

COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 4232

Konkoly Observatory
Budapest
21 August 1995

HU ISSN 0374 – 0676

CI Aql: A NEW SHORT-PERIOD ECLIPSING BINARY

CI Aql was classified as a doubtful nova by Duerbeck (1987), mainly based on a $\sim 4^m 6$ eruption observed in 1917. The small amplitude of the outburst and the lack of subsequently recorded eruptions suggested CI Aql might be a dwarf nova with a very long recurrence time. However, a dwarf nova classification was not supported by a recent spectrum (Szkody & Howell 1992) that did not have the Balmer lines in emission.

CI Aql was included in a program of automated long-term monitoring of cataclysmic variables conducted at Indiana University since about 1991 (Honeycutt et al., 1990; Honeycutt and Turner, 1992). Nearly 300 V differential magnitudes, spanning a time range of 4 years, have been obtained. The overall light curve does not show any significant long-term modulation, but rather several low-brightness data points homogeneously distributed. A phase dispersion minimization analysis (Stellingwerf 1978) applied over the whole data sample revealed a strong minimum in the θ window at $P = 0^d 618355(9)$. On this period the light curve shows a sinusoid with an amplitude of $0^m 2$ and a period of half the orbital period, with a superimposed eclipse $0^m 6$ deep and 0.15 phase units wide. The sinusoid is probably an ellipsoidal modulation from the secondary, though it could be a secondary eclipse (Figure 1). The ephemeris of the eclipse minimum is:

$$\text{J.D. } 2448412.167(25) + 0^d 618355(9) \times E$$

There is (to within the errors) little scatter in the light curve of Figure 1, suggesting that flickering, if present, is quite small. This conclusion is supported by an upper limit of $0^m 08$ in the star's variability during a one hour photometric run in March 1991 (Mennickent, 1992).

Two spectra of CI Aql were obtained using the 2.5 meter telescope at Las Campanas Observatory, Chile in 1991. On May 20 (UT) the Modular Spectrograph and a CRAF CCD chip with 12μ pixels was used with a grating of 600 lines/mm. This combination gave a spectral resolution of 5 \AA over the range 6400-8900 \AA . The exposure time was 1800 seconds and the mid UT = $9^h 14^m 3^s$. The second spectrum was obtained on August 03, 1991. On this occasion a grating of 300 lines/mm was selected, yielding a spectral resolution of 14 \AA , and a range of 4800-8800 \AA . The exposure time was 900 seconds, and the mid UT = $4^h 38^m 21^s$. Helium-Argon comparison spectra were taken before and after the scientific exposures and all spectra were reduced using IRAF standard packages. The observations were made as part of a monitoring program of the near infrared spectral region of several CV candidates. The equivalent widths of some of the prominent absorption lines in Figures 2 and 3 are tabulated in Table 1. In addition, weak TiO bands are clearly visible in both spectra (for example, around $\lambda 6700 \text{ \AA}$). The KI $\lambda 7696 \text{ \AA}$ line and the OI $\lambda 7774 \text{ \AA}$ line were visible as weak absorptions in the May spectrum.

