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# PHOTOMETRY OF HIGH-AMPLITUDE DELTA SCUTI STARS IN 2013

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This report is the sixth paper in a series on photometry of High-Amplitude Delta Scuti (HADS) Stars (see Wils et al., 2013 for references to the earlier papers in this series). It presents details on 390 times of maximum for 75 HADS, obtained during 2013. The method used to calculate the times of maximum is described in the first paper of the series (Wils et al., 2009).

Table 1 lists the code used for the observers and their instruments. We list the observed maxima in Table 2 with star name (Col. 1), the epoch of the observed maximum (Col. 2), the uncertainty of the epoch (Col. 3), the observer's code (Col. 4) and the filter used (Col. 5) for the observations. When a maximum was observed in more than one filter by the same observer, the table shows the average value of the times obtained in each filter individually (note that there may be a significant delay between the maximum times when observed in different filters).

We found that the observed times of maximum deviated considerably from their ephemeris for some stars. Insufficient precision in the original determination of the period is often the cause. We give new elements for these stars in Table 3. To obtain the highest possible precision, we used data from the ASAS (Pojmański, 2002), NSVS (Woźniak et al., 2004), CRTS (Drake et al., 2009) and SuperWASP surveys (Butters et al., 2010) in conjunction with our own data.

We detected a sudden change in the period of V376 Cam, likely at the beginning of 2013. A plot of the $O-C$ data calculated from our observations using a linear ephemeris are given in Fig. 1. Assuming a constant period before and after the change, the period shortened by $0.282 \pm 0.006$ seconds, or $\Delta P/P = 2.3 \times 10^{-5}$. Sweigart and Renzini (1979) proposed small random mixing events in a semiconvective zone and at the edge of the

Table 1: List of instruments used for the observations.

| Code | Observer(s) | Telescope | Observatory | CCD |
|---|---|---|---|---|
| AA | AA | Catadioptric 30 cm | Perseus Observatory | SBIG ST-10XME |
| AB | AB | Catadioptric 35 cm | Carpe Noctem Observatory | SBIG ST-9E |
| FN | FN | Catadioptric 40 cm | Alkmaar, Nederland | SBIG ST-7XME |
| FNA | FN | Catadioptric 25 cm | ABT Metius | SBIG ST402XME |
| HMBW | FJH | Catadioptric 30 cm | Astrokolkhoz, New Mexico | SBIG ST-9XE |
| HMBC | FJH | Catadioptric 40 cm | Chile Remote Obs. Atacama Desert | FLI ML16803 |
| HO40 | PL+PVC | Newton 40 cm | R.O.B.-Humain | SBIG ST-10XME |
| IS | IS | Catadioptric 25 cm | ABT Metius | SBIG ST402XME |
| MAV | MV | Maksutov 26 cm | Leest Observatory | SBIG ST-10XME |
| MAVN | MV | Newton 35 cm | Leest Observatory | QSI583 WSG |
| RP | RDP | Catadioptric 36 cm | Shobdon, UK | Starlight XPress SXV-H9 |
| SBL | BS | Cassegrain 28 + 23.5 cm | Alan Guth Observatory | Starlight XPress MX-716 |
| SK | SK | Catadioptric 30 cm | Zagori Observatory | SBIG ST-7XMEI |
| SO30 | CWR | Catadioptric 30 cm | SETEC Observatory | SBIG ST-8iXME |
| SO40 | CWR | Catadioptric 40 cm | SETEC Observatory | SBIG ST-8XME |
| VWSR | JVW | Refractor 15.2 cm | Hooglede, Belgium | SBIG ST-7XME |
| VWS | JVW | Catadioptric 23.5 cm | Hooglede, Belgium | SBIG ST-8XME |

convective core as the cause of sudden period changes in RR Lyrae stars. A similar mechanism may be at work here. Alternatively the light time effect from the passage through periastron of a companion in a highly elliptic orbit may mimick a sudden change in period. In that case these events should reoccur at regular intervals.

