KODAIKANAL OBSERVATORY

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# Two Colour Photoelectric observations of the eclipsing variable UW Canis Majoris

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**Abstract**

Photoelectric light curves of the eclipsing binary UW Canis Majoris have been obtained in the blue and yellow. A new ephemeris is given for the system. The depth of the primary minimum is about $0^m.45$ in B and $0^m.47$ in V and that of the secondary is about $0^m.43$ in B and $0^m.42$ in V.

## Introduction

The variability of UW Canis Majoris was discovered by Frost (1906). Later spectroscopic orbits of this system have been published by several authors. Gaposchkin (1936) first observed the light variation from Harvard patrol plates and published its photographic light curve. Struve (1958) has given a schematic model of UW CMa with gas streaming from the the primary that encircles the secondary and envelopes the whole system. The only photoelectric observations that were carried out so far on this system are those by Elvey and Rudnick and their results were utilized by Kuiper (1938) and by Sahade (1959) who has given an alternate model of UW CMa. Seyfert (1941) has obtained a photographic light curve of this star and made three solutions for the ellipticity and eclipses of the components.

The star UW CMa is one of the massive systems known with O7f and O9III stars as components. The present project has been undertaken mainly to obtain accurate photoelectric light curves of UW CMa in B and V of the U, B, V system and to improve the available ephemeris. The results of an analysis of the light curve will be published later.

## The Observations

The star was observed photoelectrically at Kodaikanal between January 1964 and March 1966 with a photometer attached to the 20cm Cooke refractor. The photomultiplier tube used was an unrefrigerated RCA 1P21. The out-put from the photomultiplier was amplified by a linear D.C. amplifier and recorded on a Brown recording

potentiometer. The observations were taken in two colours. The blue deflections were obtained through a Corning 5030 and 2mm Schott GG13 filter combination and the yellow deflections through a Corning 3384 filter. These are the standard filters of the UBV system.

30 CMa was observed as comparison star. The following are the details of the variable and the comparison star as given in the Yale Bright Star Catalogue.

| Star | HD | RA (1900) | Dec. (1900) | Vis. Mag. | Spectral Class |
|---|---|---|---|---|---|
| 29 UW CMa . . . | 57060 | $7^h\ 14^m31^s$ | -24°23′ | 4.5 † | O7f |
| 30τ CMa . . . | 57061 | 7 14 34 | -24 46 | 4.39* | O9III |

*Visual magnitude in the standard UBV system.

†Original HR visual magnitude.

The variable was observed for 37 days during the period between January 1964 and March 1966 and 221 points in yellow and 208 points in blue were obtained. The values have been reduced to magnitudes outside the atmosphere by applying suitable extinction corrections. These have been converted into standard B, V magnitudes using linear transformations.

### New ephemeris

It is seen that the primary minimum occurs about 2.5 hours earlier than the computed epoch with the Gaposchkin (1936) ephemeris (JD 2426326.76 + 4.3934E) From the present set of observations an exact epoch of primary minimum was determined to be JD 2439164.176. Harper's (1917) epoch of JD 242482.207 combined with a period of 4.3934 seems to be nearly correct as can be inferred from Soyfert's (1941) light curve of UW CMa, who has computed phases with the above value. Hence, between Harper's (1917) epoch and the present epoch 3228 cycles have elapsed from which an accurate period was computed.

The new ephemeris is JD (Hel) 2439164.176 + 4.393423E.

It is with this new ephemeris that all the phases (heliocentric) were computed. These are given in Table I for B magnitudes and Table II for V magnitudes. The individual points are plotted in Figures 1 and 2 for getting the light curves of UW CMa in blue and yellow respectively.

