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Photoelectric observations and current elements for the two Mira variables, DW Mus and BI Sco

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PHOTOELECTRIC OBSERVATIONS AND CURRENT ELEMENTS FOR THE TWO MIRA VARIABLES, DW Mus AND BI Sco

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Our photoelectric observations of two Mira variables, DW Mus and BI Sco, complemented by ASAS3[†] survey data, allowed us to construct light curves for these Mira stars as well as to define their current light elements.

KEYWORDS: mira variable stars, photometric techniques

1   INTRODUCTION

DW Mus was included in our programme of photoelectric observations of Cepheids, because it was listed in the General Catalog of Variable Stars (4th edition) (GCVS-IV) as a possible Cepheid (type CEP). In GCVS-IV, the Cepheid GW Sco has exactly the same coordinates as the Mira variable BI Sco, and we observed it under the impression that it was also a Cepheid.

2   OBSERVATIONAL DATA

DW Mus was observed in the BVI_c system using the 50 cm reflector of the South African Astronomical Observatory (Julian date (JD) 2451248-86), while the 60 cm reflector of Siding Spring Observatory (Australia) was used to observe BI Sco in VI_c (JD 2453073-118). The observational uncertainties are close to 0.02 magnitude in all bands. All observations are given in Table 1.

We later found published data for both Mira variables in the ASAS survey (Pojmanski, 2002) and discovered that our observations fell on the faintest parts of their light curves, which were

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† All Sky Automatic Survey.

Table 1.   Photoelectric observations of two Mira variables (JD hel Julian date heleocentric).

JD hel 2 400 000+	V	B − V	V − I$_c$	JD hel 2 400 000+	V	B − V	V − I$_c$
			DW Mus				
51 248.5304	13.321	–	5.068	51 260.5371	13.386	–	5.044
51 249.4606	13.334	–	5.048	51 275.3594	13.327	–	5.009
51 249.5556	13.384	–	5.079	51 275.5588	13.365	–	5.026
51 251.3797	13.365	–	5.058	51 279.3992	13.294	–	5.030
51 252.3118	13.335	1.771	5.037	51 279.4987	13.292	–	5.004
51 252.3645	13.335	–	5.049	51 280.3200	13.290	–	5.009
51 252.4984	13.357	–	5.042	51 280.3956	13.306	–	5.009
51 252.5749	13.335	–	5.037	51 280.4591	13.296	–	5.003
51 253.3529	13.361	–	5.062	51 280.5329	13.286	–	5.023
51 253.4716	13.355	–	5.055	51 280.6056	13.280	–	5.005
51 253.5357	13.378	–	5.068	51 281.3221	13.310	–	5.021
51 254.4076	13.365	–	5.049	51 281.3950	13.271	–	5.010
51 254.4830	13.402	–	5.046	51 281.4659	13.275	–	5.003
51 254.5525	13.418	–	5.088	51 281.5305	13.287	–	5.026
51 255.3521	13.355	–	5.052	51 281.5903	13.321	–	5.026
51 255.4417	13.364	–	5.023	51 282.3324	13.269	–	5.002
51 255.5143	13.383	–	5.038	51 282.4451	13.276	–	4.990
51 255.5788	13.387	–	5.054	51 282.5775	13.275	1.801	4.999
51 256.5127	13.372	–	5.036	51 283.3810	13.256	–	4.991
51 259.4141	13.385	–	5.044	51 283.4804	13.263	–	4.994
51 259.4767	13.374	–	5.040	51 284.3530	13.279	–	4.994
51 259.5416	13.403	–	5.052	51 284.4702	13.298	–	5.021
51 259.6067	13.426	–	5.084	51 286.3075	13.242	–	4.999
51 260.3298	13.375	–	5.032	51 286.3885	13.204	–	4.952
51 260.4188	13.376	–	5.030	51 286.4501	13.224	–	4.964
51 260.4778	13.376	–	5.043	51 286.5221	13.222	–	4.965
			BI Sco				
53 073.2042	13.925	–	2.943	53 111.1839	15.497	–	3.670
53 080.2271	14.353	–	3.220	53 112.0772	15.467	–	3.595
53 081.2158	14.399	–	3.257	53 114.0499	15.328	–	3.581
53 082.1736	14.444	–	3.299	53 114.1642	15.342	–	3.588
53 084.1599	14.573	–	3.362	53 116.1059	15.220	–	3.517
53 085.1437	14.696	–	3.426	53 116.1636	15.296	–	3.484
53 085.2412	14.723	–	3.437	53 116.2194	15.318	–	3.544
53 109.0890	15.515	–	3.671	53 116.2841	15.295	–	3.535
53 109.1890	15.544	–	3.700	53 118.0427	15.269	–	3.478
53 111.0827	15.424	–	3.616	53 118.1316	15.220	–	3.416
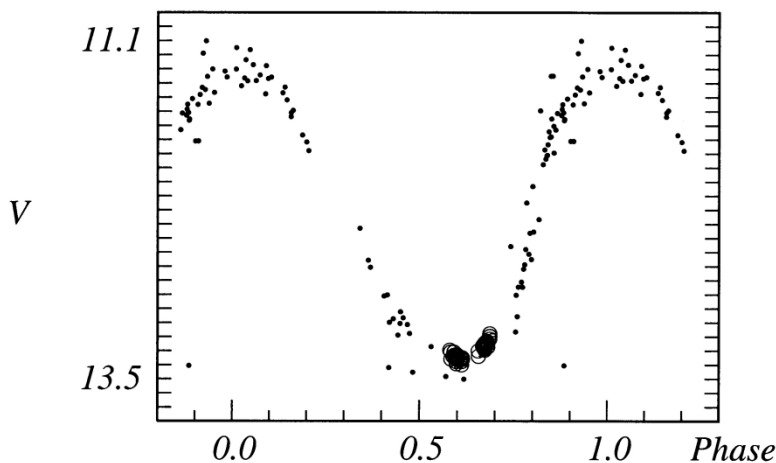
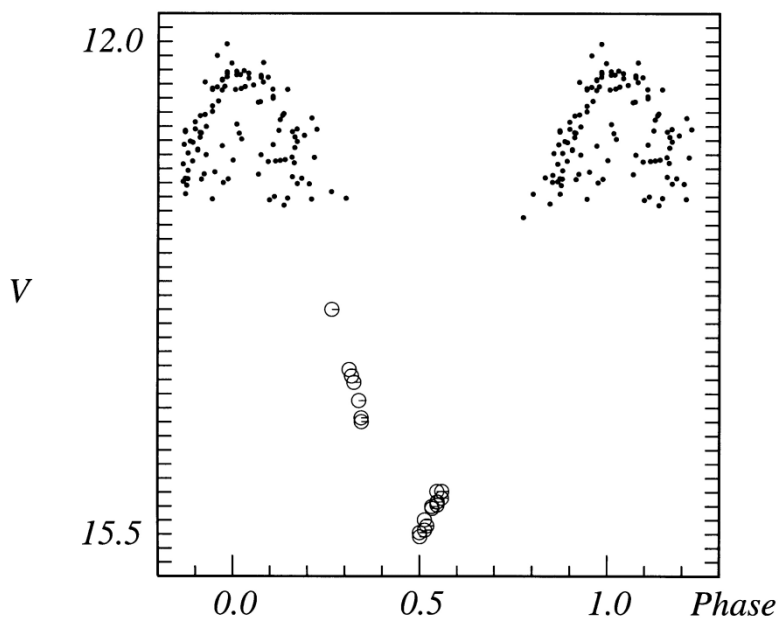**Figure 1.   Light curve of DW Mus: ∘, our *V* measurements; ASAS3 data.**

