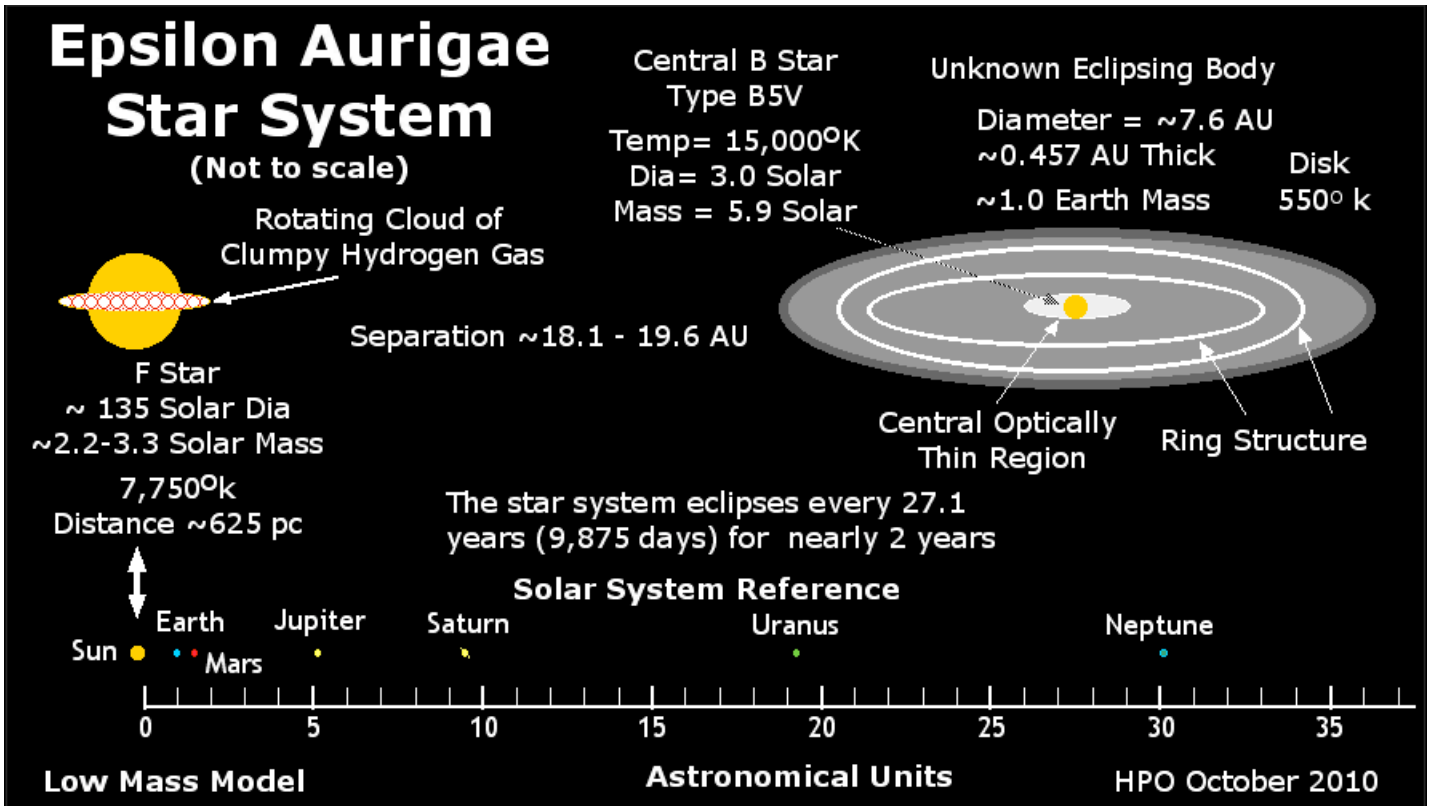
2009/2011
Epsilon Aurigae Eclipse
International Campaign Newsletter #21
Winter 2011 - Totality-Approaching Third Contact



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,

We are fast approaching 3rd Contact estimated around mid-March 2011. This will mark the end of Totality for another 27 years. During the last eclipse strange variations occurred just before 3rd Contact so detailed and continued observations are needed. Once past 3rd Contact the data will be essential for determining the egress slope and therefore more precise 3rd and 4th Contact times.

The Out-of-Eclipse (OOE) variations seem to continue to dance and be unpredictable. Variations during Totality have changing periods which vary from around 55 days to 72 days. Predicting precisely when the next cycle will start and the amplitudes seem not possible. The eclipse is deemed a flat bottomed eclipse, but obviously it is anything but flat. If it were not for the OOE variations in would probably be closer to flat. A flat bottomed eclipse is just a term to denote that the eclipse totality is not brief, but lasts a significant portion of the whole eclipse. Some light curves which are not flat bottomed (like Algol) decrease in magnitude to a minimum and then start increasing immediately.

Rings in the eclipsing body have been theorized, but any light coming through the eclipsing body is masked by the OOE variations, so photometrically there is not firm evidence of rings. The mid-eclipse brightening is still a tantalizing mystery. While there are hints that something may have happened, the observations were at the worst possible time with bright skies and extremely high air masses for those who could even see the star system at that time. A heroic effort was put forth, but even then the data are conflicting.

217th AAS Meeting

The second week of January saw a very successful 217th meeting of the American Astronomical Society in Seattle, Washington, USA. There were close to 3,000 astronomers in attendance. Thanks to Dr. Stencel we had our own Poster Paper and Presentation Sessions. There were nine Poster Papers on Epsilon Aurigae and six talks. Pictures and more information can be seen on our web site at:

http://www.hposoft.com/EAur09/AAS217.html

At the conclusion of our sessions we had a special Epsilon Aurigae Reunion Dinner. The following are pictures from the dinner. To the right are Brian Kloppenborg, Elizabeth Griffin, Dr. Bob Stencel, John Clover and at the end Jeff Hopkins. To the left are Bill Ketzeback and his wife, Tom Ake and Greg Jones. After dinner Campaign Contribution Recognition Awards were given to Dr. Bob, Brian Kloppenborg and Robin Leadbeater (who could not attend). Robin's award was sent to him.

Jeff

The Epsilon Aurigae Reunion Dinner

Campaign Appreciation Awards

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
CO -	3							3	CCD
DES -	176							176	DSLR
EAO -	68							68	CCD
EGO -	81							81	DSLR
EUO -	1	39	9		40			89	PMT
FJM -	50							50	SSP-3
GHO -	124					120		244	CCD
GO -	12			12				24	CCD
GS -	120	119		124		122		485	CCD
GVO -	13	8			13		13	47	SSP-3
HPO -	127	189	189					505	PMT
JBO -	16	41			16		16	89	SSP-3
JESO-	26							26	
KO -	84							84	CCD
LO -	82							82	SSP-3
MSO -	3	3						6	CCD
NKO -	31							31	DSLR
NPO -	0				16		16	32	SSP-3
RES -	35							35	DSLR
RLO -	29							29	DSLR
SGGO-	64	17		59				140	CCD
TP -	80							80	DSLR
VO -	139							139	DSLR
WWC-	41	40						81	DSLR
Total	1483	456	198	195	85	242	45	2704	XXX

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. As of 20 February 2011 we have over 2,700 total observations during the eclipse with the visual band having by far the most at nearly 1,500 observations.

Plot Observer Key

CH - Colin Henshaw, Tabuk, Saudi Arabia
CO - Steve Orlando,Custer Observatory, East Northport, NY, USA
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

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IMPORTANT NOTICE

Please review the photometric plots and look for your data. See how close they are to the rest of the reported magnitudes at about the same time. Most data are excellent, but some are obvious flyers. If your data are varying significantly from others, you may want to reexamine your reduction and/or procedures.

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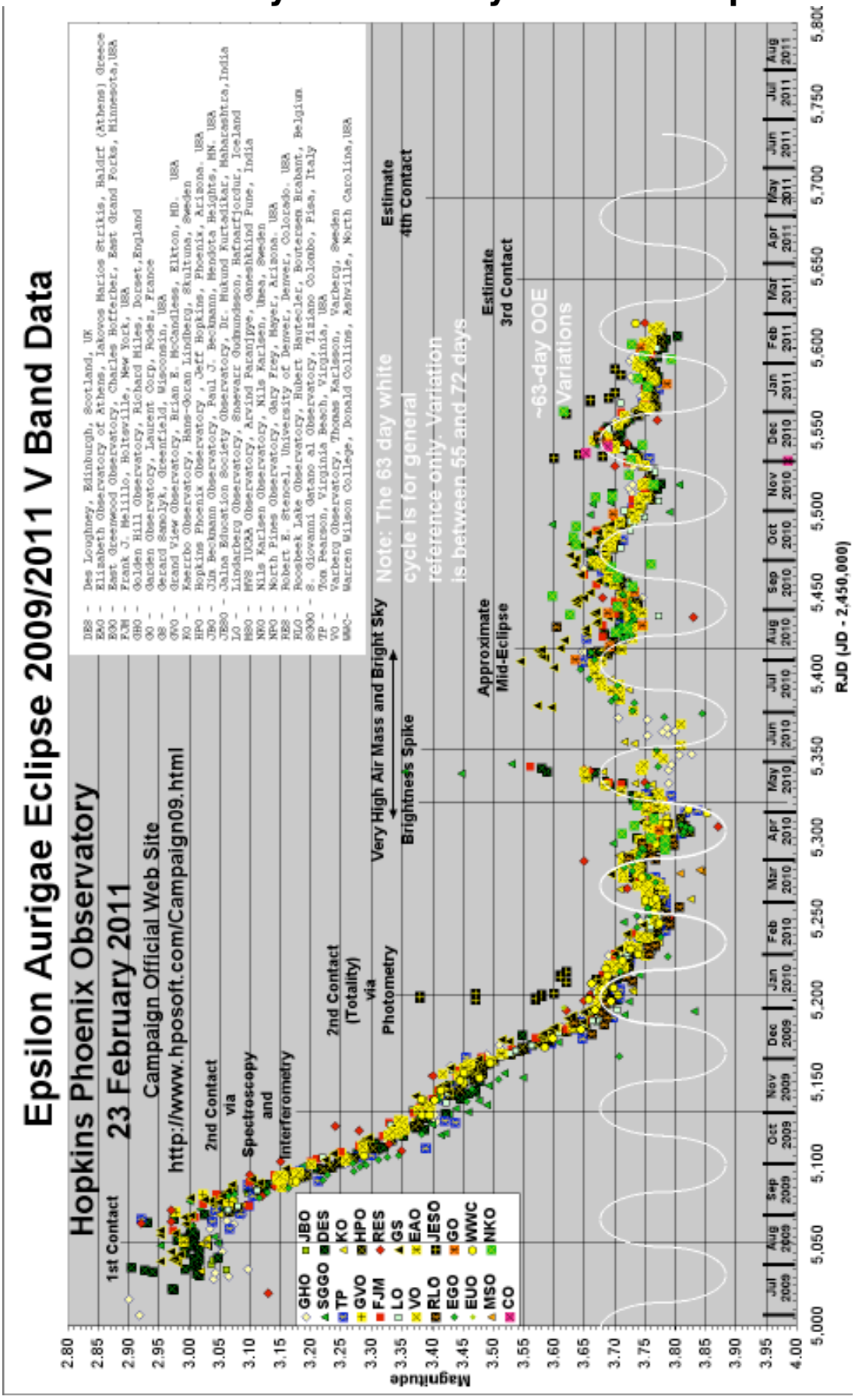
Note: Full resolution images of the photometric data plots can be seen at:

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

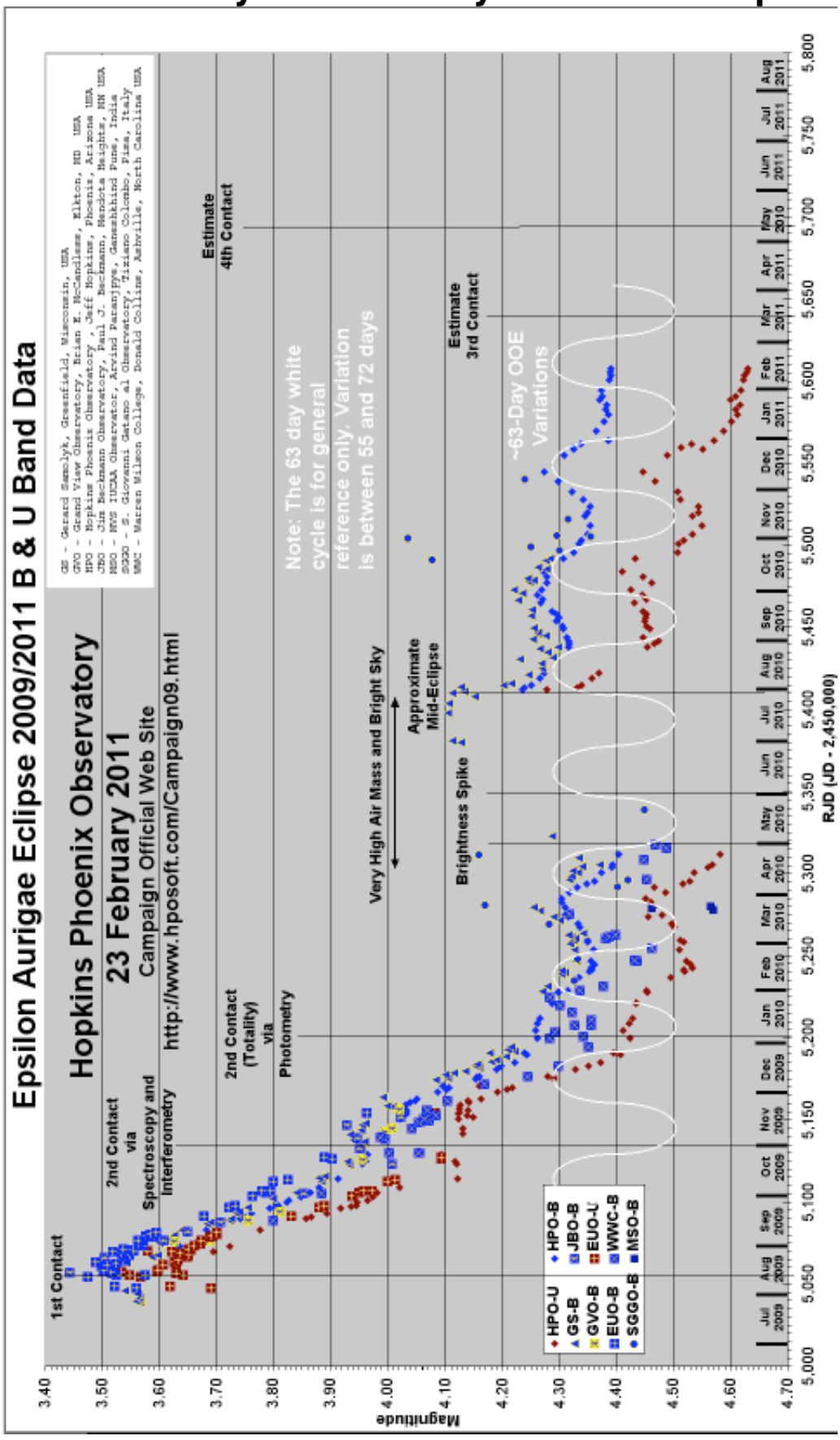
UB Band Plots:
http://www.hposoft.com/Plots09/UBFall09.jpg

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

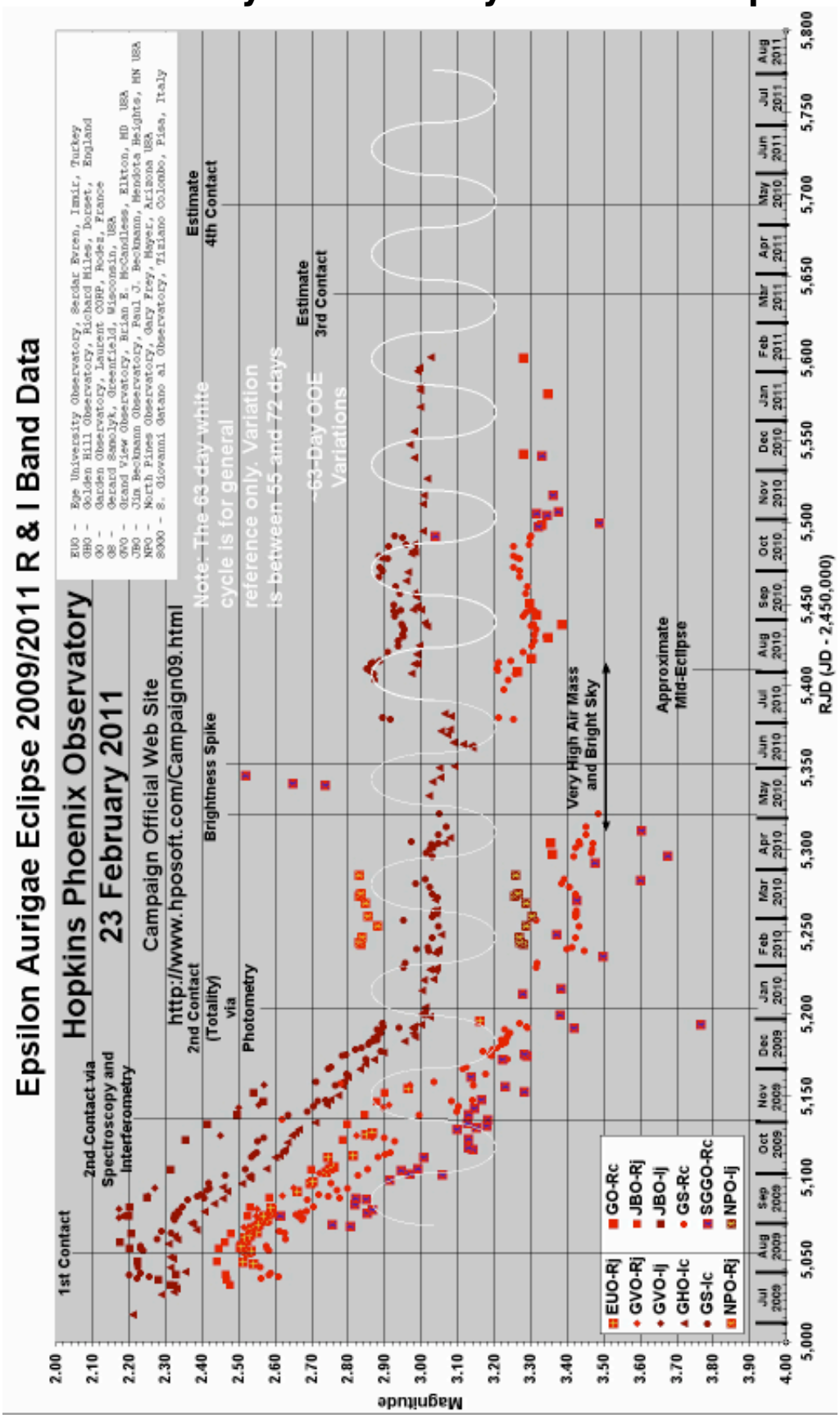
Ingress and Totality Photometry V Data Composite Plot



Ingress and Totality Photometry UB Data Composite Plot



Ingress and Totality Photometry RI Data Composite Plot



Comparison stars for Epsilon Aurigae

Richard Miles, Golden Hill Observatory

The standard approach for photometry of epsilon Aurigae is to use lambda Aurigae as the comparison star even though their separation is some 4.9°. For the present campaign, I have been carrying out absolute CCD photometry using telescopes having a field of view of 87' x 64', which is too small to encompass both epsilon and lambda and so I have utilized stars which are located only a degree or so from the variable. The use of a small FOV enables one to improve the precision of the measurement especially at low altitudes however there is an issue concerning the accuracy of the measurements since this depends not only on the adopted magnitudes for the comparisons but also on their photometric stability. The chart (Figure 1) illustrates the general field with selected stars identified by their Greek symbol or HD number. The inner rectangle is the FOV of my telescopes. The colors shown are indicative of spectral type.