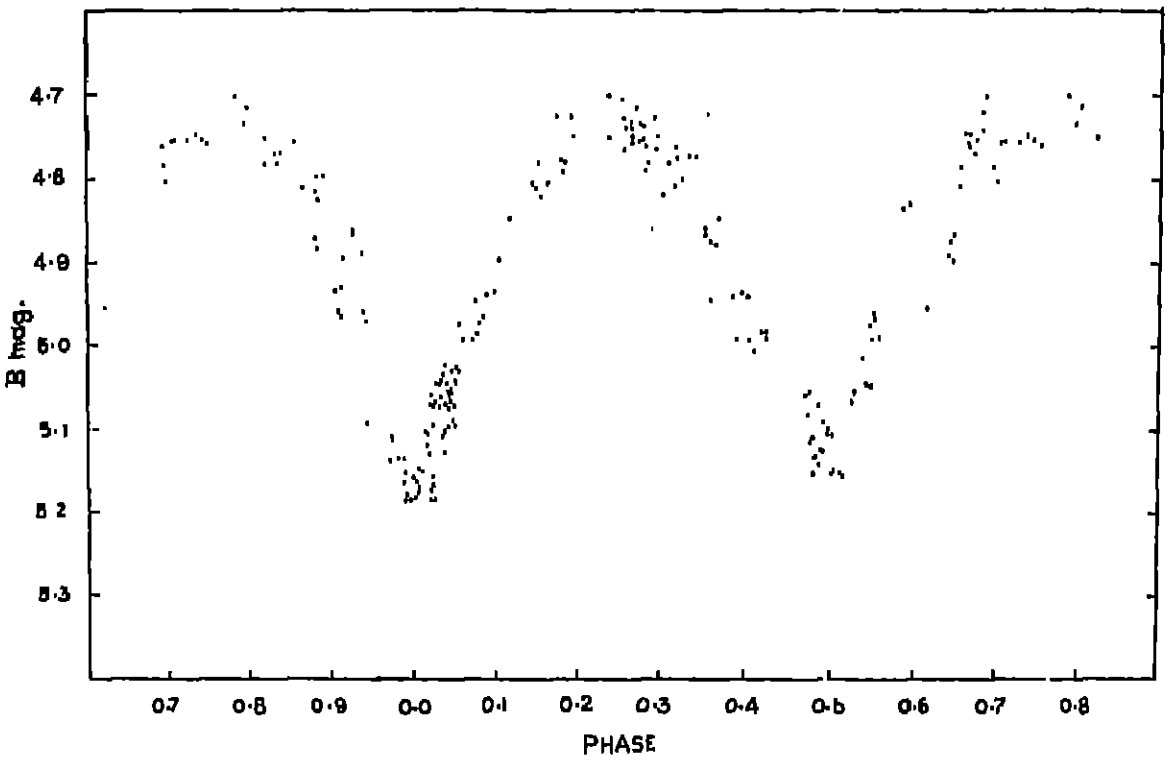


*Figure 1*—Light curve of UW CMa in blue.

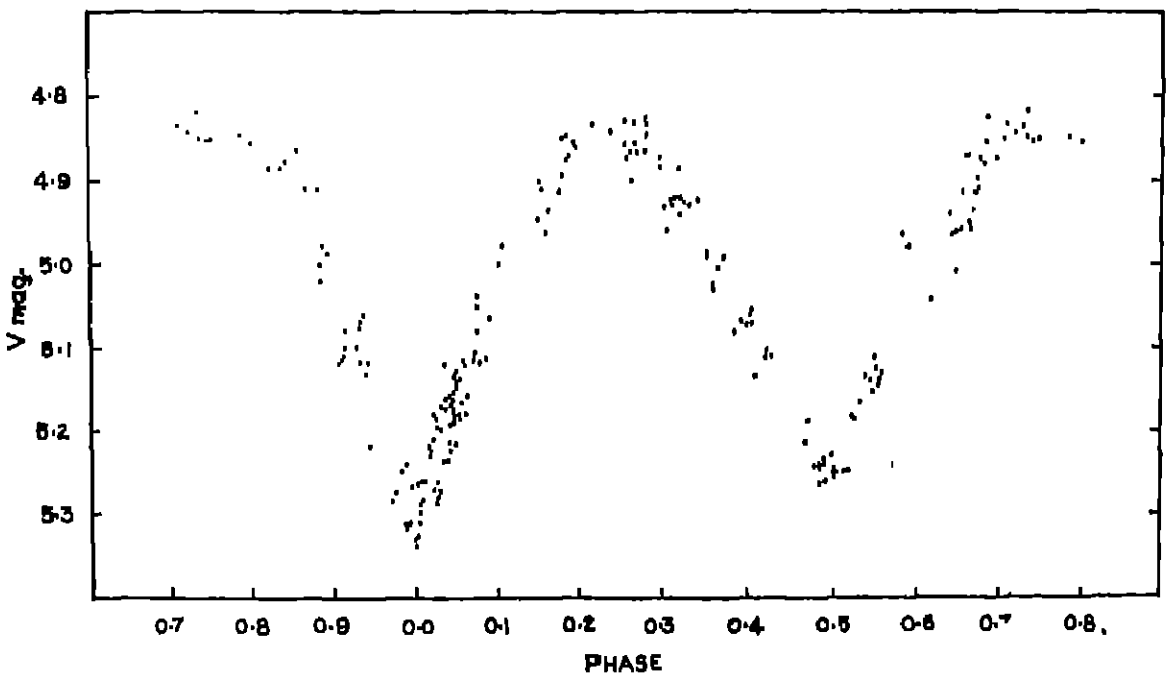


*Figure 2*—Light curve of UW CMa in yellow.

