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PHOTOELECTRIC OBSERVATIONS OF UX URSAE MAJORIS, 1955–1962*

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ABSTRACT

Photoelectric observations obtained between 1955 and 1962 show that, while the period of UX UMa was probably increasing in the interval from 1949 to 1953, it has been decreasing since 1953. Photometric solutions of a number of the eclipse-curves have been attempted, for both different wavelengths and different dates. No geometrical solutions exist, presumably owing to distortions of the eclipse-curve by luminous, detached material within the system. Consequently, the photometric elements of this system are completely unknown The variation of eclipse depth with wavelength has been derived. This variation could result either from radiation by a late-type companion star or from the detached material in the system; spectroscopic observations in infrared light during primary minimum are needed to determine which of these possibilities is correct.

I. INTRODUCTION AND OBSERVATIONS

Observations of the short-period, Algol-type eclipsing variable UX UMa are of interest because this system belongs to a group which now includes RW Tri, DQ Her, WZ Sge, and T Aur, the last three of which are known to be ex-novae. Extensive photoelectric observations of UX UMa have been made by Linnell (1950), Johnson, Perkins, and Hiltner (1954), and Walker and Herbig (1954). These studies have served to bring out very clearly the characteristics of the light-curve. However, several problems remained unsolved. First, the observations of Johnson *et al.* (1954) indicated that the period of the system might be increasing. Second, there was a change in the nature of the light-curve between the time of the observations by Linnell (1950) and those by Johnson *et al.* and Walker and Herbig, in the sense that Linnell observed a bright shoulder after primary minimum, while the other observers found this shoulder usually to occur before primary eclipse. Third, no trace of a secondary eclipse was detected in ultraviolet, blue, or yellow light. However, the primary star is of spectral type B or O (Walker and Herbig 1954), and if the secondary is of later type, there is the possibility that its presence may be detected by observing in the infrared. To investigate these questions, observations were obtained occasionally during the interval from 1955 to 1962.

The instruments, photomultipliers, and filters used in these observations are listed in Table 1. Except for the observations in 1955, the photomultipliers were all refrigerated with dry ice. The observations in 1955 and 1958 were obtained by Walker, those on April 10 and 14, 1961, by Walker and Krzeminski, and all others by Krzeminski.

The observations are tabulated in Tables 2–7, in terms of the magnitude difference UX UMa *minus* comparison star, reduced to no atmosphere. The observations have been left on the instrumental system of the particular telescope, photomultiplier, and filters used on a given night. BD+52°1722 was used as the comparison star on all nights except April 10 and 14, 1961 (Tables 2, 3, and 4), when BD+52°1720 was used. The magnitudes and colors of both these comparison stars have been measured on the U, B, V system of Johnson and Morgan (1953). Tie-ins to the U, B, V system were made on six nights, five in 1961 and one in 1962. The means of these measures are listed in Table 8. No evidence of variability in the comparison stars greater than 0.01 mag. was

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† On leave from the Astronomical Institute, Polish Academy of Sciences, Warsaw, Poland; the 1962 observations of UX UMa were made while W. K. was on the staff of the Lowell Observatory, Flagstaff, Arizona.

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found; the probable errors of the values given in Table 8 are $V = \pm 0.006$, $B - V = \pm 0.006$, $U - B = \pm 0.016$. The value of $U - B$ for BD+52°1720 is given to 0^m1, since the standards used did not have as red a color as this star. In the reductions of the observations of UX UMa, allowance was made for the difference in color of the variable and the standard star.

The observations in Tables 2–7 are plotted against heliocentric JD in Figures 1–6. The light-curves show the same features as were found in 1953 (Johnson *et al.* 1954; Walker and Herbig 1954), including rapid intrinsic variations, asymmetry of the rising branch of the eclipse-curve, a bright shoulder before eclipse, and a decrease in light near 0.7 P. The last two features are absent in the infrared curve obtained on April 10, 1961, but, since only one such light-curve has been obtained, it is not completely certain whether this represents a real change in the nature of the light-curve with wavelength or only a night-to-night change in the characteristics of the curve. It is also to be noted that even in the infrared there is no trace of a secondary eclipse. This point will be discussed further in Section IV.

TABLE 1

TELESCOPES, PHOTOMULTIPLIERS, AND FILTERS USED IN OBSERVATION OF UX URSAE MAJORIS

Year or Date	Telescope	Photomultiplier	Color, Filters
1955	Lowell 42-inch	Lallemand "Adrienne"	(*b*) Corning 5030+2-mm Schott GG13
1958.....	Crossley 36-inch	RCA 1P21 i	(*y*) 3-mm Corning 3384
1961, Apr. 10 and 14...	Lick 120-inch	RCA 7102	(*ir*) 2-mm Schott RG5 (*r*) 2.5-mm Corning 9380 +1.2-mm Schott RG5 +1.3-mm Schott KG3 (*g*) 2-mm Schott BG18 +2-mm Schott OG4
1961, Apr. 13.....	Crossley 36-inch	RCA 1P21 j	(*y*) 4-mm Corning 3384
1961, other nights	Crossley 36-inch	RCA 1P21 X9	(*y*) 4-mm Corning 3384 (*uv*) 2-mm Schott UG2 +2-mm Corning 7910
1962.	Lowell 42-inch	RCA 1P21	(*y*) 2-mm Corning 3384

II. THE ORBITAL PERIOD

Times of primary minimum have been derived from each of the light-curves in Tables 2–7 and Figures 1–6 and are listed in Table 9. In addition, four times of minimum observed in 1962 are included, although the light-curves from which these were derived have not been fully reduced and are not given in this paper. As in 1953 (Walker and Herbig 1954), there is no evidence in the present observations of a systematic variation in the time of minimum light with wavelength. Consequently, in the discussion which follows, all times of minimum have been used without regard for the wavelength in which they were observed.

In order to investigate possible changes in the period, residuals have been formed between the observed times of minimum and those calculated from the elements derived by Johnson *et al.*:

$$\text{Minimum} = \text{JD}_\odot\, 2427341.2221 + 0^d196671379E\,.$$

These residuals are listed in Table 9 and are plotted in Figure 7. Also plotted in Figure 7 are the residuals between all other available times of minimum of UX UMa and the

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TABLE 2

OBSERVATIONS OF UX URSAE MAJORIS IN INFRARED LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
7399.7945	+4.900	7399.8570	+4.639	7399.9313	+4.654	7399.9765	+5.480
.7949	+4.888	.8574	+4.643	.9320	+4.657	.9768	+5.483
.7952	+4.870	.8577	+4.643	.9345	+4.672	.9782	+5.430
.7956	+4.850	.8598	+4.612	.9352	+4.660	.9786	+5.415
.7970	+4.813	.8605	+4.625	.9508	+4.648	.9789	+5.402
.7973	+4.809	.8688	+4.635	.9511	+4.666	.9793	+5.392
.7977	+4.796	.8695	+4.648	.9515	+4.681	.9810	+5.226
.7980	+4.786	.8716	+4.667	.9536	+4.687	.9813	+5.199
.8001	+4.754	.8723	+4.657	.9539	+4.667	.9817	+5.163
.8008	+4.738	.8744	+4.637	.9542	+4.655	.9831	+5.119
.8015	+4.720	.8751	+4.655	.9546	+4.658	.9834	+5.080
.8036	+4.708	.8768	+4.661	.9563	+4.671	.9838	+5.051
.8043	+4.704	.8772	+4.657	.9567	+4.666	.9841	+5.033
.8049	+4.698	.8779	+4.655	.9570	+4.665	.9845	+5.016
.8056	+4.700	.8803	+4.671	.9588	+4.694	.9848	+5.009
.8063	+4.710	.8810	+4.660	.9591	+4.695	.9862	+4.977
.8088	+4.730	.8834	+4.681	.9595	+4.698	.9865	+4.972
.8091	+4.734	.8841	+4.671	.9598	+4.715	.9869	+4.962
.8095	+4.753	.8858	+4.687	.9615	+4.775	.9872	+4.943
.8122	+4.750	.8865	+4.680	.9619	+4.771	.9886	+4.919
.8126	+4.732	.8890	+4.689	.9622	+4.766	.9890	+4.913
.8133	+4.723	.8897	+4.692	.9626	+4.773	.9893	+4.902
.8161	+4.741	.8918	+4.646	.9640	+4.805	.9897	+4.897
.8168	+4.756	.8924	+4.648	.9643	+4.825	.9914	+4.859
.8289	+4.688	.8949	+4.654	.9647	+4.843	.9918	+4.862
.8296	+4.695	.8956	+4.654	.9650	+4.868	.9921	+4.864
.8320	+4.682	.9095	+4.642	.9664	+4.927	.9925	+4.870
.8327	+4.675	.9112	+4.654	.9668	+4.922	.9928	+4.872
.8345	+4.703	.9115	+4.662	.9671	+4.915	.9956	+4.781
.8352	+4.699	.9136	+4.689	.9685	+5.005	.9959	+4.773
.8372	+4.634	.9143	+4.681	.9688	+5.016	.9963	+4.754
.8379	+4.635	.9168	+4.695	.9692	+5.036	.9980	+4.759
.8397	+4.662	.9174	+4.690	.9695	+5.040	.9984	+4.751
.8404	+4.664	.9192	+4.669	.9713	+5.218	.9987	+4.741
.8411	+4.663	.9199	+4.661	.9716	+5.237	7399.9990	+4.723
.8424	+4.659	.9220	+4.649	.9720	+5.274	7400.0008	+4.720
.8431	+4.655	.9227	+4.651	.9723	+5.311	.0011	+4.712
.8438	+4.646	.9247	+4.682	.9737	+5.329	.0015	+4.707
.8543	+4.631	.9254	+4.657	.9740	+5.344	.0036	+4.712
.8550	+4.630	.9282	+4.653	.9744	+5.366	.0039	+4.710
7399.8553	+4.610	7399.9289	+4.663	7399.9761	+5.466	7400.0043	+4.707

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TABLE 3

OBSERVATIONS OF UX URSAE MAJORIS IN RED LIGHT

$JD_{\odot}$ 2430000+	Δm	$JD_{\odot}$ 2430000+	Δm	$JD_{\odot}$ 2430000+	Δm	$JD_{\odot}$ 2430000+	Δm
7403.6917	+4.09	7403.7087	+4.66	7403.7201	+4.49	7403.7330	+4.17
.6934	+4.12	.7090	+4.72	.7212	+4.47	.7340	+4.17
.6972	+4.11	.7100	+4.79	.7222	+4.42	.7364	+4.12
.6982	+4.14	.7111	+4.81	.7232	+4.37	.7378	+4.12
.6986	+4.15	.7121	+4.85	.7239	+4.36	.7382	+4.11
.6996	+4.17	.7125	+4.85	.7250	+4.33	.7396	+4.10
.7000	+4.18	.7135	+4.87	.7264	+4.32	.7410	+4.11
.7021	+4.19	.7142	+4.86	.7291	+4.23	.7420	+4.10
.7031	+4.24	.7153	+4.86	.7302	+4.22	.7423	+4.12
.7034	+4.26	.7163	+4.77	.7305	+4.19	.7437	+4.09
.7055	+4.36	.7187	+4.59	.7316	+4.17	.7451	+4.11
.7066	+4.44	.7191	+4.57	7403.7319	+4.17	7403.7462	+4.09
7403.7076	+4.55	7403.7198	+4.53				

TABLE 4

OBSERVATIONS OF UX URSAE MAJORIS IN GREEN LIGHT

$JD_{\odot}$ 2430000+	Δm	$JD_{\odot}$ 2430000+	Δm	$JD_{\odot}$ 2430000+	Δm	$JD_{\odot}$ 2430000+	Δm
7403.6868	+2.79	7403.7073	+3.27	7403.7184	+3.41	7403.7312	+2.92
.6885	+2.84	.7080	+3.36	.7194	+3.30	.7323	+2.89
.6937	+2.81	.7083	+3.39	.7205	+3.21	.7326	+2.87
.6941	+2.81	.7094	+3.59	.7219	+3.14	.7337	+2.89
.6975	+2.85	.7097	+3.64	.7225	+3.14	.7357	+2.86
.6979	+2.86	.7104	+3.71	.7229	+3.12	.7361	+2.85
.6989	+2.87	.7114	+3.76	.7236	+3.09	.7371	+2.86
.6993	+2.87	.7118	+3.77	.7246	+3.05	.7375	+2.86
.7014	+2.88	.7128	+3.83	.7257	+3.04	.7385	+2.85
.7028	+2.94	.7139	+3.82	.7260	+3.04	.7403	+2.86
.7038	+2.98	.7149	+3.83	.7271	+3.05	.7417	+2.87
.7042	+3.00	.7156	+3.74	.7274	+3.01	.7430	+2.86
.7059	+3.13	.7160	+3.73	.7295	+2.95	.7444	+2.85
.7062	+3.14	.7177	+3.50	.7298	+2.94	.7458	+2.88
7403.7069	+3.21	7403.7180	+3.46	7403.7309	+2.93	7403.7469	+2.85

