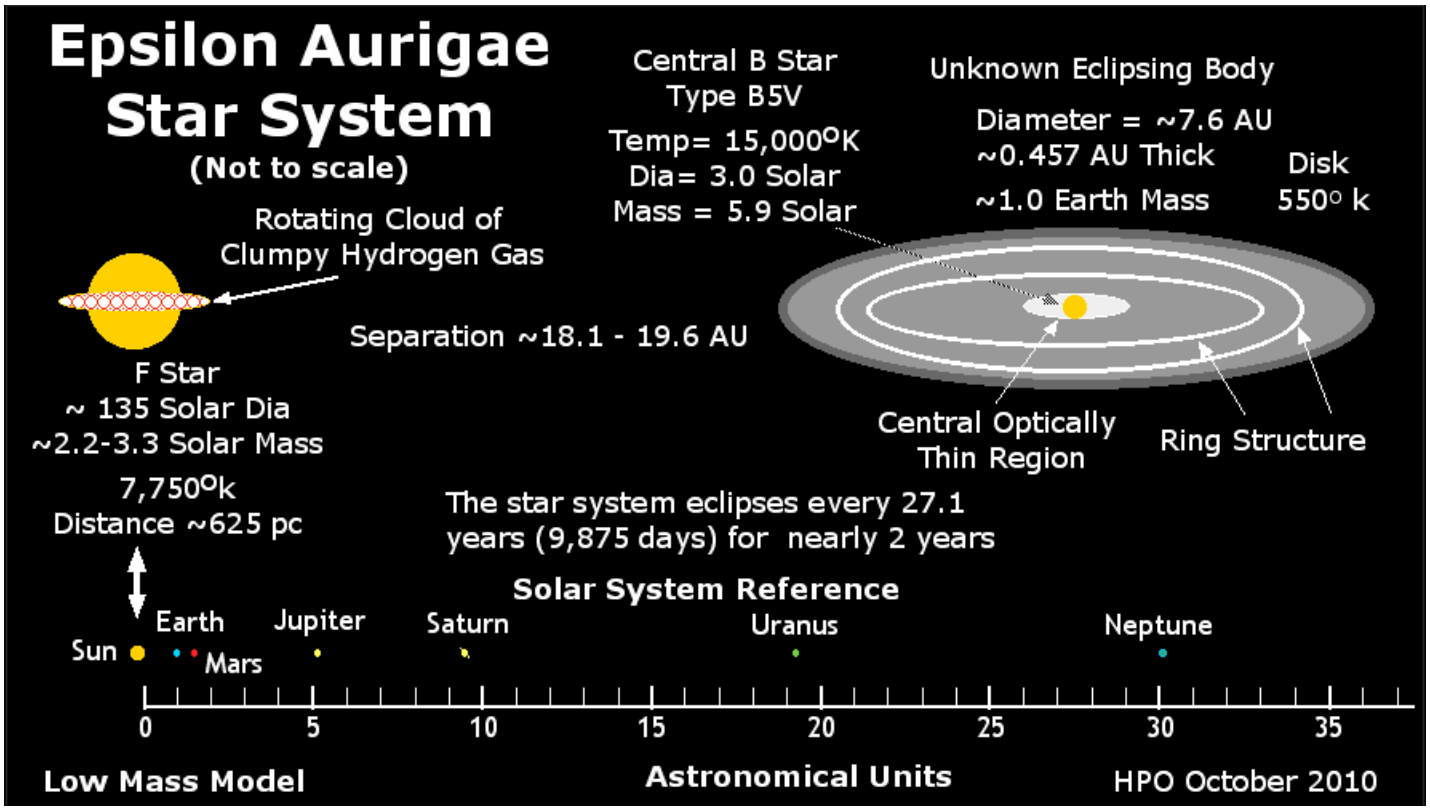
2009/2011
Epsilon Aurigae Eclipse
International Campaign Newsletter #20
Fall/Winter 2010/2011 - Totality



Jeffrey L. Hopkins, Editor
Hopkins Phoenix Observatory

Dr. Robert E. Stencel, Co-editor
University of Denver

Robin Leadbeater, Co-editor
Three Hills Observatory

Campaign Web Site
http://www.hposoft.com/Campaign09.html
and
Epsilon Aurigae Forum
http://tech.groups.yahoo.com/EpsilonAurigae/
see also
https://twitter.com/epsilon_Aurigae

In This Newsletter

Editor's Remarks

Dear Colleagues,

A Happy New Year and a belated Happy Winter Solstice!

Third Contact is fast approaching and is estimated for middle of March 2011. While we have seen significant variations of photometric magnitude during totality, we did not see firm evidence of a mid-eclipse brightening. However, as we all knew the critical time for observing that was the worst possible time for photometry. We did see some evidence of a brightening spike, but it is inconclusive.

The second week of January 2011 is the American Astronomical Society meeting in Seattle, Washington. There will be multiple poster paper on epsilon Aurigae as well as several talks,. Dr. Bob and I will be presenting poster papers and talks.

We will put the poster papers and talks (Power Point presentations) on the Campaign web site after the meeting. Watch for an announcement on the Campaign Yahoo list.

2010 Christmas Week Trip To Mount Hopkins

The MMT Observatory resides atop Mount Hopkins at 8,550 feet (2608 meters) 45 miles South of Tucson, Arizona. While 8,500 feet may not sound exceptionally high, the mountain rises from a much lower plain and the grade is impressive. Beginning in 1979 and through 1998 MMT stood for Multiple Mirror Telescope and consisted of six 1.8 meter (72 inch) mirrors focusing light into one path. This provided an equivalent of a 4.5 meter (177 inch) telescope.

In 1998 the six mirrors were replaced with a single 6.5 meter (256 inch) mirror. This mirror provides more than double the light gathering power and increased the field-of-view by a factor of 300. First light with the new mirror was in May of 2000. There are three secondary mirrors that can be used with the system, f/5, f/9 and f/15. With the f/5 mirror the field-of-view is one degree, about 4 times the size of a full Moon. The telescope also uses adaptive optics.

Perhaps one of the most unusual features of the observatory is that the telescope is mounted on and Alt/Az mount as opposed to the usual equatorial mount. The telescope moves up and down for the elevation (altitude)axis and rotates for the azimuth axis. The building also rotates, but is on a separate bearing from the telescope. Two giant shutters open to allow the sky to be seen. One disadvantage of this over a dome is that high winds restrict when the shutters can be opened. There is less wind protection for the telescope with this arrangement. The rotating building is 4 stories high complete with elevator, kitchen, bathroom and multiple rooms. To enter the building when it's rotating one must grab the rail and hop up on the stairs much like a merry-go-round.

Dr. Bob Stencel invited me to accompany him during Christmas week for a couple nights of infrared spectroscopic observing with the MMT of epsilon Aurigae. The goal was to look for CO and silicate lines in the infrared using the Mid-Infrared Array Camera 4 (MIRAC4) coupled to the MMT 6.5 meter telescope. On schedule I picked Dr. Bob up at the Tucson International Airport at 1:30 PM. He reported no TSA hassles. We stopped in Green Valley and had lunch at a Denney's restaurant.

Our trip up the mountain was uneventful. It was interesting to note that we had to get a walkie-talkie at the base camp and keep track of traffic on the mountain. There are a couple of large gamma ray telescopes at the base camp, but that's another story. Most of the mountain road is single lane and you do not want to have to back up. There are a few wide spots for passing, but most is strictly single lane.

The last short drive from the dorm to the MMT observatory was most interesting. We were greeted by an even narrower road right on a ridge with sheer drop off on either side and a steep climb. There are detectors a long side the road at each end with red lights that flash to let you know someone is on the road. On Wednesday night we had freezing rain in a cloud with 50 MPH winds and going down that road was very exciting.

We settled in our dorm rooms. They were nice furnished, but a bit on the bare side. At least they were warm and comfortable. A short walk from the dorm is the Commons building. A lovely place to relax, A compete kitchen, library, pool table, dart board, TV and lounge. We even had wireless Internet access, most of the time.

Our first night on the mountain was for adjustment. We visited the observatory and took some pictures. Later we stayed up to watch the lunar eclipse. It was a special night, a lunar eclipse and winter solstice. The darkest day in 456 years. I took some pictures, but got too cold to stay for totality. I headed back to my nice warm dorm room and bed.

On Tuesday night we had the first observing session. It was cloudy, but we were able to do some between and through the clouds spectroscopy. A 6.5 meter telescope gathers lots of photons. We were observing in the 2 - 15 micron spectral region using the instrument's grism looking for CO and SI lines. We had success in getting good data despite the clouds.

Wednesday night was our last night of observing. Arriving at the observatory and looking up I saw a most spectacular sky. No clouds and brilliant stars against black velvet. The down side was a cold strong wind. Entering the control room we were told it did not look good. While clear, the winds were too high (50 MPH gusts) to open the shutters. Anything over 35 MPH and there are problems so the observatory shutters stayed shut. Then is got worse. The mountain top was enveloped in a cloud and the temperature dropped. No observing Wednesday. Leaving the observatory building that night was interesting. We could see no more than a couple of feet. The wind was fierce, cold and very wet. After finding my SUV we made our way down slowly to the dorm.

