

# Deep Sky Catalogues, the New Uranometria and Other Stories

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## Introduction

This paper treats the new Uranometria and its catalogue, the Deep Sky Field Guide (DSFG) concerning its amount and quality of data. In view of the great number of NGC/IC objects, it is worth to compare the product with the results of the international NGC/IC project [1,2]. The result confirms the well-known fact that a sky atlas (or planetarium software) is only as good as its underlying database.

## Deep sky objects in sky charts and the question „What is a good datenbase?“

Tab. 1 summarizes the development of printed sky atlases. Whereas the older ones only include Messier- and prominent NGC objects, the newer (Becvar, Tirion) consider other catalogues too. An exotic example is the atlas of the Smithsonian Astrophysical Observatory (SAO), which presents the whole NGC/IC catalogue – with all its errors! The first large, modern atlas was the Uranometria in two volumes. It uses the reliable Sky Catalogue II but also the lousy Revised New General Catalogue (RNGC) and thus contains many errors. The Millenium Star Atlas does better, using the Third Reference Catalogue of Bright Galaxies (RC3). Both atlases and the new Uranometria were recently discussed in [3].

Atlas	Year	Deep sky objects	Database	Remarks
Schurig-Götz	1925	500 (300 galaxies)	Messier, NGC	5th edition
Beyer-Graff	1950	1000 (700 galaxies)	Messier, NGC	no labels
Becvar	1964	2000 (1500 galaxies)	Messier, NGC/IC, PK	catalogue: Becvar (1964)
SAO Atlas	1969	all 13226 NGC/IC objects	NGC/IC	old positions for 1950.0 no labels
Tirion, Sky Atlas 2000	1981	2500 (1800 galaxies)	Becvar Catalogue, Burnham, Webb	catalogue: Sky Atlas Companion (2000)
Uranometria	1987	8900 (6700 galaxies)	Sky Catalogue II (1985), RNGC (1977)	catalogue: DSFG (1993)
Millenium Star Atlas	1997	10000 (8000 galaxies)	Sky Catalogue II (1985), RC3 (1991)	
Uranometria II	2001	29674 (25674 galaxies)	Megastar	catalogue: DSFG II (2001)

Tab. 1: A selection of atlases, their deep sky objects and databases.

There are three criteria for a good deep sky database (see also [1]).

**Correct image of the sky.** The data should be free of errors and present a complete image of the real sky, within the chosen definitions (see next criterion).

**Clearly defined object classes and selection criteria.** The „optical“ object classes should be contained: open and globular clusters, emission-, reflection- and dark nebulae, planetary nebulae, galaxies (including quasars) and clusters of galaxies. If there is a selection within a class, it must be based on reasonable criteria, e.g. visual magnitude or size.

**Correct designations.** Unambiguous and historically correct designations are necessary. Traditionally one starts with the Messier- and NGC/IC catalogues, which contain different object classes. Than special catalogues appear in a natural sequence (e.g. UGC, CGCG, MCG, ESO, PGC for galaxies). To avoid double entries, it must be proven that, for instance, a CGCG object is not already in the UGC or even in the NGC/IC. If this is ignored (normally caused by uncritical mixing various catalogues) „clusters of identical objects“ may appear. Therefore correct „cross identifications“ are an absolute must.

## The new Uranometria in comparison with modern NGC/IC data

The new Uranometria was introduced in 2001 by Willmann-Bell with some advertising expense. Three persons are responsible for the work: Perry Remaklus (editor), Murray Cragin (DSFG) and Emil Bonanno (Megastar). The atlas

