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UBV LIGHT CURVES OF THE NEAR-CONTACT BINARY AK CANIS MINORIS

In our study of the eccentric eclipsing binary (EEB) candidates of Hegedüs (1988), we obtained UBV photoelectric light curves of AK Canis Minoris [R.A.(2000) = $07^h40^m15\overset{s}{.}5$, D.(2000) = 03°57'09"]. AK CMi (BD+04°1778, AN310.1934, P3052, SVS 1102) was discovered by Hoffmeister (1934). Notni (1955) published a photographic light curve, and determined a period of ∼0.57d. He states that the shallow secondary eclipse (we measure 0.16 mag in B) occurred at phase 0.55. Given the high scatter and the sparse coverage of his light curve, this result is highly questionable. Strohmeier et al. (1957) includes a finder chart in his study. Robb and Moffat (1987) give two precision epochs of primary minima and one of a secondary minimum. We find that their secondary eclipse occurs at phase 0.46. Shaw (1994) includes AK CMi in his list of near-contact binaries. In all, some 200 timings of minimum light are found in the literature or in the BAV data base.

The present observations were taken on 1994, February 10-15, inclusive, at Lowell Observatory, Flagstaff, Arizona with the National Undergraduate Research Observatory 0.78-m reflector. A thermoelectric cooled PMT was used with Johnson UBV filters. Two nearby stars were used as comparison [R.A.(2000) = $07^h41^m5\overset{s}{.}9$, D.(2000) = 03°50'08"] and check [R.A.(2000) = $07^h40^m18\overset{s}{.}0$, D.(2000) = 03°52'19"]. The comparison star was an excellent color match to the variable with the Δ(B−V) and the Δ(U−B) averaging ∼0.1 and ∼0.0, respectively.

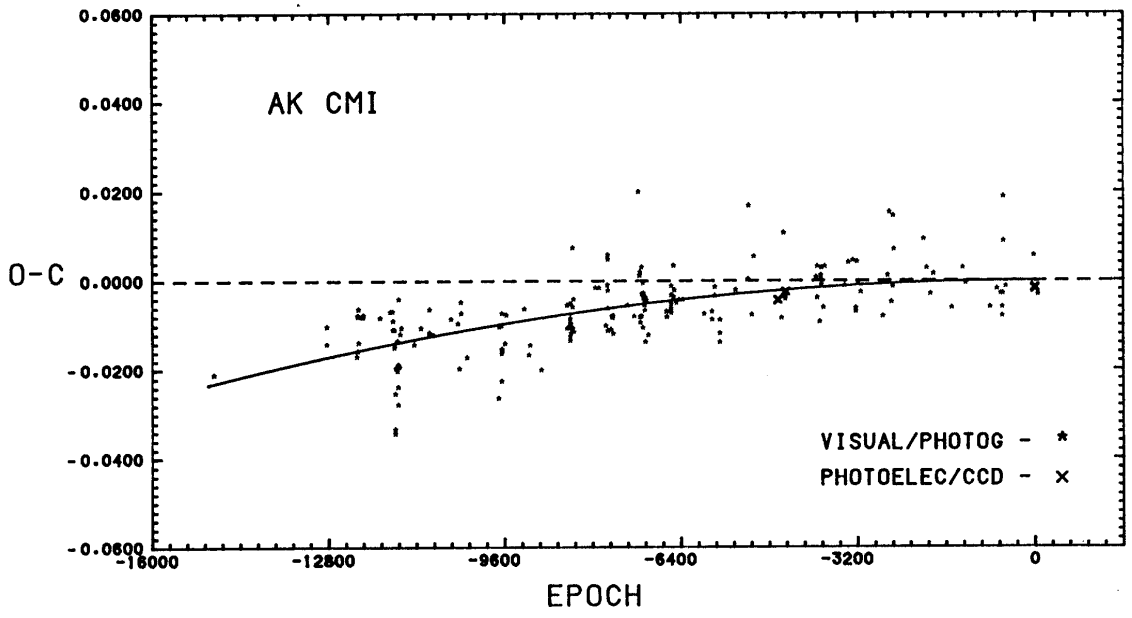

Figure 1. Period behavior of AK CMi as shown by the calculated from the quadratic ephemeris.