When we left Thursday morning everything was coated with a layer of ice. It took several minutes to get the ice off the windshield of my SUV. The sky was brilliant blue with no clouds, but as we wound our way down the mountain we could see many clouds much lower covering the valley below. It felt like I was back in my Mooney cruising VFR above the clouds.

A web site has been set up for images of the trip and observing.

See http://www.hposoft.com/MMTTrip.html.

Jeff

IMPORTANT NOTICES

Data Copyright

Data in this and other Newsletters and on the Campaign web site are provided for viewing and downloading. Use of any data in any papers requires approval from the observer(s). Please contact me at phxjeff@hposoft.com or the specific observer(s) for more information and permission.

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Standard Deviation versus Standard Error

There has been some discussion about whether to use standard deviation or standard error when reporting photometric observational data.

It is preferred that photometric observations include a standard deviation of at least three data points for each observed band for the session. The purpose is not to report an error, which is actually not what is important, but to give an idea of the quality of the observation and an idea of the data spread. That is all it does and all that it needs to do.

Standard error is the standard deviation divided by the square root of the number of samples. By have a large number of samples the standard can be much less than the standard deviation, yet the data spread can be the same. These means that while the standard error may look very good and much better than someone else's standard deviation, it is very misleading.

Please submit photometric data as an average of at least three data points with a standard deviation of the data. Thank you!

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Yahoo Epsilon Aurigae Chat List Forum

As mentioned in the last Newsletter, we have started a chat list forum to enhance our communications. Lots of interesting things are happening and many time dependent. The Epsilon Aurigae Chat list will allow near instantaneous communication with everyone who is interested in the project. It's free and to sign up just go to

http://tech.groups.yahoo.com/EpsilonAurigae/

and sign up.

Photometry Report

by
Jeffrey Hopkins
Hopkins Phoenix Observatory

Summary of Data Point Observations by Observer

Obser	V Band	B Band	U Band	Rc Band	Rj Band	Ic Band	Ij Band	Total	Equip
CH -	78							78	DSLR
DES -	162							162	DSLR
EAO -	68							68	CCD
EGO -	81							81	DSLR
EUO -	1	39	9		40			89	PMT
FJM -	45							45	SSP-3
GHO -	118					114		232	CCD
GO -	10			10				20	CCD
GS -	120	119		124		122		485	CCD
GVO -	13	8			13		13	47	SSP-3
HPO -	115	178	178					471	PMT
JBO -	16	41			16		16	89	SSP-3
JESO-	11							11	
KO -	82							82	CCD
LO -	75							75	SSP-3
MSO -	3	3						6	CCD
NKO -	26							26	DSLR
NPO -	0				16		16	32	SSP-3
RES -	33							33	DSLR
RLO -	29							29	DSLR
SGGO-	64	17		59				140	CCD
TP -	76							76	DSLR
VO -	122							122	DSLR
WWC-	39	39						78	DSLR
Total	1387	444	187	193	85	236	45	2577	XXXX

The above is a summary of data taken from the data plots. While the data is mainly from just the beginning of the eclipse, the UB data contain data from before the eclipse so the actual number of observations total is greater, but during the eclipse the UB data contains data from before.

We have nearly 2,600 total observations during the eclipse with the visual band having by far the most at nearly 1,400 observations.

Plot Observer Key

CH - Colin Henshaw, Tabuk, Saudi Arabia
DES - Des Loughney, Edinburgh, Scotland, UK
EAO - Elizabeth Observatory of Athens, Iakovos Marios Strikis**,** Haldrf (Athens) Greece
EGO - East Greenwood Observatory, Charles Hofferber, East Grand Forks, Minnesota, USA
EUO - Ege University Observatory, Serdar Evren, Izmir, Turkey
FJM - Frank J. Melillo, Holtsville, New York, USA
GHO - Golden Hill Observatory, Richard Miles, Dorset, England
GO - Laurent Corp, Garden Observatory, Rodez, France
GS - Gerard Samolyk, Greenfield, Wisconsin, USA
GVO - Grand View Observatory, Brian E. McCandless, Elkton, MD. USA
HPO - Hopkins Phoenix Observatory, Jeff Hopkins, Phoenix, Arizona. USA
JBO - Jim Beckmann Observatory, Paul J. Beckmann, Mendota Heights, MN. USA
JESO - Jalna Education Society Observatory, Dr. Mukund Kurtadikar, Maharashtra, India
KO - Hans-Goran Lindberg, Kaerrbo Observatory**,** Skultuna, Sweden
LO - Lindarberg Observatory, Snaevarr Gudmundsson, Hafnarfjordur, Iceland
MSO - Arvind Paranjpye, MVS IUCAA Observatory, Ganeshkhind Pune, India
NKO - Nils Karlsen, Nils Karlsen Observatory, Umea, Sweden
NPO - Gary Frey, North Pines Observatory, Mayer, Arizona. USA
RES - Dr. Robert E. Stencel, University of Denver, Denver, Colorado. USA
RLO - Hubert Hautecler, Roosbeek Lake Observatory, Boutersem Brabant, Belgium
SGGO - Tiziano Colombo, S. Giovanni Gatano al Observatory, Pisa, Italy
TP - Tom Pearson, Virginia Beach, Virginia, USA
VO - Thomas Karlsson, Varberg Observatory, Varberg, Sweden
WWC- Donald Collins, Warren Wilson College, Ashville, North Carolina, USA

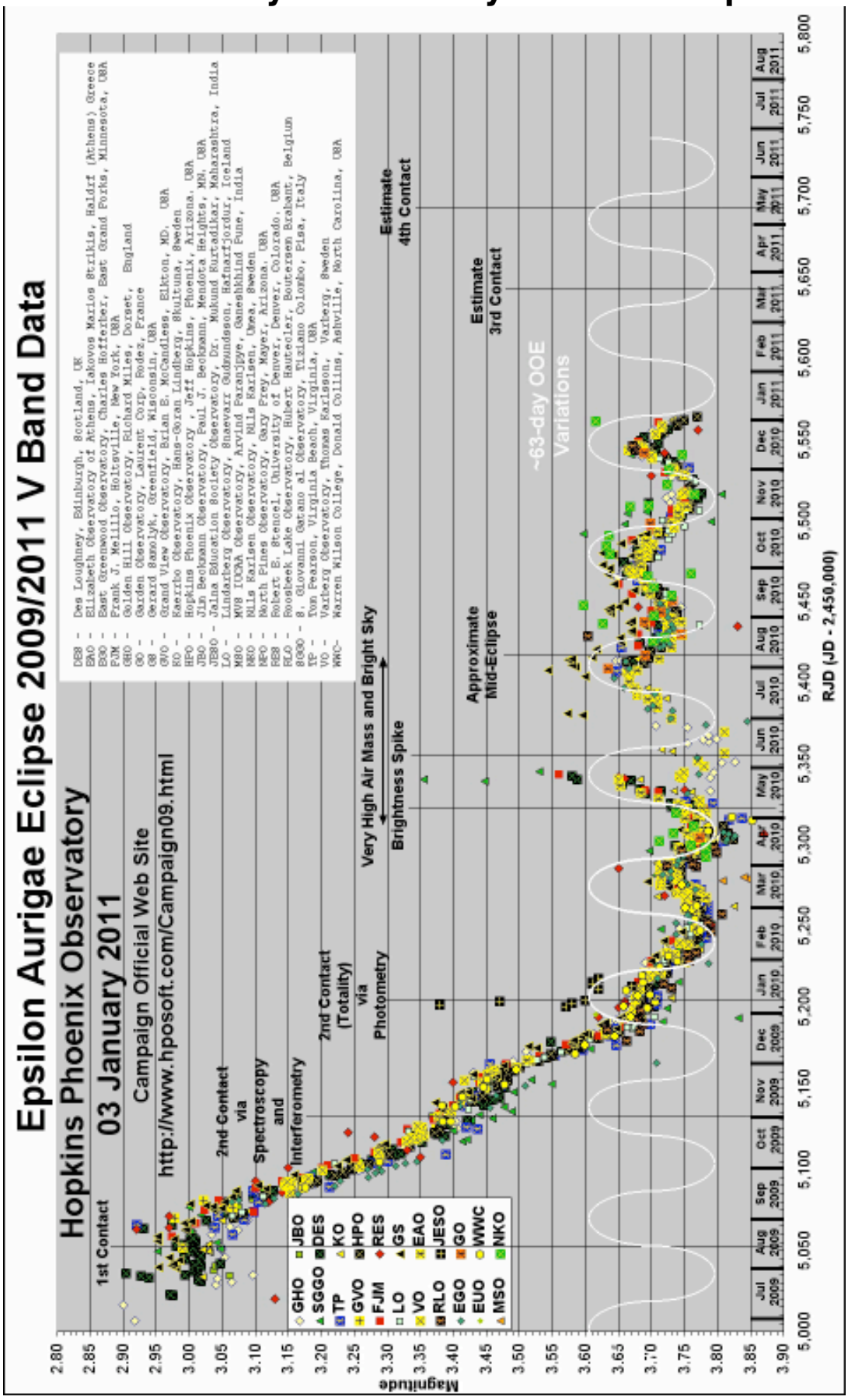
Note: Full resolution images of the photometric data plots can be seen at:

