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1995 BVRI PHOTOMETRY OF CG CYGNI

CG Cygni (# 177 in the catalog of Strassmeier et al. 1993) is a member of the short period eclipsing RS CVn class of stars. Zeilik et al. (1994) model the spot structure for available data from 1922 to 1993 and review the literature on this star. Heckert (1994) models 1994 BVRI data. Continuing with this work, I observed CG Cyg on the nights of 13, 14, 15, and 16 August 1995 with the San Diego State University 61-cm telescope on Mt. Laguna. The instrument and procedure were the same as described in Heckert (1994). The data, plotted in Figures 1 and 2, are differential magnitudes (variable−comparison) in the standard Johnson-Cousins system. The data files may be obtained from the author. 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, latitude, and radius of a 0K circular spot. Figures 3 and 4 show these fits for the V band. Performing the fits for each wavelength independently, I get the spot fits summarized in Table 1.

Table 1. Spot fits

	B band	V band	R band	I band
Longitude	260.2±2.7	260.4±2.8	258.7±3.3	256.5±3.4
Latitude	55.4±8.9	55.7±8.6	53.0±20.7	51.9±15.2
Radius	19.2±2.9	18.3±2.5	16.7±4.6	15.1±2.8
χ^2	266.6	188.6	175.4	136.6

Table 2. Clean fits

	B band	V band	R band	I band
U	0.923±0.003	0.942±0.002	0.949±0.002	0.963±0.002
L_1	0.701±0.040	0.690±0.038	0.693±0.040	0.694±0.017
$k(=r_2/r_1)$	0.881±0.094	0.837±0.077	0.800±0.079	0.778±0.074
r_1	0.259±0.013	0.266±0.011	0.270±0.011	0.271+0.010
i(deg)	82.6±1.0	82.5±0.9	82.6±1.0	82.5±1.0
L_2	0.223±0.042	0.252±0.040	0.256±0.042	0.269±0.041
$q(=M_2/M_1)$	0.828±0.199	0.782±0.173	0.817±0.182	0.825±0.188
χ^2	219	144	127	87

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 (ALBs) at 90° and 270°. These models show the same phenomenon. Compare the 1995 spots to those in 1994. Heckert (1994) finds two spots in 1994. The spot that was in the 90° ALB during

