OT And:
A LONG PERIOD EA BINARY WITH INCREASING O-C

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Summary:
Results are compared with literature [2]. There seems to be indication for increasing O-C. Further observations are encouraged to improve the current elements.

The variability of this relatively bright variable was discovered by Crawford in 1975 [1] during an observation of AN And. About ten years later a survey on OT And was published by Crawford et al. in IBVS 1984 [2]. Since 1984 until today this variable was not observed much and was brought to my attention by Helmut Busch from the german BAV in 1999. Even being an Hipparcos star, there were no minima observed by Hipparcos. The search in SIMBAD did not reveal newer observations on OT And except those cited in this paper.

Identification of OT And: HD 219989 = GSC 3238.1651 = HIP 115200;
Position RA=$23^h20^m01^s$; DEC= + 41°45'18" (J2000);
Elements: E_o = 2445711.73; P=20.85290 ± 0.00001 [d];
Spectral type A3V+A3V; the magnitude in maximum light is 7.32 mag.

According to Crawford et al. the primary minimum is 0.55 mag (V), the secondary minimum 0.38 mag (V) deep.

Already Crawford mentioned the secondary minimum to be displaced: it is at phase 0.52. The duration of both minima is the same and approximately 15 hours long.

Why do I write here in detail about two minimum timings which have already been published in IBVS [3][4]? Simply as you do not see the challenge in the two timings printed in IBVS. And it IS quite a big challenge to obtain a precise timing of the minimum light of OT And!
Further OT And needs to be observed in the next years to come and there are only a few observations possible per year (see APPENDIX III at the end).

Some consideration to make when observing OT And:
The change of magnitude in the minimum is smaller then 0.04 mag/hour. This is the reason why you will need CCD equipment. The precision needed is in the order of 0.01 or less to get a timing error of less than 15 minutes. But this does not necessarily mean that you need a big instrument! OT And is relatively bright, so there is enough light. Small instruments with large field of view are very well suited for the observation, as the closest suitable reference star is at 13 arcmin distance. This is GSC/TYC 3325.2844 with 8.52 mag (Johnson V). It is favourable to select the brightest possible star(s) as reference star to have the maximum signal to noise ratio possible.
I strongly suggest to use a Johnson V filter for the measurement for two good reasons. First: even with smaller instruments there is enough light. Secondly: the proposed comparison does

unfortunately not have the same spectral class as OT And. It is a very red star (spectral type K0), so that any extinction change of the atmosphere will result in relative magnitude changes which can be reduced to a mimimum by using photometric filters.

For my observations I used a (Bessel type) V filter with 20-cm and 40-cm SCTs respectively. As using different CCD cameras and telescopes the exposure times have been 30 seconds and 1 second respectively. The had to be carefully adjusted to produce unsaturated images. You may also help yourself by defocusing to avoid saturation. The CCD camera should be run without pausing between the images to obtain as much data as possible. I wish you successful observing!