V Band Plot:
http://www.hposoft.com/Plots09/VFall09.jpg

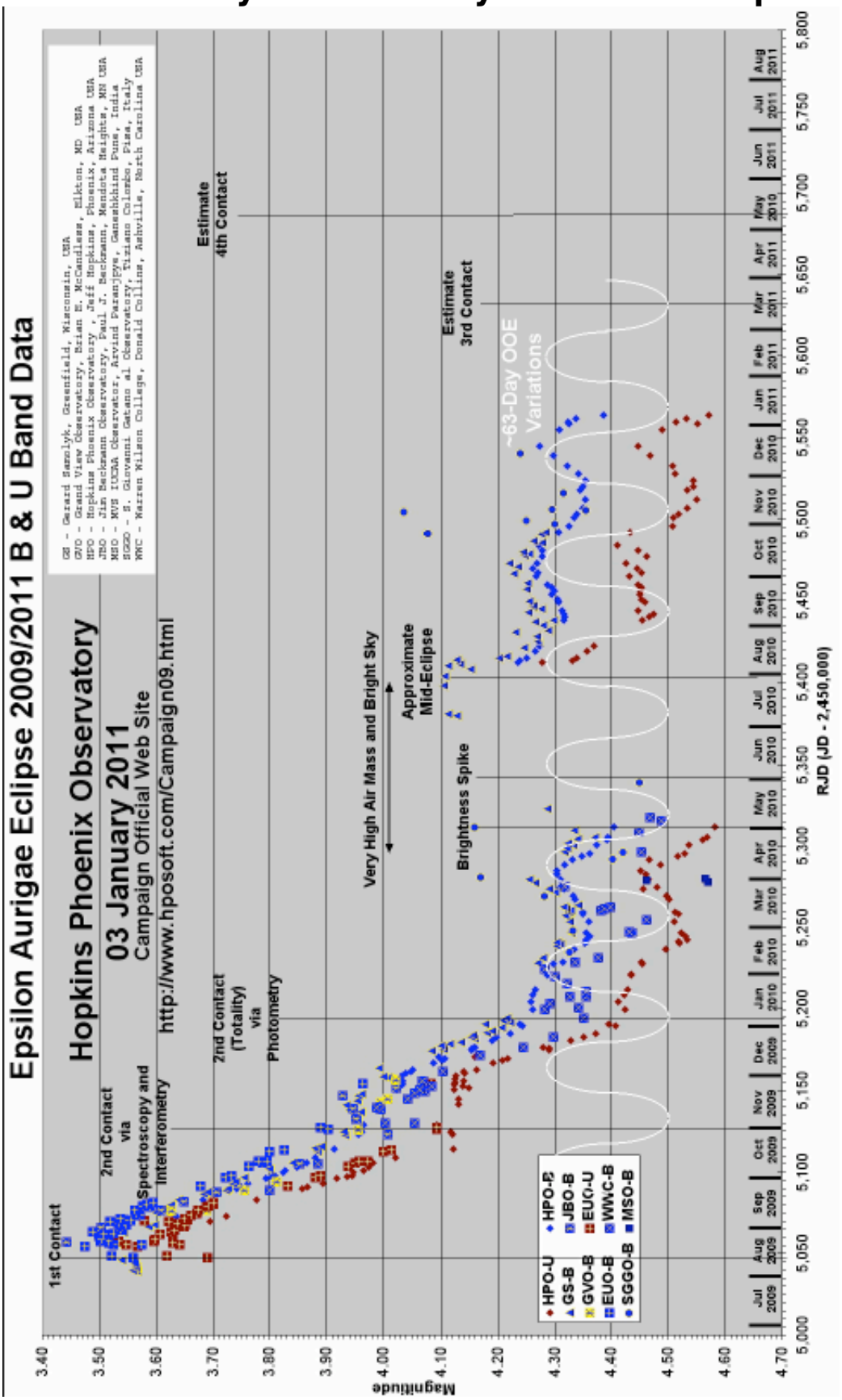
UB Band Plots:
http://www.hposoft.com/Plots09/UBFall09.jpg

RI Band Plots:
http://www.hposoft.com/Plots09/RIFall09.jpg

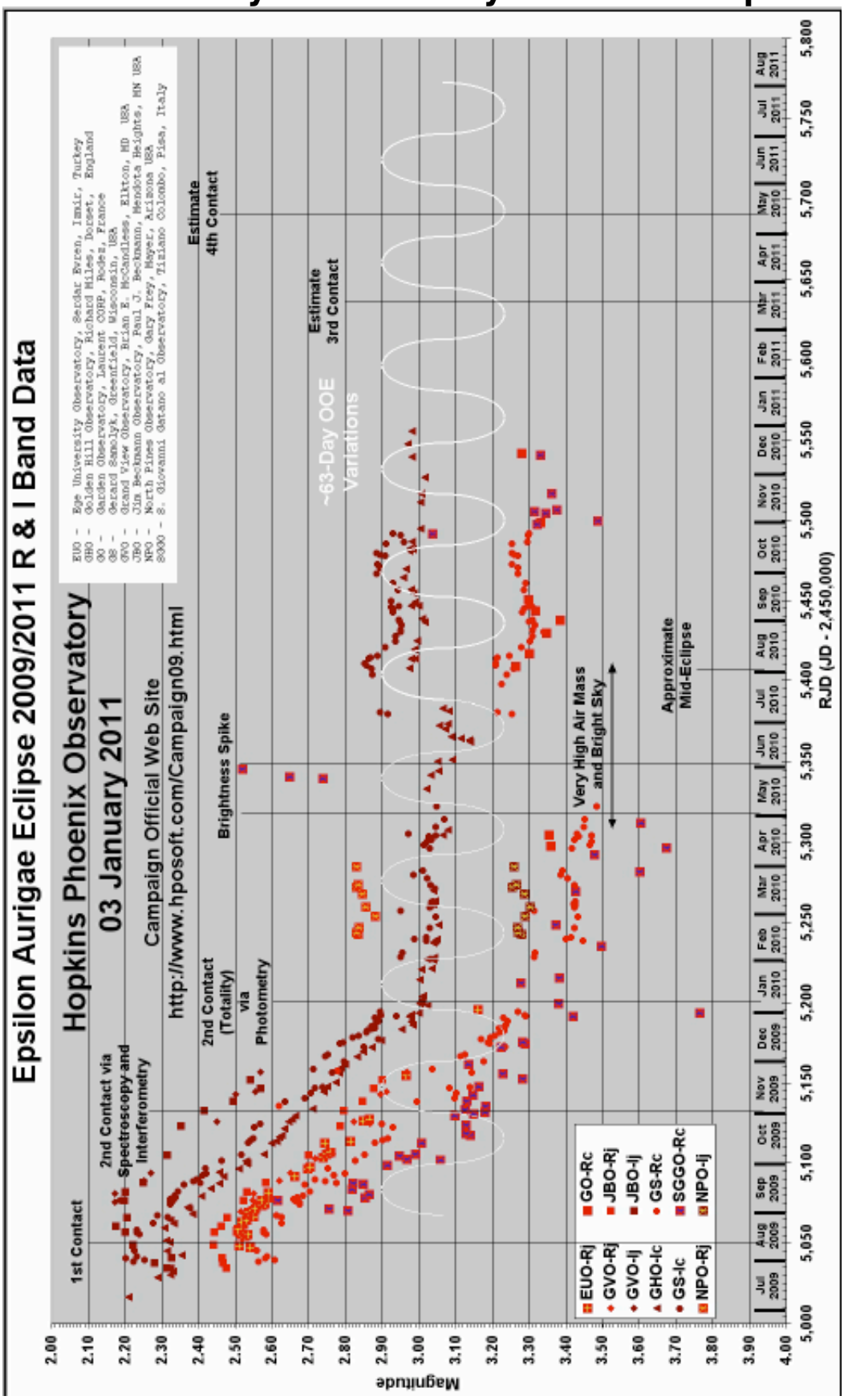
Ingress and Totality Photometry V Data Composite Plot



Ingress and Totality Photometry UB Data Composite Plot



Ingress and Totality Photometry RI Data Composite Plot



Photometric Observers

Note: Bold data are data submitted since Newsletter #19.

Des Loughney (DES)
Edinburgh, Scotland, UK
Canon DSLR . 200 ISO . f4 . 85 mm lens. Exposure 5 seconds
Eta Aurigae used as the comparison star at V = 3.18
Des uses a remote switch to activate the Canon 200 Digital Single Lens Reflex (DSLR) camera with 85 mm lens. He takes between 10 and 20 exposures stacks and processes 5 sets of them with AIP4WIN.