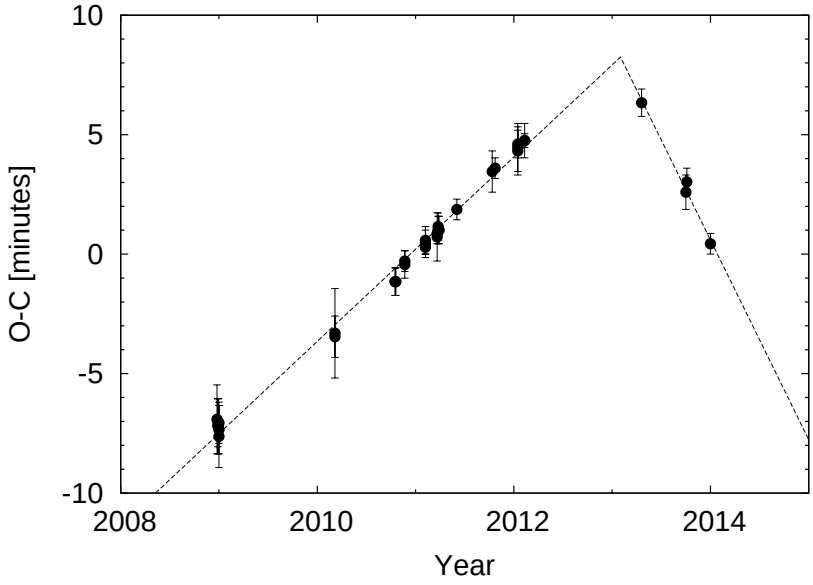


**Figure 1.** $O-C$ values for the maxima of V376 Cam with respect to the ephemeris Max HJD = $2454823.4194 + 0^{\rm d}.14032268 \times E$. The straight lines indicate the instantaneous period before and after the change.

Four of the observed stars observed turned out be multiperiodic variables. We found V879 Her (observed by AA), GSC 1489-0914 (observed by AA) and GSC 4145-0919 (observed by JVW and AA) to be double-mode pulsators while GSC 1566-2802 (observed by AA and MV) showed at least one other pulsation mode, probably a non-radial mode. Table 4 lists details about the independent frequencies $f_0$, the fundamental radial mode, and $f_1$, the first overtone mode in the case of the double-mode pulsators and a non-radial

mode for GSC 1566-2802. The frequencies, amplitudes and phases, and their uncertainties were determined using Period04 (Lenz & Breger, 2005). The uncertainties were derived using Monte Carlo simulations. We also detected a number of linear combinations of the independent frequencies in all stars. In 2014 Hümmerich independently discovered the double-mode behaviour of GSC 1489-0914[1]. Data of these four stars are available from the IBVS website: `6122-t1.txt` (V879 Her); `6122-t2.txt` (GSC 1489-0914); `6122-t3.txt`, `6122-t4.txt` (GSC 4145-0919); `6122-t5.txt`, `6122-t6.txt` (GSC 1566-2802).

One of us (JVW) found one of the comparison stars used for LW Dra, GSC 4431-0698, to be a W UMa type variable with a period of 0.36949 days. GSC 4431-0698 is a close pair of two stars (2MASS J19053535+6840195 and 2MASS J19053648+6840169) 6.″7 apart. We could not determine which one of these stars is the variable. The data are available online (`6122-t7.txt`).

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[1]AAVSO VSX: "Fundamental period and epoch are tabulated. First overtone period: 0.0419105 d. Period ratio: 0.7734. J-K=0.15 (2MASS); B-V=0.21 (APASS)" (`http://www.aavso.org/vsx`)

Table 2: Observed times of maximum (Epoch = HJD − 2400000).