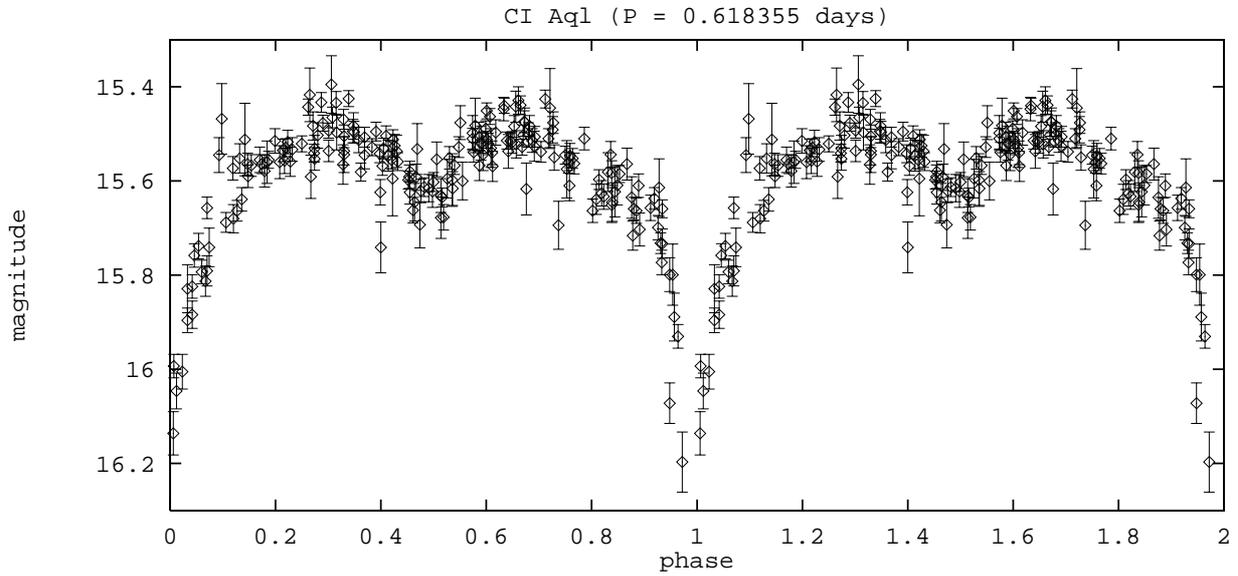


Figure 1. V-band differential magnitude of CI Aql phased with a period $P = 0.618355$. The zero point of the magnitude scale is accurate to only 0.2 mag.

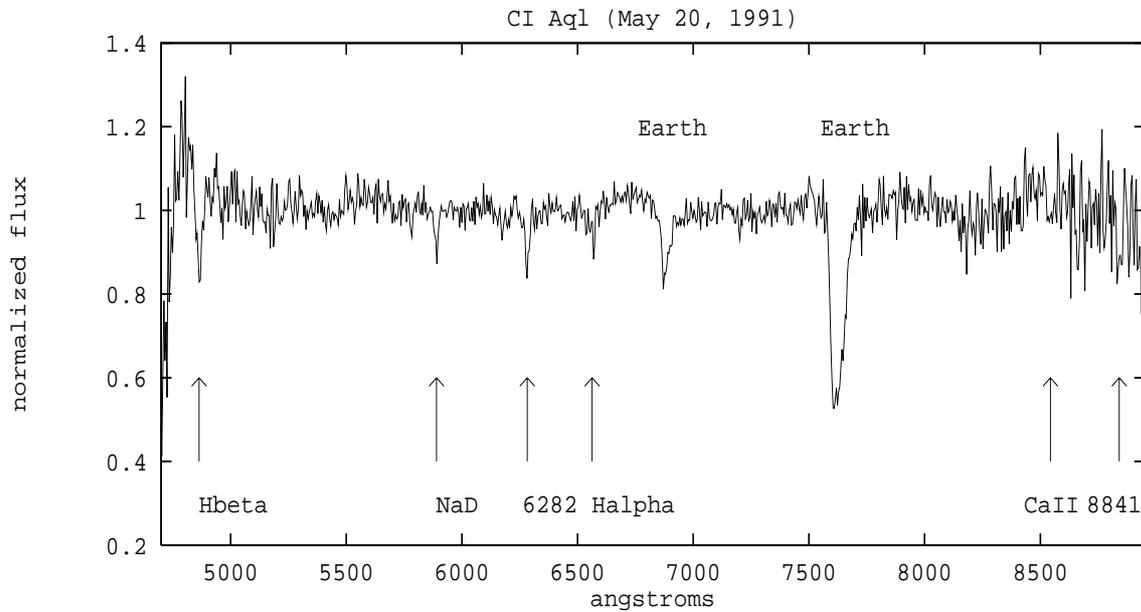


Figure 2. Spectrum of CI Aql obtained at Las Campanas in May 20, 1991.

