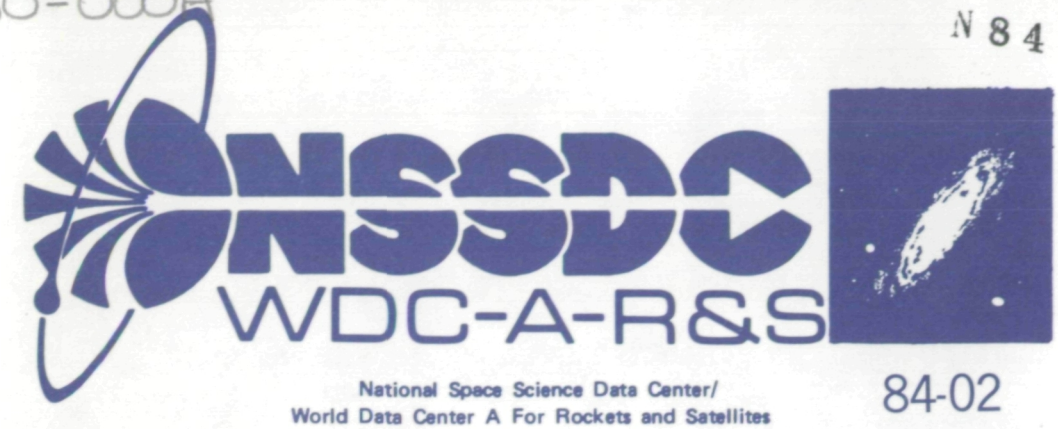

National Space Science Data Center/
World Data Center A For Rockets and Satellites

84-02

Documentation for the Machine-Readable Version of the Smithsonian Astrophysical Observatory Star Catalog (SAO) Version 1984

January 1984

NSSDC/WDC-A-R&S 84-02

DOCUMENTATION FOR THE MACHINE-READABLE VERSION

OF THE

SMITHSONIAN ASTROPHYSICAL OBSERVATORY STAR CATALOG (SAO)

VERSION 1984

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January 1984

National Space Science Data Center (NSSDC)/
World Data Center A for Rockets and Satellites (WDC-A-R&S)
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ABSTRACT

An updated, corrected and extended machine-readable version of the catalog is described. Published and unpublished errors discovered in the previous version have been corrected, and multiple-star and supplemental BD identifications added to stars where more than one SAO entry has the same Durchmusterung number. *Henry Draper Extension* (HDE) numbers have been added for stars found in both volumes of the extension. Data for duplicate SAO entries (those referring to the same star) have been blanked out, but the records themselves have been retained and flagged so that sequencing and record count are identical to the published catalog.

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SECTION 1 - INTRODUCTION AND PROCEDURE

INTRODUCTION

A character-coded machine-readable version of the *Smithsonian Astrophysical Observatory Star Catalog* (SAO, SAO Staff 1966) was prepared by T. A. Nagy (1979) from a packed binary tape obtained from the Smithsonian Astrophysical Observatory. In addition to certain format modifications, equatorial coordinates in radians and cross identifications from the *Table of Correspondences SAO/HD/DM/GC* (Morin 1973) were added to the converted version; however, the known errata lists were not incorporated at that time. This version of the catalog served as a starting point for the new version described here. As a prelude to creation of the new SAO, a new version of the *SAO-HD-GC-DM Cross Index* was prepared (Roman, Warren and Schofield 1983) since most of the changes and extensions for the SAO involve data presently in the Cross Index. The current version of the SAO contains the corrected and extended cross identifications, all errata published up until the date of this version (January 1984) and known to us, numerous errors forwarded to us by colleagues, and errors discovered at the Astronomical Data Center during the course of this work.

This document describes the new version of the machine-readable SAO Catalog. It outlines the procedures used to correct and extend the previous version and is intended to enable users to read and process the data without problems and guesswork. The following section describes the analysis and methods used to cross identify the stars and to add component identifications for stars where more than one SAO record has the same Durchmusterung (DM) identification. Section 2 provides detailed descriptions of the catalog format and codes used in the data records, while Section 3 contains information on the characteristics of the magnetic tape file. Miscellaneous remarks and sources for the corrections incorporated into this version are given in Section 4, which also contains bibliographical references. A sample listing of data records exactly as they are recorded on the tape comprises Section 5. A copy of this document should accompany any machine-readable version of the SAO Catalog.

