COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4008

Konkoly Observatory
Budapest
24 March 1994
*HU ISSN 0324 - 0676*

# A PHOTOMETRIC STUDY OF THE NEW ECLIPSING BINARY HD 21155

HD 21155 is an eighth magnitude B8 star that was discovered to be a $3^{d}.045$ eclipsing binary by Kaiser (= DHK 9) some five years ago (Baldwin & Kaiser 1989). Very little is known about the system but visual observations reveal a primary minimum of $\sim 0.4$ mag and the secondary minimum is not seen. Photoelectric observations around phase 0.5 (Kaiser et al. 1990) put an upper limit on the secondary minimum of $\sim 0.03$ mag, so it is possible that the true period is $\sim 6$ d. However, the visual and photographic observations show no differences between alternate minima.

New photoelectric observations of this system have been made on 47 nights during 1991 to 1993 from Catsfield, East Sussex in southern England with a 25-cm Newtonian equipped with a prototype JEAP (EMI9924B PMT based) photon-counting photometer (Walker 1986, 1991) and computer controlled data acquisition. All the observations were made with a nominal $V$ filter and integration times were 30 seconds through a 1 arc minute aperture. The comparison and check stars were HD 21193 and HD 21099 respectively and the sequence, comparison - sky - variable - check was repeated between 2 (one night only) and 6 times for each observation. The mean $\Delta$m magnitudes, variable minus comparison and comparison minus check, and their errors were calculated. The standard deviation of the comparison minus check star measurements (both stars are fainter than the variable) is 0.026 mag.

The magnitude differences, variable - comparison, are plotted in Figure 1, using the ephemeris

$$\mathrm{HJD_I} = 2435988.336 + 3.0452976 \times \mathrm{E}$$

given by Kaiser et al. (1990). The plot shows a well defined primary minimum of $\sim$ 0.44 mag and strong indication of secondary minimum of $\sim 0.04$ mag. If the secondary eclipse has been detected then it confirms that the period given in the ephemeris is correct, as opposed to twice that value. Unfortunately all the observations in the core of primary minimum are from the same (6 day) minima, so it is not possible to provide the additional confirmation of identical alternate minima. Nevertheless, the secondary minimum, although small, seems well established. The time of primary minimum derived from these observations is

$$2449049.621 \pm 0.007,$$

and has an O–C of 0.004 days with respect to the ephemeris. Although this timing is arguably the most accurate one available, it does not make any significant improvement to the ephemeris, which should be more than adequate for some years.

An attempt has been made to model the system using Hill's LIGHT2 code. The details will be published elsewhere (Lloyd & Watson 1994) but the results suggest that both components are evolved. The secondary is cool, Te probably $< 5000$ K, underluminous

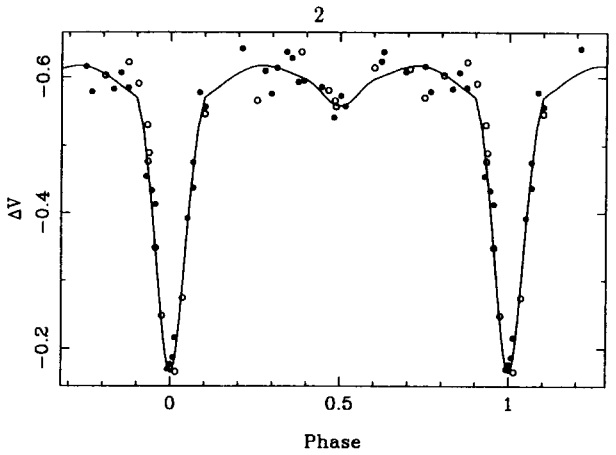


Figure 1. The light curve of HD 21155 from the new photoelectric data. The open symbols indicate the less reliable data, where the s.e. of the mean $\Delta$m's $> 0.015$ mag.

and probably fills its Roche lobe. The solution plotted in Figure 1 is for a slightly-evolved B8 primary with R = 5.0 R$\odot$ and a Roche lobe filling secondary of 1.5 M$\odot$, with R = 4.6 R$\odot$ and $T_e$ = 5000 K. The standard deviation of the residuals from this line is 0.026 mag, which is consistent with the observational errors. The evolved, cool, low-mass secondary clearly indicates that this is an Algol binary.

At present there are no radial velocities of this system, but if it is at all similar to the solution presented here then the spectroscopic orbit, should have an easily detectable $K_1$ $\sim$ 70 km/sec. Additional photoelectric observations of rather higher precision than those presented here will be necessary to improve the details of the light curve, but the most vital requirement is for a radial velocity solution.

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