

A Catalog of Accurate Equatorial Coordinates for Variable Stars in Globular Clusters

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ABSTRACT. We have compiled a catalog of equatorial coordinates for 3398 variable stars in those 103 globular clusters that, according to the most recent update of the Catalogue of Variable Stars in Globular Clusters (CVSGC) available in 2008 June (essentially that of 2002, with some more recent additions), had known variable stars. Our catalog is in the electronic attachment to this article. We found that 216 stars are also contained in the General Catalogue of Variable Stars (GCVS) or in the New Catalogue of Suspected Variable Stars (with Supplement); most of these identifications were not previously recognized. We also detected a number of previously unknown cross-identifications among stars of the CVSGC. Our results allow us to initiate compilation of name lists in order to add to the GCVS those stars from the CVSGC that satisfy GCVS naming criteria.

Online material: machine readable table

1. INTRODUCTION

For reasons of tradition, most known variable stars in globular clusters remain outside the General Catalogue of Variable Stars (GCVS; cf. Kholopov et al. 1985). The origin of this tradition is not quite clear: in principle, the GCVS should include all reliably identified variable stars of our Galaxy. Globular-cluster variable stars were not included in the catalogs that preceded the GCVS, namely the variable star catalogs published by the “Astronomische Gesellschaft” (see Prager 1926, Schneller 1942); apparently the rule was introduced when membership of globular clusters in the Galaxy had not yet been established beyond doubt.

The need in catalogs of variable stars in the Galaxy’s globular clusters is obvious, and the total number of variable stars in globular clusters exceeded 1000 as early as in the first half of the twentieth century. Thus, specialized catalogs appeared. Three editions of the Catalogue of Variable Stars in Globular Clusters (CVSGC) were compiled and published in Canada (Sawyer 1939, 1955; Sawyer Hogg 1973). This work was continued by Helen Sawyer Hogg’s successors who are now keeping the catalog as an Internet resource (Clement et al. 2001).

The presentation of information on star positions in the CVSGC differs from that in the GCVS. All the printed CVSGC editions contain rectangular coordinates of different precision (as a rule, formally to 1” in both coordinates) for variable stars in each globular cluster. The catalog presents low-accuracy equatorial coordinates of globular-cluster centers (to 0.1^m in right ascension and 1’ in declination, or even worse in some cases).

In all the CVSGC printed editions, the coordinates of globular-cluster centers are given for the equinox 1950.0. There is no information on the equinox of the rectangular coordinates of variables, but they are often directly taken from original papers, possibly from several papers for the same cluster, including papers published as early as by the end of the nineteenth century. Thus, the equinox of the rectangular coordinates is not exactly fixed. Obviously, a system of rectangular coordinates with axes along right ascension and declination for a certain equinox will be aligned incorrectly for a different equinox. In many cases, the precision of published rectangular coordinates, reproduced in the CVSGC, was no better than 3” or even worse. This can lead to ambiguous identifications in the crowded central regions, and identification charts are a valuable resource.

