A VISUAL LIGHT CURVE OF THE ECLIPSING VARIABLE 143025 AD BOOTIS

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INTRODUCTION

AD Bootis, which is situated about four degrees southwest of Epsilon Bootis, is an eighth magnitude eclipsing binary that has been almost entirely neglected since its discovery by Strohmeier (GCVS, 1969). In 1969 the Swiss Observers of Eclipsing Variables (BBSAG) began observing this star with the purpose of obtaining minimum timings. Most recently, members of the Willingboro (N.J.) Astronomical Society's Eclipsing Binary Program (WASEBPRO) have conducted a study of the system in order to construct the full light curve, revise the light elements given by Strohmeier (if necessary) and attempt a solution of the system. This solution, currently in progress, will be discussed in a subsequent paper.

THE OBSERVATIONS

309 magnitude estimates of AD Bootis were made by the observers listed below during the interval from Julian Day 2440700 to J.D. 2441850 both at random and during observing runs. These observers and their equipment are:

Observer	Location	Instrument
R. Diethelm	Winterthur, Switzerland	15cm refl.
R. Germann	Im Nahren, Switzerland	15 & 17.5cm "
M. Jargelius	Johanneshov, Sweden	7.5cm rfr.
K. Locher	Grüt-Wetzikon, Switzerland	10 & 12.5cm refl.
H. Peter	Oetelfingen, Switzerland	25cm "
R. Sötebeer	Wageningen, The Netherlands	15cm "
D. Van Buren	Wageningen, The Netherlands	15cm "

The estimates were made using a chart prepared by R. Diethelm for the BBSAG and a magnitude sequence of four stars by Dr. L. Baldinelli observing in V of UBV with the 35cm reflector at Bologna, Italy. Dr. Baldinelli (1973) states concerning the accuracy of his measurements, "We have not corrected our UBV instrumental system, but the method used and the aims of the work can assure a good agreement with UBV international magnitudes under a few hundredths of a magnitude."

This chart is shown in Figure 1. The symbols R, RX, UV, RY, and W denote other variables in the field.

PERIOD REVISION

Recent minimum timings made by the BBSAG and WASEBPRO observers of AD Bootis, and published in Orion and the BBSAG Bulletin (1970, 1971, 1972, a, b, 1973, a, b,) were used in determining whether or not a change in period had taken place. These timings, all heliocentric, are shown in Table 1, column I and plotted on the graph of $O-C_I$ (fraction of a day) versus

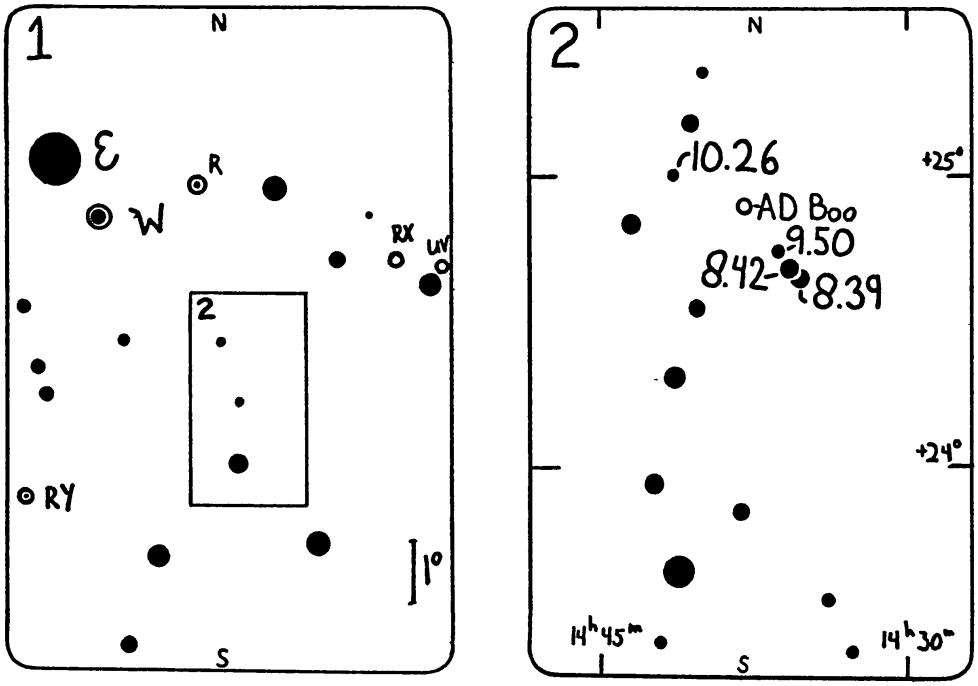

Figure 1. Finder Charts for AD Bootis.