UT Date	RJD	V Mag	SD
04/05 October 2010	5474.467	3.659	0.015
06/07 October 2010	5476.460	3.682	0.008
11/12 October 2010	5481.43	3.678	0.004
18/19 October 2010	5488.431	3.693	0.015
23/24 October 2010	5493.438	3.710	0.008
24/25 October 2010	5494.435	3.726	0.012
27/28 October 2010	5497.477	3.734	0.006
02/03 November 2010	5503.425	3.746	0.008
09/10 November 2010	5510.490	3.696	0.013
14/15 November 2010	5513.513	3.770	0.009
16/16 November 2010	5516.421	3.776	0.010
24/25 November 2010	5525.406	3.763	0.013
02/03 December 2010	5533.373	3.726	0.011
05/06 December 2010	5536.400	3.734	0.004
06/07 December 2010	5537.373	3.722	0.012
07/08 December 2010	5538.410	3.721	0.008
10/11 December 2010	5541.304	3.699	0.007
11/12 December 2010	5542.302	3.707	0.008
16/17 December 2010	5547.429	3.710	0.010
18/19 December 2010	5549.260	3.684	0.019
20/21 December 2010	5551.323	3.689	0.013
22/23 December 2010	5553.423	3.714	0.010
23/24 December 2010	5554.411	3.718	0.002
25/26 December 2010	5556.510	3.725	0.012

RJD = JD - 2,450,000

Iakovos Marios Stkis, Elizabeth Observatory of Athens (EAO)
Haldrf (Athens) Greece
ATIC Monochrome CCD Camera with 55 mm lens at f 6.3, 30 images, 9 second exposures

UT Date	RJD	V	SD
01-02 October 2010	5471.5576	3.685	0.011
08-09 October 2010	5478.5437	3.683	0.006
14-15 October 2010	5484.5472	3.690	0.002
17-18 October 2010	5487.5680	3.692	0.005
23-24 October 2010	5493.5576	3.709	0.009
28-29 October 2010	5498.5611	3.730	0.008
31-01 October 2010	5501.5472	3.740	0.004
03-04 November 2010	5504.5403	3.74	0.007
07-08 November 2010	5508.5542	3.753	0.009

RJD = JD - 2,450,000

Gerard Samolyk (GS)
Greenfield, Wisconsin . USA
Equipment, CCD Camera and Camera Lens , ST9XE + 50 mm lens
Comparison star lambda Aurigae; B= 5.329; V= 4.705; Rc= 4.340; Ic= 3.998

RJD	V	SD	B	SD	Rc	SD	Ic	SD
5442.8078	3.638	0.027	4.253	0.021	3.281	0.018	2.929	0.024
5444.8712	3.635	0.020	4.277	0.017	3.287	0.022	2.931	0.022
5445.8958	3.639	0.022	4.263	0.016	3.311	0.015	2.926	0.016
5446.8837	3.650	0.010	4.263	0.022	3.301	0.009	2.925	0.007
5449.8680	3.660	0.019	4.255	0.026	3.297	0.012	2.946	0.007
5456.8865	3.674	0.011	4.250	0.009	3.287	0.006	2.943	0.013
5460.8857	3.644	0.022	4.252	0.026	3.291	0.013	2.930	0.019
5466.7623	3.634	0.017	4.228	0.030	3.271	0.007	2.885	0.016
5470.8162	3.637	0.025	4.236	0.020	3.271	0.011	2.894	0.006
5472.7718	3.626	0.025	4.220	0.018	3.254	0.006	2.887	0.012
5477.8925	3.671	0.007	4.248	0.018	3.270	0.008	2.910	0.022
5478.8151	3.643	0.016	4.255	0.014	3.262	0.006	2.895	0.011
5479.7579	3.627	0.016	4.244	0.028	3.253	0.013	2.886	0.012
5485.7487	3.655	0.010	4.278	0.024	3.254	0.018	2.912	0.021
5486.8354	3.673	0.011	4.263	0.007	3.296	0.005	2.961	0.009
5490.8134	3.685	0.012	4.276	0.016	3.299	0.013	2.950	0.005
5491.7679	3.693	0.011	4.284	0.016	3.301	0.004	2.929	0.008

RJD = JD - 2,450,000

Frank J. Melillo (FJM)
Holtsville , NY USA
Lat:+ 40d 40' Long: 73 W Elevation: 100'
Instrument: Optec SSP-3, Telescope: C-8 8"
Gate Time: 10 Seconds

RJD	Date	V Mag	SD
5472.7243	02/03 October 2010	3.65	0.001
5478.7101	08/09 October 2010	3.68	0.032
5487.6535	17/18 October 2010	3.67	0.016
5493.7322	22/23 October 2010	3.70	0.013
5501.6463	31 Oct/01 Nov 2010	3.73	0.022
5506.6806	05/06 November 2010	3.73	0.023
5513.7251	12/13 November 2010	3.75	0.019
5520.7222	19/20 November 2010	3.74	0.019
5529.6424	28/29 November 2010	3.72	0.033
5538.7118	07/08 December 2010	3.70	0.016
5548.7104	17/18 December 2010	3.68	0.019
5560.6389	29/30 December 2010	3.71	0.031

RJD = JD - 2,450,000

Richard Miles, Golden Hill Observatory (GHO)
Stourton Caundle, Dorset, England
Latitude/Longitude/Altitude (ASL): West 2.405 deg, North 50.931 deg
Time Zone: GMT = 0 hours
Telescope: 0.06-m Refractor (Takahashi FS60C)
Filters: Johnson V=4.71 for lambda Aurigae, Cousins Ic= 3.99 for HD32655
Detector: CCD Camera (Type: Starlight Xpress SXV-H9)
Note: as of 01 January 2010 all previous data has been corrected. The following data is an updated list of the correct data. Some V band data was calculated using lambda Aurigae and some HD32655. It appears HD32655 may be variable. For data 94 August 2010 and after the comparison stars used were HD 72328 for V band with magnitude V= 7.64 and HD 32655 for Ic band with Ic= 5.65.

Observation Date	RJD	V mag	SD	Ic	SD
10/11 October 2010	5480.4865	3.693	0.003	2.974	0.004
11/12 October 2010	5481.5481	3.680	0.006	2.983	0.002
12/13 October 2010	5482.3955	3.675	0.013	2.977	0.008
16/17 October 2010	5486.3770	3.686	0.004	2.982	0.006
24/25 October 2010	5494.3815	????	????	3.005	0.004
10/11 November 2010	5511.2710	3.728	0.001	3.005	0.003
12/13 November 2010	5513.7885	3.723	0.008		
15/16 November 2010	5516.2835	3.730	0.005	3.007	0.007
25/26 November 2010	5526.4110	3.730	0.004	3.016	0.004
08/09 December 2010	5539.3640	3.685	0.005	2.982	0.004
16/17 December 2010	5547.4305	3.683	0.005	2.969	0.002
24/25 December 2010	5555.421	3.701	0.003	2.981	0.003

Laurent Corp, Garden Observatory (GO),
Rodez, France
SBIG ST7 Cooled CCD - temp -20°C
50mm f/2.2 non diaphragmé
Comparizons: 3.261 / 2.949

Date	RJD	V	SD	Rc	SD
28/29 October 2010	5498.3940	3.6978	0.002	3.3312	0.002
10/11 December 2010	5541.4695	3.6890	0.002	3.2808	0.002

RJD = JD - 2,450,000

Jeff Hopkins, Hopkins Phoenix Observatory (HPO)
Phoenix, Arizona USA
Latitude: 33.5017 North, Longitude: 112.2228 West, Altitude: 1097 feet ASL
Time Zone: MST (UT -7) Telescope: C-8 8" SCT, Filter Set: UBV Standard
Detector: 1P21 PMT in Photon Counting Mode, Differential Photometry
lambda Aurigae as Comparison star: V= 4.71; B= 5.34; U= 5.46
Data transformed and corrected for nightly extinction.

UT Date	RJD	U	SD	B	SD	V	SD
06/07 October 2010	5476.9253	4.4612	0.0087	4.2775	0.0041	3.6976	0.0018
10/11 October 2010	5480.8899	4.4459	0.0018	4.2780	0.0013	3.7013	0.0038
13/14 October 2010	5483.8371	4.4100	0.0157	4.2718	0.0074	3.6904	0.0067
21/22 October 2010	5491.7732	4.4333	0.0126	4.3065	0.0071	3.7116	0.0021
25/26 October 2010	5495.8100	4.5069	0.0192	4.3256	0.0059	3.7241	0.0019
30/31 October 2010	5500.7836	4.5080	0.0158	4.3342	0.0029	3.7428	0.0034
01/02 November 2010	5502.7982	4.5175	0.0066	4.3389	0.0022	3.7414	0.0031
05/06 November 2010	5506.7809	4.5323	0.0149	4.3494	0.0045	3.7589	0.0047
10/11 November 2010	5511.7677	4.5502	0.0101	4.3540	0.0090	3.7605	0.0042
16/17 November 2010	5517.7667	4.5336	0.0116	4.3447	0.0028	3.7546	0.0017
18/19 November 2010	5519.7684	4.5436	0.0042	4.3485	0.0012	3.7580	0.0041
22/23 November 2010	5523.7691	4.5437	0.0056	4.3535	0.0438	3.7625	0.0090
26/27 November 2010	5527.7503	4.5120	0.0113	4.3423	0.0005	3.7471	0.0084
01/02 December 2010	5532.7531	4.5069	0.0079	4.3223	0.0019	3.7393	0.0026
07/08 December 2010	5538.7323	4.4669	0.0007	4.2979	0.0030	3.7168	0.0020
13/14 December 2010	5544.7211	4.4469	0.0061	4.2738	0.0010	3.6999	0.0065
23/24 December 2010	5554.7253	4.4887	0.0019	4.3079	0.0048	3.7178	0.0014
27/28 December 2010	5558.6906	4.5516	0.0374	4.3248	0.0033	3.7391	0.0019
28/29 December 2010	5559.6962	4.5129	0.0018	4.3237	0.0063	3.7392	0.0020
30/31 December 2010	5561.6809	4.5311	0.0019	4.3367	0.0034	3.7495	0.0028
01/02 January 2011	5563.6837	4.5712	xxxxxx	4.3859	xxxxxx	3.7694	xxxxxx