Table 1
GLOBULAR-CLUSTER VARIABLE STARS IN THE GCVS AND NSV CATALOGUES

GC	Var	GCVS, NSV	GC	Var	GCVS, NSV	GC	Var	GCVS, NSV	GC	Var	GCVS, NSV
104	.....	CO Tuc	6304	.....	V2167 Oph	6441	.....	V1169 Sco	6638	.....	NSV 24475
	V12	Z Col		V1	V2161 Oph		V49	V1167 Sco		V56	V4054 Sgr
	V1	Y Col		V2	V2171 Oph		V50	V1166 Sco		V57	NSV 24476
3201	.....	NSV 04813		V3	NSV 21164	6522	.....	V3900 Sgr		V58	NSV 24478
	V15	KP Vel		V4	V2173 Oph		V8	V1437 Sgr		V59	NSV 24481
	V65	NSV 04810		V5	NSV 21193		V9	V1438 Sgr		V60	V3845 Sgr
Rup 106	.....	V887 Cen		V6	V2166 Oph	6535	.....	MO Ser		V61	NSV 24485
4590	.....	FI Hya		V7	V2177 Oph		V1	MP Ser		V62	IL Sgr,
	V27	EN Hya		V8	V2181 Oph	6541	.....	SS CrA		V63	V4056 Sgr
4833	.....	RY Mus		V9	V2155 Oph	6553	.....	V1148 Sgr	6642	.....	V2578 Sgr
	V1	RZ Mus		V10	V2159 Oph	6558	.....	V4301 Sgr	6637	.....	V3484 Sgr
	*V2	FQ Mus		V11	V2160 Oph		V5	V4601 Sgr		V2	V1894 Sgr
	V11	NSV 06235		V12	NSV 08349		V8	V4595 Sgr		V4	V3616 Sgr
5139	.....	V825 Cen		V13	V2163 Oph	6569	.....	V2711 Sgr		V7	V3641 Sgr
	V1	V833 Cen		V14	NSV 08361		V9	NSV 10364		V9	V1311 Sgr
	V2	V813 Cen		V15	V2169 Oph		V6	V2698 Sgr		V14	V4068 Sgr
	V56	V814 Cen		V16	NSV 08377	6584	.....	PX Tel		V17	V3853 Sgr
	V78	V826 Cen		V17	V2180 Oph		V15	PU Tel		V22	V2007 Sgr
	V129	V594 Cen		V18	NSV 08367		V24	PT Tel		V26	V2367 Sgr
	V133	V832 Cen		V19	NSV 08369		V27	PS Tel		V28	NSV 11080
	V168	V791 Cen		V20	NSV 08385	6626	.....	V4137 Sgr		V29	NSV 11084
	V269	V1045 Cen	6341	V21	V798 Her		V7	V4128 Sgr		V30	V3855 Sgr
5272	.....	XX CVn	6333	V14	V1864 Oph		V15	V4130 Sgr		V31	V4067 Sgr
	V113	RV CVn		V3	V1845 Oph		V16	V2342 Sgr		V32	V4069 Sgr
	*V141	WY CVn		V7	V1840 Oph		V17	V4129 Sgr	6681	.....	V4082 Sgr
	V205	WZ CVn		V12	V2208 Oph		V24	NSV 10895		V2	V4081 Sgr
	V206	GI Cen	6356	V13	V2009 Oph	6638	.....	NSV 10896		V5	MP Sct
5286	.....	BL Boo		V5	V1995 Oph		V2	V4051 Sgr		V1	AP Sct
5466	.....	PQ Aps	6352	V6	V819 Ara		V3	NSV 10908		*V2	CH Sct
IC 4499	.....	S Sco	HP 1	V6	NSV 08984		V4	NSV 10913		*V7	MR Sct
6093	.....	R Sco		V1	NSV 08989		V5	NSV 10914		V8	MW Sct
	V7	T Sco		V2	NSV 08973		V6	NSV 10916		V15	LZ Sct
	*Nova	NSV 20592		V3	NSV 09002		V7	NSV 10918		V16	MN Sct
6101	.....	NSV 20587		V4	NSV 09011		V8	NSV 10921	6723	.....	NSV 24641
	V12	NSV 20591		V5	NSV 09016		V9	NSV 10928	6752	.....	V394 Pav
	V13	NSV 20604		V6	NSV 08967		V10	NSV 10930		V4	V395 Pav
	V14	BP Sco		V7	NSV 08978		V11	V4052 Sgr		V5	V396 Pav
6144	.....	BO Sco		V8	NSV 08983		V12	V1673 Sgr,		V6	V397 Pav
	V1			V9			V13			V8	

Table 1 (Continued)