## TABLE I

### *Blue observations of U W Canis Majoris*

| J.D. Heliocentric 2438000+ | Phase | B |
|---|---|---|
| 411·2145 | 0·0162 | 4·955 |
| 413·2240 | 0·0736 | 4·914 |
| 414·1032 | 0·2797 | 4·756 |
| 414·2928 | 0·3169 | 4·759 |
| 415·2025 | 0·5239 | 5·088 |
| 415·2991 | 0·5509 | 5·096 |
| 415·2636 | 0·5378 | 5·016 |
| 415·2017 | 0·5419 | 5·045 |
| 415·3053 | 0·5473 | 5·048 |
| 416·1602 | 0·7419 | 4·752 |
| 416·1997 | 0·7509 | 4·757 |
| 416·3470 | 0·7841 | 4·700 |
| 425·1809 | 0·7851 | 4·732 |
| 425·2010 | 0·7097 | 4·715 |
| 425·2899 | 0·8200 | 4·750 |
| 426·1746 | 0·0213 | 5·173 |
| 426·2190 | 0·0316 | 5·061 |
| 426·2581 | 0·0902 | 5·053 |
| 426·2719 | 0·0135 | 5·031 |
| 427·1205 | 0·2366 | 4·749 |
| 427·2010 | 0·2519 | 4·727 |
| 427·2274 | 0·2610 | 4·738 |
| 427·2434 | 0·2646 | 4·733 |
| 427·2489 | 0·2659 | 4·740 |
| 427·3017 | 0·2779 | 4·735 |
| 427·3156 | 0·2810 | 4·761 |
| 428·1469 | 0·4702 | 5·057 |
| 428·1635 | 0·4740 | 5·054 |
| 428·2121 | 0·4851 | 5·069 |
| 428·2295 | 0·4890 | 5·128 |
| 428·2759 | 0·4992 | 5·152 |
| 428·2851 | 0·5017 | 5·149 |
| 428·3902 | 0·5120 | 5·152 |
| 428·3494 | 0·5150 | 5·150 |
| 429·1371 | 0·6956 | 4·788 |
| 429·1509 | 0·6990 | 4·802 |
| 429·1809 | 0·7056 | 4·755 |
| 429·1920 | 0·7081 | 4·756 |
| 429·2705 | 0·7260 | 4·755 |
| 429·3052 | 0·7339 | 4·748 |
| 431·1162 | 0·1461 | 4·806 |
| 431·1315 | 0·1496 | 4·810 |
| 431·1426 | 0·1521 | 4·779 |
| 431·1613 | 0·1563 | 4·817 |
| 431·1843 | 0·1616 | 4·006 |
| 431·2398 | 0·1742 | 4·725 |
| 431·2590 | 0·1772 | 4·783 |
| 431·2634 | 0·1796 | 4·778 |
| 431·2752 | 0·1823 | 4·790 |
| 431·2940 | 0·1866 | 4·760 |
| 431·3168 | 0·1921 | 4·724 |
| 431·3280 | 0·1943 | 4·750 |
| 432·2580 | 0·4018 | 4·992 |
| 432·2704 | 0·4088 | 5·004 |
| 432·3190 | 0·4199 | 4·983 |
| 432·3329 | 0·4230 | 4·982 |
| 432·3419 | 0·4251 | 4·990 |
| 434·0828 | 0·8212 | 4·782 |
| 434·1314 | 0·8324 | 4·767 |
| 434·1397 | 0·8343 | 4·779 |
| 434·1571 | 0·8382 | 4·767 |
| 434·2244 | 0·8535 | 4·754 |
| 434·2797 | 0·8648 | 4·809 |
| 434·3507 | 0·8798 | 4·870 |

