Recent Epsilon Aurigae Bibliography
(Updated 11/83)

Ake, et al. 1983 IAUC 3763 -- IR & UV ingress data.
Backman 1984 Ph.D. Dissertation, U. Hawaii -- 1 to 20 micron ptm
Boehm & S. Ferluga 1983 Inf. Bull. Var. Stars No. 2326 (Konkoly Obs., Budapest) -- H alpha during eclipse.
Boehm, S. Ferluga & M. Hack 1983 Astron. & Astrophys. (submitted) -- UV spectra ingress and totality.
Castelli 1977 Astrophys. & Space Sci. 49, 179 -- H alpha out of eclipse variations.
Castelli, R. Hoekstra & Y. Kondo 1982 Astron. & Astrophys. Suppl. Ser. 50, 233 -- BUSS UV pre-ingress spectra.
Chapman, Y. Kondo & R. Stencel 1983 Astrophys. Journal 269, L17 -- ingress UV spectra.
Darling 1983 Astronomy 12, 66 (August) -- overview.
Gyldenkerne 1970 Vistas in Astron. 12, 199 -- 1956 ptm summary
Hack & P. Selvelli 1979 Astron. Astrophys. 75, 316 -- UV sp.
Henson, J. Kemp and D. Kraus 1983 IAUC 3759 -- polarimetry.
Oki, et al. 1983 Inf. Bull. Var. Stars. No. 2371 (Konkoly Obs., Budapest) -- UBV ptm.
Parthasarathy & D. Lambert 1983 IAUC 3766 -- K I e.w. var.
Parthasarathy & D. Lambert 1983 IAUC 3848 -- K I e.w. update
Parthasarathy & D. Lambert 1984 Ap.J./submitted -- UV sp.
Plavec 1982 in Proc. Symposium "Advances in UV Astronomy: Four Years of IUE Research", NASA C. P. 2238, p.526 -- models.
Reddy 1982 Sky & Telescope 64, 460 (May) -- overview.
Reddy 1983 Astronomy 11, 60 (May) -- new results.
Saito, et al. 1983 in IAU Colloq. No. 80: Double Stars, ed.?, (Dordrecht, Reidel)/in press -- optical sp.

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n order to develop a comprehensive bibliography of reports oncerning the current 1982-84 eclipse, the editors of the psilon Aurigae Eclipse Campaign Newsletter would appreciate eceiving preprints of any related work being submitted for ublication.

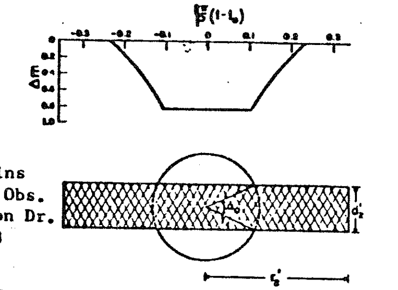
epsilon aurigae

1982-84 ECLIPSE

CAMPAIGN NEWSLETTER
No. 9

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



Huang 1965 Ap.J. 141

NOVEMBER 1983

Dear Colleague,

As the end of totality nears, we are pleased to be able to communicate recent reports we have received about Epsilon Aurigae. You will notice the somewhat larger size of this newsletter edition than in the past. We feel this is a sign of success in the campaign. On the other hand this success means a large mailing list and expenses that have wiped out our small grant funds. We will pursue additional support for a few more newsletters through 1984.

The International Astronomical Union has encouraged us to plan to present a Joint Discussion on the topic of Epsilon Aurigae during the General Assembly of the IAU in 1985, in Delhi India. In addition, we intend to seek NASA and AAS endorsement of the North American meeting to be held in the summer of that year. Future newsletters will provide details.

This newsletter is partially supported by a grant from the National Aeronautics and Space Administration which is administered by the American Astronomical Society.

PHOTOMETRY REPORT

This newsletter's Photometry report is by far the most lengthy and perhaps the most interesting. I.-S. Nha and S.J. Lee of the YONSEI UNIVERSITY OBSERVATORY, Seoul, Korea have some very interesting data on Epsilon Aurigae that indicate flare activity of 0.4 magitudes in the blue bandpass On 21 January 1982. Anyone noticing any similar activity should contact the authors and the newsletter's editors. Dana Backman of the UNIVERSITY OF HAWAII AT MANOA reports some infrared photometry and requests data on Epsilon Aurigae taken 30 Jan-1 Feb 1980, 29-31 Jan 1981, 13 november 1981, 9-10 Dec 1981 and 17 Dec 1981. We have several new sets of data plus some updates on previous data. The PEP data base in this newsletter includes all known PEP data to date. The data is looking very good, however, Dr. Paul Schmidtke of KPNO has some suggestions that may improve the accuracy even more. A portion of a recent letter is reproduced below. Anyone needing a star chart for the recommended stars can obtain one by sending a self addressed and stamped envelope to the PHOTOMETRY editor of this newsletter.

P/O Dr. Schmidtke's letter to J. Hopkins 8 Nov 83

Regarding ϵ Aur, I have several comments:

1) The newsletter states that extinction ought to be determined nightly. Are observers adhering to this recommendation?

2) What 'standard' values (i.e. V, B-V, U-B) are observers using for λ Aur? An adopted standard set ought to be used by all.

3) The table on the accompanying page gives my recommendation for stars to test observer's transformation coefficients. Although cluster stars are often used (e.g. Praesepe would be a good cluster, having a good range in B-V for V=6 stars), they can require rather small photometer diaphragms. Instead, I chose bright field stars within 5-10° of λ Aur. All these stars have been measured by Johnson, Mitchell, Iriarte, and Wisniewski (1966, Comm. Lunar and Planetary Lab. No. 63). I recommend that all observers measure these stars differentially with respect to λ Aur, in the same manner as ϵ Aur. This calibration need only be done once or twice during the observing season, provided there is no change in instrumentation. If seven stars is too many, first drop μ Aur from the list, then drop 16 Aur. A plot of observed values versus 'standard' values will reveal any systematic errors for a given observer's instrument.

Star	RA 1985	DEC 1985	V	B-V	U-B	Sp. Type
ω Aur	4:58.2	+37:52	4.95	+0.05	+0.01	A0V
9 Aur	5:05.5	+51:35	5.00	+0.34	-0.01	F0V
η Aur	5:05.5	+41:13	3.18	-0.18	-0.67	B3V
μ Aur	5:12.4	+38:28	4.88	+0.18	+0.10	Am
16 Aur	5:17.2	+33:21	4.54	+1.27	+1.27	K3III
τ Aur	5:45.1	+39:11	4.53	+0.94	+0.69	G8III
ν Aur	5:50.4	+39:09	3.97	+1.14	+1.09	K0III
λ Aur	5:18.1	+40:05	4.71	+0.62	+0.13	G0V

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2405

Konkoly Observatory
Budapest
28 September 1983
HU ISSN 0374-0676

FLARE ACTIVITY OF EPSILON AURIGAE?*

Epsilon Aurigae has been regularly observed at the Yonsei University Observatory with the 40-cm and the 60-cm reflectors in the UBV system. The number of observations in each color, since the observation began in 1982 April, exceeds one hundred. Normally the observation of Eps Aur each night lasted for about an hour or so and the rest of the night was shared with other program stars. Atmospheric extinction for each color was determined by the observation of an extinction star, i. e., a star chosen to observe throughout the night for the determination of the given night's extinction coefficients, and thus the differential extinction was corrected promptly for each night.

Soon after the termination of the ingress of Eps Aur we preempted several photometrically excellent nights to monitor Eps Aur for the entire night, with no other program stars included, using Lamda Aur as a comparison and as the extinction star for the night. Nine such good nights were available in two months, January and February, during which Eps Aur went well into its total eclipse. Eta Aur served as the check star. It is our customary procedure to make a net deflection vs. time diagram for each color of each star in order to correct any misread or misrecorded net deflection(star-sky), which could easily be made by the reader of the chart paper, at the earliest stage of the reduction work preceding computer processing. Through this reduction an unusually large net deflection in B was noticed on the diagram made for the Eps Aur observations of Jan. 21. Among over fifty nights' observations made so far, this Jan. 21 data

*Yonsei University Observatory Contribution No.8.

has been reduced in the instrumental magnitude system and the results are shown in Figure 1. In this figure the open circles represent the blue light curve of

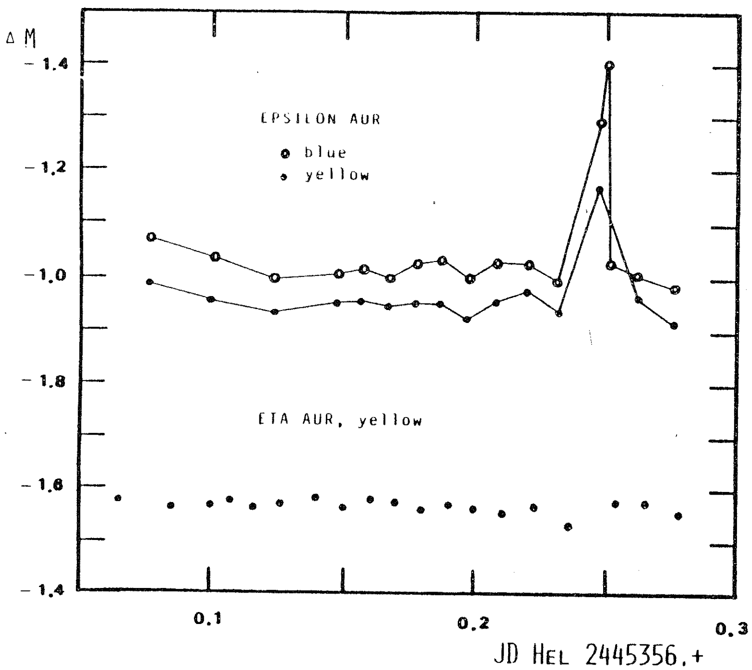


Figure 1.