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TABLE 5

OBSERVATIONS OF UX URSAE MAJORIS IN YELLOW LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
6308.7944	+2.704	6308.8402	+3.262	6308.8638	+2.777	6308.9125	+2.737
.7996	+2.683	.8406	+3.324	.8642	+2.779	.9132	+2.725
.8000	+2.678	.8409	+3.366	.8645	+2.781	.9135	+2.720
.8006	+2.676	.8413	+3.411	.8663	+2.772	.9187	+2.761
.8114	+2.708	.8416	+3.466	.8666	+2.771	.9191	+2.760
.8163	+2.661	.8420	+3.548	.8670	+2.771	.9194	+2.762
.8166	+2.657	.8423	+3.576	.8673	+2.772	.9208	+2.743
.8170	+2.665	.8427	+3.599	.8677	+2.772	.9215	+2.740
.8180	+2.667	.8430	+3.616	.8680	+2.773	.9222	+2.743
.8184	+2.666	.8434	+3.637	.8694	+2.773	.9225	+2.756
.8187	+2.662	.8437	+3.671	.8701	+2.774	.9236	+2.718
.8191	+2.656	.8441	+3.693	.8774	+2.760	.9243	+2.718
.8194	+2.651	.8444	+3.717	.8777	+2.762	.9257	+2.720
.8197	+2.667	.8448	+3.725	.8795	+2.726	.9288	+2.718
.8201	+2.684	.8451	+3.725	.8798	+2.736	.9291	+2.722
.8208	+2.678	.8454	+3.728	.8802	+2.751	.9302	+2.714
.8211	+2.667	.8458	+3.728	.8836	+2.776	.9316	+2.718
.8215	+2.668	.8461	+3.726	.8840	+2.785	.9319	+2.724
.8222	+2.672	.8472	+3.706	.8847	+2.783	.9322	+2.730
.8225	+2.667	.8475	+3.670	.8854	+2.769	.9402	+2.736
.8229	+2.658	.8479	+3.632	.8857	+2.786	.9409	+2.718
.8232	+2.649	.8482	+3.595	.8868	+2.753	.9427	+2.715
.8236	+2.648	.8500	+3.413	.8875	+2.745	.9430	+2.716
.8239	+2.658	.8503	+3.345	.8881	+2.736	.9437	+2.718
.8243	+2.668	.8506	+3.281	.8888	+2.737	.9444	+2.719
.8246	+2.671	.8510	+3.223	.8892	+2.748	.9451	+2.719
.8250	+2.671	.8517	+3.138	.8899	+2.750	.9458	+2.729
.8256	+2.660	.8520	+3.129	.8902	+2.750	.9461	+2.731
.8302	+2.691	.8527	+3.090	.8909	+2.768	.9479	+2.719
.8305	+2.703	.8531	+3.066	.8923	+2.754	.9482	+2.720
.8309	+2.715	.8534	+3.051	.8930	+2.761	.9486	+2.740
.8312	+2.727	.8538	+3.034	.8934	+2.774	.9489	+2.758
.8326	+2.745	.8541	+3.021	.8944	+2.731	.9493	+2.755
.8329	+2.755	.8545	+3.008	.8947	+2.751	.9500	+2.731
.8333	+2.766	.8559	+2.964	.8961	+2.739	.9503	+2.727
.8336	+2.776	.8562	+2.950	.9010	+2.756	.9507	+2.724
.8340	+2.787	.8566	+2.934	.9013	+2.757	.9576	+2.744
.8343	+2.803	.8579	+2.902	.9020	+2.744	.9583	+2.736
.8350	+2.828	.8583	+2.894	.9031	+2.724	.9590	+2.735
.8354	+2.838	.8586	+2.886	.9034	+2.736	.9597	+2.735
.8357	+2.846	.8590	+2.882	.9041	+2.754	.9604	+2.749
.8361	+2.851	.8593	+2.876	.9048	+2.741	.9611	+2.753
.8364	+2.868	.8597	+2.873	.9069	+2.723	.9625	+2.758
.8368	+2.910	.8611	+2.830	.9076	+2.725	.9632	+2.752
.8371	+2.940	.8614	+2.822	.9083	+2.724	.9638	+2.741
.8375	+2.960	.8618	+2.816	.9090	+2.725	.9645	+2.743
.8378	+2.989	.8621	+2.814	.9097	+2.731	.9652	+2.745
.8382	+3.013	.8628	+2.783	.9104	+2.733	.9715	+2.775
.8385	+3.033	.8631	+2.779	.9111	+2.734	.9722	+2.763
6308.8399	+3.203	6308.8635	+2.777	6308.9118	+2.746	6308.9729	+2.791

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TABLE 5 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN YELLOW LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
6308.9736	+2.771	6316.7209	+3.022	6316.7802	+2.773	6316.8288	+2.793
.9743	+2.787	.7223	+3.003	.7809	+2.786	.8292	+2.797
.9746	+2.791	.7226	+3.003	.7823	+2.788	.8351	+2.820
.9805	+2.749	.7230	+2.995	.7830	+2.802	.8358	+2.817
.9812	+2.755	.7233	+2.981	.7837	+2.785	.8365	+2.817
.9819	+2.765	.7236	+2.973	.7855	+2.811	.8372	+2.812
.9826	+2.776	.7240	+2.963	.7858	+2.808	.8379	+2.807
.9833	+2.768	.7243	+2.954	.7865	+2.803	.8386	+2.811
.9840	+2.764	.7247	+2.972	.7872	+2.790	.8393	+2.820
.9847	+2.757	.7250	+2.981	.7879	+2.783	.8410	+2.834
.9864	+2.728	.7268	+2.934	.7886	+2.787	.8414	+2.836
.9868	+2.740	.7271	+2.904	.7893	+2.815	.8420	+2.837
.9875	+2.761	.7275	+2.894	.7900	+2.785	.8427	+2.849
.9881	+2.762	.7278	+2.924	.7907	+2.779	.8434	+2.818
.9892	+2.746	.7372	+2.827	.7917	+2.763	.8441	+2.841
.9895	+2.748	.7379	+2.812	.7920	+2.756	.8448	+2.834
.9902	+2.763	.7386	+2.810	.7924	+2.785	.8455	+2.830
.9909	+2.754	.7407	+2.807	.7927	+2.799	.8473	+2.842
.9916	+2.762	.7414	+2.832	.7931	+2.804	.8479	+2.838
.9923	+2.770	.7420	+2.838	.7980	+2.791	.8486	+2.838
.9930	+2.775	.7427	+2.852	.7983	+2.783	.8490	+2.831
6308.9993	+2.749	.7434	+2.848	.7990	+2.806	.8539	+2.818
6309.0000	+2.745	.7441	+2.827	.7997	+2.790	.8545	+2.822
.0007	+2.748	.7448	+2.818	.8004	+2.803	.8552	+2.814
.0013	+2.746	.7455	+2.816	.8018	+2.814	.8570	+2.813
.0027	+2.732	.7462	+2.818	.8025	+2.783	.8577	+2.853
.0034	+2.732	.7469	+2.807	.8032	+2.772	.8601	+2.813
.0041	+2.732	.7479	+2.789	.8039	+2.795	.8608	+2.800
.0048	+2.733	.7486	+2.789	.8045	+2.779	.8615	+2.794
.0052	+2.734	.7490	+2.789	.8052	+2.797	.8622	+2.795
.0062	+2.737	.7511	+2.797	.8059	+2.798	.8629	+2.809
.0069	+2.702	.7518	+2.796	.8066	+2.784	.8650	+2.803
.0076	+2.719	.7559	+2.791	.8073	+2.797	.8657	+2.811
.0083	+2.749	.7566	+2.798	.8087	+2.795	.8664	+2.818
.0090	+2.737	.7573	+2.797	.8094	+2.802	.8670	+2.816
.0097	+2.717	.7580	+2.794	.8101	+2.785	.8677	+2.824
.0104	+2.732	.7587	+2.792	.8108	+2.801	.8740	+2.785
6309.0107	+2.745	.7594	+2.785	.8184	+2.808	.8747	+2.786
6316.7143	+3.821	.7601	+2.785	.8191	+2.810	.8754	+2.777
.7146	+3.764	.7608	+2.788	.8198	+2.806	.8761	+2.765
.7150	+3.736	.7625	+2.785	.8205	+2.809	.8771	+2.773
.7157	+3.653	.7632	+2.810	.8212	+2.806	.8778	+2.765
.7160	+3.597	.7639	+2.816	.8216	+2.807	.8785	+2.772
.7164	+3.542	.7667	+2.794	.8240	+2.796	.8795	+2.766
.7167	+3.508	.7674	+2.802	.8247	+2.782	.8802	+2.751
.7184	+3.264	.7681	+2.811	.8254	+2.792	.8809	+2.749
.7188	+3.192	.7691	+2.813	.8261	+2.796	.8816	+2.757
.7191	+3.182	.7785	+2.785	.8268	+2.796	.8823	+2.767
.7202	+3.078	.7789	+2.799	.8275	+2.798	.8827	+2.770
6316.7205	+3.052	6316.7795	+2.779	6316.8282	+2.788	6316.8837	+2.757

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TABLE 5 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN YELLOW LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
6316.8841	+2.753	6316.9150	+3.252	6316.9476	+2.795	6323.7987	+3.16
.8844	+2.760	.9153	+3.204	.9483	+2.802	.7991	+3.13
.8848	+2.764	.9157	+3.179	.9490	+2.805	.8005	+3.058
.8851	+2.765	.9160	+3.153	6316.9497	+2.796	.8008	+3.054
.8854	+2.767	.9164	+3.129	6323.7588	+2.684	.8012	+3.048
.8858	+2.770	.9167	+3.107	.7591	+2.676	.8015	+3.036
.8861	+2.771	.9170	+3.089	.7595	+2.666	.8032	+2.976
.8865	+2.771	.9177	+3.060	.7598	+2.658	.8036	+2.968
.8868	+2.761	.9181	+3.053	.7612	+2.651	.8039	+2.956
.8952	+2.817	.9184	+3.045	.7616	+2.651	.8053	+2.910
.8955	+2.823	.9188	+3.042	.7619	+2.654	.8057	+2.911
.8969	+2.833	.9191	+3.038	.7623	+2.661	.8060	+2.906
.8973	+2.853	.9226	+2.935	.7626	+2.671	.8074	+2.847
.8976	+2.870	.9229	+2.952	.7644	+2.673	.8078	+2.857
.8980	+2.888	.9233	+2.962	.7647	+2.664	.8081	+2.867
.8983	+2.893	.9236	+2.915	.7650	+2.661	.8084	+2.866
.8986	+2.903	.9240	+2.899	.7720	+2.651	.8088	+2.867
.8990	+2.926	.9243	+2.904	.7723	+2.656	.8105	+2.849
.8993	+2.953	.9247	+2.912	.7727	+2.656	.8109	+2.823
.8997	+2.988	.9250	+2.919	.7730	+2.655	.8112	+2.815
.9000	+3.014	.9254	+2.920	.7782	+2.715	.8116	+2.805
.9014	+3.066	.9257	+2.922	.7786	+2.724	.8119	+2.793
.9018	+3.099	.9261	+2.915	.7789	+2.736	.8123	+2.788
.9021	+3.126	.9264	+2.902	.7821	+2.854	.8137	+2.762
.9025	+3.166	.9268	+2.888	.7824	+2.859	.8140	+2.764
.9028	+3.200	.9271	+2.879	.7827	+2.867	.8143	+2.774
.9032	+3.243	.9275	+2.872	.7831	+2.878	.8147	+2.781
.9035	+3.291	.9285	+2.838	.7834	+2.892	.8209	+2.735
.9042	+3.443	.9288	+2.832	.7848	+2.969	.8213	+2.732
.9045	+3.477	.9292	+2.831	.7852	+3.003	.8216	+2.742
.9049	+3.537	.9341	+2.828	.7862	+3.065	.8220	+2.752
.9052	+3.591	.9344	+2.821	.7866	+3.125	.8223	+2.750
.9056	+3.653	.9348	+2.811	.7880	+3.371	.8237	+2.755
.9059	+3.693	.9351	+2.807	.7883	+3.398	.8241	+2.752
.9063	+3.733	.9355	+2.806	.7887	+3.421	.8244	+2.746
.9066	+3.763	.9358	+2.808	.7900	+3.583	.8248	+2.737
.9080	+3.813	.9361	+2.804	.7904	+3.604	.8251	+2.733
.9084	+3.833	.9365	+2.800	.7907	+3.642	.8255	+2.734
.9087	+3.838	.9368	+2.809	.7918	+3.672	.8272	+2.743
.9091	+3.841	.9372	+2.830	.7921	+3.681	.8279	+2.745
.9094	+3.851	.9393	+2.829	.7925	+3.676	.8286	+2.737
.9098	+3.850	.9400	+2.811	.7939	+3.680	.8300	+2.742
.9104	+3.778	.9407	+2.801	.7942	+3.668	.8307	+2.743
.9108	+3.755	.9414	+2.795	.7946	+3.654	.8314	+2.725
.9111	+3.732	.9420	+2.801	.7959	+3.486	.8328	+2.725
.9129	+3.545	.9427	+2.804	.7963	+3.435	.8334	+2.719
.9132	+3.503	.9434	+2.808	.7966	+3.400	.8341	+2.720
.9136	+3.444	.9441	+2.796	.7970	+3.369	.8355	+2.726
.9139	+3.391	.9462	+2.807	.7973	+3.330	.8362	+2.709
6316.9143	+3.329	6316.9469	+2.790	6323.7977	+3.275	6323.8369	+2.696