GC	Var	GCVS, NSV	GC	Var	GCVS, NSV	GC	Var	GCVS, NSV	GC	Var	GCVS, NSV
6171	*V1	V720 Oph	V10	NSV 08988		V11	V4053 Sgr		V11	V398 Pav
6235	V3	V2249 Oph	V11	NSV 08997		V14	NSV 10942	6779	V7	V487 Lyr
6266	V4	V2250 Oph	V12	NSV 09007		V15	V4055 Sgr		V8	V485 Lyr
	V29	PU Oph	V13	NSV 09012		V16	NSV 10948		V9	V486 Lyr
	V70	OU Oph	V14	NSV 09021		V17	NSV 10951		V10	V483 Lyr
6273	*V2	FK Oph	V15	NSV 09023		V18	NSV 10952		V11	V484 Lyr
	V6	NSV 20887	V4	NSV 22828	Ter 1	V19	NSV 10956	Pal 10	V2	MV Sge
	V7	V2135 Oph	V4	MU Sco	6388	V46	NSV 24458		V3	MZ Sge
6284	V10	V2121 Oph	V29	V1164 Sco		V47	NSV 24460	6838	*V1	Z Sge
	V11	V2123 Oph	V1	NSV 09335	6401	V48	NSV 24459		V3	QU Sge
	V12	GM Oph	V1	V639 Ara	6397	V49	NSV 24461		V4	NSV 24932
6293	V2	V2137 Oph	V2	V825 Ara		V50	NSV 24463		V6	V345 Sge
	V7	V2145 Oph	V3	V826 Ara		V51	NSV 24462	6934	V75	OP Del
6293, continued		V9	NSV 21001	*V11	V979 Oph	6426	V52	NSV 24465	6934, continued	V76	OO Del
		V10	V2136 Oph	V36	V1165 Sco	6441	V53	NSV 24466	7099	V4	NSV 25717
		V11	V2102 Oph	V47	V1168 Sco		V54	NSV 24472			
		V12	IW Oph	V48	V1170 Sco		V55	NSV 24471			

Table 2

A FRAGMENT OF THE CATALOGUE OF ACCURATE EQUATORIAL COORDINATES FOR VARIABLE STARS IN GLOBULAR CLUSTERS

NGC 1261	.....		!				
NGC 1261	.....	V	1	03 12 12.51	-55 13 25.5	1999.821	2MASS	
NGC 1261	.....	V	2	03 12 11.28	-55 12 22.0		X,Y	
NGC 1261	.....	V	3	03 12 21.78	-55 13 50.7	1999.821	2MASS	
NGC 1261	.....	V	4	03 12 18.56	-55 13 28.4		X,Y	
NGC 1261	.....	V	5	03 12 11.93	-55 13 01.9		X,Y	
NGC 1261	.....	V	6	03 12 25.05	-55 13 08.6	1999.821	2MASS	
NGC 1261	.....	V	7	03 11 58.44	-55 10 37.3	1999.821	2MASS	
NGC 1261	.....	V	8	03 12 00.44	-55 15 16.4	1999.821	2MASS	
NGC 1261	.....	V	9	03 12 20.40	-55 13 35.3		X,Y	
NGC 1261	.....	V	10	03 12 21.99	-55 11 45.9	1999.821	2MASS	
NGC 1261	.....	V	11	03 12 05.50	-55 11 27.7	1999.821	2MASS	
NGC 1261	.....	V	12	03 12 26.15	-55 12 45.8	1999.821	2MASS	
NGC 1261	.....	V	13	03 12 07.01	-55 14 33.1	1999.821	2MASS	
NGC 1261	.....	V	14	03 12 09.75	-55 14 07.6	1999.821	2MASS	
NGC 1261	.....	V	15	03 12 02.50	-55 10 48.1	1999.821	2MASS	Wrong X,Y in CVSGC
NGC 1261	.....	V	16	03 12 13.90	-55 13 12.9		X,Y	
NGC 1261	.....	V	17	03 12 15.48	-55 12 36.6		X,Y	
NGC 1261	.....	V	18	03 12 13.80	-55 12 40.6	1999.821	2MASS	
NGC 1261	.....	V	19	03 12 18.19	-55 12 44.7		X,Y	
NGC 1261	.....	V	20	03 12 19.31	-55 13 00.4		X,Y	
NGC 1261	.....	V	21	03 12 14.47	-55 12 31.3		X,Y	
NGC 1851	.....		!				
NGC 1851	.....	V	1	05 14 28.93	-40 02 56.5	1998.997	2MASS	Z Col
NGC 1851	.....	V	2	05 14 02.75	-40 02 24.4	1998.997	2MASS	Y Col
NGC 1851	.....	V	3	05 14 02.44	-40 01 20.6	1998.997	2MASS ?	
NGC 1851	.....	V	4	05 14 08.53	-40 02 17.0	1994.0	GCVS	
NGC 1851	.....	V	5	05 14 09.89	-40 02 11.8	1998.997	2MASS	
NGC 1851	.....	V	6	05 14 00.01	-40 03 04.2	1998.997	2MASS	
NGC 1851	.....	V	7	05 14 07.06	-40 04 42.9	1998.997	2MASS	
NGC 1851	.....	V	8	05 14 08.90	-40 02 26.9	1994.0	GCVS	
NGC 1851	.....	V	9	05 14 01.33	-40 02 05.8	1998.997	2MASS	
NGC 1851	.....	V	10	05 14 10.95	-40 06 08.9	1998.997	2MASS	
NGC 1851	.....	V	11	05 14 12.64	-40 05 07.6	1998.997	2MASS	
NGC 1851	.....	V	12	05 13 59.84	-40 03 41.8	1998.997	2MASS	
NGC 1851	.....	V	13	05 14 06.73	-40 02 07.4	1998.997	2MASS	
NGC 1851	.....	V	14	05 14 12.85	-40 02 34.8	1998.997	2MASS	
NGC 1851	.....	V	15	05 14 09.07	-40 02 01.1	1994.0	GCVS	
NGC 1851	.....	V	16	05 14 12.27	-40 02 51.9	1994.0	GCVS	
NGC 1851	.....	V	17	05 14 02.90	-40 03 50.2	1998.997	2MASS	
NGC 1851	.....	V	18	05 14 09.91	-40 00 13.5	1998.997	2MASS	
NGC 1851	.....	V	19	05 14 08.76	-40 03 25.2	1998.997	2MASS	
NGC 1851	.....	V	20	05 14 05.57	-40 03 16.8	1994.0	GCVS	
NGC 1851	.....	V	21	05 14 01.14	-40 01 53.6	1998.997	2MASS	
NGC 1851	.....	V	22	05 14 17.50	-40 01 00.8	1998.997	2MASS	
NGC 1851	.....	V	23	05 14 16.15	-40 03 47.5	1998.997	2MASS	
NGC 1851	.....	V	24	05 14 19.34	-40 04 23.9	1998.997	2MASS	
NGC 1851	.....	V	25	05 13 55.80	-40 07 31.8	1998.997	2MASS	
NGC 1851	.....	V	26	05 13 55.35	-40 01 10.9	1998.997	2MASS	
NGC 1851	.....	V	27	05 14 03.70	-40 03 05.8	1994.0	GCVS	
NGC 1851	.....	V	28	05 14 09.75	-40 03 10.4	1994.0	GCVS	
NGC 1851	.....	V	29	05 14 05.52	-40 02 20.8	1994.0	GCVS	

