2007: The Journal of Astronomical Data 13, 2.

Observations of UU Cancri

P. Kalv[1,*], T. Oja[2] and V. Harvig[1]

[1]Institute of Physics, Tallinn University of Technology,
Tallinn Observatory, Tähetorni 2, Tallinn, Estonia
Tartu Observatory
[2]Astronomical Observatory, Box 515, SE-751 20 Uppsala, Sweden

Received 17 May 2007; accepted 26 July 2007

Abstract

We present $UBVR$ photometric observations of the 96-day binary system UU Cancri (K4 III) obtained in 1972–1994. A relatively large scatter in the orbital light curves turned out to be intrinsic with a modulating cycle lasting at least 8000 days. Using all available archived photographic and visual observations covering nearly 100 years, we find the orbital period of the system to be constant. This fact, together with the pattern of the colour curves, makes the existence of a powerful accretion disk in the system improbable.

1 Introduction

The main problem of UU Cancri was brought forth in the first spectroscopic studies (Popper 1956, 1977; Eggen 1973): the component whose lines were measured for velocity is in front at phase zero and must be the cooler component, but its hydrogen lines are too strong for a K4 III star. Popper (1956) notes that the spectral type of the visible component is K4 III, except for the hydrogen lines, being about as strong relative to metallic lines as in a G8 III star. He also suggests the component stars to be of nearly equal mass and

*P. Kalv passed away on 1 January 2002.

radius. High-dispersion spectra at H_α obtained by Eaton (1990, 1991), as well as IUE spectra, only enhanced the contradictions:

- no variations greater than $0\overset{m}{.}3$ in the ultraviolet continuum;
- the UV flux is lower than expected from a star as massive as the unseen component;
- the rotational velocity near conjunction requires the optically undetected companion star to be more massive than the K4 giant.

The phase-dependent Balmer absorption seemingly implies a semi-detached accreting system, but a strong chromosphere or wind from the secondary of a contact system is possible as well. A new spectroscopic orbit of UU Cancri was obtained from Coravel and Elodie radial velocity measurements by Imbert (2002), who notes that only one component is visible. The mass of the unseen companion is estimated by Zola et al. (1994) and adopted by Imbert (2002).

Photoelectric V light curves were published by Winiarski & Zola (1987), Lee (1988), and B, V light curves by Eaton (1990). From these observations three light-curve solutions were presented in which the system is a contact binary with both components overfilling their Roche lobes (Winiarski & Zola 1987; Barone 1989), and three semi-detached models (Winiarski & Zola 1987; Eaton 1990; 1991). The most important physical parameters are quite different in these models, e.g. the mass ratio ranged from 0.3 to 1.5. Thereafter Zola et al. (1994) rediscussed earlier results and presented an accretion disk model for the system.

2 Observations

UU Cancri was observed with the Tallinn 50-cm telescope (BV from 1972, $UBVR$ from 1980), the Kvistaberg 40-cm telescope (UBV from 1985), the 60-cm telescope of the Royal Swedish Academy of Sciences at Observatorio Astrofisico del Roque de los Muchachos, La Palma Canary Islands (UBV from 1991) and 2.5-m Nordic Optical Telescope ($UBVRI$ on seven nights from 1990). Up to 1994 in total 234 observations (one normal point per night, see Fig. 1) have been obtained. The brightness of the comparison and the check star (also used as extinction stars) given in Table 1 are from measurements with the Nordic Optical Telescope (NOT). Two standard stars from the list of Oja (1996) were each observed 7 times: SAO 97490 = BD 16°1614 and SAO 97489 = BD 15°1731.

The root-mean-square errors of the normal points, as calculated from the measurements of comparison and check stars, are less than $0\overset{m}{.}01$ for V, $B-V$

