COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4127

Konkoly Observatory
Budapest
20 December 1994

HU ISSN 0374 – 0676

1994 BVRI PHOTOMETRY OF CG CYGNI

CG Cygni (= BD+34°4217 = # 177 in the catalog of Strassmeier et al., 1993) is a member of the short period eclipsing RS CVn class of stars. Budding and Zeilik (1987) first modeled the spots on this star. Zeilik et al. (1994) model the spot structure for available data from 1922 to 1993 and review the literature on this star.

I observed CG Cyg on the nights of 13, 15, 16, 18, and 19 August 1994 using the San Diego State University 61-cm telescope on Mt. Laguna. The telescope is equipped with a photometer using a Hamamatsu R943-02 tube operated at −1450V and cooled to −15°. The BVRI filters are chosen to closely match the Johnson–Cousins system. I used BD+34°4216 (=SAO 70728) as a comparison star. The data, plotted in Figures 1 and 2, are differential magnitudes (star−comparison) in the standard Johnson–Cousins system. Zeilik et al. (1994) discuss small amplitude variations outside the eclipses that are seen by several different independent observers. These variations are apparent in the 1994 data, but their nature is still uncertain.

I modeled the data using the Information Limit Optimization Technique (ILOT) described in detail by Budding and Zeilik (1987). I extracted a distortion wave from the initial binary star fit, then fit the distortion wave for the longitude and radius of two 0K circular spots at a fixed 45° latitude. Figures 3 and 4 show these fits for the B band. The fits for each wavelength are performed independently. I get:

	B band	V band	R band	I band
Longitude	254.7±10.1	258.5±8.1	257.5±7.0	259.9±7.5
Latitude	45	45	45	45
Radius	8.2±1.0	9.1±0.9	10.1±0.8	9.6±0.9
Longitude	106.5±10.7	113.9±16.0	125.3±13.6	130.6±20.5
Latitude	45	45	45	45
Radius	6.9±1.2	5.3±1.6	6.1±1.4	5.5±1.5
χ^2	132.2	103.3	92.9	85.0

Note that the models in the different bands agree to within the errors. Zeilik et al. (1994) find that the spots for CG Cyg tend to cluster in Active Longitude Belts at 90°and 270°. These models show the same phenomenon.