Table 2 (Continued)

NGC 1851	.....	V	30	05 14 07.53	−40 02 59.2	1994.0	GCVS
NGC 1851	.....	V	31	05 14 08.73	−40 03 07.9	1994.0	GCVS
NGC 1851	.....	V	32	05 14 04.65	−40 02 15.7	1994.0	GCVS
NGC 1851	.....	V	33	05 14 07.91	−40 03 13.9	1994.0	GCVS

NOTE.—Units of right ascension are hours, minutes, and seconds, and units of declination are degrees, arcminutes, and arcseconds. Table 2 is published in its entirety in the electronic edition of the *PASP*. A portion is shown here for guidance regarding its form and content.

The use of rectangular rather than equatorial coordinates surely had its historical reasons. It is easy to point a telescope at a globular cluster even if the telescope setting is off by as much as a minute of arc. Until recently, studies of clusters were mostly photographic and were undertaken with relatively wide field cameras. The way the investigators identified the variables was to label them on photographic prints, and the rectangular coordinates provided a useful guide for locating a star on the identification chart. Another convenience of the rectangular coordinate system was that one could easily get a sense of how far the star was from the cluster center, just by reading the table.

In the “online” Internet catalog of variable stars in globular clusters, for some clusters, the rectangular coordinates were replaced with equatorial coordinates, for the equinox B1950.0 or J2000.0. The sources of the equatorial coordinates were heterogeneous and, as we will describe, not always reliable. However, the online CVSGC contained, until recently, rectangular coordinates for most stars, often unchanged as compared to the printed editions.

The SIMBAD database provides equatorial coordinates for some objects of the CVSGC, but the majority of globular-cluster variables are not contained there.