RJD = JD - 2,450,000

Hans-Goran Lindberg, Kaerrbo Observatory (KO)
Skultuna, Sweden
Observation using: (50 mm fl camera lens, HX-516 B/W Camera, y2-filter
Exp 30*3 sec, .fits images stacked, TeleAuto software, with Superstar)
Comp star lambda Aurigae at V= 4.71

RJD	CV
5490.3819	3.723
5497.4306	3.733
5513.4583	3.742
5515.4972	3.748
5529.3757	3.746
5538.3750	3.721
5554.3479	3.713
5561.2917	3.732
5562.1667	3.733

RJD = JD - 2,450,000

Snaevarr Gudmundsson, Lindarberg Observatory (LO)
Hafnarfjordur, Iceland
Location (WGS 84) Latitude: +64d 03.740 Longitude: 21d 55.297
Optec SSP-3 on 12" Meade LX 200

Double Date	RJD	V	#	SD	X
15/16 September 2010	5455.5837	3.723		0.010	1.39
22/23 September 2010	5461.5427	3.703		0.005	1.48
07/08 October 2010	5477.5697	3.710		0.008	1.54
09/10 October 2010	5479.6230	3.696		0.005	1.32
18/19 October 2010	5488.4446	3.727		0.005	1.61
22/23 October 2010	5492.4730	3.732		0.012	1.33
23/24 October 2010	5493.6746	3.727		0.006	1.07
26/27 October 2010	5496.5193	3.750		0.024	1.25
29/30 October 2010	5499.5785	3.744		0.005	1.12
30/31 October 2010	5500.5489	3.717		0.021	1.16
04/05 November 2010	5506.3624	3.773		0.006	1.80
05/06 November 2010	5506.5784	3.753		0.005	1.10
14/15 November 2010	5515.4478	3.760		0.000	1.30
23/24 November 2010	5524.4231	3.768		0.017	1.30
25/26 November 2010	5526.4138	3.758		0.005	1.31
27/28 November 2010	5528.5287	3.747		0.012	1.09
02/03 December 2010	5533.4884	3.727		0.006	1.12
05/06 December 2010	5533.4872	3.727		0.006	1.11
07/08 December 2010	5538.4728	3.713		0.015	1.12
15/16 December 2010	5546.4302	3.693	0.006	1.15	

RJD = JD - 2,450,000

Nils Karlsen, **Nils Karlsen Observatory (NKO)**
Umea, Sweden
Latitude 63, Longitude 19 east,
EOS 1000D, Obj 18-55mm, TeleAuto. Photometri, 2" and 5" exp 6

Double Date	RJD	V mag	SD
09/10 October 2010	5479.3750	3.637	0.20
14/15 October 2010	5484.3750	3.632	0.10
20/21 October 2010	5490.3750	3.636	0.09
07/08 November 2010	5508.3333	3.668	0.01
08/09 November 2010	5509.3333	3.696	0.01
15/16 November 2010	5516.3333	3.765	0.10
21/22 November 2010	5520.2500	3.726	0.15
30 Nov/01 Dec 2010	5531.2083	3.726	0.09
09/10 December 2010	5540.3333	3.746	0.09
30/31 December 2010	5561.2917	3.616	0.08

RJD = JD - 2,450,000

Robert E. Stencel, University of Denver (RES)
Denver, Colorado USA
DSLR V Band Data, Comparison Star eta Aurigae assumed to be V-3.17

RJD	V	SD
5434.83	3.83	0.06
5446.895	3.68	0.05
5470.19	3.67	0.110
5518.65	3.75	0.03
5527.72	3.70	0.04
5541.70	3.72	0.03
5555.55	3.77	0.05

RJD = JD - 2,450,000

Hubert Hautecler, Roosbeek Lake Observatory (RLO)
Boutersem , Brabant, Belgium
DSLR Camera - Canon 400D w/85 mm lens
Five sets of 10 images.

UT Date	RJD	V Mag	SD
20/21 August 2010	5428.6271	3.604	0.0340
13/13 December 2010	5543.3514	3.676	0.0014
15/16 December 2010	5546.2125	3.672	0.0013

RJD = JD - 2,450,000

Dr. Tiziano Colombo . S. Giovanni, Gatano al Observatory (SGGO)
Pisa, Italy, CCD Camera: Mead DSI Pro, 2 sec exposures, 20 images stacked , F 2.8

RJD	B Mag	SD	V Mag	SD	Rc Mag	SD
5461.4556	4.077	0.128	3.597	0.114	3.038	0.137
5497.4540	4.301	0.072	3.660	0.003	3.321	0.012
5499.4340	4.251	0.001	3.790	0.001	3.487	0.187
5504.4403	4.037	0.054	3.664	0.016	3.345	0.020
5505.4340	4.356	0.020	3.693	0.020	3.315	0.021
5506.4215	4.296	0.015	3.741	0.005	3.375	0.013
5516.3854	4.316	0.013	3.806	0.033	3.381	0.013
5540.3424	4.240	0.015	3.669	0.025	3.331	0.019

RJD = JD - 2,450,000

Tom Pearson (TP)
Virginia Beach, Virginia USA
DSLR Canon 20 D, 400 ISO, f5.6, 58 mm lens/70 mm FL,
Exposure 5 seconds 30 Images Stacked

RJD	UT Date	V Mag	SD
5462.9069	23/23 September 2010	3.678	0.034
5476.8534	06/07 October 2010	3.680	0.021
5481.8965	11/12 Oxtober 2010	3.714	0.015
5491.8965	21/22 October 2010	3.718	0.014
5501.9006	31 Oct/01 Nov 2010	3.729	0.014
5509.7917	08/09 November 2010	3.755	0.017
5532.6972	01/02 December 2010	3.757	0.019

RJD = JD - 2,450,000

Thomas Karlsson, Varberg Observatory (VO)
Varberg, Sweden
Observation using: Canon 450D 6 second exposures EF 35 - 80 mm
Comparison star is lambda Aurigae V= 4.705

Date	RJD	V	SD
08/09 October 2010	5478.3896	3.695	0.016
09/10 October 2010	5479.4000	3.685	0.009
11/12 October 2010	5481.3590	3.693	0.003
15/16 October 2010	5485.3736	3.702	0.014
25/26 October 2010	5495.3167	3.734	0.009
03/04 November 2010	5504.3264	3.742	0.010
05/06 November 2010	5506.3542	3.740	0.008
07/08 November 2010	5508.3264	3.745	0.008
15/16 November 2010	5516.2590	3.746	0.009
16/17 November 2010	5517.3736	3.750	0.012
27/28 November 2010	5528.2701	3.750	0.045
29/30 November 2010	5530.2806	3.735	0.011
30 Nov/01 Dec 2010	5531.4386	3.729	0.010
01/02 December 2010	5532.3319	3.733	0.002
07/08 December 2010	5538.4118	3.701	0.007
09/10 December 2010	5540.2410	3.700	0.004
12/13 December 2010	5543.2507	3.665	0.005
14/14 December 2010	5544.4028	3.688	0.015
14/15 December 2010	5545.2861	3.685	0.010
15/16 December 2010	5546.2917	3.680	0.004
22/23 December 2010	5553.2500	3.706	0.005
26/27 December 2010	5557.3250	3.716	0.013
27/28 December 2010	5558.2486	3.716	0.006

RJD = JD - 2,450,000

Spectroscopy Report
by

Robin Leadbeater
Three Hills Observatory
robin@leadbeaterhome.fsnet.co.uk
robin_astro@hotmail.com

Overview
Since the last newsletter a further 75 amateur spectra have been submitted to the campaign. These are listed in the table below and are accessible on line via the campaign list of spectra. http://www.threehillsobservatory.co.uk/epsaur_spectra.htm Further information for observers wanting to contribute spectra or researchers wishing to use the data can be found here on the main campaign web site
http://www.hposoft.com/EAur09/Robin.html

