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1997 PHOTOMETRY OF RT ANDROMEDAE

PAUL A. HECKERT

Dept. of Chem. & Physics, Western Carolina University Cullowhee, NC 28723 USA

As part of an ongoing study of short period eclipsing RS CVn stars, this work reports 1997 light curves and spot models of RT And. Previous papers in this series (Heckert 1995 and Heckert et al. 1996) report 1995 and 1996 data and summarize previous similar work. Arévalo et al. (1995) report infrared observations from which they estimate the system parameters.

I observed RT And on the nights of 7, 8, 9, 10, and 11 January 1997 with the 61 cm telescope at Mt. Laguna Observatory operated by San Diego State University. I used the instrument, technique, and calibration reported in Heckert (1995). Figure 1 shows the BVRI differential magnitudes (star–comparison) in the standard Johnson-Cousins system. Phases for the 93 data points in each filter, were computed with the ephemeris given by Strassmeier et al. (1993): $\phi = 2441141.8888 + 0.62892984 \times E$.

As for the 1995 and 1996 data, I used the Information Limit Optimization Technique (ILOT) of Budding and Zeilik (1987) to model the data to find the spot structure. Figures 2 and 3 show the fits. In degrees, I get:

Table 1: Spot Fits

	B band	V band	R band	I band
Longitude	239.5 ± 4.2	237.9 ± 4.9	239.4 ± 6.3	244.2 ± 8.5
Latitude	39.0 ± 19.2	44.3 ± 26.9	45	45
Radius	11.2 ± 2.4	12.0 ± 4.1	11.0 ± 0.7	11.1 ± 0.7
χ^2	233.0	136.0	127.1	109.0

As for most previous results, the data fit well with a single spot. It is interesting to compare these results to those for the 1995 and 1996 data. Figure 4 plots the spot positions. The spot is roughly the same size and at mid latitudes for all three years. Note however that the modeled latitudes are quite uncertain and in some cases values had to be fixed at 45° because I was unable to fit this parameter. The spot migrated from the 90° Active Longitude Belt (ALB) to the 270° ALB between 1995 and 1996. In 1996 the spot was at 216° longitude, barely within the region that could be considered the 270° ALB. By 1997 the spot had migrated to 240° longitude, closer to the center of the 270° ALB. Heckert et al. (1998) notice a similar trend for WY Cnc. Spots originate near the edge of an ALB and migrate to increasing longitudes.

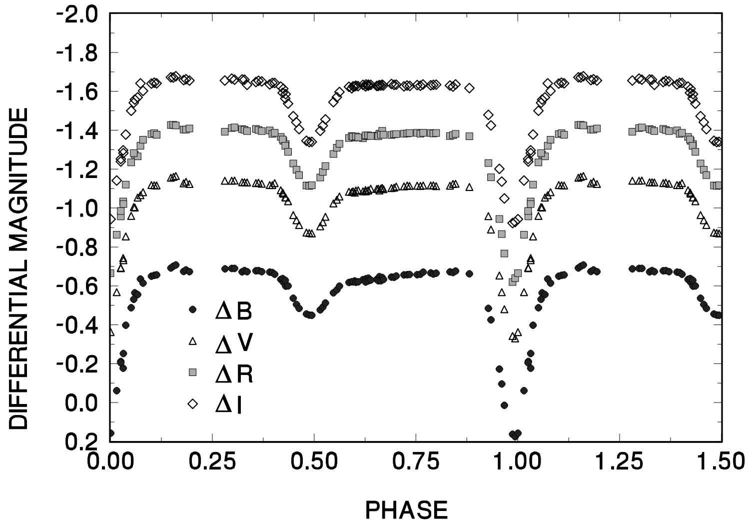

Figure 1.

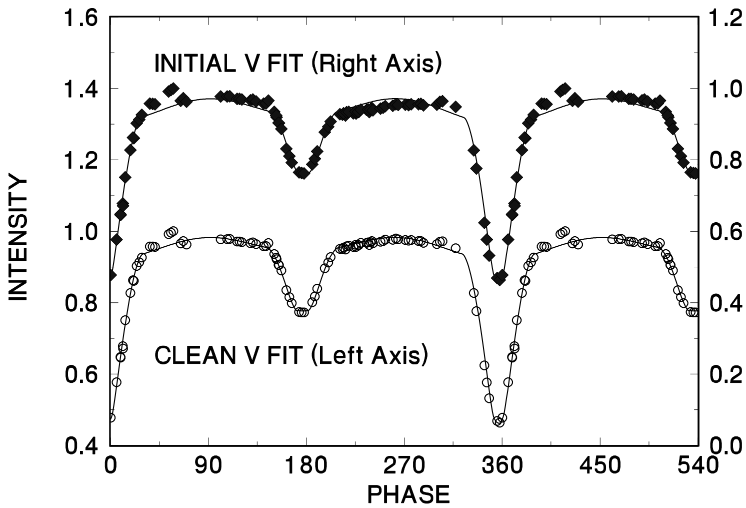

Figure 2.