In the twenty-first century, it is more advantageous to list accurate equatorial coordinates of globular-cluster variables for several reasons. First, they allow one to point the telescope immediately at the right star. Second, it becomes possible to cross correlate the catalog with other catalogs, and check possible cross-correlations for variables in the same cluster. For some stars, it is possible to find observations in the public domain of the Internet and thus to improve the CVSGC information (see § 3).

When working on the GCVS, its authors often thought about adding all reliable and sufficiently well-studied globular-cluster variable stars to the GCVS, their omission being in contradiction with the declared purpose of the catalog. (If these plans are fulfilled, the specialized catalogs of variable stars in globular clusters will still remain important, as they present needed information in a form handy for those studying individual clusters.) However, we were not able to start implementing such plans until the solution was found to the problem of finding equatorial coordinates for all variable stars in the CVSGC.

We decided to compile a catalog of equatorial coordinates of globular-cluster variable stars, containing as close to all the CVSGC objects as possible.

2. COMPILATION OF THE CATALOGUE

For the list of objects, we downloaded the most recent update of the Catalogue of Variable Stars in Globular Clusters (CVSGC) available in 2008 June. This was essentially the version of 2002, with more recent additions for a small number of clusters. Note that this version is no longer accessible; currently (2009 September), a new revision is partially posted.

The CVSGC lists 147 globular clusters of our Galaxy. The number of variable stars strongly varies from one cluster to another. No variable stars were detected in many clusters, despite searches. The CVSGC contains a total of 103 globular clusters with known variable stars, from a single star in NGC 6380 and in NGC 6717, to almost 300 in NGC 5139 (ω Cen) and NGC 5272 (M3).

It is possible to find in the literature one or more photographic finding charts of variable stars for most clusters. In several clusters, we were able to use earlier studies aimed at identification of variables or their astrometry. The key references, not including papers with few stars, are the following. NGC 104: Geffert et al. (1997); NGC 288: Kaluzny (1996); NGC 2808, NGC 5024: Evstigneeva et al. (1997); NGC 4147: Stetson et al. (2005); NGC 5139: Shokin & Samus (1996a), Kaluzny et al. (2004); NGC 5272: Evstigneeva et al. (1994), Bakos et al. (2000); Pal 5: Vivas et al. (2004); NGC 5897, NGC 6712: B. Skiff, (private communication to the CVSGC compilers); NGC 5904: Evstigneeva et al. (1995); NGC 6121: Shokin & Samus (1996b), Kaluzny et al. (1997); NGC 6341: Tucholke et al. (1996); NGC 6362: Mazur et al. (1999); NGC 6397: Kaluzny (1997); NGC 6584: Samus et al. (1995); NGC 6656: Kravtsov et al. (1994); NGC 6752: Thompson et al. (1999); NGC 6809: Olech et al. (1999), Pych et al. (2001); NGC 6838: Park & Nemeč (2000); NGC 6934: Kaluzny et al. (2001). If necessary, we checked the coordinates from these papers using finding charts, and improved them as needed using position catalogs or performing special measurements.

It should be noted that all the equatorial coordinates presented for 37 variables in the globular cluster NGC 6638 in

Rutly & Terzan (1977) are quite wrong (Samus et al. 2008). The errors are from 13 to 49 *minutes* of arc (exceeding half a degree in 18 cases). We have an impression that Rutly and Terzan calculated their equatorial coordinates from rectangular coordinates measured with respect to a reference point in several arcminutes to the northeast of the cluster center and used a wrong scale factor in these calculations. The very wrong coordinates in this article led to the result that two of the variable stars in the region of NGC 6638 have two GCVS identifications each (V13 = V1673 Sgr = V4053 Sgr; V63 = IL Sgr = V4056 Sgr).

For most clusters, the CVSGC contained no equatorial coordinates of their variable stars. In each of such clusters, we usually proceeded in the following way.

1. A search for all finding charts. For this purpose, we used not only the online version of the CVSGC but also the earlier CVSGC editions (Sawyer 1955; Sawyer Hogg 1973) and, in some cases, other sources of bibliography, selecting the best charts, checking agreement of the identifications suggested for the same stars.