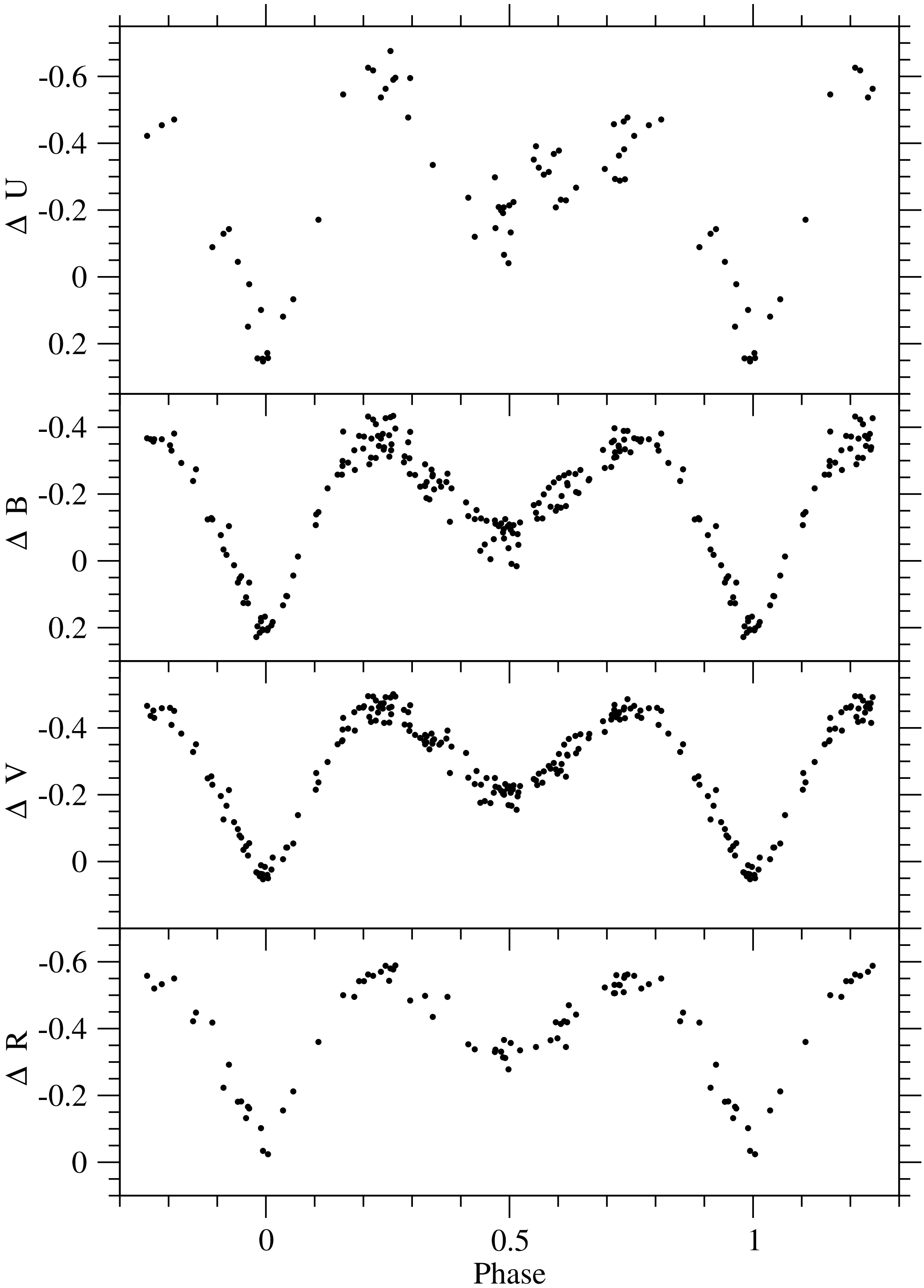

Figure 1: Differential phase diagram for UU Cancri ($P = 96\overset{\mathrm{d}}{.}6760$).

Table 1: Magnitudes and colour indices of UU Cancri, comparison and check star (NOT, 1991).

Star		V	$U-B$	$B-V$	$V-R$
UU Cancri	SAO 97496				
	max	8.67	1.26	1.40	0.81
	min	9.19	1.50	1.50	0.84
Comparison star	SAO 97490	9.15	1.46	1.33	0.72
Check star	SAO 97489	9.35	−0.03	0.44	0.27

and $V-R$. In the ultraviolet, UU Cancri was too faint for the Tallinn and Kvistaberg telescopes. Often the sky background was bright from full or nearly full Moon and we have attempted to observe also in relatively poor atmospheric conditions. Therefore, in many nights the error in U may reach up to $0\overset{\mathrm{m}}{.}04$. On the other hand, some observations made on the same nights at La Palma and Tallinn convince us that this was not too often the case, and that irregular variations up to $0\overset{\mathrm{m}}{.}2$ in the ultraviolet are real.

The observations were carried out at Tallinn Observatory (former observational station of Tartu Observatory and now the educational observatory of Tallinn University of Technology). The photoelctric photometers were attached to the Cassegrain focus of the 48 cm reflector AZT–14A ($f/16$). The photomultiplier tubes used were:

1. EMI 9502B JD 2439430–2444000
2. EMI 9502SA JD 2444100–JD 2444317 and JD 2445500–JD 2450220
3. FEU-79 JD 2444317–JD 2445000

As only differential observations of the variable relative to the comparison star were made in Tallinn, attention was given to the determination of the mean extinction coefficients. Among several methods for the determination of extinction, the differential method (Hardie 1962) is the most suitable for our purposes.

All measurements have been reduced to the Johnson system, see Oja (1996). The generic formula for differential transformation of the instrumental *uvbr* to the standard $UBVR$ are:

$$\begin{array}{rllcl}
\Delta(U-B) = & [& \Delta(u-b) & - & k'_{u-b} \times \Delta X] \times C_1 \\
\Delta(B-V) = & [(1+k''_{b-v} \times \overline{X})\times & \Delta(b-v) & - & k'_{b-v} \times \Delta X] \times C_2 \\
\Delta V = & & \Delta v & - & k'_{v} \quad \times \Delta X - C_3 \times \Delta(B-V) \\
\Delta(V-R) = & [& \Delta(v-r) & - & k'_{v-r} \times \Delta X] \times C_4
\end{array}$$

where ΔX is the differential air mass, and k' the extinction coefficients. The numerical coefficients are given in Table 2. The differential magnitudes are given in Table 5.

