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Variable Stars in the Globular Cluster NGC 6752[1]

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ABSTRACT

We report time-series photometry for 16 variable stars located in the central part of the globular cluster NGC 6752. The sample includes 13 newly identified objects. The precision of our differential photometry ranges from 1 mmag at $V = 14.0$ mag to 10 mmag at $V = 18.0$ mag. We detected four low amplitude variables located on the extended horizontal branch (EHB) of the cluster. They are candidate binary stars harboring sdB subdwarfs. A candidate degenerate binary was detected about 2 mag below the faint end of the EHB. The star is blue and its light curve is modulated with a period of 0.47 d. We argue that some of the identified variable red/blue stragglers are ellipsoidal binaries harboring degenerate stars. They have low amplitude sine-like light curves and periods from a few hours to a few days. Spectroscopic observations of such objects may lead to the detection of detached inactive binaries harboring stellar mass black holes or neutron stars. No binaries of this kind are known so far in globular clusters although their existence is expected based on the common occurrence of accreting LMXBs and millisecond pulsars. An eclipsing SB1 type binary was identified on the upper main sequence of the cluster. We detected variability of optical counterparts to two X-ray sources located in the core region of NGC 6752. The already known cataclysmic variable B1=CX4 experienced a dwarf nova type outburst. The light curve of an optical counterpart to the X-ray source CX19 exhibited modulation with a period of 0.113 d. The same periodicity was detected in the HST-ACS data. The variable is located on the upper main sequence of the cluster. It is an excellent candidate for a close degenerate binary observed in quiescence.

Key words: *Stars: dwarf novae – novae, cataclysmic variables – globular clusters: individual: NGC 6752 – Stars: horizontal-branch – binaries: eclipsing*

1. Introduction

NGC 6752 is a nearby globular cluster whose low reddening and relatively high Galactic latitude $((m-M)_V = 13.02$ mag, $E(B-V) = 0.04$ mag, $b = -25\overset{\circ}{.}6$ – Harris 1996) make it an attractive target for detailed studies. Optical counterparts

[1]This paper includes data gathered with the 6.5-m Magellan Telescopes located at Las Campanas Observatory, Chile.

for 12 out of 19 faint X-ray sources detected with CHANDRA were reported by Pooley *et al.* (2002). This sample included ten likely cataclysmic variables (CVs) and 1–3 RS CVn or BY Dra stars. Two of the candidate CVs were detected and studied earlier by Bailyn *et al.* (1996) based on HST/WFPC2 data. So far there have been no reports of dwarf novae type outbursts in the field of NGC 6752. The cluster is known to host five millisecond pulsars (D'Amico *et al.* 2002), one of which has an optical counterpart (Ferraro *et al.* 2003, Bassa *et al.* 2003). A wide-field CCD based survey of NGC 6752 conducted by Thomson *et al.* (1999) led to the detection of eleven photometric variables, seven of which were classified as contact binaries, and three as SX Phe stars. The issue of membership status of these variables remains open. In particular, Rucinski (2000) argues that the group of contact binaries is dominated by field interlopers.

The cluster has a rich population of blue horizontal branch (BHB) and extreme horizontal branch (EHB) stars (Buonanno *et al.* 1986, Momany *et al.* 2002). Until recently not a single photometric variable was known among the horizontal branch stars in NGC 6752. Catelan *et al.* (2008) reported possible detection of a BHB pulsator, while Kaluzny and Thompson (2008) detected four variables located on the BHB/EHB of the cluster. Only one spectroscopic binary was found among a few dozen BHB/EHB stars observed by Moni Bidin *et al.* (2008). This result was unexpected, as close binaries are common among field sdB stars (Maxted *et al.* 2001, Napiwotzki *et al.* 2004).

The photometric survey presented here was conducted as a part of the CASE project (Kaluzny *et al.* 2005). It is complementary to the wide-field study presented by Thompson *et al.* (1999). The new data, collected with a larger telescope at a finer spatial scale, allowed a more detailed study of the central part of the cluster. Since the pioneering work by Mateo *et al.* (1990) several globular clusters have been surveyed with CCD photometry for faint variables, and in particular for main sequence binaries. These surveys, usually conducted with 1-m class telescopes, are very incomplete in the cluster core regions, arising mainly from the saturation of stellar profiles of densely packed bright stars. This saturation is hard to avoid as exposures times have to be at least a few minutes long to assure sufficient S/N for the relatively faint main-sequence stars. The problem can be partially overcome by using larger telescopes with finer pixel scales producing images with a reduced number of saturated stars. An even better solution is to use imaging capabilities of the HST, but so far only one cluster has been systematically surveyed for variability with this instrument (47 Tuc – Gilliland *et al.* 2000, Albrow *et al.* 2001). Results published for a few other clusters observed with the HST are based on fragmentary data.

It is expected that most of the eclipsing variables are located in the central parts of globular clusters. First, by definition, roughly 50% of all stars are observed within the half-light radius of a given cluster. Second, dynamical considerations indicate that most of the binary stars migrate toward the core regions due to mass segregation (Stodółkiewicz 1986, Hut 1992). As we show below, our adopted observing strategy along with careful data reduction has allowed a successful search for variability in a large sample of stars in the central part of NGC 6752. Good quality photometry extends down to $V \approx 21$ mag and the light curves of the brightest stars show an *rms* of about 1 mmag.

