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THE HIPPARCOS VARIABLE CD LYNCIS

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The 9th magnitude star CD Lyn (HIP 37615, GSC 3409-2180), spectral type F2, was first detected as a variable by the Hipparcos satellite (ESA, 1997). The satellite data indicated an amplitude of 0.7 V with an uncertain period and type but probably an eclipsing binary.

Our group has observed CD Lyn to determine its period and confirm its status as an eclipsing binary. Continuous visual monitoring by Baldwin and Berg eventually detected minima, which allowed CCD observers Billings, Henden, and Nelson to observe additional minima at higher precision. The minima occurred at multiples of 2.27 days, but further CCD observations including those of Lubcke and Kaiser established that the true period is 4.55 days with the variable constant at maximum at phases 0.25 and 0.75 of this longer period.

Subsequently Williams and Hager investigated CD Lyn in the Harvard College Observatory plate collection, finding 24 times of minimum dating back to 1901. These archival plate minima and the recent CCD timings (reduced with software based on the Kwee–Van Woerden method, 1956) are listed in Table 1. A least-squares analysis with weight 1 for the photographic data and weight 100 for the CCD data resulted in the period in Equation 1, which we have combined with the best CCD timing of minimum to produce the following light elements:

$$\text{Min. I} = \text{HJD } 2451665.6526(2) + 4^{\text{d}}5494840(4) \times E. \quad (1)$$

Henden performed high-precision *BVRI* photometry at maximum and during primary minimum and *BV* photometry during secondary minimum with the 1-meter Naval Observatory reflector (Table 2). These observations show that the primary and secondary eclipses are virtually identical in depth and color. We have chosen the nominally deeper

Table 1: Times of Minimum, CD Lyn

HJD 2400000 +	Cycle	$O - C$	Observer
15683.778	-7909.0	-0.006	Harvard plate
16584.584	-7711.0	+0.003	"
16834.709	-7656.0	-0.094	"
16891.622	-7643.5	-0.050	"
16932.578	-7634.5	-0.039	"
17321.606	-7549.0	+0.008	"
18374.695	-7317.5	-0.108	"
19384.802	-7095.5	+0.013	"
19716.880	-7022.5	-0.021	"
20485.774	-6853.5	+0.010	"
26306.847	-5574.0	+0.018	"
28192.636	-5159.5	+0.046	"
28872.792	-5010.0	+0.054	"
28904.659	-5003.0	+0.075	"
29020.583	-4977.5	-0.013	"
29657.627	-4837.5	+0.103	"
30014.732	-4759.0	+0.074	"
31122.572	-4515.5	+0.114	"
33592.832	-3972.5	+0.005	"
45348.705	-1388.5	+0.011	"
45639.846	-1324.5	-0.015	"
45696.741	-1312.0	+0.011	"
45753.579	-1299.5	-0.019	"
46408.722	-1155.5	-0.002	"
51640.6309(5)	-5.5	0.000	Henden CCD
51649.731(1)	-3.5	+0.002	Nelson CCD
51665.6526(2)	0.0	0.000	Henden CCD
51674.7526(8)	2.0	+0.001	Billings CCD

Table 2: CD Lyn Photometry

Phase	V	$B - V$	$V - R$	$R - I$
Maximum	9.80	0.36	0.25	0.23
Minimum I	10.33	0.39	0.27	0.28
Minimum II	10.32	0.39		

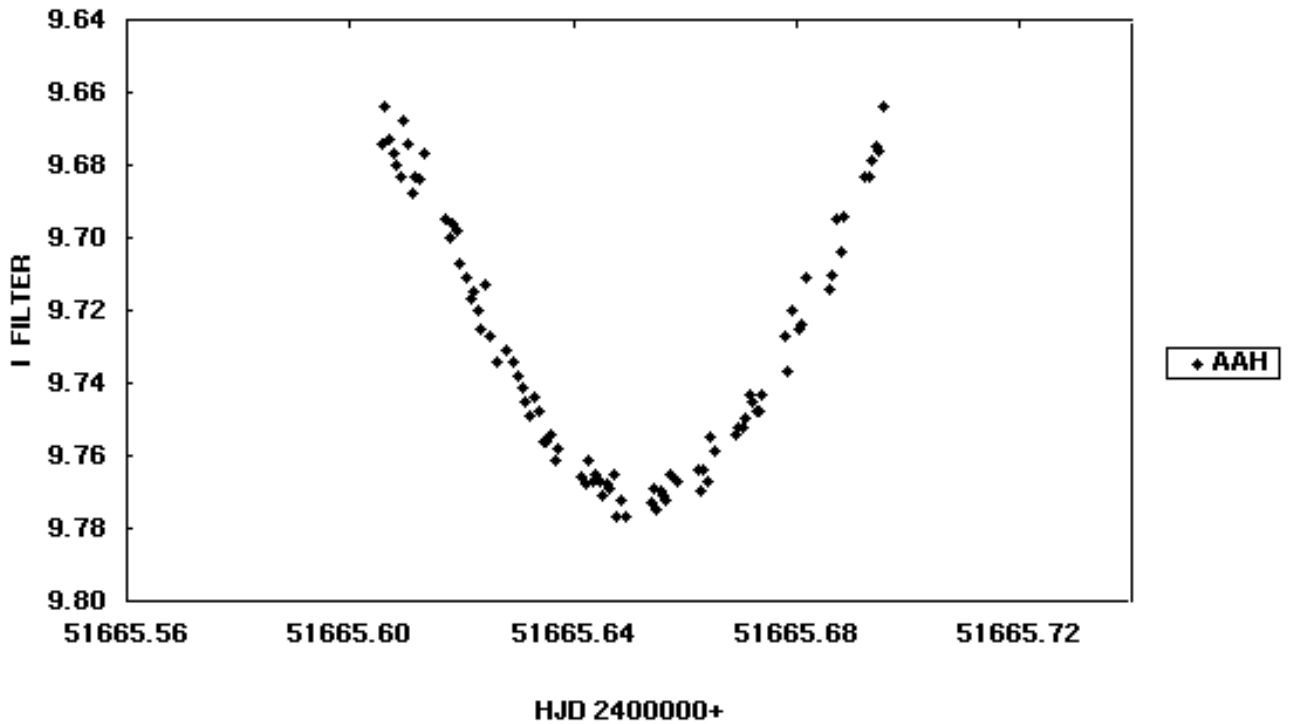


Figure 1. Primary eclipse of CD Lyn, *I* filter

Table 3: Comparison Stars

Comp Star	RA (2000)	Dec (2000)	<i>V</i>	<i>B</i> – <i>V</i>
GSC 3409–1129	07 ^h 42 ^m 39 ^s .78	+48°46′51″.3	9.981 ± 0.007	0.481 ± 0.011
GSC 3409–1825	07 ^h 42 ^m 52 ^s .10	+48°43′43″.9	12.072 ± 0.011	0.670 ± 0.011

minimum as the primary eclipse, but the difference between the two eclipses is so small that the choice may be arbitrary. The eclipses are partial and duration is about 0.15 P. Comparison stars are listed in Table 3.

In summary, CD Lyn is a detached binary system with minima of equal depth. This star is a good candidate for a high-precision radial velocity and light curve solution to determine accurate stellar masses and radii.

References:

- ESA, 1997, *The Hipparcos and Tycho Catalogues*, ESA SP-1200
 Kwee, K.K., and Van Woerden, H., 1956, *BAN*, **12**, No. 464, 327