PROCEDURE

The assignment of components to SAO stars for which more than one entry has the same DM number was done when preparing the new *SAO-HD-GC-DM Cross Index*, and that procedure is described in Roman *et al.* (1983). A somewhat less detailed description is given here for completeness.

Components were assigned according to the *Index Catalogue of Visual Double Stars* (IDS, Jeffers *et al.* 1963; Worley 1980); for stars not in the IDS, components were labeled according to visual magnitude. Supplemental (footnoted) BD stars (Warren and Kress 1980) were identified and entered with lower case letters. Corrections and additions to cross-identification data were made as necessary. Some duplicate DM numbers actually referred to the same star for which SAO data had been obtained from different source catalogs In these cases, all data were deleted for one entry, normally for the one

whose position was judged to be of lower accuracy. However, the data records have been retained and the deleted entries indicated by placing a "D" immediately following the SAO number of each deleted star.

Many stars occur in two DM catalogs (CD, CPD) in the southern hemisphere. The SAO gives numbers from different catalogs for the components of some double stars; hence, although there are no duplicate DM numbers, component confusion can occur. Although a search for such systems was not exhaustive, the catalog was searched for adjacent entries with declinations within 3' of each other. Most of these entries proved to be double stars and were appended with letter designations as if their DM numbers had been the same. These DM numbers were not changed.

An important subset of rather bright stars in the published SAO Catalog has no DM numbers given. (Most of the stars in this subset were identified as FK3 double stars which were omitted from the FK4.) Many of these had been identified by W. L. Stein, who supplied probable DM numbers. The positions for these stars were compared manually with their positions in the various DM catalogs and many additional identifications were made.

Although the *Henry Draper Extension* (Cannon 1925-1936) stars from *Harvard Annals*, Volume 100, having DM numbers listed in the original catalog, were included in the SAO, those listed with AG numbers only (Astronomische Gesellschaft, zones +50° to +54°, Harvard, Rogers 1892; zones +55° to +59°, Helsingfors-Gotha, Krüger 1890) had not been cross identified and inserted into the machine version. The *Yale Zone Catalogues* (YZ, Barney *et al.* 1959*a*, 1959*b*), which identify stars by their AG numbers, but also give corresponding DM numbers, were used to cross identify the AG stars. This was accomplished by using the magnetic tape versions of the YZ and HD catalogs and matching the stars by machine. A cross index of *Henry Draper Extension* stars from *Harvard Annals*, Volume 112 (Cannon and Walton Mayall 1949) and DM numbers (Bonnet 1978) was used to insert HDE numbers from the final HD volume.

Since the GC (Boss 1937) numbers in the *SAO-HD-GC-DM Cross Index* had been assigned by comparing with HD numbers in the GC, stars without HD numbers in the Cross Index were missing GC identifications. The magnetic tape file of the GC was therefore searched by DM number for all stars having no GC numbers in the Cross Index. Additional GC numbers were found manually (by position) for the few remaining stars without DM numbers. Fourteen GC stars were found not to be in the SAO Catalog. HD numbers in the GC were then compared with their counterparts in the Cross Index for stars in common, leading to the detection and correction of a number of additional errors.

The catalog contains a numerical code appended to each HD number. The code originally followed the convention of the Strasbourg *Catalog of Stellar Identifications* (CSI, Ochsenbein *et al.* 1981) which assigned the numbers 1, 2, ... for individual components of multiple systems and the digit 9 if two contiguous HD stars are included in the entry (the lower HD number is usually given with code 9). Since the component codes were assigned to CSI entries without regard to letter designations, and because letter designations have now been added, the HD code was changed to a consistent indication of major contamination of the spectral type of the component to which the entry applies by the spectrum of another star (see Table 2). A visual magnitude

difference of 0.3 was used as the limit for which contamination was indicated. Although photographic magnitudes would have been more appropriate, the visual magnitudes in the SAO appeared to be more consistent.

Many HD numbers were added to the *SAO-HD-GC-DM Cross Index* and subsequently to the SAO, and quite a few incorrect HD numbers were changed. The SAO already contained spectral types for many of these stars; those types were compared with the types in the HD, and discrepancies were corrected only where it seemed desirable. For stars with new HD numbers and no spectral types in the SAO, the latter were inserted using the machine version of the HD for the main catalog and the first extension. Spectral types were read from the charts of the second extension (*Harvard Annals* 112) and approximately 5000 inserted manually; types were also inserted for other HD stars for which they were missing in the SAO. For components of multiple stars, spectral types were added or removed according to the likelihood that the star contributed the HD type.