Wavelength							
RJD	Date	Time	Start λ	End λ	Range λ	Disp	Observer
2,400,000		UT	Å	Å	Å	Å/Pixel	
55559.448	28-Dec-10	22:45	6499	6610	111	0.17	Garrel
55556.322	25-Dec-10	19:44	6499	6610	111	0.17	Garrel
55555.739	25-Dec-10	05:44	5799	5991	192	0.13	Gorodenski
55555.368	24-Dec-10	20:50	7675	7726	51	0.09	Leadbeater
55551.367	20-Dec-10	20:48	7675	7726	51	0.09	Leadbeater
55551.266	20-Dec-10	18:23	4280	7114	2834	0.1	Buil
55550.224	19-Dec-10	17:23	4280	7114	2834	0.1	Buil
55549.384	18-Dec-10	21:13	7675	7726	51	0.09	Leadbeater
55549.224	18-Dec-10	17:23	4280	7114	2834	0.1	Buil
55548.401	17-Dec-10	21:37	6499	6610	111	0.17	Garrel
55547.315	16-Dec-10	19:34	6523	6707	184	0.09	Ribeiro
55547.311	16-Dec-10	19:28	7675	7726	51	0.09	Leadbeater
55545.437	14-Dec-10	22:29	7675	7726	51	0.09	Leadbeater
55545.239	14-Dec-10	17:44	4280	7114	2834	0.1	Buil
55544.259	13-Dec-10	18:13	4280	7114	2834	0.1	Buil

Wavelength							
RJD	Date	Time	Start λ	End λ	Range λ	Disp	Observer
2,400,000		UT	Å	Å	Å	Å/Pixel	
55544.240	13-Dec-10	17:46	6499	6610	111	0.17	Garrel
55543.394	12-Dec-10	21:27	4280	7114	2834	0.1	Buil
55542.578	12-Dec-10	01:52	7675	7726	51	0.09	Leadbeater
55542.531	12-Dec-10	00:45	6499	6610	111	0.17	Garrel
55540.317	09-Dec-10	19:36	6539	6603	64	0.08	Lopez
55540.310	09-Dec-10	19:26	6499	6610	111	0.17	Garrel
55538.377	07-Dec-10	21:03	7675	7726	51	0.09	Leadbeater
55537.803	07-Dec-10	07:17	5799	5991	192	0.13	Gorodenski
55535.452	04-Dec-10	22:51	7675	7726	51	0.09	Leadbeater
55535.323	04-Dec-10	19:45	6499	6610	111	0.17	Garrel
55535.286	04-Dec-10	18:52	4280	7114	2834	0.1	Buil
55534.456	03-Dec-10	22:57	6530	6690	160	0.11	Mauclaire
55533.407	02-Dec-10	21:46	7675	7726	51	0.09	Leadbeater
55533.314	02-Dec-10	19:32	6499	6610	111	0.17	Garrel
55532.344	01-Dec-10	20:15	6539	6603	64	0.08	Lopez
55531.920	01-Dec-10	10:04	4280	7114	2834	0.1	Buil
55528.356	27-Nov-10	20:32	7675	7726	51	0.09	Leadbeater
55527.292	26-Nov-10	19:00	4280	7114	2834	0.1	Buil
55526.361	25-Nov-10	20:40	6499	6610	111	0.17	Garrel
55525.300	24-Nov-10	19:12	4280	7114	2834	0.1	Buil
55524.455	23-Nov-10	22:55	6499	6610	111	0.17	Garrel
55524.447	23-Nov-10	22:44	7675	7726	51	0.09	Leadbeater
55524.330	23-Nov-10	19:55	6539	6603	64	0.08	Lopez
55524.289	23-Nov-10	18:56	4280	7114	2834	0.1	Buil
55521.456	20-Nov-10	22:57	6499	6610	111	0.17	Garrel
55520.504	20-Nov-10	00:06	4280	7114	2834	0.1	Buil
55520.429	19-Nov-10	22:18	7675	7726	51	0.09	Leadbeater
55519.503	19-Nov-10	00:05	4280	7114	2834	0.1	Buil
55519.452	18-Nov-10	22:51	6530	6690	160	0.11	Mauclaire
55517.324	16-Nov-10	19:47	4280	7114	2834	0.1	Buil
55516.479	15-Nov-10	23:30	7675	7726	51	0.09	Leadbeater
55511.393	10-Nov-10	21:26	6499	6610	111	0.17	Garrel
55510.472	09-Nov-10	23:20	7675	7726	51	0.09	Leadbeater
55508.503	08-Nov-10	00:04	4280	7114	2834	0.1	Buil
55506.474	05-Nov-10	23:23	6499	6610	111	0.17	Garrel
55505.403	04-Nov-10	21:40	6525	6705	180	0.09	Ribeiro
55504.735	04-Nov-10	05:39	5799	5994	195	0.13	Gorodenski
55503.372	02-Nov-10	20:56	6499	6610	111	0.17	Garrel
55500.460	30-Oct-10	23:02	7675	7726	51	0.09	Leadbeater
55498.404	28-Oct-10	21:42	4280	7114	2834	0.1	Buil
55497.341	27-Oct-10	20:11	6539	6603	64	0.08	Lopez
55496.455	26-Oct-10	22:55	4280	7114	2834	0.1	Buil
55496.419	26-Oct-10	22:03	6499	6610	111	0.17	Garrel
55496.318	26-Oct-10	19:38	6539	6603	64	0.08	Lopez
55495.398	25-Oct-10	21:33	4280	7114	2834	0.1	Buil
55494.517	25-Oct-10	00:24	7675	7726	51	0.09	Leadbeater
55493.469	23-Oct-10	23:16	7675	7726	51	0.09	Leadbeater

Wavelength							
RJD	Date	Time	Start λ	End λ	Range λ	Disp	Observer
2,400,000		UT	Å	Å	Å	Å/Pixel	
55492.478	22-Oct-10	23:28	6530	6690	160	0.11	Mauclaire
55491.426	21-Oct-10	22:13	4280	7114	2834	0.1	Buil
55491.345	21-Oct-10	20:17	6499	6610	111	0.17	Garrel
55490.502	21-Oct-10	00:03	4280	7114	2834	0.1	Buil
55488.630	19-Oct-10	03:07	6455	6776	321	0.25	Strachan
55488.472	18-Oct-10	23:19	7675	7726	51	0.09	Leadbeater
55488.421	18-Oct-10	22:06	4280	7114	2834	0.1	Buil
55486.462	16-Oct-10	23:05	7675	7726	51	0.09	Leadbeater
55485.558	16-Oct-10	01:24	6498	6609	111	0.17	Garrel
55485.476	15-Oct-10	23:25	4280	7114	2834	0.1	Buil
55484.385	14-Oct-10	21:15	4280	7114	2834	0.1	Buil
55478.319	08-Oct-10	19:40	6499	6610	111	0.17	Garrel
55477.794	08-Oct-10	07:04	5798	5993	195	0.13	Gorodenski
55477.481	07-Oct-10	23:32	7675	7726	51	0.09	Leadbeater

Additionally Lothar Schanne has added 20 spectra taken during 2005-6 to the VdS database. They can be found here. http://stahl.homelinux.org/otmar/specdb/ They will be useful in defining the range of out of eclipse variability in the H alpha region. These will also be listed in and linked from the campaign list of spectra in the near future.

AAS meeting poster

A poster summarising the amateur spectroscopic observations to date will be presented on 11th January 2011 at the 217th AAS meeting in Seattle. The abstract is included below and the full poster will be available on line from 11th January at
www.threehillsobservatory.co.uk/astro/ASS217_poster_257_04.pdf

Spectroscopic Wonders During The 2010 Eclipse Of Epsilon Aurigae

Robin Leadbeater[1], C. Buil[2], T. Garrell[3], S. Gorodenski[4], J. Hopkins[5], B. Mauclaire[6], J. Ribeiro[7], L. Schanne[8], O. Thizy[9], R. Stencel[10]

1-Three Hills Observatory, 2-Castanet Tolosan Observatory, France, 3-Observatoire de Foncaude, France, 4-Blue Hills Observatory, 5-Hopkins Phoenix Observatory, 6-Observatoire du Val de l'Arc, France, 7-Observatorio de Instituto Geografico de Exercito, Portugal, 8-Voelklingen Observatory, Germany, 9-Shelyak Instruments, France, 10-University of Denver.

Remarkable spectroscopic coverage is reported of the 2009-2011 eclipse of the enigmatic binary, epsilon Aurigae. Due to the availability of new spectrographs and digital detectors, unprecedented monitoring by a network of observers using small telescopes has revealed a number of details and surprises that must be taken into account in any updated model for the over-luminous F star and the dark disk companion, recently detected interferometrically. Over 400 spectra were obtained during 2007 to 2010 (pre eclipse to post mid eclipse). They include R ~12000 echelle spectra giving broad coverage from 4300-7000A and detailed spectra at R ~17000- 25000 covering the Sodium D, Hydrogen alpha and Potassium 7699Å line regions. Evidence of the eclipsing body was first seen in the 7699Å line profile 83 days before photometric first contact. During ingress, the strength of this

line increased in a stepwise fashion suggesting structure in the disc. During the first half of totality, the line strength trend deviated from that seen during the last eclipse. Radial velocity measurements of the 7699Å line during ingress are consistent with the disc material orbiting a central object of 5.3 solar masses. Changes in the hydrogen alpha line profile during totality reveal the presence of a foreground emission source centered at the systemic radial velocity. A small transient emission line has been seen at 6604Å on two occasions during the eclipse. This work was supported in part by the bequest of William Herschel Womble in support of astronomy at the University of Denver, and by NSF grant 1016678 to the University of Denver. We are grateful for the assistance of the epsilon Aurigae spectral monitoring team at Apache Point Observatory (W. Ketzeback, J.Barentine, et al.) and all observers participating in the international eclipse monitoring campaign.