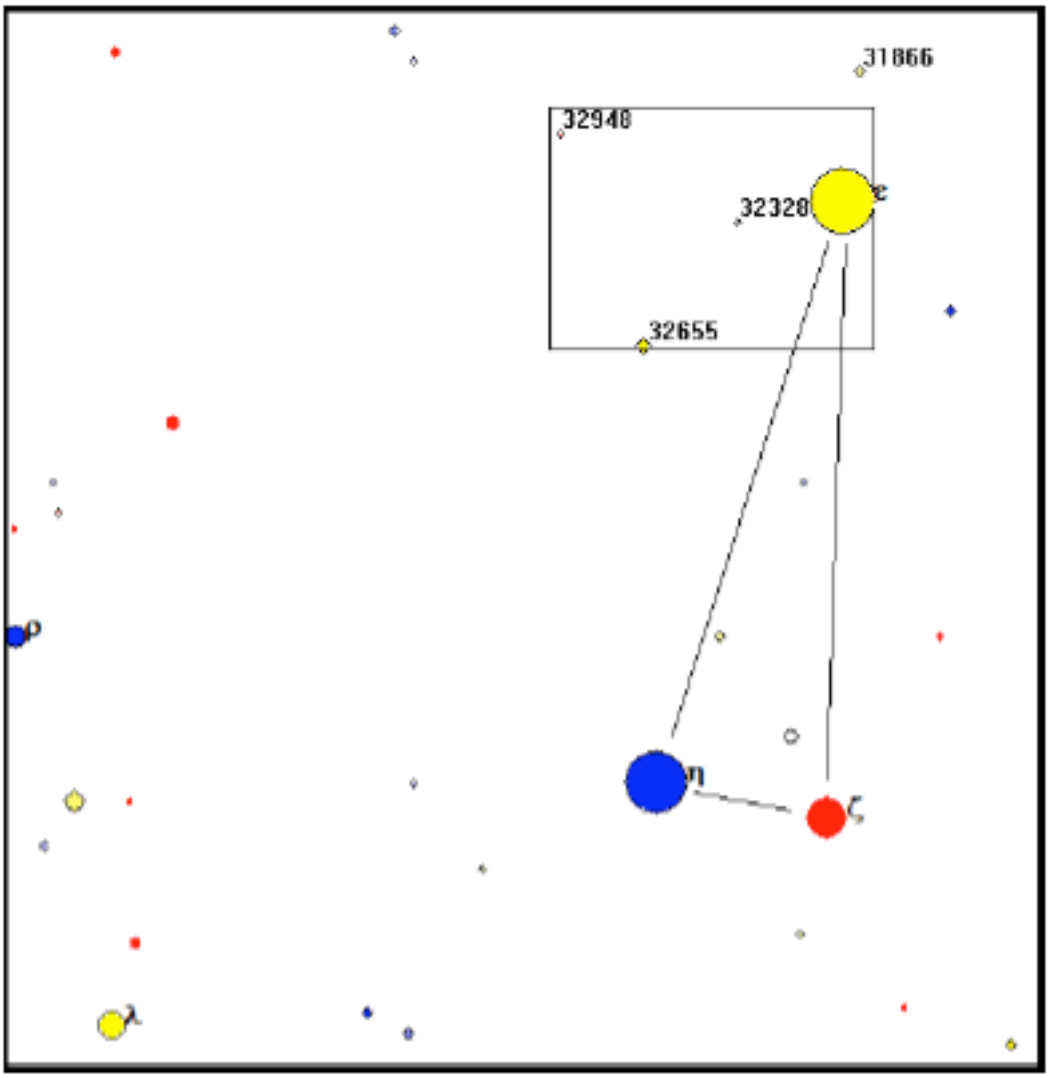


Figure 1

Originally I used HD 32655 as my comparison star for photometry in Johnson-V and Cousins-I (Ic), however it gradually became apparent by using the check star (HD 32328) that HD 32655 (or HD 32328) was slightly variable in V. The star HD 32655 is classed spectrally as an F2IIp bright giant having V=6.216 and B-V = 0.41 (Simbad data) and so has certain peculiar features in its spectrum. Hipparcos data do not show it to be variable (nor to be constant) in that the difference between the

5th percentile and 95th percentile measure is just 0.02 magnitude. By contrast, HD 32328 is a B8V main-sequence star having V=7.64 and B-V = -0.05 and it, according to the Hipparcos flag, is constant.

As part of the procedure, the photometric measurements (in ADU) along with all other relevant data (filename, mid-time of exposure, exposure time, etc.) are pasted into a spreadsheet which then performs the data reduction. So for each reference star (comparison and check) it generates a mean zero point magnitude from the values (v – V) and (I – Ic) where the values used for V and Ic are the adopted magnitudes for each star taken from the literature (Hipparcos catalog). Importantly, these values are also each adjusted for extinction and a color transformation is applied.

The plot (Figure 2) illustrates the difference in the zero point magnitudes of the comparison and check stars. It was particularly evident that jumps in brightness appeared to coincide with discontinuities in the V light curve of epsilon Aurigae – a telltale sign of the variability of the comparison star.

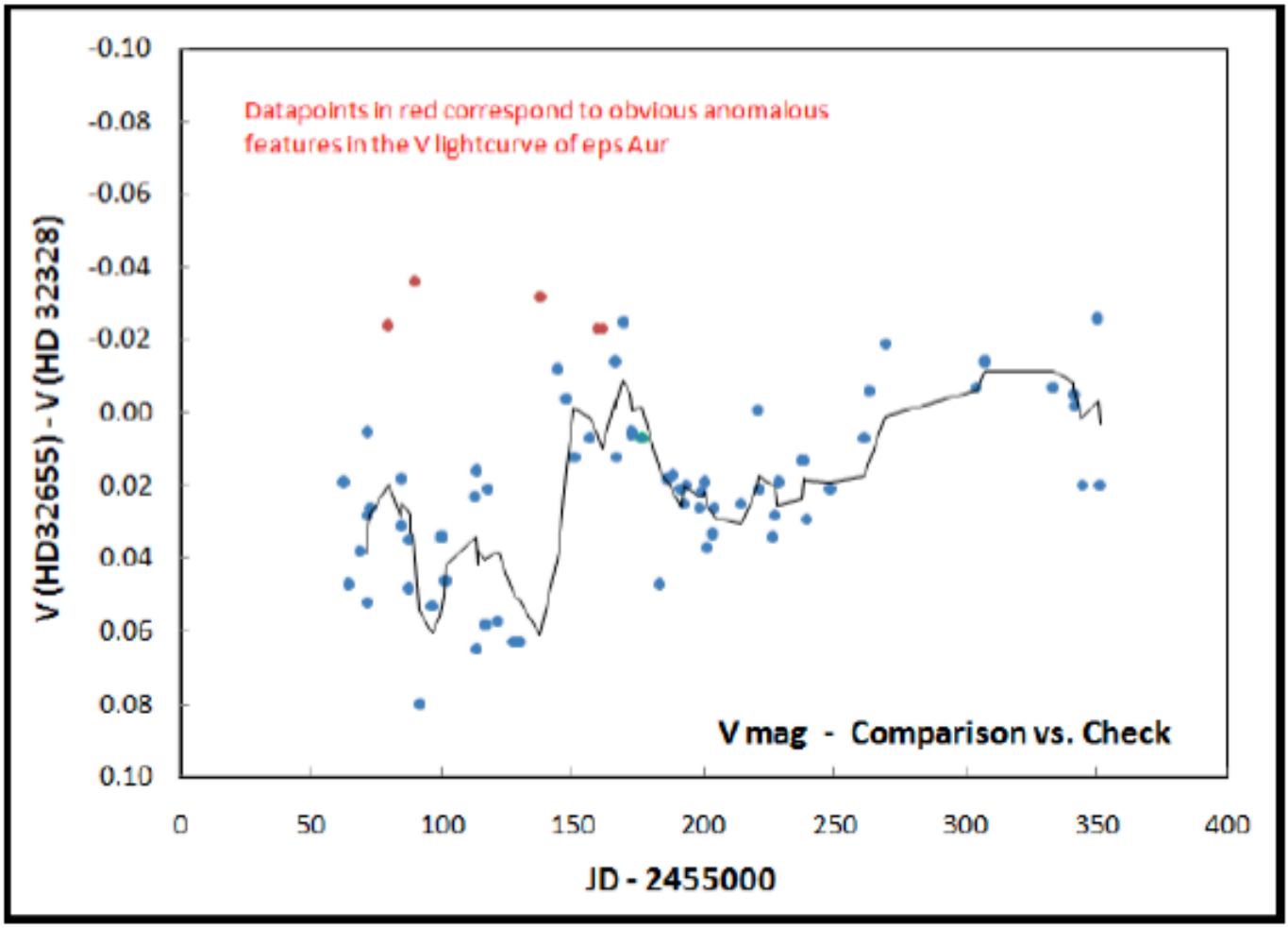


Figure 2

This plot (Figure 2) shows that HD 32655 exhibits an erratic variability in V which may be in part a consequence of emission line variability since occasionally the star can brighten by up to 0.05 magnitude almost overnight. In contrast, the same star appeared to be relatively stable in the Cousins-I pass band with no correspondingly anomalous features evident in the Ic plot of epsilon Aurigae.

From 2010 June 14 onwards, I switched the observing methodology so as to use HD 32328 as the

reference star for V magnitude and kept HD 32655 for Ic magnitude determinations. However at the same time, I changed the pointing of the telescope to include two additional check stars for both filters. For V, I included HD 32948 (Sp. G5) and HD 31866 (Sp. A3V), whereas for Ic the check stars were HD 32948 and HD 32328.

Eight months on, it is now opportune to look back at the results on the check stars to test for variability. It turns out that for the V pass band, the two check stars are essentially constant relative to the comparison star HD 32328 as shown below (x-axis = JD-2455000, y-axis is difference in zero point magnitudes). HD 31866 appears particularly stable although the other check star is significantly fainter hence the greater scatter in the results. See Figure 3.

As to the checks for the variability of the HD 32655 comparison star in the near infrared, when measured relative to HD 32948 the changes over an interval of nearly 200 days amounts to a gradual rise of about 0.01 magnitude with the expected degree of scatter in the data given the relative insensitivity of the system in the Ic pass band. This result essentially confirms the suitability of the comparison star in the near infrared in contrast to its instability in V. Note that the region of the spectrum isolated by the V filter does not overlap with that of the Cousins-I filter hence the difference in behaviour of the star in these two pass bands.

One surprising finding was that the V-band comparison star, HD 32328, appears to be slowly variable in Ic as shown in the plot of Comp – Check 2. Although HD 32328 was not measured in Ic prior to 2010 June 14, I can go back to those images and determine the zero point difference Ic[HD32655-HD32328] to further check on long-term variability back to around JD 2455060. As it is a B8 main-sequence star, it is relatively faint in the Ic pass band and so the scatter in the data is proportionately greater. See Figure 4.

In the next report, I'll take a look at the R and I data for epsilon Aurigae, and in particular what the V-I and V-R color indices tell us about the nature of the eclipse to date.

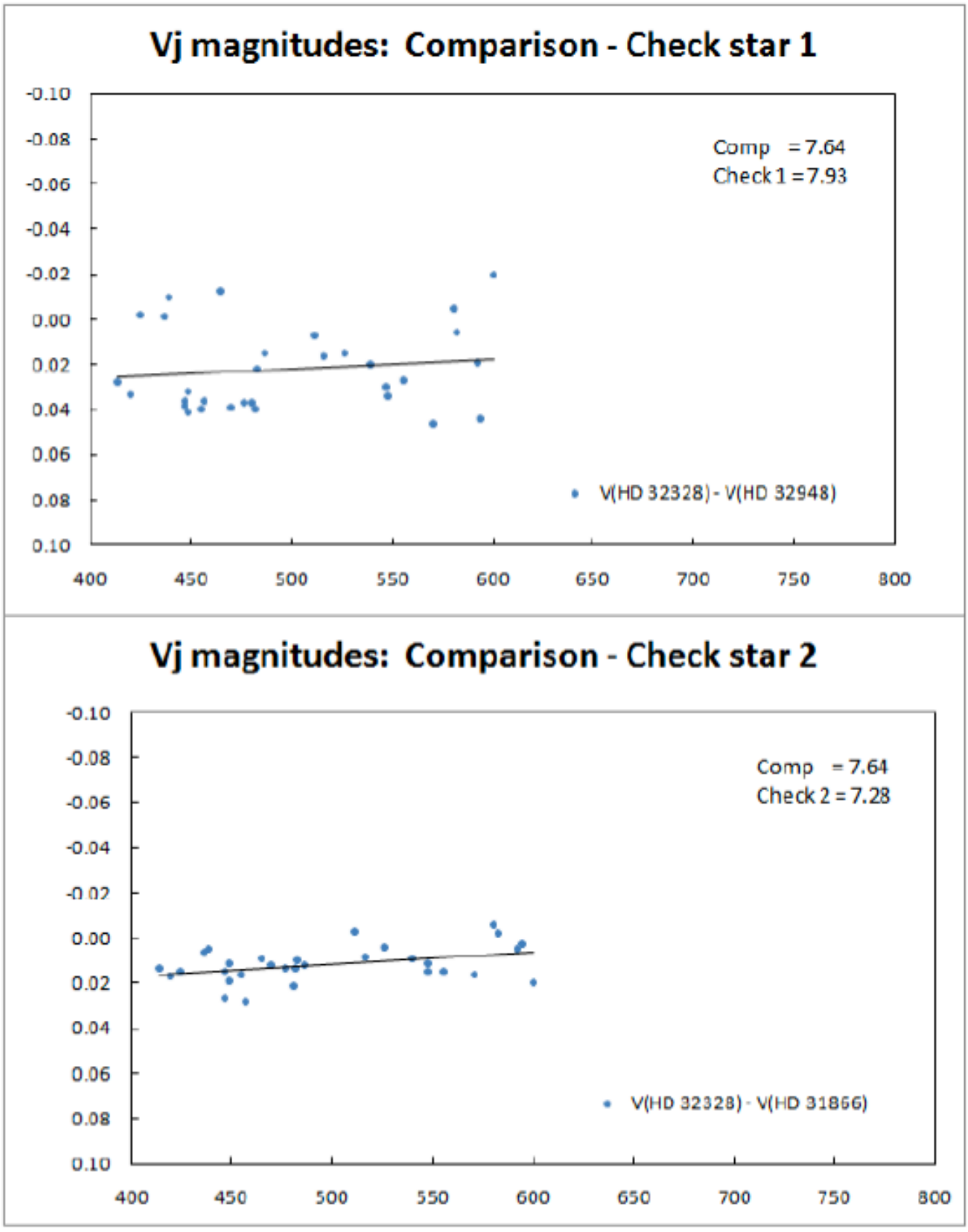

Vj magnitudes: Comparison - Check star 1
-0.10
-0.08
-0.06
-0.04
-0.02
0.00
0.02
0.04
0.06
0.08
0.10
400
450
500
550
600
650
700
750
800
Comp = 7.64
Check 1 = 7.93
V(HD 32328) - V(HD 32948)
Vj magnitudes: Comparison - Check star 2
-0.10
-0.08
-0.06
-0.04
-0.02
0.00
0.02
0.04
0.06
0.08
0.10
400
450
500
550
600
650
700
750
800
Comp = 7.64
Check 2 = 7.28
V(HD 32328) - V(HD 31866)