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TABLE 5 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN YELLOW LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
6323.8387	+2.710	7402.9399	+2.909	7402.9697	+2.779	7427.7038	+3.618
.8432	+2.749	.9402	+2.910	.9701	+2.774	.7041	+3.656
.8456	+2.726	.9406	+2.916	.9704	+2.778	.7045	+3.685
.8505	+2.707	.9413	+2.923	.9781	+2.790	.7048	+3.710
.8508	+2.700	.9416	+2.913	.9784	+2.773	.7052	+3.753
.8515	+2.695	.9420	+2.905	.9788	+2.755	.7055	+3.781
.8532	+2.722	.9423	+2.900	.9791	+2.753	.7059	+3.793
.8536	+2.719	.9427	+2.892	.9795	+2.765	.7062	+3.800
6323.8543	+2.735	.9434	+2.913	.9809	+2.744	.7066	+3.801
7402.9208	+3.191	.9437	+2.909	.9812	+2.754	.7076	+3.791
.9211	+3.226	.9441	+2.882	.9815	+2.760	.7079	+3.791
.9215	+3.289	.9444	+2.884	.9819	+2.762	.7083	+3.789
.9225	+3.440	.9448	+2.872	.9822	+2.760	.7086	+3.778
.9229	+3.478	.9451	+2.864	.9833	+2.756	.7090	+3.757
.9232	+3.527	.9454	+2.859	.9836	+2.758	.7093	+3.728
.9236	+3.567	.9527	+2.806	.9840	+2.761	.7097	+3.694
.9246	+3.646	.9531	+2.804	.9843	+2.762	.7100	+3.665
.9250	+3.680	.9534	+2.793	.9847	+2.762	.7104	+3.626
.9253	+3.709	.9538	+2.796	.9854	+2.774	.7107	+3.587
.9257	+3.721	.9552	+2.794	.9861	+2.771	.7111	+3.545
.9260	+3.721	.9555	+2.798	.9868	+2.761	.7114	+3.509
.9267	+3.727	.9559	+2.806	.9885	+2.730	.7118	+3.465
.9270	+3.731	.9562	+2.832	.9888	+2.737	.7121	+3.400
.9274	+3.733	.9566	+2.816	.9895	+2.758	.7125	+3.351
.9277	+3.734	.9576	+2.806	.9902	+2.758	.7128	+3.295
.9298	+3.495	.9579	+2.788	.9909	+2.758	.7131	+3.239
.9302	+3.473	.9583	+2.779	.9916	+2.746	.7135	+3.210
.9305	+3.431	.9586	+2.766	.9923	+2.745	.7138	+3.181
.9309	+3.372	.9590	+2.764	.9979	+2.742	.7142	+3.153
.9316	+3.275	.9593	+2.771	7402.9986	+2.721	.7145	+3.142
.9319	+3.254	.9597	+2.785	7403.0000	+2.708	.7149	+3.120
.9323	+3.232	.9600	+2.777	.0007	+2.722	.7152	+3.094
.9326	+3.184	.9604	+2.768	7403.0014	+2.720	.7156	+3.078
.9329	+3.140	.9614	+2.774	7427.6965	+2.942	.7159	+3.067
.9333	+3.096	.9618	+2.793	.6968	+2.958	.7163	+3.061
.9336	+3.070	.9621	+2.783	.6972	+2.965	.7166	+3.059
.9340	+3.059	.9625	+2.764	.6975	+2.988	.7170	+3.050
.9343	+3.053	.9635	+2.782	.6979	+3.011	.7173	+3.044
.9347	+3.050	.9638	+2.772	.6982	+3.032	.7187	+3.032
.9350	+3.029	.9645	+2.783	.6986	+3.043	.7190	+3.020
.9354	+3.015	.9649	+2.803	.6993	+3.099	.7194	+3.006
.9357	+3.016	.9652	+2.793	.6996	+3.118	.7197	+2.989
.9364	+3.019	.9656	+2.793	.7000	+3.135	.7201	+2.977
.9368	+3.005	.9666	+2.787	.7013	+3.288	.7204	+2.972
.9371	+2.979	.9670	+2.801	.7017	+3.341	.7281	+2.875
.9375	+2.981	.9673	+2.799	.7020	+3.414	.7288	+2.884
.9378	+2.982	.9677	+2.789	.7024	+3.441	.7295	+2.893
.9388	+2.952	.9680	+2.772	.7027	+3.468	.7302	+2.900
.9392	+2.937	.9691	+2.794	.7031	+3.521	.7315	+2.900
7402.9395	+2.920	7402.9694	+2.788	7427.7034	+3.571	7427.7322	+2.911

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TABLE 5 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN YELLOW LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
7427.7350	+2.904	7427.8697	+2.742	7427.8958	+3.044	7427.9166	+2.940
.7357	+2.889	.8701	+2.746	.8961	+3.074	.9176	+2.913
.7364	+2.880	.8704	+2.764	.8965	+3.111	.9180	+2.905
.7371	+2.861	.8708	+2.775	.8968	+3.145	.9183	+2.904
.7378	+2.854	.8711	+2.779	.8972	+3.176	.9187	+2.906
.7385	+2.866	.8715	+2.776	.8975	+3.203	.9190	+2.900
.7392	+2.872	.8718	+2.760	.8979	+3.253	.9194	+2.891
.7413	+2.814	.8722	+2.741	.8989	+3.407	.9197	+2.894
.7420	+2.807	.8725	+2.735	.8992	+3.447	.9253	+2.834
.7427	+2.815	.8729	+2.740	.8996	+3.501	.9256	+2.833
.7434	+2.813	.8732	+2.755	.8999	+3.562	.9260	+2.837
.7440	+2.802	.8784	+2.755	.9003	+3.611	.9263	+2.848
.7447	+2.796	.8788	+2.764	.9006	+3.663	.9267	+2.857
.7454	+2.802	.8791	+2.780	.9010	+3.701	.9270	+2.853
.7461	+2.803	.8795	+2.805	.9013	+3.733	.9277	+2.834
.7541	+2.827	.8798	+2.778	.9017	+3.754	.9281	+2.825
.7545	+2.813	.8802	+2.762	.9020	+3.772	.9284	+2.825
.7552	+2.817	.8805	+2.752	.9024	+3.790	.9288	+2.830
.7559	+2.822	.8822	+2.761	.9027	+3.815	.9295	+2.842
.7566	+2.821	.8826	+2.771	.9031	+3.830	.9302	+2.842
.7579	+2.811	.8829	+2.785	.9034	+3.821	.9308	+2.841
.7586	+2.813	.8833	+2.800	.9038	+3.810	.9312	+2.845
.7593	+2.812	.8836	+2.811	.9041	+3.800	.9315	+2.860
.7600	+2.812	.8840	+2.812	.9058	+3.749	.9319	+2.853
.7607	+2.793	.8843	+2.813	.9062	+3.746	.9322	+2.844
.7614	+2.781	.8847	+2.811	.9065	+3.697	.9329	+2.849
.7621	+2.789	.8867	+2.817	.9069	+3.651	.9350	+2.854
.7628	+2.793	.8871	+2.809	.9072	+3.590	.9354	+2.841
.7635	+2.794	.8874	+2.799	.9076	+3.554	.9357	+2.835
.7642	+2.793	.8878	+2.794	.9079	+3.516	.9361	+2.836
.7649	+2.784	.8881	+2.797	.9083	+3.457	.9364	+2.836
.7656	+2.780	.8885	+2.803	.9086	+3.384	.9367	+2.832
.7663	+2.750	.8888	+2.809	.9090	+3.327	.9371	+2.824
.8624	+2.762	.8892	+2.813	.9093	+3.276	.9374	+2.816
.8628	+2.764	.8895	+2.818	.9097	+3.237	.9378	+2.815
.8631	+2.768	.8899	+2.822	.9100	+3.199	.9381	+2.822
.8635	+2.769	.8902	+2.827	.9104	+3.151	.9385	+2.831
.8638	+2.773	.8913	+2.825	.9114	+3.087	.9388	+2.843
.8642	+2.778	.8916	+2.826	.9118	+3.076	.9392	+2.850
.8645	+2.780	.8920	+2.833	.9121	+3.055	.9440	+2.806
.8659	+2.766	.8923	+2.843	.9124	+3.028	.9447	+2.827
.8663	+2.768	.8926	+2.861	.9128	+3.007	.9454	+2.813
.8666	+2.771	.8930	+2.886	.9131	+2.992	.9461	+2.807
.8670	+2.777	.8933	+2.898	.9135	+2.972	.9468	+2.820
.8673	+2.792	.8937	+2.919	.9145	+2.963	.9475	+2.823
.8676	+2.787	.8940	+2.935	.9149	+2.961	.9482	+2.823
.8680	+2.773	.8944	+2.945	.9152	+2.963	.9489	+2.826
.8683	+2.777	.8947	+2.965	.9156	+2.962	.9496	+2.817
.8690	+2.785	.8951	+2.987	.9159	+2.954	.9499	+2.809
7427.8694	+2.757	7427.8954	+3.018	7427.9163	+2.946	7427.9545	+2.840

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TABLE 5 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN YELLOW LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
7427.9551	+2.840	7428.6891	+3.803	7428.7169	+2.853	7428.8061	+2.818
.9558	+2.836	.6895	+3.809	.7173	+2.847	.8141	+2.810
.9565	+2.825	.6898	+3.841	.7180	+2.850	.8148	+2.784
.9572	+2.815	.6902	+3.864	.7183	+2.849	.8162	+2.791
.9579	+2.815	.6912	+3.830	.7186	+2.848	.8166	+2.797
.9586	+2.807	.6916	+3.822	.7190	+2.847	.8398	+2.781
.9593	+2.795	.6919	+3.812	.7193	+2.842	.8416	+2.795
.9614	+2.805	.6933	+3.676	.7197	+2.841	.8423	+2.786
.9621	+2.800	.6936	+3.632	.7200	+2.841	.8440	+2.768
.9628	+2.798	.6940	+3.595	.7204	+2.845	.8447	+2.791
.9635	+2.782	.6943	+3.555	.7207	+2.843	.8513	+2.820
.9642	+2.777	.6950	+3.475	.7221	+2.851	.8520	+2.813
.9649	+2.770	.6954	+3.387	.7225	+2.834	.8534	+2.801
.9676	+2.776	.6957	+3.335	.7228	+2.822	.8537	+2.828
.9683	+2.772	.6961	+3.300	.7398	+2.853	.8541	+2.842
.9690	+2.772	.6971	+3.187	.7405	+2.853	.8568	+2.808
.9697	+2.776	.6975	+3.154	.7412	+2.855	.8572	+2.799
.9704	+2.764	.6978	+3.138	.7419	+2.855	.8575	+2.795
.9711	+2.769	.6982	+3.118	.7436	+2.853	.8589	+2.798
.9715	+2.772	.6985	+3.079	.7440	+2.853	.8593	+2.790
.9729	+2.767	.6992	+3.055	.7468	+2.860	.8596	+2.788
.9732	+2.760	.6996	+3.044	.7475	+2.852	.8627	+2.826
.9739	+2.755	.7002	+3.040	.7502	+2.831	.8648	+2.794
.9746	+2.761	.7006	+3.030	.7516	+2.817	.8652	+2.776
.9753	+2.745	.7009	+3.019	.7523	+2.815	.8721	+2.804
.9760	+2.739	.7013	+3.001	.7544	+2.794	.8725	+2.800
.9767	+2.752	.7016	+3.000	.7558	+2.810	.8735	+2.837
.9788	+2.773	.7027	+2.991	.7562	+2.816	.8739	+2.844
7427.9805	+2.776	.7030	+2.972	.7593	+2.800	.8759	+2.867
7428.6794	+2.900	.7034	+2.958	.7596	+2.805	.8763	+2.863
.6798	+2.903	.7037	+2.945	.7614	+2.779	.8773	+2.896
.6801	+2.912	.7041	+2.941	.7620	+2.810	.8777	+2.904
.6812	+2.989	.7044	+2.942	.7801	+2.843	.8787	+3.008
.6815	+2.994	.7048	+2.942	.7822	+2.839	.8791	+3.032
.6818	+3.010	.7051	+2.941	.7825	+2.824	.8801	+3.144
.6822	+3.032	.7055	+2.935	.7871	+2.833	.8811	+3.282
.6825	+3.054	.7103	+2.865	.7888	+2.834	.8815	+3.392
.6829	+3.085	.7107	+2.847	.7891	+2.818	.8829	+3.618
.6836	+3.124	.7110	+2.835	.7895	+2.813	.8832	+3.676
.6839	+3.176	.7121	+2.864	.7916	+2.830	.8843	+3.804
.6843	+3.227	.7124	+2.851	.7919	+2.841	.8846	+3.832
.6846	+3.288	.7127	+2.848	.7936	+2.828	.8870	+3.935
.6853	+3.394	.7131	+2.858	.7940	+2.825	.8874	+3.894
.6857	+3.455	.7138	+2.870	.7989	+2.815	.8877	+3.878
.6867	+3.603	.7141	+2.869	.7992	+2.808	.8888	+3.828
.6871	+3.640	.7145	+2.867	.8009	+2.822	.8898	+3.756
.6874	+3.680	.7155	+2.849	.8013	+2.832	.8902	+3.664
.6881	+3.727	.7159	+2.860	.8030	+2.810	.8912	+3.569
.6884	+3.760	.7162	+2.864	.8037	+2.805	.8923	+3.395
7428.6888	+3.792	7428.7166	+2.860	7428.8058	+2.815	7428.8933	+3.285

