COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2474

Konkoly Observatory
Budapest
8 February 1984
HU ISSN 0374-0676

NEW OBSERVATIONS OF CN ANDROMEDAE

The eclipsing binary CN Andromedae, BD +39°0059, was observed on five nights at the Stephen F. Austin State University Observatory. The photometer, which utilizes a dry-ice cooled EMI 6256B photomultiplier, has been described elsewhere (Hibbs, 1980, Michaels, 1981, and Markworth and Michaels, 1982). The 707 observations in the natural B and V system of the telescope/photometer combination are presented in Figure 1. An additional 259 observations in the natural U system were also utilized to determine a total of eight new timings of primary minimum.

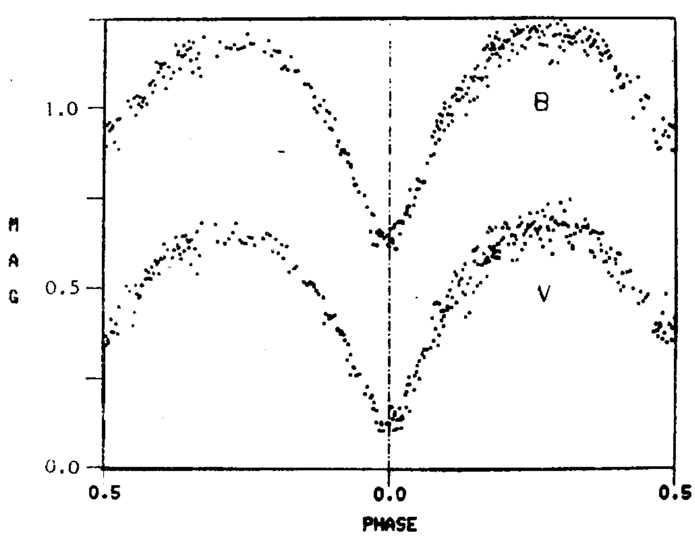

Figure 1

The individual differential magnitudes of CN And in the sense (variable-comparison).

The eclipses during this epoch are rather asymmetric, with the egress branch of either eclipse rising faster than the descent of the ingress branch. Two methods of determination of the times of minimum were, therefore, attempted. Method 1 was the tracing paper method, where a free-hand curve drawn through the ingress branch was reflected upon the egress branch. The ingress branch was selected as the more symmetric, since evidence of excess light can be seen clearly at the maximum following primary minimum and probably affects the primary egress. Method 2 was a least squares fit of the bottom of the eclipse curve (i.e., before the inflexion points) by a parabola. The results are found in Table I. For the least squares fit, the quoted error was determined by standard error propagation techniques, which incorporate the individual errors for the best fit quadratic.

Table I

Filter	JD(2440000+) Tracing Paper	JD(2440000+) Least Squares
V	5608.6999	5608.7001 ±.0047
B	5608.6999	5608.6987 ±.0048
U		5608.6982 ±.0067
V	5620.7300	5620.7299 ±.0041
B	5620.7291	5620.7282 ±.0027
U		5620.7335 ±.0067
V	5654.7426	5654.7441 ±.0018
B	5654.7387	5654.7423 ±.0028

A period study has been conducted using all available times of minimum. Table II lists the Heliocentric Julian Date of minimum, the (O-C) in days from our linear ephemeris, the type of minimum (primary or secondary), the method of observation, the weight given to the timings in the weighted least squares solution, and the reference. The timings of Löchel (1960) were found to be photographic observations (not photoelectric as identified by Seeds and Abernathy (1982)), and their weights reflect this change. The weighted least squares solution for the initial epoch and the period gives the ephemeris

$$\text{Hel JD}_{min} = 2433570.48113 + 0^{d}.46279475 \cdot E$$
$$\pm 0.00361 \quad \pm 0.00000016$$