As no appreciable systematic differences between the differential magnitudes obtained in different instrumental configurations showed up, all results could easily be merged in one single time series for each band.

Table 2: Differential transformation and extinction coefficients.

JD	k'_{u-b}	k'_{b-v}	k'_{v}	k'_{v-r}	k''_{b-v}	C_1	C_2	C_3	C_4
2439430–2444000		0.20	0.36		0.05		1.19	0.07	
2444100–2444317 2445500–2450220	0.26	0.20	0.36	0.11	0.05	1.19	0.94	0.09	1.09
2444317–2445000	0.32	0.18	0.24	0.11	0.04	1.12	1.00	0.11	1.09

3 Period

The times of minimum were determined using Pogson's tracing paper method in differential mode (Albo 1964), computerized by Kalv (1979). We have used all available times of minimum beginning with the Huth (1963) photographic determinations from the beginning of last century. The results are given in Table 3 and Fig. 2. The quadratic term of the light elements derived from the same data is of the same order of magnitude as its error. Therefore we have used linear light elements[1] derived by the least-squares method:

$$\begin{array}{rl} T_{\min} = & 2425600.6 + 96.6760 \times E \\ & \pm 0.4 \quad \pm 0.0019 \end{array}$$

The determination of the weights of the normal minima given in Table 3 was arbitrary in some respects. The weights corresponding to square-root errors σ

[1] There is an apparent discrepancy between the period given by Imbert (2002) and our ephemeris. The divergence results from a misprint in Table 2 of Imbert (2002) which lists another value for the period than the one given in his Figure 6.

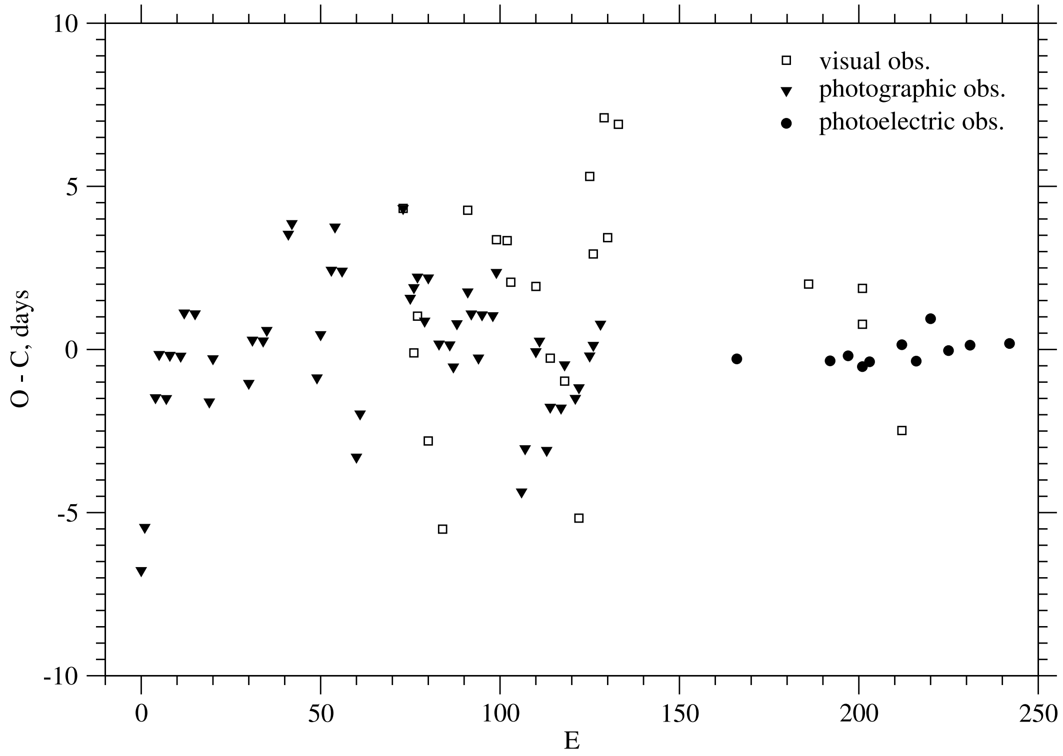

Figure 2: $O - C$ diagram with all available times of minimum.

(indicated by m.e. in the Table) of normal minima were calculated according to their dispersion in a preliminary non-weighted solution and were adopted as follows: $\pm 3\overset{d}{.}6$ for visual, $\pm 2\overset{d}{.}2$ for photographic and $\pm 0\overset{d}{.}3$ for photoelectric times of minima. Striving not to be unjust to modern visual observers, whose observations seem to be as accurate as those of earlier photographic recordings, we adopt $\pm 2\overset{d}{.}2$ days for them too. The number of the first photoelectric observations (Eggen 1973) is too small for determining the accurate moment of minimum. Therefore we have merged Eggen's data with the data of our first series (minimum $E = 166$). We also have determined two minima from the measurements by HIPPARCOS. The photoelectric mimimum $E = 220$, with $O - C > 3\sigma$ did not take part in the final levelling-off procedure with weights.

