A Catalog of Spectroscopically Identified White Dwarfs (McCook and Sion 1987)

Documentation for the Computer-Readable Version

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Abstract

The machine-readable version of the catalog, as it is currently being distributed from the Astronomical Data Center, is described. This catalog is a compilation of 1279 white dwarfs that been identified spectroscopically up to January 1987. It is the third edition of the Villanova *Catalog of Spectroscopically Identified White Dwarfs* and contains a large collection of basic photometric and spectroscopic data (with literature references), cross identifications to alternate designations, and computed absolute visual magnitudes based upon trigonometric parallaxes or the best available color-magnitude calibration.

1 Introduction

1.1 Description

The present compilation is an expanded and updated successor to the first (McCook and Sion 1977) and second (McCook and Sion 1984) editions of the catalog. Due to the great increase in the number of newly identified spectroscopic degenerates and the publication of important surveys since the previous editions, a new catalog was considered appropriate at this time. Although the third edition does not incorporate a large number of newly discovered stars, quite a few revisions, corrections, and some additions have been made. New parallax and photometric data have been included, the descriptions of the names entries expanded, and the notes section considerably enlarged. As such, the new catalog provides a valuable addition to the large number of machine-readable catalogs presently available to the astronomical community.

This document describes the machine-readable version of *A Catalog of Spectroscopically Identified White Dwarfs* as it is currently being distributed from the Astronomical Data Center (ADC). It is intended to enable users to read and process the computerized catalog without problems and guesswork, and it should be used only to supplement the information contained in the published paper. Since there are several important formatting differences between the published and machine-readable tables, users of the machine version are encouraged to carefully study the data descriptions in the following sections of this document before using and interpreting the data. **A copy of this document should be transmitted to any recipient of the machine-readable catalog originating from the ADC**.

1.2 Source Reference

McCook, G. P. and Sion, E. M. 1987, *Astrophys. J. Suppl.* **65**, 603.

2 Structure

2.1 File Summary

The machine version of *A Catalog of Spectroscopically Identified White Dwarfs* consists of five files. Table 1 gives the machine-independent file attributes. All logical records are of fixed length, and if the catalog is received on magnetic tape, it will contain blocks of fixed length (as noted below) except that the last block of each file may be short. The second file contains the basic data of the catalog, while succeeding ones contain textual information to facilitate the use of the catalog data. The data file is in a multiple-record format per object in order to allow all known observations of a star to be reported. Although coordinates have been added to all records, those other than the first for a given object may contain mostly blank fields except for those that were needed to record particular multiple observations of the object.

A Catalog of Spectroscopically Identified White Dwarfs (McCook and Sion 1987)				
File	Contents	Record Format	Record Length	Number of Records
1	Introduction	Fixed	80	501
2	Data	Fixed	188	2420
3	Notes	Fixed	80	200
4	Names	Fixed	30	2809
5	References	Fixed	80	320

Table 1: Summary Description of Catalog Files

The information contained in the above table is sufficient for a user to describe the indigenous characteristics of the machine-readable version of *A Catalog of Spectroscopically Identified White Dwarfs* to a computer. Information easily varied from installation to installation, such as block size (physical record length), blocking factor (number of logical records per physical record), total number of blocks, density, number of tracks and character coding (ASCII, EBCDIC) for tapes, is not included, but should always accompany secondary copies if any are supplied to other users or installations.

2.2 Introduction (File 1 of 5)

This file is composed of straight text and contains the introduction to the published catalog. Column descriptions of catalog data are given here and are therefore only briefly repeated in this document. A detailed byte-by-byte description of the data format is not included in this introduction, however, and is therefore given in the following section of this document.

2.3 Catalog (File 2 of 5)

This file contains the compilation of basic data for the degenerate stars included in the catalog. General data descriptions and remarks about the data sources, etc. are given in the introductory file.

As mentioned in Section 2.1, the data file may contain more than one logical record per object if multiple values of reported data exist. This means that any data field, except for the WD number and coordinates, may be blank. Since the "names" field contains two subfields, there is space for two alternate designations before a second record is needed. The inclusion of more than a single value of any other datum requires that a second or succeeding record be present. Thus, for example, the object WD0000+171 (the first degenerate in the catalog) has only a single record, whereas WD0000-170 (the second object) has four records because four values of the proper motion are included in the catalog. All of the other fields are not blank, however, because three alternate identifiers, two UBV values, and two multichannel spectrophotometric data are included.