Table II

JD_{min}	$O\text{-}C_{days}$	Type	Method	Weight	References
2433570.465	-.0161	pri	pg	2	Löchel
4603.437	-.0019	pri	pg	2	"
4653.406	-.0149	pri	pg	2	"
4748.288	-.0057	pri	pg	2	"
4779.283	-.0180	pri	pg	2	"
5400.342	-.0296	pri	pg	2	"
5868.244	-.0131	pri	pg	2	"
6051.526	.0022	pri	pg	2	"
6102.453	.0218	pri	pg	2	"
6108.450	.0025	pri	pg	2	"
6127.386	-.0361	pri	pg	2	"
6399.533	-.0124	pri	pg	2	"
6544.379	-.0212	pri	pg	2	"
6848.466	.0097	pri	pg	2	"
6899.366	.0022	pri	pg	2	"
2441509.4930	-.0006	sec	pe	6	Bozkurt, et al.
1509.4954	.0017	sec	pe	6	"
1512.5044	.0025	pri	pe	6	"
1512.5049	.0031	pri	pe	6	"
1567.5746	.0002	pri	pe	6	"
1567.5761	.0017	pri	pe	6	"
1568.5012	.0012	pri	pe	6	"
1568.5016	.0016	pri	pe	6	"
1577.5278	.0033	sec	pe	6	"
1577.5282	.0037	sec	pe	6	"
1595.344	.0019	pri	v	1	BBSAG 6, 1972
1664.282	-.0164	pri	v	1	BBSAG 7, 1973
1930.401	-.0045	pri	v	1	BBSAG 11, 1973
1981.301	-.0119	pri	v	1	BBSAG 12, 1973
2369.352	-.0143	sec	v	1	BBSAG 18, 1974
2427.267	.0513	sec	v	1	BBSAG 20, 1975
2740.286	-.0103	pri	v	1	BBSAG 24, 1975
2993.450	.0050	pri	v	1	BBSAG 29, 1976
3069.357	.0136	pri	v	1	BBSAG 32, 1977
3431.277	.0281	pri	v	1	BBSAG 35, 1977
3432.462	.0561	sec	v	1	"
3791.358	.0548	pri	v	1	BBSAG 39, 1978
4881.6483	.0007	pri	pe	6	Seeds and Abernathy
4886.7382	-.0001	pri	pe	6	"
4898.7716	.0006	pri	pe	6	"
4908.2602	.0019	sec	pe	6	Yulan and Qingyao
4899.2182	-.0156	pri	pe	6	"
4934.1762	.0014	sec	pe	6	"
4945.5136	.0003	pri	pe	6	Seeds and Abernathy
5608.7001	.0019	pri	pe	6	this paper
5608.6987	.0006	pri	pe	6	"
5608.6982	.0000	pri	pe	6	"
5620.7299	-.0009	pri	pe	6	"
5620.7282	-.0026	pri	pe	6	"
5620.7335	.0027	pri	pe	6	"
5654.7441	-.0021	sec	pe	6	"
5654.7423	-.0039	sec	pe	6	"

where the errors are standard errors. Parabolic, cubic, and differential corrections periodic/parabolic solutions were also attempted for this data using the program of Rafert (1977, 1982). The errors in the higher order terms were found to exceed the numerical values of the parameters in all cases, thus indicating a preference for the linear ephemeris.

The clear evidence of excess light following primary minimum, and the disparity in the heights of the maxima are in stark contrast to the well-behaved light curve of Seeds and Abernathy (1982) which were observed only a year previously. A complete study of CN And will be presented elsewhere.

E.J. MICHAELS
N.L. MARKWORTH
J.B. RAFERT

Stephen F. Austin State University
Department of Physics
Box 13044
Nacogdoches, Tx 75962

References:

BBSAG 6 (1972), 7,11,12 (1973), 18 (1974), 20,24 (1975), 29 (1976), 32, 35 (1977), 39 (1978)
Bozkurt, S., Ibanoğlu, C., Gülmen, O., Güdür, N., 1976, I.B.V.S. No. 1087
Hibbs, M.F., 1980, Master's Thesis, Stephen F. Austin State University
Löchel, K., 1960, M.V.S. 457-458
Markworth, N.L. and Michaels, E.J., 1982, Publ.Astr.Soc. Pacific 94, 350
Michaels, E.J., 1981, Master's Thesis, Stephen F. Austin State University
Rafert, J.B., 1977, Doctoral Dissertation, University of Florida
Rafert, J.B., 1982, Publ.Astr.Soc. Pacific 94, 485
Seeds, M.A. and Abernathy, D.K. 1982, Pub.Astr.Soc.Pac, 94, 1001
Yulan, Y. and Qingyao, L., 1982, I.B.V.S. No. 2202