Blue and yellow light curves of Eps Aur and the yellow light curve of Eta Aur.

Eps Aur and the dots represent the yellow light curves of Eps Aur and Eta Aur. As shown in the figure, Eps Aur exhibits a sudden brightening by about $0^m.4$ in B and $0^m.2$ in V above their mean magnitudes. This light variation appears to be real because the V light curve of Eta Aur shown in the same figure remains constant throughout the night.

Since the previous eclipse 27 years ago the eclipse light curve of Eps Aur is known to be trapezoidal with a depth of $0^m.8$ in the range and neighborhood of

visual light wavelengths. There are small, about $0^m.1$, irregular variation, on a time scale of about 100 days in V and B-V in all orbital phases, but the light variation increases to about $0^m.2$-$0^m.3$ during eclipse. There seems, however, no report that Eps Aur has ever been intensively observed to search for light variation shorter than 100 days, say night-to-night or even during a night.

It may be too early to say that there are flare activities in Eps Aur during total eclipse. The light change of $0^m.4$ in B is, however, much larger than the long range variations in V reported by Gyldenkerne(1970). In addition the brightening lasted for only about 20 minutes, which is comparable to the longer flare durations of known flare stars. The light variation in V is insignificant, but we will have to account for the fact that the V measurement was 2 minutes ahead of the peak brightening time estimated on the B light curve. This report requires comformation by other Eps Aur campaign participants.

I.-S. NHA and S. J. LEE

Yonsei University Observatory, Seoul, Korea

Reference:

Gyldenkerne, k. 1970, Vistas in Astronomy 12, 190.

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

Number 2371

Konkoly Observatory
Budapest
19 July 1983

HU ISSN 0374-0676

PHOTOELECTRIC OBSERVATIONS OF ε AURIGAE DURING THE INGRESS

UBV photoelectric observations reported here were made by members of JAPOA (Japan Amateur Photoelectric Observers Association) during the period of October 1982 to March 1983 covering the ingress. Being in co-operation with the international campaign of this remarkable binary star (e.g., Campaign Letters by Hopkins and Stencel 1982), several Japanese amateur astronomers participated in the UBV observations with their own telescopes furnished with photoelectric photometers. The observers and used telescopes are as follows:

Observer	Place	Telescope
T. Abe	Niigata	30-cm reflector
S. Ohmori	Kanagawa	20-cm refractor
T. Ohki and H. Yoshinari	Fukushima	20-cm reflector

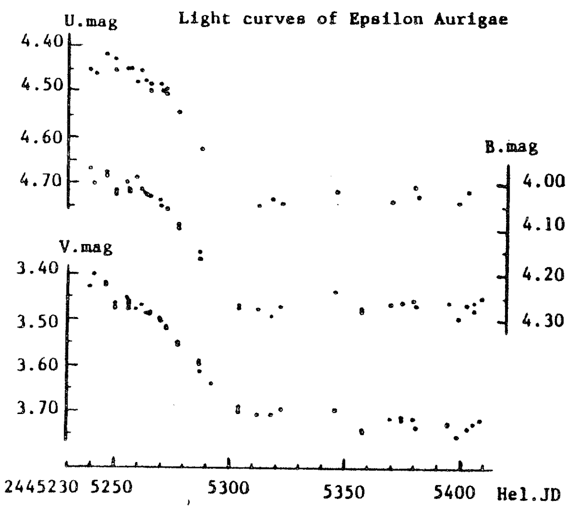


Figure 1

Table I

UBV Photoelectric Observations of Epsilon Aurigae

Date(UT)	Hel.JD 2440000+	U.mag	B.mag	V.mag	Observer
1982					
Sep.24	5239.15	4.452	4.067	3.529	OY
Sep.28	5241.19	4.460	4.102	3.499	OY
Oct. 3	5246.131	4.417	4.084	3.518	Ab
	.141	4.417	4.075	3.524	Ab
Oct. 7	5250.089	4.427	4.116	3.518	Ab
	.101	4.450	4.125	3.563	Ab
Oct.12	5255.15	4.465	4.096	3.552	OY
Oct.13	5256.126	4.451	4.119	3.577	Ab
	.16	4.450	4.113	3.559	OY
	.173	4.458	4.115	3.566	Ab
Oct.16	5259.14	4.477	4.088	3.576	OY
Oct.18	5261.14	4.452	4.114	3.565	OY
Oct.20	5263.118		4.125	3.586	Om
	.121		4.122	3.587	Om
Oct.20	.17	4.473	4.119	3.585	OY
Oct.22	5265.107	4.495	4.127	3.582	Ab
	.116	4.497	4.129	3.580	Ab
	.17	4.497	4.128	3.589	OY
Oct.26	5269.12	4.481	4.132	3.596	OY
Oct.27	5270.18	4.495	4.147	3.601	OY
Oct.29	5272.089	4.490	4.156	3.614	Ab
	.150	4.592	4.158	3.619	Ab
Nov. 3	5277.036	4.540	4.200	3.659	Ab
	.046	4.542	4.188	3.649	Ab
Nov.12	5286.239		4.244	3.691	Om
	.242		4.249	3.691	Om
Nov.13	5287.08	4.623	4.264	3.712	OY
Nov.18	5292.06	4.742		3.738	OY
Nov.30	5304.153		4.367	3.787	Om
	.164		4.374	3.800	Om
Dec. 8	5312.13	4.731	4.373	3.804	OY
Dec.14	5318.17	4.742	4.390	3.803	OY
1983					
Jan.11	5345.08	4.715	4.333	3.793	OY
Feb. 2	5375.002		4.361	3.810	Om
	.006		4.362	3.820	Om
Feb. 4	5370.00	4.737	4.363	3.816	OY
Feb.14	5380.01	4.705	4.354	3.813	OY
Feb.15	5381.10	4.724	4.365	3.835	OY
Feb.28	5394.959		4.380	3.829	Om
	.968		4.381	3.825	Om
Mar. 5	5399.03	4.739	4.392	3.854	OY
Mar. 9	5402.99	4.714	4.363	3.837	OY
Mar.11	5405.953		4.378	3.827	Om
	.958		4.359	3.825	Om
Mar.14	5408.933		4.351	3.817	Om
	.936		4.348	3.814	Om

Abbreviation: T.Abe=Ab, S.Ohmori=Om, T.Ohki and H.Yoshinari=OY

Actual observations were carried out differentially with respect to λ Aur s the primary comparison star and standard stars of Johnson were also observed on each night to make it possible to reduce the individual observations o the standard UBV magnitudes. The observed nights are altogether thirty. he results of the observations are all listed in Table I and they are also lotted in Figure 1.

From the figure, we can estimate the magnitudes in UBV of the bottom level o be U=4.74, B=4.28 and V=3.74, respectively. The epoch of the second conact can be estimated to be about JD 2445306, which is found to be 9 days arlier than predicted by Gyldenkerne (1970).

Photometric reductions to the standard UBV system were carefully made by hmori with his computer PC 8801. The participated members of JAPOA would ike to express their hearty thanks to Prof. M. Kitamura of Tokyo Astronomical bservatory for his encouragement and generous guidance.

JAPOA
(Japan Amateur Photoelectric
Observers Association)

c/o Geology Section

Education Centre of Kanagawa
Prefecture, Fujisawa City,
Fujisawa 4210,
Kanagawa, 251 Japan

erences:

denkerne, K. 1970, Vistas in astronomy, Vol.12, 199
kins, J.L. and Stencel, R.E., 1982, Campaign letters for ε Aur 1982-84 eclipse

U B V Photometry of ε Aurigae

During the 1982-83 Eclipse in its Ingress Phase

by

Tosio ŌKI and Hiroko YOSHINARI

Department of Earth Science, Faculty of Education,
Fukushima University, Fukushima. 960-12

(9 Sept. 1983)

長周期食連星 ε Aur の 1982～83年食潜入期
における UBV 三色測光

大木俊夫．吉成浩子

Abstract

The three color photometry of a long period eclipsing binary ε Aur was made in its ingress phase of 1982-83 minimum. The color does not change notwithstanding the progression of the eclipse, as previously mentioned. It appeared that the second contact occured earlier by 5 days than the prediction of Gyldenkerne. It is suggested that the companion star may be a large dust cloud.

Submitted To

The Science Reports of
Fukushima University

Table 2

J.D.	ΔV	B-V	U-B	J.D.	ΔV	B-V	U-B
2445239	0.3468	0.5811	0.2057	2445292	0.5560	-	-
5241	0.3168	0.6462	0.1802	5312	0.6220	0.6121	0.1979
5255	0.3696	0.5869	0.1742	5318	0.6206	0.6311	0.1634
5256	0.3767	0.5975	0.1582	5322	0.6113	0.6188	0.1953
5259	0.3936	0.5554	0.2136	5345	0.6110	0.5826	0.2027
5261	0.3850	0.5896	0.1617	5370	0.6341	0.5899	0.1981
5263	0.4031	0.5772	0.1817	5380	0.6312	0.5839	0.1738
5265	0.4066	0.5832	0.1759	5381	0.6525	0.5729	0.1804
5269	0.4138	0.5789	0.1727	5399	0.6722	0.5810	0.1716
5270	0.4193	0.5888	0.1709	5403	0.6545	0.5699	0.1729
5286	0.5196	0.6180	0.1697	5408	0.6757	0.5855	0.1607
5287	0.5300	0.5952	0.1823				

Differential magnitudes:

Epsilon Aur - Eta Aur

(Oki & Yoshinari)

University of Hawaii at Manoa

Institute for Astronomy
2680 Woodlawn Drive • Honolulu, Hawaii 96822
Telex: 723-8459 • UHAST HR

October 5, 1983

Mr. Jeffrey Hopkins
Hopkins-Phoenix Observatory
7812 W. Clayton Drive
Phoenix, AZ 85033

Dear Mr. Hopkins:

I am sending you a summary of my infrared photometry of epsilon Aurigae's eclipse in advance of a preprint of my article for Astrophysical Journal. The magnitudes are reported on a scale where α Lyr defines magnitude = 0.00 at all wavelengths. This is safe to 20 μm, even with the recent news about a far-IR excess in α Lyr. The pre-eclipse baseline is a mean of measurements taken on 7 nights in January, November, and December 1981. The post-2nd contact values are the mean of 4 nights' measurements in January and February 1983.