Figure 3

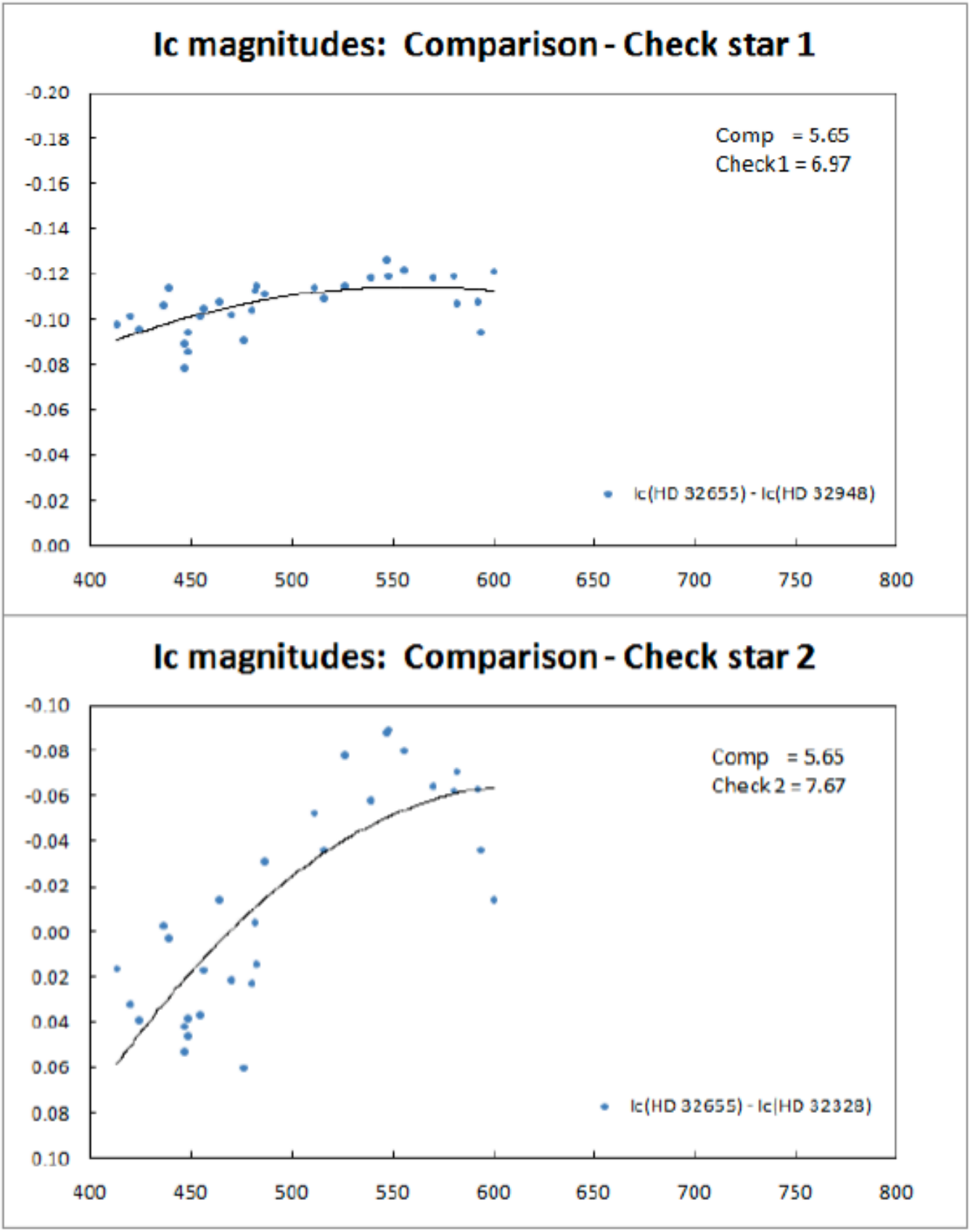

Ic magnitudes: Comparison - Check star 1
Comp = 5.65
Check1 = 6.97
Ic(HD 32655) - Ic(HD 32948)
-0.20
-0.18
-0.16
-0.14
-0.12
-0.10
-0.08
-0.06
-0.04
-0.02
0.00
400
450
500
550
600
650
700
750
800
Ic magnitudes: Comparison - Check star 2
Comp = 5.65
Check 2 = 7.67
Ic(HD 32655) - Ic(HD 32328)
-0.10
-0.08
-0.06
-0.04
-0.02
0.00
0.02
0.04
0.06
0.08
0.10
400
450
500
550
600
650
700
750
800

Figure 4

Photometric Observers

Note: Bold data are data submitted since Newsletter #20.

Steve Orlando, Custer Observatory (CO)
East Northport, NY, USA
Telescope: CGE-1400
Photometer: SBIG ST10XME

Date	RJD	V Mag	SD
30 Nov/01 Dec 2010	**5530.6549**	**3.986**	**0.039**
05/06 December 2010	**5535.6373**	**3.652**	**0.010**
09/10 December 2010	**5539.6248**	**3.689**	**0.037**

RJD = JD - 2,450,000

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
06/07 January 2011	**5568.450**	**3.766**	**0.009**
09/10 January 2011	**5571.248**	**3.763**	**0.007**
16/17 January 2011	**5578.285**	**3.779**	**0.010**
17/18 January 2011	**5579.296**	**3.772**	**0.004**
19/20 January 2011	**5581.498**	**3.754**	**0.014**
20/21 January 2011	**5582.423**	**3.772**	**0.003**
23/24 January 2011	**5585.483**	**3.768**	**0.016**
01/02 February 2011	**5594.377**	**3.770**	**0.009**

Des Loughney (DES)

UT Date	RJD	V Mag	SD
07/08 February 2011	5600.313	3.780	0.007
10/11 February 2011	5603.285	3.775	0.003
12/13 February 2011	5605.273	3.785	0.003
14/15 February 2011	5607.448	3.804	0.009
16/17 February 2011	5609.410	3.778	0.013

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
02/03 October 2010	5472.7243	3.65	0.001
08/09 October 2010	5478.7101	3.68	0.032
17/18 October 2010	5487.6535	3.67	0.016
22/23 October 2010	5493.7322	3.70	0.013
31 Oct/01 Nov 2010	5501.6463	3.73	0.022
05/06 November 2010	5506.6806	3.73	0.023
12/13 November 2010	5513.7251	3.75	0.019
19/20 November 2010	5520.7222	3.74	0.019
28/29 November 2010	5529.6424	3.72	0.033
07/08 December 2010	5538.7118	3.70	0.016
17/18 December 2010	5548.7104	3.68	0.019
29/30 December 2010	5560.6389	3.71	0.031
05/06 January 2011	**5567.5243**	**3.75**	**0.036**
13/14 January 2011	**5575.5269**	**3.75**	**0.013**
30/31 January 2011	**5592.6347**	**3.74**	**0.021**
03/04 February 2011	**5596.5285**	**3.76**	**0.026**
10/11 February 2011	**5603.5310**	**3.75**	**0.012**

RJD = JD - 2,450,000

Richard Miles, Golden Hill Observatory (GHO)
Stourton Caundle, Dorset, England,Time Zone: GMT = 0 hours
Latitude/Longitude/Altitude (ASL): West 2.405 deg, North 50.931 deg
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)
NoteFor 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.

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
08/09 January 2011	**5570.345**	**3.743**	**0.001**	**2.997**	**0.002**
18/19 January 2011	**5580.352**	**3.729**	**0.003**	**2.997**	**0.003**
20/21 January 2011	**5582.313**	**3.727**	**0.004**	**2.998**	**0.002**
30/31 January 2011	**5592.318**	**3.725**	**0.004**	**2.991**	**0.003**
01/02 February 2011	**5594.292**	**3.729**	**0.003**	**2.995**	**0.002**
07/08 February 2011	**5600.438**	**3.744**	**0.003**	**3.027**	**0.002**

RJD = JD - 2,450,000

Dr. Mukund Kurtadikar, Jalna Education Society Observatory (JESO)
Maharashtra, India
Team:
1. Dr.M.L. Kurtadikar, J.E.S.College, Jalna 431 203, India.
2. A.N. Ardad, Shiv Chatrapati College, Aurangabad 431 003, India.
3. Dr.P.M. Kokne, Barwale College , Jalna 431 203.
4. A.D. Dashrath, High Tech Polytechnic and Eng. College, Aurangabad.
5. S.K. Pandit, Barwale College , Jalna 431 203.
Postgraduate Department of Physics
Jalna Education Society's
R.G.B.Arts , S.B.Lakhotia Commerce & R.Bezonji Science College,Optec SSP-3

Date	JD	V mag	S.D.
03/04 January 2010	**5200.3376**	**3.57**	**0.01**
04/05 January 2010	**5201.3911**	**3.38**	
05/06 January 2010	**5202.3441**	**3.58**	**0.033**
06/07 January 2010	**5203.3843**	**3.47**	
07/08 January 2010	**5204.3312**	**3.60**	**0.025**
14/15 January 2010	5211.3616	3.62	0.019
15/16 January 2010	5212.5871	3.67	0.016
17/18 January 2010	5214.6358	3.61	0.005
18/19 January 2010	5215.5664	3.61	0.015
20/21 January 2010	5217.6193	3.62	0.010
01/02 December 2010	**5532.4809**	**3.68**	**0.008**
02/03 December 2010	**5533.3869**	**3.64**	**0.033**
03/04 December 2010	**5534.3966**	**3.62**	**0.015**
28/29 December 2010	**5559.4167**	**3.66**	**0.000**
05/06 January 2011	**5567.4000**	**3.66**	**0.014**
06/07 January 2011	**5568.4044**	**3.69**	**0.014**
07/08 January 2011	**569.3873**	**3.70**	**0.037**
10/11 January 2011	**5572.3855**	**3.71**	**0.010**
21/22 January 2011	**5583.3325**	**3.70**	**0.008**
25/26 January 2011	**5587.3337**	**3.74**	**0.038**

RJD = JD - 2,450,000

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	3.698	0.002	3.331	0.002
10/11 December 2010	5541.4695	3.689	0.002	3.2801	0.002
16/17 January 2011	**5578.2662**	**3.786**	**0.002**	**3.347**	**0.002**
07/08 February 2011	**5600.3214**	**3.742**	**0.002**	**3.281**	**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
07/08 January 2011	**5569.6830**	**4.5883**	**0.0048**	**4.3681**	**0.0158**	**3.7635**	**0.0052**
13/14 January 2011	**5575.6892**	**4.6014**	**xxxxxx**	**4.3780**	**xxxxxx**	**3.7596**	**xxxxxx**
17/18 January 2011	**5579.6802**	**4.6125**	**0.0078**	**4.3850**	**0.0066**	**3.7651**	**0.0020**
20/21 January 2011	**5582.6573**	**4.6095**	**0.0008**	**4.3814**	**0.0037**	**3.7591**	**0.0016**
23/24 January 2011	**5585.6475**	**4.6171**	**0.0033**	**4.3819**	**0.0039**	**3.7662**	**0.0071**
26/27 January 2011	**5588.6462**	**4.5991**	**0.0051**	**4.3697**	**0.0024**	**3.7544**	**0.0116**
28/29 January 2011	**5590.6552**	**4.6086**	**0.0048**	**4.3755**	**0.0041**	**3.7603**	**0.0043**
01/02 February 2011	**5594.3778**	**4.6180**	**0.0007**	**4.3738**	**0.0061**	**3.7636**	**0.0107**
07/08 February 2011	**5600.6399**	**4.6229**	**0.0015**	**4.3865**	**0.0032**	**3.7734**	**0.0019**
10/11 February 2011	**5603.6344**	**4.6237**	**0.0033**	**4.3918**	**0.0036**	**3.7768**	**0.0026**
12/13 February 2011	**5605.6246**	**4.6288**	**0.0072**	**4.3886**	**0.0048**	**3.7695**	**0.0071**
14/15 February 2011	**5607.6135**	**4.6300**	**0.0040**	**4.3901**	**0.0040**	**3.7774**	**0.0032**

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
5572.3750	3.751
5575.3333	3.748

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
16/17 December 2010	**5547.4897**	**3.693**		**0.006**	**1.08**
19/20 December 2010	**5550.5755**	**3.690**		**0.000**	**1.08**
21/22 December 2010	**5552.4317**	**3.705**		**0.006**	**1.12**
22/23 December 2010	**5553.4096**	**3.707**		**0.006**	**1.15**
04/05 January 2011	**5566.3914**	**3.710**		**0.022**	**1.13**
07/08 February 2011	**5600.3259**	**3.770**		**0.012**	**1.09**
17/18 February 2011	**5610.3534**	**3.776**		**0.009**	**1.07**

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
14/15 January 2011	**5576.2708**	**3.754**	**0.14**
19/20 January 2011	**5581.3750**	**3.738**	**0.90**
31 Jan/01 Feb 2011	**5593.2892**	**3.794**	**0.10**
02/03 February 2011	**5595.2500**	**3.749**	**0.104**
09/10 February 2011	**5602.2917**	**3.728**	**0.006**

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
5576.55	**3.75**	**0.07**
5615.71	**3.75**	**0.04**

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

UT Date	RJD	V Mag	SD
23/23 September 2010	5462.9069	3.678	0.034
06/07 October 2010	5476.8534	3.680	0.021
11/12 Oxtober 2010	5481.8965	3.714	0.015
21/22 October 2010	5491.8965	3.718	0.014
31 Oct/01 Nov 2010	5501.9006	3.729	0.014
08/09 November 2010	5509.7917	3.755	0.017
01/02 December 2010	5532.6972	3.757	0.019
03/04 December 2011	**5566.7465**	**3.746**	**0.022**
12/13 January 2011	**5574.7229**	**3.773**	**0.016**
22/23 January 2011	**5584.6889**	**3.753**	**0.021**
30/31 January 2011	**5592.6521**	**3.761**	**0.024**

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
01/02 January 2011	**5563.3646**	**3.757**	**0.006**
02/03 January 2011	**5564.2174**	**3.747**	**0.009**
09/10 January 2011	**5571.1972**	**3.752**	**0.011**
18/19 January 2011	**5580.2958**	**3.766**	**0.009**
19/20 January 2011	**5581.4396**	**3.761**	**0.007**
20/21 January 2011	**5582.2118**	**3.761**	**0.009**
23/24 January 2011	**5585.3139**	**3.752**	**0.011**
26/27 January 2011	**5588.2910**	**3.742**	**0.016**
27/28 January 2011	**5589.3486**	**3.737**	**0.010**
30/31 January 2011	**5592.3132**	**3.739**	**0.019**
05/06 February 2011	**5598.2514**	**3.756**	**0.009**
08/09 February 2011	**5601.2347**	**3.759**	**0.006**
10/11 February 2011	**5603.4385**	**3.749**	**0.010**
11/12 February 2011	**5604.3660**	**3.761**	**0.015**
18/19 February 2011	**5611.3883**	**3.769**	**0.022**
19/20 February 2011	**5613.3153**	**3.774**	**0.015**

RJD = JD - 2,450,000

Donald Collins, Warren Wilson College (WWC)
Ashville, North Carolina USA
DSLR - Canon XT1, 35 mm lens , f 5.6, All data corrected for extinction and transformed

Date	RJD	V mag	SD	B mag	SD
22/23 January 2011	**5584.6728**	**3.749**	**0.019**	**4.498**	**0.041**
22/23 February 2011	**5615.5263**	**3.735**	**0.020**		

RJD = JD - 2,450,000

Spectroscopy Report
by

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

Note: Jeff Hopkins helping out

Overview (Robin)
Since the last newsletter a further 85 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

The additional spectra include several from new observers (Thanks! And welcome to the campaign) and a set from Lothar Schanne dating from 2005-6 which show some unusual variations in the H alpha line (reported in IBVS 5747 Jan 2007) Further information for observers wanting to contribute spectra or researchers wishing to use the data can be found here on the main campaign website http://www.hposoft.com/EAur09/Robin.html

			WAVELENGTH				
JD	DATE	TIME	START	END	RANGE	DISP	OBSERVER
(2400000+)		(UT)	(A)	(A)	(A)	(A/pixel)	
55610.500	18-Feb-11		4285	7115	2830	0.1	Buil
55608.500	16-Feb-11		7674	7719		0.07	Schanne
55605.500	13-Feb-11						Hansen
55605.500	13-Feb-11		7674	7719		0.07	Schanne
55604.266	11-Feb-11	8:23	4285	7115	2830	0.1	Buil
55603.266	10-Feb-11	8:23	4285	7115	2830	0.1	Buil
55601.264	08-Feb-11	8:20	4285	7115	2830	0.1	Buil
55601.234	08-Feb-11	17:37	4327	7278			Stober
55599.500	07-Feb-11						Hansen
55599.500	07-Feb-11		7674	7719		0.07	Schanne
55600.228	07-Feb-11	17:28	4327	7278			Stober

