COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 5533

Konkoly Observatory
Budapest
4 June 2004

HU ISSN 0374 – 0676

NEWLY DISCOVERED VARIABLE STARS IN THE GLOBULAR CLUSTER NGC 1851

SUMEREL, A. N.[1]; CORWIN, T. M.[1,4]; CATELAN, M.[2,4]; BORISSOVA, J.[2,4]; SMITH, H. A.[3]

[1] Department of Physics, University of North Carolina at Charlotte, Charlotte, NC 28221, USA; e-mail: ansumere, mcorwin@uncc.edu

[2] Pontificia Universidad Católica de Chile, Departamento de Astronomía y Astrofísica, Av . Vicuña Mackenna 4860, 782-0436 Macul, Santiago, Chile; email: mcatelan, jborisso@astro.puc.cl

[3] Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA; email: smith@pa.msu.edu

[4] Visiting Astronomer, European Southern Observatory, La Silla, Chile

The Galactic globular cluster NGC 1851, which has recently been associated, along with NGC 2808, with a previously unknown dwarf galaxy in Canis Major (Martin et al. 2004), belongs (again like NGC 2808) to a relatively rare group of clusters that display bimodal horizontal-branch (HB) morphology (Catelan et al. 1998 and references therein). We have recently discovered a sizeable RR Lyrae population in NGC 2808 (Corwin et al. 2004). Here we report on the discovery of 19 previously unknown variables in NGC 1851.

Prior to our study, thirty-three variables were known in NGC 1851, 29 of which of the RR Lyrae type. The RR Lyrae variables in NGC 1851 have most recently been studied by Walker (1998). The CCD images used in the present study were obtained with the Danish 1.54-m telescope located at the European Southern Observatory at La Silla, Chile. The instrument used was the DFOSC with a field of view of $13\farcm7 \times 13\farcm7$. The data reported here are from four nights, 2002 December 11/12 and 12/13 amd 2003 February 18/19 and 19/20. The seeing was around 1.0 arcsec or better. Image-subtraction (Alard & Lupton 1998; Alard 2000) analysis results are reported here for 65 B (December) and 83 B (February) images.

The location and tentative period of the variables are given in Table 1.The x and y coordinates are given in arcseconds and with respect to the cluster center, given in the Clement et al. (2001) catalog as R.A. $05^{\rm h}12\fm4$ and Dec $-40^\circ05\farcm0$ (1950). Because the data are relatively limited, the periods are not definite. Light curves based on the periods given in Table 1 are shown in Figure 1. Because two different reference frames were used to determine the differential flux for December and for February, the light curve data for December were adjusted to match as closely as possible the light curve data for February. Thus the exact relationship between these data sets might not be as shown in Figure 1. When the new variable was found in both the December and the February data, the different symbols represent data from each of the two runs. NV6, NV7, NV9, NV18, and NV19 were found only in the February data and in those cases the different symbols represent data from the two consecutive nights.

As for the previously known variables, it should be noted that the period 0.426653 d given in Walker (1998) for V31 does not phase our December/February data properly. Our

data suggest that the period may be either approximately 0.0016 d shorter or 0.0011 d longer than Walker's period.

As can be seen from Table 1 and Figure 1, we have likely detected about 15 previously unknown RR Lyrae variables in NGC 1851. Together with the 29 variables of this type previously known, this raises the specific frequency of RR Lyrae variables in the cluster from $S_{\rm RR} = 13.5$ (Harris 1996) to $S_{\rm RR} \simeq 20.5$.

Table 1. Locations and tentative periods for new variables.

Variable	$x('')$	$y('')$	Period (d)	Type
NV1 (V34)	38.77	−10.87	0.515	RRab
NV2 (V35)	22.18	4.31	0.321	RRc
NV3 (V36)	14.07	12.49	0.318	RRc
NV4 (V37)	12.26	−13.97	0.350	RRc
NV5 (V38)	3.52	−13.30	0.75?	RRab?
NV6 (V39)	3.27	−1.46	0.573	RRab
NV7 (V40)	0.59	12.32	0.503	RRab?
NV8 (V41)	−1.26	5.89	0.400	RRab?
NV9 (V42)	−1.46	−3.10	0.341	RRc
NV10 (V43)	−2.14	10.31	0.283	RRc
NV11 (V44)	−2.73	0.83	0.253	RRc?
NV12 (V45)	−4.68	17.77	0.389	RRab
NV13 (V46)	−7.06	−0.80	0.297	RRc
NV14 (V47)	−14.92	14.48	0.283	RRc
NV15 (V48)	−21.22	−6.12	0.520	RRab
NV16 (V49)	−23.30	−1.80	0.267	RRc
NV17 (V50)	−38.58	−28.44	0.327	RRc
NV18 (V51)	−41.86	31.50	0.507	RRab
NV19 (V52)	−44.82	21.60	0.401	?

Acknowledgements:
We thank J. M. Fernández for his assistance during some of the observing runs. M.C. acknowledges support by Proyecto FONDECYT Regular No. 1030954. H.A.S. acknowledges the NSF for support under grant AST 02-05813.