2. Observations and Data Analysis

All images were taken at Las Campanas Observatory with the 2.5-m du Pont telescope. A field of 8.84×8.84 arcmin^2 was observed with the TEK5 CCD camera at a scale of 0.259 arcsec/pixel. The cluster core was positioned roughly 1 arcmin north of the detector center to eliminate a nearby 7th magnitude field star from the images. Observations were made on eight consecutive nights between 28 May and 4 June 1998. Images were taken in two bands with average exposure times 35 s and 60 s for the *V* and *B* filters, respectively. The readout time of the detector was 68 s. In total, 495 useful frames in *V* and 287 frames in *B* were collected. The field was monitored for a total of about 30 hours. The median seeing was $1\farcs09$ and $1\farcs15$ for the *V* and *B*-bands, respectively. Sequences of 3–4 exposures in *V* were interlaced with sequences of 2 exposures in *B*. The images taken in a given sequence were combined, resulting in 152 and 143 stacked frames for *V* and *B*, respectively. The photometric analysis was conducted separately for individual frames and for the stacked frames. These stacked frames have a higher S/N ratio but have a poorer time resolution of about 10 minutes. The search for variable stars was made with a modified version of the ISIS image subtraction package (Allard and Lupton 1998, Allard 2000), while DAOPHOT/Allstar codes (Stetson 1987) were used to extract lists of point sources for the reference images. The observed field was divided into a 3×3 mosaic to reduce potential degradation of photometry caused by a spatially variable point spread function. Light curves were extracted for 46 905 and 40 078 point sources detected on the reference images for the *V* and *B*-bands, respectively. The instrumental photometry was transformed to the standard *BV* system using linear transformations based on 47 measurements of 16 stars from four Landolt (1992) fields. Fig. 1 shows the *rms* of individual measurements *vs.* average magnitude for light curves extracted from single as well as from stacked frames. Stars with $V < 14.0$ mag are overexposed on the template images and photometry of these objects is unreliable. Photometry based on single frames has an accuracy of about 2 mmag for the brightest unsaturated stars, decreasing to about 10 mmag at $V = 18$ mag. Light curves of the brightest unsaturated stars extracted from stacked frames show an *rms* of 1 mmag. The light curves were checked for variability with AOV and AOVTRANS algorithms running in the TATRY program (Schwarzenberg-Czerny 1996, Schwarzenberg-Czerny and Beaulieu 2006). The residual images produced with ISIS were also searched for potential variables lacking counterparts in the list of point sources detected with DAOPHOT/Allstar in the template images.

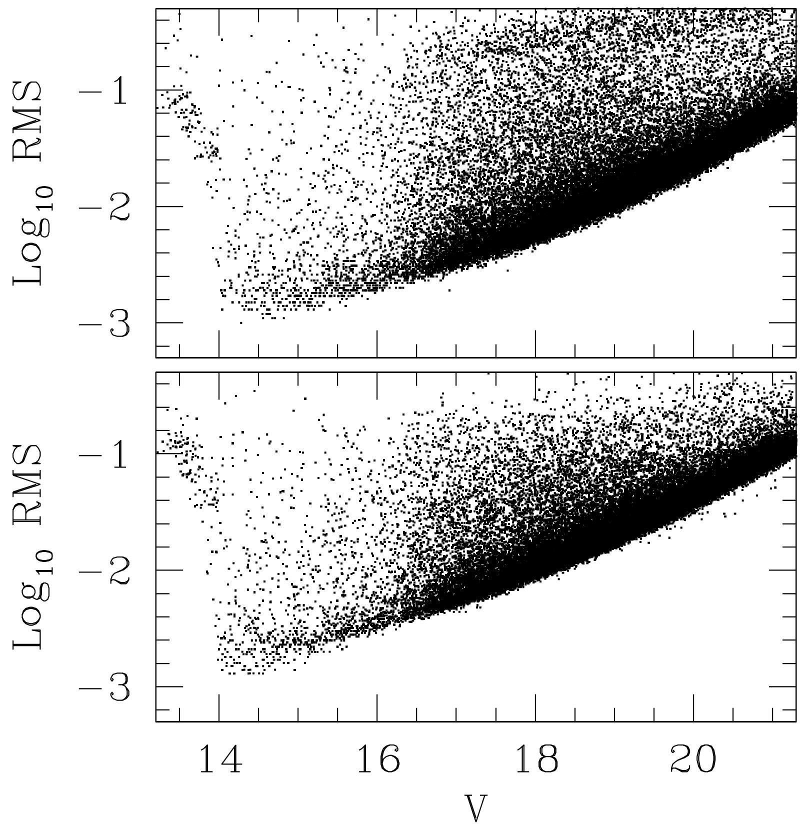

Fig. 1. Standard deviation *vs.* average *V* magnitude for light curves based on individual *V* frames (*bottom panel*) and for light curves based on stacked *V* frames (*upper panel*).

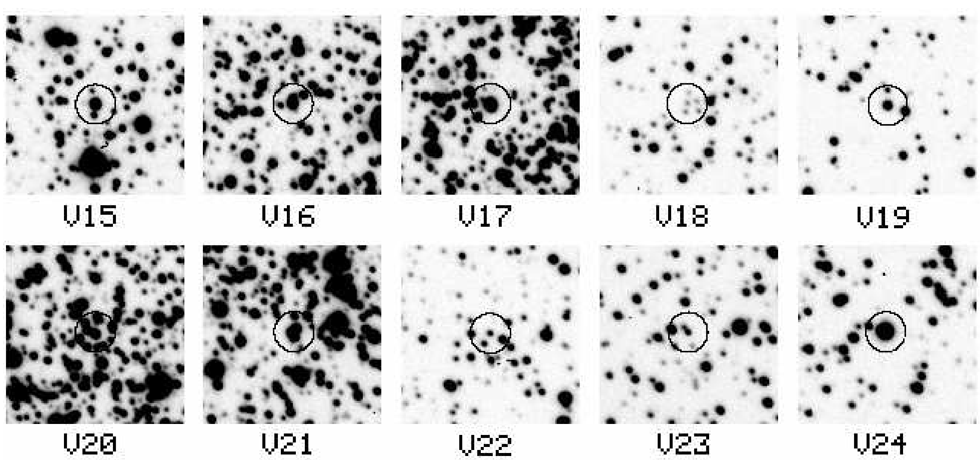

Fig. 2. Finding charts for variables V15–24. Each chart is 30″ on a side: North is up and East to the left.