		WAVELENGTH					
JD	DATE	TIME	START	END	RANGE	DISP	OBSERVER
(2400000+)		(UT)	(A)	(A)	(A)	(A/pixel)	
55599.246	06-Feb-11	17:54	4285	7115	2830	0.1	Buil
55598.500	06-Feb-11						Barbotin
55598.244	05-Feb-11	17:51	4285	7115	2830	0.1	Buil
55597.284	04-Feb-11	18:49	4285	7115	2830	0.1	Buil
55596.500	04-Feb-11						Ribeiro
55596.292	03-Feb-11	9:00	6540	6690	150	0.12	Mauclaire
55594.446	01-Feb-11	22:42 7	675	7726		0.13	Leadbeater
55593.267	31-Jan-11	8:24	4327	7277			Stober
55592.235	30-Jan-111	7:39	4327	7277			Stober
55591.344	29-Jan-11	20:16	7675	7726		0.13	Leadbeater
55589.500	28-Jan-11						Garrel
55590.272	28-Jan-11	18:32	7675	7726		0.13	Leadbeater
55588.308	26-Jan-11	19:23	7675	7726		0.13	Leadbeater
55587.279	25-Jan-11	18:42	4285	7115	2830	0.1	Buil
55586.500	25-Jan-11						Garrel
55586.237	24-Jan-11	17:41	4285	7115	2830	0.1	Buil
55585.282	23-Jan-11	8:46	4285	7115	2830	0.1	Buil
55583.274	21-Jan-11	8:35	4285	7115	2830	0.1	Buil
55583.313	21-Jan-11	19:30	7675	7726		0.13	Leadbeater
55582.313	20-Jan-11	19:31	4285	7115	2830	0.1	Buil
55581.285	19-Jan-11	18:50	6530	6690	160	0.12	Mauclaire
55581.410	19-Jan-11	21:50	4285	7115	2830	0.1	Buil
55581.267	19-Jan-11	18:24	7675	7726		0.13	Leadbeater
55580.237	18-Jan-11	17:42	7675	7726		0.13	Leadbeater
55579.317	17-Jan-11	19:36	4285	7115	2830	0.1	Buil
55578.500	17-Jan-11						Garrel
55579.283	17-Jan-11	18:48	7675	7726		0.13	Leadbeater
55577.500	16-Jan-11						Desnoux
55577.500	16-Jan-11						Barbotin
55578.289	16-Jan-11	18:56	7675	7726		0.13	Leadbeater
55577.230	15-Jan-11	17:31	4285	7115	2830	0.1	Buil
55576.343	14-Jan-11	20:14	6530	6690	160	0.12	Mauclaire
55576.249	14-Jan-11	17:59	4285	7115	2830	0.1	Buil
55575.289	13-Jan-11	18:56	4285	7115	2830	0.1	Buil
55573.500	12-Jan-11						Garrel
55571.254	09-Jan-11	8:06	4285	7115	2830	0.1	Buil
55571.345	09-Jan-11	20:17	7675	7726		0.13	Leadbeater
55568.337	06-Jan-11	20:05	7675	7726		0.13	Leadbeater
55567.448	05-Jan-11	22:45	675	7726		0.13	Leadbeater
55563.378	01-Jan-11	21:04	6520	6680	160	0.12	Mauclaire
55562.500	01-Jan-11						Garrel
55556.356	25-Dec-10	20:33	4285	7115	2830	0.1	Buil
55502.399	01-Nov-10	21:35	4342	7297			Stober
55494.370	24-Oct-10	20:53	4551	7696			Stober
55491.349	21-Oct-10	20:23	4551	7696			Stober
55484.334	14-Oct-10	20:01	4559	7695			Stober

			WAVELENGTH				
JD	DATE	TIME	START	END	RANGE	DISP	OBSERVER
(2400000+)		(UT)	(A)	(A)	(A)	(A/pixel)	
54405.458	31-Oct-07	22:59	6464	6630		0.38	Schanne
54388.418	14-Oct-07	22:02	6432	6562		0.38	Schanne
54380.458	06-Oct-07	23:00	6455	6626		0.38	Schanne
54224.365	03-May-07	20:46	6480	6651		0.38	Schanne
54175.416	15-Mar-07	21:59	6520	6604		0.38	Schanne
54174.403	14-Mar-07	21:41	6531	6615		0.38	Schanne
54115.320	14-Jan-07	19:41	6342	6605		0.38	Schanne
54092.344	22-Dec-06	20:15	6376	6654		0.38	Schanne
54055.477	15-Nov-06	23:27	6347	6627		0.38	Schanne
54016.488	07-Oct-06	23:43	6394	6661		0.38	Schanne
54000.542	22-Sep-06	01:01	6393	6669		0.38	Schanne
53987.628	09-Sep-06	03:04	6380	6640		0.38	Schanne
53858.437	02-May-06	22:29	6377	6651		0.38	Schanne
53845.424	19-Apr-06	22:10	6407	6630		0.38	Schanne
53833.412	07-Apr-06	21:53	6406	6661		0.38	Schanne
	13-Mar-06	21 47	6397	6663		0.38	Schanne
53807.368	12-Mar-06	20:50	6399	6652		0.38	Schanne
53768.408	01-Feb-06	21:48	6490	6715		0.38	Schanne
53766.383	30-Jan-06	21:12	6367	6611		0.38	Schanne
53759.354	23-Jan-06	20:30	6422	6666		0.38	Schanne
53715.496	10-Dec-05	23:54	6389	6627		0.38	Schanne
53674.472	30-Oct-05	23:20	6506	6748		0.38	Schanne
53502.446	11-May-05	22:42	6329	6591		0.38	Schanne
53501.447	10-May-05	22:43	6305	6569		0.38	Schanne
53482.444	21-Apr-05	22:39	6337	6607		0.38	Schanne
53472.438	11-Apr-05	22:31	6332	6603		0.38	Schanne
53462.456	01-Apr-05	22:57	6428	6689		0.38	Schanne

Overview (Jeff)
Since the last newsletter a lot has been happening.

Robin reports a serious illness in his family which has required travel away from home and thus he is unable to provide a Spectroscopy Report for this Newsletter. We all wish the best for Robin and his family.

On 04 February 2011 Robin reported that strong winds destroyed Robin's Three Hills Observatory. It appears the equipment have survived and he is in the process of rebuilding the observatory, with a stronger connection tot he foundation. To provide continued coverage of the K I 7699 Å line Robin has loaned his modified grating to Lothar Schanne in Germany, Lothar has agreed to monitor the K I 7699 Å line while Robin gets his observatory rebuilt.

I have included some recent spectra submitted to the Campaign. For full resolution versions please see:

http://www.threehillsobservatory.co.uk/astro/epsaur_campaign/epsaur_campaign_spectra_table.htm

here on the main campaign website http://www.hposoft.com/EAur09/Robin.html

Hydrogen Alpha

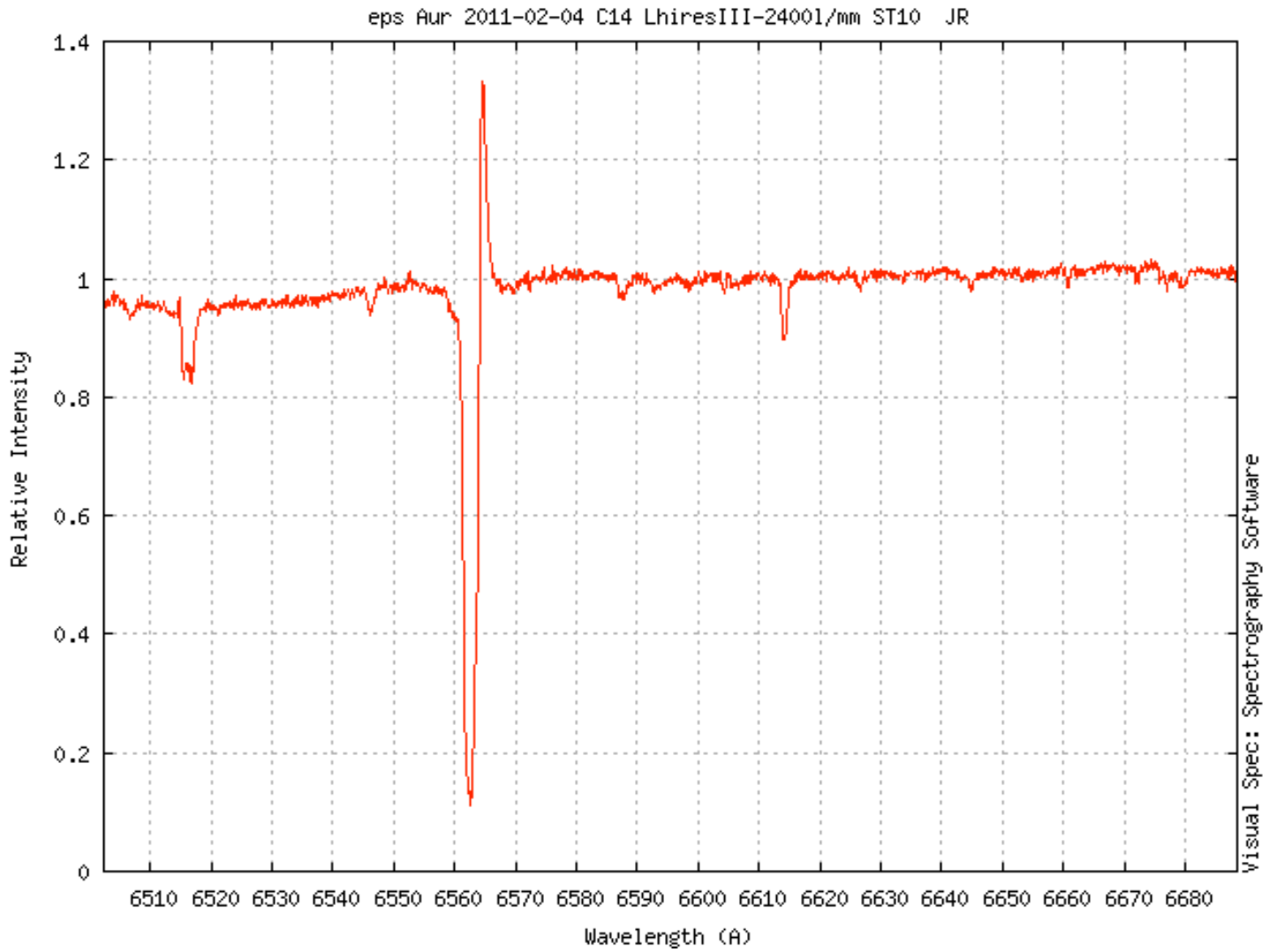


Figure 1
Hydrogen alpha spectra on 04 February 2011
by
Jose Riberio

As can be seen in Figure 1 the hydrogen alpha red horn has become very large. Both the red and blue horns were not present for most of the eclipse. Toward the last half of totality the red horn started growing.

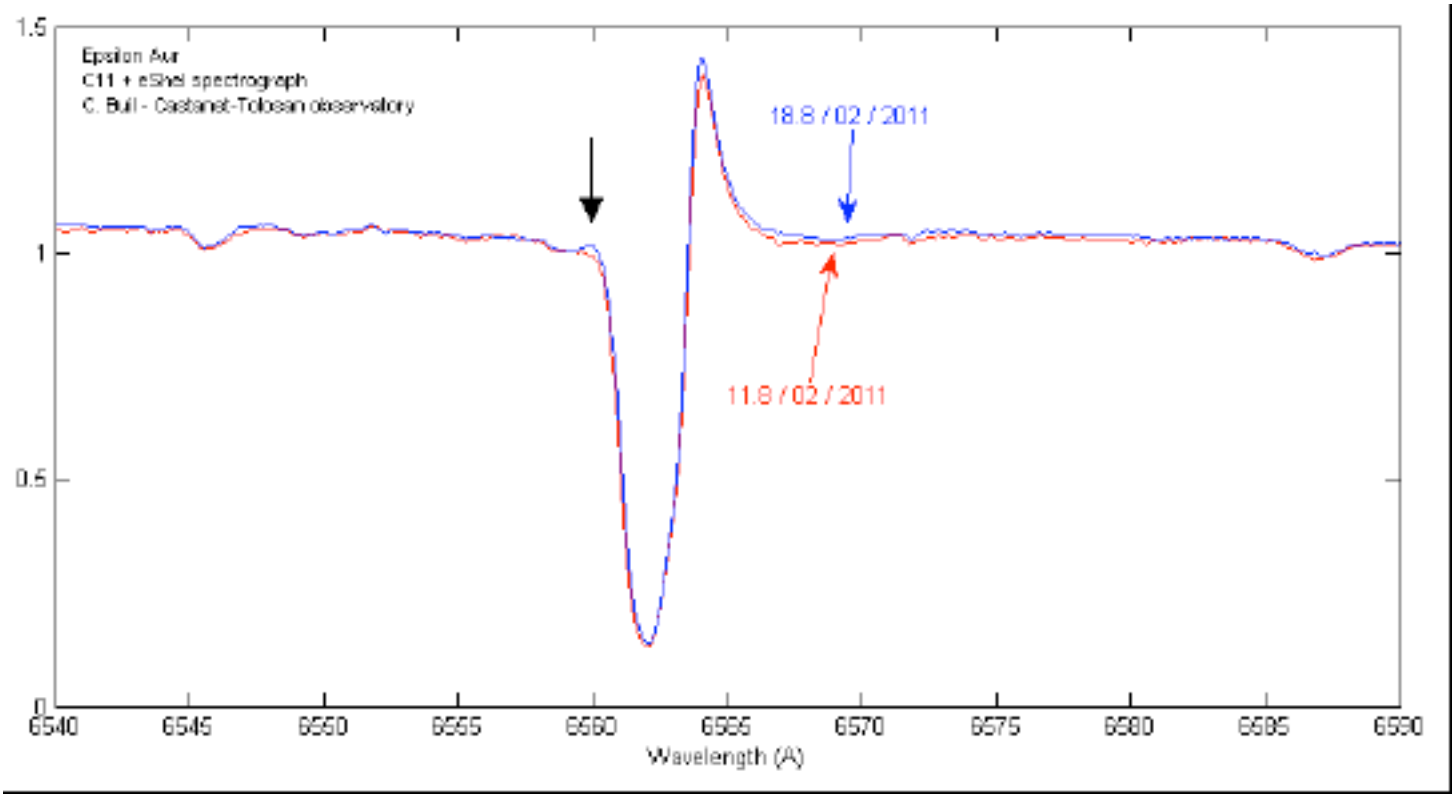


Figure 2
Hydrogen alpha spectra on 11 and 18 February 2011
Christian Buil, Castanet-Tolosan Observatory
eShel Spectrograph

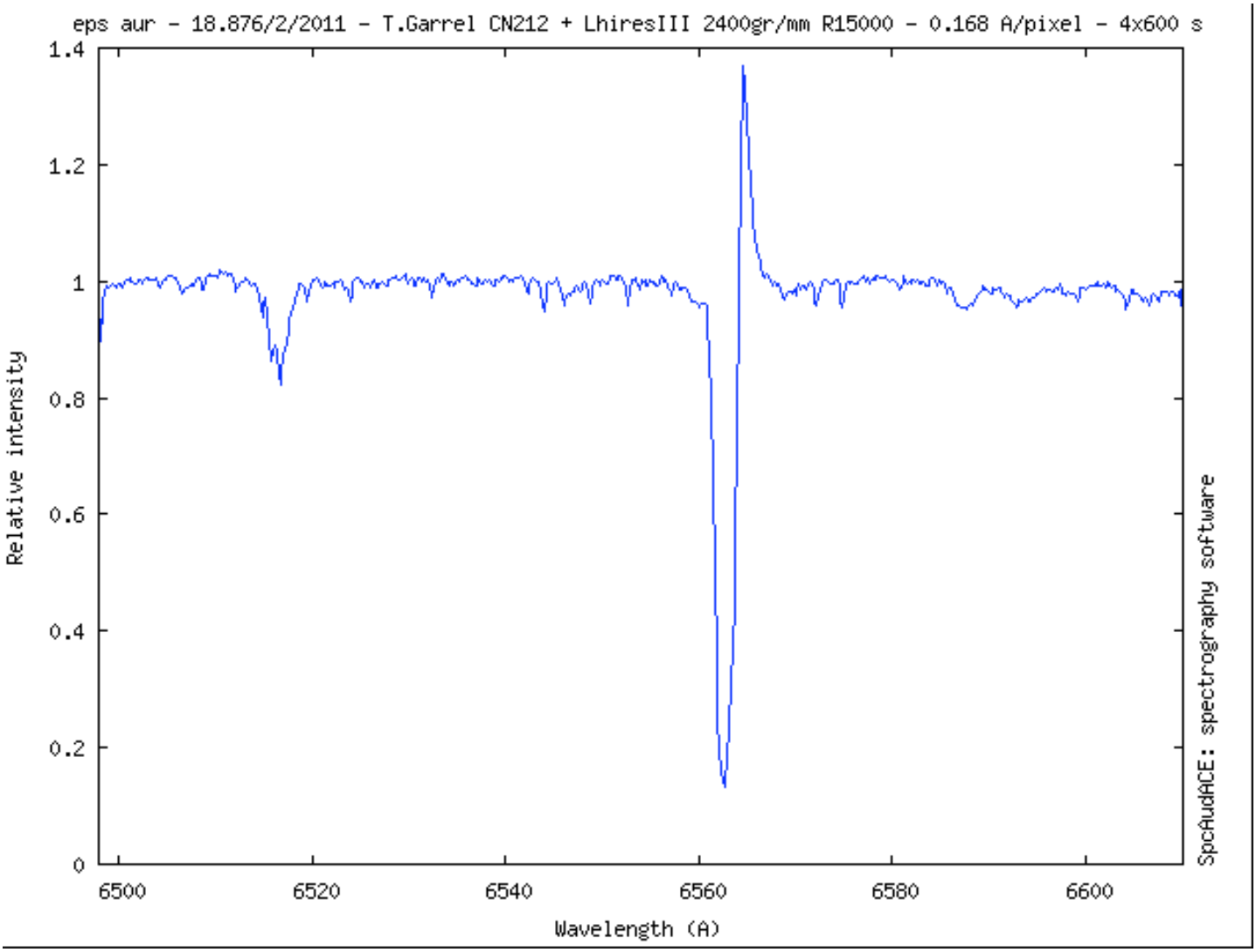


Figure 3
Thierry Garrel
18 February 2011

Sodium D Line

On 11 February 2011 Dr. Bob posted the following request:

Spectroscopy alert!!! Na D emission core expected!!!

