Lick Northern Proper Motion Program: NPM1 Catalog Cross-Identifications and Appendices

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Documentation for the Computer-Readable Version

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Abstract

The *NPM1 Catalog* provides absolute proper motions, positions, and photographic photometry, measured in the Lick Northern Proper Motion (NPM) program, for some 149,000 stars with $8 \leq B \leq 18$ mag. covering the sky outside the Milky Way north of declination $-23°$. This catalog, the *NPM1 Catalog Cross-Identifications and Appendices* consists of two parts: the NPM1 Cross-Identifications and the NPM1 Appendices. The NPM1 Cross-Identifications file provides some 42,000 cross-identifications between the *NPM1 Catalog* numbers and star names, stellar type classifications, and publication references. These additional data, extracted from the Lick *Input Catalog of Special Stars*, facilitate many practical uses of the *NPM1 Catalog.* Six Appendices to the NPM1 Catalog provide references, footnotes, and other useful information.

1 Introduction and Source Reference

A copy of this document should accompany any further distribution of these files.

1.1 Introduction

The Lick Northern Proper Motion (NPM) program is a mammoth photographic survey of the northern sky, whose goal is to measure absolute proper motions, on an inertial system defined by some 50,000 faint galaxies, for some 300,000 stars over a blue apparent magnitude range from 8 to 18, covering the northern two-thirds of the sky. A full description of the NPM program is given by Klemola, Jones, and Hanson (1987).

The NPM survey is based on photographs taken with the Lick 51 cm (20 in) Carnegie double astrograph. There are 1,246 $6° \times 6°$ fields in the NPM survey (from $+90°$ to $-23°$). First-epoch photography began in 1947; second-epoch photography was completed in 1988. Measurements and reductions for proper motions, positions, and photometry in the sky outside the Milky Way (Part I of the NPM program) began in 1975 and were completed in 1992.

The resulting catalog, the *NPM1 Catalog*, containing some 149,000 stars from 899 of the 1,246 NPM fields, was deposited with the Astronomical Data Center in 1993, as ADC catalog number A1199 (Klemola, Hanson, and Jones 1993). Documentation for the *NPM1 Catalog* is given by Hanson (1993). A more detailed discussion of the *NPM1 Catalog* is being prepared for publication (Klemola, Hanson, and Jones 1995).

Included in the *NPM Catalog* are some 94,000 anonymous stars for astrometric and galactic studies, some 23,000 positional reference stars, and some 35,000 "special stars" chosen from the astronomical literature. (These numbers total more than 149,000 due to overlaps among categories.) The *NPM Catalog* will serve as a valuable database or many applications – astrometric (correction to precession, comparison with Hipparcos), galactic (stellar kinematics, galactic rotation), and statistical (luminosity calibrations).

The *NPM1 Catalog* designates each star with a numerical "name" in a zone-catalog format (e.g., NPM1+89.0001). The only star identifications given in the *NPM1 Catalog* are the AGK3 (northern zones) or SAO (southern zones) numbers for the positional reference stars. Many useful applications of the NPM1 data will require knowledge of the star names, stellar type classifications, and publication references for the NPM1 stars.

The NPM1 Catalog Cross-Identifications file provides this information. For each NPM1 special star, this file connects the *NPM1 Catalog* "name" to the original publication references used in construction of the Lick *Input Catalog of Special Stars (ICSS)*, which is the database for selection and identification of special stars for the NPM program. Thus, the NPM1 Catalog Cross-Identifications file allows the user of the *NPM1 Catalog* to relate it to star lists and catalogs from the astronomical literature. Beyond merely identifying the NPM1 stars, this file allows the user to perform such tasks as selecting subsets from the *NPM1 Catalog* containing stars of a particular classification type, or from a particular literature reference or author. This will greatly expand the utility of the *NPM1 Catalog*.

Accompanying the NPM1 Catalog Cross-Identifications file are six Appendices to the NPM1 Catalog, providing explanations of the NPM1 stellar type designations, publication references, footnotes, and other useful information.

1.2 Source Reference

"Lick Northern Proper Motion Program: NPM1 Catalog", 1993, Klemola, A.R., Hanson, R.B., and Jones, B.F., National Space Science Data Center – Astronomical Data Center Catalog No. A1199.

2 Structure and Content of the NPM1 Catalog Cross-Identifications and Appendices.

2.1 File Structure

The NPM1 Catalog Cross-Identifications file as distributed here is in a single fixed block file. It contains 41,858 records, each 80 bytes long. It is the concatenation of 114 NPM1 zone cross-identification files, each covering 1° of declination. As in the *NPM1 Catalog*, the zones are ordered from north to south (+89° through +00°, −00° through −23°). Unlike the *NPM1 Catalog*, there may be more than one entry per star, reflecting the fact that the Lick *ICSS* may give more than one publication source per star.

Six Appendices to the NPM1 Catalog are also distributed here, in seven files. Each is a single variable block file, up to 100 bytes long. *Appendix 1* contains 113 records, giving a translation of the NPM1 star class codes. *Appendix 2* contains 69 records, giving a statistical summary of the NPM1 star classes. *Appendix 3* contains 649 records, relating publication reference numbers in the *NPM1 Catalog Cross-Identifications* to the actual literature references. *Appendix 4* is presented as two files: *(a)* an AAS LaTex file containing 3,321 records, giving the full list of literature references for the Lick *ICSS*; and *(b)* a plain ascii file, containing 2,222 records, giving the same information. *Appendix 5* contains 737 records, giving the Footnotes to the *NPM1 Catalog*. *Appendix 6* contains 18 records, giving a list of stars to be rejected from the *NPM1 Catalog*.