| J.D. Heliocentric 2438000+ | Phase | B |
|---|---|---|
| 434·3550 | 0·8833 | 4·882 |
| 435·0765 | 0·0475 | 5·098 |
| 435·0870 | 0·0500 | 5·010 |
| 435·0974 | 0·0523 | 5·050 |
| 435·1013 | 0·0538 | 4·972 |
| 435·1751 | 0·0699 | 4·992 |
| 435·1967 | 0·0749 | 4·986 |
| 435·2092 | 0·0777 | 4·978 |
| 435·2974 | 0·0978 | 1·981 |
| 435·3117 | 0·1017 | 4·896 |
| 435·3765 | 0·1158 | 4·817 |
| 436·0918 | 0·2786 | 4·733 |
| 436·0987 | 0·2802 | 4·736 |
| 436·1698 | 0·2963 | 4·706 |
| 436·2590 | 0·3169 | 4·808 |
| 437·3069 | 0·5550 | 4·966 |
| 437·3116 | 0·5569 | 4·990 |
| 442·0719 | 0·6404 | 4·882 |
| 442·0798 | 0·6415 | 4·875 |
| 442·0902 | 0·6439 | 4·898 |
| 442·0902 | 0·6160 | 4·868 |
| 442·1784 | 0·6640 | 4·736 |
| 442·1847 | 0·6654 | 4·760 |
| 459·2122 | 0·5479 | 4·971 |
| 459·2177 | 0·5492 | 1·992 |
| 459·2575 | 0·5514 | 4·959 |
| 461·0997 | 0·9707 | 5·151 |
| 461·1016 | 0·9718 | 5·110 |
| 461·1088 | 0·9728 | 5·113 |
| 461·1129 | 0·9737 | 5·113 |
| 464·1037 | 0·6545 | 4·808 |
| 464·1099 | 0·6559 | 4·784 |
| 464·1291 | 0·6603 | 4·741 |
| 464·1342 | 0·6614 | 4·744 |
| 464·1717 | 0·6700 | 4·770 |
| 464·1815 | 0·6722 | 4·753 |
| 464·2106 | 0·6787 | 4·710 |
| 464·2211 | 0·6812 | 4·717 |
| 464·2329 | 0·6839 | 4·699 |
| 465·1037 | 0·8821 | 4·816 |
| 465·1086 | 0·8832 | 4·826 |
| 465·1090 | 0·8833 | 4·798 |
| 465·1942 | 0·8990 | 4·791 |
| 465·2092 | 0·9061 | 4·995 |
| 465·2127 | 0·9067 | 4·958 |
| 465·2204 | 0·9087 | 4·929 |
| 465·2231 | 0·9093 | 4·985 |
| 465·2903 | 0·9123 | 4·894 |
| 470·1027 | 0·0199 | 5·184 |
| 470·1096 | 0·0215 | 5·164 |
| 470·1124 | 0·0221 | 5·184 |
| 470·1166 | 0·0231 | 5·155 |
| 470·1184 | 0·0237 | 5·095 |
| 470·1201 | 0·0239 | 5·072 |
| 470·1228 | 0·0245 | 5·068 |
| 470·1367 | 0·0277 | 5·044 |
| 470·1402 | 0·0285 | 5·075 |
| 470·1430 | 0·0291 | 5·042 |
| 470·1714 | 0·0356 | 5·123 |
| 470·1742 | 0·0362 | 5·109 |
| 470·1784 | 0·0371 | 5·046 |
| 470·1819 | 0·0379 | 5·022 |
| 470·1941 | 0·0408 | 5·107 |
| 470·1951 | 0·0409 | 5·097 |