A total of 15 variable stars were identified in our data. Their equatorial coordinates along with basic photometric parameters are listed in Table 1. Equatorial coordinates of the variables were determined using 92 stars from the UCAC2 catalog (Zacharias *et al.* 2004) which were identified on the *V*-band reference image. Objects 7–12 were reported by Thompson *et al.* (1999) while objects 15–24 are new identifications[2]. Variable number 25 is a cataclysmic variable originally identified by Bailyn *et al.* (1996) based on HST imaging. Finding charts for the new variables are given in Fig. 2. Fig. 3 shows the location of the detected variables (with the exception of V25) on the cluster color–magnitude diagram (CMD). The plotted positions correspond to magnitudes at maximum light and average colors. Only 50% of all stars with extracted *BV* photometry are included in Fig. 3. Stars with formal errors of *V* photometry exceeding the median value of σ_V at a given magnitude level have been omitted. However, we have plotted all detected stars with $B-V<0.3$ mag regardless of the quality of their photometry.

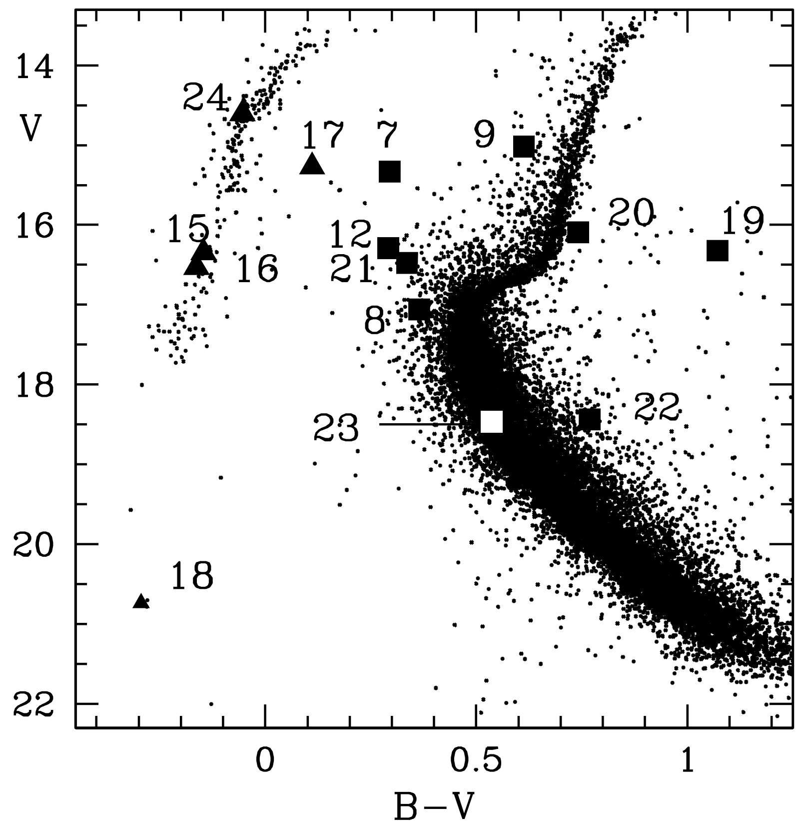

Fig. 3. CMD for NGC 6752, with positions of the variables marked.

[2]Light curves of all variables discussed in this paper are available from the CASE archive at *http://case.camk.edu.pl/*

Table 1

Equatorial coordinates and basic data for NGC 6752 variables

ID	α_{2000} [°]	δ_{2000} [°]	V_{max}	$\langle B-V \rangle$	ΔV	P [d]	Remarks
V7	287.72527	−60.00345	15.33	0.295	0.45	0.059051(2)	SX[a]
V8	287.79417	−59.98151	17.058	0.365	0.36	0.314938(36)	EW[b]
V9	287.85929	−60.02352	15.018	0.613	0.06	0.363602(53)	EW?
V12	287.64263	−59.94921	16.292	0.291	0.05	0.040901(2)	SX
V15	287.79719	−59.99593	16.344	−0.146	0.02	0.6895(12)	EHB[c]
V16	287.77680	−59.98007	16.53	−0.163	0.04	>8	EHB
V17	287.76690	−59.98539	15.27	0.111	0.02	3.291(12)	EHB
V18	287.79165	−60.03861	20.74	−0.294	0.16	0.4676(11)	EHB
V19	287.80435	−59.92156	16.321	1.072	0.12	6.18:	
V20	287.71042	−59.96032	16.090	0.742	>0.02	>8	–
V21	287.68723	−60.00998	16.477	0.336	0.09	0.5514(15)	
V22	287.62364	−59.94002	18.437	0.769	0.13	1.76(10)	
V23	287.63577	−60.02607	18.463	0.537	0.2	-	EA[d]
V24	287.62177	−60.01576	14.606	−0.054	0.01	>8	BHB, var?
V25	287.71479	−59.98371	–	–	–	–	CX4, B1, CV[e]

Note: [a] SX Phe type variable, [b] contact binary, [c] extreme horizontal branch star, [d] detached eclipsing binary, [e] cataclysmic variable B1 (Bailyn *et al.* 1996), optical counterpart to the X-ray source CX4 (Pooley *et al.* 2002).

3. Properties of Variables

3.1. Horizontal Branch Stars

Our sample includes 239 stars with $B-V<0.22$ mag and $14<V<16.0$ mag. These are the BHB and EHB stars of NGC 6752. The light curves of these stars were examined in detail on an individual basis. Seventy-two objects with $16<V<18$ mag and $B-V<0.22$ mag are candidate B-type subdwarf (sdB) stars.

Two types of pulsating stars are known among the field sdB stars. The p-mode pulsators (sdBV or EC 14026 type stars) have periods of 100–200 s and amplitudes ranging from a few millimagnitudes up to 0.25 mag. The g-mode pulsators (PG1718–426 type stars) have periods ranging from 20 minutes to 3 hours with amplitudes not exceeding 5 mmag. The sdB stars also occur in close binaries with orbital periods ranging from a few hours to several days (Morales-Rueda *et al.* 2003) and amplitudes of their light curves ranging from a few mmag to a few tenths of a magnitude. Most often the dominant mechanism of photometric variability of sdB binaries is the reflection effect.