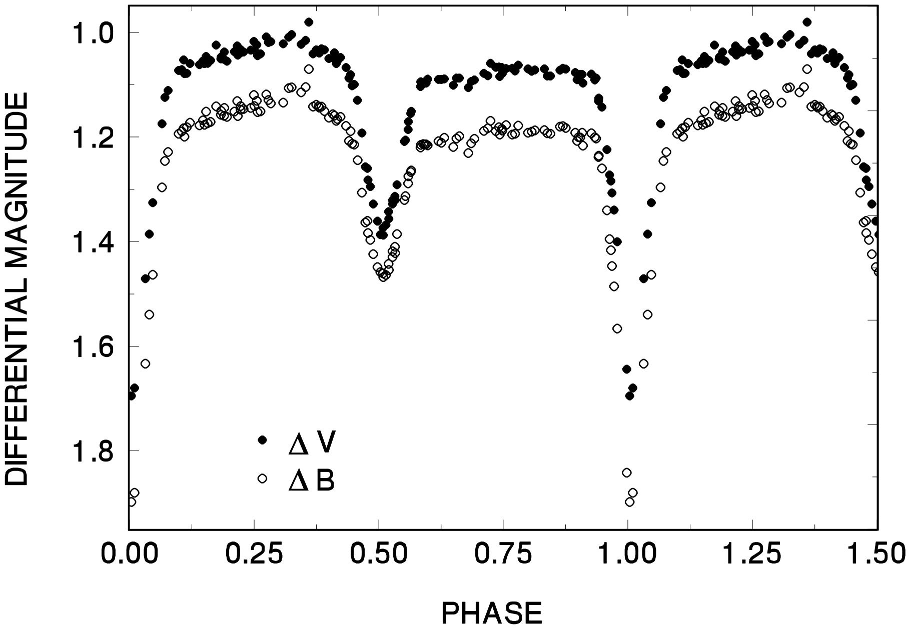

Figure 1. CG Cyg 1995 B and V light curves

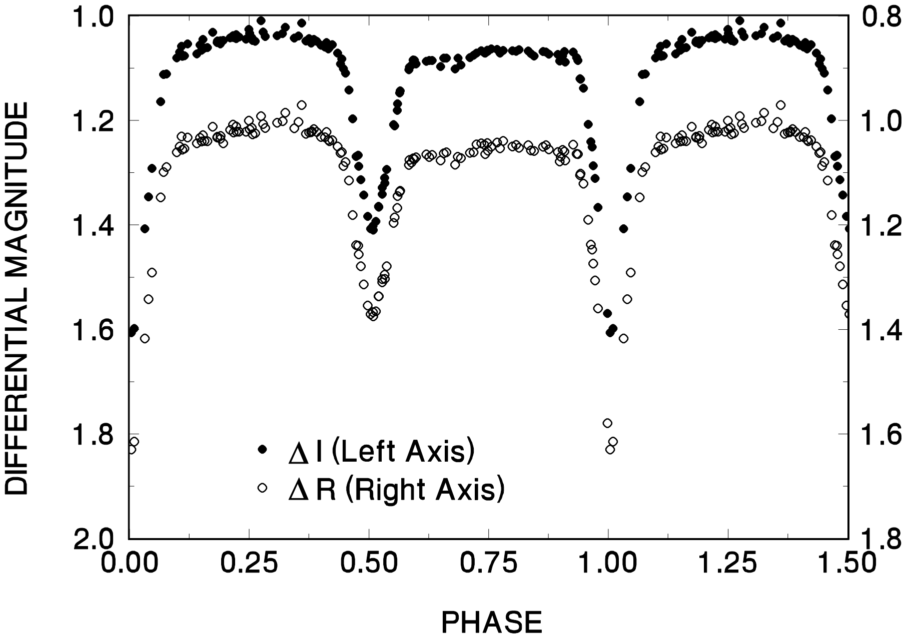

Figure 2. CG Cyg 1995 R and I light curves

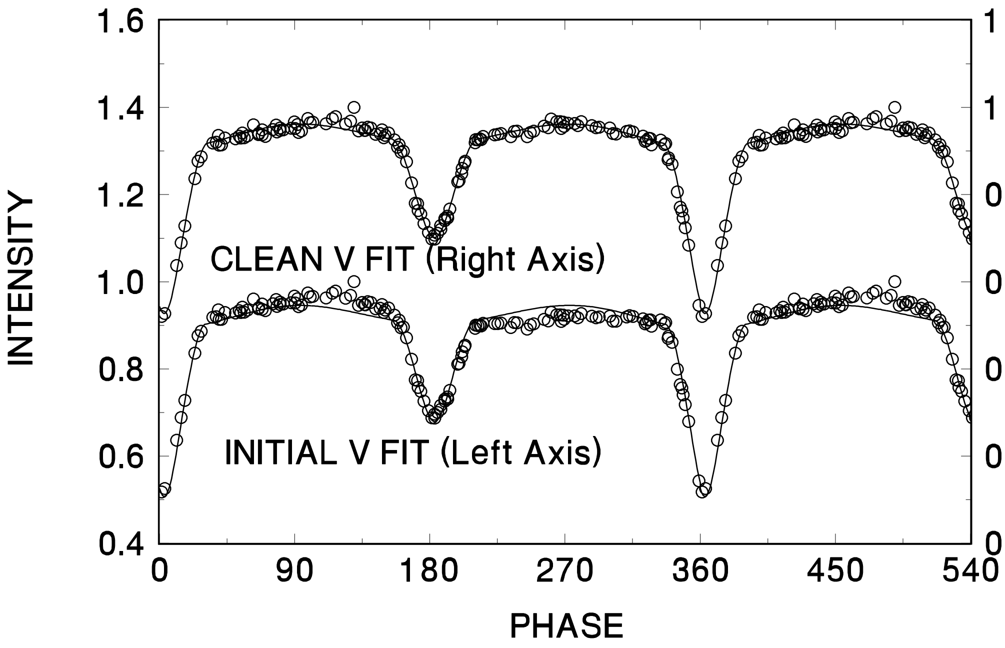

Figure 3. CG Cyg 1995 V band initial and clean fits

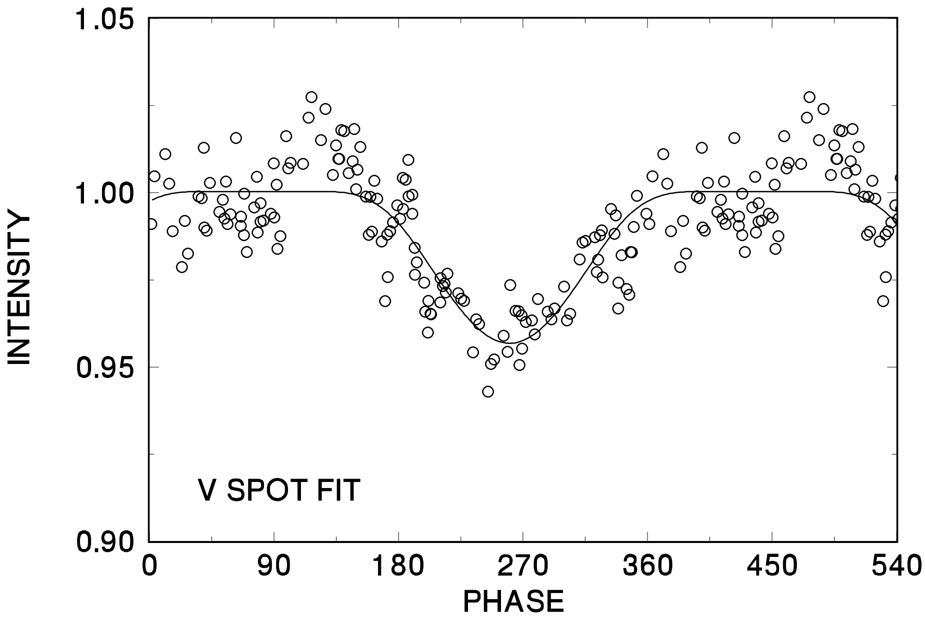

Figure 4. CG Cyg 1995 V band spot fit

1994 disappeared. At the same time, the spot in the 270° ALB roughly doubled in radius (from 9° to 18° at V). It however remained, to within errors, at the same longitude and latitude. 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 the clean fits summarized in Table 2.

For easy comparison, Table 3 shows the average values of the clean fits for the color independent parameters from this work, Heckert (1994), and Zeilik et al. (1994). The errors quoted are the standard deviations of the values averaged rather than the errors returned from the ILOT program. 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. Zeilik et al. (1994) adopted 1.0 and did not fit for the mass ratio. This work and Heckert (1994) lend credence to the lower value of the mass ratio found by Popper (1993).

Table 3. Means for Clean Fits

	$k(=r_2/r_1)$	r_1	i(deg)	$q(=M_2/M_1)$
This Work	0.826±0.048	0.267±0.006	82.6±0.1	0.813±0.022
Heckert (1994)	0.864±0.068	0.252±0.012	82.8±1.3	0.530+0.070
Zeilik et al. (1994)	0.939±0.074	0.239±0.010	83.0±1.8	1.0(fixed)

The ILOT program also makes a best fit correction to the phase of primary minimum. From this information averaged over 4 wavelengths, I find that the eclipses are observed 0.0054±0.0002 days after they are computed to occur during this epoch.

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