Table 2 gives a byte-by-byte description of the contents of the data file. A suggested Fortran format specification for reading each data field is included and can be modified depending upon individual programming and processing requirements (Fortran 77 character string-type formats are used); however, caution is advised when substituting format specifications, since many data fields contain character data and others are blank when data are absent. Particular care is required for the photometric data (color indices), proper motions, and trigonometric parallax, where valid zero values can exist, but where fields are blank for nonexistent data, and where precision may vary within the same field. It is safest to buffer in records in an unformatted mode or read them with character (A) formats and test for blank data fields before processing with numerical formats for calculations and/or searching purposes. For such fields, primary numerical format specifications are given to indicate decimal-point locations, while alternate A-type formats are specified in parentheses. Default (null) values are always blanks in data fields for which primary suggested formats are given as A.

WD number — Stars having identical catalog numbers, whether binary or not, are distinguished by using the designations .1 and .2 in bytes 9-10.

Coordinate accuracy flag — Specifies the accuracy (and in some cases precision) to which the equatorial coordinates are given:

- **1** Right ascension given in hours, minutes and seconds; Declination reported in degrees, arcminutes and tenths.
- **2** RA originally given in hours, minutes and tenths, in which case a conversion to seconds has been effected in order to make the format uniform. In some cases, RA may be given to hours and minutes only (bytes 18-19 blank). Dec is generally given in degrees and whole minutes only (byte 28 blank).

Equatorial coordinates — Equinox 1950.

Bytes	Units	Suggested Format	Default Value	Data
1-10	—	A10 (I4,F6.1)	—	WD number
11-13	hours	I3	—	Right ascension
14-16	min	I3	—	RA
17-19	sec	I3	—	RA
20	—	I1	—	Coordinate accuracy flag
21-23	deg	I3	—	Declination
24-28	arcmin	F5.1	—	Dec
29	—	1X	—	Blank
30-35	—	A6	—	Spectral type
36-39	—	A4	—	Spectral-type reference
40	—	1X	—	Blank
41-65	—	A25	—	Names
66-71	mag	F6.2 (A6)	blank	Visual or photographic magnitude
72	—	A1	—	Magnitude uncertainty flag (:)
73-74	—	A2	—	Photographic magnitude designation
75-79	mag	F5.2 (A5)	blank	B-V color
80	—	A1	—	B-V uncertainty flag (:)
81-83	—	A3	—	Color class
84-88	mag	F5.2 (A5)	blank	U-B color
89	—	A1	—	U-B uncertainty flag (:)
90-93	—	A4	—	Wide-band photometry reference
94-95	—	2X	—	Blank
96-100	mag	F5.2 (A5)	blank	Multichannel V magnitude
101	—	A1	—	Magnitude uncertainty flag (:)
102-107	mag	F6.2 (A6)	blank	Multichannel g-r color
108-111	—	A4	—	Spectrophotometric reference
112-118	mag	F7.3 (A7)	blank	$V(y)$ magnitude
119-124	mag	F6.3 (A6)	blank	b-y color
125-131	mag	F7.3 (A7)	blank	u-b color
132-135	—	A4	—	$uvby$ reference
136-137	—	2X	—	Blank
138-142	[1]	F5.2 (A5)	blank	Absolute visual magnitude
143	—	A1	—	Absolute visual magnitude code
144-146	—	A3	—	Absolute visual magnitude reference
[1] Units are magnitudes or kelvins (see M_V explanation)				

Table 2: Data File Record Format

Bytes	Units	Suggested Format	Default Value	Data
147-153	arcsec	F7.4 (A7)	blank	Annual proper motion
154	—	A1	—	PM code
155-159	deg	F5.1 (A5)	blank	PM position angle
160-163	—	A4	—	PM reference
164-168	km/s	I5	blank	Radial velocity
169-170	—	2X	—	Blank
171-174	—	A4	—	Radial-velocity reference
175-181	arcsec	F7.4 (A7)	blank	Trigonometric parallax
182	—	A1	—	Trigonometric parallax code
183-184	0.001 arcsec	I2	blank	Trigonometric-parallax mean error
185-188	—	A4	—	Trigonometric-parallax reference

Table 3: Data File Record Format (continued)

Spectral type Classification according to the new system described by Sion *et al.* (1983). A full description of the notation is given in the introductory file.