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TABLE 5 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN YELLOW LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
7428.8936	+3.194	7432.7719	+2.706	7432.8250	+3.425	7432.9472	+2.807
.8947	+3.152	.7743	+2.753	.8261	+3.287	.9486	+2.851
.8954	+3.119	.7754	+2.752	.8271	+3.143	.9493	+2.818
.8957	+3.104	.7757	+2.751	.8281	+3.073	.9524	+2.789
.8964	+3.098	.7767	+2.738	.8295	+3.006	.9528	+2.803
7428.8968	+3.065	.7771	+2.739	.8302	+3.007	.9545	+2.803
7432.7163	+2.768	.7827	+2.733	.8306	+2.981	7432.9549	+2.793
.7167	+2.756	.7830	+2.723	.8316	+2.960	7436.7297	+2.807
.7170	+2.747	.7833	+2.731	.8320	+2.960	.7311	+2.804
.7188	+2.747	.7844	+2.750	.8337	+2.985	.7342	+2.823
.7191	+2.755	.7847	+2.749	.8340	+2.959	.7345	+2.830
.7267	+2.748	.7872	+2.749	.8354	+2.919	.7359	+2.814
.7271	+2.754	.7875	+2.756	.8365	+2.917	.7373	+2.835
.7299	+2.730	.7889	+2.748	.8368	+2.878	.7391	+2.855
.7302	+2.725	.7899	+2.766	.8438	+2.843	.7404	+2.852
.7306	+2.727	.7903	+2.738	.8455	+2.844	.7425	+2.900
.7327	+2.759	.7917	+2.747	.8486	+2.812	.7429	+2.911
.7330	+2.772	.7920	+2.746	.8490	+2.811	.7432	+2.922
.7333	+2.754	.7931	+2.736	.8500	+2.844	.7443	+2.994
.7420	+2.744	.7934	+2.726	.8507	+2.848	.7446	+3.006
.7424	+2.742	.7945	+2.724	.8524	+2.859	.7457	+3.082
.7438	+2.739	.7948	+2.724	.8528	+2.848	.7467	+3.192
.7441	+2.775	.8014	+2.766	.8531	+2.837	.7471	+3.208
.7445	+2.770	.8017	+2.786	.8549	+2.832	.7481	+3.351
.7448	+2.762	.8028	+2.759	.8552	+2.826	.7491	+3.532
.7465	+2.776	.8031	+2.776	.8556	+2.821	.7495	+3.569
.7469	+2.764	.8045	+2.786	.8570	+2.803	.7505	+3.764
.7472	+2.754	.8049	+2.794	.8573	+2.807	.7516	+3.930
.7490	+2.783	.8073	+2.793	.8590	+2.825	.7526	+4.046
.7493	+2.784	.8077	+2.809	.8594	+2.818	.7536	+4.000
.7521	+2.785	.8087	+2.839	.8597	+2.835	.7547	+4.028
.7524	+2.790	.8090	+2.848	.8733	+2.799	.7557	+3.928
.7528	+2.793	.8101	+2.855	.8736	+2.797	.7561	+3.887
.7542	+2.792	.8104	+2.886	.8740	+2.800	.7571	+3.717
.7545	+2.767	.8115	+2.942	.8754	+2.808	.7585	+3.527
.7549	+2.752	.8118	+2.972	.8757	+2.803	.7595	+3.360
.7563	+2.772	.8129	+3.014	.8761	+2.803	.7606	+3.248
.7566	+2.772	.8132	+3.055	.9139	+2.805	.7609	+3.205
.7570	+2.767	.8139	+3.128	.9146	+2.792	.7616	+3.161
.7573	+2.762	.8142	+3.167	.9160	+2.769	.7627	+3.105
.7577	+2.766	.8156	+3.377	.9170	+2.767	.7637	+3.079
.7653	+2.796	.8167	+3.546	.9243	+2.761	.7641	+3.105
.7656	+2.795	.8177	+3.691	.9247	+2.761	.7651	+3.078
.7667	+2.790	.8188	+3.749	.9250	+2.770	.7655	+3.050
.7670	+2.778	.8198	+3.805	.9264	+2.806	.7682	+3.004
.7684	+2.767	.8212	+3.784	.9267	+2.791	.7686	+3.000
.7688	+2.761	.8222	+3.763	.9340	+2.762	.7696	+2.968
.7698	+2.771	.8226	+3.704	.9347	+2.776	.7700	+2.964
.7702	+2.767	.8233	+3.664	.9361	+2.771	.7714	+2.966
7432.7715	+2.705	7432.8236	+3.613	7432.9386	+2.747	7436.7717	+2.968

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TABLE 5 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN YELLOW LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
7436.7804	+2.942	7436.8686	+2.889	7436.9439	+3.233	7464.7473	+2.753
.7807	+2.939	.8700	+2.872	.9443	+3.273	.7480	+2.769
.7818	+2.944	.8717	+2.890	.9446	+3.298	.7487	+2.763
.7821	+2.937	.8731	+2.874	.9457	+3.522	.7494	+2.755
.7832	+2.912	.8734	+2.858	.9460	+3.592	.7501	+2.743
.7835	+2.928	.8762	+2.867	.9463	+3.651	.7508	+2.739
.7839	+2.913	.8776	+2.879	.9467	+3.721	.7515	+2.742
.7877	+2.936	.8790	+2.864	.9470	+3.750	.7584	+2.753
.7880	+2.944	.8793	+2.880	.9474	+3.760	.7591	+2.745
.7894	+2.911	.8811	+2.860	.9477	+3.805	.7598	+2.755
.7908	+2.896	.8825	+2.846	.9481	+3.860	.7605	+2.741
.7922	+2.869	.8828	+2.872	.9484	+3.945	.7619	+2.750
.7932	+2.867	.8842	+2.855	.9488	+3.981	.7626	+2.741
.7943	+2.885	.8929	+2.897	.9491	+3.990	.7633	+2.744
.7957	+2.897	.8936	+2.920	.9495	+3.997	.7640	+2.715
.7971	+2.894	.8950	+2.907	.9498	+3.986	.7647	+2.728
.7984	+2.903	.8963	+2.896	.9509	+4.045	.7674	+2.735
.7998	+2.906	.8981	+2.925	.9512	+3.998	.7681	+2.739
.8078	+2.889	.8984	+2.911	.9516	+3.977	.7688	+2.725
.8082	+2.888	.8998	+2.896	.9519	+3.978	.7695	+2.717
.8096	+2.881	.9026	+2.910	.9522	+3.924	.7702	+2.736
.8109	+2.898	.9040	+2.875	.9526	+3.882	.7751	+2.739
.8144	+2.879	.9054	+2.900	.9543	+3.746	.7758	+2.734
.8158	+2.865	.9075	+2.891	.9547	+3.692	.7765	+2.741
.8186	+2.886	.9092	+2.871	.9550	+3.611	.7772	+2.762
.8203	+2.845	.9106	+2.859	.9554	+3.554	.7779	+2.776
.8217	+2.846	.9109	+2.870	.9557	+3.475	.7785	+2.761
.8231	+2.910	.9196	+2.846	.9561	+3.414	.7799	+2.750
.8248	+2.873	.9200	+2.837	.9564	+3.364	.7806	+2.742
.8262	+2.862	.9213	+2.843	.9568	+3.301	.7813	+2.745
.8276	+2.868	.9234	+2.840	.9571	+3.262	.7820	+2.745
.8346	+2.883	.9269	+2.862	.9575	+3.232	.7827	+2.739
.8352	+2.867	.9272	+2.860	.9578	+3.198	.7834	+2.737
.8366	+2.860	.9359	+2.871	.9582	+3.163	.7841	+2.735
.8380	+2.871	.9370	+2.879	7436.9595	+3.101	.7848	+2.739
.8394	+2.877	.9387	+2.936	7464.7341	+2.763	.7855	+2.744
.8398	+2.886	.9391	+2.952	.7348	+2.762	.7862	+2.734
.8411	+2.884	.9394	+2.956	.7355	+2.782	.7883	+2.741
.8425	+2.901	.9398	+2.954	.7362	+2.762	.7890	+2.755
.8457	+2.887	.9401	+2.966	.7376	+2.779	.7897	+2.749
.8471	+2.910	.9404	+2.977	.7383	+2.775	.7904	+2.744
.8488	+2.882	.9408	+3.008	.7390	+2.766	.7910	+2.741
.8491	+2.869	.9411	+3.027	.7410	+2.773	.7917	+2.740
.8505	+2.871	.9415	+3.053	.7417	+2.757	.7924	+2.739
.8519	+2.872	.9418	+3.062	.7424	+2.773	.7931	+2.730
.8536	+2.860	.9422	+3.102	.7431	+2.771	.7938	+2.739
.8550	+2.887	.9425	+3.114	.7445	+2.769	.8008	+2.729
.8564	+2.869	.9429	+3.148	.7452	+2.760	.8015	+2.729
.8665	+2.909	.9432	+3.174	.7459	+2.777	.8022	+2.729
7436.8682	+2.898	7436.9436	+3.185	7464.7466	+2.751	7464.8029	+2.738

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TABLE 5 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN YELLOW LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
7464.8035	+2.728	7464.8449	+2.740	7464.8650	+2.758	7464.8817	+3.483
.8042	+2.708	.8452	+2.746	.8654	+2.766	.8820	+3.424
.8091	+2.751	.8456	+2.725	.8657	+2.777	.8824	+3.362
.8098	+2.754	.8459	+2.735	.8660	+2.774	.8827	+3.301
.8105	+2.762	.8463	+2.790	.8664	+2.786	.8831	+3.241
.8112	+2.774	.8466	+2.770	.8667	+2.792	.8834	+3.205
.8119	+2.762	.8469	+2.742	.8671	+2.796	.8838	+3.160
.8126	+2.758	.8473	+2.744	.8674	+2.810	.8841	+3.121
.8140	+2.763	.8487	+2.694	.8681	+2.883	.8844	+3.099
.8147	+2.769	.8494	+2.701	.8685	+2.878	.8848	+3.076
.8154	+2.768	.8501	+2.706	.8688	+2.882	.8858	+3.028
.8160	+2.778	.8508	+2.715	.8692	+2.908	.8862	+3.018
.8167	+2.746	.8515	+2.729	.8695	+2.928	.8865	+2.995
.8174	+2.752	.8522	+2.696	.8699	+2.991	.8869	+2.964
.8181	+2.757	.8525	+2.683	.8702	+3.013	.8872	+2.945
.8188	+2.747	.8529	+2.707	.8706	+3.035	.8876	+2.938
.8195	+2.738	.8539	+2.705	.8709	+3.057	.8886	+2.927
.8202	+2.759	.8542	+2.705	.8713	+3.090	.8890	+2.921
.8216	+2.769	.8549	+2.705	.8716	+3.136	.8893	+2.930
.8237	+2.762	.8556	+2.697	.8723	+3.218	.8897	+2.925
.8244	+2.760	.8560	+2.726	.8726	+3.263	.8900	+2.899
.8251	+2.758	.8563	+2.742	.8730	+3.332	.8903	+2.890
.8258	+2.755	.8567	+2.742	.8733	+3.401	.8907	+2.884
.8265	+2.769	.8570	+2.745	.8737	+3.434	.8910	+2.876
.8272	+2.769	.8577	+2.708	.8740	+3.496	.8914	+2.874
.8292	+2.728	.8581	+2.708	.8744	+3.537	.8917	+2.876
.8299	+2.748	.8584	+2.715	.8747	+3.615	.8921	+2.868
.8306	+2.753	.8588	+2.705	.8751	+3.663	.8924	+2.854
.8313	+2.734	.8591	+2.699	.8754	+3.725	.8935	+2.853
.8320	+2.738	.8594	+2.727	.8758	+3.743	.8938	+2.849
.8327	+2.776	.8598	+2.731	.8778	+3.792	.8942	+2.842
.8334	+2.781	.8612	+2.702	.8782	+3.757	.8945	+2.843
.8341	+2.770	.8615	+2.702	.8785	+3.725	.8949	+2.848
.8348	+2.771	.8619	+2.699	.8789	+3.720	7464.8952	+2.841
.8407	+2.716	.8622	+2.702	.8792	+3.699		
.8410	+2.716	.8626	+2.721	.8796	+3.645		
.8417	+2.709	.8629	+2.749	.8799	+3.637		
.8424	+2.709	.8633	+2.780	.8803	+3.636		
.8431	+2.730	.8636	+2.779	.8806	+3.594		
7464.8445	+2.733	7464.8640	+2.779	7464.8813	+3.526		