and database contain about 30000 deep sky objects (Tab. 1), three times more than in the first edition. The announced features: complete NGC; all galaxies brighter than  $B = 15$  mag or larger than  $1.5'$ ; correct identifications; comprehensive data (proved with Megastar and RealSky). Well-known deep sky data experts are mentioned as consultants: Brian Skiff (Lowell Observatory), Harold Corwin (NED), Steve Gottlieb (NGC/IC project), Brent Archinal (USNO). Because NGC- and IC objects build the database core, it is interesting to investigate the relation to the best modern source of NGC/IC data: the NGC/IC project, based on 25 years of investigative work. The leading members are Harold Corwin, Malcolm Thomson, Steve Gottlieb, Brian Skiff, Brent Archinal, Steve Coe, Jenni Kaye and Wolfgang Steinicke. My own contribution is the „Revised New General and Index Catalogue“, which contains proved modern object data [4]. It emphasizes on the historical identification, using original observation reports. A large number of errors was found and corrected. They originate both in the sources and in modern catalogues (often the errors were simply copied). I have checked all NGC/IC objects with the Digital Sky Survey (DSS) and measured new accurate positions. At present (2002) the percentage of residual cases are 1.3% (NGC) and 4.5% (IC), respectively.

Prior to the publication of the new Uranometria, Murray Cragin reported on the U.S. mailing list „amastro“ about the quality of the database (DSFG) and the involved experts. As some of my project colleagues are mentioned, I was first convinced that our work had been taken into account. However, I was not invited to contribute in this “all-american” matter. I soon asked the editor, if all NGC/IC objects are really contained in the database. This would either imply a massive use of the project results or the authors must have reproduced the whole work in an exceptionally short time. Due to large amount of identification “puzzles” which must be solved, such a reinvention of the wheel appeared very unlikely to me. Moreover, in cases of a new (different) solutions, better arguments should be presented.

I was excited to hear the answer of my question. The announcement was restricted: of course, not all NGC's are included in the database – only the “existing”! It was admitted that the NGC/IC project was consulted in single cases only. All plotted objects were first proved with RealSky – taking the „best shot“ in case of doubt. This is redolent of the dubious RNGC practice to take the nearest/brightest candidate as the historically correct object. The editor states that the „major players“ were involved. But checking with Harold Corwin, Malcolm Thomson und Steve Gottlieb led to an astonishing result: They were unable to contribute anything substantial, because Willmann-Bell had not provided digital data! But, how to check such an amount of data without a computer? So, only some spot tests could be made. For instance, Steve Gottlieb has investigated the “classical problem cases” – immediately finding some dozen errors! A bit alarmed (and questioning the data quality) I asked the editor to send the digital data for an independent, comprehensive check. Of course, nothing happened. The publication was forthcoming and obviously the editor was not interested in any delay (and its financial risk). For me, there were only two choices: either to forget the whole issue or to check the DSFG “by hand”. Being inquisitive and to measure the database by its own claims, I decided to do the latter. An applicable strategy was developed – and I was richly rewarded! Angry about the bad result the essential question is: Why was the hard work of the NGC/IC project completely ignored? In the following I present the result for galaxies. Based on the criteria presented above, it clearly demonstrates the “quality” of the Uranometria database.

### **1. Wrong identifications (335 cases)**

If an object is entered as NGC/IC galaxy, the following kinds of errors can occur:

- a) The object is indeed a galaxy, but is plotted at a wrong place. At the correct position (the arrow in Fig. 1 points to it) the DSFG can give: another NGC/IC galaxy (which is often identical, e.g. NGC 3479 = NGC 3502), a different galaxy (which needs to be renamed, e.g. MCG -2-29-3 = NGC 3541) or no galaxy at all (e.g. NGC 6461).
- b) The object is not a galaxy, but a star (or stars) or „not found“ (Fig. 2). A complex example: NGC 5527 is at the wrong position and should be at the place of NGC 5524. But both are not identical and NGC 5524 must be shifted too; actually it is a double star! The object at the NGC 2643 position is not NGC 2643 (but IC 2390). The historical place is farther south – but there is no object (observational error?).
- c) The NGC object appears at the correct position as a galaxy, but no NGC designation is given (see Fig. 3).

### **2. Problems concerning completeness (about 200 cases)**

There are two types: An existing NGC galaxy is not contained. An IC galaxy is not contained, which should so by definition (visual magnitude, size). Examples: NGC 4223 (12.1 mag), NGC 6993 (13.1 mag), IC 5011 (11.7 mag).