| Star | Epoch | Unc. | Obs. | Filter | Star | Epoch | Unc. | Obs. | Filter |
|---|---|---|---|---|---|---|---|---|---|
| GP And | 56573.6020 | 0.0005 | SO30 | V | V792 Cep | 56460.5081 | 0.0012 | AA | C |
| | 56573.6808 | 0.0006 | SO30 | V | | 56497.3300 | 0.0013 | AA | C |
| | 56573.7592 | 0.0005 | SO30 | V | | 56497.4624 | 0.0012 | AA | C |
| | 56573.8381 | 0.0005 | SO30 | V | XX Cyg | 56487.5234 | 0.0003 | MAV | V |
| | 56573.9166 | 0.0007 | SO30 | V | V2455 Cyg | 56482.4685 | 0.0004 | MAV | V |
| | 56577.6149 | 0.0007 | SO30 | V | LW Dra | 56403.4120 | 0.0010 | VWSR | V |
| | 56577.6931 | 0.0005 | SO30 | V | | 56410.3829 | 0.0012 | VWSR | V |
| | 56577.7718 | 0.0005 | SO30 | V | | 56423.4980 | 0.0006 | VWSR | V |
| | 56577.8508 | 0.0008 | SO30 | V | | 56451.5004 | 0.0007 | VWSR | V |
| | 56577.9295 | 0.0004 | SO30 | V | V1116 Her | 56352.9694 | 0.0017 | HMBW | V |
| | 56604.6032 | 0.0007 | SO30 | V | | 56404.3796 | 0.0018 | SBL | V |
| | 56604.6819 | 0.0006 | SO30 | V | | 56404.4768 | 0.0016 | SBL | V |
| | 56604.7606 | 0.0007 | SO30 | V | | 56404.5702 | 0.0016 | SBL | V |
| | 56604.8389 | 0.0006 | SO30 | V | | 56466.3973 | 0.0010 | AA | C |
| | 56615.4615 | 0.0006 | RP | V | | 56466.4922 | 0.0010 | AA | C |
| | 56641.6626 | 0.0004 | SO30 | V | V1209 Her | 56351.9971 | 0.0004 | HMBW | V |
| V460 And | 56506.5001 | 0.0005 | MAV | V | | 56404.3703 | 0.0004 | MAVN | V |
| | 56566.3358 | 0.0004 | MAV | V | | 56404.4218 | 0.0004 | MAVN | V |
| | 56566.4090 | 0.0009 | MAV | V | | 56404.4728 | 0.0003 | MAVN | V |
| V524 And | 56573.5811 | 0.0005 | SO40 | V | | 56404.5241 | 0.0003 | MAVN | V |
| | 56573.6753 | 0.0003 | SO40 | V | KZ Lac | 56483.4106 | 0.0018 | MAV | V |
| | 56573.7698 | 0.0003 | SO40 | V | | 56483.5146 | 0.0014 | MAV | V |
| | 56573.8644 | 0.0002 | SO40 | V | | 56507.4263 | 0.0010 | MAV | V |
| | 56573.9590 | 0.0003 | SO40 | V | | 56508.4705 | 0.0017 | MAV | V |
| V528 And | 56543.5202 | 0.0012 | AA | C | | 56508.5747 | 0.0020 | MAV | V |
| | 56590.2982 | 0.0013 | AA | C | | 56541.3611 | 0.0004 | AB | C |
| | 56590.3870 | 0.0011 | AA | C | | 56577.5934 | 0.0012 | SO40 | V |
| | 56590.4761 | 0.0011 | AA | C | | 56577.6979 | 0.0012 | SO40 | V |
| V544 And | 56581.2459 | 0.0012 | AA | C | | 56577.8026 | 0.0015 | SO40 | V |
| | 56581.3541 | 0.0008 | AA | C | | 56577.9072 | 0.0013 | SO40 | V |
| | 56587.2341 | 0.0005 | AA | C | SZ Lyn | 56299.6526 | 0.0005 | SO30 | V |
| | 56587.3408 | 0.0005 | AA | C | | 56299.7733 | 0.0009 | SO30 | V |
| | 56587.4482 | 0.0004 | AA | C | | 56299.8940 | 0.0007 | SO30 | V |
| | 56587.5549 | 0.0003 | AA | C | | 56309.6568 | 0.0009 | SO30 | BV |
| CY Aqr | 56559.4172 | 0.0008 | AB | C | | 56309.7770 | 0.0005 | SO30 | BV |
| YZ Boo | 56339.8669 | 0.0006 | HMBW | V | | 56309.8979 | 0.0010 | SO30 | BV |
| | 56339.9708 | 0.0007 | HMBW | V | | 56310.0187 | 0.0016 | SO30 | BV |
| | 56385.3547 | 0.0006 | MAVN | V | | 56310.6211 | 0.0010 | SO30 | BV |
| | 56385.4589 | 0.0005 | MAVN | V | | 56310.7416 | 0.0008 | SO30 | BV |
| V336 Boo | 56340.9529 | 0.0005 | HMBW | V | | 56310.8622 | 0.0008 | SO30 | BV |
| BL Cam | 56584.2339 | 0.0007 | AA | C | | 56310.9827 | 0.0008 | SO30 | BV |
| | 56584.2731 | 0.0005 | AA | C | V593 Lyr | 56451.4583 | 0.0017 | AB | C |
| | 56584.3120 | 0.0004 | AA | C | | 56478.4267 | 0.0007 | RP | V |
| | 56584.3509 | 0.0005 | AA | C | | 56478.5296 | 0.0005 | RP | V |
| | 56584.3900 | 0.0006 | AA | C | V1162 Ori | 56355.3484 | 0.0022 | HO40 | V |
| | 56584.4289 | 0.0004 | AA | C | | 56356.2932 | 0.0025 | HO40 | V |
| | 56584.4681 | 0.0003 | AA | C | | 56356.3731 | 0.0027 | HO40 | V |
| | 56584.5073 | 0.0003 | AA | C | | 56636.4933 | 0.0042 | HO40 | V |
| | 56584.5466 | 0.0005 | AA | C | | 56637.5167 | 0.0027 | HO40 | V |
| V367 Cam | 56356.4964 | 0.0011 | FN | C | | 56638.3805 | 0.0028 | HO40 | V |
| V376 Cam | 56403.5975 | 0.0004 | IS | V | | 56638.4612 | 0.0032 | HO40 | V |
| | 56568.4741 | 0.0005 | IS | V | | 56638.5386 | 0.0035 | HO40 | V |
| | 56568.6147 | 0.0004 | IS | V | | 56639.4055 | 0.0040 | HO40 | V |
| | 56656.3146 | 0.0003 | MAV | V | | 56639.4817 | 0.0042 | HO40 | V |
| V435 Cam | 56589.4995 | 0.0010 | AA | C | | 56639.5635 | 0.0029 | HO40 | V |
| AD CMi | 56349.6838 | 0.0009 | HMBW | V | | 56654.6679 | 0.0022 | SO30 | V |
| | 56349.8067 | 0.0011 | HMBW | V | | 56654.7476 | 0.0032 | SO30 | V |