Following completion of the Cross Index, all appropriate cross-identification data were replaced in the new SAO. Additional corrections involving the SAO only were then made. In certain cases, SAO positions had been found in error, but correct positions in the SAO system could not have been derived without a re-reduction of all the original data. Since this would clearly have been impracticable, positions were taken from the *Cape Photographic Catalogues* for 1950.0 (CPC). (Errata for the CPCs have been published in the zone catalog for -80° to -90° [Stoy 1968]). The CPC proper motions were applied to the positions at epoch to bring them to epoch 1950.0.

A total of 12,373 SAO records was corrected or supplemented with 17,915 individual data changes. All changes are itemized on the microfiche cards accompanying this document (see Section 4).

SECTION 2 - TAPE CONTENTS

A byte-by-byte description of the contents of the machine-readable SAO Catalog is given in Table 1. The suggested format specifications apply to FORTRAN formatted read statements and can be modified depending upon individual programming and processing requirements. All data fields with primary A-format specifications are blank for missing data; hence the alternate numerical specifications used for machine searches will produce zero values. Data are always present in fields for which primary numerical formats are given, except where specifically noted.

Table 1. Tape Contents. *Smithsonian Astrophysical Observatory Star Catalog.* Version 1984.

Byte(s)	Units	Suggested Format	Description
1- 6	---	I6	SAO number
7	---	A1	"D" if this SAO entry has been blank filled due to the deletion of a duplicate star from the catalog. In this case the record contains only the SAO number and a "D" in this byte.
8- 9	hours	I2	Right ascension (α) 1950.0 equinox and epoch.
10- 11	min	I2	α
12- 17	sec	F6.3	α,
18- 24	sec	F7.4	Annual proper motion μ_α.
25- 26	$0''.001\ yr^{-1}$	I2 (F2.3)	Standard deviation (σ_μ) of μ_α.
27	---	A1	A "+" or "-" to indicate that the minutes of time associated with the seconds portion of α (bytes 28-33) must be increased or decreased by 1, respectively; otherwise blank (if α_2 is the same minute as α^s in bytes 12-17).
28- 33	sec	F6.3	Seconds portion (α_2) of α at original epoch, precessed to 1950.0 (i.e. 1950 position modified by proper motion).
34- 35	$0''.01\ yr^{-1}$	I2 (F2.2)	Standard deviation (σ) of α_2.
36- 41	years	F6.1	Epoch of α_2.

Table 1 (continued)

Byte(s)	Units	Suggested Format	Description
42	---	A1	Sign of declination.
43- 44	°	I2	Declination (δ) 1950.0 equinox and epoch.
45- 46	'	I2	δ
47- 51	"	F5.2	δ
52- 57	"	F6.3	Annual proper motion μ_δ.
58- 59	0".001 yr^{-1}	I2 (F2.3)	Standard deviation (σ_μ) of μ_δ.
60	---	A1	A "+" or "-" to indicate that the arcminutes associated with the arcseconds portion of δ (bytes 61-65) must be increased or decreased by 1, respectively; otherwise blank (if δ_2 is in the same minute as δ" in bytes 47-51).
61- 65	"	F5.2	Seconds portion (δ_2) of δ at original epoch, precessed to 1950.0 (i.e. 1950 position modified by the proper motion).
66- 67	0".01 yr^{-1}	I2 (F2.2)	Standard deviation (σ) of δ_2.
68- 73	years	F6.1	Epoch of δ_2.
74- 76	0".01 yr^{-1}	I3 (F3.2)	Standard deviation of position at epoch 1950.0.
77- 80	mag	F4.1	Photographic magnitude m_{pg} (99.9 if no value present). When both magnitude fields are 99.9, the miscellaneous code (byte 95) should be checked for possible variability, in which case magnitudes may not be reported.
81- 84	mag	F4.1	Visual magnitude m_v (99.9 if no value present).
85- 87	---	A3	Spectral type ("+++" for composite spectra).
88- 89	---	I2	Coded source of visual magnitude (see Table 3).

