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REVISED ELEMENTS. II. SV VIRGINIS, BZ VIRGINIS,
SW HYDRAE, X ARAE, BQ PAVONIS, AND V865 AQUILAE

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Abstract

The Mira variables SV Vir, BZ Vir, SW Hya, X Ara, BQ Pav, and V865 Aql, considered for the HIPPARCOS observing program, have been studied using the Harvard College Observatory photographic plate collection. Previously published elements have been revised.

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This paper, the second in a series of four, examines the long-term behavior of six long period variables and updates the elements published in the fourth edition of the **General Catalogue of Variable Stars** (Kholopov *et al.* 1985) (GCVS) to aid in scheduling their observation by the HIPPARCOS astrometric satellite (Mattei 1988).

Because there were no visual observations for these stars in the AAVSO files, data were collected from the Harvard College Observatory photographic plates as described in Lysaght (1989). Published photographic sequences were not available for any of these stars, so comparison star magnitudes were determined by iris photometry at Harvard College Observatory. Photographic magnitudes from **The Guide Star Photometric Catalog I** (Lasker, Sturch *et al.* 1988) were used as standards, as well as field star magnitudes for some of the variables communicated to the AAVSO by Dr. C. Sturch (1989) of the Space Telescope Science Institute.

The stars in this paper are Mira variables which display regular behavior. A date-compensated discrete Fourier transform (DCDFT) period search program from the Maria Mitchell Observatory was used to revise the periods (Lysaght 1989).

Table I lists the stars examined in this paper, revised periods, photographic ranges of variation, and other pertinent information regarding the stars. Finder charts and photographic sequences are given in Figures (1a) - (1f).

1. SV Virginis

SV Vir was discovered by Massinger (1911) and assigned a period of 295.52 days by Gaposchkin (1954). The GCVS lists its period as 295.33 days.

To calculate the period, 150 observations (February 1930 - July 1988) were used. The revised elements are:

$$JD_{(\max)} = JD\ 2446918 + 294.96\ E. \quad (1)$$

The GCVS notes that SV Vir's period is possibly variable, but the 294.9-day period was found to be regular over the interval examined. The mean curve is shown in Figure 2. All mean curves have been calculated by a Maria Mitchell Observatory BASIC program (Lysaght 1989).

2. BZ Virginis

BZ Vir was discovered by Hoffmeister (1930), who classified it as a Mira. Buttery (1942) found its period to be 150.92 days. The period was revised using 180 observations (February 1928 - July 1988). The revised elements are:

$$JD_{(\max)} = JD\ 2446918 + 150.96\ E. \quad (2)$$

The mean curve is shown in Figure 3.

3. SW Hydrae

SW Hya was discovered by Cannon (Pickering 1914). Its period was originally found to be 219.4 days (Payne 1928) and was later revised to 219.0 days (Gaposchkin 1952) and then to 218.8 days (Kukarkin *et al.* 1969).

The DCDFT period search confirmed the 218.8-day period with 135 observations (March 1931 - July 1988). The revised elements are:

$$JD_{(\max)} = JD\ 2446170 + 218.8\ E. \quad (3)$$

SW Hya is fainter than magnitude 13.0 pg for the majority of its cycle. The mean curve is shown in Figure 4.

4. X Arae

X Ara was discovered by Fleming (Pickering 1908). Gaposchkin (1945) assigned it a period of 175.78 days.

The 129 observations spanned the interval from May 1931 to August 1987. The revised elements are:

$$JD_{(\max)} = JD\ 2446670 + 175.17\ E. \quad (4)$$

The mean curve is shown in Figure 5.

5. BQ Pavonis

BQ Pav was discovered by Hoffmeister (1943), who calculated a period of 112 days.

A period of 109.82 days was found from 150 observations (May 1931 - September 1988). The revised elements are:

$$JD_{(\max)} = JD\ 2447328 + 109.82\ E. \quad (5)$$

The mean curve is shown in Figure 6.

6. V865 Aquilae

V865 Aql was discovered by Arend (1952). Its period was found to be approximately 360 days by Erleskova and was later revised to 364.8 days (Kukarkin *et al.* 1954; 1969).

