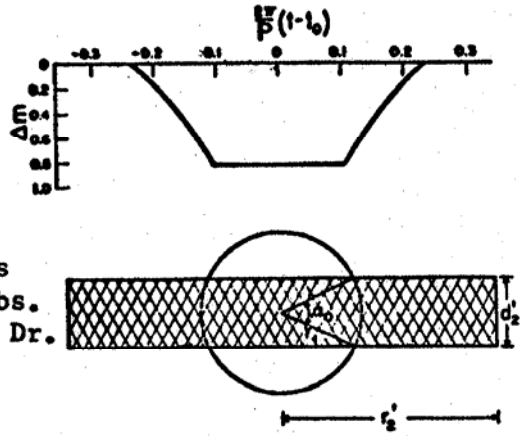
epsilon aurigae

1982-84 ECLIPSE



CAMPAIGN NEWSLETTER

NUMBER SEVEN

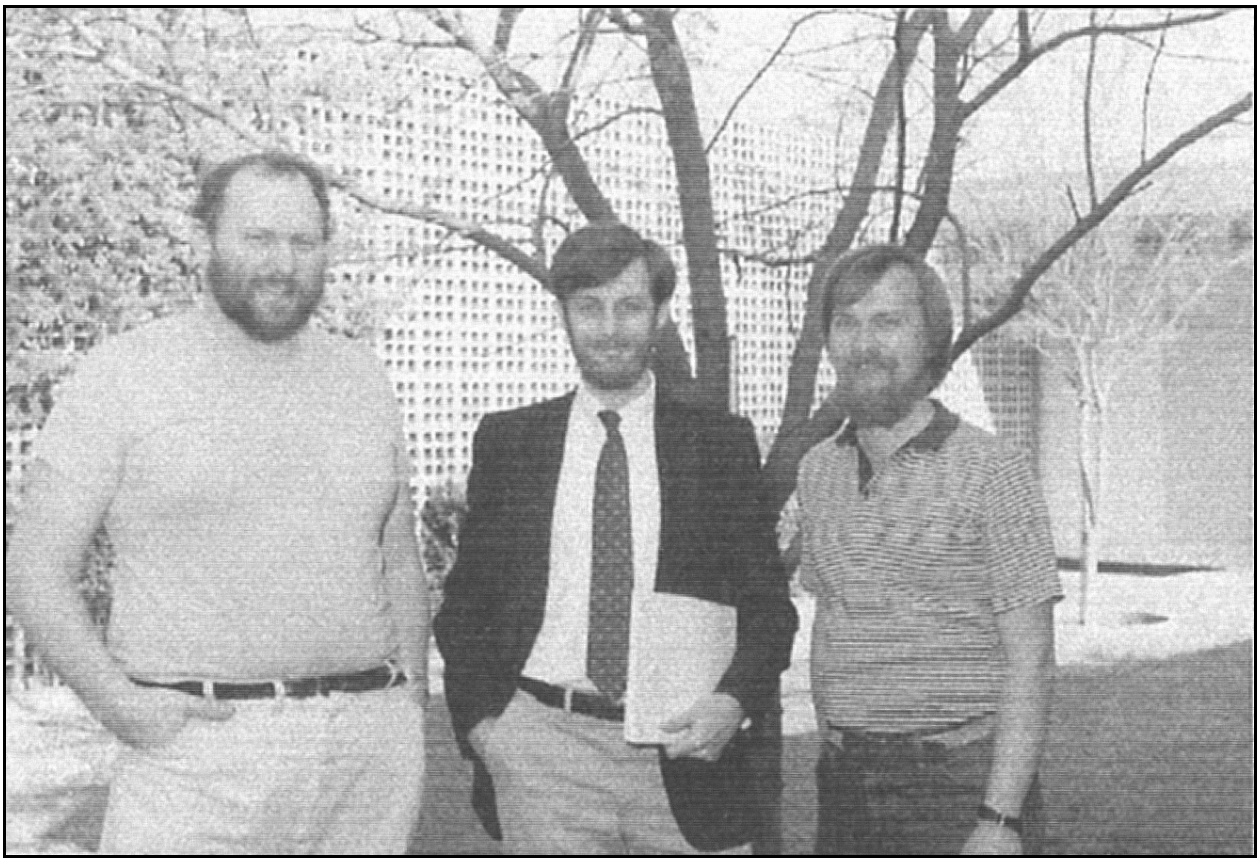
PHOTOMETRY:
Jeffrey L. Hopkins
Hopkins-Phoenix Obs.
7812 West Clayton Dr.
Phoenix AZ 85033

SPECTROSCOPY:
Robert E. Stencel
Code EZ-7
NASA - HQ
Washington DC 20546

FIG. 1.—A schematic diagram of our model for ε Aurigae and its resulting light-curve during eclipse. It is assumed that we observe this system edge-on. Consequently, the rotating gaseous disk around the secondary component will appear to be a dark rectangle which obscures the primary component during eclipse. The light-curve at the top of the figure is derived by assuming a uniform stellar disk.