4 Light curves

It is obvious from Fig. 1 that the dispersion around a mean curve is considerably higher than the errors of observation. Fig. 3 shows the residuals as a function of time.

It appears that the orbital light-variations are modulated with a wave lasting at least 8000 days. These intrinsic variations are colour-dependent with an amplitude of about $0\overset{m}{.}10$ in B and $0\overset{m}{.}06$ in V. In U the amplitude is probably greater than $0\overset{m}{.}11$ whereas in R these variations are not perceptible.

Evidently the same variations were mentioned already by Eaton et al. (1991) as a difference between the Winiarski & Zola (1987) light curve (observed at around the maximum of the 8000-day cycle) and that measured with the Vanderbilt-Tennessee State APT near the minimum of the cycle.

The long-period changes were approximated with a polynomial (except R) and for further use deviations from the polynomial were taken. We have combined all available observations. Thereafter the observations were combined into normal points and normalized with maximum II of the orbital light curve.

The normalized light curves are showing contradictory behaviour of depths of minima. From Table 4 it appears that from R to U in every light curve the depth of the minimum is increasing. The only explanation we could imagine for this phenomenon, is some kind of third light in the system, which should reveal itself through an infrared excess (for an accrection disk as well as for an envelope).

We intend to publish the results of the investigation in near future.

Acknowledgements

The authors are grateful to Dr. I. Pustylnik and Dr. J. V. Clausen for critical remarks and to Toomas Aas for his persistent help.

References

Albo, H., 1964, Tartu Publ., 34, 169

Barone, F., Milano, L., Russo, G., Sarna, M.J., 1989, Ap&SS, 159, 67

Beyer, M. & 1964, Mitt. Hamburg. Sternw. Bergedorf, No.122, 87

Eaton, J.A., 1990, MNRAS, 247, 62

Eaton, J.A., Hall, D.S., Honeycutt, R.K., 1991, ApJ, 376, 289

Eggen, O. J., 1973, PASP, 85, 42

Hardie R.H., 1962, Astronomical Techniques, ed. W.A. Hiltner, University of Chicago Press, p.178