The revised elements, calculated from 274 observations (May 1928 - August 1988), are:

$$JD_{(\max)} = JD\ 2446299 + 367.43\ E. \quad (6)$$

The mean curve is shown in Figure 7.

The stars in this paper were found to be regular over decades. All but SV Vir and SW Hya, which were found to be too faint, will be

observed by the HIPPARCOS satellite; members are encouraged to observe these stars during the HIPPARCOS mission in order to better describe the stars' behavior. Those wishing to participate in this collaboration may obtain finder charts appropriate for visual observing from AAVSO Headquarters. The charts have photoelectric (V) sequences provided by Grenon *et al.* (1989).

I would like to thank Dr. Janet A. Mattei for her guidance; Dr. Martha L. Hazen, curator of the Harvard College Observatory Photographic Plate Collection, for her assistance with the plates and the iris photometer; Dr. Emilia P. Belserene of the Maria Mitchell Observatory for kindly providing computer programs; and the staff at AAVSO Headquarters for their support. I gratefully acknowledge NASA grant NAGW-1493 to the AAVSO, which funded this project; and the Fund for Astrophysical Research, which provided the computer facility.

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TABLE I

Summary Table for SV Vir, BZ Vir, SW Hya, X Ara, BQ Pav, and V865 Aql

Star	Position (1950)		Type	Spec.	Revised Period	Revised ptg		No. Obs.	Remarks
	R.A.	Dec.				Max.	Min.		
SV Vir	11 ^h 57 ^m 47 ^s	-09°54'4"	M	M4e	294.9	<10.45>	<15.50>	150	
BZ Vir	12 58 04	-17 22.5	M	M5e	150.96	<11.4>	<15.0>	180	
SW Hya	13 00 37	-28 50	M	M2e	218.8	<10.3>	<15.4>	135	1
X Ara	16 32 21	-55 18	M	M5e-	175.17	<10.77>	(13.1	129	
				M7eII-III					
BQ Pav	19 55 05	-70 01.3	--		109.82	<12.0>	<15.0>	150	
V865 Aql	20 21 22	+00 47.0	M	M6-M7	367.43	<11.45>	<14.50>	274	

Remarks:

1. Period reported by the GCVS is confirmed by a DCDFT period search.

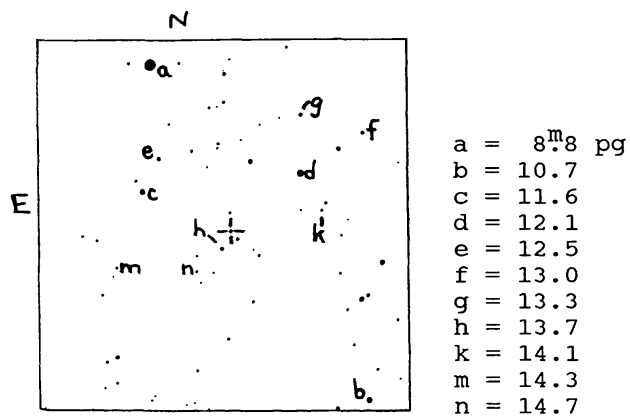


Figure 1a. SV Vir. From an AAVSO (e) chart. Each side is 30'.

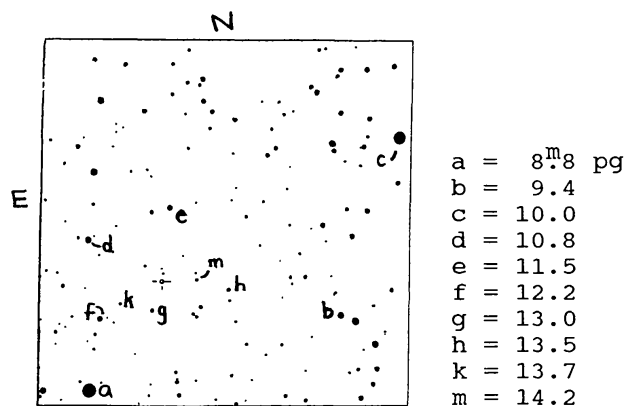


Figure 1b. BZ Vir. From an AAVSO (d) chart. Each side is 50'.