Can anyone check for the appearance of core emission in the sodium D lines? By this phase last eclipse, Barsony et al noticed same?

http://adsabs.harvard.edu/abs/1986PASP...98..637B

THEY REPORT THE APPEARANCE OF A SODIUM EMISSION BUMP STARTING AT RJD 45,711, WHICH TRANSLATES TO THIS WEEK: 55,601 - see their FIGURE 3C & TABLE 4. There was a long gap between spring 83 and winter 84 observations, so Na D core emission may have started some while ago.? Thanks for your report on this.

Dr. Bob Stencel, U of Denver Astronomy

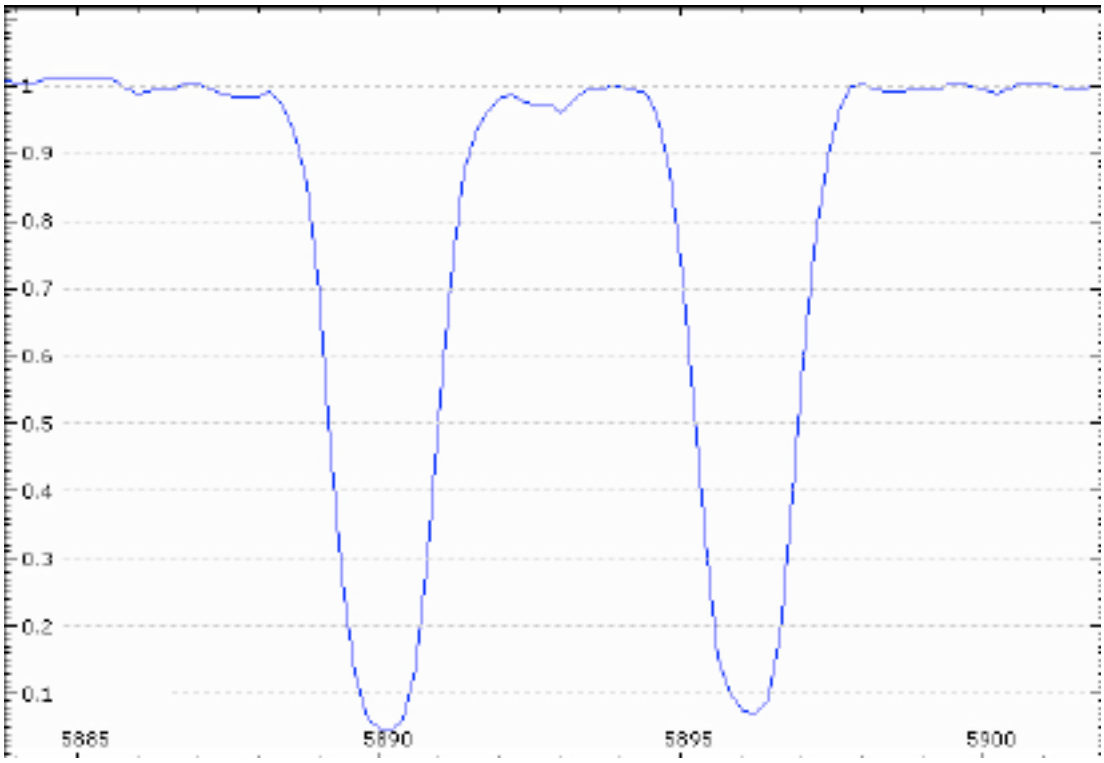


Figure 4
Na D lines mean of spectra
taken 30/31 January 2011 and 07/08 February 2011
by
Stober

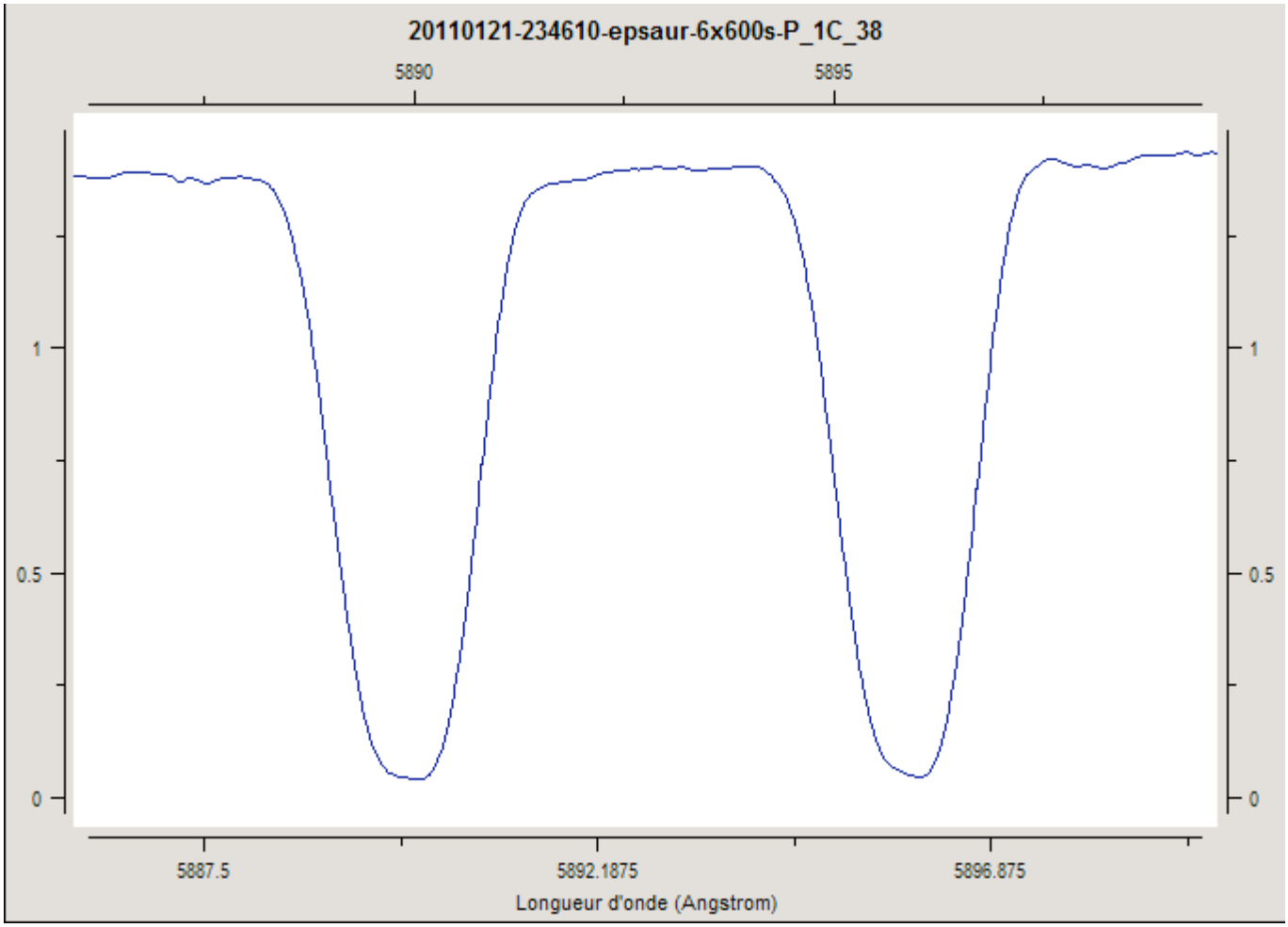


Figure 5
Na D lines 21 January 2011
by Theirry Garrel
Using an eschel spectrograph

R9000 RMS cal 0.01Å small bump, fill in, in the bottom of the red line sodium doublet and symmetric profiles

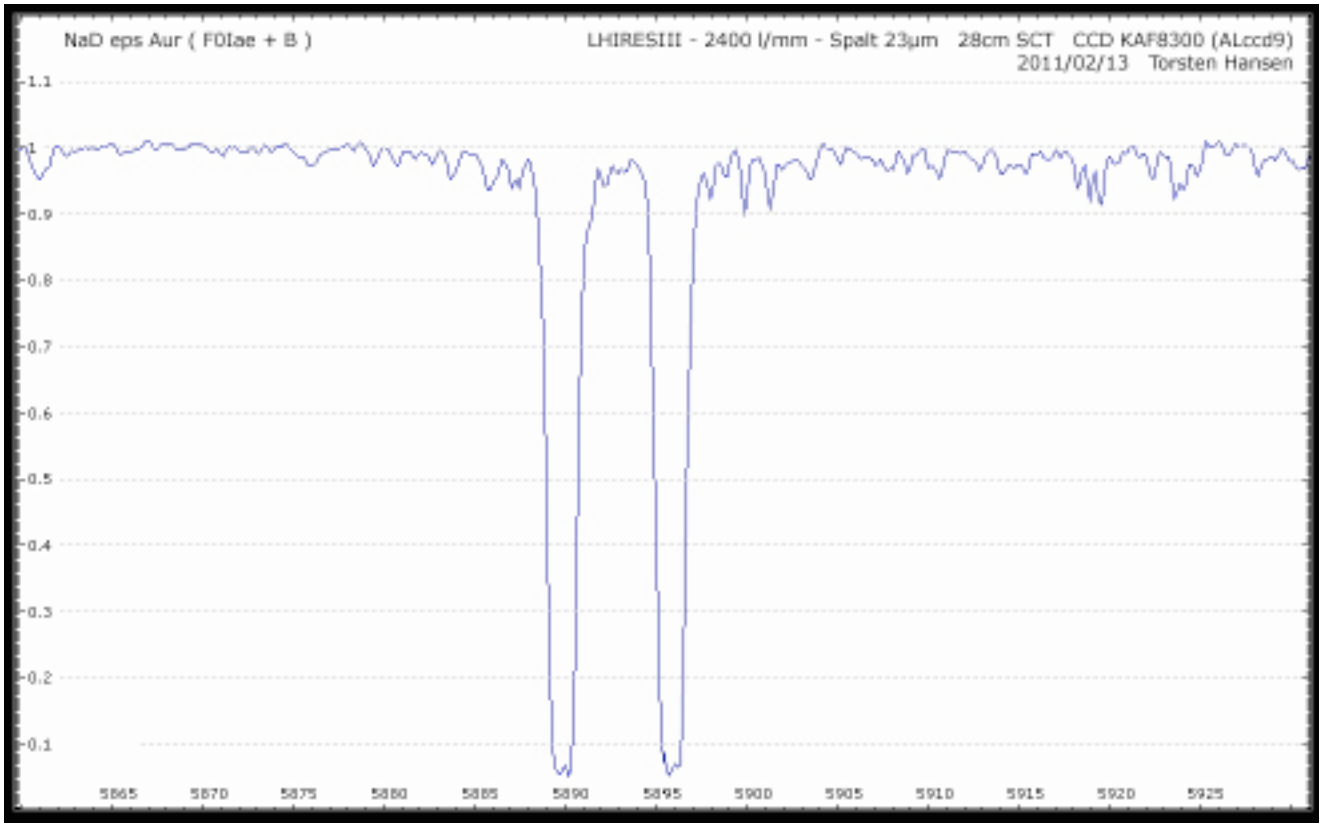


Figure 6
Na D lines 13 February 2011
by Torsten Hansen
Using a Lhires III with 2400 l/mm grating

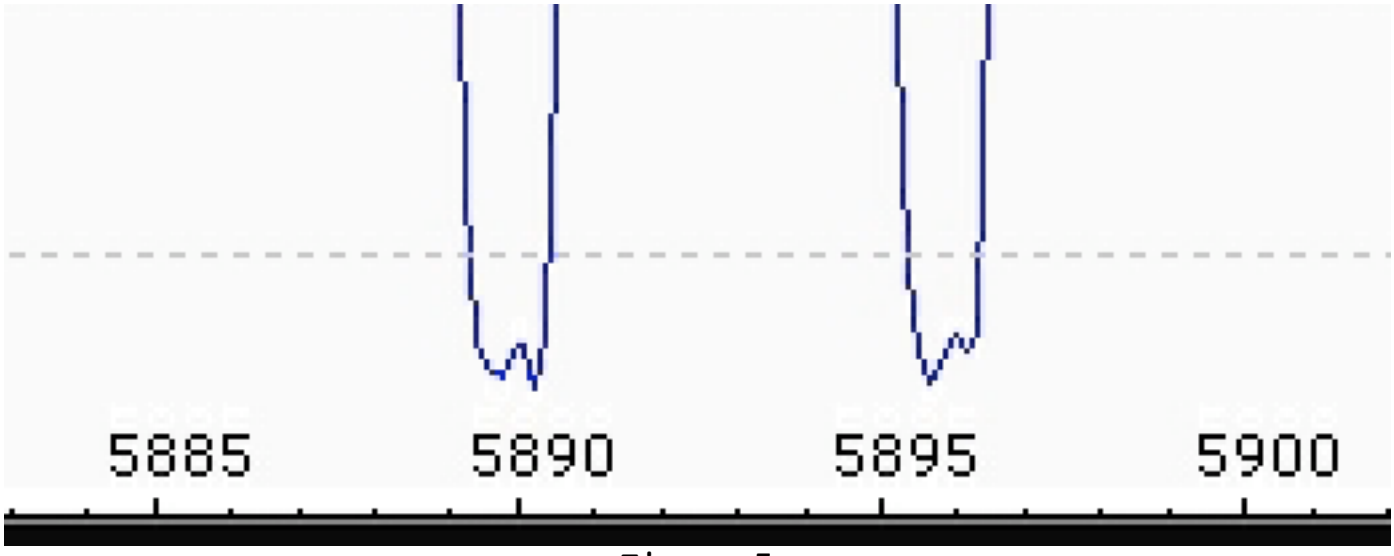


Figure 7
Na D lines 13 February 2011
by Torsten Hansen - Magnified

Stanley Gorodenski provides us a report from his Bill Hills Observatory in Dewey, Arizona USA

On the nights of January 17 and 25 and February 12, 2011 UT spectra were obtained of Epsilon Aurigae in the Na D lines region.

Location:
Blue Hills Observatory
Dewey, Arizona USA
Latitude +34° 31.89'
Longitude -112° 18.11'

Observer:
Stanley A. Gorodensk
Stanlep@commspeed.net

Equipment:
16" Meade LX200R
ST-8XME
LHIRES III 2400 g/mm
Integration Time: 10 mins

Processing on Spectra:
Heliocentric Corrected
Telluric Water Lines Removed

January 17, 2011 spectra:
Integration started at 5:14:35 UT
Julian Date = 2455578.718461

January 27, 2011 spectra:
Integration started at 4:44:27 UT
Julian Date = 2455586.697535

February 12, 2011 spectra:
Integration started at 3:55:31 UT
Julian Date = 2455604.663553

ENTIRE SODIUM D LINES REGION FOR EACH DATE

Note that the 5853.4 Angstroms absorption line is split near the center of the line on January 25th, and is only partially split on the red side of the line on February 12th. This will be discussed in the section on this absorption line.