Looking ahead

Although the predicted date of 4th contact is 15th May 2011, the outer regions of the eclipsing object are expected to be detectable in the spectrum for some months after this date and out of eclipse observations are also required as a base line so observers should plan to continue taking spectra throughout 2011, including the difficult but key
period around solar conjunction if possible.

Further information for observers wanting to contribute spectra or researchers wishing to use the data can be found here on the main campaign web site http://www.hposoft.com/EAur09/Robin.html

From Dr. Bob

Dr. Robert E. Stencel . Co- Editor
University of Denver Astronomy Program
<rstencel@du.edu>
https://twitter.com/epsilon_Aurigae

The year 2010 was the year of total eclipse. At the dawn of this new year, 2011, we are beginning to see hints of the end of eclipse now only a matter of weeks away. The end of totality (third contact) is predicted for 19 March, when V is anticipated to begin rising quickly. Previous eclipses have seen the time between third contact (end of totality) and fourth contact (end of eclipse) abbreviated to as little as 50- 60 days, which would mean mid-May in this cycle. But these are merely predictions, and your continued observational effort will help tell the tale.

December 2010 was been a busy month observationally, and we were fortunate to have obtained time and good weather with the following large telescopes:

Dec.6th - SpeX near-IR spectra using the 3 meter NASA IRTF telescope atop Mauna Kea HI

Dec.9-10 - near-IR interferometric imaging at the CHARA Array, Mt.Wilson CA

Dec.9 - far UV spectra with the COS instrument on Hubble Space Telescope

Dec.22 - mid-IR spectra with the MIRAC instrument at the 6 meter MMT, Mt.Hopkins AZ

Dec.29 - near IR high resolution spectra at Gemini North (Mauna Kea) 8 meter telescope with its new IR Spectrometer (GNIRS).

This probably represents a high point in terms of number and diversity of large telescope data sets in a given month during the present eclipse. While we have some time still pending in the remaining winter months, similar large telescope observations will not be obtained quite so frequently, sad to say. Large telescope time is very competitive and we are fortunate to have attracted this level of interest. Many of the results of these observations and the series preceding those will be "on display" at the Seattle meeting of the American Astronomical Society scheduled for Jan.9-12, 2011.

I'm happy to report that Gary Cole has made progress with his polarimetry studies of epsilon Aurigae, and he has detected some variations during totality that appear similar to those measured by Jack Kemp during the last eclipse. Details in future newsletters.

Last spring, Robin Leadbeater and I published a summary of step-wise changes in the equivalent width strength of the red neutral potassium line:

http://arxiv.org/abs/1003.3617

In that paper, we likened the steps to ring-like structure in the disk, and made predictions for related events that could occur during EGRESS (Table 5): Predicted times during egress, 2010-2011 (RJD = J.D. - 2,400,000)

Features	**RJD**	**Calendar dates**
Nominal mid-eclipse	55413	4 Aug 2010
Disc east inner rim	55550	19 Dec 2010
F ring crossing	55576 — 55592	14 — 30 Jan 2011
E ring crossing	55602 — 55611	9 — 18 Feb 2011
3rd contact, predicted	55640	19 Mar 2011
D ring crossing	55649 — 55667	28 Mar — 15 Apr 2011
4th contact, predicted	55695	13 May 2011
C ring crossing	55705 — 55767	23 May — 24 Jul 2011
B ring crossing	55793 — 55818	19 Aug — 13 Sep 2011
A ring crossing	55850 — 55863	15 — 28 Oct 2011

With some cooperation from winter weather, photometry and spectra may be able to confirm this simple, symmetric prediction about disk sub-structure. However, nature is usually more interesting than our models for it, so keep watching all year long – maybe not the year of totality, but during last eclipse, some indicators did last ~6 months after 4th contact. Thanks again for making this the most well observed eclipse in history!

Interesting Papers

Here's a list for Interesting papers, presented at the Seattle meeting of the American Astronomical Society, January 2011:

Campaign Photometry During The 2010 Eclipse Of Epsilon Aurigae

Jeff Hopkins[1], R. E. Stencel[2]

1-HPO Soft, 2-Denver University.

Epsilon Aurigae is a long period (27.1 years) eclipsing binary star system with an eclipse that lasts nearly 2 years, but with severe ambiguities about component masses and shape. The current eclipse began on schedule in August of 2009. During the previous, 1982-1984 eclipse, an International Campaign was formed to coordinate a detailed study of the system. While that Campaign was deemed successful, the evolutionary status of the star system remained unclear. Epsilon Aurigae has been observed nearly continuously since the 1982 eclipse. The current Campaign was officially started in 2006. In addition to a Yahoo forum we have a dedicated web site and more than 18 online newsletters reporting photometry, spectroscopy, interferometry and polarimetry data. High quality UBVRIJH band photometric data since before the start of the current eclipse has been submitted. We explore the color differences among the light curves in terms of eclipse phases and archival data. At least one new model of the star system has been proposed since the current Campaign began: a low mass but very high luminosity F star plus a B star surrounded by a debris disk. The current eclipse and in particular the interferometry and spectroscopic data have caused new thoughts on defining eclipsing variable star contact points and phases of an eclipse. Second contact may not be the same point as start of totality and third contact may not be the same point as the start of egress and end of totality. In addition, the much awaited mid-eclipse brightening may or may not have appeared. This paper identifies the current Campaign contributors and the photometric data. This work was supported in part by the bequest of William Herschel Womble in support of astronomy at the University of Denver, by NSF grant 1016678 to the University of Denver.

Analysis of Epsilon Aurigae light curve from the Solar Mass Ejection Imager

John Clover[1], B. V. Jackson[1], A. Buffington[1], P. P. Hick[1], B. Kloppenborg[2], R. Stencel[2]

1-University of California, San Diego, 2-University of Denver.

The Solar Mass Ejection Imager (SMEI) was launched aboard the Coriolis spacecraft in 2003. It is equipped with 3 CCD cameras to measure the brightness of Thomson-scattered electrons in the heliosphere. Each CCD images a strip of the sky that is 3°x60°. The three cameras are mounted on the satellite with their fields of view aligned end-to-end so that SMEI sweeps nearly the entire sky each 102 minute orbit. SMEI has now accumulated stellar time series for about 5700 bright stars, including epsilon Aurigae, for each orbit where data is available. SMEI data provide nearly year-round coverage of epsilon Aurigae. The baffled SMEI optics provide more accurate photometric data than ground-based observations, particularly at mideclipse when epsilon Aurigae is close to the Sun. We present an analysis of the brightness variations of the epsilon Aurigae system, before and during the eclipse. The University of Denver participants are grateful for support under NSFgrant 10-16678 and the bequest of William Hershel Womble in support of astronomy at the University of Denver.

Interferometric Images Of The Transiting Disk In The Epsilon Aurigae System

Brian K. Kloppenborg[1], R. Stencel[1], J. D. Monnier[2], G. Schaefer[3], M. Zhao[4], F. Baron[2], H. McAlister[5], T. ten Brummelaar[5], X. Che[2], C. Farrington[5], E. Pedretti[6], P. Sallave-Goldfinger[5], J. Sturmann[5], L. Sturmann[5], N. Thureau[7], N. Turner5, S. Carroll[8]

1-University of Denver, 2-University of Michigan, 3-Georgia State, 4-Jet Propulsion Laboratory, 5-Georgia State University, 6-SUPA, University of St. Andrews, United Kingdom, 7-University of St. Andrews, United Kingdom, 8-California Institute of Technology.

We have been using the CHARA Array with the MIRC beam combiner to obtain the first-ever interferometric observations of the enigmatic binary, epsilon Aurigae. The first two in-eclipse images, obtained in 2009, prove that the eclipsing body is a thin, opaque disk of material akin to transitional or debris disks. From these data we have derived a mass ratio that shows the F-type star is 3.6 ± 0.7 M •, making it the less massive component in the system and thus not a high-mass supergiant as was classically believed. Four additional observations were scheduled in 2010. In this work we present reconstructed images from all epochs using two new image reconstruction algorithms, SQUEEZE and GPAIR. We discuss the progress towards our goals: to determine the evolutionary status of the components in the binary; and define the composition, density, and temperature structure of the disk. The CHARA Array, operated by Georgia State University, was built with funding provided by the Nationa l Science Foundation, Georgia State University, the W. M. Keck Foundation, and the David and Lucile Packard Foundation. This research is supported by the National Science Foundation as well as by funding from the office of the Dean of the College of Arts and Science at Georgia State University. MIRC was supported by the National Science Foundation. The University of Denver participants are grateful for support under NSF grant 10-16678 and the bequest of William Hershel Womble in support of astronomy at the University of Denver.