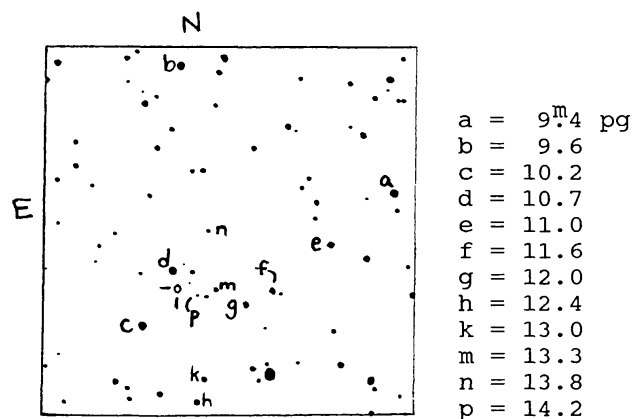


Figure 1c. SW Hya. From Papadopoulos (1980). Each side is 45'.

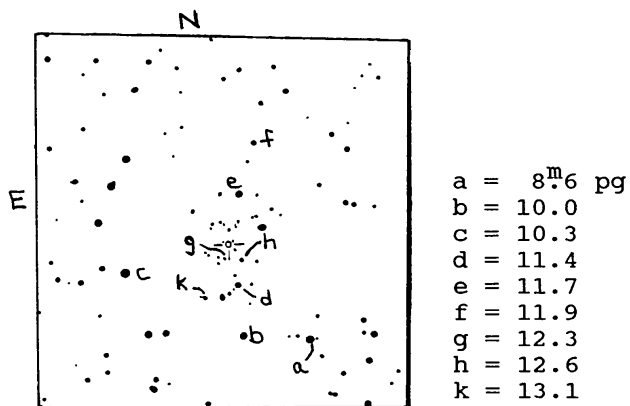


Figure 1d. X Ara. From an AAVSO (d) chart. Each side is 35'.

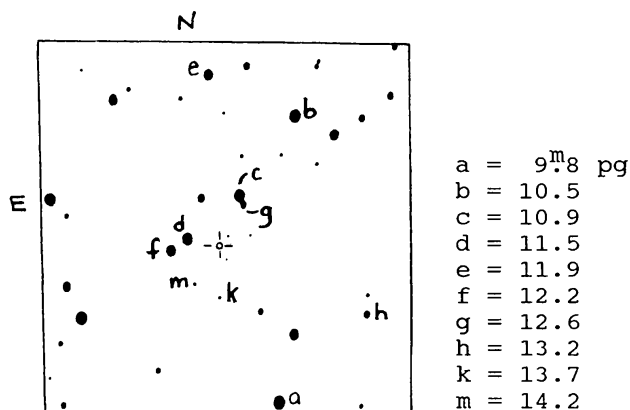


Figure 1e. BQ Pav. From an AAVSO (d) chart. Each side is 35'.

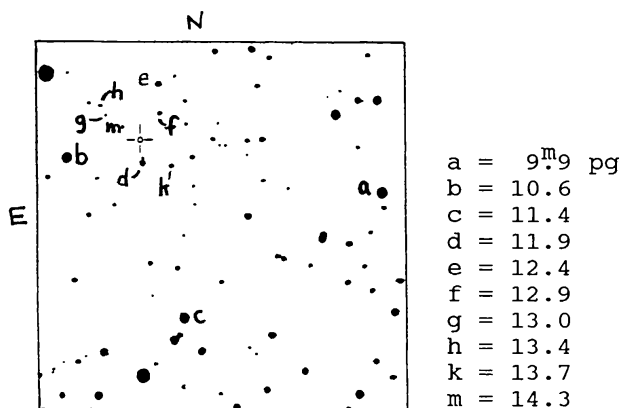


Figure 1f. V865 Aql. From an AAVSO (d) chart. Each side is 45'.

