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LOST VARIABLES ON NANTUCKET PLATES

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For the reasons discussed by Hazen and Samus (1999), it is important to recover Harvard variables lacking finding charts. This problem can be most effectively solved using the Harvard plate collection, where many plates still hold ink marks left by the discoverers. However, much can be done using plate collections of other observatories. In particular, the plate collection of the Maria Mitchell Observatory (MMO), containing especially many plates of the Scutum cloud, can be used with success to recover "lost" Harvard variables in this part of the sky.

In 1999 we have successfully recovered 7 "lost" Harvard variable stars on Nantucket 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). 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 Nantucket and Moscow data (epochs refer to minimum light for eclipsing variables and to maximum light for other types; for Algols, the elements are heliocentric).

We would like to discuss the case of one more star, the "lost" Cepheid IU Aql, in greater detail. It was discovered by Walton (1927) as varying between $13\overset{\mathrm{m}}{.}7$ and $15\overset{\mathrm{m}}{.}2$ on Nantucket plates. Walton writes that, at the MMO, 22 plates of the M 11 region were taken in 1918–1926, 16 of them showing "stars of magnitude 15.5 or fainter", obviously too optimistic an opinion about old Nantucket plates. Harwood (1931) classified the star as a possible Cepheid, with light elements

$$\mathrm{Max} = \mathrm{JD}\ 2415661 + 22^{\mathrm{d}} \times E.$$

Near the position given by Walton, there is only one star bright enough, namely GSC 5129.00219 ($19^{\mathrm{h}}14^{\mathrm{m}}33\overset{\mathrm{s}}{.}53$, $-0°56'51\overset{''}{.}6$, 2000.0). The only published finding chart (Bateson

et al. 1981) is not sufficiently detailed but does not contradict the above GSC identification. However, this GSC star is definitely not a Cepheid and probably does not vary at all according to modern photoelectric and CCD data (Berdnikov 1999).

Table 1: Identifications and Coordinates

Name	HV	GSC	$\alpha_{2000.0}$	$\delta_{2000.0}$	Source
BC Sgr	3116	5414.00438	$18^h59^m32^s.29$	$-11°58'19''.4$	GSC
BY Sgr	3654		19 11 15.18	−13 30 20.9	A2.0
CU Sgr	3125		19 06 33.39	−12 16 28.1	A2.0
UW Sct	3643	5710.00841	18 56 33.16	−10 32 59.1	GSC
ZZ Sct	3821		18 44 37.74	−10 12 50.1	A2.0
AE Sct	3826		18 47 10.93	−07 43 54.6	A2.0
BC Sct	3838		18 56 05.4	−07 49 46	DSS

Table 2: Types and Light Elements

Name	Type	Epoch, JD 24...	Period
BC Sgr	M:	44490	200^d
BY Sgr	SR:		
CU Sgr	SR:		~ 1 yr?
UW Sct	LB	48151	
ZZ Sct	EA	47739.703	$2^d.199127$
AE Sct	EA	35246.779	$4^d.664022$
BC Sct	M	46662	$254^d.30$

Notes on individual stars

BC Sgr The provisional elements in Table 2 are based on 13 maxima after JD 2439000.

ZZ Sct Elements have been slightly modified from those published by Delhaye (1948) taking into account timings of 14 fadings on Moscow plates and one, comparatively recent, fading on Nantucket plates.

AE Sct We have found the star faint on 23 plates (JD 2435246–2448422); these fadings are in poor agreement with the light elements from Oosterhoff (1943). Our new elements (see Table 2) give $O - C = -0^d.376$ for Oosterhoff's epoch 2427884.521, so the period has probably really changed.

BC Sct According to the discoverer, Cannon (1924), the following star in a close pair varies. The star found variable on MMO plates is definitely a pair in the DSS. Its following component, not contained in the USNO A1.0/2.0 catalog, is red and comparatively faint on POSS prints, whereas it is brighter than the preceding component in the DSS. The epoch of the DSS plate (JD 2446668) nearly coincides with the brightest maximum observed by us (JD 2446662).

The MMO possesses a copy of a PhD dissertation by Marjorie Williams (1941) containing some unpublished results of probably the last study of IU Aql on Nantucket plates. A photographic finding chart in the dissertation clearly identifies IU Aql with the star now known as GSC 5129.00219. No individual measurements are given for the star, and the conclusion is the following:

"**IU Aql.** At first this star was thought to have a period of less than one day, and later was thought to be a Cepheid with a period of about 22 days. Only 87 observations were made in the present study, and it is felt that they are not very reliable, as the star was usually near the edge of the plates and the images were diffuse. Not enough observations in one day were obtained to tell whether it is a cluster-type or a typical Cepheid."

We have located Dr. Williams's working notebooks at the MMO. Most estimates show IU Aql fainter than $14^{\rm m}$; Williams estimated it brighter only on 8 plates. We have reexamined these 8 plates and, at least for 7 of them, could not reliably confirm the maximum. We conclude that the MMO plates studied by Williams show few maxima, if any, and do not definitely confirm variability. Harwood (1931) must have studied IU Aql on Harvard, not MMO, plates because her light elements give the initial maximum not represented in the MMO plate collection, and IU Aql is not mentioned in M. Harwood's MMO notebooks. Either the actual variable was lost soon after Harwood's study, or it ceased variations as early as in the 1920ies. M. Walton Mayall's MMO notebook, found by Dr. V. Strelnitski, does not contain finding charts.

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