2. Identifying the finding charts with position catalogs using the Aladin interactive atlas (the Strasbourg Center of Astronomical Data). Only two CVSGC stars could be identified with the Tycho-2 Catalogue (Høg et al. 2000), which also provided their proper motions.

In the cases of Tycho-2 identifications not available, we identified variable stars with the following catalogs, in the order of our preferences.

2MASS: Two Micron All Sky Survey (Cutri et al. 2003).

GSC2.3: Guide Star Catalog, version 2.3 (Lasker et al. 2008).

B1.0: Whole-Sky USNO-B1.0 Catalog of 1,045,913,669 sources (Monet et al. 2003).

Images from the 2MASS survey provided by the Aladin atlas often were also the most suitable for our purposes, the central cluster areas being, as a rule, not overexposed.

3. Measurements of photographic and CCD images of globular-cluster fields with variable stars using astrometric calibration from stars of the catalogs cited above. This approach was applied to stars missing in the position catalogs, as well as to double and multiple stars if the position of the variable component looked biased compared to the coordinates given for the whole blend in the position catalog.

4. Reductions of rectangular coordinates to equatorial coordinates. Such an approach was effective if there were sufficiently accurate rectangular coordinates in the same system for variables of a given cluster in the literature. It can be used to determine equatorial coordinates for stars with no other sources of information or to check identifications. Especially helpful were the precise catalogs of stars in the globular clusters NGC 5272 (Küstner 1922); NGC 5904 and NGC 6218 (Küstner 1933); NGC 6205 (Ludendorff 1905); NGC 6779 (Küstner 1920); NGC 7078 (Küstner 1921).

11.8

12.4

5. A check of the derived coordinates for possible matching of the CVSGC stars with objects of the GCVS or of the New Catalogue of Suspected Variable Stars (the NSV catalog, Kukarkin et al. 1982) and its Supplement (Kazarovets et al. 1998).

We found that 146 CVSGC stars are already contained in the GCVS (as noted, two of them, in the globular cluster NGC 6638, have two GCVS names each). GCVS names were given in the CVSGC only for nine stars. Designations from the NSV catalog (with Supplement) are available for 70 stars, with none of these identifications mentioned in the CVSGC. The identifications we found are collected in Table 1. The cluster numbers with no prefix in its first column are from the NGC. The column “Var” presents CVSGC designations; asterisks mark those with the GCVS identification given in the CVSGC.

The referee, Professor C. M. Clement, turned our attention to two problem identification cases in the globular cluster NGC 7078 (M15). We made our identifications without using the new paper, Corwin et al. (2008), that contains, among other results including discoveries of new variables, accurate equatorial coordinates for many previously known variable stars. The agreement with the coordinates in our catalog is generally very good. The referee found, however, several discrepant cases. In most of them, we agree that the identification in Corwin et al. (2008) is correct (it is often confirmed with reliable period determinations by Corwin et al.), so we have introduced necessary corrections in our catalog. Two problem cases, however, should be discussed here.

The star called V106 in Corwin et al. (2008) is Küstner 421 (Küstner 1921), while the star originally announced as V106 (Rosino 1969) is Kü 438. The angular distance between the two stars is only 5". In the catalog, we decided to call Kü 438, V106a and Kü 421, V106b.

The variable V114, first announced by Kadla et al. (1984), is definitely not Kü 537 but rather is Kü 579. Thus, the real V114 is the star called NV3 in Corwin et al. (2008), and their “V114” is a new variable.

3. THE CATALOG

The catalog is available in electronic form in the online Table 2 of this article. The structure of the file is the following.

The first catalog line for each cluster contains the cluster name, with an exclamation mark in the sixteenth position. An asterisk in the fifteenth position means that there is a remark to the cluster as a whole in column (5) of the table. Then, lines for variable stars in the cluster follow.

Column 1. CVSGC name of the variable.

Column 2. Equatorial coordinates for equinox 2000.0, to 0.01^s in right ascension and $0.1''$ in declination. For 218 stars, the coordinates are less precise.

Column 3. Epoch and source of the coordinates. Some of the symbols in this column will be explained below.

Column 4. GCVS and NSV identifications of the variable, if any. An asterisk after the GCVS or NSV identification means that the identification was mentioned in the CVSGC.