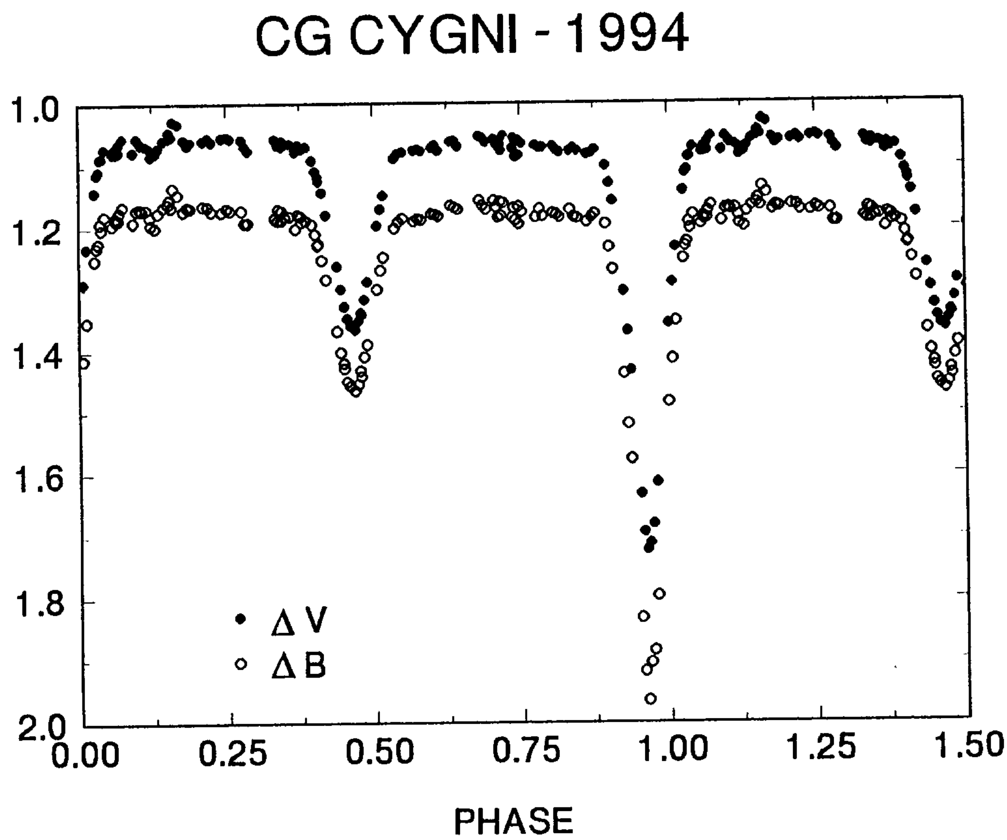

Figure 1

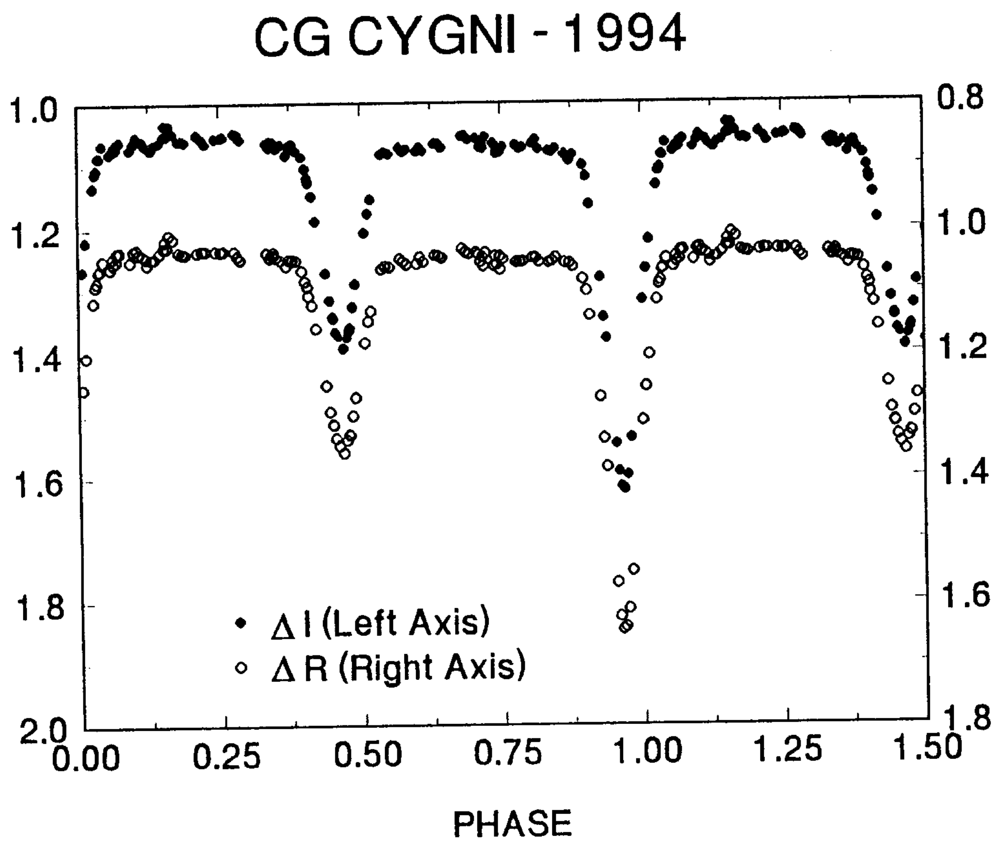

Figure 2

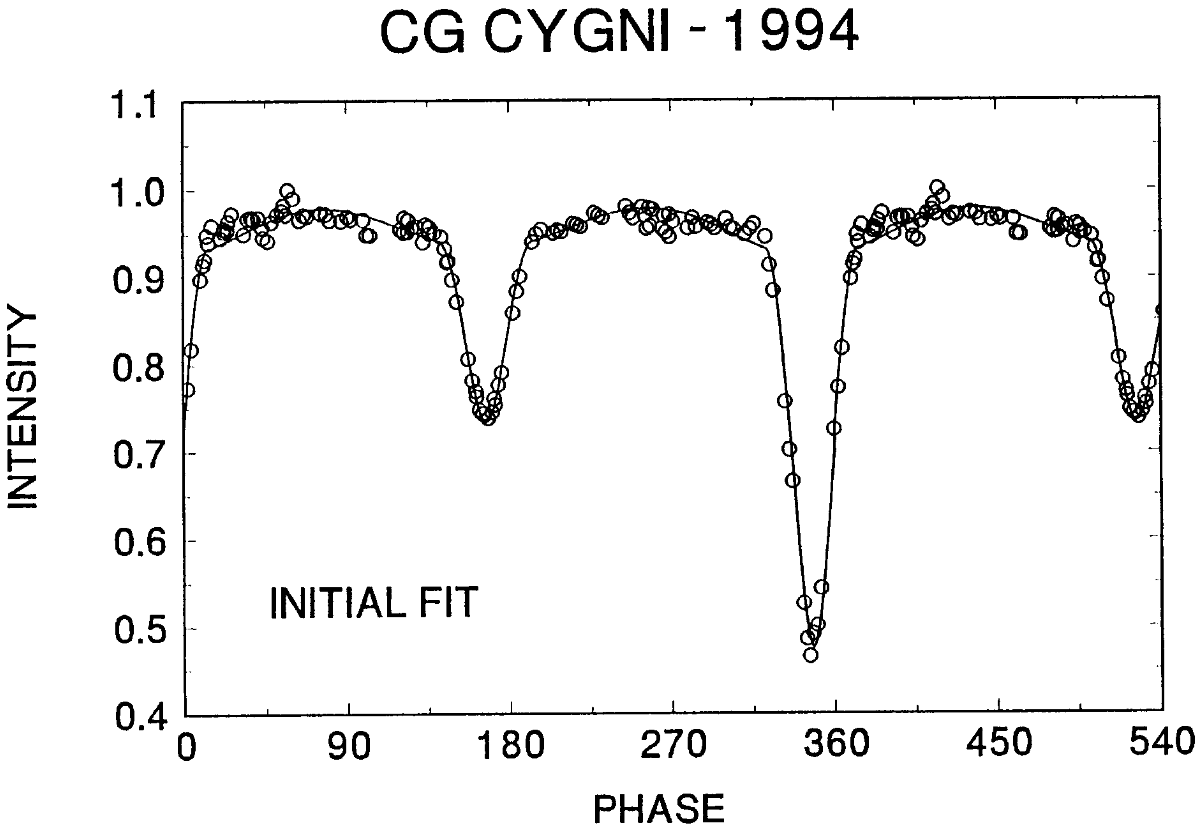

Figure 3

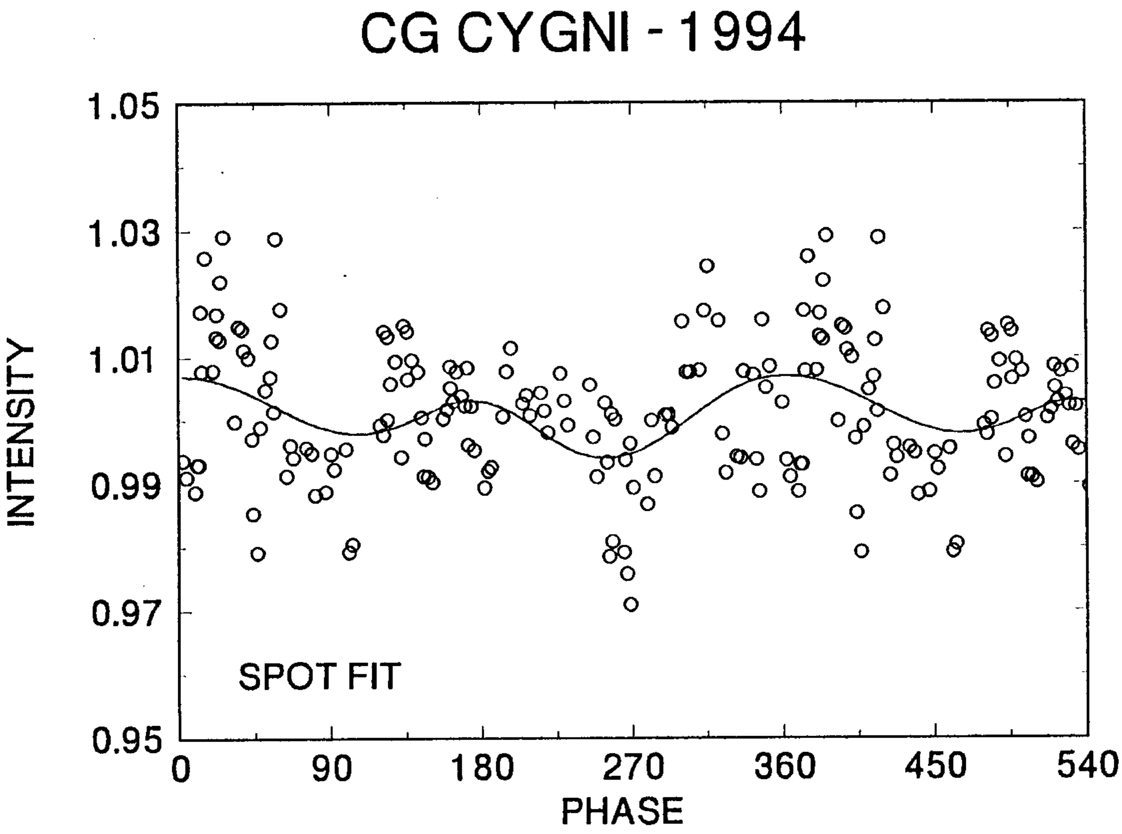

Figure 4

After performing the spot fits, the effects of the distortion wave were removed and clean fits were made to the corrected light curve. I get:

λ	L_1	$k=r_2/r_1$	r_1	i	L_2	$q=M_2/M_1$	χ^2
B	0.700±0.076	0.948±0.181	0.237±0.024	82.8±1.3	0.264±0.079	0.623±0.293	107
V	0.686±0.012	0.883±0.023	0.248±0.005	fixed	0.280±0.012	0.485±0.077	73
R	0.695±0.011	0.836±0.019	0.257±0.005	fixed	0.277±0.012	0.469±0.097	162
I	0.705±0.014	0.790±0.017	0.265±0.005	fixed	0.272±0.015	0.544±0.373	50

The values of L_1, k, r_1, i, and L_2 all agree with the values found by Zeilik et al. (1994). I was only able to simultaneously fit the inclination and mass ratio in the B band. In the other bands I fixed the inclination to try to get some information on the mass ratio because the results of Zeilik et al. (1994) give a good value for the inclination. Most previous values of the mass ratio are 1.0 (Naftilan and Milone 1985, Sowell et al. 1987). Jassur (1980) gets 0.95 and Popper (1993) gets 0.84. The values above are derived from only photometric data at one epoch and are therefore less reliable than values derived using spectroscopic data. However these values lend credence to the lower value of the mass ratio found by Popper (1993).

Because I was unable to observe an entire primary or secondary eclipse on a single night I am not able to give a reliable observed time for either the primary or secondary eclipse. However, the ILOT program makes a best fit correction to the phase of primary minimum. From that information averaged over the 4 observed wavelengths, I find that the eclipses are observed 0.02245+0.0001 days before they are computed to occur during this epoch.

I thank Ron Angione for scheduling generous amounts of observing time at Mt. Laguna and the Research Corporation for providing generous financial support.

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