Band	J	H	K	L'	M	N	Q
λ, μm	1.25	1.65	2.20	3.80	4.80	10.1	20
Δλ, μm	0.30	0.35	0.42	0.67	0.57	5.1	9
Pre-eclipse	+1.83±.01	+1.61±.01	+1.48±.01	+1.34±.01	+1.19±.01	+1.03±.02	+1.03
Post-2nd Contact	+2.52±.01	+2.31±.01	+2.17±.01	+2.02±.01	+1.87±.02	+1.65±.02	+1.37
Depth, mags.	0.69	0.70	0.69	0.68	0.68	0.62	0.

I would like to know if any of the visual photometry you have received includes data on ε Aur from: 30 Jan-1 Feb 1980, 29-31 Jan 1981, 13 Nov 1981, 9-10 Dec 1981, or 17 Dec 1981. These are the dates of my pre-eclipse measurements. The 1980 measurement are brighter by ∿ 0.05 magnitudes than the 1981 measurements.

Thank you for the service you are providing with the newsletter. The information it ha contained has been a great help in my own data analysis.

Yours truly,

Dana Backman
Dana Backman

DB:jl

AN EQUAL OPPORTUNITY EMPLOYER

REPORT AS 17 NOVEMBER 1983

EPSILON AURIGAE COMPOSITE
1982-1984 ECLIPSE

UT	DATE	2440000 + HJD	VISUAL V	N	SD	BLUE B	N	SD	ULTRA VIOLET U	N	SD	NOTES/ OBSERVER
	JAN 82											
	FEB 82											
9	MAR 82	5048.71	2.932	1	----	-----	-	----	-----	-	----	ECO ML
22	MAR 82	5051.62	2.937	1	----	-----	-	----	-----	-	----	ECO ML
23	MAR 82	5052.62	2.938	1	----	-----	-	----	-----	-	----	ECO ML
25	MAR 82	5054.38	2.920	1	.030	-----	-	----	-----	-	----	RM MO
28	MAR 82	5057.23	3.025	2	.016	3.508	2	.008	-----	-	----	IED AUO
8	APR 82	5068.29	3.000	1	----	3.529	1	----	-----	-	----	IED AUO
27	APR 82	5087.46	3.030	2	.040	-----	-	----	-----	-	----	RM MO
30	APR 82	5091.61	3.120	1	----	-----	-	----	-----	-	----	P/E GCO
5	MAY 82	5095.43	3.124	4	.020	3.590	4	.030	3.710	4	.040	RM MO
8	MAY 82	5099.60	3.160	1	----	-----	-	----	-----	-	----	P/E GCO
9	MAY 82	5100.60	3.110	1	----	-----	-	----	-----	-	----	P/E GCO
10	MAY 82	5100.42	3.103	3	.030	-----	-	----	-----	-	----	RM MO
10	MAY 82	5101.58	3.080	1	----	-----	-	----	-----	-	----	P/E GCO
	JUNE 82											
21	JULY 82	5172.47	3.098	9	---	3.649	3	.005	-----	-	----	SII TAO
26	JULY 82	5177.50	3.127	6	.003	3.658	3	.014	-----	-	----	SII TAO
29	JULY 82	5181.50	3.126	4	.009	3.702	3	.012	-----	-	----	SII TAO
31	JULY 82	5182.49	3.111	4	.005	3.663	3	.008	-----	-	----	SII TAO
2	AUG 82	5184.48	3.115	3	.007	3.654	3	.017	-----	-	----	SII TAO
4	AUG 82	5186.50	3.119	3	.009	3.679	3	.011	-----	-	----	SII TAO
13	AUG 82	5195.61	3.224	3	.015	3.921	3	.020	-----	-	----	RM MO
28	AUG 82	5210.46	3.180	3	.006	3.737	3	.003	-----	-	----	SII TAO
28	AUG 82	5210.57	3.168	4	.015	3.849	4	.015	4.001	4	.025	RM MO
2	SEPT 82	5215.63	3.217	5	.015	3.879	5	.015	4.006	5	.020	RM MO
4	SEPT 82	5217.48	3.236	3	.007	3.768	3	.009	-----	-	----	SII TAO
11	SEPT 82	5224.48	3.305	3	.007	3.884	3	.009	-----	-	----	SII TAO
16	SEPT 82	5229.41	3.386	3	.015	3.958	3	.009	-----	-	----	SII TAO
18	SEPT 82	5231.99	3.425	3	.031	3.954	3	.007	4.141	3	.004	JLH HPO
21	SEPT 82	5234.98	3.430	3	.005	3.968	3	.003	4.174	3	.005	JLH HPO
23	SEPT 82	5236.40	3.442	3	.006	3.973	3	.033	-----	-	----	SII TAO
23	SEPT 82	5236.98	3.433	3	.005	3.978	3	.003	4.167	3	.008	JLH HPO
24	SEPT 82	5237.97	3.439	3	.011	3.982	3	.001	4.171	3	.004	JLH HPO
25	SEPT 82	5238.98	3.446	3	.002	3.977	3	.003	4.174	3	.010	JLH HPO
26	SEPT 82	5239.--	3.517	1	----	4.098	1	----	4.304	1	----	O/Y JAP
26	SEPT 82	5239.15	3.529	1	----	4.067	1	----	4.452	1	----	JAPOA
27	SEPT 82	5240.83	3.350	1	----	-----	-	----	-----	-	----	P/E GCO
28	SEPT 82	5241.--	3.487	1	----	-----	-	----	-----	-	----	O/Y JAP
28	SEPT 82	5241.19	3.499	1	----	4.102	1	----	4.460	1	----	JAPOPA
28	SEPT 82	5241.71	3.446	2	.015	4.103	2	.020	4.200	2	.025	RM MO
30	SEPT 82	5243.80	3.390	1	----	-----	-	----	-----	-	----	P/E GCO
3	OCT 82	5246.13	3.521	2	.004	4.080	2	.006	4.417	2	.000	JAPOA
7	OCT 82	5250.09	3.541	2	.032	4.121	2	.006	4.439	2	.016	JAPOA
8	OCT 82	5250.87	3.496	3	----	4.056	3	----	4.466	3	----	BF BO
12	OCT 82	5255.--	3.540	1	----	4.127	1	----	4.301	1	----	O/Y JAP
12	OCT 82	5255.15	3.552	1	----	4.096	1	----	4.465	1	----	JAPOA
12	OCT 82	5254.85	3.518	3	----	4.071	3	----	4.482	3	----	BF BO