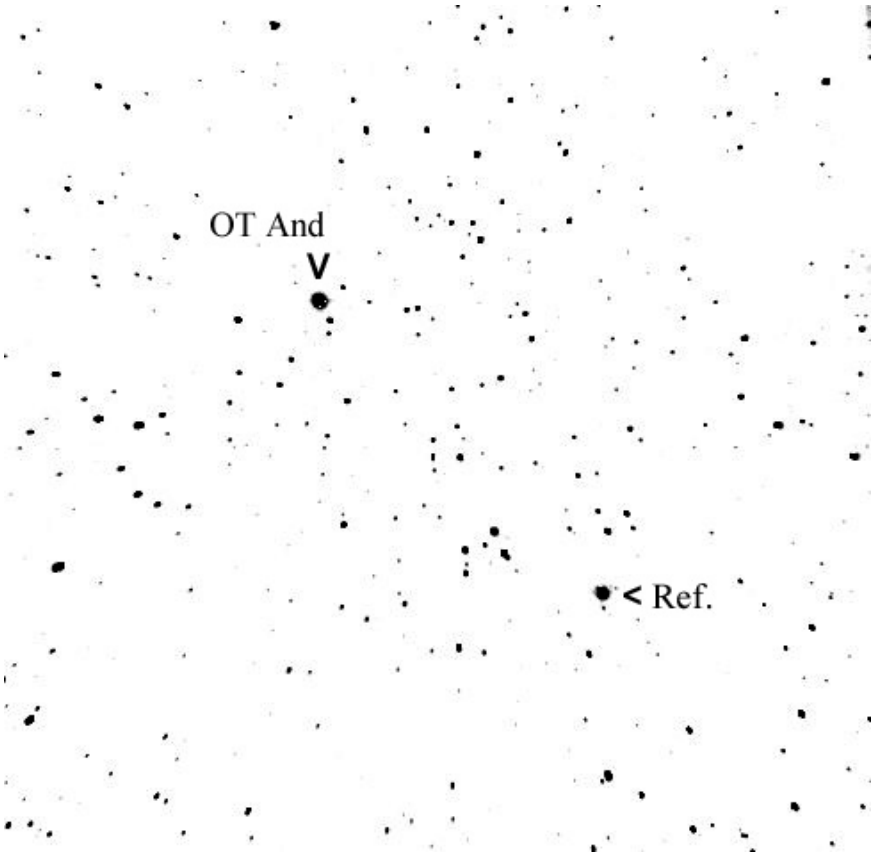

Fig.1: Identifikation chart OT And
(from second CCD observation; FOV ~27'x27')

Acknowledgement:
This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France.

References:
[1] Crawford, R.C., B.A.A.S. 7, 294 (1975)
[2] Crawford, R.C. et al., IBVS 2624 (1984)
[3] result published in IBVS 5016 (2001)
[4] result published in IBVS 5484 (2003)

APPENDIX I

My first observation of OT And [3]:
primary minimum: 1999 Sep. 03./04.; 22h 21,7m UT =

GJD 2451425.4316; **HJD 2451425.4354**; error: ± **0.0020** [d]

O-C: +0.0109 [d], accordingly +0.3 [h] with elements from [2]

Instr.: C8 (f=1188mm) w. ST7, CCD temp. -10°C / V-filter / exp. time = 30 [sec]
ref./check stars (GSC-No./mag./spec.): R: 3225.2844 / V=8.52 / K0, C: 3225.2372
weather: clear; almost no wind, medium-good transparency:
std. deviation of the measurements: 0.005 [mag]; number of obs. n=235;
method of extremum timing: mean of polynomials of 2. and 4. degree and Pogson's method;
minimum magnitude: 7.88 [mag].