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TABLE 6

OBSERVATIONS OF UX URSAE MAJORIS IN BLUE LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
5195.8788	+3.009	5195.9007	+2.520	5195.9469	+2.409	5196.0004	+2.419
.8792	+3.044	.9017	+2.479	.9476	+2.428	5196.0010	+2.398
.8795	+3.104	.9024	+2.478	.9483	+2.414	5217.7706	+2.45
.8799	+3.185	.9031	+2.431	.9490	+2.431	.7713	+2.46
.8813	+3.312	.9038	+2.429	.9504	+2.458	.7720	+2.50
.8816	+3.352	.9045	+2.443	.9510	+2.425	.7727	+2.45
.8820	+3.382	.9052	+2.458	.9517	+2.379	.7748	+2.47
.8823	+3.403	.9059	+2.411	.9524	+2.360	.7755	+2.44
.8826	+3.422	.9066	+2.423	.9566	+2.409	.7762	+2.43
.8830	+3.430	.9073	+2.440	.9573	+2.427	.7769	+2.41
.8833	+3.442	.9080	+2.429	.9580	+2.439	.7776	+2.41
.8837	+3.424	.9087	+2.403	.9587	+2.407	.7783	+2.45
.8840	+3.423	.9094	+2.387	.9594	+2.423	.7790	+2.47
.8844	+3.383	.9101	+2.412	.9601	+2.425	.7797	+2.49
.8847	+3.351	.9115	+2.442	.9622	+2.430	.7804	+2.44
.8861	+3.202	.9122	+2.437	.9629	+2.421	.7810	+2.45
.8865	+3.183	.9128	+2.398	.9635	+2.391	.7831	+2.52
.8868	+3.150	.9135	+2.386	.9642	+2.382	.7838	+2.50
.8872	+3.091	.9142	+2.406	.9649	+2.406	.7873	+2.468
.8889	+2.801	.9149	+2.409	.9656	+2.422	.7880	+2.431
.8892	+2.744	.9156	+2.431	.9663	+2.444	.7887	+2.473
.8896	+2.725	.9198	+2.438	.9691	+2.462	.7894	+2.495
.8899	+2.761	.9205	+2.421	.9698	+2.482	.7901	+2.478
.8906	+2.671	.9212	+2.393	.9705	+2.477	.7908	+2.457
.8910	+2.657	.9219	+2.419	.9712	+2.475	.7922	+2.444
.8913	+2.655	.9226	+2.416	.9719	+2.443	.7929	+2.458
.8917	+2.647	.9233	+2.417	.9726	+2.450	.7935	+2.424
.8920	+2.623	.9240	+2.396	.9733	+2.444	.7939	+2.400
.8924	+2.636	.9260	+2.432	.9740	+2.486	.7974	+2.485
.8934	+2.625	.9267	+2.439	.9760	+2.439	.7977	+2.509
.8938	+2.635	.9274	+2.434	.9767	+2.486	.7984	+2.518
.8941	+2.655	.9281	+2.399	.9774	+2.550	.7991	+2.530
.8944	+2.662	.9288	+2.387	.9781	+2.533	.7998	+2.530
.8948	+2.680	.9295	+2.396	.9788	+2.481	.8005	+2.521
.8951	+2.620	.9302	+2.418	.9795	+2.437	.8019	+2.577
.8955	+2.605	.9309	+2.434	.9816	+2.446	.8026	+2.547
.8958	+2.590	.9316	+2.433	.9823	+2.472	.8033	+2.503
.8962	+2.561	.9323	+2.440	.9830	+2.474	.8040	+2.480
.8965	+2.530	.9330	+2.450	.9872	+2.490	.8047	+2.469
.8969	+2.512	.9337	+2.393	.9879	+2.470	.8081	+2.582
.8972	+2.508	.9344	+2.397	.9885	+2.460	.8088	+2.538
.8976	+2.505	.9358	+2.399	.9913	+2.439	.8095	+2.570
.8979	+2.505	.9365	+2.392	.9920	+2.452	.8102	+2.560
.8983	+2.566	.9372	+2.417	.9927	+2.386	.8109	+2.562
.8986	+2.525	.9379	+2.436	.9948	+2.437	.8116	+2.532
.8990	+2.510	.9385	+2.427	.9955	+2.406	.8123	+2.603
.8993	+2.494	.9441	+2.419	.9962	+2.360	.8126	+2.554
.8997	+2.519	.9448	+2.409	.9969	+2.418	.8144	+2.546
.9000	+2.480	.9455	+2.401	.9976	+2.480	.8151	+2.571
5195.9004	+2.504	5195.9462	+2.383	5195.9983	+2.457	5217.8206	+2.564

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TABLE 6 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN BLUE LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
5217.8213	+2.532	5217.8651	+2.364	5217.9054	+2.950	5217.9248	+2.529
.8220	+2.520	.8658	+2.364	.9057	+3.019	.9269	+2.518
.8227	+2.493	.8692	+2.325	.9060	+3.062	.9276	+2.541
.8234	+2.519	.8699	+2.376	.9064	+3.109	.9331	+2.413
.8251	+2.456	.8706	+2.388	.9067	+3.171	.9338	+2.404
.8255	+2.482	.8712	+2.357	.9071	+3.230	.9345	+2.398
.8262	+2.502	.8742	+2.352	.9074	+3.262	.9352	+2.411
.8269	+2.519	.8748	+2.363	.9078	+3.299	.9359	+2.417
.8276	+2.522	.8755	+2.354	.9081	+3.326	.9380	+2.413
.8283	+2.490	.8762	+2.373	.9085	+3.347	.9387	+2.421
.8290	+2.492	.8783	+2.399	.9088	+3.361	.9394	+2.437
.8297	+2.460	.8790	+2.394	.9092	+3.384	5217.9401	+2.453
.8304	+2.494	.8797	+2.364	.9095	+3.412	5223.7926	+2.395
.8310	+2.472	.8804	+2.335	.9099	+3.437	.7933	+2.389
.8349	+2.523	.8810	+2.355	.9102	+3.430	.7940	+2.378
.8352	+2.501	.8817	+2.370	.9106	+3.398	.7947	+2.385
.8359	+2.461	.8824	+2.361	.9109	+3.358	.7954	+2.385
.8366	+2.439	.8831	+2.399	.9113	+3.338	.7961	+2.356
.8373	+2.438	.8838	+2.403	.9116	+3.313	.7965	+2.349
.8380	+2.467	.8845	+2.417	.9120	+3.290	.7968	+2.353
.8387	+2.482	.8852	+2.427	.9123	+3.268	.7972	+2.388
.8394	+2.472	.8859	+2.414	.9126	+3.245	.7975	+2.399
.8401	+2.517	.8866	+2.408	.9130	+3.218	.7978	+2.418
.8408	+2.476	.8873	+2.393	.9133	+3.175	.7982	+2.428
.8415	+2.484	.8880	+2.379	.9140	+3.101	.7985	+2.451
.8435	+2.467	.8887	+2.387	.9144	+3.058	.7989	+2.447
.8442	+2.476	.8894	+2.378	.9147	+2.998	.7992	+2.429
.8449	+2.473	.8908	+2.400	.9151	+2.939	.8006	+2.515
.8456	+2.474	.8915	+2.380	.9154	+2.898	.8010	+2.524
.8463	+2.502	.8922	+2.354	.9158	+2.869	.8013	+2.550
.8491	+2.523	.8928	+2.360	.9161	+2.821	.8017	+2.544
.8498	+2.475	.8963	+2.372	.9165	+2.778	.8020	+2.542
.8505	+2.501	.8970	+2.373	.9168	+2.728	.8024	+2.545
.8512	+2.508	.8977	+2.366	.9172	+2.717	.8027	+2.574
.8540	+2.436	.8984	+2.376	.9175	+2.708	.8031	+2.624
.8547	+2.415	.8988	+2.386	.9179	+2.700	.8034	+2.666
.8554	+2.417	.8991	+2.399	.9182	+2.696	.8038	+2.713
.8560	+2.395	.8995	+2.431	.9185	+2.697	.8041	+2.755
.8567	+2.408	.8998	+2.451	.9189	+2.707	.8044	+2.785
.8574	+2.417	.9001	+2.480	.9199	+2.622	.8048	+2.828
.8581	+2.420	.9005	+2.500	.9203	+2.598	.8051	+2.858
.8588	+2.418	.9008	+2.517	.9206	+2.586	.8055	+2.914
.8595	+2.397	.9012	+2.520	.9210	+2.567	.8062	+3.035
.8602	+2.424	.9015	+2.533	.9213	+2.546	.8065	+3.122
.8609	+2.435	.9019	+2.545	.9217	+2.531	.8069	+3.194
.8616	+2.446	.9022	+2.579	.9220	+2.526	.8072	+3.211
.8623	+2.460	.9026	+2.607	.9224	+2.529	.8076	+3.237
.8630	+2.428	.9029	+2.613	.9227	+2.526	.8079	+3.276
.8637	+2.378	.9033	+2.645	.9234	+2.534	.8083	+3.303
5217.8644	+2.354	5217.9036	+2.680	5217.9241	+2.534	5223.8086	+3.335

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TABLE 6 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN BLUE LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
5223.8090	+3.353	5223.8281	+2.433	5223.8753	+2.573	5225.7176	+2.424
.8093	+3.367	.8288	+2.436	.8760	+2.616	.7183	+2.433
.8097	+3.373	.8301	+2.398	.8780	+2.642	.7189	+2.417
.8100	+3.363	.8308	+2.406	.8857	+2.563	.7196	+2.431
.8103	+3.353	.8315	+2.404	.8864	+2.554	.7203	+2.454
.8107	+3.332	.8322	+2.364	.8871	+2.555	.7210	+2.471
.8110	+3.322	.8329	+2.370	.8878	+2.545	.7217	+2.488
.8114	+3.310	.8336	+2.355	.8885	+2.525	.7238	+2.478
.8117	+3.292	.8350	+2.421	.8892	+2.488	.7245	+2.501
.8121	+3.290	.8357	+2.403	.8899	+2.472	.7252	+2.503
.8124	+3.281	.8364	+2.413	.8954	+2.515	.7259	+2.504
.8128	+3.242	.8371	+2.421	.8961	+2.497	.7266	+2.544
.8131	+3.200	.8378	+2.420	.8968	+2.508	.7273	+2.565
.8135	+3.174	.8385	+2.465	.8975	+2.506	.7280	+2.576
.8138	+3.134	.8426	+2.396	.8982	+2.512	.7287	+2.581
.8142	+3.063	.8433	+2.420	.8989	+2.540	.7294	+2.554
.8145	+3.011	.8440	+2.456	.8996	+2.568	.7301	+2.545
.8149	+2.963	.8447	+2.460	.9003	+2.524	.7308	+2.492
.8152	+2.894	.8454	+2.479	.9010	+2.535	.7314	+2.537
.8156	+2.853	.8461	+2.453	.9017	+2.528	.7321	+2.510
.8163	+2.751	.8468	+2.474	.9024	+2.525	.7328	+2.511
.8166	+2.720	.8475	+2.488	.9030	+2.522	.7335	+2.520
.8169	+2.700	.8482	+2.505	.9037	+2.515	.7342	+2.519
.8173	+2.689	.8489	+2.434	.9044	+2.514	.7349	+2.498
.8176	+2.679	.8496	+2.411	.9051	+2.513	.7356	+2.488
.8180	+2.678	.8503	+2.522	.9079	+2.504	.7363	+2.455
.8183	+2.677	.8510	+2.486	.9086	+2.470	.7370	+2.434
.8187	+2.672	.8517	+2.488	.9093	+2.455	.7377	+2.388
.8190	+2.672	.8522	+2.530	.9100	+2.494	.7384	+2.407
.8194	+2.658	.8538	+2.601	.9107	+2.561	.7391	+2.421
.8197	+2.649	.8544	+2.590	.9114	+2.548	.7398	+2.422
.8201	+2.641	.8551	+2.569	.9121	+2.518	.7405	+2.423
.8204	+2.625	.8558	+2.530	.9128	+2.517	.7412	+2.382
.8208	+2.626	.8565	+2.518	.9135	+2.498	.7419	+2.372
.8211	+2.631	.8572	+2.482	.9142	+2.482	.7426	+2.405
.8215	+2.635	.8579	+2.462	.9149	+2.495	.7453	+2.357
.8218	+2.634	.8586	+2.485	.9156	+2.509	.7460	+2.352
.8228	+2.637	.8593	+2.488	.9162	+2.524	.7467	+2.359
.8232	+2.627	.8600	+2.505	5223.9169	+2.528	.7474	+2.350
.8235	+2.616	.8607	+2.510	5225.7099	+2.430	.7481	+2.345
.8239	+2.606	.8614	+2.516	.7106	+2.435	.7488	+2.342
.8242	+2.588	.8683	+2.526	.7113	+2.452	.7495	+2.369
.8246	+2.568	.8690	+2.530	.7120	+2.465	.7558	+2.399
.8249	+2.551	.8697	+2.545	.7127	+2.435	.7565	+2.391
.8253	+2.541	.8704	+2.568	.7134	+2.435	.7571	+2.376
.8256	+2.528	.8711	+2.497	.7141	+2.421	.7578	+2.357
.8260	+2.515	.8718	+2.467	.7148	+2.417	.7585	+2.330
.8263	+2.495	.8725	+2.429	.7155	+2.368	.7592	+2.369
.8267	+2.484	.8732	+2.437	.7162	+2.316	.7599	+2.400
5223.8274	+2.466	5223.8746	+2.515	5225.7169	+2.309	5225.7606	+2.409