UT	DATE	2440000 + HJD	VISUAL V	N	SD	BLUE B	N	SD	ULTRA VIOLET U	N	SD	NOTES/ OBSERVER
13	OCT 82	5256.--	3.547	1	----	4.145	1	----	4.303	1	----	O/Y JAP
13	OCT 82	5256.16	3.567	3	.009	4.116	3	.003	4.453	3	.004	JAPOA
14	OCT 82	5257.74	3.430	1	----	-----	-	----	-----	-	----	P/E GCO
14	OCT 82	5256.85	3.522	3	----	4.084	3	----	4.470	3	----	BF BO
15	OCT 82	5257.84	3.521	1	----	4.074	1	----	4.482	1	----	BF BO
16	OCT 82	5259.--	3.564	1	----	4.119	1	----	4.333	1	----	O/Y JAP
16	OCT 82	5259.14	3.576	1	----	4.088	1	----	4.477	1	----	JAPOA
16	OCT 82	5259.94	3.515	3	.006	4.062	3	.026	4.232	3	.010	JLH HPO
17	OCT 82	5259.98	3.530	3	----	4.079	3	----	4.475	3	----	BF BO
17	OCT 82	5260.46	3.525	3	.004	4.078	3	.007	-----	-	----	SII TAO
18	OCT 82	5261.--	3.555	1	----	4.145	1	----	4.307	1	----	O/Y JAP
18	OCT 82	5261.14	3.565	1	----	4.114	1	----	4.452	1	----	JAPOA
19	OCT 82	5261.95	3.532	3	----	4.071	3	----	4.460	3	----	BF BO
20	OCT 82	5263.--	3.573	1	----	4.150	1	----	4.332	1	----	O/Y JAP
20	OCT 82	5263.12	3.586	3	.001	4.122	3	.003	4.473	1	----	JAPOA
22	OCT 82	5265.--	3.577	1	----	4.160	1	----	4.336	1	----	O/Y JAP
22	OCT 82	5265.12	3.584	3	.005	4.128	3	.001	4.496	3	.001	JAPOA
22	OCT 82	5265.59	3.321	2	.010	4.078	2	.001	-----	-	----	IED AUO
24	OCT 82	5267.40	3.554	2	.004	4.108	2	.002	-----	-	----	IED AUO
24	OCT 82	5267.46	3.538	3	.009	-----	-	----	-----	-	----	SII TAO
24	OCT 82	5267.74	3.550	1	----	-----	-	----	-----	-	----	P/E GCO
25	OCT 82	5268.48	3.552	2	.002	4.096	2	.005	-----	-	----	IED AUO
26	OCT 82	5269.--	3.584	1	----	4.163	1	----	4.336	1	----	O/Y JAP
26	OCT 82	5269.12	3.596	1	----	4.132	1	----	4.481	1	----	JAPOA
27	OCT 82	5270.--	3.589	1	----	4.178	1	----	4.178	1	----	O/Y JAP
27	OCT 82	5270.18	3.601	1	----	4.147	1	----	4.495	1	----	JAPOA
28	OCT 82	5270.77	3.561	3	----	4.121	3	----	4.495	3	----	BF BO
29	OCT 82	5272.12	3.617	2	.004	4.157	2	.001	4.541	2	.072	JAPOA
2	NOV 82	5275.84	3.592	3	----	4.157	3	----	4.544	3	----	BF BO
3	NOV 82	5277.04	3.654	2	.007	4.194	2	.009	4.541	2	.001	JAPOA
4	NOV 82	5278.70	3.630	1	----	-----	-	----	-----	-	----	P/E GCO
5	NOV 82	5279.48	3.614	4	.002	4.172	3	.006	-----	-	----	SII TAO
6	NOV 82	5279.77	3.625	1	----	4.189	1	----	4.566	1	----	BF BO
6	NOV 82	5280.34	3.622	3	.014	4.178	3	.006	-----	-	----	SII TAO
7	NOV 82	5281.32	3.637	3	.020	4.196	3	.009	-----	-	----	SII TAO
7	NOV 82	5281.73	3.630	1	----	-----	-	----	-----	-	----	P/E GCO
8	NOV 82	5282.65	3.650	1	----	-----	-	----	-----	-	----	P/E GCO
9	NOV 82	5283.75	3.640	1	----	4.240	1	----	-----	-	----	P/E GCO
9	NOV 82	5283.--	3.545	1	----	4.214	1	----	-----	-	----	BO COR
12	NOV 82	5286.--	3.690	1	----	4.308	1	----	4.478	1	----	O/Y JAP
12	NOV 82	5286.24	3.691	2	.000	4.247	2	.004	-----	-	----	JAPOA
12	NOV 82	5286.--	3.663	1	----	4.237	1	----	-----	-	----	BO COR
13	NOV 82	5287.--	3.700	1	----	4.295	1	----	4.477	1	----	O/Y JAP
13	NOV 82	5287.08	3.712	1	----	4.264	1	----	4.623	1	----	JAPOA
15	NOV 82	5289.73	3.670	1	----	4.240	1	----	-----	-	----	P/E GCO
18	NOV 82	5292.--	3.726	1	----	-----	-	----	-----	-	----	O/Y JAP
18	NOV 82	5292.06	3.738	1	----	-----	-	----	4.742	1	----	JAPOA
18	NOV 82	5292.49	3.690	1	.040	4.351	1	.040	4.504	1	.050	RM MO
19	NOV 82	5293.--	3.903	1	----	4.242	1	----	-----	-	----	BO COR
25	NOV 82	5299.36	3.721	2	.020	4.370	2	.020	4.521	2	.030	RM MO
25	NOV 82	5299.84	3.720	1	----	4.252	1	----	4.563	1	----	JLH HPO
29	NOV 82	5303.36	3.724	3	.002	4.297	3	.003	-----	-	----	SII TAO
30	NOV 82	5304.16	3.794	2	.009	4.371	2	.005	-----	-	----	JAPOA

UT	DATE	2440000 + HJD	VISUAL V	N	SD	BLUE B	N	SD	ULTRA VIOLET U	N	SD	NOTES/ OBSERVER
5	DEC 82	5309.48	3.730	1	.030	4.375	1	.020	-----	-	----	RM MO
7	DEC 82	5311.31	3.740	3	.019	4.328	3	.012	-----	-	----	SII TAO
8	DEC 82	5312.--	3.792	1	----	4.404	1	----	4.602	1	----	O/Y JAP
8	DEC 82	5312.13	3.804	1	----	4.373	1	----	4.731	1	----	JAPOA
9	DEC 82	5313.58	3.780	1	----	4.280	1	----	-----	-	----	P/E GCO
11	DEC 82	5315.81	3.751	3	.012	4.298	3	.007	4.493	3	.014	JLH HPO
12	DEC 82	5316.34	3.743	3	.001	4.316	3	.008	-----	-	----	SII TAO
14	DEC 82	5318.--	3.791	1	----	4.422	1	----	4.585	1	----	O/Y JAP
14	DEC 82	5318.17	3.803	1	----	4.390	1	----	4.742	1	----	JAPOA
16	DEC 82	5320.29	3.738	3	.018	4.310	3	.004	-----	-	----	SII TAO
16	DEC 82	5320.79	3.749	1	----	4.290	1	----	4.493	1	----	JLH HPO
18	DEC 82	5322.--	3.781	1	----	4.400	1	----	4.595	1	----	O/Y JAP
18	DEC 82	5322.36	3.770	1	.030	-----	-	----	-----	-	----	RM MO
21	DEC 82	5325.55	3.786	1	.020	-----	-	----	-----	-	----	RM MO
23	DEC 82	5327.--	3.768	1	----	4.361	1	----	-----	-	----	BO COR
23	DEC 82	5327.37	3.719	3	.016	4.308	3	.007	-----	-	----	SII TAO
26	DEC 82	5330.77	3.744	1	----	4.282	1	----	4.476	1	----	JLH HPO
28	DEC 82	5332.31	3.728	3	.007	4.297	3	.005	-----	-	----	SII TAO
1	JAN 83	5336.34	3.745	2	.015	4.409	2	.020	-----	-	----	RM MO
1	JAN 83	5336.77	3.736	3	.009	4.269	3	.008	4.480	3	.021	JLH HPO
2	JAN 83	5337.36	3.745	3	.014	4.297	3	.008	-----	-	----	SII TAO
2	JAN 83	5337.75	3.739	1	----	4.265	1	----	4.466	1	----	JLH HPO
6	JAN 83	5341.35	3.740	2	.020	-----	-	----	-----	-	----	RM MO
7	JAN 83	5342.46	3.744	2	.020	-----	-	----	-----	-	----	RM MO
7	JAN 83	5342.73	3.743	1	----	4.267	1	----	4.457	1	----	JLH HPO
8	JAN 83	5343.21	3.730	3	.005	4.292	3	.005	-----	-	----	SII TAO
8	JAN 83	5343.34	3.730	3	.005	4.292	3	.005	-----	-	----	SII TAO
8	JAN 83	5343.--	3.700	2	.036	4.371	2	.093	-----	-	----	BO COR
8	JAN 83	5343.73	3.726	1	----	4.254	1	----	4.447	1	----	JLH HPO
10	JAN 83	5345.--	3.781	1	----	4.364	1	----	4.567	1	----	O/Y JAP
11	JAN 83	5346.--	3.746	1	----	4.301	1	----	-----	-	----	BO COR
11	JAN 83	5345.08	3.793	1	----	4.333	1	----	4.715	1	----	JAPOA
11	JAN 83	5346.70	3.736	1	----	4.247	1	----	4.462	1	----	JLH HPO
12	JAN 83	5347.68	3.750	1	----	4.263	1	----	4.480	1	----	JLH HPO
14	JAN 83	5349.--	3.852	2	.000	4.402	2	.029	-----	-	----	BO COR
14	JAN 83	5349.69	3.743	1	----	4.276	1	----	4.487	1	----	JLH HPO
16	JAN 83	5351.23	3.726	3	.002	-----	-	----	-----	-	----	SII TAO
18	JAN 83	5353.44	3.746	3	.003	4.303	3	.003	-----	-	----	SII TAO
19	JAN 83	5354.27	3.742	3	.009	4.303	3	.005	-----	-	----	SII TAO
22	JAN 83	5357.44	3.766	3	.004	4.317	3	.007	-----	-	----	SII TAO
22	JAN 83	5357.46	3.766	4	.015	-----	-	----	-----	-	----	RM MO
31	JAN 83	5366.24	3.762	3	.005	4.298	4	.007	-----	-	----	SII TAO
1	FEB 83	5367.66	3.756	1	----	4.293	1	----	4.468	1	----	JLH HPO
2	FEB 83	5368.00	3.815	2	.007	4.362	2	.001	-----	-	----	JAPOA
3	FEB 83	5369.35	3.725	2	.020	4.373	2	.040	4.481	-	----	RM MO
4	FEB 83	5370.--	3.804	1	----	4.394	1	----	4.583	1	----	O/Y JAP
4	FEB 83	5370.00	3.816	1	----	4.363	1	----	4.737	1	----	JAPOA
5	FEB 83	5371.68	3.772	1	----	4.281	1	----	4.436	1	----	JLH HPO
8	FEB 83	5374.29	3.758	3	.005	4.292	3	.016	-----	-	----	SII TAO
9	FEB 83	5375.31	3.754	4	.008	4.298	4	.002	-----	-	----	SII TAO
10	FEB 83	5376.64	3.780	1	----	4.286	1	----	4.469	1	----	JLH HPO
11	FEB 83	5377.45	3.762	3	.002	4.317	3	.007	-----	-	----	SII TAO
12	FEB 83	5378.29	3.764	3	.017	4.329	3	.012	-----	-	----	SII TAO
13	FEB 83	5379.65	3.766	1	----	4.287	1	----	4.445	1	----	JLH HPO