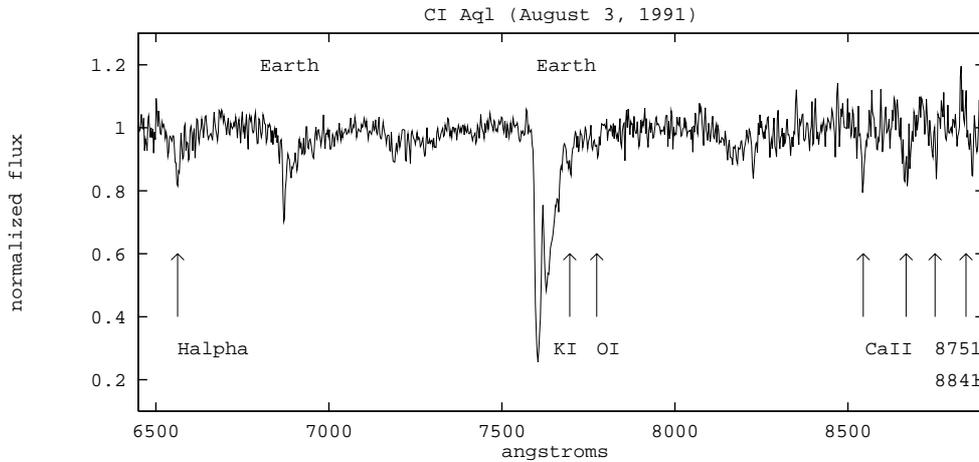


Figure 3. Spectrum of CI Aql obtained at Las Campanas in August 3, 1991.

Table 1. Equivalent width of the absorption lines observed in CI Aql

Line	W_λ (20/5/91)	W_λ (3/8/91)
$H\beta$	8	-
λ 5890 Å	2	-
λ 6279 Å	4	-
$H\alpha$	3	6
CaII λ 8542 Å	-	2
CaII λ 8662 Å	-	4
λ 8749 Å	-	2
λ 8863 Å	-	2

Table 2. CI Aql magnitudes and colors observed in different epochs. S94 refers to Szkody (1994), H94 to Harrison (1992) and M95 to Mennickent (1995)

Color or Mag	Epoch	Reference	Color r Mag.	Epoch	Reference
$V = 16.22$	88/08/31	S94	$J = 14.5$	88/09/06	S94
$B-V = 1.08$	88/08/31	S94	$K = 13.5$	88/09/06	S94
$V-R = 0.68$	88/08/31	S94	$V-J = 1.7$	88/09/06	S94
$V = 16.20$	91/03/20	M95	$J-H = 0.51$	May-June 92	H92
$B-V = 0.95$	91/03/20	M95	$H-K = 0.22$	May-June 92	H92
$U-B = 0.53$	91/03/20	M95	$K = 12.67$	May-June 92	H92

A set of UBV exposures was obtained using the 1.0 m telescope at Las Campanas Observatory on March 20, 1991 (UT) as part of a monitoring campaign of poorly known CV candidates (Mennickent, 1995). The colors $B-V = 0^m95 \pm 0^m06$ and $U-B = 0^m53 \pm 0^m11$ are not typical of dwarf novae, being comparable, instead, to the colors observed in CVs with evolved companions (for example V1017 Sgr, T CrB and RS Oph). Our data, supported by near-infrared colors obtained by other authors (see Table 2), indicate a steeply red flux distribution.

The dominance of the spectrum of a cool star in the near-IR spectrum suggests that CI Aql has an evolved companion, perhaps similar to that of recurrent nova systems (Webbink et al., 1987). However, note that the lack of emission lines and the lack of flickering implies that CI Aql may not be interacting (at least at the present time). The NaD, KI lines and TiO bands are characteristic of a K-M type star, and the weakness of NaD, KI and Mgb imply a luminosity higher than IV (see the atlas of Turnshek et al., 1985 at similar spectral resolution). The Ca II infrared triplet is known to increase in strength with luminosity. Applying the equivalent width calibration of Ginestet et al. (1994) to the data in Table 1 implies a luminosity class of II-III. (However, the Ginestet et al. calibration is at substantially higher spectral resolution than our spectra, so this result is preliminary.) A determination of the stellar parameters of CI Aql is beyond the scope of this note but will be the subject of a future investigation.

Acknowledgements: This research was supported by the Dirección de Investigación de la Universidad de Concepción, Chile, DI # 95.11.11.1-1, and by a National Science Foundation grant to Indiana University.

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