Hipparcos Catalogue Epoch Photometry Data, HIP 39341

Huth, H., & 1963, Mitt. Verand. Sterne, No. 744–745

Imbert, M., 2002, A&A, 387, 850

Isles, J., 1986, BAAVS Circ., No. 63, 19

Kalv, P., 1979, Tartu AO Teated, No. 58, 64

Kim, H.I., Chun, Y.W., Lee, Y.S., 1988, Vistas in Astron., 31, 343

Lause, F., 1938, Astron. Nachrichten., 266, 237

Lee, Y-S., 1988, Vistas Astron., 31, 323

Oja, T., 1996, Baltic Astronomy, 5, 103

Popper, D. M., 1956, PASP, 68, 131

Popper, D. M., 1977, PASP, 89, 315

Schachowskoi, N.M., 1956, Bull. AO Stalinabad, No.17, 35

Taylor, M.D., 1984, BAAVS Circ., No. 58, 11

Taylor, M.D., 1985, BAAVS Circ., No. 60, 19

Winiarski, M., & Zola, S., 1987, Acta Astron., 37, 375

Zola, S., Hall, D.S., Henry, G.W., 1994, A&A, 285, 531

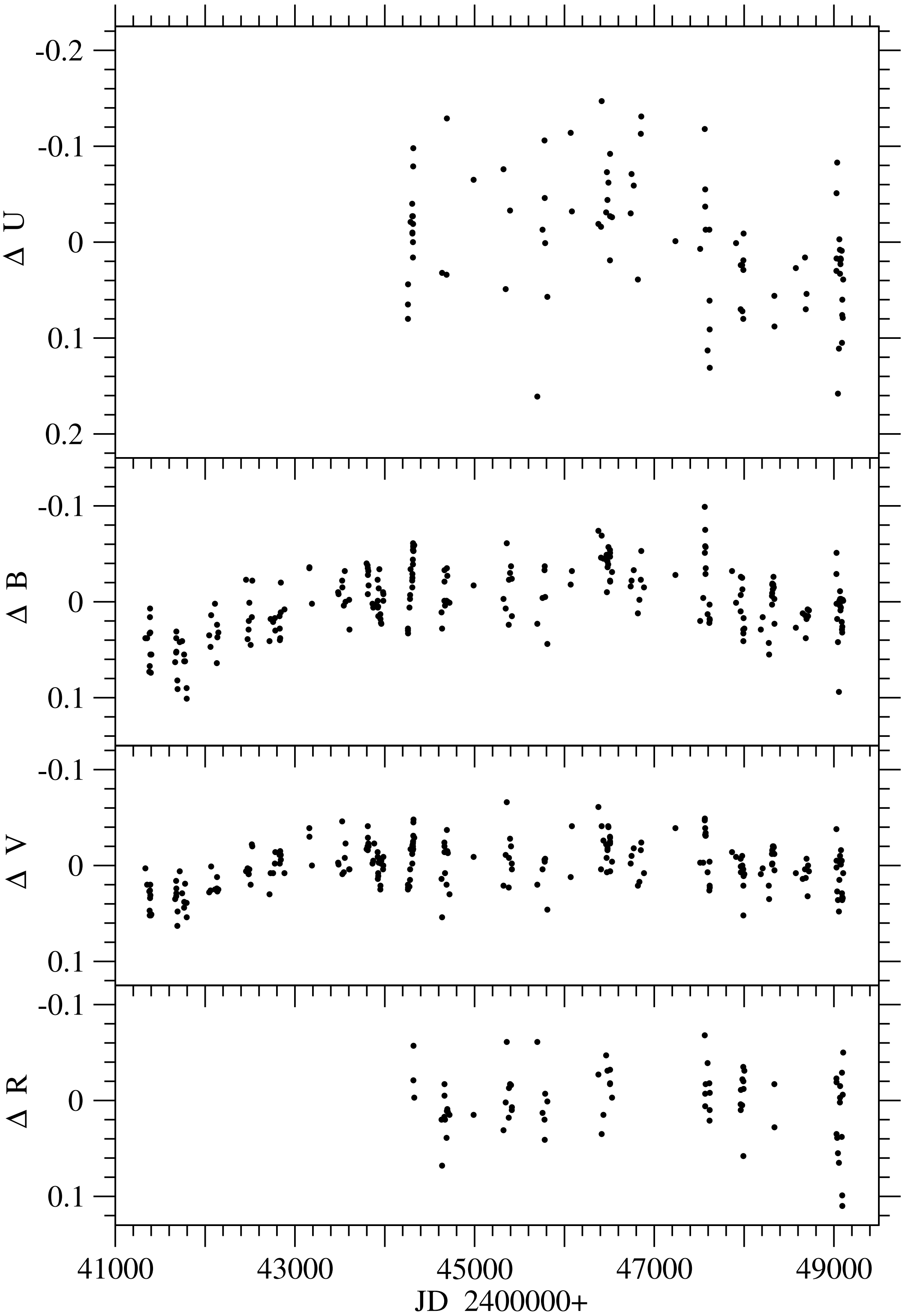

Figure 3: The residuals calculated with the time series statistical program `TS`, developed by the American Association of Variable Star Observers.

Table 3: Times and mean errors of normal minima of UU Cancri.

HJD−2400000	m.e.	E	$O-C$	Observer
25594	2.2	0	−6.77	H
25692	2.2	1	−5.45	H
25986	2.2	4	−1.48	H
26084	2.2	5	−0.15	H
26276	2.2	7	−1.50	H
26374	2.2	8	−0.18	H
26664	2.2	11	−0.20	H
26762	2.2	12	1.12	H
27052	2.2	15	1.10	H
27436	2.2	19	−1.61	H
27534	2.2	20	−0.28	H
28500	2.2	30	−1.04	H
28598	2.2	31	0.29	H
28888	2.2	34	0.26	L
28985	2.2	35	0.59	L
29568	2.2	41	3.54	H
29665	2.2	42	3.86	H
30337	2.2	49	−0.87	H
30435	2.2	50	0.46	H
30727	2.2	53	2.43	H
30825	2.2	54	3.76	H
31017	2.2	56	2.40	H
31398	2.2	60	−3.30	H
31496	2.2	61	−1.97	H
32662	3.4	73	4.32	B
32663	2.2	73	4.92	H
32853	2.2	75	1.57	H
32948	3.4	76	−0.10	B
32950	2.2	76	1.90	H,S
33045	3.4	77	1.02	B
33047	2.2	77	2.22	H
33239	2.2	79	0.87	H,S
33332	3.4	80	−2.80	B
33337	2.2	80	2.20	H,S
33625	2.2	83	0.17	H,S
33716	3.4	84	−5.51	B
33915	2.2	86	0.14	H
34011	2.2	87	−0.53	H
34109	2.2	88	0.79	H,S
34400	2.2	91	1.77	H,S
34402.5	3.4	91	4.27	B

Table 3: Times and mean errors of normal minima of UU Cancri (*continued*).