### **3. Problematic designation/data, typos (more than 150 cases)**

Examples (including non-NGC/IC objects): For the round galaxy NGC 5742 a position angle is given ( $PA = 112^\circ$ ); MCG -5-21-1 is elongated ( $2.6' \times 0.7'$ ), but a PA is missing; for UGC 1739 we have  $a < b$  ( $0.4' \times 1.2'$ ); NGC 672 has 18.1 mag (14.6 mag is correct); the open cluster King 2 has 19.8 mag (12.5 mag is correct).

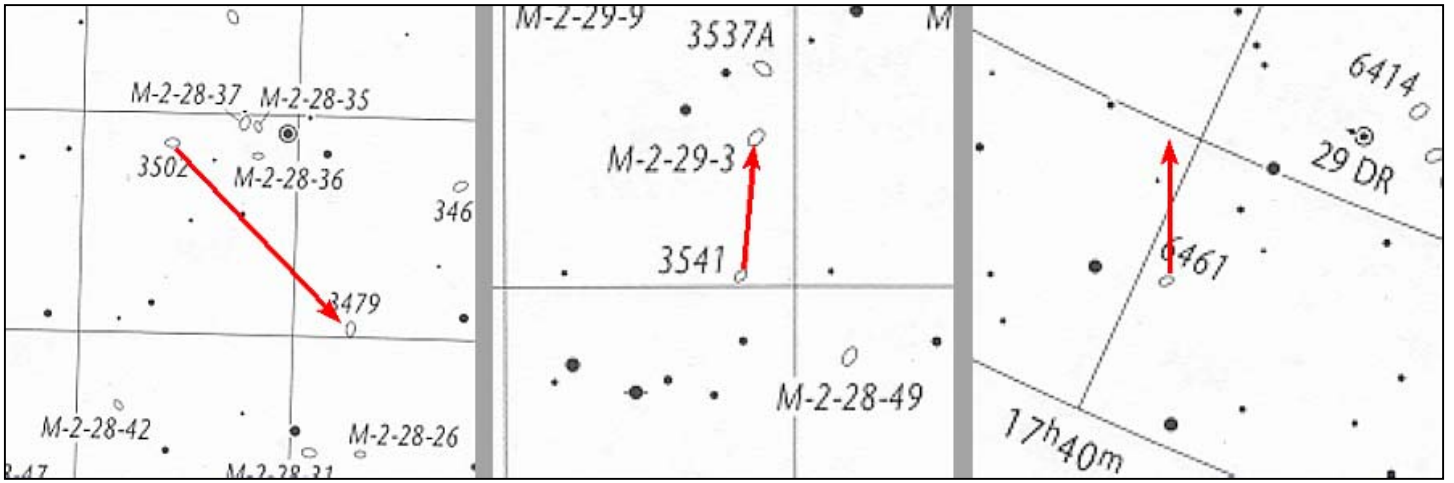


Fig. 1: The examples of identification problems (see text).