| J.D. Heliocentric | Phase | B |
|---|---|---|
| 2438000+ | | |
| 470·1978 | 0·0416 | 5·068 |
| 470·2008 | 0·0122 | 5·061 |
| 470·2041 | 0 0130 | 5·075 |
| 470·2089 | 0·0411 | 5·089 |
| 470·2374 | 0·0503 | 5·078 |
| 470·2409 | 0·0511 | 5·046 |
| 471·1966 | 0·2572 | 1·701 |
| 471·1702 | 0·2618 | 4 755 |
| 471·1811 | 0·2654 | 4·782 |
| 471·2172 | 0·2731 | 4·714 |
| 472·1161 | 0 1789 | 5·152 |
| 472·1251 | 0·4803 | 5 132 |
| 472·1524 | 0·4819 | 5 124 |
| 472·1359 | 0·4871 | 5·091 |
| 172·1928 | 0·4956 | 5 105 |
| 472·1956 | 0·4909 | 5·100 |
| 472·2071 | 0·4989 | 5·108 |
| 439000+ | | |
| 155·3864 | 0·9880 | 5·164 |
| 155·3406 | 0·9890 | 5·179 |
| 155·3189 | 0·9908 | 5·186 |
| 155 3816 | 0·9983 | 5·186 |
| 155 3837 | 0·0002 | 5·182 |
| 155·3962 | 0·0016 | 5·163 |
| 155·4009 | 0·0025 | 5·175 |
| 155·4024 | 0·0030 | 5·178 |
| 155·4107 | 0·0019 | 5·167 |
| 161·1169 | 0·3037 | 1·020 |
| 161·1502 | 0·3119 | 1·779 |
| 161·1849 | 0·3190 | 1·776 |
| 161·2118 | 0·3252 | 1·801 |
| 161·2505 | 0·3351 | 1·772 |
| 161·2848 | 0·3418 | 1·779 |
| 161·3336 | 0·3330 | 1·867 |
| 161·3627 | 0·8597 | 4·941 |
| 164·0940 | 0·9819 | 5·135 |
| 164·1079 | 0·9845 | 5·135 |
| 164·1384 | 0·9814 | 5·152 |
| 164·1794 | 0·0008 | 5·156 |
| 164·1975 | 0·0019 | 5·148 |

| J.D. Heliocentric | Phase | B |
|---|---|---|
| 2439000+ | | |
| 161·2111 | 0·0087 | 5·150 |
| 164 2969 | 0·0137 | 5·108 |
| 164·2419 | 0·0150 | 5 104 |
| 164·2451 | 0·0158 | 5·118 |
| 161·2556 | 0·0182 | 5·129 |
| 161·2611 | 0·0201 | 5·071 |
| 161·2690 | 0·0212 | 5·057 |
| 161·2870 | 0·0238 | 5·046 |
| 161·3155 | 0·0318 | 5·092 |
| 161·3419 | 0 0378 | 5·015 |
| 161·3600 | 0 0419 | 5·057 |
| 164·3697 | 0 0441 | 5·055 |
| 170·1202 | 0·9550 | 4·860 |
| 170·1445 | 0 9585 | 4 871 |
| 170·1702 | 0·9644 | 4·877 |
| 170·1875 | 0·9689 | 4·845 |
| 170·2018 | 0·9852 | 4·940 |
| 170·2696 | 0·9915 | 4 991 |
| 170·3180 | 0·9982 | 4·994 |
| 170·3408 | 0·1032 | 4·911 |
| 171·1414 | 0·5861 | 1·833 |
| 171·1708 | 0·5921 | 4·828 |
| 173·1027 | 0·0318 | 5·107 |
| 173·1256 | 0·0371 | 5 070 |
| 173·1519 | 0·0429 | 5·055 |
| 173·1805 | 0·0496 | 5·026 |
| 173·2124 | 0·0560 | 4·998 |
| 173·2200 | 0·0815 | 4 965 |
| 173·3451 | 0·0870 | 4·937 |
| 209·1035 | 0·2375 | 4·700 |
| 209·2264 | 0·2511 | 4·766 |
| 210·1718 | 0·4692 | 5·083 |
| 210·1864 | 0·4726 | 5·112 |
| 210·2003 | 0·4776 | 5·110 |
| 210·2278 | 0·4820 | 5·142 |
| 212·1703 | 0.9260 | 4·865 |
| 212·1018 | 0·9267 | 4·863 |
| 212·2186 | 0·9331 | 4·887 |
| 212·2318 | 0·9381 | 4 937 |
| 212·2456 | 0·9413 | 4 971 |
| 212·2505 | 0·9424 | 5·099 |