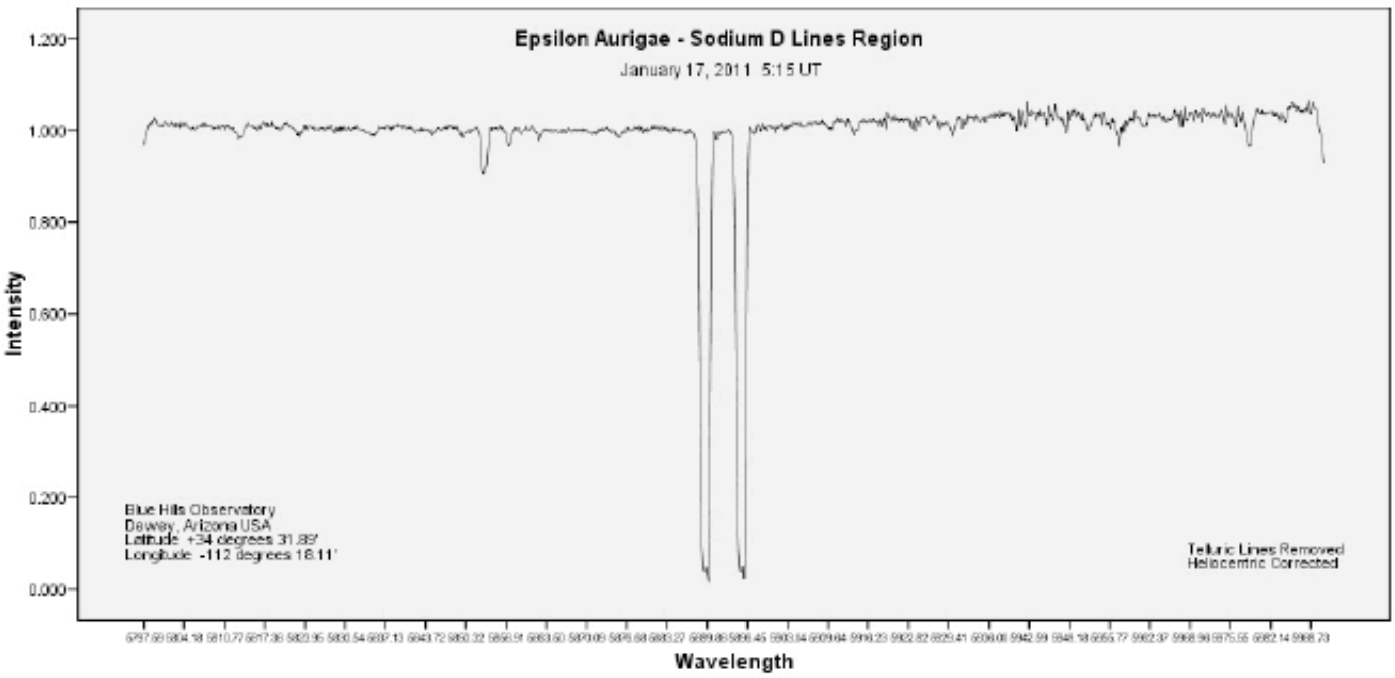


Figure 8
January 17, 2011,
RJD 5578.7185

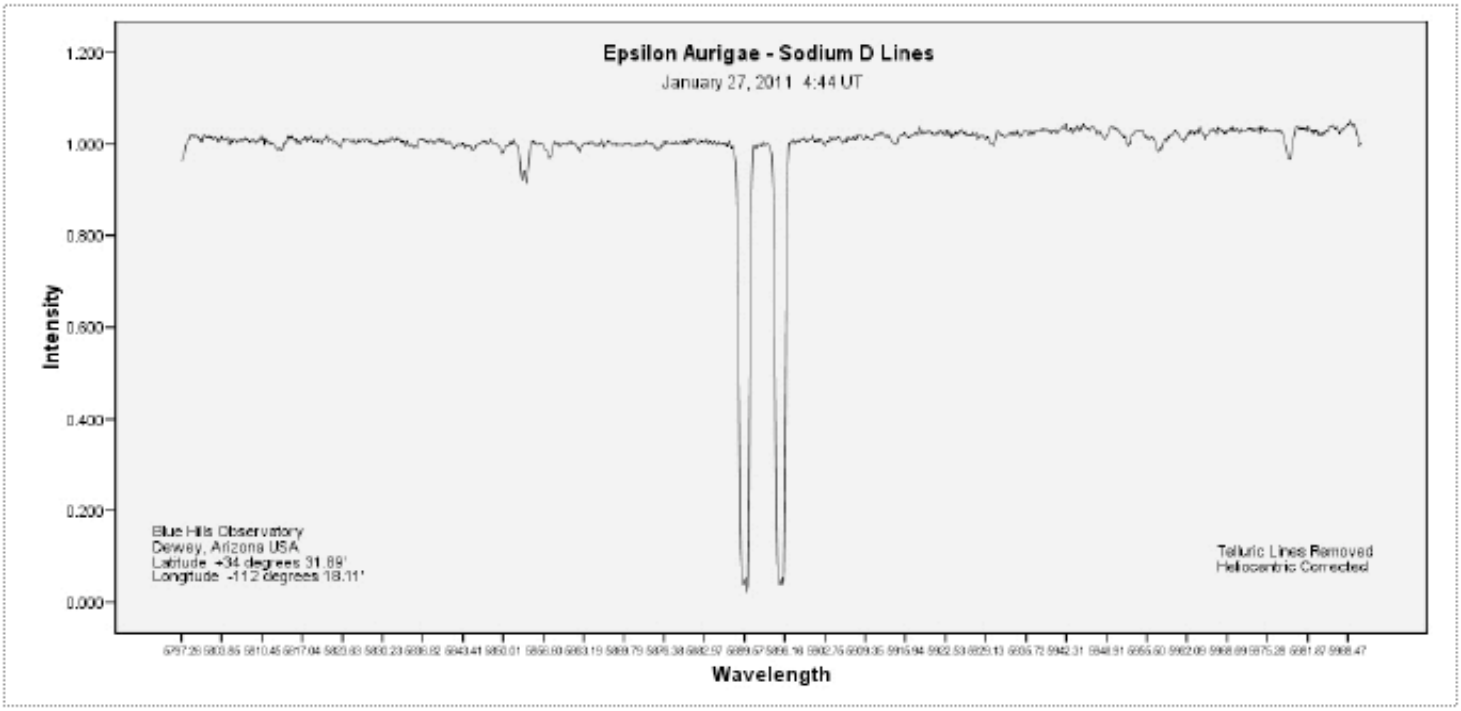


Figure 9
January 27, 2011 ,
RJD 5586.6975

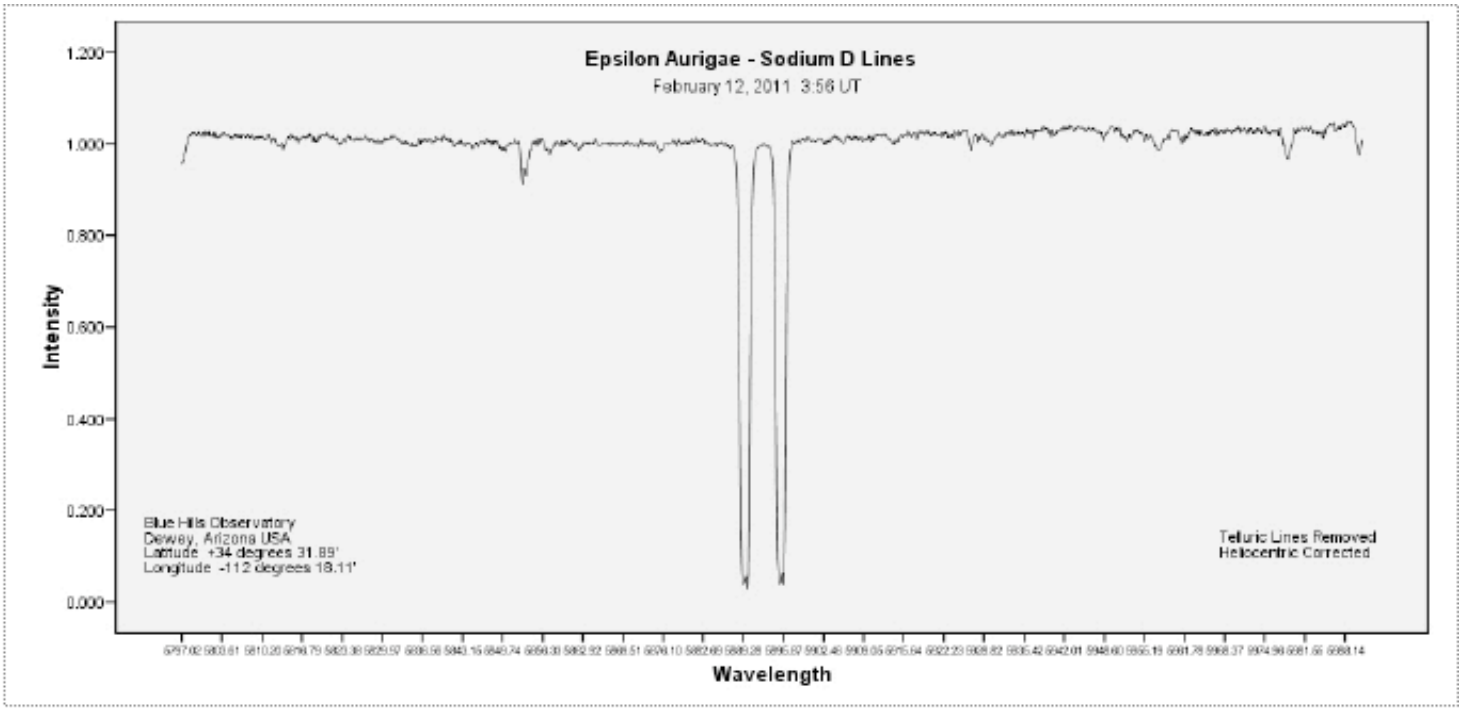


Figure 10
February 12, 2011
RJD 5604.6635

SODIUM D LINES FOR EACH DATE SHOWING MORE DETAIL

These graphs are a subset, an enlargement, of the previous ones. I like to see data points in graphs like these and so each data point is represented by a small circle. Let me know if this is objectionable. I do not know what to look for regarding unusual activity. There appears to be a hint of humps, but this may just be noise because nothing stands out as being real obvious. Some of the noise, and maybe even hint of humps, at the continuum may just be my inadequacy of removing telluric lines. I'm still learning. Also, even though the telluric lines agreed with my neon calibrations, I cannot be certain the calibration is right on because I am still learning. Overall, it appears not much has happened during the time span these spectra represent. I have one graph for each spectrum because I am not able yet to stack spectra in one graph with the graphics package I have. I will be working to remedy this shortcoming.

