Nonstellar objects in old star catalogues – Part 1

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Abstract. Thirty astrometric catalogues, dating from 1752 to 1917, were searched for references to nonstellar objects; 138 were found. Of these, 64 were identified in modern nonstellar databases. A further 62 objects are presented as being candidate open cluster remnants or microclusters.

1 Introduction

Astrometry – measuring stellar positions – is a fundamental astronomical activity. It can be argued that astronomy in South Africa owes its existence to this desire to know, as precisely as possible, the absolute positions of the stars.

Early star catalogues, such as those by Hipparchos, Ptolemy, Ulu-Begh and Tycho Brahe, were compiled from naked-eye observations and contained only stars visible in the northern hemisphere.

Edmond Halley was one of the first astronomers to use a telescope to measure stellar positions. His 1678 catalogue of 300 stars is the first telescopic southern star catalogue.

For the next two and a half centuries, astronomers would continue to compile star catalogues by making painstaking visual observations and using increasingly elaborate instrumentation.

The advent of astrophotography in the 1900s, pioneered by Sir David Gill (HM Astronomer at the Cape), brought to a close the era of visual astrometry.

In 2000, the Hipparcos satellite was used to produce the Tycho-2 catalogue, giving positions and magnitudes for 2.5 million stars across the entire sky. Recently (2002 September) the USNO-B catalogue was released, listing some 1 billion stars.

A basic issue facing the compiler of any star catalogue is simply this: Is the object I am listing, really a star? Contemporary compilers take a mathematical approach to help decide the question, which has become known as the "star/galaxy separation" problem. Visual observers, however, had to rely on their own neural networks to reach a decision.

In this paper, we examine 18th, 19th and early-20th century visual star catalogues, concentrating primarily on those compiled in the southern hemisphere.

2 Procedure

A catalogue typically contains data fields for an identifier (usually a running number), right ascension, declination, magnitude, and cross-identification. Table 1 lists the thirty catalogues reviewed here.

Each catalogue was carefully checked for any mention of non-stellar objects, either within the main body of the catalogue, in the footnotes, or the appendices. In many cases, the "magnitude" column would list "Neb" or "cluster" to identify a non-stellar entry.

A list of such objects was compiled, and if a cross-identification in another catalogue was indicated, those data were also collected. The final list contained both stars, nebulae, and clusters.

All equatorial coordinates were precessed to J2000.0 *without* taking proper motion into account. Numerous new cross-identifications were noted. In only a handful of cases was it necessary to include proper motion (retrieved from the Tycho-2 database) when precessing stellar coordinates in order to cross-identify stars.

Based on coordinates and appearance, each object was searched for in a database of nonstellar objects previously compiled by the author from various standard references.

3 Results

In the thirty catalogues reviewed, 138 references to nonstellar objects were found. Of these, 56 could be positively identified as NGC objects (galaxies, open clusters, globular clusters, and planetary nebulae). Eight other open clusters were also identified and are discussed below.

IC 2391 First recorded by Lacaille (1752, 1755) as a "small heap of stars." Later listed as Brisbane 2148, "cluster".

IC 2395 First recorded by Lacaille (1752, 1755) as a "star of 6th magnitude, connected to another more southern one by a nebulous trace." Other catalogues only note the star (e.g. Brisbane 2161, Cp40 1079, Madras 3779, Cp80 4575).

IC 2488 First recorded by Lacaille (1752, 1755) as a "faint star surrounded by nebulosity." The BAC lists the star as No. 3247 and remarks: "This nebula is not in any modern catalogue, position from Lacaille's observation." Taylor (1844) comments on this remark: "Cluster, no nebula seen." Stone (1881) and Gould (1886) record the cluster.

IC 2602 A huge (> 1°) cluster of bright stars, first recorded by Lacaille (1755) as "the star Theta Navis...surrounded by many 6/7/8 mag like the Pleiades." The cluster is recorded in the Brisbane catalogue in connection with stars 3113, 3138 and 3216, where it is called "a very fine cluster, five stars of 6th magnitude, and smaller stars." Stone (1881) makes no mention of it.

Trumpler 10 First recorded by Lacaille (1752, 1755) as "7 or 8 stars, slightly compressed." The Brisbane catalogue lists two stars, 2208 and 2210, as being in a region with "a few small stars cursorily scattered." Stone (1881) and Taylor (1844) list only individual stars here. Gould (1886), however, describes the "Brisbane 2210 cluster" in detail.

Trumpler 16 This cluster was first recorded in the Brisbane catalogue (No. 3198) as surrounding Eta Carinae, then a 2nd magnitude star, situated "in a very rich cluster, with four double stars in the field."

