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A PHOTOELECTRIC STUDY OF THE ECLIPSING BINARY SYSTEM V566 OPHIUCHI

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INTRODUCTION

The eclipsing star system V566 Ophiuchi was discovered and classified by Hoffmeister (1935, 1943). This W Ursae Majoris system was studied photoelectrically without a filter by Fresa (1954), while Binnendijk (1959, 1965) made observations at the effective wavelengths of 4420 and 5300 Å. The unusual stability of this system was indicated by Bookmyer (1969), whose light curves could be superimposed almost perfectly onto those observed by Binnendijk nine years earlier. Bookmyer also confirmed that the secondary minimum is a total eclipse, and determined a new set of light elements based on a fourteen year interval of observation. From these observations, which are summarized in the above publication (Bookmyer 1969) she concluded that V566 Oph had a constant orbital period from 1952 to 1966. More recent epochs of minimum light have been published by Popovici (1971) and Pohl and Kizilirmak (1970, 71, 72).

In light of the unusual history of this W Ursae Majoris system, the authors obtained some further observations.

OBSERVATIONS

Photoelectric observations were made with the 12-inch Cassegrain reflecting telescope of the Ball State University Observatory. The observations were made in blue and yellow light at approximate effective wavelengths of 4400 and 5400 angstroms respectively. The output of the non-refrigerated RCA 1P21 photomultiplier tube was amplified and then recorded with a Heath servo strip chart recorder. Two one-minute deflections were averaged as a single observation. Yellow light observations were made on three nights in late June and three nights in early July of 1971 for a total of 110 observations. Blue light observations were made on seven nights in late July and one night in August 1971 for a total of 129 observations. The probable error of a single observation is ±0ᵐ02. The above observations were not limited to the primary eclipse but covered the entire light cycle.

Table I lists information concerning the check and comparison stars as well as the binary system. The coordinates, as well as the visual magnitudes and approximate spectral types, are taken from Atlas Eclipticalis (Becvar 1958). The comparison star was found to be of constant brightness over the interval of this study. Differential atmospheric extinction corrections were neglected due to the proximity of the binary system and the comparison star.

Table II lists the individual observations in the form of heliocentric Julian dates and magnitude differences between the comparison star and the variable (m_c-m_v).

Three primary minima were observed. The epochs of minima were found by the method of Kordylewski (Szafraniec 1948) and are listed in Table III. The light elements of Bookmyer (1969),

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J.D. Hel. Min. I = 2436744.4200 + 0.40964091E
± 1 ± 3 (p.e.)

were used to determine the values of the O-C's. The errors listed in Table III are considered to be the extreme upper limit of the observational error.

Table I. Data for Variable, Comparison and Check Stars.

Star	R.A. (1950)	Dec. (1950)	Sp.	Mag.
V566 Oph.	17h 54m 24s	+04° 59m	F5	7.6-8.0
Comparison	17h 54m 50s	+04° 56m	F	8.5
Check	17h 56m 45s	+04° 58m	F	8.5

Table IIa. Yellow Observations

J.D. Hel. 2441000+	D mag.	J.D. Hel. 2441000+	D mag.	J.D. Hel. 2441000+	D mag.
119.6931	1.166	132.7068	0.817	135.8478	1.216
.6971	1.214	.7100	0.791	.8557	1.206
.7084	1.273	.7188	0.829		
.7130	1.231	.7218	0.771	136.7162	1.170
.7313	1.252	.7296	0.854	.7194	1.218
.7364	1.223	.7325	0.844	.7284	1.161
.7471	1.158	.7407	0.933	.7323	1.221
.7518	1.145	.7438	0.986	.7409	1.154
.7632	1.049	.7663	1.086	.7438	1.154
.7675	0.987	.7698	1.147	.7533	1.076
.7842	0.890	.7787	1.172	.7562	1.011
.7871	0.770	.7815	1.167	.7651	1.039
.8007	0.803	.8094	1.188	.7683	1.008
.8056	0.738			.7775	0.983
.8165	0.739	135.6532	1.209	.7809	1.004
.8205	0.761	.6575	1.209	.7895	0.841
.8334	0.911	.6678	1.208	.7930	0.825
.8374	0.900	.6715	1.208	.8021	0.813
.8512	1.092	.6822	1.180	.8053	0.851
.8557	1.097	.6856	1.183	.8137	0.801
.8668	1.158	.6950	1.226	.8171	0.789
		.6992	1.186	.8273	0.961
120.6885	1.140	.7184	1.162	.8297	0.941
.6913	1.160	.7219	1.133		
.7049	1.204	.7314	1.093	148.6805	0.823
.7084	1.201	.7351	1.073	.6833	0.804
.7211	1.226	.7447	1.016	.6920	0.838
.7281	1.213	.7489	0.970	.6947	0.818
.7431	1.194	.7601	0.850	.7038	0.898
.7484	1.196	.7644	0.796	.7068	0.923
.7664	1.071	.7779	0.771	.7164	0.974
.7722	1.062	.7804	0.750	.7197	0.962
.7843	1.046	.7900	0.816	.7288	1.067
.7874	0.985	.7940	0.795	.7335	1.079
.7981	1.019	.8035	0.880	.7419	1.120
.8086	0.968	.8078	0.941	.7452	1.093
.8119	0.842	.8180	1.042	.7546	1.194
.8151	0.866	.8219	1.038	.7581	1.189
.8329	0.884	.8330	1.122		
.8370	0.785	.8375	1.132		