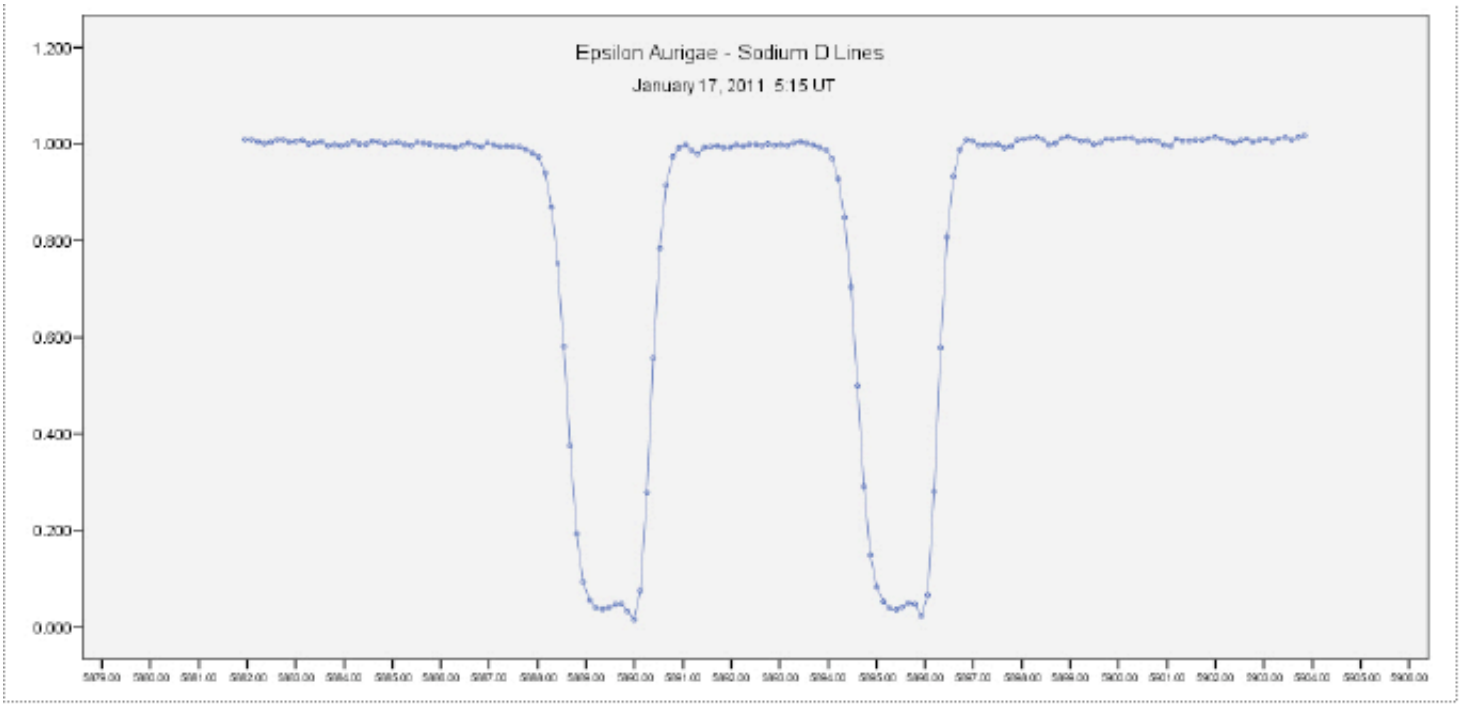


Figure 11
January 17, 2011,
RJD 5578.7185

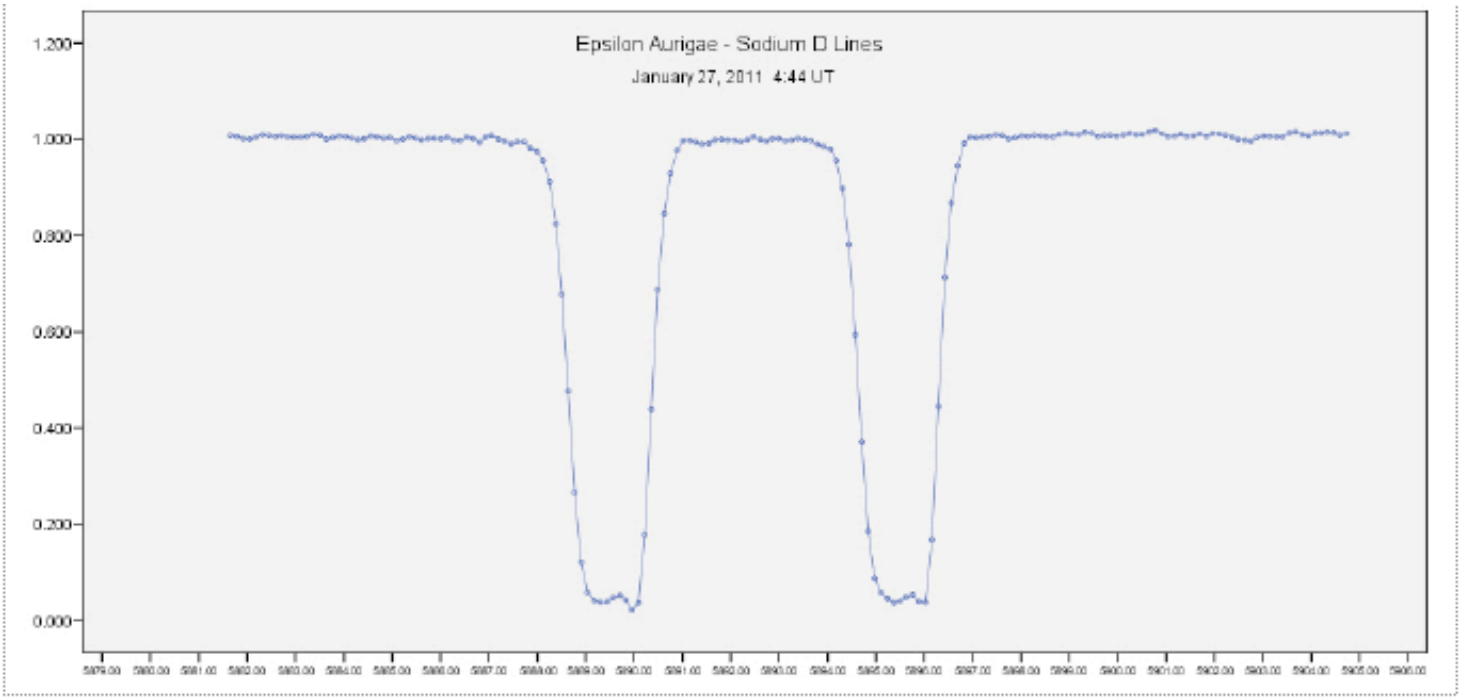


Figure 12
January 27, 2011
RJD 5586.6975

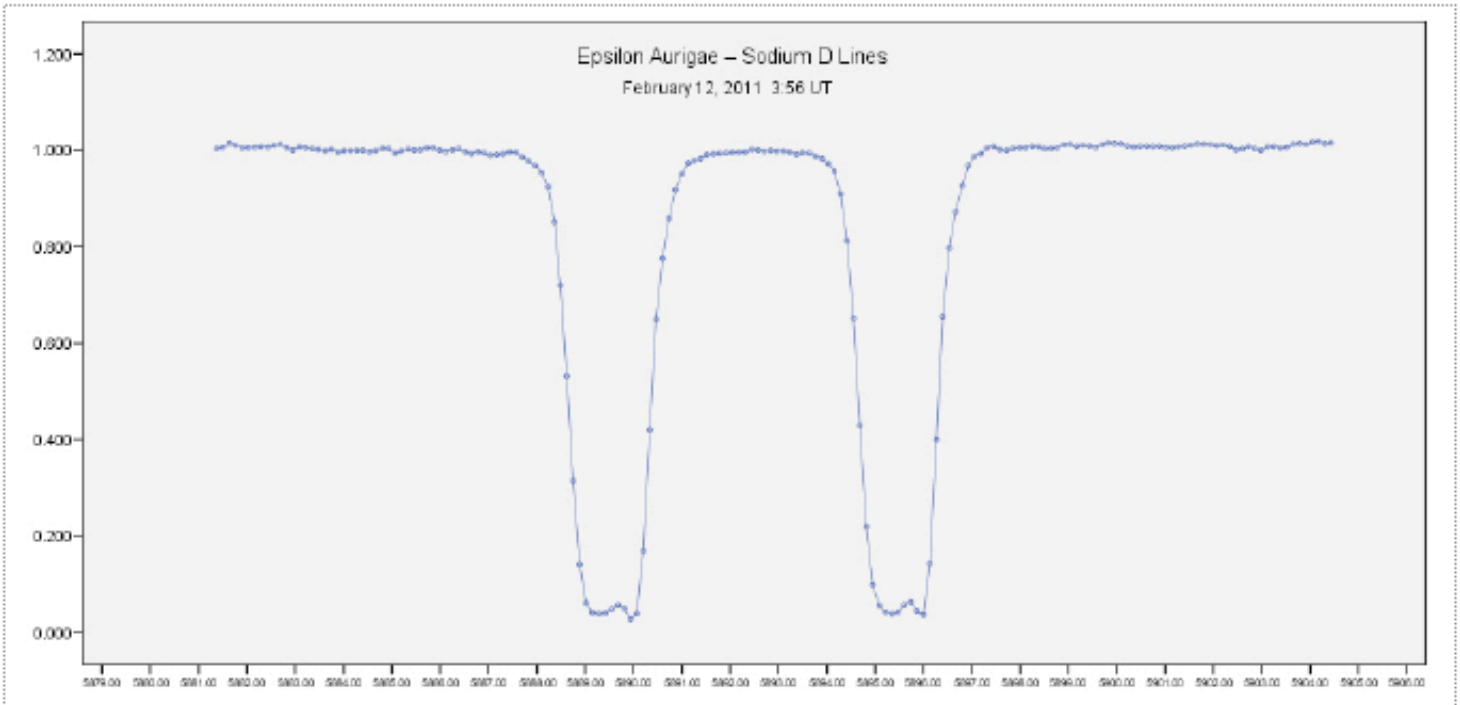


Figure 13
February 12, 2011
RJD 5604.6635

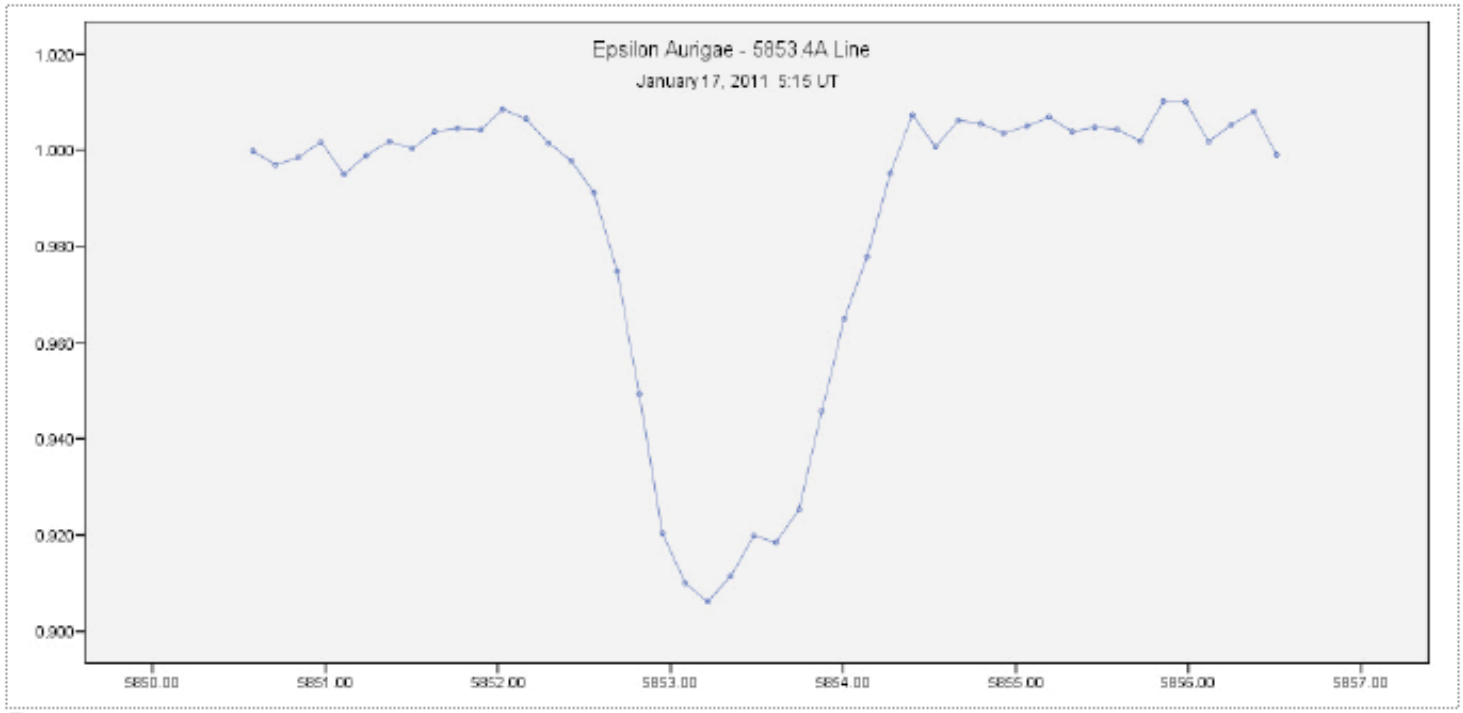


Figure 14
January 17, 2011,
RJD 5578.7185

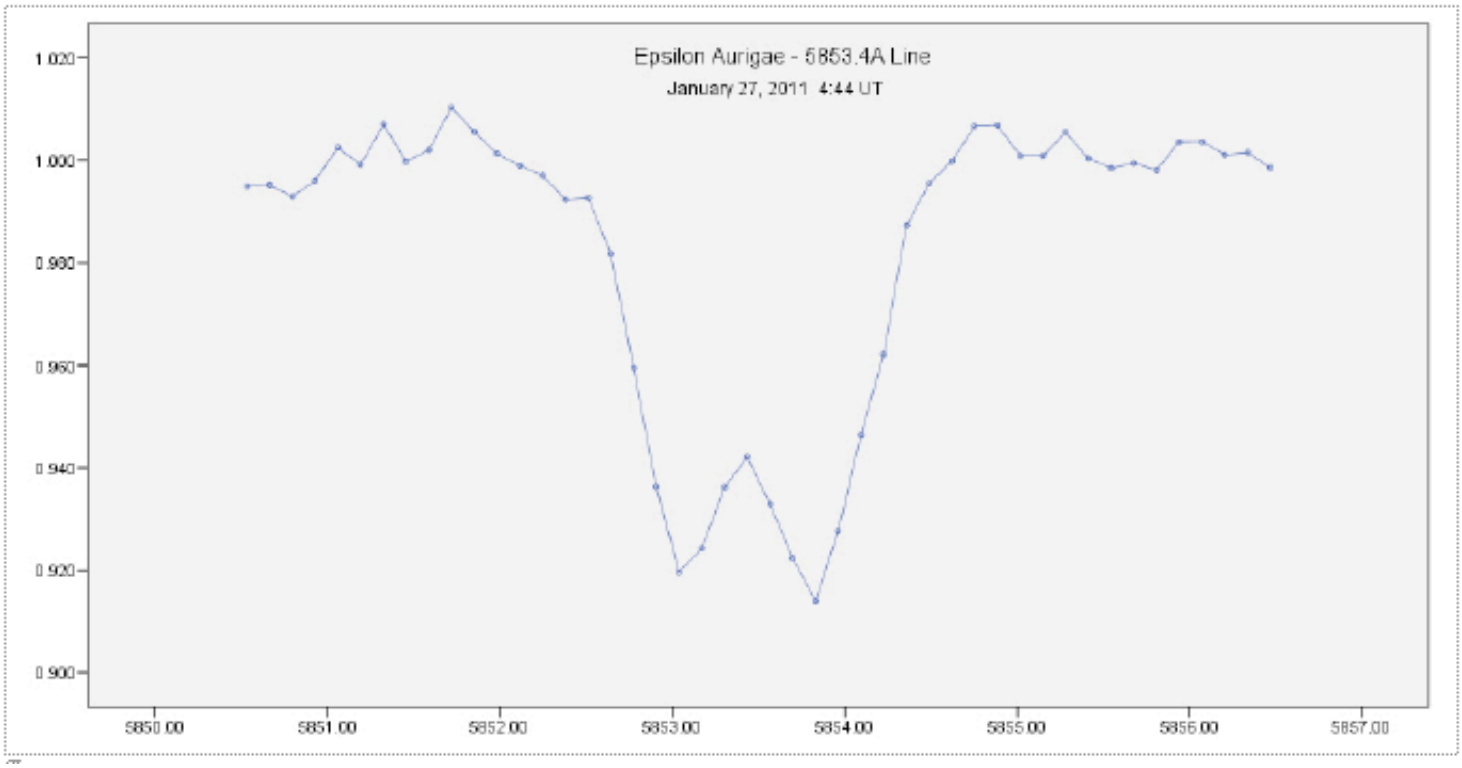


Figure 15
January 27, 2011 ,
RJD 5586.6975

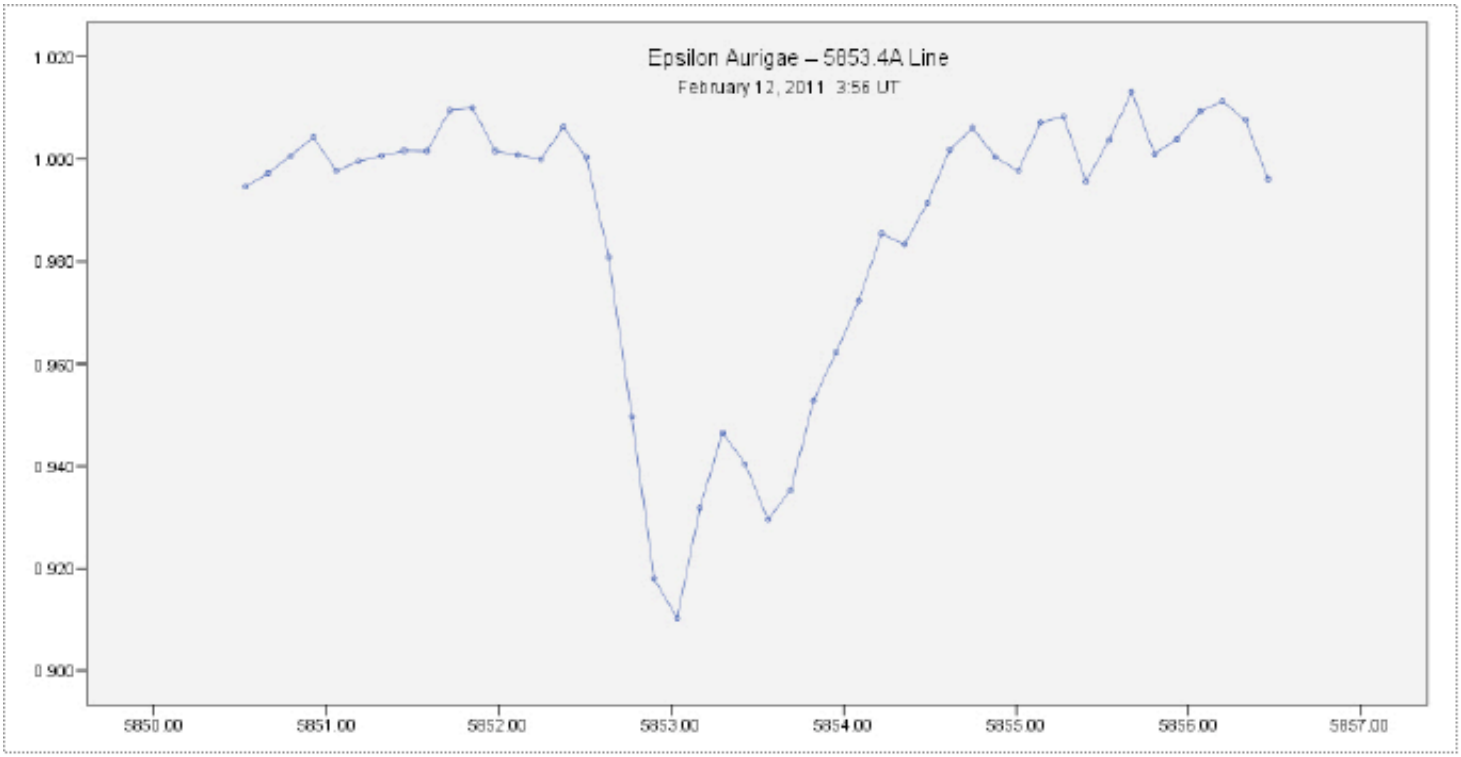


Figure 16
February 12, 2011
RJD 5604.6635

Looking at these spectra, one is tempted to speculate that there is an evolutionary aspect to the split line. On January 17th it can just barely be seen on red side of the line, although it could be argued it is just noise. On January 27th, ten days later, the split has reached nearly the center of the absorption line. On February 12th, 15 days later, it once appears on the red side of the absorption line, but it is more advanced than on January 17th. One could speculate there is a periodicity to this split of less than a month, maybe three weeks, but this is pure speculation.

I looked at the spectra I took last year, 2010, and the three this year to see if it had occurred previously and if there was any pattern. The double asterisks are there to tag the dates the line was split.

	February 13, 2010:	No Split	(808,578)
	February 19, 2010:	No Split	(822,569)
	February 26, 2010:	No Split	(797,562)
**	March 4, 2010:	Line is Split	(814,565)
	March 13, 2010:	No Split	(802,546)
**	March 28, 2010:	Line Split very Slightly	(840,525)
	May 8, 2010:	No Split	(885,515)
	August 5, 2010:	No Split	(818,427)
**	September 24, 2010:	Line Split Slightly	(776,520)
	October 8, 2010:	No Split	(784,517)
	November 4, 2010:	No Split	(793,486)
**	December 7, 2010:	Line is Split	(771,444)
	December 25, 2010:	No Split	(764,475)
**	January 17, 2011:	Line Split very Slightly	(762,499)
**	January 27, 2011:	Line Split	(759,455)
**	February 12, 2011:	Line Split	(762,472)

From this it does not appear there is a long term pattern. However, all three spectra I took this year had split lines which is atypical compared to last year.

There is a possibility that the split lines this year are from a hot pixel that I just happen to hit each time I take a spectrum. To see if this is a possibility, I obtained the x and y coordinates of the center of the D1 and D2 lines from CCDSOFT. These are the values in parentheses. The width of the 5853.4A absorption line is about 17 pixels, and I normally optimize the spectrum over about 26 pixels. The first value in the parentheses for January 17, January 27, and February 12 of this year are well within the range of the width of the absorption line. The y values for these dates, the second value in the parentheses, are within the approximate 26 pixels I optimize on. Hence, for these three dates it is possible I am seeing a hot pixel. However, the other four dates that had split lines are well outside this range. It is possible I am seeing hot pixels on these other dates.

Potassium I 7699 Å Line EW

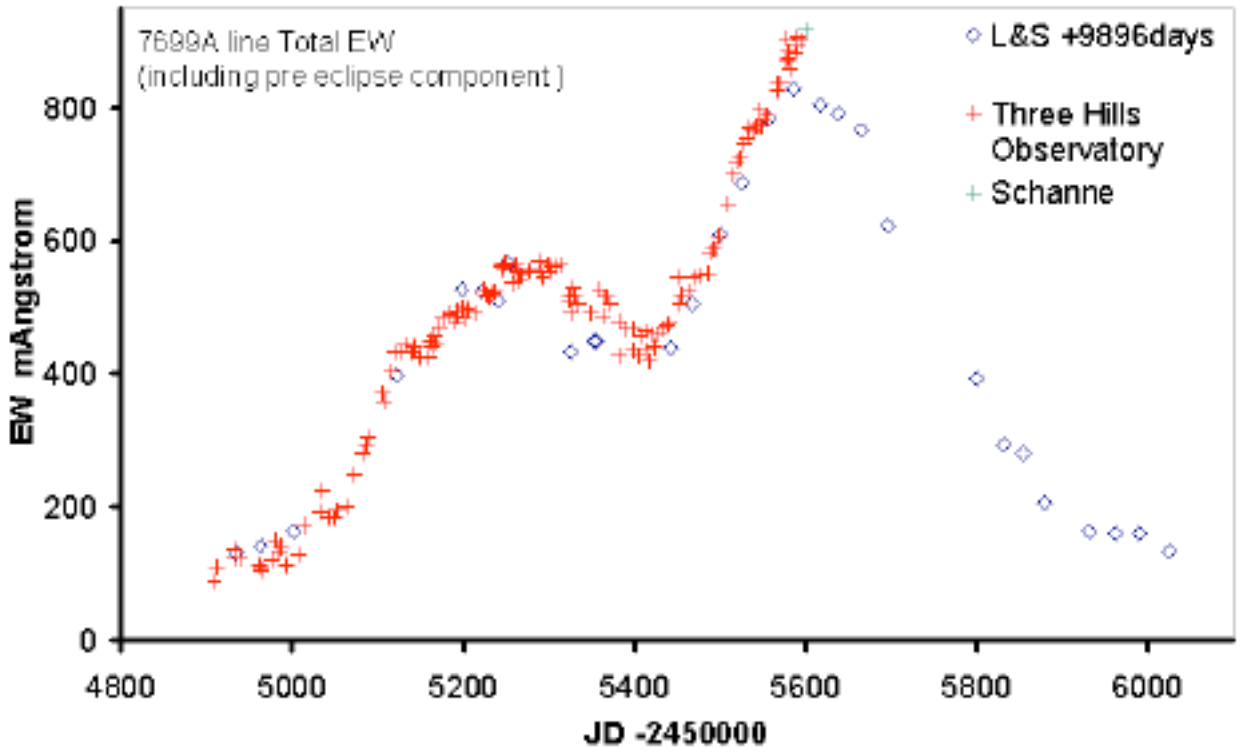


Figure 17
Graph of the Equivalent Width (EW) of the K I 7699 Å Line

Robin Leadbeater has provided Figure 7 which shows the EW of the K I 7699 Å line through the eclipse. Lothar Schanne has provided the most recent data. What is interesting is compared to the last eclipse (Lambert and Swayer) where the EW started decreasing at this point of the eclipse, the current eclipse shows a continued large increase in EW.
The red emission wing returned rapidly on 19th November 2010 (RJD 55520) and there are now reports 18th February 2011 (RJD 55613) that the blue wing has started to reappear.