The time resolution of photometry measured from the individual frames is sufficient to detect coherent variations with periods of the order of 100 s. As can be seen in Fig. 1, the precision of photometry at $V\approx 18$ mag is about 10 mmag, improving to 4 mmag at $V = 16.0$ mag. With light curves containing 495 data points we should be able to detect sdB stars pulsating with amplitudes as small as 1–2 mmag. Not a single candidate for a pulsating sdB star was detected in our sample. We have identified, however, four variables located in the BHB/EHB region on the CMD of the cluster. A fifth blue variable is located on the faint extension of the EHB. Time domain *V*-band light curves of these five variables are presented in Fig. 4. The *B*-band light curves are similar to those observed in *V*.

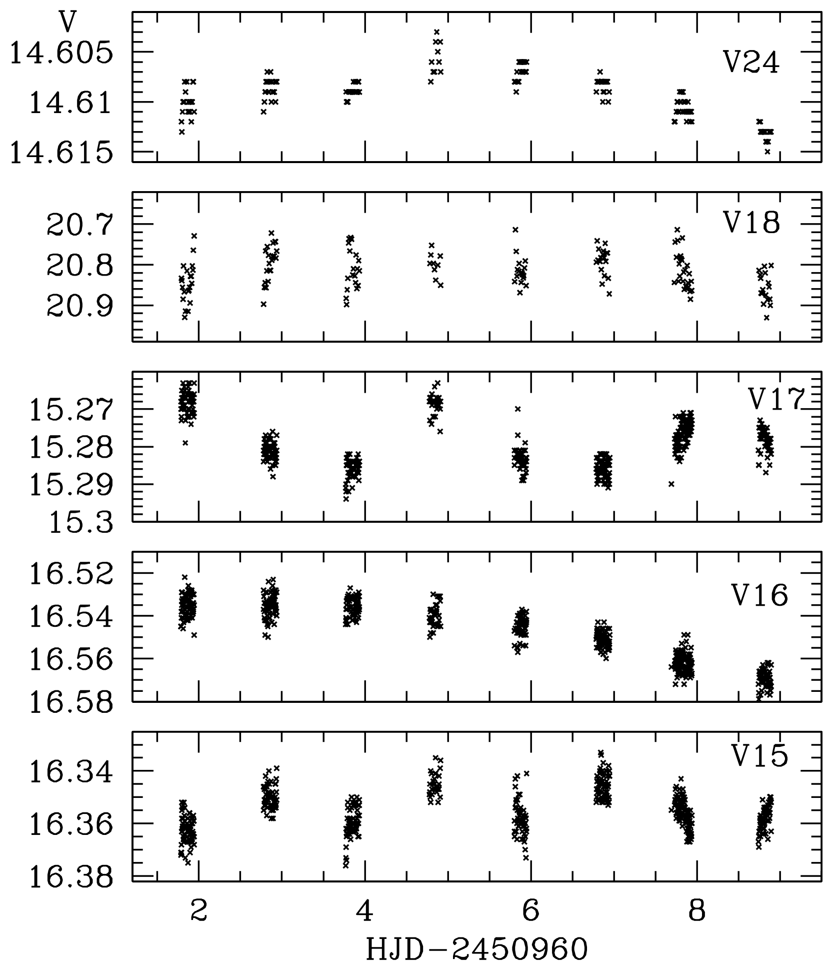

Fig. 4. Light curves of variables from the BHB/EHB of NGC 6752.

Stars V24 and V16 showed some systematic changes of luminosity during our observations. However, their possible periods exceed the eight day interval spanned by our data. The light curves of the remaining three variables can be phased with preliminary periods, as shown in Fig. 5.

For star V17 we have adopted a period of $P = 3.1$ d, with $P = 6.2$ d also a possibility. The location of this variable on the cluster CMD (see Fig. 3) indicates

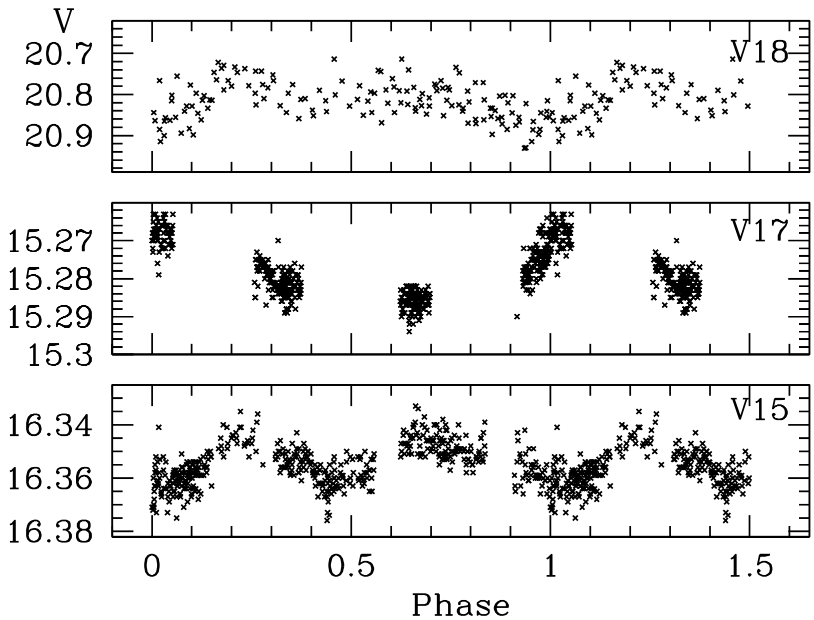

Fig. 5. Phased *V* light curves of the variables V15, V17 and V18.

that it may be a binary composed of a hot EHB star and a red companion. In such a case the observed variability could be due to the reflection and/or ellipsoidality effect.

The light curve of V15 was phased with $P_1 = 1.318$ d (representing the highest peak in a power spectrum of the V15 light curve), but periods $P_2 = 0.687$ d or $P_3 = 0.406$ d are also possible. The variable is a good candidate for binary sdB star.

