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**UBV OBSERVATIONS OF THE TYCHO VARIABLE, EF BOOTIS
AND THE DISCOVERY OF A PULSATING VARIABLE, GSC 3479_230**

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EF Boo [BD +51°1929, GSC 3479_1127, PPM 34572, SAO 29189, RA(2000) = 14^h32^m30^s.57, DEC (2000) = 50°49′41″.0] was first reported in the Tycho catalog (Hog et al. 1997) and was discovered as a part of the Hipparcos program (Perryman et al. 1997).

The catalog gives a spectral type of G5, a mag range 9.427–9.994 in *V*, and a light curve of type EB. The following light elements are given:

$$\text{J.D. Hel Min I} = 2448500.3018 + 0^{\text{d}}420512 \times E. \quad (1)$$

Our present observations were taken with the Lowell 0.79-m reflecting telescope in conjunction with a cooled S-13 type PMT on April 14–16, 1999. Standard *U*, *B*, and *V* filters were used. The finding chart in Figure 1 shows the comparison stars [HIP#71043, GSC 3479_316, SAO 29183, RA(2000) = 14^h31^m46^s.4, DEC(2000) = 50°55′43″, spectral type G5], and [GSC 3479_230, SAO 29195, RA(2000) = 14^h33^m32^s.1, DEC(2000) = 50°45′11″] as *C* and *C'*, respectively, along with the variable, *V*. Over 1200 observations were taken in each pass band. The curves are of typical W UMa type (EW) with spot activity. The maximum at phase 0.25 has a 3% increased flux over that at phase 0.75 in *B*. The difference in eclipse depths is less than 0.03 mag in all passbands. Five mean epochs of minimum light were determined from three primary, and two secondary eclipses using the bisection of chords method. The only other epoch of minimum light available is given in Equation 1. The precision epochs of minimum light are given in Table 1 along with their standard error of the last digit in parentheses. The following ephemeris improves upon that given by Tycho:

$$\text{J.D. Hel Min I} = 2451283.6774(1) + 0^{\text{d}}42060833(7) \times E. \quad (2)$$

Equation 2 was used to calculate the *O* – *C* residual in Table 1.

The *UBV* light curves are shown in Figure 2 as differential standard magnitudes (variable – comparison) versus phase. The probable error of a single observation was 5 mmag in *B* and *V*, and 6 mmag in *U*. A good fit to the light curves was found with Binary Maker as shown in Figure 3. We obtained a component temperature difference of ~ 100 K, a mass ratio of 1.75 and a fill-out of 25%. A cool spot of radius 14 degrees with a temperature factor of 0.76 was modeled on the cooler, more massive component.

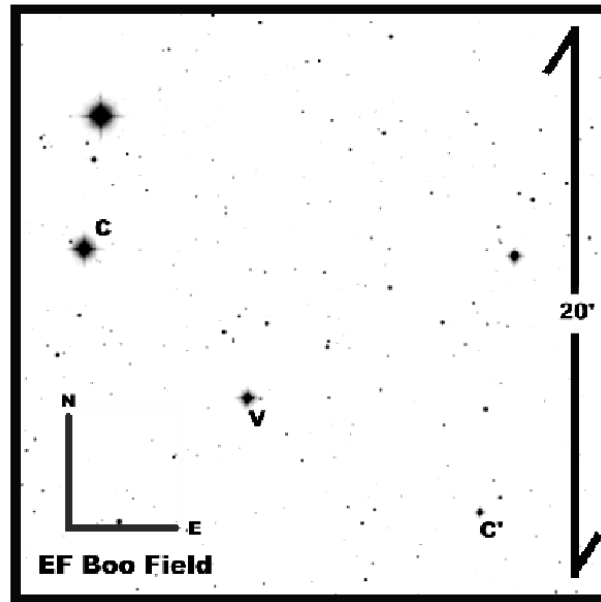


Figure 1. Finding chart made from Real Sky of the Variable, EF Boo, V, the comparison stars, C and C'.