UT	DATE	2440000 + HJD	VISUAL V	N	SD	BLUE B	N	SD	ULTRA VIOLET U	N	SD	NOTES/ OBSERVER
14	FEB 83	5380.--	3.801	1	----	4.385	1	----	4.559	1	----	O/Y JAP
14	FEB 83	5380.01	3.813	1	----	4.354	1	----	4.705	1	----	JAPOA
14	FEB 83	5380.36	3.767	4	.007	4.330	3	.015	-----	-	----	SII TAO
14	FEB 83	5380.64	3.771	1	----	4.299	1	----	4.466	1	----	JLH HPO
15	FEB 83	5381.--	3.823	1	----	4.396	1	----	4.576	1	----	O/Y JAP
15	FEB 83	5381.10	3.835	1	----	4.365	1	----	4.724	1	----	JAPOA
16	FEB 83	5382.36	3.763	3	.004	4.322	3	.002	-----	-	----	SII TAO
16	FEB 83	5382.63	3.759	1	----	4.294	1	----	4.468	1	----	JLH HPO
18	FEB 83	5384.62	3.762	1	----	4.296	1	----	4.469	1	----	JLH HPO
19	FEB 83	5385.64	3.813	1	----	4.328	1	----	4.440	1	----	JLH HPO
19	FEB 83	5385.65	3.788	1	----	4.348	1	----	-----	-	----	P/E GCO
20	FEB 83	5386.25	3.769	3	.007	4.315	3	.005	-----	-	----	SII TAO
20	FEB 83	5386.69	3.802	1	----	4.298	1	----	4.531	1	----	JLH HPO
21	FEB 83	5387.62	3.808	1	----	4.298	1	----	4.488	1	----	JLH HPO
22	FEB 83	5388.26	3.771	4	.003	4.324	4	.007	-----	-	----	SII TAO
24	FEB 83	5390.26	3.776	4	.019	4.334	3	.003	-----	-	----	SII TAO
25	FEB 83	5391.59	3.872	1	----	4.446	1	----	-----	-	----	P/E GCO
26	FEB 83	5392.62	3.792	1	----	4.312	1	----	4.494	1	----	JLH HPO
28	FEB 83	5394.96	3.827	2	.002	4.381	2	.001	-----	-	----	JAPOA
1	MAR 83	5395.61	3.727	1	----	4.442	1	----	-----	-	----	P/E GCO
4	MAR 83	5398.29	3.780	3	.011	4.340	4	.005	-----	-	----	SII TAO
5	MAR 83	5399.--	3.842	1	----	4.423	1	----	4.595	1	----	O/Y JAP
5	MAR 83	5399.03	3.854	1	----	4.392	1	----	4.739	1	----	JAPOA
7	MAR 83	5401.41	3.789	4	.006	4.340	3	.001	-----	-	----	SII TAO
8	MAR 83	5402.61	3.788	1	----	4.313	1	----	4.497	1	----	JLH HPO
9	MAR 83	5402.99	3.837	1	----	4.363	1	----	4.714	1	----	JAPOA
9	MAR 83	5403.--	3.825	1	----	4.395	1	----	4.568	1	----	O/Y JAP
9	MAR 83	5403.62	3.757	1	----	4.266	1	----	4.446	1	----	JLH HPO
11	MAR 83	5405.35	3.781	3	.002	4.331	3	.002	-----	-	----	SII TAO
11	MAR 83	5405.95	3.826	2	.001	4.369	2	.013	-----	-	----	JAPOA
12	MAR 83	5406.62	3.792	1	----	4.369	1	----	-----	-	----	P/E GCO
14	MAR 83	5408.--	3.846	1	----	4.432	1	----	4.523	1	----	O/Y JAP
14	MAR 83	5408.93	3.816	2	.002	4.350	2	.002	-----	-	----	JAPOA
19	MAR 83	5413.34	3.775	3	.001	4.319	3	.009	-----	-	----	SII TAO
22	MAR 83	5416.62	3.771	1	----	4.379	1	----	-----	-	----	P/E GCO
23	MAR 83	5417.32	3.774	3	.005	4.315	3	.012	-----	-	----	SII TAO
31	MAR 83	5425.58	3.950	1	----	4.450	1	----	-----	-	----	P/E GCO
4	APR 83	5429.42	3.749	3	.014	4.299	3	.015	-----	-	----	SII TAO
4	APR 83	5429.--	3.735	2	.000	4.459	2	.124	-----	-	----	BO COR
5	APR 83	5430.--	3.769	3	.007	4.356	3	.006	-----	-	----	BO COR
11	APR 83	5436.61	3.830	1	----	4.420	1	----	-----	-	----	P/E GCO
13	APR 83	5438.38	3.700	3	.008	4.257	3	.012	-----	-	----	SII TAO
15	APR 83	5440.57	3.700	1	----	4.280	1	----	-----	-	----	P/E GCO
4	MAY 83	5459.41	3.639	3	.011	4.197	3	.009	-----	-	----	SII TAO
5	MAY 83	5460.43	3.645	3	.021	4.201	3	.004	-----	-	----	SII TAO
11	MAY 83	5466.46	3.576	4	.025	4.133	4	.020	-----	-	----	SII TAO
	JUNE 83											
20	JULY 83	5536.48	3.673	3	.014	4.242	3	.013	-----	-	----	SII TAO
22	JULY 83	5538.49	3.645	3	.002	4.249	3	.005	-----	-	----	SII TAO
29	JULY 83	5545.45	3.691	3	.020	4.263	3	.013	-----	-	----	SII TAO
8	AUG 83	5555.50	3.702	3	.003	4.281	4	.006	-----	-	----	SII TAO
9	AUG 83	5556.46	3.696	4	.031	4.252	4	.013	-----	-	----	SII TAO
16	AUG 83	5563.45	3.696	4	.029	4.261	3	.014	-----	-	----	SII TAO
20	AUG 83	5567.51	3.723	3	.005	4.278	3	.003	-----	-	----	SII TAO

UT	DATE	2440000 + HJD	VISUAL V	N	SD	BLUE B	N	SD	ULTRA VIOLET U	N	SD	NOTES/ OBSERVER
25	AUG 83	5572.46	3.724	3	.006	4.286	3	.007	-----	-	----	SII TAO
25	AUG 83	5572.47	3.722	4	.006	4.291	3	.004	-----	-	----	SII TAO
27	AUG 83	5574.47	3.726	4	.005	4.284	3	.005	-----	-	----	SII TAO
28	AUG 83	5575.45	3.749	3	.006	4.316	3	.006	-----	-	----	SII TAO
7	SEPT 83	5585.40	3.781	3	.003	-----	-	----	-----	-	----	SII TAO
22	SEPT 83	5600.37	3.762	3	.003	4.324	4	.001	-----	-	----	SII TAO
22	SEPT 83	5600.38	3.763	3	.002	-----	-	----	-----	-	----	SII TAO
27	SEPT 83	5605.42	3.748	4	.003	4.331	4	.015	-----	-	----	SII TAO
29	SEPT 83	5607.68	3.760	3	.006	-----	-	----	-----	-	----	SII TAO
30	SEPT 83	5608.41	3.764	3	.004	4.333	3	.003	-----	-	----	SII TAO
30	SEPT 83	5608.46	3.762	3	.003	-----	-	----	-----	-	----	SII TAO
6	OCT 83	5614.41	3.748	4	.005	4.331	3	.013	-----	-	----	SII TAO
8	OCT 83	5616.78	3.760	1	----	4.375	1	----	4.651	1	----	JLH HPO
9	OCT 83	5617.48	3.747	3	.011	4.320	3	.016	-----	-	----	SII TAO
9	OCT 83	5617.48	3.747	3	.011	4.316	3	.024	-----	-	----	SII TAO
22	OCT 83	5630.63	3.740	3	.005	4.300	2	.008	4.453	2	.010	RM MO
28	OCT 83	5636.66	3.725	1	.008	4.316	1	.008	4.439	1	.013	RM MO
28	OCT 83	5636.82	3.763	1	----	4.342	1	----	4.552	1	----	JLH HPO
4	NOV 83	5643.83	3.729	1	----	4.337	1	----	4.558	1	----	JLH HPO
11	NOV 83	5650.81	3.724	1	----	4.316	1	----	4.553	1	----	JLH HPO
13	NOV 83	5652.86	3.725	1	----	4.307	1	----	4.529	1	----	JLH HPO

NOTES AND OBSERVERS

BF BO - BOB FRIED, BRAESIDE OBSERVATORY ARIZONA, USA

BO COR - BOB O'CONNELL, COLLEGE OF THE REDWOODS, CALIF. USA
NOTE: BO COR DATA NOT CORRECTED FOR COLOR OR EXTINCTION

ECO ML - EDWARD C. OLSON, MOUNT LAGUNA OBSERVATORY, ILLINOIS, USA

IED AUO - I. ETHEM DERMAN, ANKARA UNIVERSITY OBSERVATORY, ANKARA, TURKEY

JAPOA - T. ABE, S. OHMURI, T. OHKI, H. YOSHINARI, JAPAN

JLH HPO - J.L. HOPKINS, HOPKINS PHOENIX OBSERVATORY, ARIZONA, USA

O/Y JAP - TOSIO OKI, HIROKO YOSHINARI, JAPAN

P/E GCO - B. POWELL AND D. EDWARDS, GEORGIA COLLEGE OBSEVATORY GEORGIA USA

RM MO - RICHARD MILES, MOULDSWORTH OBSERVATORY, CHESHIRE, U.K.

SII TAO - STIG I. INGVARSSON, T.A.O. OBSERVATORY, SKARHAMN, SWEDEN
NOTE: SII TAO JD'S ARE GEO NOT HELIO.