Table 1. (continued)

Byte(s)	Units	Suggested Format	Description
90- 91	---	I2	Coded source of star number and footnotes (see Table 4).
92	---	I1	Coded source of photographic magnitude (see Table 5).
93	---	I1	Coded source of proper motions (see Table 6).
94	---	I1	Coded source of spectral type (see Table 7).
95	---	I1	Coded miscellaneous remarks for duplicity and variability (see Table 8).
96	---	I1	Accuracy of visual magnitude: 0 indicates that the magnitude in the source catalog is reported to 0^{m}00; 1 to 0^{m}0.
97	---	I1	Accuracy of photographic magnitude: same coding as for byte 96.
98- 99	---	I2	Code for source catalog (see Table 9).
100-104	---	I5	Number in source catalog.
105-106	---	A2	Durchmusterung (DM) identification (BD = *Bonner Durchmusterung*; CD = *Córdoba Durchmusterung*; CP = *Cape Photographic Durchmusterung*). All DM fields are blank if no DM identification present.
107	---	A1	Sign of DM zone.
108-109	---	I2 (A2)	DM zone
110-114	---	I5 (A5)	DM number.
115-116	---	A2	Component identification if there are two or more SAO stars having the same DM number. For multiple systems included in the *Index Catalogue of Visual Double Stars* (IDS, see Worley 1980) the IDS components are given; for non IDS stars, components were

Table 1 (concluded)

Byte(s)	Units	Suggested Format	Description
			assigned on the basis of magnitude. If two components of southern double stars are listed, DM numbers from different catalogs are often quoted for the components. In these cases, component identifications are usually given without changing the DM numbers.
117	---	A1	Lower case letter identification for BD supplemental stars (Warren and Kress 1980).
118-123	---	A6 (I6)	*Henry Draper* (HD or HDE) *Catalogue* number.
124	---	A1 (I1)	HD code (1, 2, ... for component identifications where more than one star has the same HD number [not necessarily equivalent to A, B, ... or to the component identifications in the IDS]; 9 in cases where HD and HD+1 are included, e.g. 179957/8; 0 otherwise).
125-129	---	A5 (I5)	Number in *General Catalogue of 33342 Stars for 1950* (GC, Boss 1937).
130-139	rad	F10.8	Right ascension (1950.0).
140-150	rad	F11.8	Declination (1950.0).

Table 2 gives a detailed description for each HD code that can occur in byte 124 of a data record.

Table 2. Explanation of HD Codes.

Code	Meaning
0	Single star, or primary with a companion > $0^{m}.3$ (visual) fainter.
1	Brighter component with a companion ≤ $0^{m}.3$ fainter.
2	Fainter component with a companion ≤ $0^{m}.3$ brighter.
9	The SAO Catalog entry refers to two consecutive HD numbers, the lower of which is given.

Tables 3 through 9 give data sources and duplicity / variablility codes.

Table 3. Visual Magnitude Sources.

Visual	Photo-visual	Magnitude source
0		Does not appear in source catalog
1		Determined by source catalog
2		Determined by source catalog or by authority in footnote
3	23	Source cited in source catalog introduction
	24	Source unspecified
5		Taken from *Bonner Durchmusterung*
8		Based on Durchmusterung magnitudes and visual estimates
9		Taken from AGK1
10		Taken from Córdoba Zones (Resultados)
12		Taken from CGA (Perrine 1911*a*, *b*) or Córdoba Zones
13		Taken from Harvard publications
14		Taken from Harvard or San Luis photometry
15		Taken from the *Henry Draper Catalogue*
16		Combined magnitude of component stars
17		Arithmetic mean of maximum and minimum magnitudes of a variable star

Always check the duplicity / variability code (Table 8) when using magnitudes. When blank, code = 0 and field = 99.9.

Table 4. Star-Number Sources and Footnotes.

Footnote without	Footnote with	Star Number
0	16	Source catalog only
1	17	Source catalog and BD
2	18	Source catalog and CD
3	19	Source catalog and CPD
4	20	Córdoba B (Resultados) and CD
5	21	Córdoba A (Resultados) and CD
6	22	AGK1 and BD
7		GC and BD
8	24	Córdoba B (Resultados) and CPD
9		Córdoba A (Resultados) and CPD

When blank, the code for DM is 0 or 16, footnote is 0 through 9, and field is all zeros. Footnotes and star numbers are those appearing in the source catalogs.

Table 5. Photographic Magnitude Sources.