Trumpler 24 First reported in the Brisbane catalogue as being near No. 5891, which has "a number of stars in the field."

Collinder 240 The star Brisbane 3462 is recorded as being involved in "a very fine small cluster."

4 Discussion

Seventy-three nonstellar objects could not be identified in modern catalogues. A few of these are described as nebulae. The remainder are described as scattered star fields, groups of stars, or clusters. Table 2 lists the right ascension and declination of the centre of each object.

The intriguing, though slim, possibility exists that some of the objects from Table 2 could be *microclusters* (Lodén 1980) or *probable open cluster remnants* (Bica et al. 2001).

Several recent investigations (e.g. Bica at al. 2001, Baumgardt 1998, Platais et al. 1999) have made use of Hipparcos and Tycho data

to examine the reality of similar clusterings.

Work is currently in progress to analyze the stellar groupings in Table 2 to establish cluster membership probabilities from proper motion data.

References

Baumgardt H (1998) The nature of some doubtful open clusters as revealed by Hipparcos. *Astron. Astrophys.*, 340, 402–414.

Platais I, Kozhurina-Platais V & van Leeuwen F (1999) A search for star clusters from the Hipparcos data. *ASP Conf. Series*, 167, 296–299.

Bica E, Santiago B X, Dutra C M, Dottori H, de Oliveira M R & Pavani D (2001) Dissolving star cluster candidates. *Astron. Astrophys.*, 366, 827–833.

Lodén L O (1980) Concluding observations of loose stellar clusterings in the southern Milky Way. *Astron. Astrophys. Suppl. Ser*, 41, 173-181.

Table 1. Astrometric catalogues searched for references to non-stellar objects

Catalogue	Compiler; observatory	Year published	Non-stellar objects?
Table des ascensions droites et des declinaisons apparentes. *Mem.Acad.R.Sci.*, 539-592.	Lacaille; Cape Town	1752	yes
Sur les etoiles nebuleuses du ciel austral. *Mem.Acad.R.Sci.*, 194-199.	Lacaille; Cape Town	1755	yes
Coelum Australe stelliferum; seu observationes ad ... Caput Bonae-Spei. Paris. J D Maraldi (ed)	Lacaille; Cape Town	1763	yes
Preliminary Catalogue of Fixed Stars ... at Paramatta by Charles Rumker. Hamburgh.	Rumker; Paramatta	1832	no
A Catalogue of 606 Principal Fixed Stars ... at St. Helena, from November 1829 to Aprl 1833. By Manuel J. Johnson London.	Johnson; St Helena	1835	no
A Catalogue of 7385 Stars ... Brisbane, by Mr William Richardson. London.	Dunlop, Rumker, Paramatta	1835	yes
Astronomical Observations made at the Royal Observatory, Cape of Good Hope, in the year 1834 ... Volume 1. Cape Town.	Maclear; Cape Town	1840	yes
A General Catalogue of the Principal Fixed Stars ... at Madras in the years 1830-1843. By Thomas Glanville Taylor. Madras.	Taylor; Madras	1844	yes
The Catalogue of Stars of the British Association for the Advancement of Science. London.	Baily (compilation)	1845	yes
A Catalogue of 9766 Stars ... from the observations of the Abbe de Lacaille ... in the years 1751 and 1752. London.	Henderson; Cape Town	1847	yes

continued

Table 1. continued...