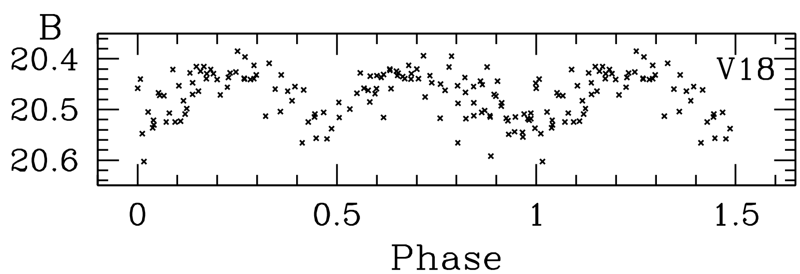

Fig. 6. Phased *B* light curve of the variable V18.

The light curve of V18 was phased with a period of 0.4673 d. An examination of nightly light curves indicates that the detected variability is very likely real although not strictly regular. This claim is further supported by the photometry in the *B*-band. The phased *B* light curve of V18 is presented in Fig. 6. It has a similar shape but a slightly larger amplitude than the *V* curve. We have used images of NGC 6752 collected in 2007 and 2008 season to look for possible long term variability of V18. There was no evidence for any change of the average *V* luminosity exceeding 0.1 mag with respect to the 1998 season. As a result it seems unlikely that V18 is a dwarf nova. The location on the cluster CMD indicates that it may be a degenerate binary hosting a low-mass helium white dwarf. A binary of this type and at a similar location on the cluster CMD was found in the globular M4 (O'Toole *et al.* 2006). The suggested orbital period of V18 of 0.46 d falls within the range occupied by low mass degenerate binaries (Downes *et al.* 2001).

3.2. Blue Stragglers

Four of the detected variables are candidate blue stragglers. Objects V7 and V12 are SX Phe stars (Thompson *et al.* 1999). Our new photometry indicates that they are multi-modal pulsators. In the light curve of V7 we detected three periodicities: $P_1 = 0.059051(2)$ d, $P_2 = 0.06152(2)$ d, $P_3 = 0.040519(1)$ d. A fourth possible period is $P_4 = 0.05691(4)$ d or $P_4 = 0.06027(4)$ d – the power spectrum of the pre-whitened light curve has equal height peaks at these two periods. In the case of V12 we detected two periods: $P_1 = 0.040901(2)$ d and $P_2 = 0.039509(7)$ d. The light curves of V7 and V12 phased with periods P_1 are shown in Fig. 7.

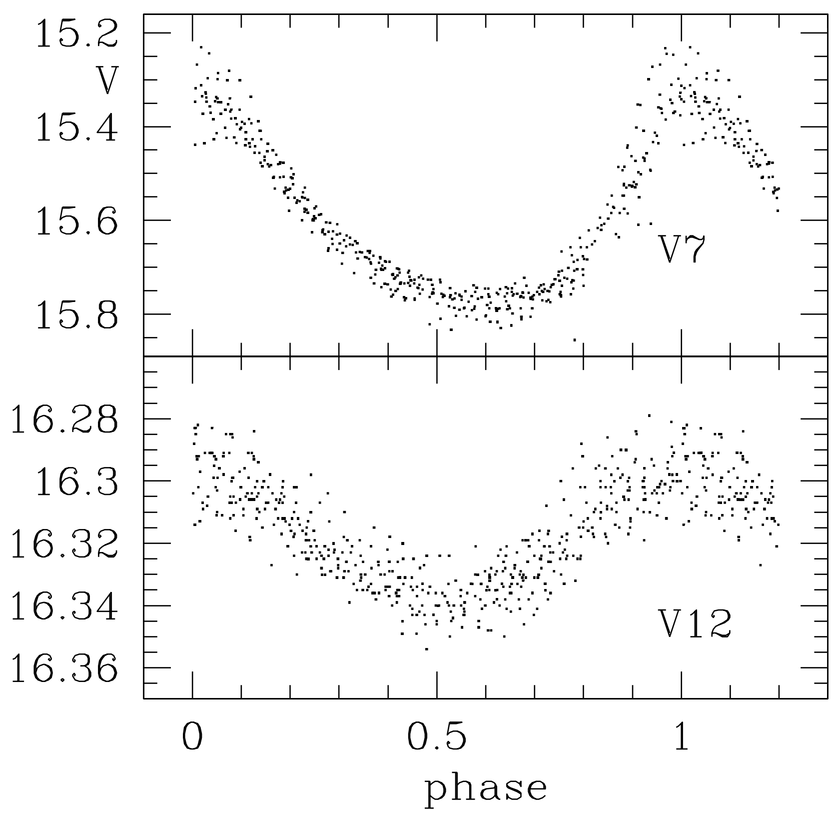

Fig. 7. Phased *V* light curves of SX Phe stars V7 and V12.

The blue straggler V21 is a likely γ Dor type pulsator. Its time-domain light curve is presented in Fig. 8. It shows periodic modulation with a variable amplitude. The light curve phased with the dominant period of 0.5513 d is presented in Fig. 9. The variable becomes bluer at the maximum light with a total range of $B-V$ of about 0.05 mag and an average color $\langle B-V\rangle = 0.335$ mag. The average magnitude is $\langle V\rangle = 16.54$ mag. Assuming cluster membership for V21 implies an absolute magnitude $M_V = 3.41$ mag and unreddened color $(B-V)_0 = 0.295$ mag.[3] The observed characteristics of V21 are fully consistent with those of a γ Dor star (Henry, Fekel and Henry 2005) belonging to NGC 6752. A spectroscopic confirmation of pulsations of V21 would be a challenging task, as radial velocity amplitudes of γ Dor stars are on the level of a few km/s.