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TABLE 6 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN BLUE LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
5225.7613	+2.416	5225.7853	+2.690	5225.8321	+2.480	5225.8766	+2.521
.7620	+2.424	.7856	+2.681	.8328	+2.477	.8773	+2.485
.7641	+2.337	.7860	+2.678	.8335	+2.486	.8780	+2.481
.7644	+2.363	.7863	+2.678	.8342	+2.545	.8787	+2.486
.7648	+2.422	.7867	+2.658	.8349	+2.543	.8794	+2.471
.7651	+2.447	.7870	+2.629	.8356	+2.553	.8801	+2.482
.7655	+2.470	.7874	+2.609	.8377	+2.472	.8808	+2.505
.7658	+2.512	.7877	+2.586	.8384	+2.490	.8815	+2.543
.7662	+2.536	.7898	+2.624	.8391	+2.502	.8821	+2.547
.7665	+2.544	.7905	+2.611	.8398	+2.496	.8828	+2.543
.7669	+2.558	.7912	+2.621	.8405	+2.468	.8884	+2.520
.7672	+2.567	.7926	+2.592	.8412	+2.497	.8891	+2.516
.7676	+2.575	.7933	+2.572	.8419	+2.494	.8898	+2.519
.7679	+2.593	.7940	+2.560	.8426	+2.504	.8905	+2.527
.7683	+2.610	.7946	+2.539	.8433	+2.486	.8912	+2.544
.7686	+2.617	.7953	+2.527	.8440	+2.532	.8919	+2.537
.7690	+2.622	.7960	+2.505	.8446	+2.547	.8926	+2.536
.7693	+2.640	.7967	+2.497	.8509	+2.489	.8933	+2.496
.7696	+2.671	.7974	+2.484	.8516	+2.471	.8938	+2.443
.7700	+2.701	.7981	+2.470	.8523	+2.470	.8940	+2.454
.7703	+2.748	.7995	+2.470	.8530	+2.450	.8946	+2.504
.7707	+2.781	.8002	+2.454	.8537	+2.425	.8953	+2.525
.7710	+2.801	.8009	+2.437	.8542	+2.390	.8960	+2.472
.7714	+2.831	.8030	+2.487	.8544	+2.414	.8965	+2.435
.7717	+2.885	.8037	+2.477	.8551	+2.461	.8967	+2.455
.7721	+2.942	.8106	+2.448	.8558	+2.482	.8974	+2.525
.7724	+2.992	.8113	+2.475	.8564	+2.504	.8981	+2.504
.7728	+3.037	.8120	+2.494	.8571	+2.498	.8995	+2.504
.7731	+3.083	.8127	+2.488	.8578	+2.499	.9002	+2.506
.7735	+3.141	.8134	+2.504	.8599	+2.495	.9009	+2.513
.7738	+3.186	.8141	+2.496	.8606	+2.488	.9016	+2.518
.7742	+3.223	.8148	+2.514	.8613	+2.515	.9023	+2.523
.7745	+3.251	.8155	+2.508	.8620	+2.536	5225.9030	+2.518
.7749	+3.273	.8176	+2.526	.8627	+2.547	5250.7351	+2.434
.7787	+3.376	.8183	+2.517	.8634	+2.547	.7358	+2.423
.7790	+3.356	.8189	+2.520	.8641	+2.576	.7365	+2.415
.7792	+3.335	.8196	+2.513	.8648	+2.576	.7372	+2.411
.7804	+3.175	.8203	+2.524	.8655	+2.566	.7379	+2.392
.7808	+3.122	.8210	+2.519	.8662	+2.518	.7383	+2.375
.7811	+3.065	.8217	+2.540	.8669	+2.487	.7386	+2.379
.7815	+3.008	.8224	+2.559	.8676	+2.498	.7390	+2.383
.7818	+2.967	.8231	+2.547	.8683	+2.527	.7393	+2.391
.7821	+2.938	.8238	+2.538	.8710	+2.504	.7397	+2.399
.7825	+2.917	.8245	+2.538	.8717	+2.511	.7400	+2.406
.7832	+2.837	.8252	+2.570	.8724	+2.522	.7404	+2.405
.7835	+2.813	.8287	+2.513	.8731	+2.480	.7407	+2.395
.7839	+2.784	.8294	+2.565	.8738	+2.465	.7410	+2.431
.7842	+2.759	.8301	+2.542	.8745	+2.454	.7414	+2.435
.7846	+2.718	.8307	+2.518	.8752	+2.476	.7417	+2.454
5225.7849	+2.698	5225.8314	+2.514	5225.8759	+2.492	5250.7421	+2.465

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TABLE 6 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN BLUE LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
5250.7424	+2.470	5250.7608	+2.785	5250.7921	+2.566	5250.8331	+2.543
.7428	+2.485	.7612	+2.769	.7928	+2.526	.8338	+2.606
.7431	+2.496	.7615	+2.743	.7935	+2.542	.8345	+2.580
.7435	+2.513	.7619	+2.723	.7942	+2.568	.8351	+2.526
.7445	+2.604	.7622	+2.726	.7949	+2.530	.8358	+2.501
.7449	+2.617	.7626	+2.715	.7956	+2.491	.8365	+2.452
.7452	+2.626	.7629	+2.703	.7963	+2.497	.8372	+2.457
.7456	+2.643	.7633	+2.686	.7970	+2.526	.8379	+2.520
.7459	+2.655	.7636	+2.645	.7976	+2.483	.8386	+2.510
.7463	+2.670	.7640	+2.614	.7983	+2.465	.8393	+2.540
.7466	+2.685	.7643	+2.608	.7990	+2.452	.8414	+2.487
.7470	+2.710	.7647	+2.605	.7997	+2.450	.8421	+2.516
.7473	+2.754	.7650	+2.604	.8004	+2.513	.8428	+2.526
.7476	+2.793	.7654	+2.604	.8011	+2.528	.8435	+2.520
.7480	+2.826	.7657	+2.570	.8018	+2.503	.8442	+2.514
.7483	+2.848	.7660	+2.552	.8025	+2.518	.8449	+2.523
.7487	+2.876	.7664	+2.583	.8032	+2.503	.8456	+2.543
.7490	+2.930	.7685	+2.510	.8094	+2.477	.8462	+2.534
.7494	+2.988	.7688	+2.512	.8101	+2.510	.8469	+2.540
.7497	+3.062	.7692	+2.515	.8108	+2.502	.8525	+2.580
.7501	+3.078	.7695	+2.522	.8115	+2.508	.8532	+2.540
.7504	+3.115	.7699	+2.535	.8122	+2.446	.8539	+2.544
.7508	+3.136	.7702	+2.528	.8129	+2.486	.8546	+2.528
.7511	+3.177	.7706	+2.527	.8136	+2.500	.8553	+2.530
.7515	+3.215	.7709	+2.533	.8143	+2.486	.8560	+2.503
.7518	+3.265	.7713	+2.535	.8150	+2.471	.8567	+2.512
.7522	+3.370	.7723	+2.517	.8157	+2.429	.8574	+2.507
.7525	+3.388	.7726	+2.485	.8164	+2.438	.8581	+2.544
.7529	+3.417	.7730	+2.468	.8171	+2.470	5250.8588	+2.542
.7532	+3.417	.7733	+2.450	.8178	+2.497		
.7536	+3.433	.7737	+2.435	.8185	+2.549		
.7539	+3.426	.7740	+2.436	.8192	+2.512		
.7542	+3.414	.7747	+2.421	.8199	+2.558		
.7546	+3.398	.7754	+2.438	.8206	+2.586		
.7549	+3.388	.7761	+2.429	.8213	+2.616		
.7553	+3.380	.7768	+2.410	.8219	+2.629		
.7561	+3.357	.7775	+2.384	.8226	+2.620		
.7563	+3.344	.7782	+2.405	.8240	+2.526		
.7567	+3.325	.7789	+2.430	.8247	+2.535		
.7570	+3.275	.7796	+2.460	.8254	+2.495		
.7574	+3.225	.7803	+2.455	.8261	+2.577		
.7577	+3.203	.7810	+2.482	.8268	+2.545		
.7581	+3.136	.7817	+2.514	.8275	+2.583		
.7584	+3.066	.7824	+2.520	.8282	+2.592		
.7588	+3.003	.7838	+2.515	.8289	+2.611		
.7591	+2.940	.7844	+2.514	.8296	+2.600		
.7594	+2.904	.7851	+2.515	.8303	+2.575		
.7598	+2.837	.7858	+2.537	.8310	+2.567		
.7601	+2.815	.7907	+2.562	.8317	+2.566		
5250.7605	+2.800	5250.7914	+2.562	5250.8324	+2.547		

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TABLE 7

OBSERVATIONS OF UX URSAE MAJORIS IN ULTRAVIOLET LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
7428.7443	+1.844	7428.8544	+1.784	7432.7285	+1.740	7432.7924	+1.680
.7447	+1.834	.8551	+1.800	.7309	+1.694	.7927	+1.681
.7457	+1.824	.8579	+1.785	.7313	+1.711	.7938	+1.679
.7461	+1.821	.8582	+1.772	.7316	+1.732	.7941	+1.667
.7495	+1.808	.8586	+1.781	.7319	+1.740	.7952	+1.629
.7509	+1.812	.8600	+1.736	.7340	+1.751	.7955	+1.669
.7530	+1.821	.8603	+1.750	.7344	+1.753	.8021	+1.726
.7537	+1.794	.8607	+1.763	.7431	+1.801	.8024	+1.724
.7551	+1.771	.8634	+1.745	.7434	+1.809	.8035	+1.725
.7582	+1.785	.8641	+1.751	.7452	+1.839	.8038	+1.734
.7586	+1.782	.8655	+1.694	.7455	+1.842	.8052	+1.752
.7600	+1.788	.8659	+1.699	.7479	+1.846	.8056	+1.757
.7607	+1.794	.8731	+1.764	.7483	+1.842	.8080	+1.771
.7808	+1.860	.8745	+1.758	.7486	+1.819	.8083	+1.806
.7815	+1.857	.8766	+1.763	.7497	+1.780	.8094	+1.817
.7829	+1.818	.8770	+1.772	.7500	+1.796	.8097	+1.814
.7836	+1.838	.8780	+1.856	.7535	+1.827	.8108	+1.827
.7877	+1.807	.8784	+1.869	.7538	+1.822	.8122	+1.861
.7884	+1.797	.8794	+1.899	.7552	+1.726	.8125	+1.892
.7902	+1.777	.8798	+1.980	.7556	+1.727	.8136	+1.997
.7905	+1.808	.8808	+2.120	.7580	+1.772	.8146	+2.091
.7909	+1.809	.8818	+2.375	.7583	+1.787	.8149	+2.158
.7926	+1.842	.8822	+2.446	.7587	+1.791	.8160	+2.400
.7929	+1.834	.8825	+2.530	.7590	+1.811	.8170	+2.587
.7947	+1.814	.8836	+2.706	.7660	+1.805	.8174	+2.604
.7954	+1.805	.8839	+2.751	.7663	+1.783	.8181	+2.736
.7999	+1.762	.8850	+2.883	.7674	+1.803	.8184	+2.786
.8002	+1.766	.8853	+2.914	.7677	+1.763	.8191	+2.846
.8020	+1.785	.8881	+2.940	.7691	+1.754	.8194	+2.861
.8023	+1.796	.8884	+2.901	.7694	+1.792	.8205	+2.833
.8044	+1.771	.8891	+2.780	.7705	+1.752	.8215	+2.815
.8047	+1.748	.8895	+2.732	.7708	+1.696	.8229	+2.696
.8051	+1.741	.8905	+2.598	.7712	+1.653	.8240	+2.525
.8065	+1.781	.8916	+2.404	.7722	+1.695	.8254	+2.250
.8068	+1.791	.8926	+2.270	.7726	+1.730	.8257	+2.224
.8072	+1.804	.8929	+2.241	.7729	+1.758	.8264	+2.097
.8075	+1.810	.8940	+2.086	.7747	+1.740	.8267	+2.028
.8155	+1.778	.8943	+2.036	.7750	+1.789	.8274	+2.021
.8169	+1.762	.8950	+1.992	.7764	+1.757	.8278	+2.060
.8176	+1.788	7428.8961	+1.973	.7778	+1.741	.8288	+2.036
.8405	+1.765	7432.7174	+1.753	.7781	+1.707	.8299	+1.968
.8409	+1.754	.7177	+1.710	.7837	+1.725	.8309	+1.929
.8412	+1.741	.7181	+1.712	.7840	+1.743	.8313	+1.935
.8426	+1.754	.7198	+1.742	.7854	+1.729	.8323	+1.954
.8429	+1.773	.7202	+1.723	.7878	+1.752	.8347	+1.977
.8433	+1.783	.7205	+1.740	.7882	+1.762	.8361	+1.977
.8454	+1.775	.7208	+1.753	.7885	+1.734	.8372	+1.973
.8457	+1.744	.7274	+1.811	.7896	+1.751	.8375	+1.959
.8527	+1.773	.7278	+1.821	.7910	+1.696	.8445	+1.862
7428.8530	+1.784	7432.7281	+1.770	7432.7913	+1.682	7432.8462	+1.917

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TABLE 7 (continued)

OBSERVATIONS OF UX URSAE MAJORIS IN ULTRAVIOLET LIGHT

$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm	$JD_\odot$ 2430000+	Δm
7432.8465	+1.892	7436.7377	+1.737	7436.7842	+1.886	7436.8727	+1.925
.8493	+1.864	.7380	+1.774	.7845	+1.914	.8741	+1.851
.8514	+1.873	.7384	+1.807	.7887	+1.951	.8769	+1.856
.8517	+1.905	.7394	+1.822	.7901	+1.870	.8783	+1.893
.8535	+1.888	.7398	+1.789	.7915	+1.847	.8800	+1.868
.8538	+1.893	.7411	+1.767	.7929	+1.859	.8818	+1.836
.8542	+1.890	.7415	+1.794	.7939	+1.777	.8832	+1.836
.8559	+1.874	.7436	+1.840	.7950	+1.838	.8849	+1.827
.8562	+1.846	.7439	+1.898	.7960	+1.831	.8852	+1.816
.8580	+1.840	.7450	+1.915	.7964	+1.861	.8943	+1.886
.8583	+1.870	.7453	+1.955	.7977	+1.875	.8957	+1.913
.8587	+1.798	.7460	+1.980	.7991	+1.852	.8970	+1.876
.8601	+1.832	.7464	+2.009	.7995	+1.812	.8974	+1.890
.8604	+1.809	.7474	+2.106	.8002	+1.833	.8991	+1.887
.8608	+1.786	.7477	+2.163	.8005	+1.858	.9005	+1.896
.8611	+1.787	.7484	+2.293	.8088	+1.823	.9033	+1.876
.8743	+1.814	.7488	+2.374	.8102	+1.832	.9047	+1.904
.8747	+1.803	.7498	+2.659	.8137	+1.849	.9061	+1.871
.8750	+1.793	.7502	+2.718	.8151	+1.822	.9064	+1.871
.8764	+1.763	.7509	+2.867	.8165	+1.860	.9082	+1.882
.8767	+1.752	.7519	+2.996	.8193	+1.867	.9085	+1.846
.8771	+1.751	.7523	+3.051	.8196	+1.857	.9099	+1.870
.9153	+1.839	.7533	+3.152	.8210	+1.838	.9113	+1.819
.9177	+1.784	.7543	+3.125	.8224	+1.838	.9116	+1.848
.9257	+1.808	.7550	+3.040	.8238	+1.839	.9207	+1.774
.9261	+1.817	.7554	+3.020	.8255	+1.829	.9220	+1.789
.9271	+1.772	.7564	+2.907	.8259	+1.780	.9224	+1.793
.9274	+1.800	.7568	+2.875	.8269	+1.788	.9227	+1.816
.9278	+1.801	.7575	+2.676	.8283	+1.808	.9245	+1.829
.9354	+1.711	.7578	+2.662	.8356	+1.780	.9248	+1.808
.9368	+1.727	.7589	+2.405	.8359	+1.827	.9280	+1.846
.9375	+1.744	.7592	+2.306	.8373	+1.819	.9283	+1.828
.9392	+1.693	.7599	+2.256	.8387	+1.867	.9286	+1.823
.9396	+1.781	.7602	+2.184	.8405	+1.885	7436.9363	+1.769
.9399	+1.774	.7613	+2.109	.8418	+1.849		
.9479	+1.810	.7623	+2.052	.8432	+1.851		
.9483	+1.829	.7634	+2.051	.8464	+1.841		
.9500	+1.846	.7644	+1.999	.8481	+1.957		
.9504	+1.802	.7648	+2.020	.8498	+1.854		
.9535	+1.749	.7658	+1.960	.8512	+1.867		
.9538	+1.767	.7661	+1.945	.8526	+1.850		
.9556	+1.781	.7689	+2.001	.8543	+1.848		
.9563	+1.784	.7703	+1.992	.8557	+1.862		
7432.9570	+1.805	.7707	+1.993	.8575	+1.850		
7436.7304	+1.758	.7721	+1.992	.8672	+1.923		
.7318	+1.709	.7724	+2.036	.8689	+1.882		
.7349	+1.793	.7811	+1.979	.8693	+1.907		
.7352	+1.789	.7814	+1.962	.8706	+1.864		
.7356	+1.781	.7825	+1.990	.8710	+1.864		
7436.7366	+1.759	7436.7828	+1.964	7436.8724	+1.946		

