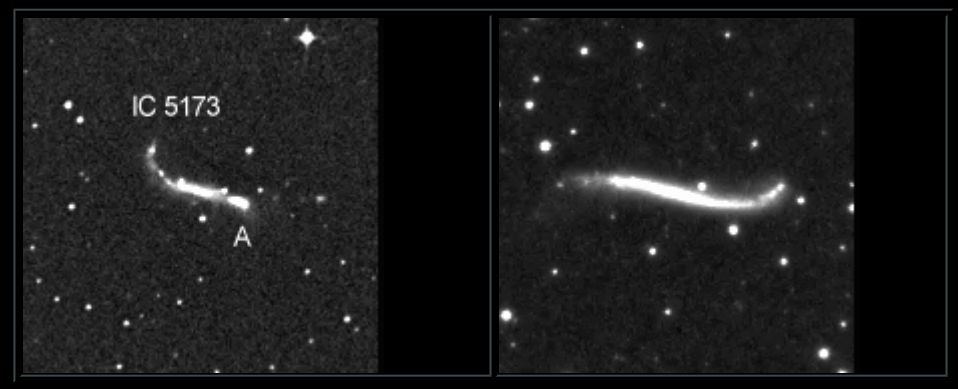

Fig. 9 - The Southern and Northern Integral-signs: IC 5173 = AM 2210-693 in Indus (left) and UGC 3697 in Camelopardalis (see explanation above).

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

Name	**Identification**
47 Tucanae	NGC 104
Ambartsumian's Knot	30" s of NGC 3561
Andromeda Nebula	NGC 224 = M 31
Antennae	NGC 4038, NGC 4039
Atoms For Peace Galaxy	NGC 7252
Barnard's Galaxy	NGC 6822 = IC 4895
Barnard's Merope Nebula	IC 349
Baxendell's Nebula	NGC 7088
Bear Claw/Paw 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 869, NGC 884
Christmas Tree Cluster	NGC 2264
Cocoon Nebula	IC 5146
Coddington Nebula	IC 2574
Copeland Septet	NGC 3745, NGC 3746, NGC 3748, NGC 3750, NGC 3751, NGC 3753, NGC 3754
Crab Nebula	NGC 1952 = M 1
Crescent Nebula	NGC 6888
Double Cluster	NGC 869, NGC 884
Dumbbell Nebula	NGC 6853 = M 27
Eagle Nebula	IC 4703 (in M 16)
Eight-burst Planetary	NGC 3132
Epsilon Orionis Nebula	NGC 1990
Eskimo Nebula	NGC 2392
Eta Carinae Nebula	NGC 3372
Flame Nebula	NGC 2024
Flaming Star Nebula	IC 405
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 Quartet	NGC 7552, NGC 7582, NGC 7590, NGC 7599
Helix Galaxy	NGC 2685
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
Maia Nebula	NGC 1432
Markarian Chain	NGC 4374, NGC 4406, NGC 4435, NGC 4438, NGC 4458, NGC 4461, NGC 4473, NGC 4477
Miniature Spiral	NGC 3928
Merope Nebula	NGC 1435
Mirach's Ghost	NGC 404
Nubecula Minor	NGC 292 = SMC

North America Nebula	NGC 7000
Omega Centauri	NGC 5139
Omega Nebula	NGC 6618 = M 17
Omikron Velorum Custer	IC 2391
Orion Nebula	NGC 1976 = M 42
Owl Nebula	NGC 3587 = M 97
Papillon	IC 708
Pelican Nebula	IC 5067, IC 5070
Perseus A	NGC 1275
Pinwheel Galaxy	NGC 5457 = M 101
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 2246 (around NGC 2244 = NGC 2239)
Sagittarius Star Cloud	IC 4715 = M 24
Saturn Nebula	NGC 7009
Sculptor Galaxy	NGC 253
Seyfert Sextet	NGC 6027 (A-E)
Siamese Twins	NGC 4567, NGC 4568
Silver Dollar	NGC 253
Small Magellanic Cloud (SMC)	NGC 292
Sombrero Galaxy	NGC 4594 = M 104
Southern Integral-sign	IC 5173
Southern Pleiades	IC 2602
Spindle Galaxy	NGC 3115
Starqueen Nebula	IC 4703 (in M 16)
Stephan's Quintet	NGC 7317, NGC 7318A, NGC 7318B, NGC 7319, NGC 7320
Struve's Lost Nebula	NGC 1554
Sunflower Galaxy	NGC 5055 = M 63
Tarantula Nebula	NGC 2070 = 30 Dor
Taurus A	NGC 1952 = M 1
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 = M 51
Wild Duck Cluster	NGC 6705 = M 11
Witch Head Nebula	IC 2118
Zwicky's Triplet	IC 3481, IC 3481A, IC 3483

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