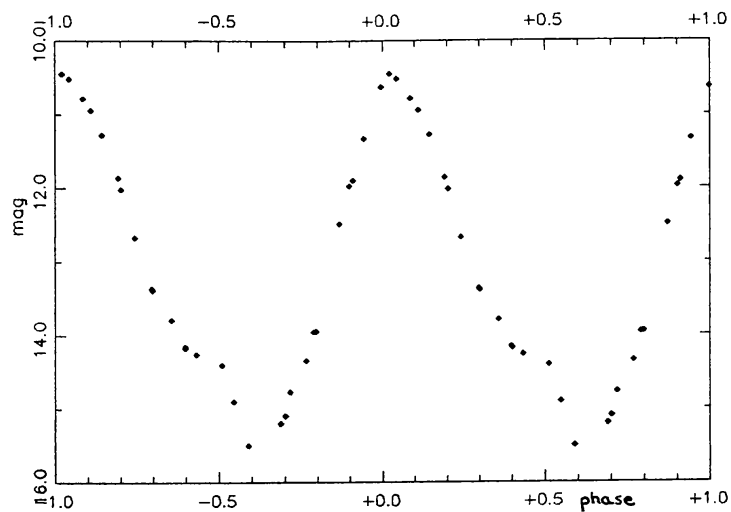


Figure 2. Photographic mean light curve for SV Vir.

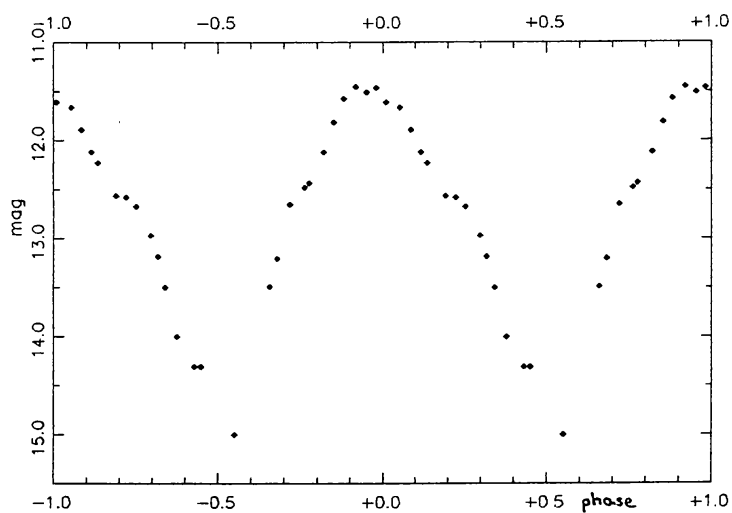


Figure 3. Photographic mean light curve for BZ Vir.

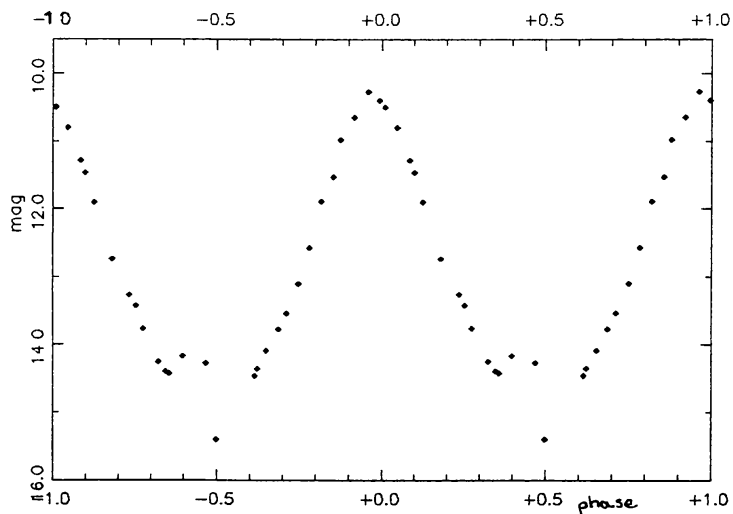


Figure 4. Photographic mean light curve for SW Hya.