Spectral-type reference Coded reference given in the references file (5). In many cases, the primary classification reference is not given, but may be found in the secondary reference listed.

Names Cross identifiers to the various designations by which each star is commonly known. A key to the names is given in the introductory file and an extensive table of cross identifications, ordered alphabetically, is provided in the NAMES file (4).

Visual or photographic magnitude A V magnitude on the UBV sytem is given where available. If the star has not been observed on the UBV system, a photographic magnitude may be reported. Precision varies from whole magnitudes to hundredths for V; it is to tenths only for *ptg*.

Magnitude uncertainty flag A colon (:) denotes an uncertain value.

Photographic magnitude designation The characters "pg" are present if the magnitude is photographic.

B-V color This field may be blank for succeeding records of the same object (as can any fields except for the WD identifier and coordinates) or if a photographic magnitude is reported in bytes 67-71 and a color class is coded in bytes 81-83.

B-V uncertainty flag A colon (:) denotes an uncertain value.

Color class A color class from either the Lowell or Luyten proper-motion surveys is given if only a photographic magnitude is available.

U-B color *U-B* on the Johnson and Morgan *UBV* system.

U-B uncertainty flag A colon (:) denotes an uncertain value.

Wide-band photometry reference Coded reference given in the references file (5).

Multichannel V magnitude *V* magnitude determined from multichannel spectrophotometric observations. Precision varies (tenths or hundredths).

Magnitude uncertainty flag A colon (:) denotes an uncertain value.

Multichannel g-r color Color determined from multichannel spectrophotometric observations.

V(y) magnitude *V* as determined from four-color (*uvby*) photoelectric observations. In general, this should agree well with the *V* magnitude from wide-band photometry. Most values are reported to hundredths, but a few to thousandths are included.

b-y color Values are generally reported to thousandths, but precision varies.

u-b color As determined from four-color observations. The *u-b* index is computed from the nominal *uvby* colors c_1 and m_1 by:

$$(u-b) = c_1 + 2[m_1 + (b-y)]$$

uvby reference Coded reference given in the references file (5).

Absolute visual magnitude M_V M_V computed from either a trigonometric parallax or from measured colors according to the following priority:

(1) $\pi_{\rm trig} > 0.1$ arcsec

(2) Multichannel spectrophotometric colors

(3) *uvby* colors

(4) *UBV* photometry

Exceptions to this priority system are denoted by the codes (0), (5) and (6) and are described in the introductory file. A notable exception is present in the machine version for reference code (5) [see byte 143 explanation].

M_V **code** In most cases, data are given in units of magnitudes. However, for the DO and DOZ white dwarfs, the compilers have replaced M_V values with directly derivable effective temperatures. These are given in bytes 138-142 in units of 10^5 K in the machine version and are denoted by the presence of an "E" in byte 143. See the introductory file or the published paper for additional information. A colon for uncertainty in M_V can occur here also.

M_V reference Coded reference given in the references file (5).

Proper Motion The annual proper motion is given in seconds of arc and the precision varies. Estimated proper motions (EPM) are also reported with a code in byte 154 (see explanation below).

PM code In cases where only an EPM is reported in the Lowell proper-motion surveys, bytes 148-153 are blank and a corresponding code is given in byte 154. These codes are defined in Giclas *et al.* (1967, 1970) and are the following:

- **0** Stars of blue color whose motions are too small to definitely verify on all plates.
- **1** Estimated proper motion ≤ 0.1 arcsec.
- **2** Estimated proper motion 0.1 arcsec $\leq$ PM < 0.2 arcsec.
- **3** Estimated proper motion 0.2 arcsec $\leq$ PM < 0.26 arcsec.

PM position angle Position angles are given to varying precision, but there is always a decimal point in byte 158 in the machine version.

PM reference Coded reference given in the references file (5).

Radial velocity Observed radial velocity uncorrected for solar motion and for gravitational redshift.

Radial-velocity reference Coded reference given in the references file (5).

Trigonometric parallax, $\pi_{\rm trig}$ Published values of observed $\pi_{\rm trig}$.

Trigonometric parallax code A colon (:) denotes an uncertain value.

$\pi_{\rm trig}$ mean error Reported mean errors associated with measured parallaxes.

$\pi_{\rm trig}$ reference Coded reference given in the references file (5).

2.4 Notes (File 3 of 5)

This file contains the notes for stars flagged by an asterisk in byte 35 of the data file.

WD number Number of the star in the main data file.