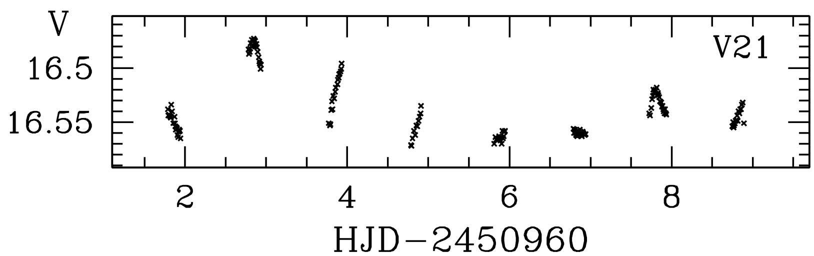

Fig. 8. Light curve of the variable V21.

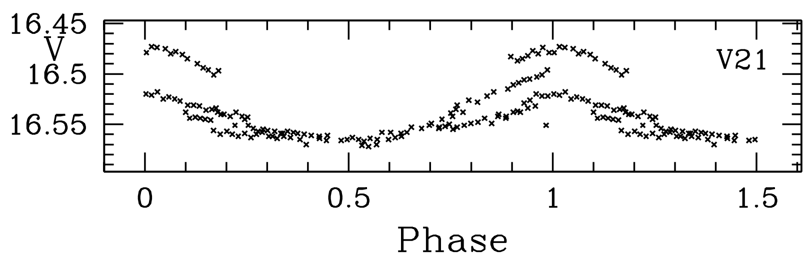

Fig. 9. Phased *V* light curve of the variable V21.

The last of the variable blue stragglers, V8, was originally detected by Thompson *et al.* (1999). It has a classical W UMa type light curve with period of 0.31 d and a total primary eclipse. A detailed analysis of this star will be presented separately. V8 is a semidetached system, which is unexpected given its short orbital period and the shape of the light curve.

3.3. Other Variables

Variables V19 and V20 are located to the right of the subgiant branch on the cluster CMD. Their light curves are shown in Fig. 10. The variability of V19 seems to be periodic with $P \approx 6$ d ($P \approx 1.2$ d is also possible). The $B-V$ color varies

[3]Following Harris (1996) we adopt for the cluster $(m-M)_V = 13.13$ mag and $E(B-V) = 0.04$ mag.

by about 0.018 mag, the star is bluer at maximum light. V20 shows a systematic decline in luminosity during the observing run. Over eight nights the V magnitude decreased by about 0.018 mag, while the $B-V$ color remained constant.

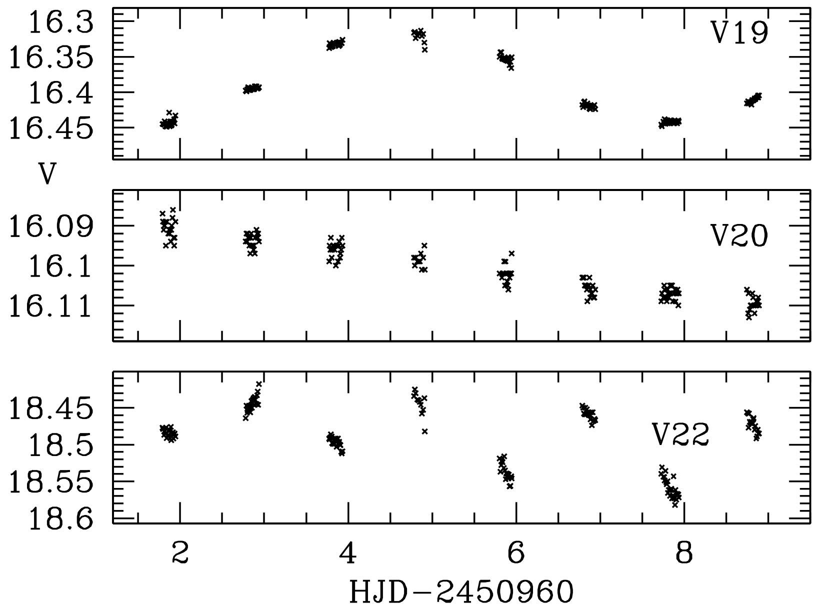

Fig. 10. Light curves of the variables V19, V20 and V22.

The time domain light curve of V22 is shown in Fig. 10. The variable is located about 1 mag above the upper main-sequence of the cluster. Its light curve can be phased with several periods, of which $P = 1.872$ d corresponds to the highest peak in the power spectrum. Problems with aliasing and insufficient time coverage do not allow us to derive the period of variability of V22 with confidence.

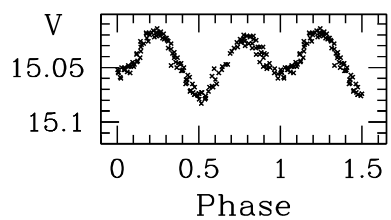

Fig. 11. Phased V light curve of the variable V9.

The location of variable V9 on the cluster CMD makes it a candidate yellow straggler. It shows variability with a period of 0.364 d. The phased light curve is shown in Fig. 11. The period and shape of the light curve suggest that V9 is a low inclination W UMa type binary, and is a field star not related to the cluster. Nevertheless the nature and membership status of this relatively bright star are worth of further study.

As can be seen in Fig. 12, variable V23 is an eclipsing binary. Only one eclipse was observed. The star is located on the main-sequence of the cluster. Such binaries are potentially valuable as they can be used for accurate distance determination of the host cluster (Paczyński 1997). The observed eclipse of V23 has a flat bottom suggesting that the eclipse is total. There was no detectable change of the $B-V$ color between maximum and minimum light implying that the eclipse is in fact a transient of a substantially cooler and smaller companion in front of the primary. We suppose that the system has a large mass and luminosity ratio. V854 was observed with the MIKE spectrograph on the Clay 6.5-m Magellan Telescope on the nights of UT 04 August 2007 and UT 16 August 2007. Analysis of the spectra with the IRAF FXCOR routine show that the star is an SB1 binary with no evidence of a secondary component. The measured heliocentric velocities were -23.23 ± 0.19 km/sec at HJD 2454316.5889 (mid exposure), and -40.32 ± 0.20 km/sec at HJD 2454328.6134.