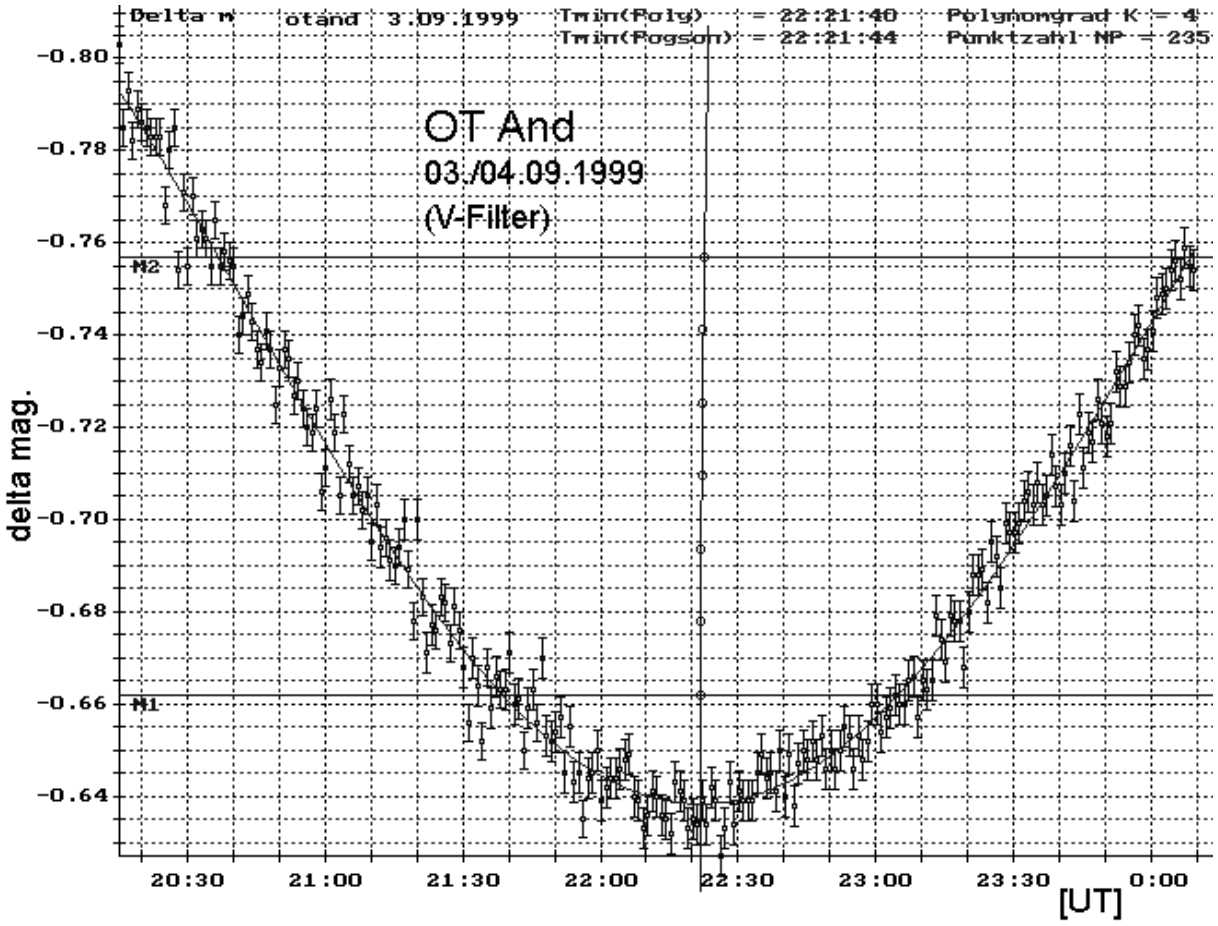

Fig. 2: OT And (primary minimum).

APPENDIX II

My second observation of OT And [4]:
Secondary minimum: 2000 Nov. 04./05.; 21h 10.0m UT

GJD 2451853.3819; **HJD 2451853.3856**; error ± **0.007** [d]

O-C: +0.0595 [d], accordingly +1.43 [h] with elements from [2]

Instr.: 16"-SCT (f=1500 mm) w. AP7p, cooled to -35°C / V-filter / exp.-time 1 [sec]
ref./check stars (GSC-Nr./mag./sp.): R:3225.2844/8.52, C:3225.1346, C2:3225.958
weather: partly cloudy -> misty, medium transparency, moon: somewhat disturbing
std. deviation of measurement: ±0.008 [mag]; number of obs. n=568 (n_{FIT}= 469);
method of extremum timing: mean of polynomials of 2. to 8. degree and Pogson's method;
mimimum magnitude: 7.74 [mag]

As Fig. 3 shows, the observation suffered clearly from the bad weather conditions, but shows also the possibility to make useful observations under such conditions.