HJD−2400000	m.e.	E	$O-C$	Observer
34496	2.2	92	1.09	S
34688	2.2	94	−0.26	H
34786	2.2	95	1.06	H
35076	2.2	98	1.04	H
35174	2.2	99	2.36	H
35175	3.4	99	3.36	B
35465	3.4	102	3.34	B
35560.4	3.4	103	2.06	B
35844	2.2	106	−4.36	H
35942	2.2	107	−3.04	H
36235	2.2	110	−0.07	H
36237	3.4	110	1.93	B
36332	2.2	111	0.26	H
36522	2.2	113	−3.09	H
36620	2.2	114	−1.77	H
36621.5	3.4	114	−0.27	B
36910	2.2	117	−1.79	H
37007.5	3.4	118	−0.97	B
37008	2.2	118	−0.47	H
37297	2.2	121	−1.50	H
37390	3.4	122	−5.17	B
37394	2.2	122	−1.17	H
37685	2.2	125	−0.20	H
37690.5	3.4	125	5.30	B
37782	2.2	126	0.13	H
37784.8	3.4	126	2.93	B
37976	2.2	128	0.78	H
38079	3.4	129	7.10	B
38172	3.4	130	3.43	B
38465.5	3.4	133	6.90	B
41648.6	0.5	166	−0.29	E+KO
43584.4	2.2	186	2.00	T
44162.1	0.5	192	−0.35	KO
44645.63	0.5	197	−0.19	WZ
45032.0	0.5	201	−0.53	WZ
45033.3	2.2	201	0.77	T
45034.4	2.2	201	1.87	Br
45225.5	0.5	203	−0.38	KO
46096.1	0.5	212	0.14	KO
46093.47	2.2	212	−2.49	I
46482.3	0.5	216	−0.36	KCL

Table 3: Times and mean errors of normal minima of UU Cancri (*continued*).

HJD−2400000	m.e.	E	$O-C$	Observer
46870.3	0.5	220	0.94	KCL
47352.7	0.5	225	−0.04	KO
47932.92	0.5	231	0.13	EHH
48996.4	0.5	242	0.18	KO
41695.8	–	166.5	−0.92	E+KO
43630.5	–	186.5	0.12	KO
44596.2	–	196.5	−1.01	KO
46047.9	–	211.5	0.45	KO
46821.20	–	219.5	0.28	KCL
46918.78	–	220.5	1.18	KCL
47111.5	–	222.5	0.53	KO
48562.1	–	237.5	0.79	KO

Observers: B: Beyer (1964), Br: Brelstaff (1985), E: Eggen (1973), EHH: Eaton, Hall & Honeycutt (1991), H: Huth (1963), I: Isles (1986), KCL: Kim, Chun & Lee (1988), KO: this paper, L: Lause (1938), S: Schachowskoi (1956), T: Taylor (1984, 1985), WZ: Winiarski & Zola (1987).

Table 4: Depths of minima from orbital light-curves, corrected for intrinsic variations and normalized by maximum II (phase = 0.75).

	Flux	
Band	min I	min II
U	0.535	0.755
B	0.595	0.763
V	0.636	0.791
R	0.645:	0.805

Table 5: Differential magnitudes of UU Cancri.

HJD−2400000	ΔU	ΔB	ΔV	ΔR	ΔI
41334.5651		−0.325	−0.458		
41354.4074		0.126	−0.035		
41379.4097		−0.289	−0.433		
41382.3477		−0.340	−0.415		
41383.3788		−0.312	−0.416		
41386.4143		−0.313	−0.410		
41387.3588		−0.307	−0.391		
41390.3436		−0.225	−0.361		
41391.3376		−0.184	−0.336		
41395.3958		−0.117	−0.265		
41402.3123		−0.049	−0.181		
41666.5725		−0.272	−0.392		
41677.4593		−0.260	−0.408		
41678.5132		−0.257	−0.379		
41679.5263		−0.222	−0.370		
41680.5042		−0.224	−0.351		
41691.4696		−0.030	−0.176		
41693.4857		−0.005	−0.175		
41717.4591		−0.281	−0.425		
41744.3761		0.215	0.044		
41766.4400		−0.309	−0.418		
41767.3799		−0.308	−0.422		
41777.4354		−0.188	−0.357		
41794.3283		0.009	−0.167		
41795.3501		0.016	−0.155		
42045.4984		−0.107	−0.215		
42060.4635		−0.331	−0.441		
42067.5097		−0.236	−0.375		
42109.3846		−0.364	−0.436		
42130.3915		0.228	0.032		
42133.3865		0.193	0.024		
42136.3350		0.105	−0.042		
42147.3618		−0.258	−0.360		
42455.3727		−0.253	−0.353		
42472.4311		−0.048	−0.207		
42484.3467		−0.203	−0.337		
42486.3650		−0.241	−0.369		
42492.3049		−0.345	−0.443		
42507.4271		−0.124	−0.249		
42520.3300		0.183	−0.012		
42525.3523		−0.013	−0.139		

Table 5: Differential magnitudes of UU Cancri (*continued*).