Table 2: Observed times of maximum (continued).

| Star | Epoch | Unc. | Obs. | Filter | Star | Epoch | Unc. | Obs. | Filter |
|---|---|---|---|---|---|---|---|---|---|
| V1162 Ori | 56654.8262 | 0.0022 | SO30 | V | GSC 0632-0812 | 55851.7790 | 0.0007 | HMBC | V |
| | 56654.9084 | 0.0034 | SO30 | V | | 55851.8627 | 0.0008 | HMBC | V |
| V465 Peg | 56560.3500 | 0.0007 | AB | C | | 55852.7904 | 0.0005 | HMBC | V |
| V536 Peg | 56567.4058 | 0.0003 | AB | C | | 55852.8747 | 0.0007 | HMBC | V |
| DW Psc | 56558.8889 | 0.0003 | HMBC | V | | 55855.7406 | 0.0006 | HMBC | V |
| | 56560.8568 | 0.0004 | HMBC | V | | 55855.8254 | 0.0010 | HMBC | V |
| | 56564.8539 | 0.0002 | HMBC | V | GSC 0753-1489 | 56341.3893 | 0.0015 | AB | C |
| | 56637.2662 | 0.0004 | HO40 | C | | 56637.4594 | 0.0008 | AB | C |
| AX Tri | 56591.2745 | 0.0004 | AA | C | | 56656.3897 | 0.0005 | AB | C |
| | 56591.3434 | 0.0005 | AA | C | GSC 0914-0684 | 56414.3073 | 0.0010 | AA | C |
| | 56591.4122 | 0.0004 | AA | C | | 56414.3847 | 0.0007 | AA | C |
| | 56591.4812 | 0.0006 | AA | C | | 56414.4623 | 0.0009 | AA | C |
| | 56591.5501 | 0.0005 | AA | C | | 56414.5399 | 0.0008 | AA | C |
| | 56599.2081 | 0.0005 | AA | C | GSC 0933-0651 | 56341.9448 | 0.0006 | HMBW | V |
| | 56599.2769 | 0.0006 | AA | C | | 56460.3215 | 0.0013 | AA | C |
| | 56599.3458 | 0.0006 | AA | C | | 56460.4259 | 0.0007 | AA | C |
| | 56599.4150 | 0.0005 | AA | C | GSC 1061-1651 | 56503.3033 | 0.0008 | AA | C |
| | 56599.4838 | 0.0004 | AA | C | | 56503.4396 | 0.0004 | AA | C |
| GW UMa | 56379.5664 | 0.0007 | IS | V | GSC 1076-0158 | 56458.4368 | 0.0006 | AB | C |
| | 56386.4748 | 0.0006 | IS | V | | 56483.4509 | 0.0010 | AB | C |
| YZ UMi | 56389.4098 | 0.0004 | VWSR | V | | 56528.3585 | 0.0047 | AB | C |
| | 56541.3789 | 0.0004 | VWS | V | | 56533.3987 | 0.0008 | AB | C |
| GSC 0191-1282 | 56309.4144 | 0.0010 | IS | V | GSC 1220-1131 | 56320.2791 | 0.0007 | FN | V |
| | 56357.3552 | 0.0006 | FN | C | | 56320.3601 | 0.0009 | FN | V |
| | 56357.4016 | 0.0006 | FN | C | | 56337.2794 | 0.0016 | FN | C |
| | 56357.4487 | 0.0005 | FN | C | | 56578.3817 | 0.0007 | AA | C |
| | 56366.3632 | 0.0003 | IS | C | | 56578.4628 | 0.0007 | AA | C |