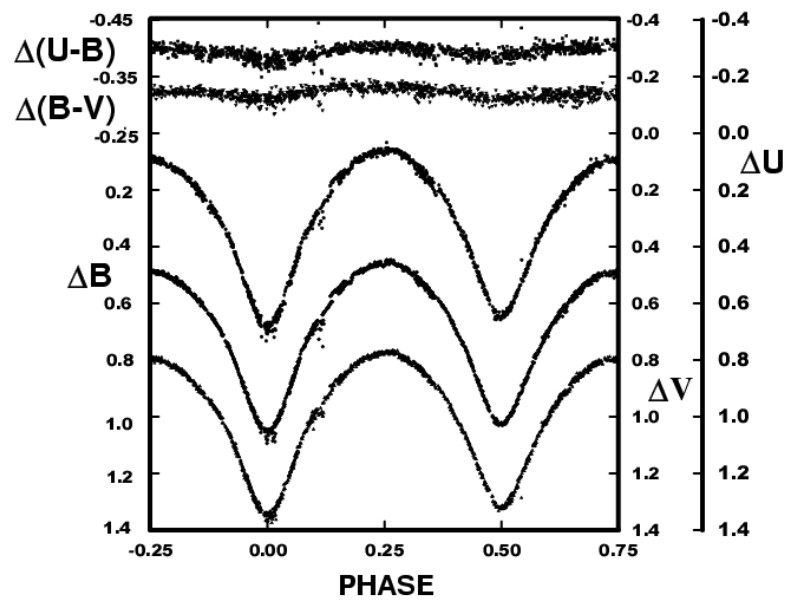


Figure 2. U, B, V light curves and U-B, B-V color curves for EF Boo as magnitude differences, variable minus comparison star.

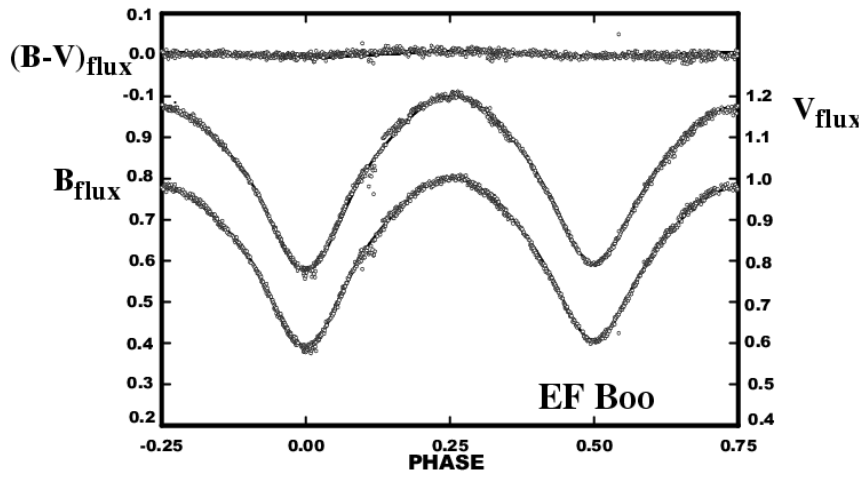


Figure 3. Binary Maker fit of the light curve in B and V.

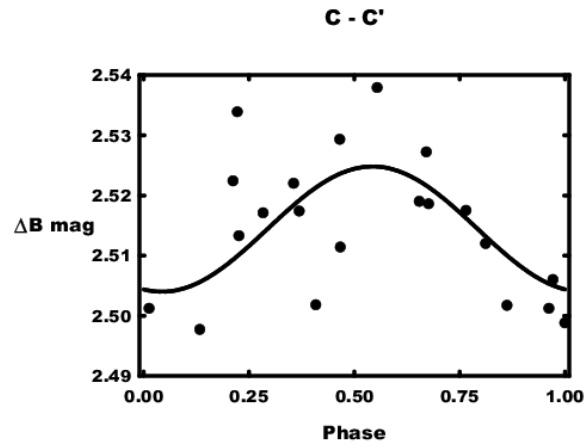


Figure 4. V observations of GSC 3479 230 phased with an 87.3minute period.

Table 1: New Epochs of Minimum Light, EF Boo

JD Hel. 2400000 +	Min	Cycles	$O - C$
48500.30180	II	-6617.5	-0.0026
51282.8356(6)	I	-2.0	-0.0006
51283.6776(1)	I	0.0	0.0001
51283.8889(11)	II	0.5	0.0011
51284.7290(1)	II	2.5	0.0000
51284.9386(6)	I	3.0	-0.0006

GSC 3479 230 (star C') was used as the comparison star on April 14–15. Plots of $C' - C$ reveal that it is a possible pulsating variable. SAO gives a spectral type of F8 for this star, designated SAO 29195. We performed an FFT on the data and found a peak at 17.9/d or a period of 80.4 min. Starting with this period we fit a least-squares sinusoid to the data and obtained a period of ~ 87.3 min. The amplitude was 0.02–0.03 mags in U, B, V . This curve is shown in Figure 4 overlaying the phased data.

Further observations and analyses are needed to disclose the nature of this variable.

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