Julian Date, Figure 2. The line of best fit as found by least squares is shown as the dashed line. All points were given equal weight. The slope of this line corresponds to a period length of 1.034397 days as compared to Strohmeier's 1.034399 days (GCVS, 1969). The small discrepancy is within the errors introduced in the actual estimates and in data handling. The elements corresponding to the dashed line are:

JD (hel) pri. min. = 2441135.498 + 1.034397 E

Since we conclude that the period has not changed measurably, we are permitted to refine the period by using the epoch of Strohmeier (GCVS, 1969) and the epoch of the above elements, which are separated by 14885 cycles. The resulting period is $1^d.034401 \pm 0^d.000001$. Hence the light elements:

JD (hel.) pri. min. = 2441135.498 + 1.034401 E

are the best available to date for AD Bootis.

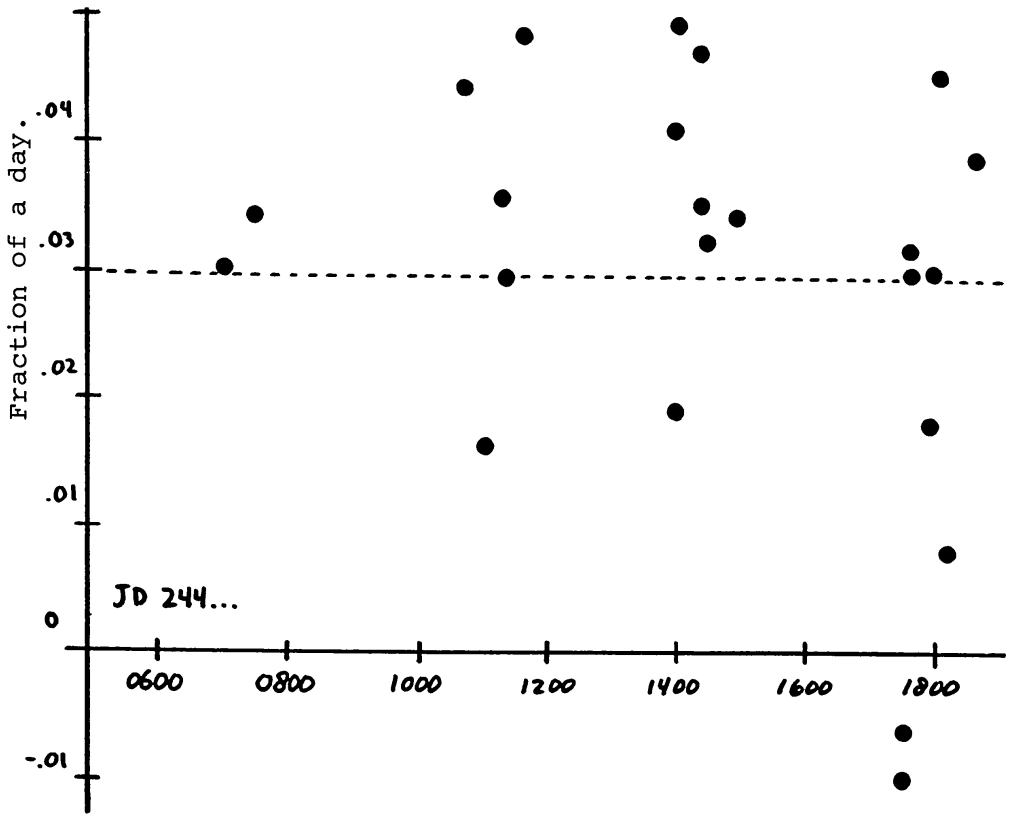

Figure 2. O-C Values for observed minima since 1969.

TABLE 1. O-C VALUES
(all units days)

Julian Day	$O-C_I$	$O-C_{II}$
2440711.396	+0.030	+0.001
0745.534	+0.034	+0.006
1071.381	+0.044	+0.015
1104.453	+0.016	-0.013
1134.446	+0.035	+0.006
1135.498	+0.029	0.000
1135.503	+0.034	+0.006
1162.412	+0.048	+0.019
1402.385	+0.041	+0.013
1402.393	+0.049	+0.020
1405.466	+0.019	-0.009
1433.423	+0.047	+0.019
1434.442	+0.032	+0.003
1494.440	+0.034	+0.006
1763.339	-0.010	-0.038
1763.381	+0.032	+0.004
1764.378	-0.006	-0.034
1764.413	+0.030	+0.002
1794.399	+0.018	-0.010
1794.411	+0.030	+0.002
1795.459	+0.045	+0.017
1824.387	+0.008	-0.020
1853.381	+0.039	+0.011