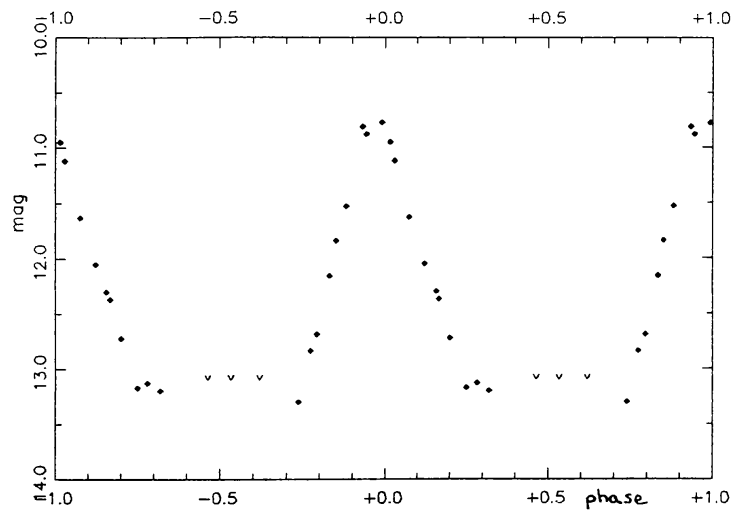


Figure 5. Photographic mean light curve for X Ara.

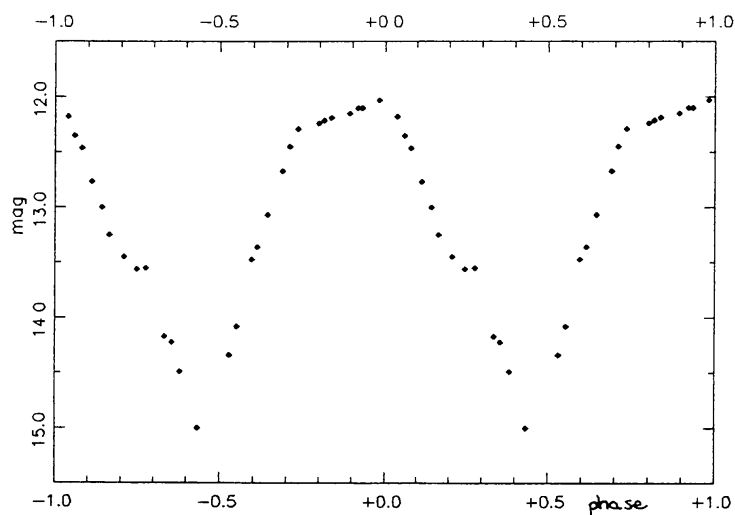


Figure 6. Photographic mean light curve for BQ Pav.

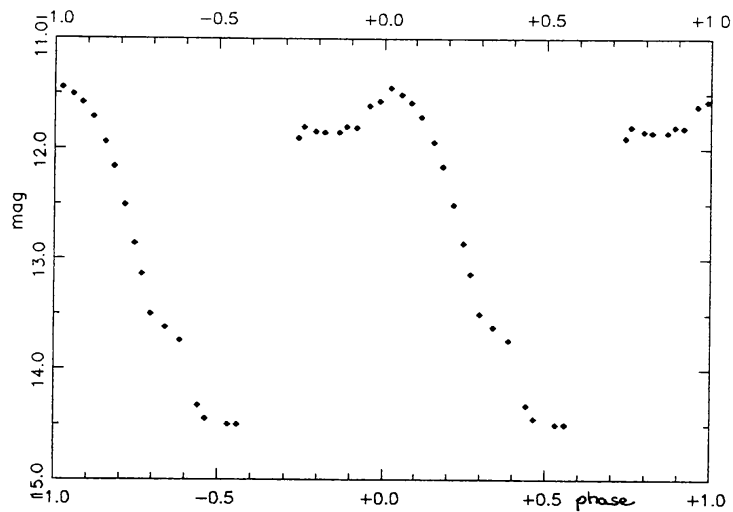


Figure 7. Photographic mean light curve for V865 Aql.