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Table IIb. Blue Observations

J.D. Hel. 2441000+	D mag.	J.D. Hel. 2441000+	D mag.	J.D. Hel. 2441000+	D mag.
150.6452	1.452	154.7927	1.272	160.7146	1.260
.6507	1.470	.7957	1.184	.7186	1.250
.6604	1.421			.7621	0.939
.6639	1.368	157.6482	1.299	.7653	0.920
.6736	1.330	.6516	1.288	.7743	0.981
.6770	1.335	.6607	1.255	.7773	0.956
.6864	1.318	.6730	1.084	.7867	1.005
.6899	1.291	.6762	1.122	.7899	1.051
.7005	1.221	.6848	1.075	.7993	1.246
		.6879	1.067	.8025	1.249
153.6590	1.373	.6966	1.079		
.6626	1.361	.7085	1.014	164.6678	1.052
.6721	1.409	.7114	1.079	.6709	1.026
.6772	1.420	.7198	1.133	.6805	1.145
.6862	1.473	.7220	1.150	.6839	1.143
.6900	1.436	.7333	1.179	.6942	1.261
.6997	1.460	.7360	1.166	.6986	1.271
.7031	1.458	.7564	1.298	.7102	1.357
.7128	1.454	.7596	1.264	.7138	1.336
.7164	1.413	.7686	1.408	.7236	1.378
.7262	1.438	.7714	1.403	.7276	1.366
.7298	1.391			.7380	1.409
.7393	1.388	159.6623	1.463	.7415	1.359
.7433	1.357	.6670	1.449		
.7534	1.324	.6793	1.412	165.6225	1.394
.7569	1.285	.6836	1.411	.6263	1.355
		.6944	1.316	.6364	1.278
154.6596	1.259	.6984	1.289	.6402	1.271
.6630	1.253	.7085	1.220	.6504	1.183
.6722	1.320	.7121	1.151	.6540	1.097
.6766	1.361	.7218	1.102	.6633	1.088
.6853	1.447	.7256	1.070	.6669	1.018
.6890	1.437	.7342	1.026	.6758	1.009
.6986	1.399	.7396	1.015	.6790	0.950
.7025	1.420	.7492	1.019	.6886	0.965
.7124	1.453	.7530	1.015	.6919	0.965
.7162	1.418	.7642	1.120	.7017	1.017
.7262	1.508	.7673	1.118	.7051	1.048
.7301	1.494	.7783	1.257	.7159	1.196
.7407	1.449	.7819	1.223	.7196	1.183
.7444	1.430			.7334	1.323
.7540	1.383	160.6738	1.472	.7371	1.318
.7575	1.349	.6784	1.421	.7469	1.455
.7669	1.399	.6881	1.524	.7505	1.413
.7701	1.312	.6917	1.458	.7603	1.540
.7795	1.339	.7005	1.374	.7645	1.448
.7827	1.295	.7040	1.358		

Table III. Times of Primary Minima.

J.D. Hel.	Filter	E	O-C
2,441,119.807 ± .008	yellow	10,681	0.012 ±.008
2,441,135.780 ± .003	yellow	10,720	0.010 ±.003
2,441,165.684 ± .004	blue	10,793	0.010 ±.004

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PERIOD STUDY

Bookmyer compiled photoelectric observations of minimum light of V566 Oph from 1952 to 1966. Table IV of this study extends her compilation to the present time. The residuals are based on Bookmyer's light elements. Figure 1 shows a plot of these residuals versus epoch.

Figure 1 indicates that the period of V566 Ophiuchi has undergone change in recent years. This W Ursae Majoris system has had an unusually long history of stability. The observations since 1967, as indicated on Figure 1, show a large scatter. This indicates the need for further timings of minimum light. However, the small light amplitude (about .4 magnitude) will limit accurate timings to photoelectrically equipped observers.