$O-C_I$ refers to O-C using Strohmeier's elements: 2425738.440 + 1.034399 E

$O-C_{II}$ refers to O-C using the new elements: 2441135.498 + 1.034397 E

THE LIGHT CURVE

At this point it should be emphasized that a complete light curve was obtained and not just that of the primary minimum. The light curve was constructed in the following way: (1) Using the new elements the phase for each estimate was calculated. (2) Where possible (i.e. for observing runs during the eclipse) these estimates were plotted on the graph of phase against magnitude by superposition. (3) Where this was not possible the points were plotted using the calculated phase. (4) For each .005-phase interval the average magnitude was found and a running average operation was performed on these points. (5) Because a few minor irregularities remained, a smooth curve was drawn as carefully as possible. (6) Since the light changes so rapidly at primary minimum an interval of .00125-phase (one-fourth of .005) was used when it was found that .005-phase was too large, and the same procedure was followed with these points. This light curve is given in Figure 3, and in numerical form in Table 2.

From the light curve the following results are evident: The variable has a range of $1^{m}.04$, normal maximum light is $8^{m}.76$, magnitude at primary minimum is $9^{m}.80$, and that of secondary minimum is $8^{m}.90$. The duration of the eclipse is 28% of the period.

After careful scrutiny of the individual estimates at the bottom of primary eclipse, it was unfortunately not certain whether or not there was a brief phase of constant light.

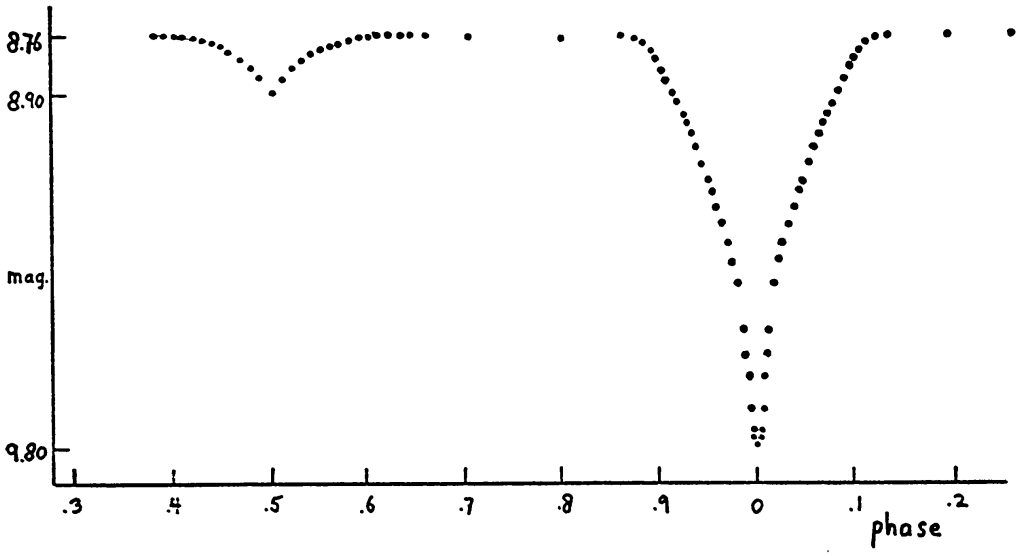

Figure 3. Light Curve of AD Bootis.

TABLE 2

PHASE-MAGNITUDE RELATION

Phase	Mag.	Phase	Mag.	Phase	Mag.
.0000	9.80	.0625	9.03	.3600	8.76
.0006	9.78	.0675	9.00	.3700	8.76
.0021	9.76	.0725	8.97	.3800	8.76
.0037	9.71	.0775	8.95	.3900	8.76
.0075	9.62	.0825	8.92	.4000	8.76
.0125	9.52	.0875	8.90	.4100	8.76
.0175	9.45	.0925	8.86	.4200	8.77
.0215	9.38	.0975	8.84	.4300	8.77
.0275	9.32	.1075	8.81	.4400	8.28
.0315	9.28	.1125	8.80	.4500	8.79
.0375	9.23	.1175	8.79	.4600	8.80
.0425	9.18	.1375	8.76	.4700	8.82
.0475	9.15	.1500	8.76	.4800	8.84
.0525	9.12	.2100	8.76	.4900	8.87
.0575	9.08	.3200	8.77	.5000	8.90

Because the light curve is symmetrical, the relation has only been given for the first half of the period.

REFERENCES

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