| | 56384.3344 | 0.0007 | FN | C | | 56605.2256 | 0.0007 | AA | C |
| | 56384.3826 | 0.0006 | FN | C | | 56605.3065 | 0.0006 | AA | C |
| | 56384.4301 | 0.0006 | FN | C | | 56605.3878 | 0.0004 | AA | C |
| | 56384.4773 | 0.0006 | FN | C | | 56605.4693 | 0.0004 | AA | C |
| | 56638.4485 | 0.0005 | AB | C | | 56622.4697 | 0.0019 | RP | V |
| | 56638.4963 | 0.0003 | AB | C | | 56646.3853 | 0.0009 | FN | C |
| GSC 0321-0314 | 56364.8096 | 0.0008 | HMBW | V | GSC 1306-0466 | 56309.3121 | 0.0036 | FNA | V |
| GSC 0435-3806 | 56461.3768 | 0.0013 | AA | C | | 56366.3820 | 0.0014 | FN | C |
| | 56461.4407 | 0.0010 | AA | C | | 56639.3443 | 0.0009 | HO40 | V |
| | 56461.5063 | 0.0009 | AA | C | | 56639.4307 | 0.0010 | HO40 | V |
| GSC 0513-0624 | 56460.8962 | 0.0007 | HMBC | V | | 56656.3212 | 0.0019 | AB | C |
| | 56461.9095 | 0.0007 | HMBC | V | GSC 1442-1358 | 56354.8875 | 0.0004 | HMBW | V |
| | 56540.3876 | 0.0005 | AB | C | | 56358.8290 | 0.0006 | HMBW | V |
| | 56573.3272 | 0.0007 | SO40 | C | GSC 1594-2234 | 56470.4074 | 0.0012 | SK | V |
| GSC 0632-0812 | 55829.6929 | 0.0005 | HMBC | V | | 56470.5470 | 0.0007 | SK | V |
| | 55829.7762 | 0.0008 | HMBC | V | | 56494.3294 | 0.0007 | AA | C |
| | 55829.8617 | 0.0008 | HMBC | V | | 56494.4662 | 0.0006 | AA | C |
| | 55830.7895 | 0.0010 | HMBC | V | | 56541.3488 | 0.0006 | AA | C |
| | 55830.8728 | 0.0005 | HMBC | V | | 56543.4000 | 0.0005 | AA | C |
| | 55831.8002 | 0.0007 | HMBC | V | GSC 1716-1598 | 56571.5260 | 0.0009 | RP | V |
| | 55831.8844 | 0.0006 | HMBC | V | GSC 1750-1237 | 56637.2991 | 0.0011 | AB | C |
| | 55833.8230 | 0.0008 | HMBC | V | GSC 2043-1201 | 56378.5892 | 0.0018 | IS | V |
| | 55837.7013 | 0.0006 | HMBC | V | | 56378.6677 | 0.0013 | IS | V |
| | 55837.7850 | 0.0005 | HMBC | V | | 56402.5160 | 0.0017 | IS | V |
| | 55839.8081 | 0.0008 | HMBC | V | | 56402.5933 | 0.0024 | IS | V |
| | 55841.8315 | 0.0007 | HMBC | V | | 56412.5688 | 0.0010 | RP | C |
| | 55843.7707 | 0.0006 | HMBC | V | GSC 2080-0986 | 56448.4316 | 0.0004 | AB | C |
| | 55843.8551 | 0.0009 | HMBC | V | GSC 2194-2001 | 56493.3230 | 0.0007 | AA | C |
| | 55850.7670 | 0.0005 | HMBC | V | | 56493.4375 | 0.0012 | AA | C |
| | 55850.8512 | 0.0008 | HMBC | V | | 56552.3756 | 0.0011 | AA | C |