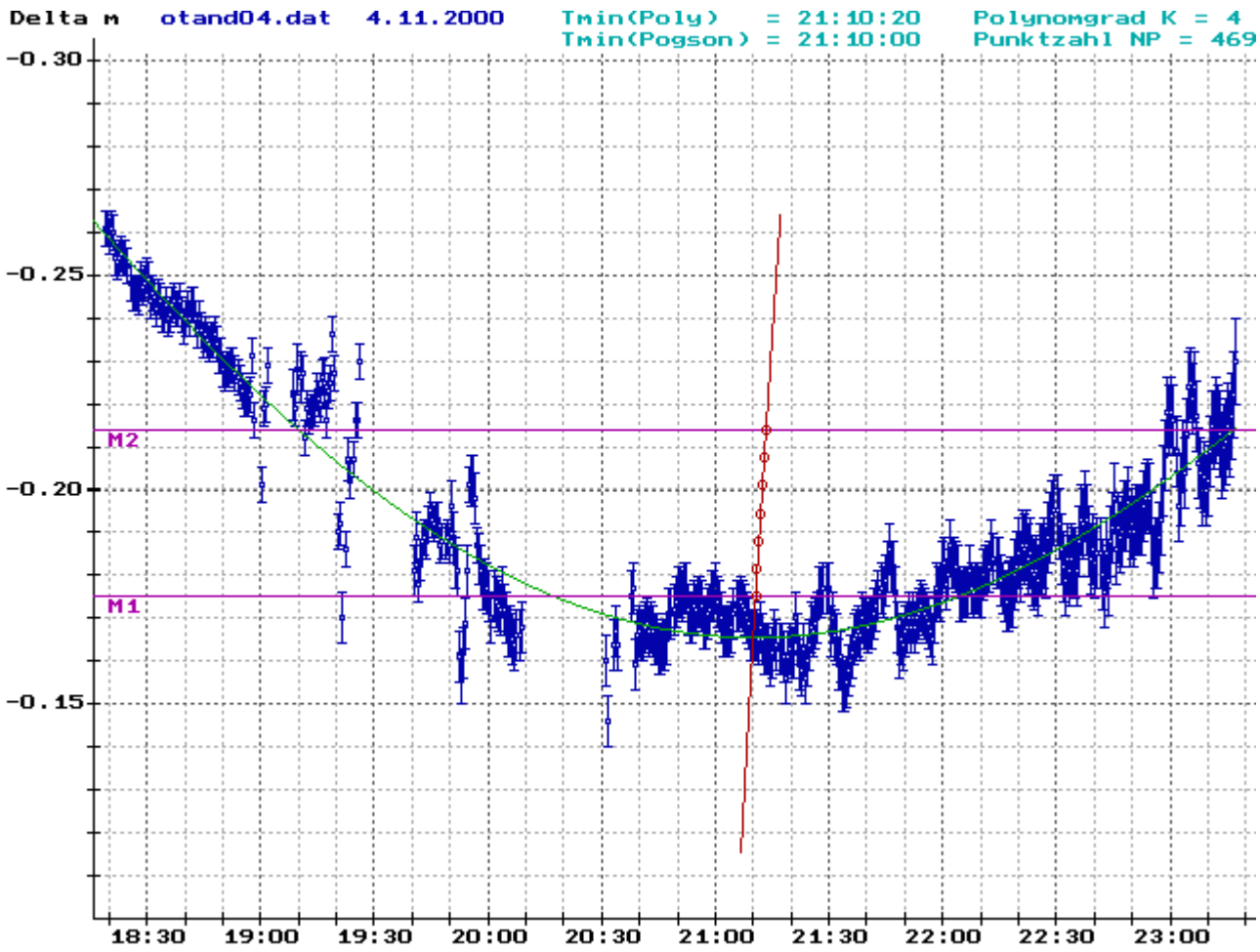

Fig. 3: OT And (secondary minimum).

APPENDIX III (Some Predicted Minima 2006-2008)

Primary Minima

n	JD (ext)	date (ext)	UT	hour angle	h
394	53927.7726	**10.07.2006**	6:32	**3.2**	**56**
395	53948.6255	**31.07.2006**	3:00	**1.0**	**74**
396	53969.4784	**21.08.2006**	23:28	**-1.1**	**73**
397	53990.3313	**11.09.2006**	19:57	**-3.3**	**55**
404	54136.3016	**04.02.2007**	19:14	**5.6**	**36**
408	54219.7132	**28.04.2007**	5:07	**-3.1**	**57**
409	54240.5661	**19.05.2007**	1:35	**-5.2**	**39**
415	54365.6835	**21.09.2007**	4:24	**5.8**	**34**
416	54386.5364	**12.10.2007**	0:52	**3.7**	**52**
417	54407.3893	**02.11.2007**	21:20	**1.5**	**71**
418	54428.2422	**23.11.2007**	17:48	**-0.7**	**76**
428	54636.7712	**18.06.2008**	6:30	**1.7**	**69**
429	54657.6241	**09.07.2008**	2:58	**-0.4**	**77**
430	54678.4770	**30.07.2008**	23:26	**-2.6**	**62**
431	54699.3299	**20.08.2008**	19:55	**-4.7**	**43**

Secondary Minima

n	JD (ext)	date (ext)	UT	hour angle	h
393	53917.7632	**30.06.2006**	6:19	**2.3**	**64**
394	53938.6161	**21.07.2006**	2:47	**0.1**	**78**
395	53959.4690	**11.08.2006**	23:15	**-2.0**	**66**
396	53980.3219	**01.09.2006**	19:43	**-4.2**	**48**
403	54126.2922	**25.01.2007**	19:00	**4.7**	**43**
407	54209.7038	**18.04.2007**	4:53	**-3.9**	**50**
414	54355.6741	**11.09.2007**	4:10	**4.9**	**41**
415	54376.5270	**02.10.2007**	0:38	**2.8**	**60**
416	54397.3799	**23.10.2007**	21:07	**0.6**	**76**
417	54418.2328	**13.11.2007**	17:35	**-1.5**	**70**
427	54626.7618	**08.06.2008**	6:17	**0.8**	**75**
428	54647.6147	**29.06.2008**	2:45	**-1.3**	**72**
429	54668.4676	**20.07.2008**	23:13	**-3.5**	**54**
430	54689.3205	**10.08.2008**	19:41	**-5.6**	**35**
436	54814.4379	**13.12.2008**	22:30	**5.4**	**37**