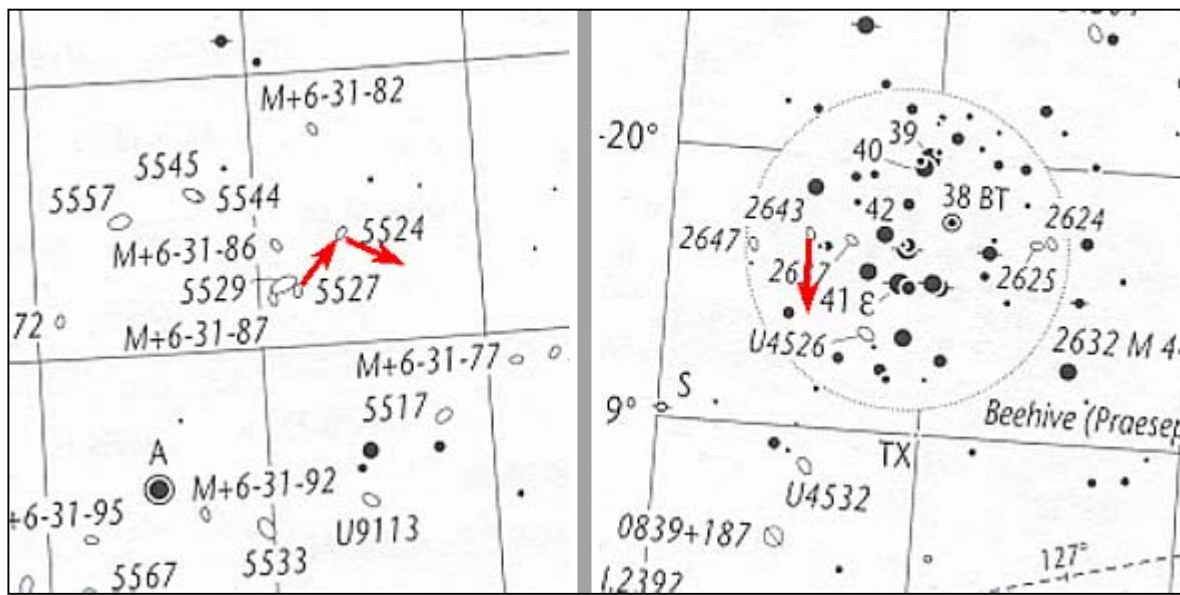


Fig. 2: Problems concerning the existence of objects (see text).

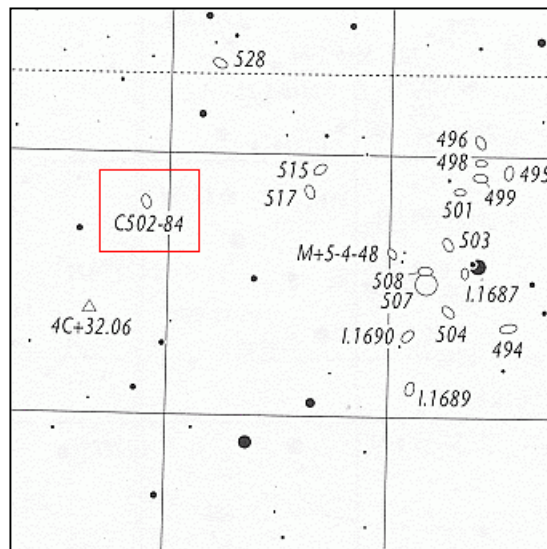


Fig. 3: Designation problem: CGCG 502-84 is actually NGC 553.

## **Conclusion**

About 10 % of all NGC/IC galaxies show errors – too much in view of the announced high standard! Non-NGC/IC galaxies and other object classes were only randomly proved (thus the error ratio is probably higher for the whole database). A correct sky image (first criterion) is not realized. All relevant object classes are included, but at least for NGC/IC galaxies there is no completeness relating to the given definitions (second criterion). Identifications are not historically correct (third criterion). Though some errors of the classical NGC/IC were corrected, unfortunately new ones appear. **A big opportunity to present a clean atlas/catalogue was missed!**

I have presented my (qualitative) results to Willmann-Bell. After first doubts and some forlorn attempts to discredit the output of the NGC/IC project, the mood changed to dismay. Damage mitigation was the new motto and improvement was promised. However, any corrections were passed to a new edition. In the meantime, the user must content oneself with the existing (expensive) publication, always doubting the reliability of the presented data. Despite the errors: the new Uranometria is a tremendous product, based on many hours of work. Perhaps we have seen the last large printed sky atlas.

## **References**

- [1] Steinicke, W., Digital deep-sky data, visual observing and the NGC/IC project (see page „Bibliography“)
- [2] <http://www.ngcicproject.org>
- [3] Stoyan, R., Duell der Atlanten, interstellarum 21, 66 (2002)
- [4] <http://www.klima-luft.de/steinicke>