# TABLE II

## *Yellow observations of UW Canis Majoris*

| J.D. Heliocentric | Phase | V |
|---|---|---|
| 2438000+ | | |
| 411·2129 | 0·6159 | 5·042 |
| 413·2261 | 0·0711 | 5·079 |
| 414·2060 | 0·2971 | 4·806 |
| 414·2240 | 0·3012 | 4·991 |
| 414·5011 | 0·3187 | 4·885 |
| 415·2004 | 0·5294 | 5·102 |
| 415·2296 | 0·5373 | 5·106 |
| 415·2615 | 0·5379 | 5·133 |
| 415·2809 | 0·5176 | 5·150 |
| 415·3067 | 0·5416 | 5·151 |
| 416·1622 | 0·7424 | 4·878 |
| 416·2011 | 0·7512 | 4·951 |
| 416·3483 | 0·7017 | 4·848 |
| 425·2024 | 0·8000 | 4·996 |
| 425·3260 | 0·8282 | 4·900 |
| 426·1767 | 0·0210 | 5·281 |
| 426·2212 | 0·0519 | 5·161 |
| 426·2545 | 0·0905 | 5·166 |
| 426·2752 | 0·0115 | 5·182 |
| 426·3106 | 0·0901 | 5·157 |
| 427·2031 | 0·2054 | 4·872 |
| 427·2281 | 0·2011 | 4·961 |
| 427·2552 | 0·2673 | 4·861 |
| 427·3031 | 0·2702 | 4·825 |
| 427·3170 | 0·2814 | 5·031 |
| 428·1239 | 0·4050 | 5·215 |
| 428·1476 | 0·4704 | 5·187 |
| 428·1649 | 0·4713 | 5·105 |
| 428·2185 | 0·4851 | 5·206 |
| 428·2760 | 0·4996 | 5·251 |
| 428 2857 | 0·5018 | 5·249 |
| 428·3316 | 0·5123 | 5·249 |
| 428 3455 | 0·5155 | 5·247 |
| 428·3854 | 0·5245 | 5·188 |
| 429·1392 | 0·6961 | 5·075 |
| 429·1823 | 0·7059 | 1·054 |
| 429·1934 | 0·7004 | 1·036 |
| 429·2508 | 0·7214 | 1·043 |
| 429·2680 | 0·7288 | 4·856 |
| 429·2948 | 0·7315 | 1·017 |
| 429·3066 | 0·7342 | 4·850 |
| 431·1190 | 0·1467 | 1·945 |
| 431·1329 | 0·1499 | 1·899 |
| 431·1412 | 0·1510 | 1·010 |
| 431·1620 | 0·1505 | 1·062 |
| 431·1636 | 0·1614 | 4·996 |
| 431·2412 | 0·1715 | 4·012 |
| 431·2528 | 0·1771 | 1·080 |
| 431·2641 | 0·1707 | 4·849 |
| 431·2759 | 0·1824 | 4·876 |
| 431·2928 | 0·1862 | 4·871 |
| 431·3197 | 0·1924 | 4·855 |
| 431·3279 | 0·1911 | 4·860 |
| 432·2502 | 0·4042 | 5·050 |
| 432·2725 | 0·4003 | 5·139 |
| 432·3201 | 0·4202 | 5·100 |
| 432·3343 | 0·4293 | 5·102 |
| 432·3475 | 0·4263 | 5·109 |
| 434·0842 | 0·8210 | 4·885 |
| 434·1411 | 0·8346 | 4·884 |
| 434·1585 | 0·8385 | 4·878 |
| 434·2258 | 0·8539 | 4·862 |
| 434·2758 | 0·8652 | 4·909 |
| 434·3418 | 0·8803 | 4·910 |