Column 5. Note. For supplemental information as needed. For example, a note was added for several clusters where we detected mutual identifications of CVSGC stars not recognized earlier. Notes can describe identification problems or present other additional information.

The catalog contains a total of 3398 variable stars in 103 globular clusters (15 stars entered in the CVSGC twice under different names have been counted once in the total; V106 in NGC 7078, the star with two identifications, has also been counted once).

The coordinates of 2184 stars (64%) were taken from the 2MASS catalog. All other sources of coordinates were used much less frequently. For 332 stars, the coordinates were measured by the authors using images, with respect to reference stars. For such stars, the column identifying the source of data contains the abbreviation GCVS. We took the coordinates of 403 stars directly from sources in the literature (indicated by the code Lit.; most of these sources are cited in the previous section). The equatorial coordinates of 229 stars in our catalog are based on reductions of rectangular coordinates of different precision (marked X,Y). Notes for 85 stars indicate doubtful identifications or low accuracy of their coordinates. Uncertain identifications and/or coordinates are designated with question marks after the column with the source of the coordinates.

New prospects from this catalog of equatorial coordinates for globular-cluster variable stars can be illustrated using, as an example, the following three CVSGC stars, which have quite insufficient information in the CVSGC but can now be studied using public-domain data of automatic photometric sky surveys. So far, such possibilities exist only for brightest cluster stars, mostly red variables.

V68 (NGC 3201). Identified with NSV 4810. The CVSGC gives the type “long”, even without a variation range indicated. The star is very bright in the infrared ($K_S = 3.49^m$ in the 2MASS catalog). It can be found in the ASAS-3 catalog of variable stars (Pojmanski 2002) as the star ASAS 101711–4610.8, of unidentified type (the ASAS-3 type MISC–miscellaneous), with the period of 71.8^d . The excellent ASAS-3 light curve shows brightness variations between 11.9^m and 13.3^m V. From 580 ASAS-3 observations, we can classify the variable as LB in the GCVS system.

V2 (NGC 6366). The CVSGC mentions the star’s red color and that it is possibly a field star. Its photographic variability range ($15.7^m - 16.8^m$) is also given. There is no information on the variability type or period. The star is too faint for the ASAS-3 survey, which contains only a few observations scattered near the photometric limit, but its 123 red-light observations can be found in the ROTSE-I/NSVS survey (Woźniak et al. 2004). From these data, the star is a semiregular (SR) variable with a probable period about 72^d . Its red-light variation range is $11.9^m - 12.4^m$. Figure 1 shows its phased light curve.

V3 (NGC 6752). No type or variability range in the CVSGC, with only the star’s red color indicated. The star does not enter the ASAS-3 variable star catalog, but the photometric catalog of the same survey nevertheless provides more than 580 observations revealing LB variations approximately between 11.2^m and 11.5^m V.

4. CONCLUSIONS

We compiled a catalog of accurate equatorial coordinates for 3398 variable stars in 103 globular clusters. These coordinates made it possible to perform the first maximally complete identification of the Catalogue of Variable Stars in Globular Clusters with the General Catalogue of Variable Stars and with the New Catalogue of Suspected Variable Stars (plus Supplement). 146 CVSGC stars were found to be contained in the GCVS and 70 stars, in the NSV Catalogue (with Supplement). Only 9 of these identifications were already indicated in the CVSGC.

The complete conversion of the CVSGC to equatorial coordinates makes it much easier to identify globular-cluster variable stars in the sky, permitting automatic pointing of ground-based and space-borne telescopes as well as studies of bright variables using available data of automatic photometric surveys. It becomes possible to add to the GCVS those globular-cluster variable stars that satisfy the rather strict GCVS naming criteria.

In future, we are planning a more detailed comparison of our results to the SIMBAD data, in contact with SIMBAD astronomers. Currently, coordinates of globular-cluster variables in SIMBAD are sparse, and the SIMBAD sources of identification are not always clear. In the course of our study, we noted some cases of agreement as well as of disagreement of our identifications with those in SIMBAD.

We continue our work in close contact with the CVSGC team to improve information on variable stars in globular clusters provided to the users. Our catalog of equatorial coordinates for globular-cluster variable stars is available electronically.

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