Huang 1965 Ap.J. 141

May 1983



J. Hopkins (L), R. Stencel (M), and P. Schmidtke (R) at a recent meeting at Kitt Peak National Observatory to discuss the 1982 31 Cygni eclipse.

The eclipse of Epsilon Aur continues to progress very much on schedule. The range of observations hopefullly will be large enough this time to permit substantial progress in the interpretation of this interesting object. We are looking forward to hearing from a number of observers soon as we wind down the recent observing season and the summer solar constraints occur at all but the northern- and southern-most latitudes.

We are using the existing ma`iling list one last time for the benefit of anyone who might have missed our request in NL6 to indicate an interest in remaining on the mailing list. To date we have received more than 50 responses, from many nations. If you have not responded, this may be your last mailing. If you have responded, thank you.

We were gratified to see the write-up on the Epsilon Aur campaign which appeared in the May [1983] ASTRONOMY magazine News Notes. We trust they and other journals will continue to periodically update the situation for the wider readership. We also have received a letter from the astronomical artist David Eggem, who is considering a series of paintings of the theories propounded to explain Epsilon Aurigae.

PHOTOELECTRIC PHOTOMETRY REPORT

Since NL #6 two observers have reported data on Epsilon Aurigae. Dietmar Bohme of East Germany reports visual PEP data for 1982 (page 4) and a quarterly report for 1983 (see page 5). Bob O'Connell of the College of the Redwoods in California is the second observer reporting E Aur data. His data is listed on pages 6 through 9. Bob has had his share of problems but has not given up. He sent a list of events which is reproduced here:

Date	Event
11/09/82	Start off ok.
11/19/82	Field trip to Lick Observatory.
11/23/82	Photometer amplifier circuitry burned up. Sent for repair.
01/11/83	Coupler fell out of telescope, broke 1P21 tube.
03/14/83	Installed new tube, seems more blue sensitive.
03/21/83	Still have not done transformation work.

With all his problems, Bob is still actively observing Eps Aur and should be an inspiration to others.

Stig Ingvarsson of T.A.O. in Sweden reports he has discovered an error in his data. It seems his EMI photometer had the V and B filters reversed. He is correcting his data and will re-submit it when the corrections are complete.

We have put together a light curve of Epsilon Aurigae but a problem has become apparent. The data from several observers for the same time is widely scattered. This is not too uncommon, but to make use of the data we need estimates of accuracy, diaphragm size, airmass, sky conditions, extinction information (was it factored in?) and whether or not the data is color corrected. It is much better to include too much information rather than too little.

31 CYGNI REPORT

B. Powell and D. Edwards of the West Georgia College Observatory have submitted data on the 31 Cygni eclipse (see pages 11 and 12). Dr. Powell has agreed to coordinate the data collection for the spring secondary eclipses of 32 Cygni and Zeta Aurigae. See the information on observing these stars on page 10. Data and correspondance on 32 Cyg and Zeta Aur should be sent to:

Dr. B. Powell
Dept. of Physics
West Georgia College
Carrollton, GA 30118 USA

Remember, the IAPPP BIG BEAR SYMPOSIUM is the 25-27 May 1983. There is still space for papers. Two workshops will be devoted to PEP, how to do it, data reduction, transformation coefficient and extinction determination, plus some actual hands-on photometry with portable equipment. For more information write:

HOPKINS PHOENIX OBSERVATORY
7812 West Clayton Drive
Phoenix, Arizona 85033

ε Aur- 1982

Beobachtungsergebnisse von Epsilon Aurigae
(visuell) -visual/refractor 80/840
E. Zische, Großpostwitz, GDR

JD	mv.	JD	mv
24 45 021.3	3.11	24 45 266.5	3.75
026.3	3.06	269.3	3.71
028.3	3.09	274.7	3.68
033.3	3.08	279.3	3.71
037.3	3.08	280.3	3.76
042.4	3.05	284.3	3.76
044.3	3.09	285.3	3.74
051.3	3.08	288.2	3.81
052.3	3.06	293.4	3.82
054.3	3.06	295.3	3.79
061.3	3.04	298.7	3.82
064.3	3.04	299.7	3.84
074.3	3.07	308.3	3.87
077.3	3.07	309.2	3.89
082.3	3.08	323.2	3.89
087.3	3.09	324.7	3.89
092.3	3.05	325.2	3.88
093.3	3.07	326.2	3.90
097.3	3.07	331.3	3.92
182.5	3.4:	341.4	3.92
198.6	3.38	342.4	3.89
199.5	3.37	343.6	3.89
220.6	3.42	345.3	3.87
225.6	3.40	353.2	3.89
228.6	3.40	359.3	3.92
229.6	3.42	369.3	3.90
231.4	3.49		
232.6	3.45	comparison stars	
233.6	3.47	✓	
236.6	3.49	δ Per	2.94
240.4	3.53	δ Aur	3.71
247.7	3.57	~ Per	4.14
252.4	3.60		
259.5	3.62		
262.7	3.64		
263.3	3.71		
264.4	3.66		