Table 2: Observed times of maximum (continued).

| Star | Epoch | Unc. | Obs. | Filter | Star | Epoch | Unc. | Obs. | Filter |
|---|---|---|---|---|---|---|---|---|---|
| GSC 2194-2001 | 56552.4907 | 0.0014 | AA | C | GSC 2977-0238 | 56310.8165 | 0.0006 | SO40 | BV |
| | 56554.3287 | 0.0012 | AA | C | | 56310.8922 | 0.0006 | SO40 | BV |
| | 56554.4431 | 0.0016 | AA | C | | 56310.9682 | 0.0006 | SO40 | BV |
| | 56555.3627 | 0.0013 | AA | C | | 56390.3188 | 0.0011 | FN | C |
| | 56555.4774 | 0.0013 | AA | C | | 56390.3948 | 0.0006 | FN | C |
| | 56589.2553 | 0.0008 | AA | C | | 56390.4708 | 0.0009 | FN | C |
| | 56589.3692 | 0.0012 | AA | C | GSC 3004-0870 | 56337.3446 | 0.0006 | AB | C |
| GSC 2290-1195 | 56638.2632 | 0.0025 | MAV | V | | 56365.8537 | 0.0008 | HMBW | V |
| | 56638.3413 | 0.0031 | MAV | V | | 56385.4079 | 0.0007 | FN | C |
| GSC 2496-0118 | 56305.4470 | 0.0020 | IS | V | | 56385.4901 | 0.0007 | FN | C |
| | 56337.3564 | 0.0029 | IS | V | | 56385.5724 | 0.0007 | FN | C |
| | 56337.4255 | 0.0031 | IS | V | | 56385.6540 | 0.0008 | FN | C |
| | 56379.3635 | 0.0006 | FN | C | | 56400.2784 | 0.0005 | AA | C |
| | 56379.4309 | 0.0008 | FN | C | | 56400.3605 | 0.0005 | AA | C |
| | 56379.4990 | 0.0010 | FN | C | | 56400.4429 | 0.0005 | AA | C |
| | 56379.5664 | 0.0009 | FN | C | | 56400.5247 | 0.0009 | AA | C |
| | 56379.6333 | 0.0013 | FN | C | | 56416.3819 | 0.0007 | FN | C |
| | 56395.2830 | 0.0003 | AA | C | | 56416.4642 | 0.0009 | FN | C |
| | 56395.3504 | 0.0004 | AA | C | | 56416.5464 | 0.0011 | FN | C |
| | 56395.4177 | 0.0003 | AA | C | GSC 3031-0307 | 56356.4387 | 0.0006 | AB | C |
| | 56403.4143 | 0.0007 | FN | C | | 56411.2798 | 0.0013 | AA | C |
| | 56403.4825 | 0.0009 | FN | C | | 56412.2777 | 0.0013 | AA | C |
| | 56403.5501 | 0.0014 | FN | C | | 56412.3794 | 0.0010 | AA | C |
| | 56638.4419 | 0.0009 | MAV | V | | 56412.4785 | 0.0009 | AA | C |
| | 56638.5092 | 0.0006 | MAV | V | | 56414.4764 | 0.0012 | RP | C |
| GSC 2566-1398 | 56384.6074 | 0.0009 | IS | V | | 56414.5745 | 0.0016 | RP | C |
| GSC 2696-1396 | 56481.4575 | 0.0005 | MAV | V | | 56439.3485 | 0.0014 | AA | C |
| GSC 2843-1999 | 56254.2503 | 0.0007 | MAV | V | | 56439.4491 | 0.0013 | AA | C |