HJD−2400000	ΔU	ΔB	ΔV	ΔR	ΔI
42716.5656		0.106	−0.042		
42728.6328		−0.294	−0.398		
42757.5588		−0.065	−0.206		
42776.5201		−0.245	−0.382		
42781.4848		−0.309	−0.454		
42828.3305		−0.336	−0.461		
42831.4374		−0.344	−0.463		
42832.3796		−0.333	−0.474		
42836.4072		−0.295	−0.454		
42842.3969		−0.214	−0.366		
42843.4263		−0.238	−0.350		
42883.3484		−0.357	−0.452		
43160.4660		−0.260	−0.376		
43161.4573		−0.272	−0.381		
43189.3957		0.013	−0.118		
43480.4877		0.053	−0.078		
43485.5390		0.167	0.016		
43525.4622		−0.175	−0.325		
43528.4175		−0.127	−0.230		
43544.4314		−0.194	−0.292		
43554.4010		−0.355	−0.439		
43563.3924		−0.346	−0.460		
43603.3639		−0.366	−0.458		
43607.3473		−0.349	−0.463		
43797.5948		−0.409	−0.482		
43808.6360		−0.273	−0.383		
43810.5360		−0.222	−0.356		
43811.5804		−0.236	−0.368		
43812.6085		−0.217	−0.344		
43817.5637		−0.152	−0.271		
43819.5593		−0.120	−0.250		
43863.4783		−0.077	−0.196		
43871.4632		0.181	0.011		
43882.4382		−0.139	−0.265		
43920.4189		−0.103	−0.219		
43921.4546		−0.083	−0.216		
43922.3990		−0.080	−0.195		
43926.2980		−0.126	−0.229		
43927.3224		−0.127	−0.236		
43932.3148		−0.226	−0.317		
43939.3377		−0.332	−0.420		

Table 5: Differential magnitudes of UU Cancri (*continued*).

HJD−2400000	ΔU	ΔB	ΔV	ΔR	ΔI
43950.3709		−0.330	−0.409		
43952.3175		−0.293	−0.383		
43958.2798		−0.128	−0.255		
43961.2915		−0.018	−0.167		
43981.3691		−0.217	−0.298		
43983.3371		−0.258	−0.351		
43984.3407		−0.299	−0.395		
44257.4718	0.244	0.196	0.034		
44258.4780	0.245	0.205	0.038		
44259.4275	0.228	0.208	0.040		
44274.3512		−0.284	−0.363		
44281.4006		−0.374	−0.446		
44282.3557		−0.380	−0.458		
44287.3871	−0.477	−0.355	−0.447		
44305.3485	−0.209	−0.104	−0.221		
44306.3467	−0.208	−0.095	−0.208		
44307.4391	−0.214	−0.109	−0.225		
44308.2945	−0.224	−0.107	−0.228		
44312.3188	−0.351	−0.167	−0.247		
44313.2991	−0.327	−0.173	−0.263		
44314.2892	−0.306	−0.199	−0.270		
44315.2938	−0.314	−0.219	−0.286		
44316.2885	−0.368	−0.235	−0.295		
44317.3102	−0.378	−0.248	−0.322		
44318.3385		−0.256	−0.350	−0.422	
44319.2669		−0.263	−0.367	−0.470	
44328.3346		−0.397	−0.469	−0.531	
44631.4050		−0.239	−0.328	−0.422	
44637.4302	−0.129	−0.034	−0.126	−0.223	
44663.3913		−0.331	−0.447	−0.495	
44664.3461		−0.374	−0.460	−0.542	
44665.3076		−0.372	−0.465	−0.542	
44670.3090		−0.376	−0.460	−0.543	
44687.2977	−0.120	−0.125	−0.232	−0.338	
44691.2868	−0.298	−0.121	−0.250	−0.330	
44696.2987		−0.115	−0.226	−0.335	
44702.3489		−0.162	−0.278	−0.365	
44720.3588		−0.364	−0.430	−0.520	
44989.4832	−0.391	−0.144	−0.243	−0.345	
45321.6002	0.099	0.171	0.037	−0.102	
45345.3943	−0.537	−0.366	−0.473	−0.570	

Table 5: Differential magnitudes of UU Cancri (*continued*).

HJD−2400000	ΔU	ΔB	ΔV	ΔR	ΔI
45358.6004		−0.261	−0.392	−0.495	
45380.4417		−0.162	−0.263	−0.371	
45382.3569		−0.233	−0.320	−0.419	
45394.3304	−0.477	−0.389	−0.486	−0.562	
45405.3631		−0.274	−0.351	−0.448	
45414.3429		0.046	−0.072	−0.182	
45415.3119		0.109	−0.046	−0.132	
45698.6506	−0.089	−0.124	−0.230	−0.418	
45756.3360	−0.191	−0.085	−0.203	−0.314	
45778.3369	−0.457	−0.360	−0.440	−0.506	
45780.2894	−0.465	−0.389	−0.455	−0.509	
45785.2853	−0.454	−0.364	−0.459	−0.533	
45809.3408	0.119	0.133	−0.007	−0.155	
46069.4950	−0.494	−0.364	−0.434		
46082.4320	−0.382	−0.262	−0.365		
46378.6706	−0.143	−0.104	−0.214	−0.292	
46407.5760	−0.599	−0.413	−0.460		
46414.6264	−0.595	−0.386	−0.468	−0.484	
46433.5142		−0.125	−0.232	−0.312	
46464.4655	−0.471	−0.381	−0.451	−0.550	
46469.5030		−0.270	−0.324		
46472.4460	−0.311	−0.135	−0.227		
46479.3742	0.022	0.065	−0.055	−0.161	
46480.3460		0.091	−0.041		
46487.2730		0.023	−0.116		
46489.3530	−0.131	−0.050	−0.160		
46506.4257	−0.563	−0.427	−0.492	−0.588	
46507.3972	−0.676	−0.430	−0.491	−0.580	
46508.3234		−0.421	−0.490		
46508.3750	−0.596	−0.396	−0.494	−0.589	
46509.4079		−0.384	−0.452		
46529.3641	−0.199	−0.112	−0.212	−0.331	
46737.6609	−0.289	−0.241	−0.339		
46747.6304	−0.508	−0.378	−0.464		
46771.6326	0.114	0.139	−0.004		
46817.4601	−0.132	−0.085	−0.203		
46834.4787		−0.228	−0.322		
46850.3740	−0.563	−0.371	−0.455		
46855.3339	−0.495	−0.297	−0.360		
46885.3244		−0.316	−0.388		
47235.2979	−0.456	−0.389	−0.493		