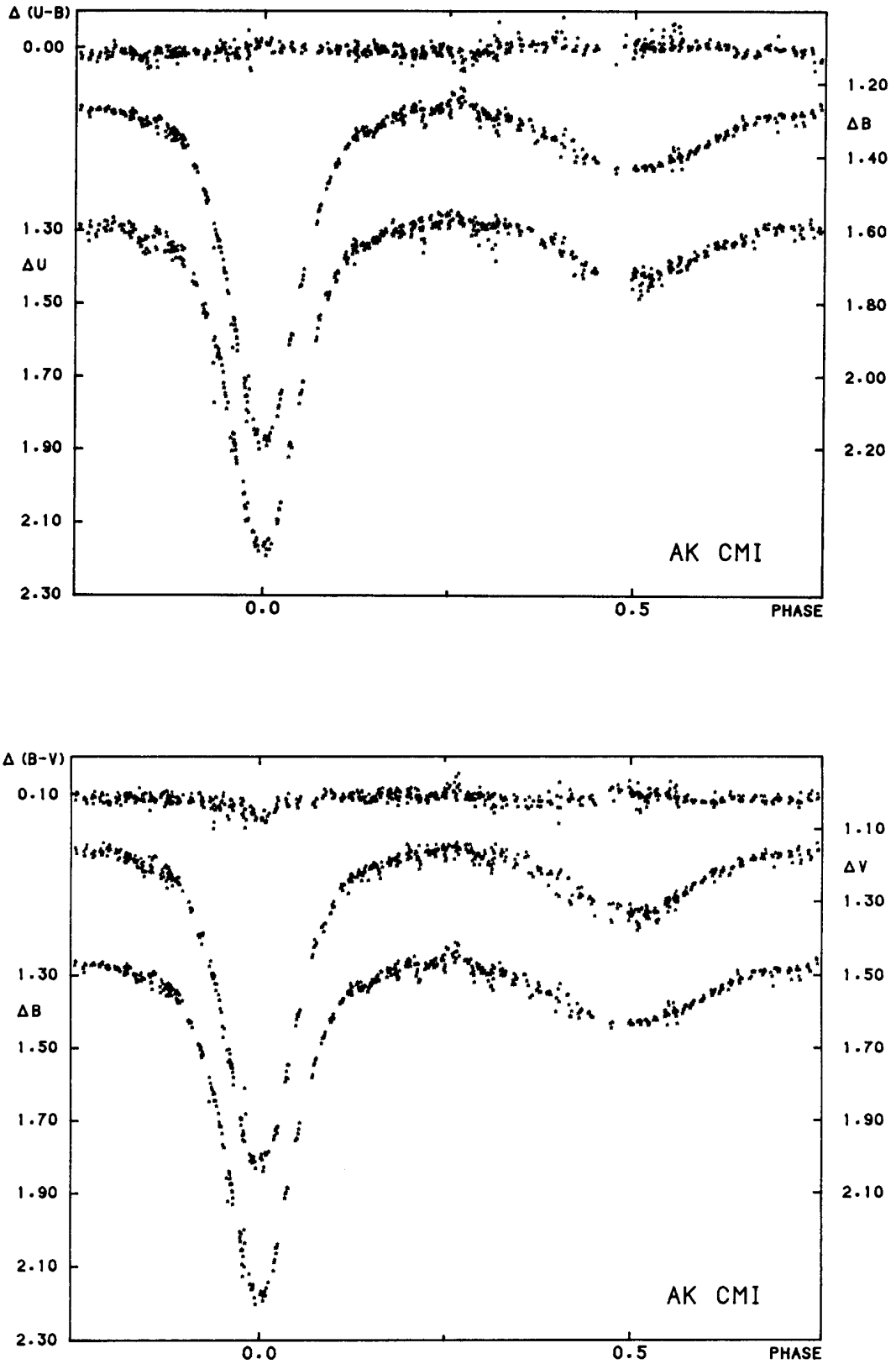

Figure 2. Light curves of AK CMi as defined by the individual observations.

Two mean epochs of minimum light were calculated from one secondary and one primary eclipse. The bisection-of-chords method was used. Our epochs were JD Hel. Min. I = 2449396.70325($\pm$.00046) and JD Hel. Min. II = 2449395.8546($\pm$.0003). From the densely packed data of the past 23 years, we determined the following improved epemeris:

$$\begin{array}{rcl} \text{JD Hel. Min I} = 2449396.7075 & + & 0^{\text{d}}.5658968 \times \text{E} \\ & \pm.0018 & \pm.0000002 \end{array} \quad (1)$$

The O$-$C's calculated from this ephemeris suggest that AK CMi is undergoing a continuous period decrease. Because of this we calculated the quadratic ephemeris:

$$\begin{array}{rcccl} \text{JD Hel. Min I} = 2449396.7050 & + & 0^{\text{d}}.5658956 \times \text{E} & - & 0.00000000010 \times \text{E}^2 \\ & \pm.0008 & \pm.0000002 & & \pm.00000000002 \end{array} \quad (2)$$

The O$-$C's generated from the first two terms of this equation are shown in Figure 1 overlain by a curve generated by the quadratic term. In these calculations, we weighted the precision epochs as 1.0 and the photographic and visual timings as 0.1. We used equation (1) to phase our observations. These equations indicate that our Min II occurred at phase 0.5 to within the errors. We believe that AK CMi is not an EEB. The appearance of the light curves about the secondary eclipse supports this conclusion.

The light curves of AK CMi defined by the individual observations are shown in Figure 2 as Δ mag vs. phase. Our preliminary light curve solution indicates that the components are in a near contact semi-detached configuration with the fillout of the primary component being $\sim$80% and a component temperature difference of $\sim$4100 K . The complete analysis of the observations are underway and will appear elsewhere.

RONALD G. SAMEC*
RICHARD J. McDERMITH
BRIAN J. CARRIGAN
Dept. of Physics and Astronomy
Millikin University
Decatur, Il 62522-2084
USA

* Visiting Astronomer, Lowell Observatory, Flagstaff, Arizona

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