| | 56254.3122 | 0.0013 | MAV | V | | 56447.3395 | 0.0011 | AA | C |
| GSC 2861-0970 | 56307.3960 | 0.0006 | FNA | V | | 56447.4391 | 0.0010 | AA | C |
| | 56335.3628 | 0.0007 | FN | C | | 56447.5399 | 0.0011 | AA | C |
| | 56573.3003 | 0.0013 | MAV | V | GSC 3428-1497 | 56323.3263 | 0.0009 | MAV | V |
| | 56573.4100 | 0.0008 | MAV | V | | 56323.4025 | 0.0012 | MAV | V |
| | 56577.4843 | 0.0006 | AA | C | | 56379.3857 | 0.0018 | IS | V |
| | 56579.3563 | 0.0006 | AA | C | GSC 3489-0868 | 56349.8601 | 0.0005 | HMBW | V |
| | 56579.4663 | 0.0006 | AA | C | | 56349.9467 | 0.0004 | HMBW | V |
| | 56579.5764 | 0.0004 | AA | C | | 56385.3868 | 0.0010 | MAV | V |
| | 56592.3488 | 0.0007 | AA | C | | 56385.4731 | 0.0005 | MAV | V |
| | 56592.4588 | 0.0006 | AA | C | GSC 3755-0845 | 56309.2795 | 0.0011 | MAV | V |
| | 56592.5689 | 0.0005 | AA | C | | 56315.2901 | 0.0016 | MAV | V |
| | 56637.2714 | 0.0006 | MAV | V | | 56315.3665 | 0.0019 | MAV | V |
| | 56637.2725 | 0.0012 | FN | C | | 56638.3258 | 0.0006 | HO40 | V |
| | 56637.3814 | 0.0014 | FN | C | | 56638.4020 | 0.0006 | HO40 | V |
| | 56637.3815 | 0.0005 | MAV | V | | 56638.4779 | 0.0005 | HO40 | V |
| GSC 2977-0238 | 56299.6544 | 0.0004 | SO40 | V | | 56638.5541 | 0.0005 | HO40 | V |
| | 56299.7306 | 0.0005 | SO40 | V | | 56639.3150 | 0.0008 | MAV | V |
| | 56299.8066 | 0.0006 | SO40 | V | GSC 3810-1553 | 56349.8406 | 0.0003 | HMBW | V |
| | 56299.8817 | 0.0009 | SO40 | V | | 56351.8206 | 0.0003 | HMBW | V |
| | 56299.9584 | 0.0003 | SO40 | V | | 56351.8914 | 0.0003 | HMBW | V |
| | 56305.5773 | 0.0006 | IS | V | | 56389.3690 | 0.0006 | FN | C |
| | 56309.6776 | 0.0008 | SO40 | BV | | 56389.4394 | 0.0012 | FN | C |
| | 56309.7533 | 0.0006 | SO40 | BV | GSC 3832-0152 | 56308.6560 | 0.0012 | IS | V |
| | 56309.8293 | 0.0004 | SO40 | BV | | 56308.7475 | 0.0005 | IS | V |
| | 56309.9052 | 0.0006 | SO40 | BV | | 56336.6076 | 0.0011 | IS | V |
| | 56309.9810 | 0.0007 | SO40 | BV | | 56336.6984 | 0.0009 | IS | V |
| | 56310.6644 | 0.0006 | SO40 | BV | | 56378.3493 | 0.0003 | MAV | V |
| | 56310.7405 | 0.0006 | SO40 | BV | GSC 3850-0137 | 56413.2733 | 0.0003 | AA | C |

Table 2: Observed times of maximum (continued).