POLARIMETRY REPORT

THE POLARIZATION OF EPSILON AURIGAE

Updated report 22 Sept. 1983

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We now have over 115 nights of optical polarimetric data since July 1982. In Figure 1 we show the data for V, B, and U bands, in terms of the equatorial Stokes parameters Q and U, where $Q = p \cos(2\theta)$ and $U = p \sin(2\theta)$. The only important gap was around June 83, when the object was too close to the Sun. Obvious variation is seen, superimposed on constant offsets taken to be interstellar. (The latter component is concentrated in the U parameter, since the p.a. is about 135°.) The structure in Fig. 1 is almost all real, at least in the V and B bands wherein the errors per nightly point were typically 0.015% in both parameters. In the U band, the much lower flux plus the large interstellar offset produced extra calibration errors in the U parameter, and some points had errors of 0.1%; that partly accounts for the rapid excursions in that case (dashed curve in Fig. 1b).

The intrinsic, variable polarization seems to have three components:

(1) A general variation on the long time scale of the eclipse. We suggest that by the heavy, hand-drawn curves in Fig. 1.

(2) Quasi-sinusoidal variation suggestive of the 100-day Cepheid-like pulsation. This effect may be absent outside eclipse and seems to build up during ingress.

(3) Rapid features on a time scale of a few days. Note e.g. the dip-like feature in the Q parameter around JD 2445430, which appears in all three filter bands.

We now attempt an interpretation, subject of course to argument. Since scattering of primary light across the cloud is almost pure "forward" scattering, little polarization is expected from the cloud itself. Instead, consider "limb polarization" originating in the primary star, modulated by the cloud's passage. Presuming the primary to be spherical, such polarization is detectable only when the primary's disk is partly covered. By coincidence, we recently discovered such eclipsing "Chandrasekhar" polarization in Algol, the first detection of this effect; see Kemp et al 1983, Ap.J. (Letters), 15 October (to appear).

We ignore first the ~100-day fluctuations ((2) above) and take up only the long-period effects, (1) above. A possible geometry is shown in Figure 2. In mid eclipse, Fig. 2b, the polarization should be parallel to the exposed limbs of the primary, thus parallel to the plane of the cloud on the sky. The astrometric orbit (Van de Kamp, A.J. 83, 975) gives position angle 95° for the system, essentially EW. In Fig. 1, assuming the zero of intrinsic polarization to correspond roughly to the polarization at JD 2445200, the mean excursion of the Q parameter in mid eclipse is negative; the mean excursion of the U parameter is rather small. Thus the mean position angle of the intrinsic polarization in mid eclipse is around 90°, consistent with the astrometric p.a. and with a model as in Fig. 2b. (Limb polarization in stars is thought to normally be parallel to the limb.)

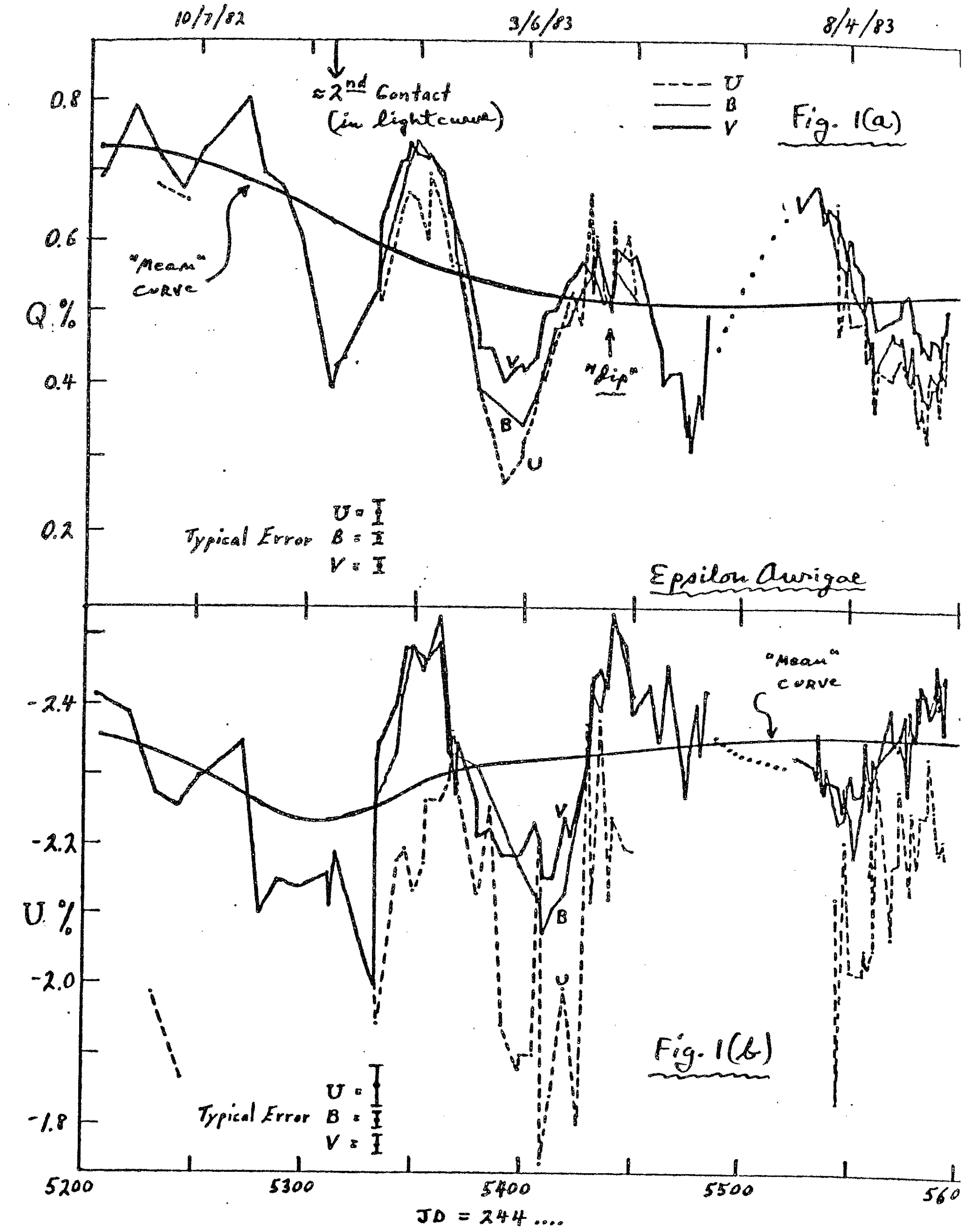
In Fig. 2 we offset the projected cloud plane above the primary star's equator; the system is not quite edge on. If the system were precisely edge on, and if the cloud is flat and the primary is spherical, the only intrinsic polarization would be in the Q parameter (parallel to the cloud or normal to it). But the U parameter, which relates to "45°" effects, also varies, at least during and somewhat after ingress. Figure 2a shows how the polarization can be tilted from 90° during ingress, producing a finite intrinsic U parameter. At mid eclipse, the U parameter should return to the interstellar value. As seen in Fig. 1b, the observed behavior seems to approximate this.

What can be called "polarimetric second contact" occurs later than photometric second contact -- see Fig. 1. This is explained if the primary supergiant has a tenuous, very extended atmosphere with a high free-electron density. The polarization then arises well out from the photometric photosphere.

Now for the 95-day (~100-day) polarimetric variation. If the primary is a spherical pulsator, no variable polarization would be seen outside of eclipse. In eclipse center, Figure 2b, in our stellar limb-polarization model the polarization would be a function of certain angles which give the fractions of exposed limb. (See our Algol paper, cited above.) Here we have two angles θ_1 and θ_2 for the upper and lower hemispheres. The primary's pulsation makes these angles change, thus making the polarization Q parameter vary. Around "polarimetric second contact" as depicted in Fig. 2a, the asymmetrical situation would cause the U parameter, also, to be modulated by the pulsation, if the system is not precisely edge-on. That is observed. The pulsation modulation of the U parameter should, though, vanish or become small towards mid eclipse, as in fact it seems to.

Finally the small features on a time scale of a few days may be explained, in terms of the primary-limb model, as due to passing protuberances in the cloud; these would change the shape and extent of the exposed area of the primary's disk. (Evidently both the Q and U parameters could be modulated this way.) Alternatively, there could be non-spherical, short-term fluctuations in the primary's extended envelope. If the latter is the case, we should see small polarization fluctuations far outside eclipse. We will look for such next summer after eclipse.

Already, constraints on the cloud's geometry and on the system are imposed. The above limb polarization model is susceptible to systematic modelling.



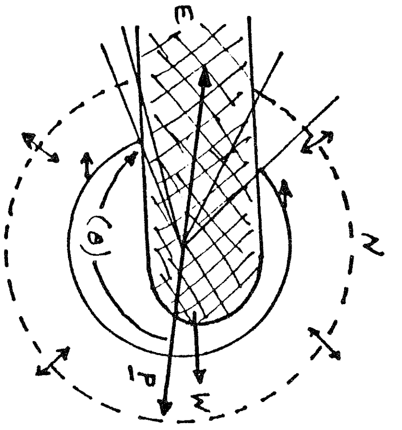


Fig. 2a: Primary limb polarization near second contact.

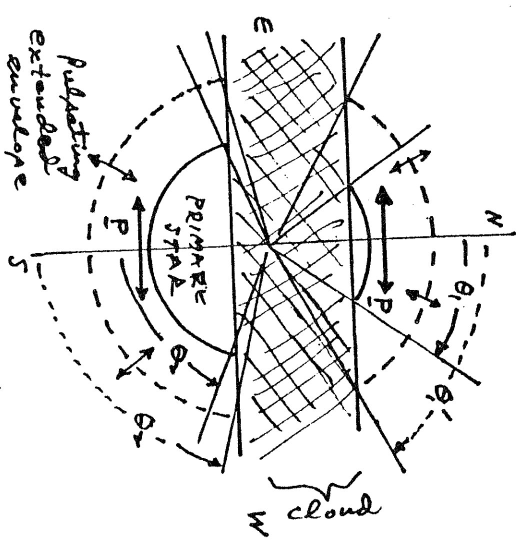


Fig. 2b: Primary limb polarization in mid eclipse.