Code	Source
0	Does not appear in source catalog
1	Determined by source catalog
4	Taken from magnitudes of the CPD and diameters of the *Cape Astrographic Catalogue*
8	Source cited in source catalog introduction
9	Columbia Contributions Numbers 30 and 31 (Schilt and Hill 1937, 1938)

When blank, code is 0 and field is all zeros.

Table 6. Proper-Motion Sources.

Code	Source
1	Determined by source catalog
3	Determined by comparison of catalog and Greenwich AC
5	Determined by comparison of catalog and AGK1
6	Determined by comparison of catalog and Greenwich AC on the basis of the smallest difference in positions (see page *xiii* of source reference)
6	Determined by comparison of catalog and AGK1 on the basis of the smallest difference in positions (see page *xiii* of source reference)

Table 7. Spectral-Type Sources.

Code	Source
0	Taken from the *Henry Draper Catalogue* or no spectrum in source catalog
1	Taken from the HD with M stars reclassified by Miss Cannon
2	Classified by G. G. Cillie
3	Classified by Goedicke
4	Classified by D. Hoffleit
5	Classified by M. W. Mayall
6	Classified at Leander McCormick Observatory
7	Classified by Nassau and Seyfert

If the spectrum is composite, "+++" is stored in the field and the code is 0.

Table 8. Miscellaneous Coded Remarks for Duplicity and Variability.

Code	Meaning
0	No additional information
1	Double star - see source catalog for source
2	Double star in Aitken's Double Star Catalogue (Aitken 1932)
3	Double star in Burnham's Double Star Catalogue (Burnham 1906)
4	Variable star in visual magnitude in source catalog
5	Variable star in photographic magnitude in source catalog
6	Variable star in both magnitudes
7	Both double and variable, in either visual or photographic magnitudes

When blank, code is 0, no field involved.

Table 9. References for the Source Catalogs

No.	Abbreviated Title
01	AGK2, Volume 1
02	AGK2, Volume 2
03	AGK2, Volume 5
04	AGK2, Volume 6
05	AGK2, Volume 7
06	AGK2, Volume 8
20	*Yale Transactions* 11
21	*Yale Transactions* 12 Part I
22	*Yale Transactions* 12 Part II
23	*Yale Transactions* 13 Part I
24	*Yale Transactions* 13 Part II
25	*Yale Transactions* 14
26	*Yale Transactions* 16
27	*Yale Transactions* 17
28	*Yale Transactions* 18
29	*Yale Transactions* 19
30	*Yale Transactions* 20
31	*Yale Transactions* 21
32	*Yale Transactions* 22 Part I
33	*Yale Transactions* 22 Part II
34	*Yale Transactions* 24
35	*Yale Transactions* 25
36	*Yale Transactions* 26 Part I
37	*Yale Transactions* 26 Part II
38	*Yale Transactions* 27
40	*Cape Annals* 17
41	*Cape Annals* 18
42	*Cape Annals* 19
43	*Cape Annals* 20
48	Cape Zone
60	Melbourne 3
61	Melbourne 4
70	GC
71	FK3
74	FK4

SECTION 3 - TAPE CHARACTERISTICS

The information in Table 10 is sufficient for a user to describe the indigenous characteristics of the machine-readable *Smithsonian Astrophysical Observatory Star Catalog*, Version 1984 to a computer. Not included is 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, tape density, number of tracks, and internal coding (EBCDIC, ASCII, etc.). These parameters should always be transmitted if secondary copies of the catalog are supplied to other users or installations.

Table 10. Tape Characteristics. *Smithsonian Astrophysical Observatory Star Catalog*, Version 1984.

NUMBER OF FILES	1
LOGICAL RECORD LENGTH (BYTES)	150
RECORD FORMAT	FB*
TOTAL NUMBER OF LOGICAL RECORDS	258997

* Fixed block length (last block may be short)

SECTION 4 - REMARKS, ACKNOWLEDGMENTS AND REFERENCES

As mentioned in Section 1, the individual data corrections, additions and changes included in this version of the SAO Catalog number 17,915, with 12,373 records (4.8%) having at least one change. Since many of the changes involve corrections to data given in previously published catalogs, it is important for a user to have access to the individual changes if a discrepancy is found between this catalog and a previously published one. For this reason, we have prepared a complete table of all changes made to the previous version to produce this one. The corrections and changes table was prepared by comparing the uncorrected file against the new version with a computer program which compared the data fields one by one and produced a formatted changes table. The complete table is given on the mirofiche cards contained in the envelope inside the back cover of this document. If a data entry is blank in either version, it is blank for the corresponding item in the table. The column labeled "S" gives the source of the change, as defined in Table 11 by its numerical code.