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times predicted by the above elements. These include visual observations by Zverev and Kukarkin (1937) extending from about JD 2427200 to 2428000, photographic observations by Krat (1940) near JD 2429300, a single visual observation by Lange (1944) near JD 2430900, photoelectric observations by Linnell (1950) near JD 2433000, photoelectric observations by Linnell, by Johnson *et al.*, and by Walker and Herbig. The figure shows that, while up until about 1953 there was some tendency for the period to increase, the period has been decreasing since 1953. It is interesting that, except for the observations of Krat and Lange, the residuals could be represented by a sinusoidal variation having a period of about 6000 days. Whether these earlier observations could be sufficiently in error to admit of this type of variation is not clear. Consequently, it will be necessary to continue to obtain accurate times of minimum of this system for a number of years, in order to determine the nature of the changes in the period.

The light-curves obtained since 1953 have, as mentioned above, the same form as those observed in 1953. Thus there has been no progressive change in the form of the light-curve as the period has decreased. This result would indicate that the observed

TABLE 8

MAGNITUDES AND COLORS OF COMPARISON STARS

Star (BD)	V	$B-V$	$U-B$	n
+52°1720... .	9 82	+1 58	+2 0	6
+52°1722... ..	10 10	+0.42	−0 06	6

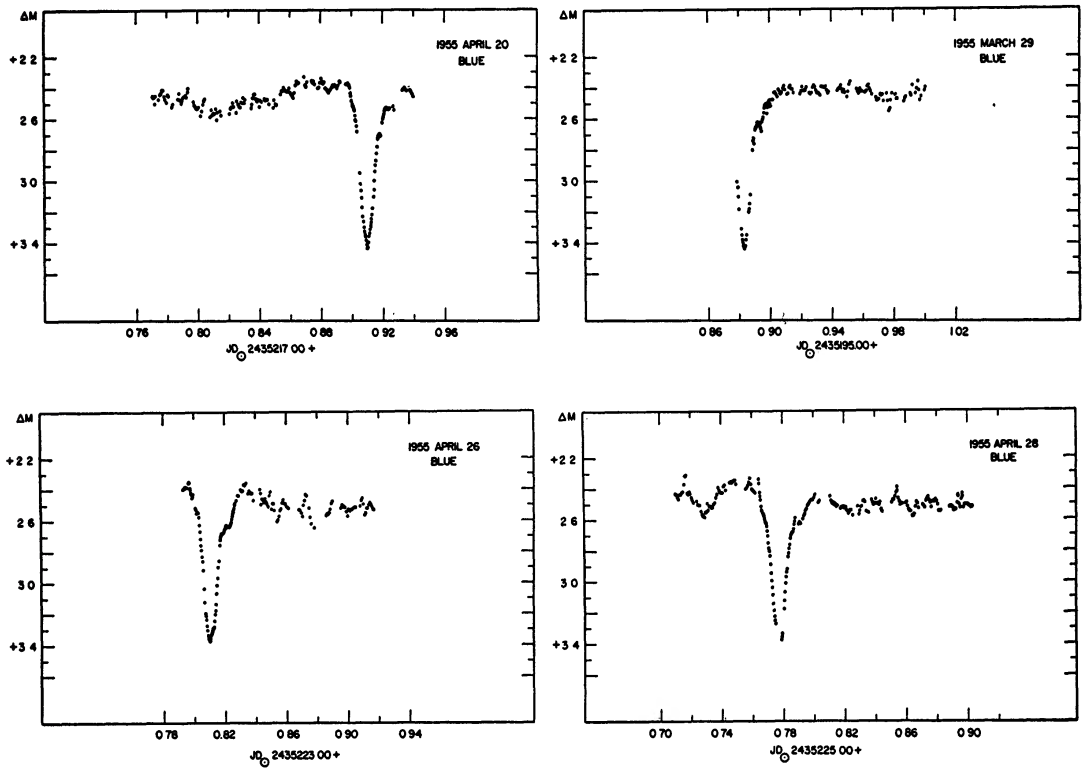


FIG. 1.—Photoelectric observations of UX UMa. The ordinate is the magnitude difference, UX UMa *minus* BD+52°1722, reduced to no atmosphere.

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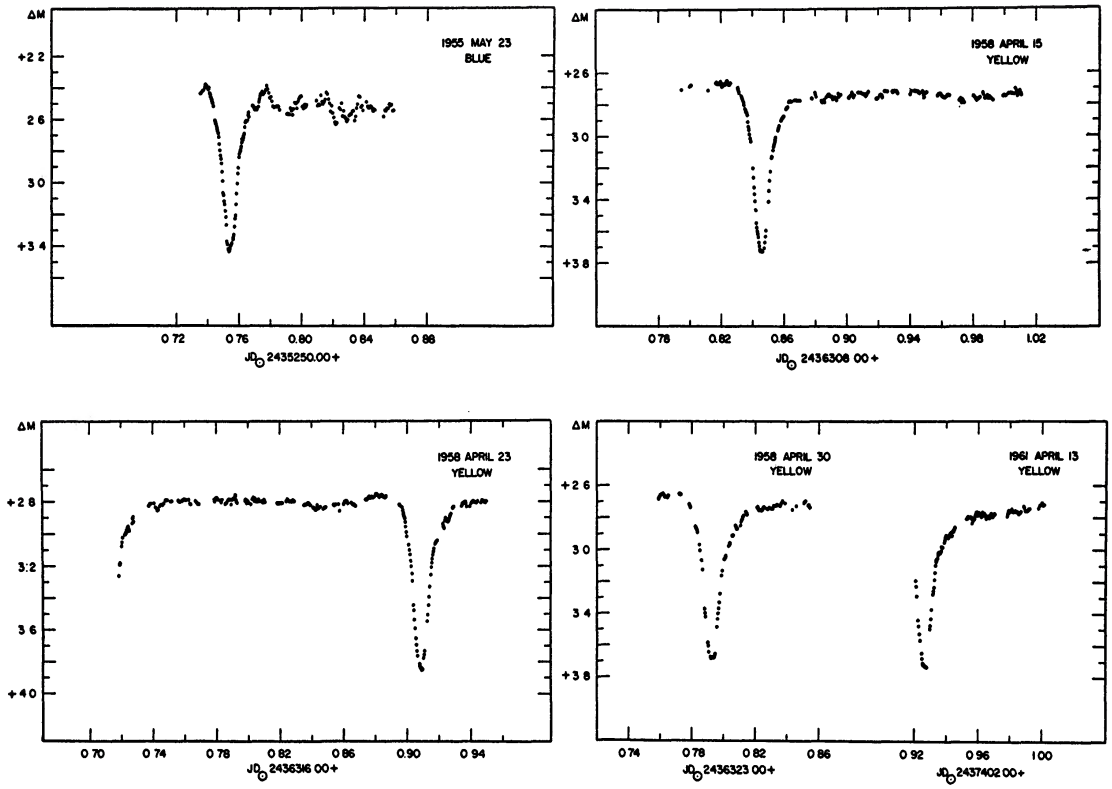


FIG. 2.—Photoelectric observations of UX UMa. Ordinate and abscissa as in Fig. 1

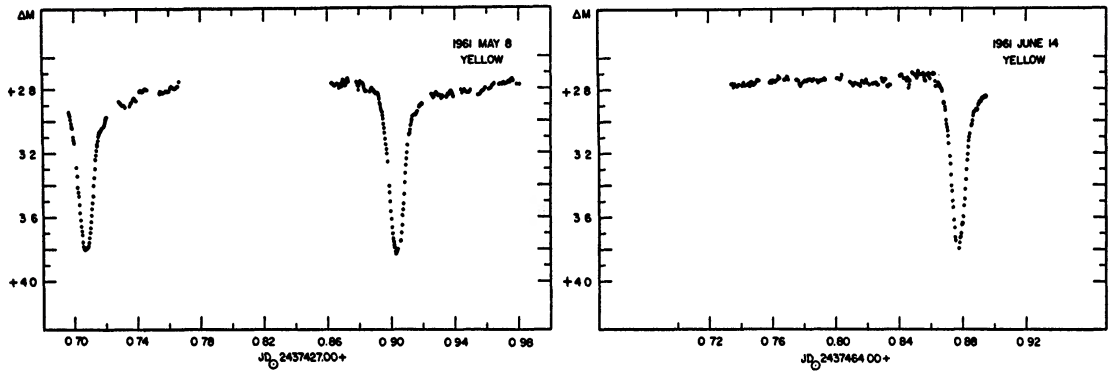


FIG. 3.—Photoelectric observations of UX UMa. Ordinate and abscissa as in Fig. 1

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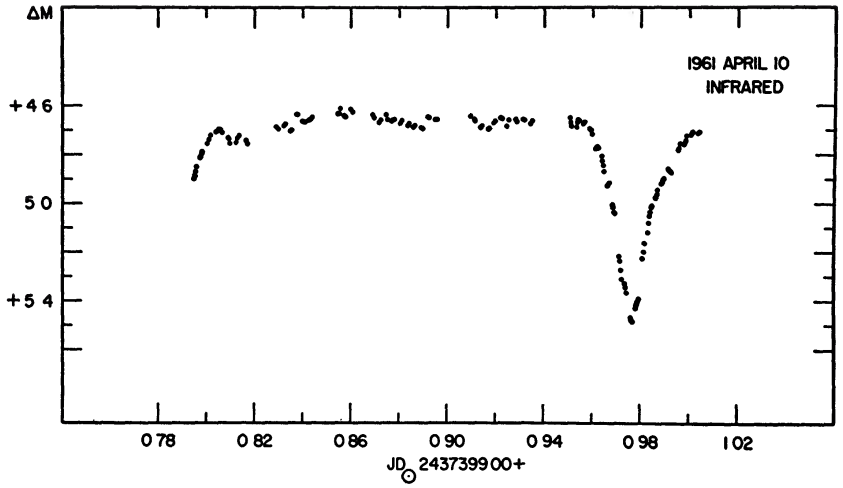


FIG. 4.—Photoelectric observations of UX UMa. The ordinate is the magnitude difference, UX UMa *minus* BD+52°1720, reduced to no atmosphere.