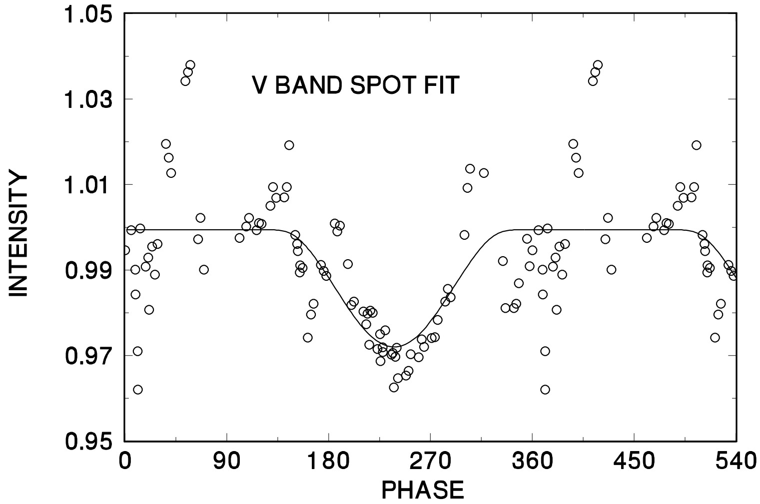

Figure 3.

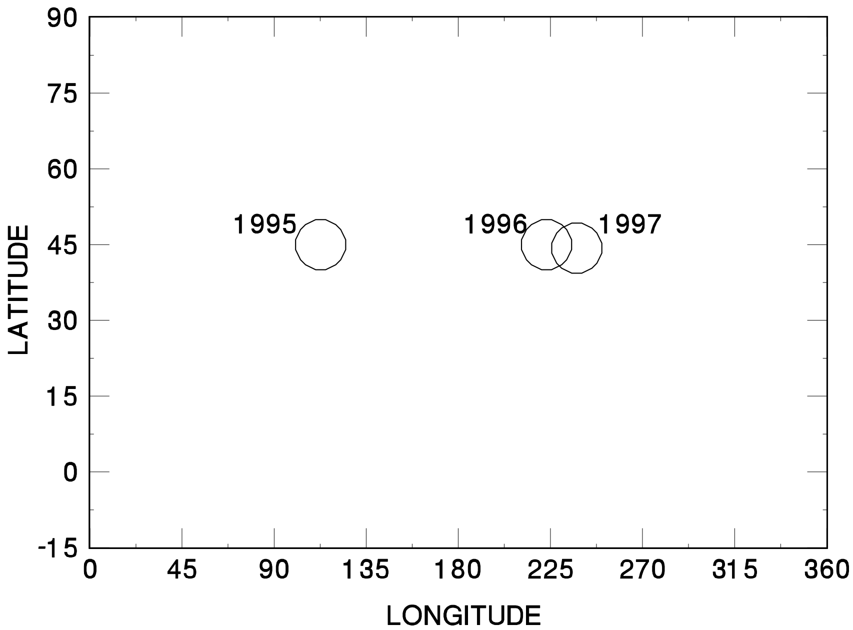

Figure 4.

Unlike the 1995 and 1996 light curves, these light curves were complete enough to perform clean fits with the effects of the spot distortion wave removed. These fits provide estimates of the system parameters. The quantities are as defined by Budding and Zeilik (1987). The result is as follows:

Table 2: Clean Fits

	B band	V band	R band	I band
L_1	0.861 ± 0.008	0.823 ± 0.008	0.807 ± 0.008	0.775 ± 0.008
$k(= r_2/r_1)$	0.718 ± 0.006	0.721 ± 0.007	0.736 ± 0.010	0.744 ± 0.007
$\Delta\theta_0$	3.660 ± 0.134	3.921 ± 0.141	3.961 ± 0.152	4.098 ± 0.150
r_1	0.319 ± 0.004	0.316 ± 0.004	0.315 ± 0.004	0.307 ± 0.003
i (deg)	90.0 ± 1.7	89.5 ± 2.3	86.9 ± 1.1	90.0 ± 1.9
e	0.024 ± 0.013	0.014 ± 0.012	0.020 ± 0.011	0.021 ± 0.012
M_0	2.929 ± 0.137	3.015 ± 0.153	2.998 ± 0.108	3.051 ± 0.080
L_2	0.111 ± 0.009	0.145 ± 0.009	0.165 ± 0.010	0.199 ± 0.010
$q(= m_2/m_1)$	0.399 ± 0.065	0.424 ± 0.083	0.54 ± 0.105	0.470 ± 0.130
χ^2	152.5	82.1	97.1	80.5

The luminosities of the primary and secondary stars, L_1 and L_2, are normalized to sum to approximately but not exactly one. $\Delta\theta_0$ is the correction in degrees that must be added to the observed times of eclipse minima to obtain the minima times computed with the ephemeris given by Strassmeier et al. (1993). The radius of the primary, r_1, is in units of the orbital separation. The averages of these values, $r_1 = 0.314 \pm 0.005$ and $k = 0.730 \pm 0.012$, compare well with the solutions of Arévalo et al. (1995) which are: $r_1 = 0.316 \pm 0.005$ and $k = 0.715 \pm 0.033$. My average value of the orbital inclination, 89.1 ± 1.5 compares to 88.4 ± 1.1 and 87 obtained by Zeilik et al. (1989) and Arévalo et al. (1995). M_0 and e are the mean anomaly and ellipticity. Zeilik et al. (1989) find that RT And has a slightly elliptical orbit rather than the circular orbit more common for these systems. They get values of 3.03 ± 0.22 and 0.026 ± 0.013 which agree with the averages of these values of 3.00 ± 0.04 and 0.020 ± 0.04. My values of the mass ratio are lower than the previous values of 0.65 used by Budding and Zeilik (1987) and the spectroscopically determined value of 0.73 (Popper 1994). However photometric mass ratios, especially when determined from a single set of light curves, are less reliable than those from spectroscopic data.

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