Table 11. References for Changes to the SAO Catalog, Version 1984.

Code	Reference(s)
1	Haramundanis, K. undated, *Errata Sheet for the SAO Star Catalog*; 1971, *Note on SAO Catalog Errata* (January).
2	Stein, W L. and Rudisill, J. C., 1977, *Introduction to the Dahlgren General Catalog*, Naval Surface Weapons Center NSWC/DL TR-3607. Stein, W. L. 1978, in Bischoff, M., *Bull. Inf. Cent. Données Stellaires*, No. 14, 2; No. 15, 103. Stein, W. L., private communication.
3	Bischoff, M. 1978, *Bull. Inf. Cent. Données Stellaires*, No. 14, 2; No. 15, 103.
4	Hoffleit, D., private communication.
5	Parsons, S. B. 1977, *Bull. Inf. Cent. Données Stellaires*, No. 12, 41.
6	Nagy, T. A. 1979, Documentation for the Machine-Readable Version of the *Smithsonian Astrophysical Observatory Catalog[ue]* (EBCDIC Version), Systems and Applied Sciences Corporation R-SAW-7/79-34.
7	Houziaux, L. and Blondelot-Lickes, J. 1970, Centre Univ. Mons, Fac. Sci., Dept. Astrophys., Communication No. 13.
8	Stoy, R. H. 1968, *Cape Photographic Catalogue for 1950.0, Zones -80° to -90°, Ann. Cape Obs.* 22 (London: Her Majesty's Stationery Office).

Table 11 (concluded)

Code	Sources
9	McLaughlin, S. F., private communication.
10	Bonnet, R. 1978, *Cross Identifications of HDE Stars, Bull. Inf. Cent. Données Stellaires*, No. 15, 155. Magnetic tape version, CDS Strasbourg catalog number 4008.
11	Warren, W. H. Jr. and Kress, K. 1980, *Catalog of Supplemental Stars to the Bonner Durchmusterung, Astron. Data Center Bull.* 1, 19.
12	Errors and additions from the present work.
13	Schmidtke, P. C., private communication.
14	Herald, D. 1979, *Occultation Newsl.* 2, 49.

Table 12 includes further notes on entries in the microfiche table for which additional explanations are considered useful to clarify the reasons for certain changes.

Table 12. Explanatory Notes to Individual Changes

SAO	Note(s)
6404	The GC incorrectly identifies this star as BD+76° 309; GC 11190 is BD+76° 309, while this star is +77° 309.
9947	This star is misidentified as BD+70° 1162 in the GC, as it is in the IDS and ADS (Aitken 1932). Source 3 corrects the DM number to +70° 1161, assuming that the double entry for +70° 1161 represents the two components of the double star. This is not the case. SAO 9949 is a duplicate entry and should be deleted.
15097	The GC incorrectly lists this star as BD+65° 761. It is actually +65° 751, while +65° 761 is SAO 15120, which does not appear in the GC.
17589	The GC incorrectly identifies this star as BD+68° 936, whereas it is actually +69° 936.
23221	Source 1 incorrectly gives this star as BD+53° 568a. It is actually +52° 568a.

Table 12 (concluded)

SAO	Note(s)
24753	This star is listed as BD+57° 825 in several catalogs. It is not in the proper position for the BD star, however. There is a star at the SAO position on photographs, but it is not in the BD.
29370 29372	These corrections are probably in error. The BD gives +54° 1724 as being SW of +54° 1725 and lists both stars as magnitude 7.5. The SAO, AGK3 and IDS list the brighter star ($\Delta m \sim 0\overset{m}{.}6$) as SE. The HD also lists the brighter star as south, but gives the same right ascension for both stars. The IDS identifies the brighter star as BD+54° 1724, as do the HD and the SAO, but the AGK3 reverses the DM numbers, listing the brighter star as +54° 1725.
101858	Sources 2 and 3 suggested changing this star to BD+17° 2945. It is part of a triple system, of which C, the fainter, more distant component, is +17° 2945. SAO 101858 and 101859 appear to be the A and B components, respectively, of +17° 2946.
238176	The GC is in error. GC 14513 is CP-54° 3795 and is not in the HD. GC 14517 is CP-54° 3797, which is HD 91593.