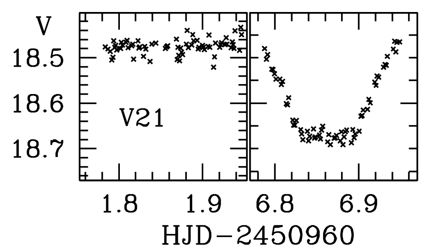

Fig. 12. Light curve of the eclipsing binary V23.

The last object detected using our standard procedure described in Section 2 is the known cataclysmic variable B1 (Bailyn *et al.* 1996). It corresponds to the X-ray source CX4 (Pooley *et al.* 2002) and is located at an angular distance of only $5''$ from the cluster center. In Table 1 B1=CX4 is listed as V25. Several bright red stars are seen close to the variable on our ground based images, causing problems with the extraction of the *V*-band photometry. However, we managed to extract *B*-band photometry. The variable underwent an outburst during our observations. The light curve, presented in Fig. 13, is typical for ordinary U Gem type dwarf novae. V25 can be added to a short list of dwarf novae known in globular clusters (Pietrukowicz *et al.* 2008).

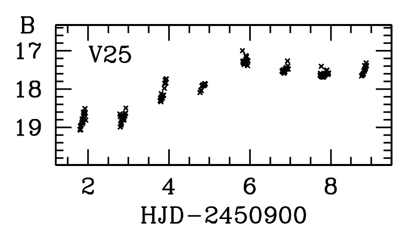

Fig. 13. Light curve of cataclysmic variable B1=V25.

We have also looked for variable objects at positions corresponding to the remaining 18 X-ray sources listed in Pooley *et al.* (2002). In the *B*-band, light curves could be extracted for all locations but for the source CX1. For the *V*-band some of examined locations were badly affected by nearby saturated stars. A clear signature of variability was detected at the position of CX19. A stellar object is seen at this location. As can be seen in Fig. 14 it shows substantial night-to-night changes of the average luminosity. A closer examination reveals a sine-like modulation of the light curve with a period of about 0.11 d. We measured the median luminosity of CX19 for each of the eight nights of data and offset the observations for each night relative to the first night. The resultant *V* light curve phased with a period of 0.11306 d is shown in Fig. 15. The variable is present on a series of HST ACS-WF images collected on 2004 September 19 between 9:13 and 17:49 UT (Proposal ID 10121; PI Bailyn). A total of 23 and 12 images were taken with F555W and

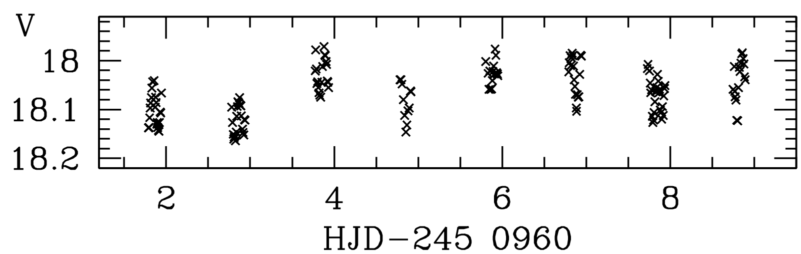

Fig. 14. *V* light curve of the optical counterpart to the X-ray source CX19.

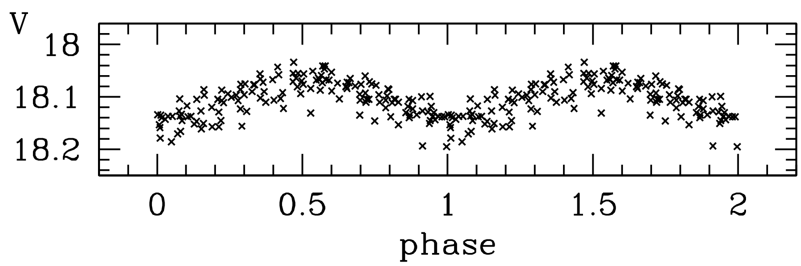

Fig. 15. Phased *V* light curve of the optical counterpart to the X-ray source CX19.

F814W filters, respectively. We extracted profile photometry from these frames using the DAOPHOT/Allstar package. The photometry was transformed to the VI_C system using the calibration provided by Sirianni *et al.* (2005). Fig. 16 shows the ACS light curves of CX19 phased with the period detected in our ground based data. The finding chart for the optical counterpart of CX19 is shown in Fig. 17. The variable is blended with two close visual companions with CX19 being the brightest, north-east, component of the blend. Components A and B are separated from CX19 by $0\overset{''}{.}12$ and $0\overset{''}{.}21$, respectively. Their magnitudes and colors are: $V_A = 19.35$ mag, $(V-I)_A = 0.76$ mag, $V_B = 21.11$ mag, $(V-I)_B = 1.27$ mag. Components A and B could not be resolved on the du Pont images. However, we

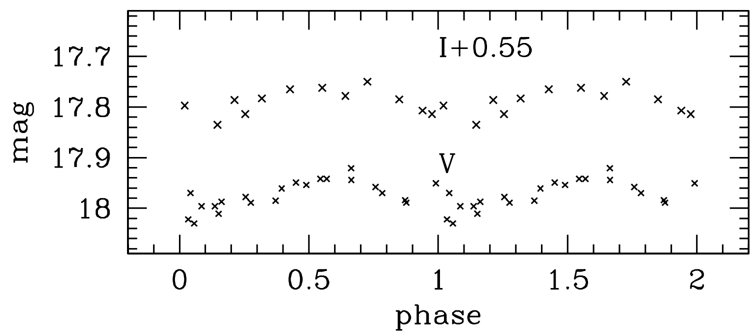

Fig. 16. Phased *VI* light curves of CX19 based on ACS data. Note shift for the *I*-band.