SPECTROSCOPY REPORT

During the latter part of totality, most observers have been busy puzzling over the information contained in spectra obtained during ingress and early totality. Several preprints have been received and we have word of additional papers in preparation.

Saito, Kawabata, Saijo and Sato reported on their optical and H-alpha spectroscopy at the Bandung IAU Colloquium this summer. Their profile and radial velocity data was used to argue for three structural components of the eclipsing body: a 20 km/s ring of neutral metals; a 40 km/s ring of neutral hydrogen, and, a low density hydrogen envelope extending twice the size of the ring structures.

Parathasarathy and Lambert reported that the neutral potassium line which showed strong ingress changes in equivalent widt:, decreased in strength during totality. They use this to argue that the cool gas is confined to the exterior of the secondary. In a preprint discussing their UV spectra, they indicate the depth of eclipse at various UV wavelength supports either the Hack model of a hot star within the disk shaped secondary, or chromospheric excess of the primary.

Additional short reports received are reproduced herein.

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College of Arts and Sciences
Department of Physics and Astronomy
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August 29, 1983

Dr. R. E. Stencel
Mail Code EZ-7
NASA-HQ
Washington, DC 20546

Dear Bob:

As I mentioned to you over the phone a few weeks ago, Paul Noah, Richard Meredith and myself have been obtaining spectroscopic observations of Epsilon Aurigae since April 1982. Presently our data have been obtained (at intervals of about six months) at Kitt Peak using CCD detectors at the Coudé Feed Telescope. The resolution of these data has been ~0.7 Å, with S/N about 50. The most recent data is from a run in March 1983 where we obtained data at Hα (e.g., scan 28) and the Na I D lines (scan 54). As others have pointed out, the Hα line has undergone some significant profile changes during the eclipse. In September 1982 (No. 19) the line had red and blue emission peaks, but the red component had vanished by March 1983. Our data from April 1982 (not illustrated) show the red emission component to be present and noticeably more intense than the blue. Thus, the red component has apparently been weakening steadily throughout the eclipse.

We will continue to observe epsilon Aurigae spectroscopically at KPNO, with our next run scheduled for September 21-25. Additionally, we anticipate that soon our own Reticon system, along with our echelle spectrograph and 1 meter reflector, will be routinely observing epsilon Aurigae during the Fall and Winter, with resolution ~0.2 Å.

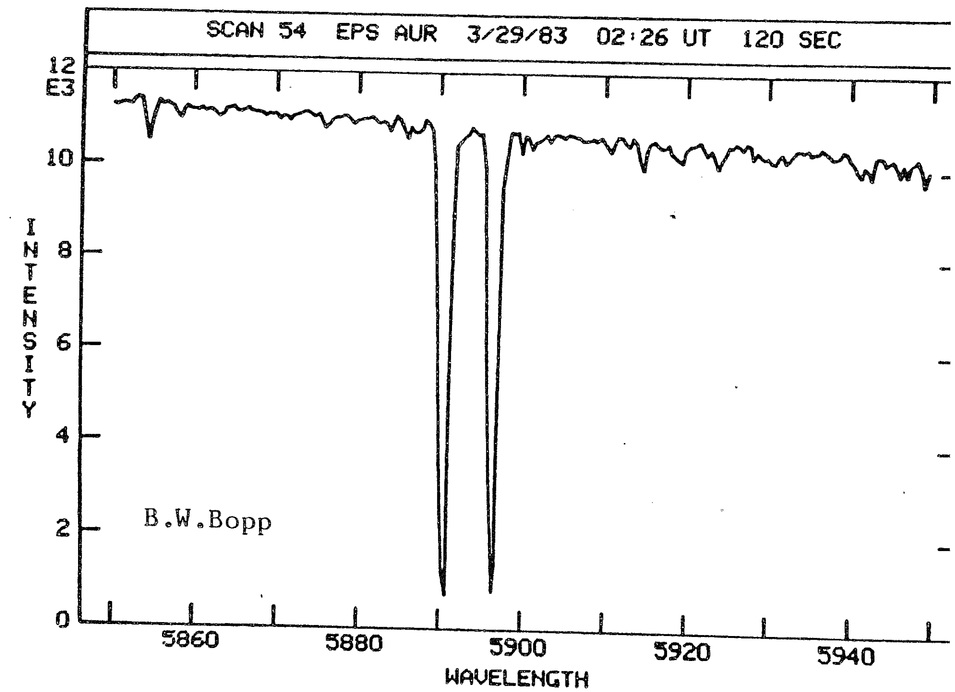
(I'd appreciate it if you would consider the above text, along with the illustrations, for inclusion in the next Newsletter. When do I get my picture on the cover??)

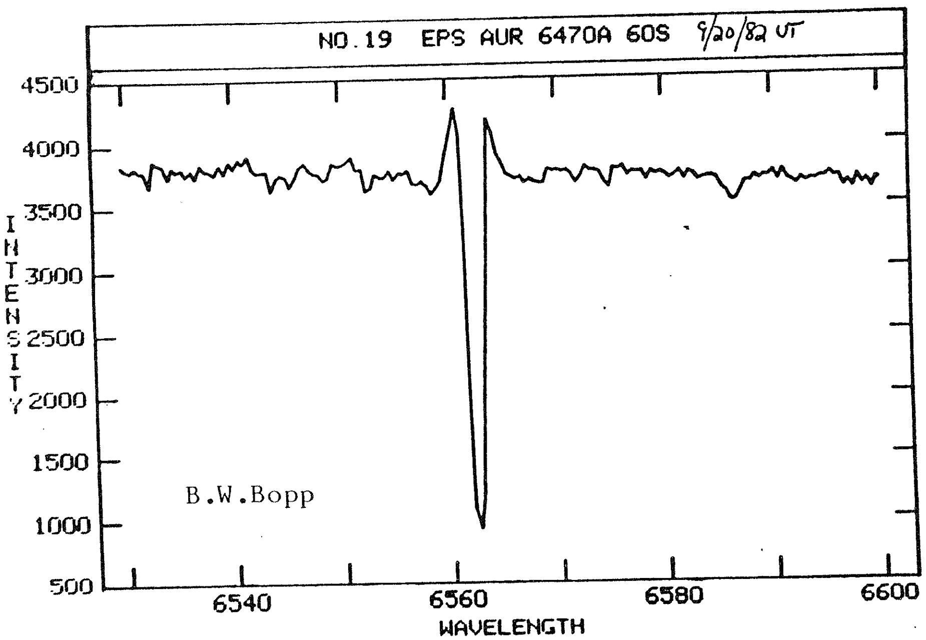
Best wishes,

Bernard W. Bopp
Professor of Astronomy

BWB:dat

enclosure

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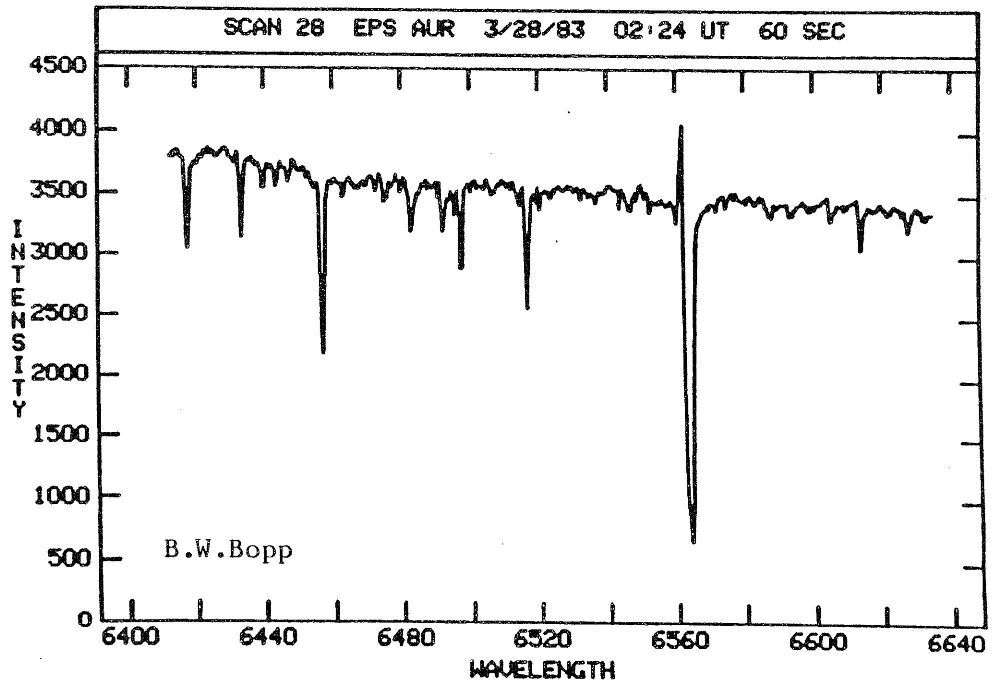
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WAVELENGTH
B.W.Bopp

We made a preliminary report about our spectroscopic observations of the eclipse of Epsilon Aurigae on the IAU Coll. No.80 'Double Stars' held at Bandung, Indonesia, on last June. The manuscript is enclosed. The papers of the Coll. shall be published from D. Reidel Publishing Company.

We would like to emphasize the importance of spectroscopic observations with high dispersion for the forthcoming egress phase.

RECEIVED
AUG 05 1983

A SPECTROSCOPIC STUDY OF EPSILON AURIGAE

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Keiich SAIJO
National Science Museum, Ueno Park, Tokyo 110
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Tokyo Astronomical Observatory, Mitaka, Tokyo 181

ABSTRACT Epsilon Aurigae has been observed during ingress and totality between 1982 and 1983 at Okayama. Analyses of profiles of H-alpha line and of radial velocities of neutral hydrogen and metals show that the secondary component consists of at least three parts in structure.