This information is sufficient for a user to describe the indigenous characteristics of the machine-readable version of the *NPM1 Catalog Cross-Identifications and Appendices* to a computer.

2.2 Content

The NPM1 Catalog Cross-Identifications file gives identifications, stellar class codes, and publication references for some 35,000 Lick *ICSS* "special" stars in the *NPM1 Catalog*. Large numbers of all classes of stars have been gathered by Klemola from the astronomical literature, to form the *ICSS*. For each *ICSS* star in the *NPM1 Catalog*, data were extracted from the *ICSS* to form that star's entry in the NPM1 Catalog Cross-identifications file.

Each star's entry begins with its NPM1 "name", containing the NPM1 declination zone and the star's running number within its zone (e.g., +89.0001). This is followed by the star name from the *ICSS* literature source (improvised where necessary), a three-letter code abbreviating the stellar type classification (*Appendices 1 and 2* explain these codes), and the *ICSS* publication reference number (*Appendices 3 and 4*). A one-digit code then follows, noting an identification comment, footnote, or rejection note. Four columns of photometry information give magnitudes and colors from the literature, where available. Finally, the *ICSS* literature reference is given in a highly abbreviated form (see *Appendix 3* description below).

Appendix 1 gives a translation of the 113 three-letter class codes used in the NPM1 Catalog Cross-Identifications file. The codes are listed in alphabetical order. These class codes are usually based on information given by the authors of the publications from which the stars were chosen. For many surveys these classes are only provisional, awaiting improved data for more definitive stellar classifications. The variable star class codes are those in GCVS3 and its three supplements (REF 0001), and the codes in the three supplements to GCVS4 (REFS 0614, 0615, 0616).

Appendix 2 is a text file giving a condensed array of class codes according to natural groupings of the objects. Counts of stars in the *NPM1 Catalog* are listed for each class. For variable stars, the number in each class in the GCVS4 are also listed, for comparison with the NPM1 counts.

Appendix 3 relates the *ICSS* publication reference numbers given in the NPM1 Catalog Cross-Identifications file to the actual literature references. After the null reference (0000) for reject stars, the entries are sorted alphabetically, by the surname of the first author. The first column of each entry gives the *ICSS* number. Then follows the abbreviated publication reference. Here, a + sign following the author denotes multiple authorship. An asterisk after the year of publication means this *ICSS* source includes additional references (see *Appendix 4*). The next column gives the total number of stars from this reference in the *NPM1 Catalog*. Finally, the three-letter codes for the classes of objects found in this reference are also listed.

Generally, *Appendix 3* has one entry per literature reference. Three exceptions to this rule are the variable star catalogs: REF 0001 (6 lines), REF 0614 (2 lines), and REF 0615 (2 lines).

It is important to note that the Lick *ICSS* includes many more publication references than actually appear in the NPM1 Catalog Cross-Identifications file. There are three reasons for this: (1) The *ICSS* covers the whole northern sky, including the Milky Way, which forms the future Part II of the NPM program (NPM2). (2) Many stars were added to the *ICSS* after their particular declination zones were already measured, i.e., too late for inclusion in NPM1. (3) Any *ICSS* stars failing to survive the NPM1 survey, measurement, or reduction stages do not appear in the *NPM1 Catalog.*

Appendix 4 gives a full listing of all *ICSS* publication references. These are in numerical order by *ICSS* reference number. There are 641 references plus the null reference (0000) for reject stars. Some *ICSS* reference numbers correspond to more than one literature reference, e.g. a series of papers. Several publications provide no additional stars but contain finding charts for other references. *Appendix 4* is presented in two versions: *(a)* in AAS LaTex format, and *(b)* in ascii format.

Appendix 5 provides 737 Footnotes to the *NPM1 Catalog.* These stars are flagged by a one-digit code in the NPM1 Catalog Cross-Identifications. Each footnote entry consists of the NPM1 "name", followed by the note itself. The entries are ordered in the same manner as the *NPM1 Catalog.*

Appendix 6 lists 18 stars which must be rejected from the *NPM1 Catalog*, for reasons identified during the compilation of the NPM1 Catalog Cross-Identifications. (These include survey errors, severe image blending, image defects, and other uncorrectable errors.) These stars are flagged by a one-digit code in the NPM1 Catalog Cross-Identifications file. Each entry in *Appendix 6* consists of the NPM1 "name", followed by the reason for rejection. The entries are ordered in the same manner as the *NPM1 Catalog.*

2.3 File Format

The "readme" file distributed with the *NPM1 Catalog Cross-Identifications and Appendices* gives a byte-by-byte description of the contents of each file, except for *Appendices 2 and 4a* which are text files.

3 Notes

The *NPM1 Catalog Cross-Identifications and Appendices* are designed to be used in conjunction with the *NPM1 Catalog.* For example:

(1) To find the identity (and other information) for a particular NPM1 "special" star, use the NPM1 "name" (e.g. +89.0001) to locate that star's entry (or entries) in the NPM1 Catalog Cross-Identifications file.

(2) To find NPM1 stars of a given stellar type or classification, first use *Appendix 1* to find the

appropriate three-letter NPM1 class code. Then search the NPM1 Catalog Cross-Identifications file (column 3) to generate a list of NPM1 "names".

(3) To find NPM1 stars from a particular literature reference, or from a particular author's paper(s), first use *Appendix 3* to find the *ICSS* reference number(s). Then search the NPM1 Catalog Cross-Identifications file (column 4) to generate a list of NPM1 "names".

4 Acknowledgments

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5 References

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