Table 5: Differential magnitudes of UU Cancri (*continued*).

HJD−2400000	ΔU	ΔB	ΔV	ΔR	ΔI
47510.5625	−0.249	−0.198	−0.332		
47544.4954		0.159	0.004		
47561.4334	−0.546	−0.387	−0.430	−0.500	
47563.3963		−0.375	−0.466		
47566.3884	−0.626	−0.432	−0.495	−0.562	
47567.3798	−0.618	−0.423	−0.494	−0.558	
47570.4281		−0.402	−0.493		
47571.3915	−0.590	−0.434	−0.501	−0.577	
47573.3603		−0.391	−0.484		
47593.3736	−0.066	−0.067	−0.200	−0.366	
47613.3628	−0.323	−0.278	−0.388	−0.523	
47615.3894	−0.293	−0.325	−0.439	−0.506	
47616.3486	−0.288	−0.328	−0.425	−0.530	
47617.3609	−0.292	−0.334	−0.429	−0.559	
47865.5009		−0.338	−0.433		
47910.4469	−0.448	−0.365	−0.470		
47961.3718	−0.383	−0.309	−0.436	−0.517	−0.433
47962.3965	−0.397	−0.309	−0.416	−0.500	−0.507
47964.4049		−0.289	−0.379	−0.498	
47978.3664	−0.146	−0.111	−0.224	−0.337	
47981.4091	−0.133	−0.093	−0.206	−0.357	
47990.3451	−0.208	−0.150	−0.276	−0.419	
47991.3477	−0.231	−0.159	−0.272	−0.414	
47992.3710	−0.229	−0.164	−0.254	−0.345	
47994.3600	−0.267	−0.206	−0.324	−0.442	
48002.3618		−0.311	−0.432	−0.560	
48186.6230		−0.182	−0.311		
48206.5960		−0.289	−0.396		
48274.4233		−0.052	−0.194		
48278.4003		−0.092	−0.216		
48310.4368		−0.098	−0.217		
48311.4444		−0.056	−0.178		
48312.4395		−0.035	−0.151		
48313.4500		−0.009	−0.136		
48314.4784		0.042	−0.093		
48315.4615		0.069	−0.058		
48319.4407		0.162	−0.003		
48324.4163		0.039	−0.092		
48326.4477		−0.023	−0.144		
48330.4335		−0.176	−0.279		
48336.3714	−0.414	−0.319	−0.421	−0.489	−0.512

Table 5: Differential magnitudes of UU Cancri (*continued*).

HJD−2400000	ΔU	ΔB	ΔV	ΔR	ΔI
48337.3864	−0.408	−0.309	−0.419	−0.485	−0.489
48575.7032	−0.241	−0.210	−0.344		
48652.4805		−0.100	−0.226		
48678.4519	−0.327	−0.308	−0.427		
48686.4562	−0.387	−0.319	−0.435		
48694.3635	−0.246	−0.171	−0.294		
48707.3283		0.181	0.047		
48712.3554		0.041	−0.105		
48721.3457		−0.273	−0.372		
49027.4945	−0.345	−0.300	−0.430	−0.515	−0.539
49029.3576	−0.335	−0.258	−0.362	−0.435	−0.512
49029.4322	−0.264	−0.233	−0.368	−0.488	
49036.4011	−0.237	−0.134	−0.251	−0.353	
49044.3830	−0.041	−0.038	−0.169	−0.278	
49055.4450	−0.141	−0.106	−0.253	−0.334	−0.519
49060.5554	−0.284	−0.260	−0.361		
49066.3200	−0.363	−0.340	−0.447	−0.531	
49067.3498	−0.382	−0.363	−0.461	−0.552	
49069.3373	−0.422	−0.367	−0.466	−0.558	
49072.3999	−0.432	−0.351	−0.456		
49073.4025	−0.439	−0.355	−0.451		
49077.4265	−0.380	−0.285	−0.386		
49078.5005		−0.259	−0.364		
49087.3484	−0.045	0.065	−0.097	−0.181	
49089.3521	0.149	0.127	−0.018	−0.166	
49092.3277	0.253	0.207	0.053	−0.034	
49093.3388	0.243	0.202	0.050	−0.024	
49098.3342	0.067	0.044	−0.054	−0.212	
49103.3377	−0.171	−0.146	−0.237	−0.360	