| Star | Epoch | Unc. | Obs. | Filter | Star | Epoch | Unc. | Obs. | Filter |
|---|---|---|---|---|---|---|---|---|---|
| GSC 3850-0137 | 56413.3366 | 0.0004 | AA | C | GSC 4552-1498 | 56356.5917 | 0.0003 | IS | V |
| | 56413.3999 | 0.0004 | AA | C | | 56356.6476 | 0.0003 | IS | V |
| | 56413.4633 | 0.0004 | AA | C | | 56385.5020 | 0.0002 | IS | V |
| | 56413.5265 | 0.0004 | AA | C | | 56385.5576 | 0.0003 | IS | V |
| GSC 3863-0740 | 56378.4134 | 0.0014 | MAVN | V | | 56506.4449 | 0.0006 | MAV | V |
| GSC 3934-1904 | 56489.4786 | 0.0003 | MAV | V | GSC 4556-1113 | 56306.3133 | 0.0004 | VWSR | V |
| | 56496.3620 | 0.0005 | SK | V | | 56371.3312 | 0.0007 | MAV | V |
| | 56496.4712 | 0.0006 | SK | V | | 56371.4173 | 0.0004 | MAV | V |
| | 56496.5799 | 0.0008 | SK | V | | 56384.3690 | 0.0003 | VWSR | V |
| GSC 4163-0984 | 56409.2712 | 0.0003 | AA | C | | 56410.2718 | 0.0006 | AA | C |
| | 56409.3505 | 0.0005 | AA | C | | 56410.3577 | 0.0008 | AA | C |
| | 56409.4300 | 0.0003 | AA | C | | 56410.4446 | 0.0013 | AA | C |
| | 56409.5095 | 0.0003 | AA | C | | 56410.5304 | 0.0007 | AA | C |
| GSC 4196-1784 | 56463.3685 | 0.0012 | AA | C | | 56487.4614 | 0.0004 | VWSR | V |
| | 56463.5395 | 0.0008 | AA | C | | 56494.4553 | 0.0005 | VWSR | V |
| GSC 4417-0394 | 56384.4256 | 0.0007 | AB | C | | 56538.4052 | 0.0003 | VWS | V |
| GSC 4464-0924 | 56398.5990 | 0.0007 | IS | V | | 56559.2999 | 0.0005 | VWS | V |
| | 56485.4400 | 0.0009 | MAV | V | | 56559.3861 | 0.0003 | VWS | V |
| | 56485.5182 | 0.0015 | MAV | V | | 56637.3526 | 0.0004 | VWS | V |
| | 56581.3087 | 0.0006 | IS | V | GSC 4923-0693 | 56353.8649 | 0.0004 | HMBW | V |
| | 56581.3895 | 0.0022 | IS | V | GSC 5018-1085 | 56385.6112 | 0.0014 | IS | V |
| GSC 4500-0083 | 56496.4233 | 0.0036 | MAV | V | | 56418.5891 | 0.0014 | IS | V |
| GSC 4552-1498 | 56305.6922 | 0.0004 | IS | V | NSVS 14243430 | 56489.4929 | 0.0004 | AB | C |
| | 56336.4999 | 0.0004 | IS | V | | 56539.4189 | 0.0004 | AB | C |

Table 3: Updated linear elements for some HADS. Uncertainties are given in units of the last decimal.

| Star | Max (HJD) | Period (d) |
|---|---|---|
| GSC 1061-1651 | 2452383.172(7) | 0.13693601(3) |
| GSC 1220-1131 | 2452625.8155(4) | 0.081343587(9) |
| GSC 1442-1358 | 2452638.0670(10) | 0.08211246(3) |
| NSVS 14243430 | 2452206.7164(9) | 0.08607561(3) |

Table 4: Independent frequencies detected in multiperiodic HADS. Uncertainties are given in units of the last decimal. The phase is given with respect to HJD = 2450000. For radial double-mode pulsators the period ratio is also listed.

| Star | | Frequency c/d | Semi-Amplitude Mag. | Phase | Period ratio |
|---|---|---|---|---|---|
| V879 Her | $f_0$ | 17.576979(4) | 0.197(5) | 0.499(4) | |
| | $f_1$ | 22.66134(2) | 0.034(5) | 0.51(3) | 0.77564 |
| GSC 1489-0914 | $f_0$ | 18.453211(2) | 0.120(2) | 0.475(2) | |
| | $f_1$ | 23.860353(10) | 0.0283(2) | 0.175(9) | 0.77338 |
| GSC 1566-2802 | $f_0$ | 16.538388(2) | 0.1926(10) | 0.5495(10) | |
| | $f_1$ | 21.97807(3) | 0.0161(12) | 0.2878(10) | 0.75250 |
| GSC 4145-0919 | $f_0$ | 15.614244(5) | 0.189(5) | 0.276(4) | |
| | $f_1$ | 20.15552(3) | 0.033(5) | 0.16(3) | 0.77469 |