# LOST HARVARD VARIABLES IN SAGITTARIUS, SCUTUM, AND SCORPIUS RECOVERED ON NANTUCKET AND MOSCOW PLATES 

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For the reasons discussed by Hazen \& Samus (1999), it is important to recover variables lacking finding charts. This problem can be most effectively solved using the Harvard plate collection, especially because many stars with no finding charts ever published were first discovered at Harvard Observatory. However, much can be done using plate collections of other observatories. For several years, we successfully use the plate collection of the Maria Mitchell Observatory (MMO) to recover "lost" variables. The results of 1998 were presented in Tam \& Samus (2000); those of 1999, in Samus et al. (1999); those of 2000, in Samus et al. (2001). Plates of the Moscow collection are also being used for this purpose for many years.

In 2001 we have successfully recovered 10 "lost" Harvard variable stars on Nantucket and Moscow plates. The main results are presented in Tables 1 and 2. The columns of Table 1 contain: GCVS name; preliminary Harvard designation (HV - Harvard Variable); GSC number (if available); the star's right ascension and declination (equinox 2000.0); source of coordinates (A2.0 means the US Naval Observatory A2.0 catalog, Monet et al. 1998; DSS means coordinates measured by us on a DSS image, relative to several reference stars with coordinates from the USNO A2.0 catalog). For the two stars lacking GSC or USNO A2.0 catalog identifications, we present finding charts based on DSS images. The columns of Table 2 contain: GCVS name; the star's type found in our study; light elements (epoch and period) if they could be derived from our data (epochs refer to minimum light for the probable eclipsing variable and to maximum light for pulsating variables). Remarks on individual stars follow the Tables.

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Table 1: Identifications and coordinates

| Name | HV | GSC | $\alpha_{2000.0}$ | $\delta_{2000.0}$ | Source |
| :--- | :--- | :--- | :--- | :--- | :--- |
| AB Sgr | 3649 |  | $19^{\mathrm{h}} 01^{\mathrm{m}} 54.75$ | $-12^{\circ} 56^{\prime} 09^{\prime \prime} .7$ | A2.0 |
| BF Sgr | 3652 |  | 190456.35 | -115850.1 | A2.0 |
| CN Sgr | 3758 |  | 190253.30 | -131146.3 | DSS |
| AM Sco | 1014 |  | 160708.55 | -234011.3 | A2.0 |
| AO Sco | 1052 | 6213.0567 | 161502.38 | -214527.6 | GSC |
| AQ Sco | 1061 | 6794.0110 | 162034.67 | -231433.4 | GSC |
| AS Sco | 1065 |  | 162236.12 | -205832.3 | A2.0 |
| TU Sct | 3645 |  | 185744.92 | -125526.5 | A2.0 |
| UV Sct | 3642 | 5714.0420 | 185523.80 | -124656.6 | GSC |
| AM Sct | 3830 |  | 185202.50 | -083117.8 | DSS |

Table 2: Types and light elements

| Name | Type \& epoch | JD <br> $24 \ldots$ | Period |
| :--- | :--- | :--- | :--- |
| AB Sgr | SR | 44491 | $260^{\text {d }:}$ |
| BF Sgr | SR: | 29430 |  |
| CN Sgr | M | 44817 | $276^{\text {d }} 4$ |
| AM Sco | S: |  |  |
| AO Sco | EB: | 40000.44 |  |
| AQ Sco | RRAB | 40706.48 | 0.482367 |
| AS Sco | $?$ |  |  |
| TU Sct | SRA | 43016 | $128^{\text {d }} 6$ |
| UV Sct | SR | 42979 | $102^{\text {d }}$ |
| AM Sct | M: | 48082 | $435^{\text {d }} 3$ |

## Notes on individual stars

AB Sgr Twelve maxima or brightenings (Table 3) were observed on Nantucket plates. Their presentation with the period in Table 2 is not quite satisfactory, the star may belong to SRB variables.

Table 3: Maxima and brightenings of AB Sgr

| Max JD 24... | Max JD 24... | Max JD 24... |
| :--- | :--- | :--- |
| 25436:: | 29435: | $42930:$ |
| 26206:: | 29908 | 44491 |
| 28020 | 33593:: | $48151:$ |
| 28257:: | $35690:$ | $48460::$ |

BF Sgr The star is double, the northern component of the pair varies. Its position, measured using DSS images, confirms the identification with the single A2.0 catalog object present in this region of the sky. The star is just outside the error ellipse of IRAS PSC 19021-1203 but nevertheless the IRAS object can be a correct identification. The maximum in Table 2 is based on two Nantucket plates; the star was faint on JD 2428400.

CN Sgr The period in Table 2 is from Harwood (1931). On Nantucket plates, the star was found bright on JD 2444817 and faint on JD 2445231.

AM Sco Leavitt (1904) considered the star a possible Mira-type variable. It is in the error ellipse of IRAS PSC 16041-2332. Nevertheless, the star is not red in the A2.0 catalog ( $b-r=1.2$ ) and does not seem red on DSS images. Moscow plates show strong brightness variations within several days. No reliable period value could be found.

AO Sco A period value of 9.42669 is possible from our limited data, based on 45 Moscow plates.

AQ Sco The star was initially thought to be a slow variable (Leavitt, 1904), then a possible Orion variable (Himpel, 1944). We now suggest to reclassify it again as an RRab star. The preliminary light elements of Table 2 were found from 48 observations on Moscow plates (JD 2437074-2447347).

AS Sco Our data (based on Moscow plates) are not sufficient to classify this star, suspected by Leavitt (1904) to be a short-period variable.

TU Sct The new elements (Table 2) satisfactorily represent epochs of 22 maxima (JD 2414210-2445231, many of them uncertain) found using Nantucket plates (18 maxima or brightenings in Table 4) or available in the literature (Harwood, 1962; 9 maxima, 5 of them also represented in our observations).

Table 4: Maxima and brightenings of TU Sct

| Max JD 24... | Max JD 24... | Max JD 24... |
| :--- | :--- | :--- |
| 25143 | $27980:$ | $32729:$ |
| 25414: | $28370:$ | $33510:$ |
| 26163: | $29523:$ | $33765:$ |
| 26587: | 29813 | 33900 |
| 27361: | 29930 | 43016 |
| 27693 | $32082:$ | $45231:$ |

UV Sct This is IRAS PSC 18525-1250. The period in Table 2 is from Harwood
(1962); the maximum was derived from 8 Nantucket plates. The star was also bright on JD 2433186 and faint on JD 2433100.

AM Sct The new light elements (Table 2) represent 7 epochs of maxima found on Moscow plates (Table 5) and do not contradict the two old approximate epochs available in the literature (Cannon, 1924).

Table 5: Maxima of AM Sct

| Max JD 24... | Max JD 24... | Max JD 24... |
| :--- | :--- | :--- |
| 32848 | $39342+$ | 48096 |
| 37198 | $41160-$ |  |
| 38968 | $41566+$ |  |



Figure 1. The finding charts for $\mathrm{CN} \operatorname{Sgr}$ (left) and AM Sct (right), from red-light images of the second Digitized Sky Survey. The side of each chart is $2^{\prime}$

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