References:

Alard, C., 2000, *A&AS*, **144**, 363
Alard, C., & Lupton, R.H., 1998, *ApJ*, **503**, 325
Catelan, M., Borissova, J., Sweigart, A.V., Spassova, N., 1998, *ApJ*, **494**, 265
Clement, C.M., et al., 2001, *AJ*, **122**, 2587
Corwin, T.M., Catelan, M., Borissova, J., Smith, H.A., 2004, *A&A*, in press (astro-ph/0405004)
Harris, W.E., 1996, *AJ*, **112**, 1487 (Feb. 2003 update)
Martin, N.F., Ibata, R.A., Bellazzini, M., Irwin, M.J., Lewis, G.F., Dehnen, W., 2004, *MNRAS*, **348**, 12
Walker, A.R., 1998, *AJ*, **116**, 220

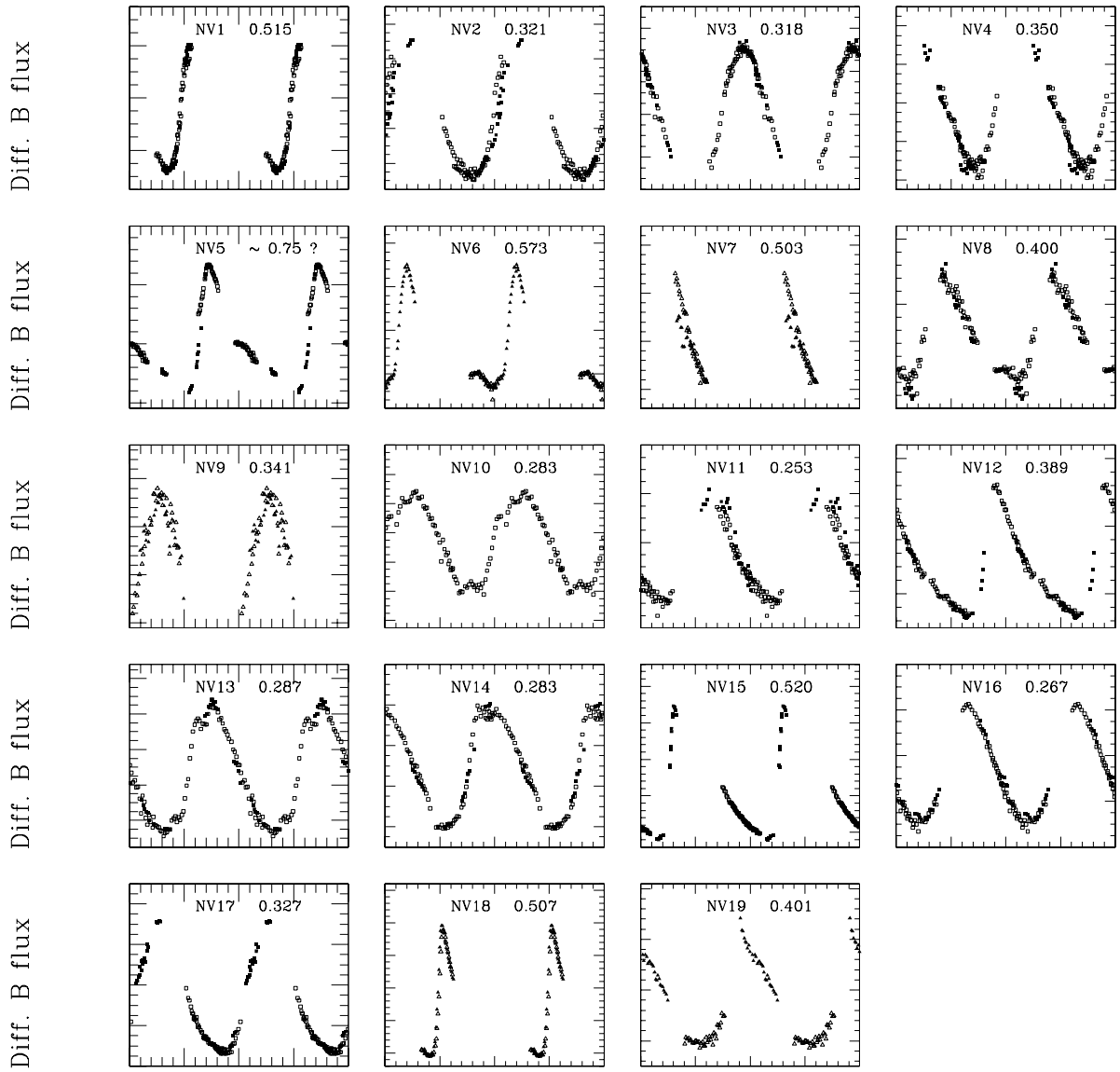

Figure 1. *B*-band light curves for newly detected variable stars in NGC 1851. ISIS relative fluxes are shown in all cases. The candidate period used to phase the light curves is given in each plot. Note that such periods are quite uncertain in some cases.