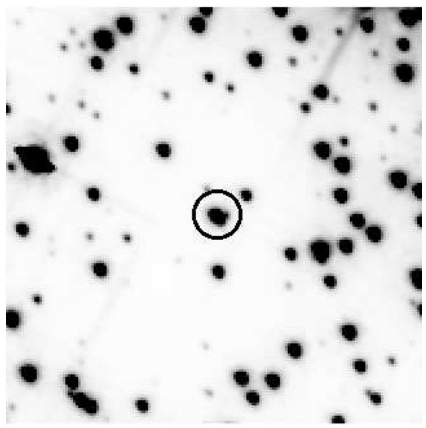

Fig. 17. Finding chart for the variable CX19 based on the ACS image. The chart is 4″ on a side with North up and East to the left. The variable is the N-E component of the blend marked with the circle.

have taken them into account when transforming the ground-based V light curve from differential counts into magnitudes. Fig. 18 shows a $V/(V-I)$ CMD extracted from the ACS data for a small region around CX19. The variable is located very close to the upper main sequence of the cluster. If it was a cluster member it would have an absolute visual magnitude of $M_V \approx 4.9$ mag.

For the moment, it is difficult to assign CX19 to any class of variables with confidence. Its light curve resembles those of SU UMa type CVs, but the period of 0.113 d is too long, and the observed luminosity is too high for such a classification. Moreover, SU UMa stars are much fainter between outbursts than $M_V = 4.9$ mag. The value of the observed period falls within the range occupied by polars. However, the X-ray luminosity of CX19 is much too low for an active magnetic CV. Assuming cluster membership, Pooley *et al.* (2002) obtained $L_X(0.5-2.5)$ keV $= 2.2 \times 10^{30}$ erg/s while active polars have $L_X > 10^{32}$ erg/s. It is possible that at the time of the CHANDRA observation the variable was in a low state. However the relatively red color observed at $M_V \approx 4.9$ mag rules out the possibility that CX19 is a polar since in their high states polars are intrinsically blue stars. We also note that observations taken in 1998 with the du Pont telescope and

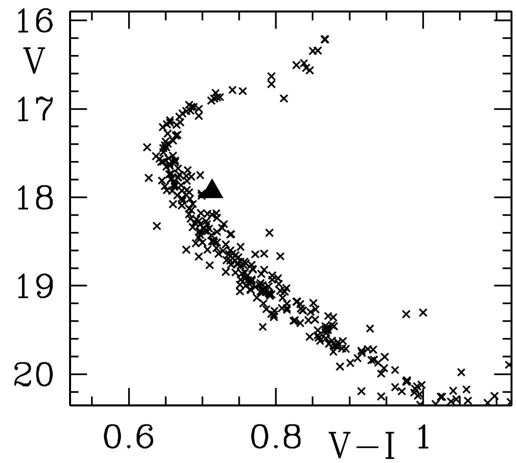

Fig. 18. *V vs. V-I* CMD of NGC 6752 with position of CX19 marked with a triangle.

in 2004 with ACS show the variable at a similar visual magnitude of $V \approx 18.0$ mag. This is unexpected for an active CV. We conclude that the variable is not a CV. Instead we propose that it is a close binary hosting a neutron star or a black hole. The observed modulation of the optical light curve could be due to the ellipsoidal effect, in which case the orbital period would be $2 \times 0.113 = 0.226$ d. Additional low-amplitude variability seen on the time scale of days can be attributed to fluctuations of the very low accretion rate from the degenerate component to its compact companion. Such a mass transfer rate may also account for the low X-ray luminosity. Despite being located close to the cluster center, the variable seems to be accessible for ground based spectroscopy, and such radial velocity observations should reveal the nature of CX19.

4. Summary and Discussion

We have obtained time series *BV* photometry for about 40 thousand stars from the central area of the globular cluster NGC 6752. The observing strategy and careful reduction of the data resulted in a photometric precision of 4 mmag stars with $V < 16.0$ mag and 1–2 mmag at $V < 15$ mag, rising to 0.01 mag at $V \approx 18.5$ mag. The sample included 72 hot subdwarf candidates. No pulsation variability was detected for any of them. We have detected, however, four low-amplitude variables which may be binary EHB/BHB stars. Spectroscopic follow up is needed to reveal their actual nature. Preliminary periods were established for two of them. A faint blue variable with $V \approx 20.7$ mag was also detected. Its light curve is likely periodic with $P \approx 0.47$ d. The variable is a good candidate for a degenerate binary belonging to the cluster. One of four periodically variable blue stragglers is a likely γ Dor star. If confirmed, it would be the first variable of this type detected in globular clusters.

We detected three variable yellow/red stragglers with $15.0 < V < 16.3$ mag. Two of them show periodic sine-like modulation of their light curves. Another periodic variable was detected at $V = 18.4$ mag on the right side of the upper-main sequence of the cluster. We propose that their light-curve modulation is related to binarity, and that they are good candidates for ellipsoidal variables hosting degenerate components. Our hypothesis is based on two main arguments. First, it is known that field X-ray novae (binaries hosting stellar mass black holes) spend most of their time in quiescence, showing only an ellipsoidal variability (Remillard and McClintock 2006). Second, the known optical counterparts to millisecond pulsars located in GCs usually occupy positions either to the red or to the blue of the main sequence on the H-R diagram (Ferraro *et al.* 2001, 2003). As GCs contain rich population of active X-ray binaries, one may expect that they also harbor a large number of non-accreting, degenerate binaries. Unambiguous detection of non-accreting degenerate binaries in GCs would open a new, exciting field of research, and may lead to the detection of the first known stellar-mass black holes in GCs. The list of possible quiescent degenerate binaries in GCs is limited to a few faint X-ray sources of unknown nature (Heinke *et al.* 2003). The binary nature of red/yellow stragglers from NGC 6752 can be checked by obtaining a few medium resolution spectra per object. These spectra could be used to estimate the mass function for confirmed binaries, further constraining the nature of possible compact components.

We have detected a likely dwarf nova type outburst of one of the CV candidates located in the cluster core region. Periodic variability was detected for the optical counterpart of the faint X-ray source CX19 located in the core region of the cluster. The star is located very close to the upper main sequence of the cluster, and is unlikely to be an ordinary cataclysmic variable. We propose that the object it is an excellent candidate for a close degenerate binary caught in quiescence. Despite being located in the crowded area the variable is accessible for ground based spectroscopy.

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