ACKNOWLEDGMENTS

We wish to express our appreciation to N. J. Schofield Jr., who worked on an early phase of the SAO project in connection with the revised *SAO-HD-GC-DM Cross Index*, and to D. Hoffleit, S. F. McLaughlin, P. C. Schmidtke and W. L. Stein for communicating errors.

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SECTION 5 - SAMPLE LISTING

The sample listing given on the following pages contains logical data records exactly as they are recorded on the tape. Sample records for stars at the beginning and the end of the data file are listed. The beginning of each record and bytes within the record are indicated by the column heading index across the top of each page (digits read vertically). Since each logical record is longer than 115 bytes, the remainder (bytes 116-150) of each record is printed on the following row.

```
L I S T I N G   O F   R E C O R D S   F R O M   T A P E   F I L E

          TAPE FILE NAME: SAO Catalog (ADC 1984)
                 RECORDS        1 TO       15
               TAPE FILE        1
           RECORD LENGTH     150 BYTES
            INPUT VOLSER    WHW034

C O L U M N                                                                                                         1111111111111111
H E A D I N G           111111111122222222223333333333444444444455555555556666666666777777777788888888889999999999000000000011111111
I N D E X      123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345

RECORD     1      1  0 0 5.097-0.0083 4   5.636101885.1+824141.82+0.002 4 41.70121887.1 2699.9 7.2A0 14 101000070    3BD+82  748
              2250190     30.00037068 1.44329914
RECORD     2      2  0 0 9.607+0.0214 6   8.451141895.9+80 013.79+0.025 4 12.33121892.2 3199.9 7.7F2 1417u1020070   4BD+79  799
              2250200     40.00069861 1.39633024
RECORD     3      3  0 038.843-0.0053 9 38.950161929.9+822242.07+0.000 9 42.07161929.9 24 9.6 9.2     517130011 1   2BD+81  841
                          0.00282474 1.43777348
RECORD     4      4  0 040.372+0.025314 39.864161929.9+801224.55-0.02520 25.06161929.9 3810.2 9.3     5 1150011 1   3BD+79  800
                          0.00293590 1.39987306
RECORD     5      5  0 051.947+0.0031 9 51.885171929.9+802733.73+0.019 9 33.36171929.9 2510.7 9.1     5 1130011 1   4BD+79  801
                          0.00377767 1.40428093
RECORD     6      6  0 1 0.687-0.0090 6   0.674131951.3+86 539.48-0.002 6 39.48131951.3 1399.9 9.3P0   9 101701036    1BD+85  411
                          0.00441325 1.50262903
RECORD     7      7  0 122.324+0.004310 22.237181929.9+845815.41+0.00710 15.27181929.9 2711.0 9.2     5 1130011 1   1BD+84  543
                          0.00598678 1.48302278
RECORD     8      8  0 138.529+0.006610 38.398181929.9+841141.54-0.01610 41.87181929.9 2611.1 9.4     5 1130011 1   2BD+83  673
                          0.00716527 1.46947776
RECORD     9      9  0 2 0.531+0.003910  0.453191929.9+8236 8.19-0.00910  8.37191929.9 2811.7 9.5     5 1130011 1   3BD+82  749
                          0.00876528 1.44168167
RECORD    10     10  0 2 1.364-0.010010  1.566171929.9+832243.42+0.00310 43.36171929.9 2610.7 9.4     5 1130011 1   1BD+82  750
                          0.00882585 1.45523334
RECORD    11     11  0 233.422-0.0128 9 33.680181929.9+8225 7.88-0.024 9  8.36181929.9 2610.9 9.5     517130011 1   4BD+81  842
                          0.01115715 1.43848039
RECORD    12     12  0 256.515+0.021210 56.089181929.9+82 431.92+0.03810 31.16181929.9 2611.2 9.5     5 1130011 1   5BD+81  843
                          0.01283650 1.43248829
RECORD    13     13  0 3 2.749-0.0030 9   2.808161929.9+804734.10-0.023 9 34.56161929.9 24 9.4 8.8A0   5 1130011 1   5BD+80  793
                   560    0.01328985 1.41010046
RECORD    14     14  0 3 3.901-0.0185 6   3.876131951.3+873639.64+0.029 6 39.68131951.3 1399.9 8.8K0   9 101701036    2BD+87  220
                          0.01337367 1.52910061
RECORD    15     15  0 335.773+0.0696 6 35.867131951.3+852223.47+0.145 6 23.66131951.3 1399.9 9.5G0   9 101601036    3BD+84  545
                          0.01569149 1.49004318
```