Spectroscopic Wonders During The 2010 Eclipse Of Epsilon Aurigae

Robin Leadbeater[1], C. Buil[2], T. Garrell[3], S. Gorodenski[4], J. Hopkins[5], B. Mauclaire[6], J. Ribeiro[7], L. Schanne[8], O. Thizy[9], R. Stencel[10]

1-Three Hills Observatory, 2-Castanet Tolosan Observatory, France, 3-Observatoire de Foncaude, France, 4-Blue Hills Observatory, 5-Hopkins Phoenix Observatory, 6-Observatoire du Val de l'Arc, France, 7-Observatorio de Instituto Geografico de Exercito, Portugal,
8-Voelklingen Observatory, Germany, 9-Shelyak Instruments, France, 10-University of Denver.

Remarkable spectroscopic coverage is reported of the 2009-2011 eclipse of the enigmatic binary, epsilon Aurigae. Due to the availability of new spectrographs and digital detectors, unprecedented monitoring by a network of observers using small telescopes has revealed a number of details and surprises that must be taken into account in any updated model for the over-luminous F star and the dark disk companion, recently detected interferometrically. Over 400 spectra were obtained during 2007 to 2010 (pre eclipse to post mid eclipse). They include R ~12000 echelle spectra giving broad coverage from 4300-7000Å and detailed spectra at R ~17000-25000 covering the Sodium D, Hydrogen alpha and Potassium 7699Å line regions. Evidence of the eclipsing body was first seen in the 7699Å line profile 83 days before photometric first contact. During ingress, the strength of this line increased in a stepwise fashion suggesting structure in the disc. During the first half of totality, the lin e strength trend deviated from that seen during the last eclipse. Radial velocity measurements of the 7699A line during ingress are consistent with the disc material orbiting a central object of 5.3 solar masses. Changes in the Hydrogen alpha line profile during totality reveal the presence of a foreground emission source centered at the systemic radial velocity. A small transient emission line has been seen at 6604Å on two occasions during the eclipse. This work was supported in part by the

bequest of William Herschel Womble in support of astronomy at the University of Denver, and by NSF grant 1016678 to the University of Denver. We are grateful for the assistance of the epsilon Aurigae spectral monitoring team at Apache Point Observatory (W. Ketzeback, J.Barentine, et al.) and all observers participating in the international eclipse monitoring campaign.

Optical and NIR Spectroscopy of • Aurigae at Apache Point Observatory, the First Half of the Eclipse

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Epsilon Aurigae (ε Aur), first confirmed as a variable in 1821, is an eclipsing binary star system with a period of 27.1 years, one of the longest known. The primary, a pulsating F supergiant star with a variability out of eclipse of approximately 60 days and possible overtones of hundreds of days, is orbited by the secondary, a B-star enveloped by an enormous, cool, spectrally gray disk producing no evident wavelength dependence to the light output variations. The eclipse lasts for over 700 days; the current eclipse began first contact in July, 2009, and August 4, 2010 marked the estimated midway point of the eclipse. Although the components of the system have now been identified, much is still unclear such as the origin, composition and structure of the disk. Modern digital spectroscopy of bright stars not only enables asteroseismology and planetary detection, but the eclipsing binary epsilon Aurigae is an unusual case in which precise spectroscopic study of the now transi ting dark disk is enabled. At Apache Point Observatory, our team has conducted high-resolution optical and NIR spectroscopic monitoring of this mysterious eclipsing system since February, 2009. We present major changes in the spectra attributable to the disk from the first half of the eclipse in the 0.4 - 2.2 μm range using ARCES, an optical echelle spectrograph ($\lambda/\Delta\lambda$=31,500), and Triplespec, a NIR cross-dispersed spectrograph ($\lambda/\Delta\lambda$=3500), on the ARC 3.5-meter telescope.

Epsilon Aurigae - Intriguing Changes with Phase

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Epsilon Aurigae has baffled generations of astrophysicists, and the need to hold a Special Session about this system arises from the depth and persistence of our bafflement. Although the obvious (dominant) star - an early-F supergiant - is partially eclipsed during its 27-year period such that the overall brightness drops by ~1 magnitude in V, the spectrum of the system does not change. That fact is what has made epsilon Aurigae traditionally famous. Moreover, the dark object that moves in front must have gigantic proportions. However, it is not actually true to say that the spectrum does not change. It is still recognizeably an early-F supergiant but it changes significantly during eclipse ingress and egress, in ways that provide invaluable information about the mysterious body that was in front throughout 2010 (and still is). Nothing is yet known regarding the properties or constancy of the dark body, and to that end we have sought new information from the long series of s pectra in heritage (photographic) archives. The two richest sets of high-dispersion spectra are from the DAO, dating back to 1972, and Mount Wilson, dating back to 1929, offering resolving power of the order of 50,000 and including both blue and red spectral regions. While both sets cover the 1983 eclipse (as do many independent photometric datasets), the Mount Wilson spectra are unique in their rich cover of the 1956 eclipse, and include some of the 1929 event. We have digitized about 300 plates, and are analysing the information by comparing spectra at all orbital phases with new CCD ones as far as

possible. The poster will summarize the findings, which will be described in greater detail during the Special Session on epsilon Aurigae on Tuesday January 11.

Hubble Space Telescope Ultraviolet Observations of Epsilon Aurigae

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1-NOAO, 2-University of Denver, 3-Spitzer Science Center.

We present the initial observations from our multiepoch COS program, with three planned observations of Epsilon Aurigae. The first observation was obtained on 2010 Sept 1st, shortly after mid-eclipse. The remaining two are scheduled for mid-December 2010, during totality, and during egress in mid-April 2011. Epsilon Aurigae is a complex binary system consisting of a post-AGB F giant orbited by a B star encircled by a large dust cloud. The B star dominates the spectral energy distribution only in the far-UV portion of the spectrum. We use our 900-2050A COS results to 1) model the B star yielding its Teff and log g, 2) search for warm circumbinary material, and 3) confirm the nature of the B star as input to our recent work providing the most detailed SED model yet developed for Epsilon Aurigae (http://adsabs.harvard.edu/abs/2010ApJ...714..549H).

Ring-like Structures Around Epsilon Aurigae Companion

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5-University of Denver.

Epsilon Aurigae, a 27.1 year eclipsing binary, consists of a post-AGB F giant and a main sequence B star. The B star is surrounded by a large dust disk. Our team obtained and analyzed over 60 red(5800 - 6600Å) and blue (3800 - 4600Å) spectra using the College of San Mateo (CSM) Meade 8" telescope, with SBIG SGS spectrograph, and the Kitt Peak National Observatory Coude feed spectrograph. Measurements of the equivalent widths of a number of elements indicate density variations in the dust disk surrounding the companion B star of epsilon Aurigae. This disk substructure is similar to that suggested by Leadbeater and Stencel (2010, http://arxiv.org/abs/1003.3617v2) and agrees with the theoretical rings proposed by S. Ferluga (1990, A&A, 238,270) based on observations of the 1982 eclipse. Our data was collected and analyzed from February 2009 (pre-eclipse) through April 2010. We are continuing to obtain spectroscopic observations through eclipse and egress in order to provide fur ther data and evidence for the possible ring structure in the dusty disk. This study is part of the NASA/IPAC Teacher Archive Research Project (NITARP).

Infrared Studies of Epsilon Aurigae in Eclipse 2010

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1-Univ. of Denver, 2-NOAO, 3-IPAC, 4-IRTF, 5-Univ. Cincinnati, 6-The Aerospace Corp., 7-Esq., 8-Space Science Institute, 9-JPL, 10-Harvard Univ., 11-Univ. Arizona.

We report a series of observations of the enigmatic long period eclipsing binary epsilon Aurigae during its eclipse interval 2009-2011, using near-infrared spectra & photometry obtained with SpeX/IRTF, Spitzer/IRAC, mid-infrared data with BASS on IRTF & AEOS, MIRSI on IRTF and MIRAC4 on MMT, along with MIRSI on IRTF and MIRAC4 on MMT; Denver's TNTCAM2 at WIRO, and an Optec SSP-4 J & H photometer at Mt.Evans Observatory. The objective of these observations include: (1) confirm the appearance of CO absorption bands at and after mid-eclipse, due to the dark disk, and (2) seek evidence for any mid-infrared solid state spectral features from particles in the disk, seen during different portions of total eclipse. The results to date show that the infrared eclipse is less deep than the optical one, and the implied disk temperature has begun to increase from 550K toward 1100K as eclipse progresses past midpoint and heated portions of the disk come into view. Material prope rties of the disk are consistent with large particles. This work was supported in part by the bequest of William Herschel Womble in support of astronomy at the University of Denver, by NSF grant 1016678 and JPL RSA 1414715 to the University of Denver, by NASA ADP grant NNX09AC73G to the University of Cincinnati, by The Aerospace Corporation's Independent Research and Development Program.

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Anyone wishing to contribute to the Newsletter, is most welcome. Please send contributions to me at phxjeff@hposoft.com. Please send spectroscopic data to Robin Leadbeater at robin@leadbeaterhome.fsnet.co.uk or robin_astro@hotmail.com

Clear Skies!

Jeff

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