| J.D. Heliocentric | Phase | V |
|---|---|---|
| 2438000+ | | |
| 435·0780 | 0·0480 | 5·216 |
| 435·0847 | 0·0505 | 5·182 |
| 435·0916 | 0·0516 | 5·161 |
| 435·1057 | 0·0541 | 5·116 |
| 435·1750 | 0·0701 | 5·105 |
| 435·1980 | 0·0752 | 5·117 |
| 435·2112 | 0·0782 | 5·093 |
| 435·3001 | 0·0984 | 4·999 |
| 435·3190 | 0·1029 | 4·978 |
| 436·0901 | 0·2783 | 4·865 |
| 436·1001 | 0·2805 | 4·844 |
| 436·1710 | 0·2966 | 4·872 |
| 436·2612 | 0·3172 | 4·919 |
| 437·3095 | 0·5544 | 5·141 |
| 437·3167 | 0·5574 | 5·150 |
| 442·0720 | 0·6400 | 4·941 |
| 442·0819 | 0·6420 | 4·965 |
| 442·0923 | 0·6444 | 5·007 |
| 442·1016 | 0·6465 | 4·962 |
| 442·1791 | 0·6642 | 4·949 |
| 442·1900 | 0·6657 | 4·958 |
| 442·2152 | 0·6724 | 4·909 |
| 442·2660 | 0·6841 | 4·824 |
| 458·2450 | 0·5486 | 5·124 |
| 459·2503 | 0·5498 | 5·113 |
| 459·2602 | 0·5520 | 5·146 |
| 461·1011 | 0·9710 | 5·262 |
| 461·1067 | 0·9729 | 5·273 |
| 464·1051 | 0·6548 | 4·907 |
| 464·1092 | 0·6557 | 4·913 |
| 464·1308 | 0·6606 | 4·871 |
| 464·1349 | 0·6616 | 4·871 |
| 464·1721 | 0·6701 | 4·916 |
| 464·1829 | 0·6725 | 4·897 |
| 464·2002 | 0·6761 | 4·876 |
| 464·2113 | 0·6790 | 4·877 |
| 464·2238 | 0·6818 | 4·855 |
| 464·2342 | 0·6842 | 4·822 |
| 465·1065 | 0·8827 | 5·020 |
| 465·1105 | 0·8832 | 5·000 |
| 465·1204 | 0·8859 | 4·981 |
| 465·1356 | 0·8894 | 4·986 |
| 465·2106 | 0·9064 | 5·118 |
| 465·2141 | 0·9072 | 5·114 |
| 465·2217 | 0·9089 | 5·111 |
| 465·2252 | 0·9097 | 5·099 |
| 465·2377 | 0·9126 | 5·079 |
| 470·1011 | 0·0202 | 5·270 |
| 470·1110 | 0·0218 | 5·286 |
| 470·1117 | 0·0220 | 5·279 |
| 470·1138 | 0·0224 | 5·277 |
| 470·1180 | 0·0234 | 5·260 |
| 470·1214 | 0·0242 | 5·195 |
| 470·1381 | 0·0280 | 6·198 |
| 470·1437 | 0·0292 | 5·167 |
| 470·1770 | 0·0368 | 5·284 |
| 470·1798 | 0·0375 | 5·222 |
| 470·1958 | 0·0411 | 5·190 |
| 470·1902 | 0·0419 | 5·174 |
| 470·2027 | 0·0427 | 5·178 |
| 470·2062 | 0·0435 | 5·179 |
| 470·2103 | 0·0444 | 5·187 |
| 470·2981 | 0·0507 | 5·179 |
| 471·1918 | 0·2542 | 4·850 |

| J.D. Heliocentric | Phase | V |
|---|---|---|
| 2438000+ | | |
| 471·1352 | 0·2519 | 4·851 |
| 471·1718 | 0·2639 | 4·851 |
| 471·1801 | 0·2667 | 4·829 |
| 472·1282 | 0·1809 | 5·264 |
| 472·1311 | 0·1821 | 5·245 |
| 472·1490 | 0·4857 | 5·239 |
| 472·1515 | 0·4862 | 5·291 |
| 472·1942 | 0·4960 | 5·227 |
| 472·1976 | 0·4967 | 5·217 |
| 472·2011 | 0·4976 | 5·256 |
| 2439000+ | | |
| 129·1642 | 0·0309 | 5·119 |
| 129·1670 | 0·0315 | 5·158 |
| 129·2233 | 0·0418 | 5·140 |
| 129·2316 | 0·0162 | 5·111 |
| 129·2908 | 0·0596 | 5·178 |
| 129·2969 | 0·0611 | 5·116 |
| 129·3110 | 0·0791 | 5·050 |
| 129·3850 | 0·0736 | 5·037 |
| 130·3020 | 0·3103 | 4·925 |
| 130·3048 | 0·3110 | 4·931 |
| 130·4017 | 0·3125 | 4·919 |
| 130·4397 | 0·3198 | 4·939 |
| 153·2032 | 0·4051 | 5·051 |
| 153·3351 | 0·0877 | 5·300 |
| 153·3395 | 0·9885 | 5·318 |
| 153·3476 | 0·0901 | 5·309 |
| 153·3802 | 0·0968 | 5·337 |
| 153·3817 | 0·0940 | 5·329 |
| 155·3071 | 0·9951 | 5·326 |
| 155·3960 | 0·0018 | 0·307 |
| 155·3902 | 0·0021 | 5·290 |
| 153·4011 | 0·0032 | 5·298 |
| 155·4111 | 0·0051 | 5·283 |
| 161·1204 | 0·3015 | 4·939 |
| 161·1330 | 0·3119 | 4·919 |
| 161·1856 | 0·3193 | 4·915 |
| 161·2184 | 0·9277 | 4·924 |
| 161·2579 | 0·3358 | 4·927 |
| 161·2836 | 0·9421 | 4·922 |
| 161·3330 | 0·3513 | 4·904 |
| 161·3611 | 0·3593 | 5·021 |
| 164·0926 | 0·9810 | 5·210 |
| 164·1126 | 0·9856 | 5·239 |
| 161·1990 | 0·9918 | 5·268 |
| 161·1800 | 0·0011 | 5·203 |
| 161·1995 | 0·0059 | 5·259 |