LISTING OF RECORDS FROM TAPE FILE

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            TAPE FILE      1
         RECORD LENGTH    150 BYTES
          INPUT VOLSER   WHW034

COLUMN
HEADING              111111111122222222223333333333444444444455555555556666666666777777777788888888889999999999000000000011111
INDEX       12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345

RECORD  258983 258983 234047.319-0.068413 50.779211899.4-8247 4.57-0.06512  0.93191894.4 6999.9 7.6G0 14 301000070329440P-83  756
                222669032944 6.19935995-1.44486387
RECORD  258984 258984 234424.915+0.0167 7 24.070 91899.4-84 824.69+0.027 6 26.14 91897.3 3499.9 7.9K0 14 301000070330080P-84  658
                2230420330086.21518403-1.46852340
RECORD  258985 258985 234553.821-0.003025 53.958451903.8-821218.79+0.02436 19.90531903.815199.9 9.3    1 301001061 50960P-82  903
                            6.22164941-1.43475173
RECORD  258986 258986 2348 5.977-0.028811  7.424191899.7-801036.48+0.01711 37.42191896.0 5999.9 7.9G0 1419010000703308 3CP-80 1078
                2235370330836.23126006-1.39934915
RECORD  258987 258987 234817.939+0.005925 17.654531901.9-853052.50+0.01636 53.25631901.916099.9 9.0    1 301001061 5102CP-65  558
                            6.23212996-1.49251102
RECORD  258988 258988 234835.477-0.032025 37.16553 1897.2-845951.07+0.01536 51.86631897.217399.9 9.7    1 301001061 5107CP-65  559
                            6.23340536-1.48348656
RECORD  258989 258989 234914.400-0.0198 2 15.377 51900.6-821748.57-0.013 2 47.86 51895.5 1299.9 5.1G5 1419010000703310 7CP-82  905
                2236470331076.23623593-1.43635054
RECORD  258990 258990 234939.049+0.0133 9 38.453121905.2-861026.88+0.016 8 27.63101901.6 4099.9 7.9B8 14 30100007033115CP-86  423
                2236480331156.23802848-1.50402234
RECORD  258991 258991 235047.461+0.013912 46.752211898.8-803710.51+0.00311 10.70191895.8 6499.9 8.4K0 14 30100007033142CP-81 1044
                2238450331426.24300356-1.40707721
RECORD  258992 258992 235052.773+0.082812 48.413181897.3-8317 8.98+0.01812  9.96171894.2 6899.9 6.8K5 14 30100007033143CP-83  758
                2238330331436.24338986-1.45361190
RECORD  258993 258993 235211.973+0.023325 10.922531904.9-802643.03+0.02436 44.12631904.915199.9 9.0G0  1 301001061 5124CP-80 1079
                2240300      6.24914940-1.40403511
RECORD  258994 258994 235358.983-0.004415 59.194221902.5-831545.98-0.00817 45.57241901.6 8099.9 8.1K0 14 30100007033203CP-83  760
                2242480332036.25693144-1.45320950
RECORD  258995 258995 235448.819-0.016025 49.476531908.9-843641.97-0.06136 39.46631908.914099.9 9.4K0  1 301001061 5135CP-85  560
                2243540      6.26055558-1.47675201
RECORD  258996 258996 235451.661-0.0148 2 52.480 61894.8-822652.62-0.020 2 51.53 61895.5 1599.9 5.7K0 1419010000703321 9CP-82  907
                2243620332196.26076224-1.43898818
RECORD  258997 258997 235852.487+0.001233 52.416751892.8-8348 5.02-0.01243  4.36571892.822999.9 8.9K0  1 001001060 3056CP-84  661
                2248670      6.27827565-1.46261027
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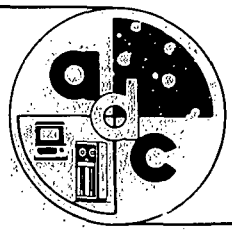

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