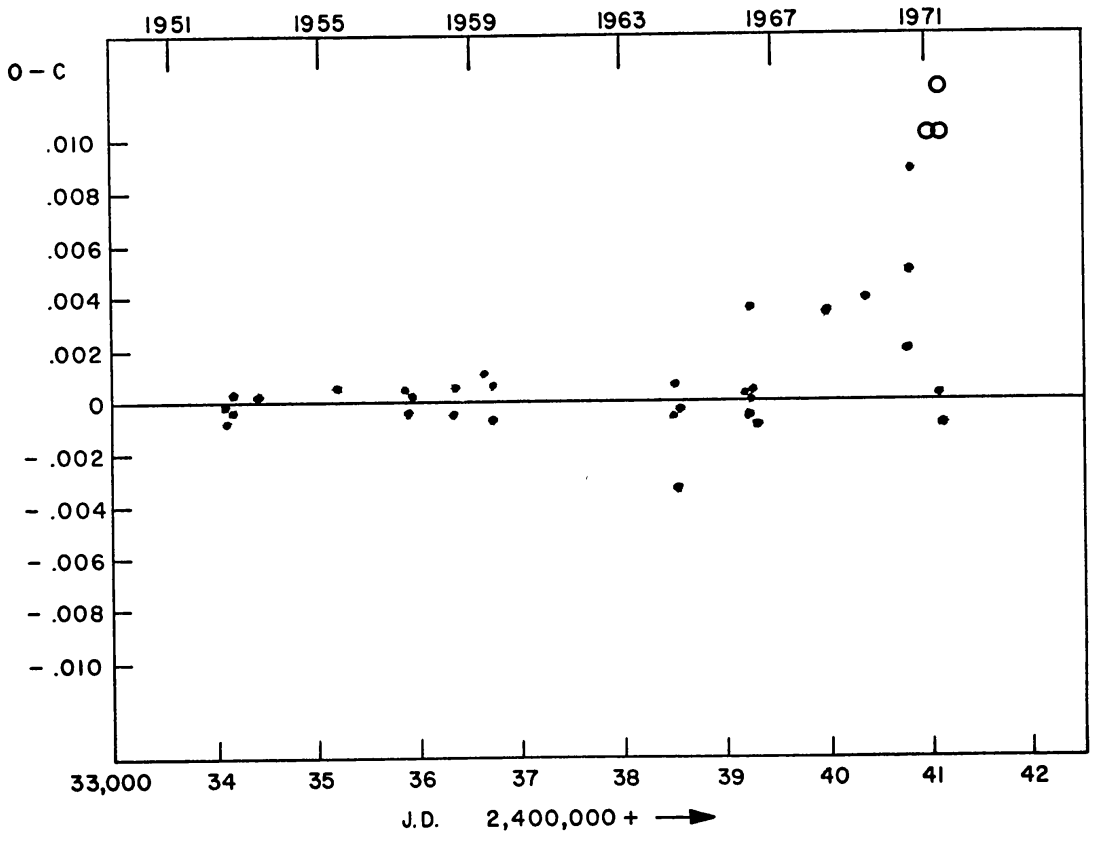

Fig. 1 Residuals versus epoch, based on Bookmyer's Light Elements. Open circles represent this study.

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Table IV. Epochs of Minimum Light, Photoelectric

J.D. Hel.	Epoch	O-C	Obs.	Ref.
2,440,047.358	8,063.0	+.003	Gd	IBVS 456
40,049.4057	8,068.0	+.0028	Kt,Ib	IBVS 456
40,418.4931	8,969.0	+.0038	Ba,Me	IBVS 456
40,820.3490	9,950.0	+.0020	Du	IBVS 508
40,846.3686	10,013.5	+.0093	Hl,Od	IBVS 530
40,853.328	10,030.5	+.005	Me,Pl	IBVS 530
41,119.807	10,681.0	+.012	K,S	
41,135.780	10,720.0	+.010	K,S	
41,136.3852	10,721.5	+.0002	Hs,Rk	IBVS 647
41,139.4564	10,729.0	-.0009	Gl	IBVS 647
41,165.684	10,793.0	+.010	K,S	

Gd = N. Güdür
Kt = M. Kurutas
Ib = C. Ibanoglu
Ba = H. Baumbach
Me = M. Meier
K,S = Kaitchuck and Sprague
Du = Al. Dumitrescu
Hl = H. Sengonca
Od = O. Demircan
Pl = E. Pohl
Hs = H. Karacan
Rk = R. Akinci
Gl = O. Gülmen

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