1. INTRODUCTION

An eclipsing binary Epsilon Aurigae has a period of 27.1 yr and the eclipse is occurring between 1982 and 1984. For the previous eclipses many observations were made in optical wavelength regions. As is well-known, the observed results have derived variuos models of the structure and physical state of the invisible secondary component (Kuiper et al. 1937, Gaposchkin 1954, Hack 1959, Huang 1965, Kopal 1971, Wilson 1971). Campaign Newsletters of Epsilon Aurigae eclipse being published by Drs. Hopkins and Stencel have announced that the present eclipse continues to progress on schedule and that many astromoners have been observing the eclipse on ultraviolet and infrared wavelength regions as well as optical region. Observations of polarization are also being done. We can expect that nature of the secondary is unveiled by these observations.

This report is preliminary results obtained by the 188 cm reflector of Okayama Astrophysical Observatory for variations of H-alpha profile and radial velocities of atoms with phase around the second contact. The results may give a constraint for models of the secondary.

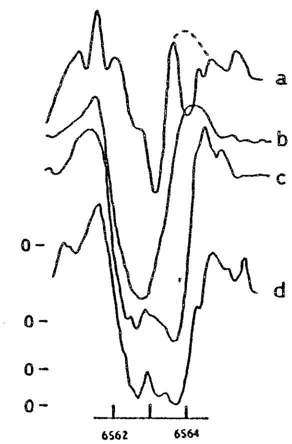

Fig. 1. Profiles of Epsilon Aurigae around the H-alpha line. Plate No. and the date observed are (a) C10-3636, 1978 Nov. 21, (b) C10-3970, 1981 Dec. 10, (c) C10-4082, 1982 Dec. 9, and (d) C10-4104, 1983 Jan. 27. There is a small flaw on plate (a). A corrected profile is drawn by a dashed curve in profile (a). The abscissas are arbitrary scale.

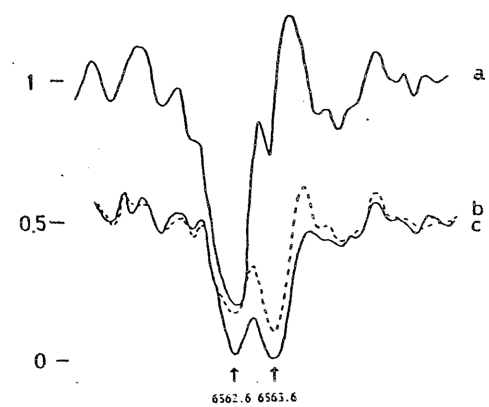

Fig. 2. Intensities around the H-alpha line at eclipsing phases relative to intensity of the plate C10-3636 obtained outside eclipse. Plate No. and the date observed are (a) C10-3970, 1981 Dec. 10, (b) C10-4082, 1982 Dec. 9, and (c) C10-4102, 1983 Jan. 27.

2. PROFILE OF H-ALPHA LINE

Figure 1 shows profiles of the H-alpha line on spectrograms with a dispersion of 8.3 angstrom per mm. The profile obtained outside eclipse, figure 1a, is characterized by a relatively narrow absorption line with emissions at both sides. We can see that the central absorption increases and progresses towards the red side with phase, and the central reversal emission appears in figures 1c and 1d. In totality just after the second contact the emission at the red-side disappears, as shown in figure 1d.

The disappearence of the red-side emission in totolity was reported by Guinan (1983) and Boehm and Ferluga (1983). In the last eclipse, Wright and Kushwaha (1957) found the same phenomenon.

Figure 2 shows intensities at three phases against outside eclipse as functions of wavelength around H-alpha. The decrease of continuum radiation has been estimated from the V-magnitude light curve of Ingvarsson (1983) at each phase. We can see from figure 2 that (1) strong absorption of H-alpha line has appeared with radial velocity of -5 km/s even at 1981 Dec. 10, at seven months before the first contact, 1982 July 29 (Gyldenkerne 1970), and the absorption gradually increases with phase, (2) at ingress and totality, absorption has been rapidly increasing at red side with radial velocity of 40 km/s, and (3) the eclipse at the H-alpha line becomes almost complete by the two absorption components, although half the continuum radiation is appearing during totality.

3. RADIAL VELOCITIES OF ABSORPTION LINES

Figure 3 shows radial velocity curves of absorption lines of neutral hydrogen and metals around the second contact. The center of gravity of the binary system moves -2.5 km/s. Our measurements have been made for seven plates of blue and ultraviolet regions with a dispersion of 4.1 angstrom per mm.

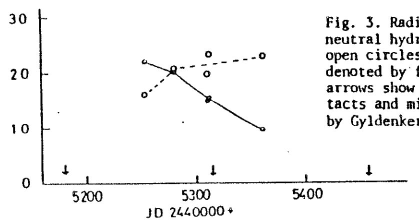

Fig. 3. Radial velocities of neutral hydrogen, denoted by open circles, and neutral metals, denoted by filled circles. Three arrows show first and second contacts and mid-eclipse predicted by Gyldenkerne (1970).

The Balmer line velocities slightly increase with phase. The velocity increse corresponds to the development of the red-side absorption of the H-alpha line with phase mentioned above. On the other hand, the radial velocities of neutral metals decrease almost linearly with phase towards zero velocity at mid-eclipse. Profiles of the neutral metals are asymmetrical with steeper gradient at the red side and the intensities scarecely change during the phases shown in figure 3 in spite of the large variations of the radial velocities.

Such a separation of the radial velocity curves between neutral hydrogen and neutral metals has also appeared around the second and third contacts of the last eclipse (Wright 1970).

4. MODEL OF THE SECONDARY COMPONENT

We may consider from the results obtained in the previous sections that the secondary consists of at least three parts in structure:

(1) Neutral metals are confined in a ring which is rotating with 20 km/s or more, because of the linearly decreasing radial velocity curve and of the almost constant intensities of the absorption lines.

(2) Neutral hydrogen with radial velocities of 40 km/s distributes in the ring of metals and also inside the ring and it eclipses all over the photosphere of the primary. The observations of Wright and Kushwaha (1957) for the last eclipse show that neutral hydrogen layer seems to be rotating with velocities increasing towards the center.

(3) A low-density neutral hydrogen envelope extends at least twice the radius of the ring of metals. The radial velocity of the envelope is almost equal to that of the binary system.

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COMET CERNIS (1983l)

Further precise positions have been reported as follows:

1983 UT	α_{1950}	δ_{1950}	m_1	Observer
July 25.77893	$2^h42^m19^s.12$	+10°21'51".5	13	Seki
26.75648	2 42 08.81	+10 09 10.2		Gilmore
26.76215	2 42 08.76	+10 09 06.0		"

T. Seki (Kochi Observatory, Geisei Station).
A. C. Gilmore (Mt. John Observatory). Measurer: P. M. Kilmartin.

Improved parabolic elements from observations July 21-26:

T = 1983 July 24.196 ET ω = 186°.918
Ω = 208.877] 1950.0
q = 3.31349 AU i = 134.808

1983 ET	α_{1950}	δ_{1950}	Δ	r	m_1
Aug. 4	$2^h39^m.90$	+ 8°12'.0			
14	2 35.00	+ 5 23.8	2.959	3.319	10.6
24	2 27.35	+ 2 03.9			
Sept. 3	2 16.62	- 1 49.0	2.633	3.336	10.3
13	2 02.64	- 6 10.8			
23	1 45.60	-10 49.9	2.450	3.363	10.2

ϵ AURIGAE

M. Parthasarathy and ~~D. L. Lambert~~, McDonald Observatory, report: "Observations of ϵ Aur during totality near zero phase show a significant decrease in the strength of the K 770-nm resonance line: W_λ was 0.055 nm during 1982 Dec.-1983 Mar., 0.040 nm during Apr.-May and 0.024 nm during July. The Na D lines also decreased in strength, their strength now being similar to that before the eclipse. The Hα line is broad, and the emission in the wings has disappeared. These observations suggest that the neutral gas is mostly confined to the outer regions of the eclipsing object."

GK PERSEI

J. Mattei, AAVSO, communicates the following additional visual magnitude estimates (cf. IAUC 3840): July 21.30 UT, 11.9 (J. Bortle, Stormville, NY); 23.30, 11.5 (C. Scovil, Stamford, CT); 25.30, 11.6 (Bortle).

1983 August 5 Brian G. Marsden

EPSILON AURIGAE IN ECLIPSE. I. ULTRAVIOLET SPECTROSCOPY DURING INGRESS AND TOTALITY

SEP 12 11 12 AM '83
RECEIVED

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and

David L. Lambert[1]

McDonald Observatory and Department of Astronomy
University of Texas at Austin
Austin, Texas 78712

Received: ____________

ABSTRACT

Epsilon Aurigae is a long-period eclipsing system containing a F0 Ia supergiant and an unseen slightly less massive secondary. A primary eclipse began in mid-1982 with the unseen companion passing in front of the supergiant.

Low resolution ultraviolet (IUE) spectra of ϵ Aur in 1982 and early 1983 provide eclipse light curves extending into the total phase of the current eclipse. The depth of eclipse from 3000 Å to 1700 Å is slightly deeper than at visual wavelengths ($0^m.8$). The depth declines for $\lambda < 1700$ Å and is just $0^m.2$ at $\lambda < 1300$ Å.

The disappearance of the eclipse at $\lambda < 1300$ Å may be attributed to a hot star or spot within the disk-shaped secondary. A main sequence star of spectral type B0 accounts for the observations. However, it is pointed out that a hot star is not yet demanded by the observations. The site of the ultraviolet excess may be the primary's upper photosphere or chromosphere.