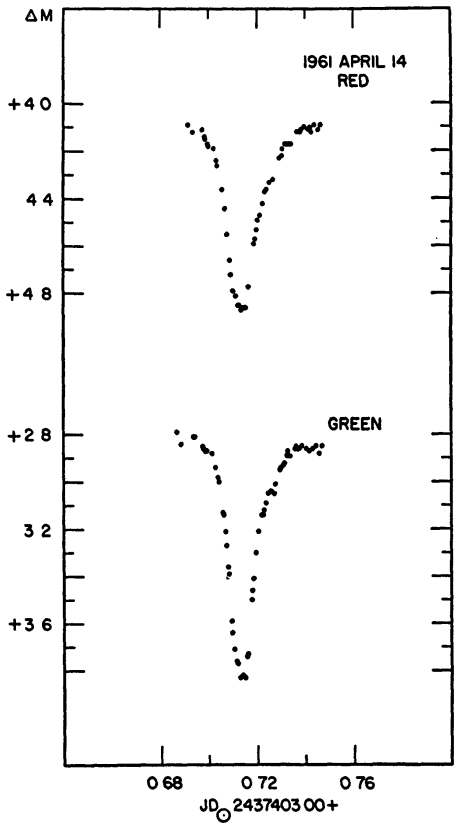


FIG. 5.—Photoelectric observations of UX UMa. Ordinate and abscissa as in Fig. 4

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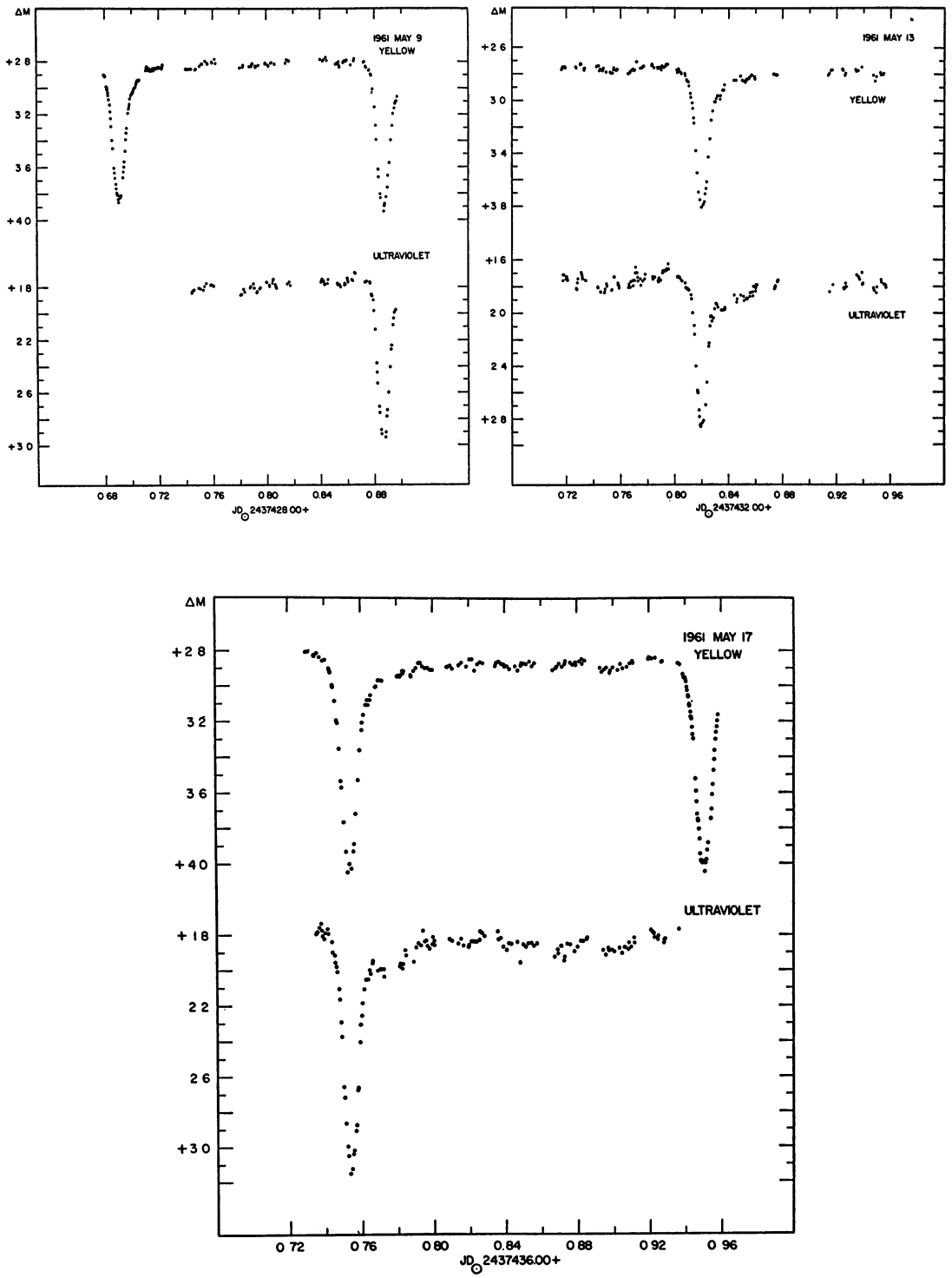


FIG. 6.—Photoelectric observations of UX UMa. Ordinate and abscissa as in Fig. 1

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decrease in period represents a real change in the period of the system and not a distortion of the eclipse-curve by the slow change in the position of a detached cloud of material within the system. At the same time, night-to-night distortions in the shape of the eclipse-curve do occur and are responsible for the scatter among the times of minimum observed in any one season; in order to obtain an accurate mean time of minimum for the season, it is necessary to have about six observations of the time of minimum. Also, as mentioned above, the light-curves obtained by Linnell in 1949 (Linnell 1950) at a

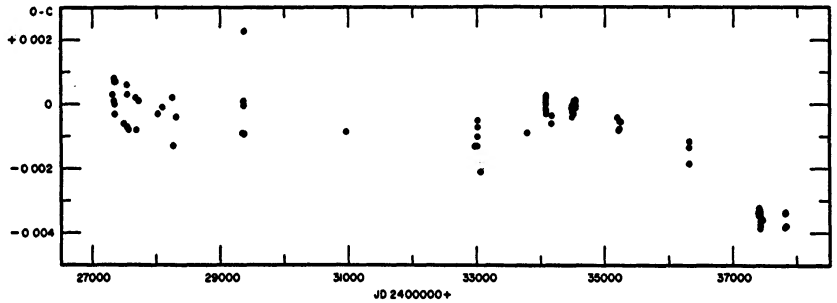


FIG. 7.—Residuals between the observed times of primary minimum of UX UMa and those computed from the elements given in the text. The residuals are expressed in decimals of a day. All available observations of the time of primary minimum are included in the figure.

TABLE 9

OBSERVED MINIMA OF UX URSAE MAJORIS, 1955–1962

Color	Helioc. JD 2430000+	O−C (day)	Color	Helioc. JD 2430000+	O−C (day)
b.....	5195.88322	−0 00041	*y*... ...	7428.69045	−0.00335
b.....	5217.91002	− .00081	*y*.....	7428.88661	− .00387
b.....	5223.81018	− .00079	*uv*.....	7428.88659	− .00388
b.....	5225.77715	− .00053	*y*.....	7432.82040	− .00350
b.....	5250.75440	− .00055	*uv*.... .	7432.82026	− .00364
y.....	6308.84563	− .00134	*y*.., ...	7436.75357	− .00376
y.....	6316.90865	− .00185	*uv*.... .	7436.75365	− .00368
y.....	6323.79282	− .00117	*y*.....	7436.95033	− .00367
ir.....	7399.97642	− .00336	*y*.....	7464.87774	− .00360
y.....	7402.92647	− .00338	*y*.....	7822.81987	− .00338
g.....	7403.71331	− .00323	*y*.....	7823.80320	− .00340
r.....	7403.71308	− .00346	*y*.....	7824.78614	− .00382
y.....	7427.70714	− .00330	*y*.....	7838.74984	−0.00379
y.....	7427.90373	−0.00338			

time when the period was lengthening did appear to be different, with a brighter shoulder following eclipse than preceding. It will be necessary to determine whether this form of light-curve is repeated when and if the period once again increases.

III. PHOTOMETRIC ELEMENTS

Photometric solutions of the eclipse-curve of UX UMa have been given by Zverev and Kukarkin (1937), Krat (1940), and Linnell (1950). The two former solutions were based on visual and photographic observations which have lower weight than modern photoelectric measures, and we shall not discuss them here. Linnell found that he could obtain a solution only by taking the level of unit intensity to be the brightness of the system, omitting the bright shoulders before and after eclipse. Even in this case, Linnell

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could obtain a solution only by a rather complicated system of weighting the observations, so that the results would appear to be of doubtful validity. Actually, it was found some years ago (Walker 1958) that if one applies Merrill's (1952, 1953*a*, *b*) nomographic solution to the descending branch of Linnell's (1950) light-curve, there is in fact no geometrical solution. It has been found in the case of the similar eclipsing system RW Tri (Walker 1963) that on some nights photometric solutions exist, while on other nights they do not, depending on the night-to-night distortions of the eclipse-curve by detached material within the system. In order to determine whether the same

TABLE 10

PHOTOMETRIC DATA

Date (U T)	JD 2430000 0+	Adopted Level of Maximum Light						Depth of Eclipse (mag)					
		Δm_{ir}	Δm_r	Δm_g	Δm_y	Δm_b	Δmu_v	*ir*	*r*	*g*	*y*	*b*	*uv*
1955													
March 29	5195 9					2 42				.		1 01	
April 20	5217 9					2 46						0 98	
26	5223 8					2 50:						0 87:	
28	5225 8					2 50						0 90	
May 23	5250 8					2 50:						0 93:	
1958													
April 15	6308 8*				2 73†		.	.			1 00		.
23	6316 9*				2 79						1 05		
30	6323 8				2 73:						0 95:		
1961													
April 10	7400 0*	4 66			. . .			0 82			. . .		
13	7402 9		. .	. . .	2 77:				. .	. . .	0 97:		.
14	7403 7		4.10:	2 85:	. . .			.	0 77:	0 99:	. . .		.
May 8	7427 7				2 80					.	1 00		
	7427 9	.			2 80	.	.	.	. .	.	1 02	.	
9	7428 7*				2 82		. . .	.	.		1 02	.	. . .
	7428 9*				2 82		1 79	.			1 09		1 17
13	7432 8				2 77		1 76	.	. .		1 03	.	1 10
17 .	7436 8*				2 87		1 84	.			1 17	. .	1 31
	7437 0*				2 87			. .	.	. .	1 15		. .
June 14 . . .	7464 9*	.	.		2 74‡			.	. .		1 06		.

* Photometric solution attempted (in yellow or infrared light only and in ultraviolet on May 17, 1961)

† Solution also attempted, using level of max light = 2 75

‡ Solution also attempted, using level of max light = 2 76

condition exists in UX UMa, photometric solutions of a number of the eclipse-curves have been attempted, again with the aid of Merrill's nomograms. Nights for which photometric solutions were attempted are indicated in Table 10, which lists the adopted level of maximum light and the observed depth of eclipse for the observations from 1955 to 1961. The level of unit intensity was taken as the brightness outside eclipse, the bright shoulders being disregarded. On three nights (April 10, May 9, and May 17, 1961), the problem of whether to take the level of unit intensity on the bright shoulder or outside is eliminated by the absence of the bright shoulder, the light of the system remaining completely constant outside eclipse except for the intrinsic variations. In addition to the solutions listed in Table 10, a photometric solution was attempted for the observations (in yellow light) of May 21, 1953 (Walker and Herbig 1954). The level of unit intensity was taken at $\Delta m_y = 2.71$, and only the first eclipse observed on this night was analyzed. In all cases, only the descending branches of the eclipse-curves were used,

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owing to the asymmetry of the rising branch. In every case it was found that there is no geometrical solution for the eclipse-curve. This result indicates (1) that the eclipse-curve is distorted, presumably by the effect of the luminous, detached material in the system (Walker and Herbig 1954); (2) that this distortion is relatively permanent, so that one does not, as in RW Tri (Walker 1963), find occasional nights when a geometrical solution may be obtained; (3) that the distortion is present in all wavelengths, from the ultraviolet to the infrared; and (4) that, as a result, we have absolutely no indication of the true photometric elements of this system.

IV. VARIATION OF ECLIPSE DEPTH WITH WAVELENGTH

It has been known for some time (Johnson *et al.* 1954; Walker and Herbig 1954) that the depth of eclipse decreases with increasing wavelength. This dependence of eclipse depth on wavelength is shown in Figure 8. In this figure, the dots represent means of the observations by Walker and Herbig (1954) in 1953, the cross represents the mean of the 1955 observations, and the circles represent means of the 1961 observations. In this

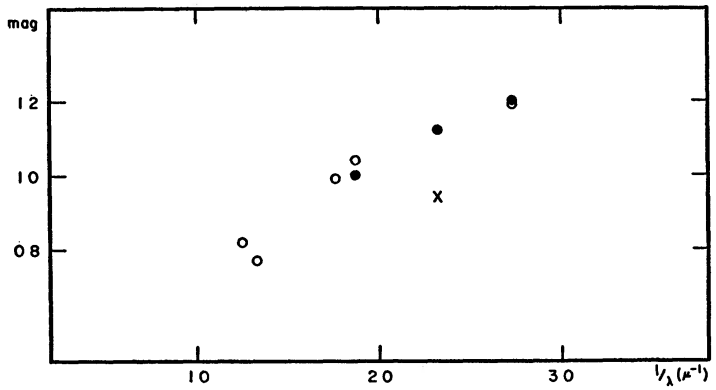


FIG. 8.—Depth of primary eclipse of UX UMa as a function of wavelength Dots represent observations made in 1953 (Walker and Herbig 1954); the cross, observations made in 1955; and the circles, observations in 1961.

figure the ordinate is the depth of eclipse in magnitudes, while the abscissa is the reciprocal of the wavelength in microns. The eclipse depths observed in 1953 agree quite well with those observed in 1961. The abnormally small eclipse depths observed in blue light in 1955 may be related to the large amount of intrinsic variability observed in this season and to the consequent difficulty in determining the level of maximum light. It may also be that the large intrinsic variations indicate the presence of an unusually large amount of detached material in the system, the radiation from which fills in the eclipse-curve.

There are two possible explanations for this variation of eclipse depth with wavelength: (1) that the detached material in the system is relatively red in color and fills in the eclipse-curve more and more as one goes to longer wavelengths and (2) that the eclipse-curve is filled in by light from a red, late-type companion star. As mentioned earlier, there is no evidence of a secondary eclipse in infrared light. If the elements given by Linnell (1950) were correct and the eclipse were a central one with two stars of about the same size, then it is easy to show that if one assumes the red companion to contribute no light in the ultraviolet and to be completely responsible for the decrease in eclipse depth with wavelength, then one should observe a secondary eclipse having a depth of about 0.16 mag. in infrared light. However, as discussed in the preceding section, we have no knowledge of the correct photometric elements. Consequently, it may be possible that the bright component of the system is extremely small compared with its companion, as appears to be the case for DQ Her (Kraft 1959; Walker 1961). In such a case

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the depth of secondary eclipse would probably be too small to be detected, even in the infrared. It appears that no additional information regarding the secondary star can be obtained from photometric observations. However, it may be possible to detect the companion star spectroscopically by observing the system in the infrared during primary minimum. Such an observational test is clearly very desirable, as it may enable us to learn something regarding the nature of the companion star, or at least to show whether the filling-in of the eclipse-curve toward longer wavelengths is caused by light from the companion or from a detached cloud.

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