DIETMAR
BÖHME

GERMANY

RCUD
24 MAR 83

Epsilon Aurigae Report (I. Quartal 1983)

Comp. star 2 Aurige

Name: Böhme, Dietmar P.M.T: 1P21

Observatory: Nessa, GDR 165/1430 neost. refl.

Date	JD	Δv	Δ(b-v)	Δ(u-b)
07.01.83	2445342.24	-0.97	-0.06	+0.09
11.01.83	5346.28	-0.96	-0.10	+0.13
24.01.83	5359.26	-0.88	-0.08	+0.21
31.01.83	5366.25	-0.96	-0.06	+0.14
12.03.83	5406.29	-0.91	0.00	+0.11
13.03.83	5407.28	-0.84	0.00	+0.09
16.03.83	5410.31	-0.91	-0.05	+0.01
25.03.83	5419.33	-0.91	0.00	+0.09

Ing. D. Böhme
DDR - 4851 Nessa 11
PSF 78

31.03.83

College of the Redwoods Observatory
Readings for ε + λ Aurigae

11- 9/10 - 82 Amp = .03 μA , Apature #2, 500 V

		Deflection	U T
ε Aur	V	74.0 mm	7:21
	B	45.75	7:18
λ Aur	V	29.25	7:32
	B	17.50	7:29
ε Aur	V	84.33	7:43
	B	49.58	7:38
λ Aur	V	28.41	7:58
	B	17.66	7:53

11- 12/13 - 82 Amp = .03 μA , Aperture #2, 500 V

ε Aur	V	122.5	8:09
	B	79.75	8:12
λ Aur	V	45.25	8:21
	B	27.5	8:24
ε Aur	V	118.75	8:30
	B	77.0	8:33
λ Aur	V	46.25	8:41
	B	28.25	8:44

11- 19/20 - 82 Amp. = .03, Aperture #3, 500 V
(Done at Lick Observatory)

		deflection	UT
E	V	105.12 mm	11:05
	B	74.75	11:02
E	V	111.5	11:53
	B	90.75	11:50
λ	V	53.0	11:55
	B	33.0	11:57

12- 23/24 - 82 Amp. = .1 μA, Aperature #3, 1000 V

E	V	80.0	8:51
	B	53.5	8:49
λ	V	32.75	8:54
	B	21.0	8:56
E	V	78.0	9:02
	B	51.75	9:00
λ	V	32.75	9:05
	B	21.0	9:06

COLLEGE OF THE REDWOODS OBSERVATORY (CONTD.)

1-8/9-83 Amp. = .03μA, Aperature #3, 1000 V

		Deflection	UT
λ	V	62.0 mm	8:00
	B	40.16	8:02
ε	V	160.0	8:09
	B	107.0	8:06
λ	V	61.33	8:13
	B	38.08	8:16
ε	V	156.0	8:40
	B	91.83	8:36
λ	V	64.66	8:43
	B	41.83	8:46

1-11/12-83 Amp .03μA, Aperature #3, 1000 V

ε	V	213.0	5:50
	B	147.5	5:55
λ	V	91.0	6:05
	B	57.75	6:02
ε	V	227.25	6:11
	B	154.6	6:16
λ	V	96.0	6:24
	B	60.5	6:21
ε	V	235.5	6:29
	B	159.5	6:32

3-14/15-83 Amp. .03 μA, Aperature #3, 1000 V

		Deflection	UT
E	V	185.0 mm	6:26
	B	176.0	6:30
λ	V	80.25	6:40
	B	71.75	6:37
E	V	178.5	6:46
	B	169.83	6:49
λ	V	77.75	6:57
	B	68.75	6:54
E	V	165.0	7:02
	B	154.0	7:07
λ	V	72.0	7:13
	B	63.5	7:16

ZETA AURIGAE AND 32 CYGNI

Both Zeta Aur and 32 Cyg are long-period systems (~3 years) with deep primary eclipses. For this reason, photoelectric observations have historically concentrated on that small range of phases surrounding primary eclipse. In contrast, the balance of the light curve of these stars is largely unobserved, especially secondary minimum. From ultraviolet spectroscopy made possible in the past few years with the IUE satellite, researchers are now beginning to appreciate that some of the basic interaction phenomena in these binaries can be best observed during secondary rather than primary minimum, and so a more complete light curve is needed to complement this work. The primary eclipses generally require about two months between contacts, but in contrast, the secondary minima (based on the limited data) seem to be much more leisurely and less contrasty events. For this reason, and in the spirit of developing a better picture of the entire light curves, we recommend that new photometric observations be obtained on average about once per two-week interval during the observing season. Both Zeta Aur and 32 Cyg will be passing through their secondary minima in the spring of 1983, but photometric coverage during the entire year would be of use.