Catalogue	Compiler; observatory	Year published	Non-stellar objects?
A Catalogue of 1963 stars ... at Santiago, Chile, during the years 1850-'51-'52 ... James M. Gilliss, Superintendent. Washington.	Gilliss etc.; Santiago	1870	yes
The Cape Catalogue of 1159 Stars ... the epoch 1860. Under the superintendence of E J Stone. Cape Town.	Maclear, Stone; Cape	1873	no
First Melbourne General Catalogue of 1227 Stars ... 1863 to 1870 ... under direction of Robert L J Ellery. Melbourne.	Ellery; Melbourne	1874	no
The Cape Catalogue of Stars ... Epoch 1840. Under the superintendence of E J Stone. Cape Town.	Maclear, Stone; Cape	1878	yes
Catalogue of 12 441 Stars, for the epoch 1880 ... during the years 1871 to 1879. Edward J Stone. London.	Stone; Cape Town	1881	yes
Catalogue of 4810 stars for the epoch 1850 ... Reduced and published under the direction of David Gill. London.	Maclear, Gill; Cape Town	1884	no
Catalogo General Argentino. Posiciones medias de Estrellas Australes determinadas en el Observatorio Nacional. Cordoba.	Gould etc; Cordoba	1886	yes
Second Melbourne General Catalogue of 1211 Stars ... 1871.0 to 1884.7 ... under direction of Robert L J Ellery. Melbourne.	Ellery, White; Melbourne	1889	no
Catalogue of Stars observed at the USNO ... 1845 to 1877... Third edition ... by Professor Edgar Frisby, USN. Washington.	Yarnall; Washington	1889	no
A Catalogue of 16,748 southern stars ... at Santiago de Chile ... US Naval Astronomical Expedition ... J M Gilliss. Washington.	Gilliss etc.; Santiago	1895	yes
The Second Washington Catalogue of Stars. John R Eastman. Washington: 1898. Washington Obs. for 1892 - Appendix I.	Eastman; Washington	1898	yes
Catalogue of 2798 Zodiacal stars for the epoch 1900 ... David Gill, HM Astronomer at the Cape of Good Hope. London.	Gill; Cape Town	1899	no
Catalogue of 1905 stars for the equinox 1865.0 ... Reduced and published under the direction of David Gill. London.	Maclear, Gill; Cape Town	1899	no
Taylors General Catalogue of Stars for the equinox 1835.0 ... at Madras ... 1831 to 1842. A M W Downing. Edinburgh.	Taylor, Downing; Madras	1901	no
A Catalogue of 1625 stars between 39° and 41° south declination ... at the Perth Observatory. Vol 2. W Ernest Cooke. Perth.	Cooke; Perth	1908	yes
A Catalogue of 1846 stars between 33° and 35° south declination for the equinox 1900.0 ... Vol 3. W Ernest Cooke. Perth.	Cooke; Perth	1909	yes
A Catalogue of 2047 stars between 31° and 33° south ... Meridian observations, vol 4. W Ernest Cooke. Perth.	Cooke; Perth	1910	yes

Table 1, continued...

Catalogue	Compiler; observatory	Year published	Non-stellar objects?
A Catalogue of 2047 stars between 35° and 37° south ... Meridian observations, vol 5. W Ernest Cooke. Perth.	Cooke; Perth	1911	yes
Meridian observations, Perth Observatory, vol 6. W Ernest Cooke. Perth.	Cooke; Perth	1912	yes
Third Melbourne General Cat of 3068 Stars ... during the period 1884.7 to 1894.0 ... under the direction of Pietro Baracchi, Gov. Astron. 1895-1915. Melbourne.	Ellery, Baracchi; Melbourne	1917	no

Table 2. Equatorial coordinates for candidate open cluster remnants identified in old astrometric catalogues

RA (2000.0)	Dec	RA (2000.0)	Dec	RA (2000.0)	Dec
01:23:17	–33:28:58	08:35:48	–34:03:30	12:35:44	–61:34:25
03:07:20	–51:27:30	08:40:22	–42:23:25	12:49:43	–71:59:10
03:27:33	–35:40:53	10:00:36	–27:09:21	13:00:31	–60:22:28
03:58:27	–56:52:54	10:14:03	–54:59:36	13:20:43	–62:00:11
04:02:54	–44:28:00	10:20:31	–59:38:08	13:36:59	–61:43:23
04:18:12	–52:54:16	10:22:35	–62:04:28	14:28:43	–59:11:49
04:24:10	–32:01:01	10:28:46	–62:35:00	14:36:18	–46:14:49
04:28:20	–65:43:14	10:38:44	–59:11:02	15:12:17	–52:05:46
05:03:13	–49:29:39	10:47:09	–60:05:47	15:22:36	–59:09:56
06:57:17	–35:30:34	10:49:52	–34:35:43	15:35:24	–66:15:14
07:04:29	–31:58:53	11:01:38	–61:33:45	15:38:01	–54:31:17
07:15:20	–30:41:13	11:07:59	–30:10:12	15:48:43	–52:34:03
07:26:41	–34:08:28	11:19:25	–28:28:25	15:52:11	–45:17:03
07:54:40	–34:50:47	11:21:32	–61:13:42	15:55:30	–60:10:26
07:57:49	–34:55:43	11:22:49	–58:18:55	16:06:34	–36:48:05
08:10:46	–34:11:20	11:29:14	–63:33:15	16:07:07	–33:08:48
08:13:51	–35:12:28	11:36:23	–61:03:08	16:09:58	–62:57:53
08:15:13	–49:10:51	11:43:30	–62:29:22	16:47:26	–48:19:09
08:20:23	–25:48:07	11:54:30	–63:41:55	17:43:55	–47:36:47
08:27:60	–35:06:50	12:20:27	–65:50:29	17:57:13	–55:22:49
				18:20:35	–32:21:04
				21:30:55	–56:52:55