Figure 2. Light curve of BI Sco: ∘, our *V* measurements; ·, ASAS3 data.

either close to the limiting magnitude of the survey for DW Mus (ASAS 130750-6853.5) or much deeper than that limit for BI Sco (ASAS 165053-2757.9). That allowed us to construct light curves for the stars, which are presented in Figures 1 and 2, where our *V* measurements (large open circles) are plotted together with data from the ASAS3 survey (small dots).

3 RESULTS

All available data were reduced using our modification of Hertzsprung's method (Berdnikov, 1992). The results are summarized in Table 2, where the first and second columns give the times of the light maximum with their estimated uncertainties, the third and fourth columns contain the epoch numbers E and $O - C$ residuals respectively, the fifth and sixth columns present the number N of reduced observations and the references for the sources of the data respectively.

Table 2. Epochs of maximum light for two Mira variables.

Maximum JD	Error	E	$O - C$	N	Reference
		DW Mus			
2 451 054.4	1.5	−3	4.6	52	This paper
2 451 759.7	1.3	−1	0.6	46	ASAS3
2 452 101.0	1.9	0	−12.9	6	ASAS3
2 452 830.8	1.7	2	7.5	44	ASAS3
		BI Sco			
2 451 959.3	1.8	−3	−3.0	25	ASAS3
2 452 426.0	1.7	0	4.5	43	ASAS3
2 452 727.8	1.9	2	0.0	30	ASAS3
2 452 884.4	2.6	3	3.5	15	ASAS3
2 453 028.7	1.2	4	−5.2	20	This paper

Table 3.　　Light elements for two Mira variables.

Variable	Initial epoch JD hel 2 400 000+	Period (days)
DW Mus	52 113.9 ± 5.7	354.7 ± 3.0
BI Sco	52 421.6 ± 2.3	153.1 ± 2.3

The data from Table 2 were used to define the current light elements, which are given in Table 3.

Acknowledgements

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Pojmanski, G. (2002) *Acta Astron.* **52**, 397.