Variable 31 CYG

Comparison 30 CYG

name B. Powell and D. Edwards report date April 6, 1983

West Georgia College Observatory PMT (1P21) Diaph 122"

year 1982-1983 PMT HV: -800 Corrected

month	double date	UT	J.D. (GEO) 2,445,000 +	Filter	Δm
SEPT. 1982	4-5	2.38	217.7194	V	-1.108
	5-6	2.10	218.6806	V	-1.108
	6-7	1:16	219.6056	V	-1.146
	19-20	1:19	232.6097	V	-0.937
	21-22	1:27	234.6208	V	-0.969
	27-28	2:32	240.7111	V	-0.970
	30-OCT 1	2:17	243.7042	V	-0.990
OCT. 1982	5-6	1.18	248.6083	V	-0.989
	14-15	2:42	257.7250	V	-0.916
	24-25	4:28	267.8722	V	-0.943
				B	0.471
	28-29	4:23	271.8653	V	-0.947
				B	0.551
	30-31	2:22	273.6972	V	-0.989
				B	0.573
NOV. 1982	1-2	4:05	275.8653	V	-0.966
				B	0.521
	4-5	4:12	278.8500	V	-0.916
				B	0.560
	7-8	4:20	281.8611	V	-0.950
				B	0.554

WEST GEORGIA COLLEGE OBSERVATORY (CONTD.)

month	double date	UT	J.D. (GEO) 2,445,000 +	Filter	Δm
NOV. 1982	8-9	2:54	282.7417	V	-.915
				B	0.554
	9-10	2:27	283.7042	V	-0.936
				B	0.554
	15-16	1:38	289.6361	V	-1.027
				B	0.074
	29-30	1:04	303.5889	V	-1.107
				B	0.072
DEC. 1982	19-20	0:30	323.5417	V	-1.077
				B	0.102
JAN. 1983	3-4	0:22	338.5306	V	-0.958
				B	0.047
	17-18	0:41	345.5569	V	-1.052
				B	-0.016

$\varepsilon_v = -0.033$

$\varepsilon_b = -0.007$

$\mu = 1.027$

SPECTROSCOPY REPORT

We are pleased to report that the allocation of observing time with the International Ultraviolet Explorer [IUE] satellite for the current operational year (April 1983 - April 1984) has been reasonably generous (again) considering the fierce competition for the valuable commodity. Three U.S. groups were allocated 4 shifts each (Chapman et al. at NASA-GSFC; Ake et al. at CSC; and Lambert et al. at U. Texas). Details of the European allocation are not presently available here but we hope to hear from our colleagues about their progress for mention here in future newsletters.

Ed Guinan (Villanova U. & Harvard Center for Astrophysics) has recently advised us of spectral observations in H-alpha obtained late January 1983 at the Mount Hopkins Obseratory 60 inch telescope in Arizona (no relation to HPO). See Figure S-1. The point to notice about this H-alpha profile obtained during totality is that it differs radically from the H-alpha profile obtained one year earlier (see note in NL2 by Basri et al.). The pre-eclipse profile showed a symmetric double peaked emission core, while the new data shows the red component has gone away. Eclipse variations of H-alpha can be striking in many interacting binaries, and provides important clues about the existence of matter between the stars in the systems.

Hideo Sato (Tokyo Astronomical Observatory) has advised us of their continuing work on Epsilon and Zeta Aur systems with the 188 cm telescope at Okayama Astrophysical Observatory. Spectra are being obtained at many wavelengths. Photoelectric photometry of these systems is being initiated with a 30 cm computer-controlled system as well.

Jim Kemp (Oregon) has advised us of the continuing polarimetry observations (see NL6) which seem to be showing a 70-80 day pulsation which was not seen prior to ingress. This data, if it can be correlated with the 100-120 day optical variation, might be an indication of non-radial pulsation in the supergiant. Otherwise, considering its appearance during eclipse, it may relate to the disk-like shape of the companion.

As always, we solicit short communications from spectroscopists concerning progress in observations and interpretation.

Figure S-1. Unreduced Spectrum of ε Aurigae (H-Alpha).

ε Aurigae F2Ip (In Eclipse)
28/29 January 1983
Observers: S. Baliunas and E. Guinan
Mt. Hopkins Observatory 60 Inch Telescope