Notes Notes in free text (upper case only) form. When bytes 5-16 are blank, this record continues the remarks for the previous star.

Bytes	Suggested Format	Data
1-4	4X	Blank
5-16	A12	WD number
17-18	2X	Blank
19-80	A62	Notes

Table 4: Notes File Record Format

2.5 Names (File 4 of 5)

This file contains an extensive cross-identification table from commonly used white-dwarf designations to the WD numbers employed in the catalog. The file is ordered alphabetically and is reasonably uniform within each designation type, *i.e.*, it can be sorted and resorted by name and the records will emerge in order by both name and numerical designation. This uniformity was achieved by allocating the first part of the names field to the alphabetic part of each designation and the second part to the corresponding number. Component designations for multiple systems follow the numerical part of a name in a uniform format.

Bytes	Suggested Format	Data
1-16	A16	Name
17	A1	Component designation
18	1X	Blank
19-30	A12	WD number

Table 5: Names File Record Format

Name The commonly used name for the degenerate.

Component designation Identification of the component for a multiple-star system.

WD number The WD designation used in the catalog.

2.6 References (File 5 of 5)

This file contains the bibliographical references ordered by the codes used in the data file.

Reference code A two-character code used in the data file to cite a reference.

Reference Reference in free text (upper case only) form. Bytes 1-9 of a record are blank if it is a continuation of a reference.

Bytes	Suggested Format	Data
1-2	A2	Reference code
3	1X	Blank
4-80	A77	Reference

Table 6: References File Record Format

3 History

3.1 Remarks and Modifications

The machine-readable data files of *A Catalog of Spectroscopically Identified White Dwarfs* were received on floppy disks from Dr. George P. McCook of Villanova University on January 20, 1988. The individual files of the catalog were uploaded to the IBM 3081K computer of the NASA Space and Earth Sciences Computing Center at Goddard Space Flight Center, where the data were examined for uniformity, structure, and ease of machine processing. Based upon this analysis, the following modifications to the data files were made with the collaboration of the compilers:

1. Individual corrections were made to the data file based upon the presence of certain superfluous characters, data misalignment, and a few erroneous values.
2. The data file was reformatted in order to isolate photographic magnitude designations, color classes, $T_{\rm eff}$ codes in the M_V field, and EPM codes from their corresponding numerical fields, thus allowing all data to be read and searched with a uniform format. Color-index data, which can have zero values, must clearly still be read with a character format and tested for blanks before data searches can be run, but the present uniformity in format and coding allows for simplified processing and sorting, etc.
3. The original data file had positional data only in the first record of a group. Right ascension values were also given in different formats ("mm ss" and "mm.m"). All data were therefore converted to the "mm ss" format and the coordinate accuracy flags were added between the RA and Dec fields. A program was then written to transcribe the coordinates from the first record of each degenerate to all other records for the same object, thus simplifying the searching and sorting of the data by position.
4. Certain data, such as declination, magnitudes, and position angles of proper motions, were present as both integer and real numbers. Decimal points were added to all of these, even if there are no fractional units, so that all data can be processed with a single format specification.
5. The names file was structured in a multicolumn format as in the published catalog. The entire file was reformatted to produce a single record per object and the name field was expanded to allow for a reasonably uniform format to be designed and implemented. Names were also converted from all upper to mixed case, depending upon how they are used in the literature and in the original sources.

3.2 Acknowledgments

Appreciation is expressed to Drs. George P. McCook and Edward M. Sion for supplying the machine-readable catalog, for collaborating to make the changes described above, and for reviewing this documentation before its final release. Dr. Sion's prompt responses by telephone and electronic mail helped greatly to speed up the completion of the work and thus to make the data available to the astronomical community sooner.

3.3 References

Giclas, H. L., Burnham, R. Jr., and Thomas, N. G. 1967, *Lowell Obs. Bull.* No. 141.

Giclas, H. L., Burnham, R. Jr., and Thomas, N. G. 1970, *Lowell Obs. Bull.* No. 153.

McCook, G. P. and Sion, E. M. 1977, *A Catalog of Spectroscopically Identified White Dwarfs*, 1st edition, *Villanova Univ. Obs. Contrib.* No. 2.

McCook, G. P. and Sion, E. M. 1984, *A Catalog of Spectroscopically Identified White Dwarfs*, 2nd edition, *Villanova Univ. Obs. Contrib.* No. 3.