| J.D. Heliocentric | Phase | V |
|---|---|---|
| 2439000+ | | |
| 161·2155 | 0·0000 | 5·261 |
| 161·2377 | 0·0140 | 5·220 |
| 164·2133 | 0·0159 | 5·223 |
| 161·2160 | 0·0161 | 5·230 |
| 164·257? | 0·0185 | 5·211 |
| 161·2862 | 0·0209 | 5·182 |
| 164·2701 | 0·0215 | 5·183 |
| 161·2891 | 0·0237 | 5·175 |
| 161·3169 | 0·0321 | 5·173 |
| 164·3493 | 0·0301 | 5·150 |
| 161·9613 | 0·0122 | 5·159 |
| 164·3711 | 0·0111 | 5·128 |
| 170·1210 | 0·9539 | 4·981 |
| 170·1461 | 0·3590 | 5·027 |
| 170·1709 | 0·9645 | 5·001 |
| 170·1689 | 0·9686 | 4·991 |
| 170·2632 | 0·9855 | 5·080 |
| 170·2910 | 0·3919 | 5·068 |
| 170·3209 | 0·9987 | 5·072 |
| 170·3171 | 0·4036 | 5·071 |
| 171·1150 | 0·5061 | 4·964 |
| 171·1722 | 0·5924 | 4·981 |
| 173·0077 | 0·0281 | 5·270 |
| 173·1014 | 0·0322 | 5·231 |
| 173·1268 | 0·0372 | 5·212 |
| 173·1527 | 0·0192 | 5·160 |
| 173·1812 | 0·0197 | 5·130 |
| 173·2130 | 0·0371 | 5·110 |
| 173·2569 | 0·0669 | 5·115 |
| 173·3222 | 0·0818 | 5·113 |
| 173·3172 | 0·0975 | 5·067 |
| 178·1573 | 0·1029 | 1·040 |
| 178·3080 | 0·2166 | 1·032 |
| 209·1539 | 0·2190 | 1·010 |
| 209·2278 | 0·2511 | 1·872 |
| 209·2592 | 0·2682 | 1·901 |
| 210·2097 | 0,4779 | 5·248 |
| 210·2283 | 0·4822 | 5·240 |
| 210·2193 | 0·4869 | 5·260 |
| 212·1700 | 0·9201 | 5·099 |
| 212·1831 | 0·9270 | 5·117 |
| 212·1929 | 0·9298 | 5·067 |
| 212·1956 | 0·9299 | 5·074 |
| 212·2200 | 0·9351 | 5·061 |
| 212·2351 | 0·9384 | 5·130 |
| 212·2169 | 0·9111 | 5·117 |
| 212·2512 | 0·9425 | 5·217 |

The zero phase given by Struve *et al* (1958) refers to the epoch of the periastron passage. Since the phase of the periastron passage was given, the epoch of the corresponding primary minimum can be known. Combining the Struve *et al*, (1958) epoch of the primary minimum with the new period of 4.393423, we find a good agreement with the present epoch.

## The light curves

The present light curves shows the same anomalies already pointed out by Seyfert (1941). From the Figures 1 and 2, it can be noted that the depth of the primary minimum is about $0^m.45$ in B and $0^m.47$ in V and that of the secondary is about $0^m.43$ in B and $0^m.42$ in V. The (B-V) colour at primary minimum is $-0^m.13$ and at secondary minnimum it is $-0^m.10$. It is also seen that the duration of the secondary minimum is more than that of the primary minimum. The general shape of the light curve indicates opacity effects caused by electron scattering in an extended envelope.

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