William Ketzeback
Apache Point Observatory, Sunspot, New Mexico, USA
Bill provides us with a summary and explanation of his AAS Poster Paper.
To see the pdf version of Bill's Poster Paper go to the Campaign web site or directly to:

http://www.hposoft.com/EAur09/AAS217PPImages/05.pdf

At Apache Point Observatory at Sunspot, NM we have been observing Epsilon Aurigae with the ARC 3.5 meter telescope on a scheduled observing plan of twice per week since February, 2009. An optical echelle spectrograph (R = 31,500) and an NIR cross dispersing spectrograph (R=3500) have been our instrumentation for this project. We have primarily been monitoring changes in line strength and profiles for absorption features prior to and during the eclipse. Our poster discusses the highlights of this observing program. We choose a small select number of important lines in our poster. The Sodium Doublet (Na D1 & D2), Hydrogen Alpha, Potassium I (K I) at 7699A, and NIR spectra from 0.95 to 1.8 microns.

The two portions of the poster that received the most attention was the monitoring of the change in line profiles (and radial velocities) of Na D1 & D2 as well as the changes of H-alpha. Much discussion was raised to how unusual the RV curve for sodium appears and what the possible physical explanation could be. The wildly changing absorption of the H alpha line surrounding mid eclipse confirmed a wind feature off the B star and perpendicular to the eclipsing body discussed in Steve Howell, et al.'s poster discussing UV observations just three panels away. This cold wind had a red and blue shifted components greater than 200 km/s at mid eclipse. A tail of material seems to follow the cone since the blue shifted component post mid eclipse raises to as high as 275 km/s.

Figure 1 shows the observing cadence of our project on the ARC 3.5m telescope. Observing date verses wavelength coverage. We are using two different instruments. Our primary instrument is an echelle spectrograph (ARCES in green) wavelength coverage 3800 Angstroms to 1.06 microns. The second instrument is a cross dispersing near infrared (NIR) spectrograph covering J,H,K wavelengths simultaneously from 0.95 microns to 2.4 microns shown in red. The are breaks in this wavelength coverage is due to low atmospheric transmission in a few regions of the NIR.

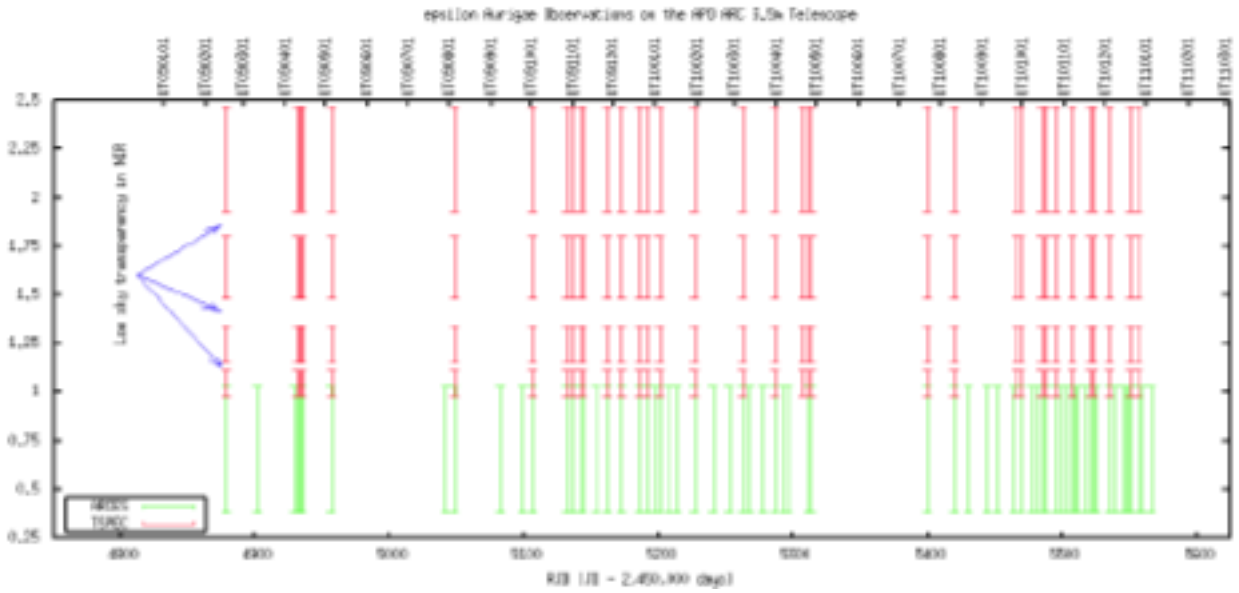


Figure 1

Figure 2 shows select regions of the optical and NIR out-of-eclipse spectrum with some of the strongest absorption lines annotated. The F star is surrounded by a gas ring containing elements such as Sodium (Na), Potassium I (K I), Iron (Fe), Magnesium (Mg), and others. These elements appear to have the same rest velocity as the F star. Hydrogen Alpha (6563 Angstroms) and its associated red and blue emission wings are an exception showing dynamical changes out-of-eclipse. Several nights within a few months prior to first contact were averaged together to produce this plot.

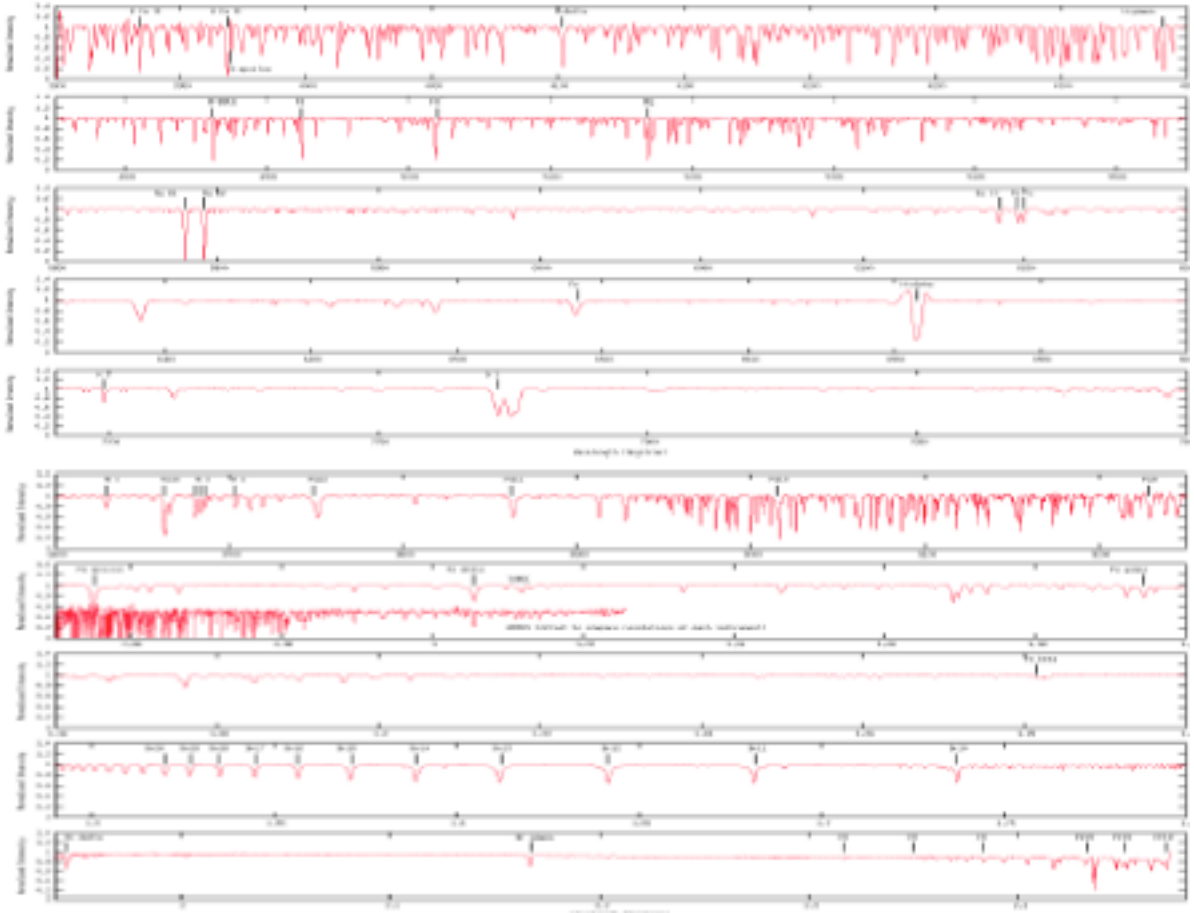


Figure 2

Figure 3 shows the morphological changes in the Sodium doublet (Na D1 & D2) lines from out of eclipse (red), first contact to mid eclipse (blue), mid eclipse (lavendar), mid eclipse to the end of 2010 (brown).

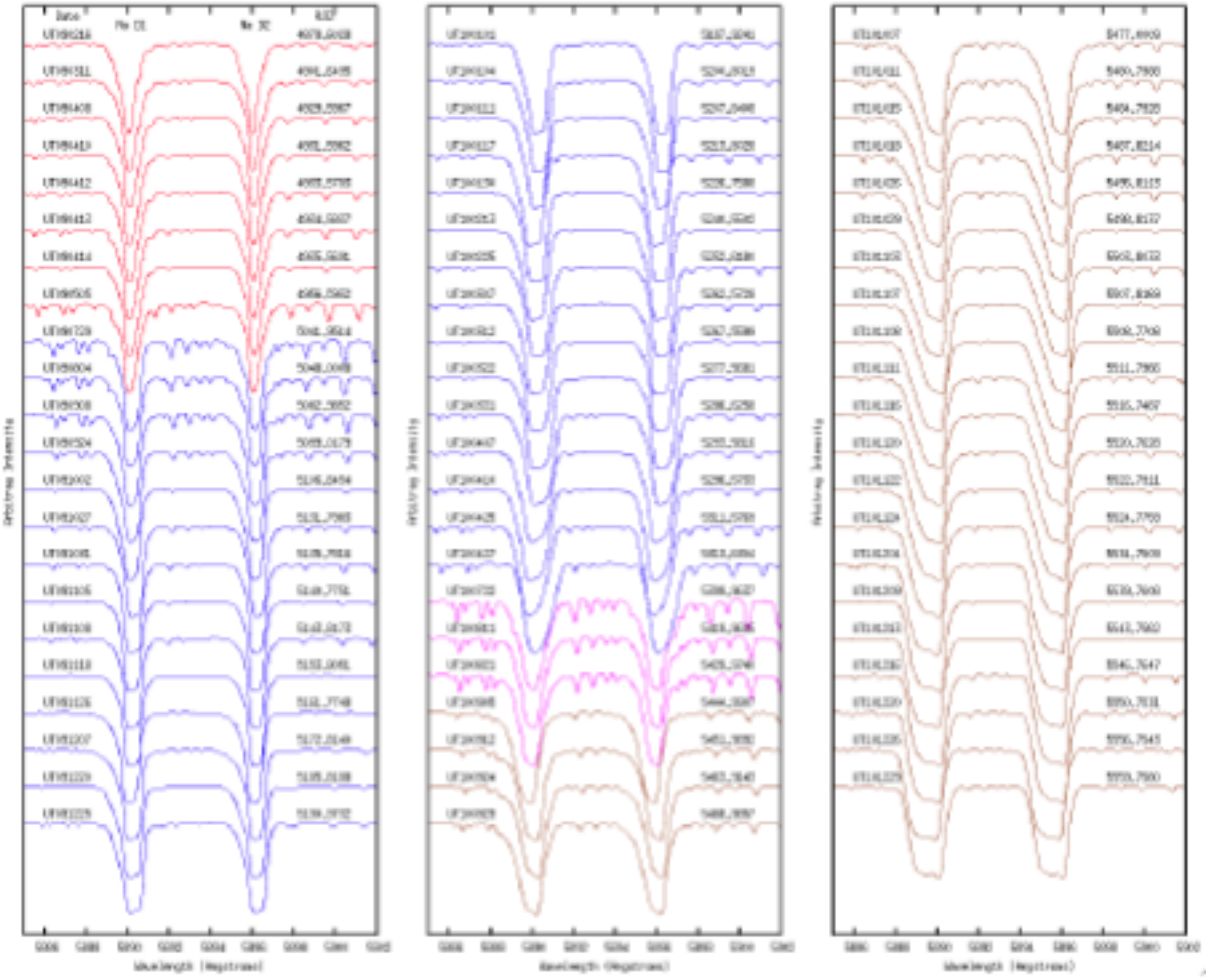


Figure 3

Figure 4 attempts to understand the changing profiles of the sodium doublet lines in radial velocity space. One set of analysis averages the out-of-eclipse sodium lines at 5889.95A and 5895.92A. This averaged line profile (pre-eclipse component) is then subtracted from later lines. The residual line profiles equivalent widths and radial velocities are then measured. The resulting radial velocities are plotted against the observed date to produce this plot. The Na D1 & D2 deblended points on the plot are produced by subtracting a Gaussian profile from the out of eclipse portion of the blended absorption line and the resulting line profile equivalent width and radial velocity is then measured. The shape of the graph is peculiar because before epsilon Aurigae disappears behind the sun (after RJD 5330) the radial velocities of the sodium doublet lines suggest that material near the center of the eclipsing body may be orbiting at a higher velocity near the B star than near the outer edges (like planets in our solar system). However, as epsilon Aurigae emerges again from behind the sun the radial velocities seem to decrease (change from extreme positive to large negative value) with radial distance from the mid eclipse point. It is frustrating that we could not have made measurements of these lines through mid-eclipse. Also noteworthy is as the end of 2010 came to a end the bottom of the Na D1& D2 lines appear to flatten out. This feature has been noted post midpoint in the literature since the 1937 eclipse.

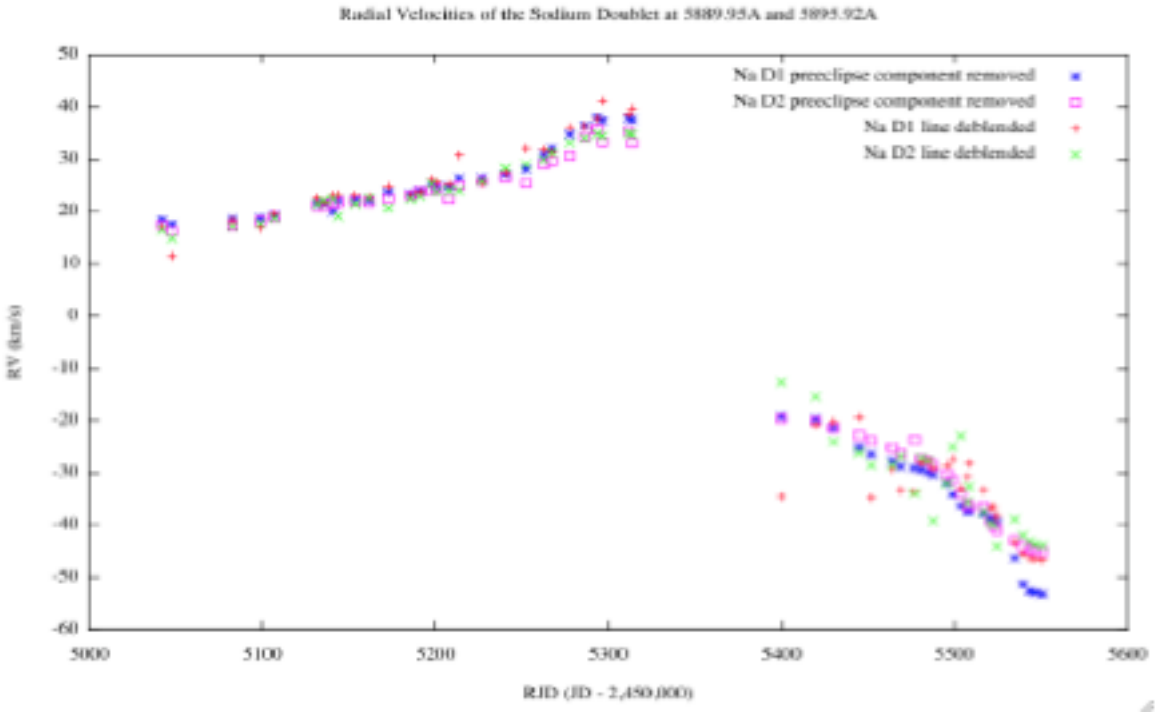


Figure 4

Figure 5 shows the morphology of the Hydrogen Alpha (6563A) line. Originally, I wasn't terribly interested in studying the H-alpha line of epsilon Aurigae because of all the attention it was getting from others following the eclipse. However after talking with others at the meeting there are some interesting things to see in this line other than the red and blue emission wings. Shortly after RJD 5240 the red emission line disappears and within a month the blue absorption starts to eat away at the blue wing. At mid-eclipse the absorption feature at first glance is a total mess with broad emission line features in the red and blue. This feature is confirmation of recent UV spectroscopy of a solar wind off the B star. (AAS Poster, S.Howell, 2011) This cold wind is a cone of hydrogen being ejected perpendicular to the disk. The wind is always present (but invisible to us) however as it passes through our line of sight to the F star it is illuminated (like fog in a flashlight beam). We are seeing a bowshock of the component of the wind that is closest to us. The size of the cone becomes evident as we move into 2011 observations and this wind component starts to disappear. The 'bump' that appears starting in September, 2009 at 6563 angstroms is currently believed to be a low emission line feature from the disk that is normally overshadowed by the continuum from the F star, it is only after the start of the eclipse event when the absorption of the disk is strong enough that this feature becomes visible. (AAS Poster, R.Leadbeater, 2011)

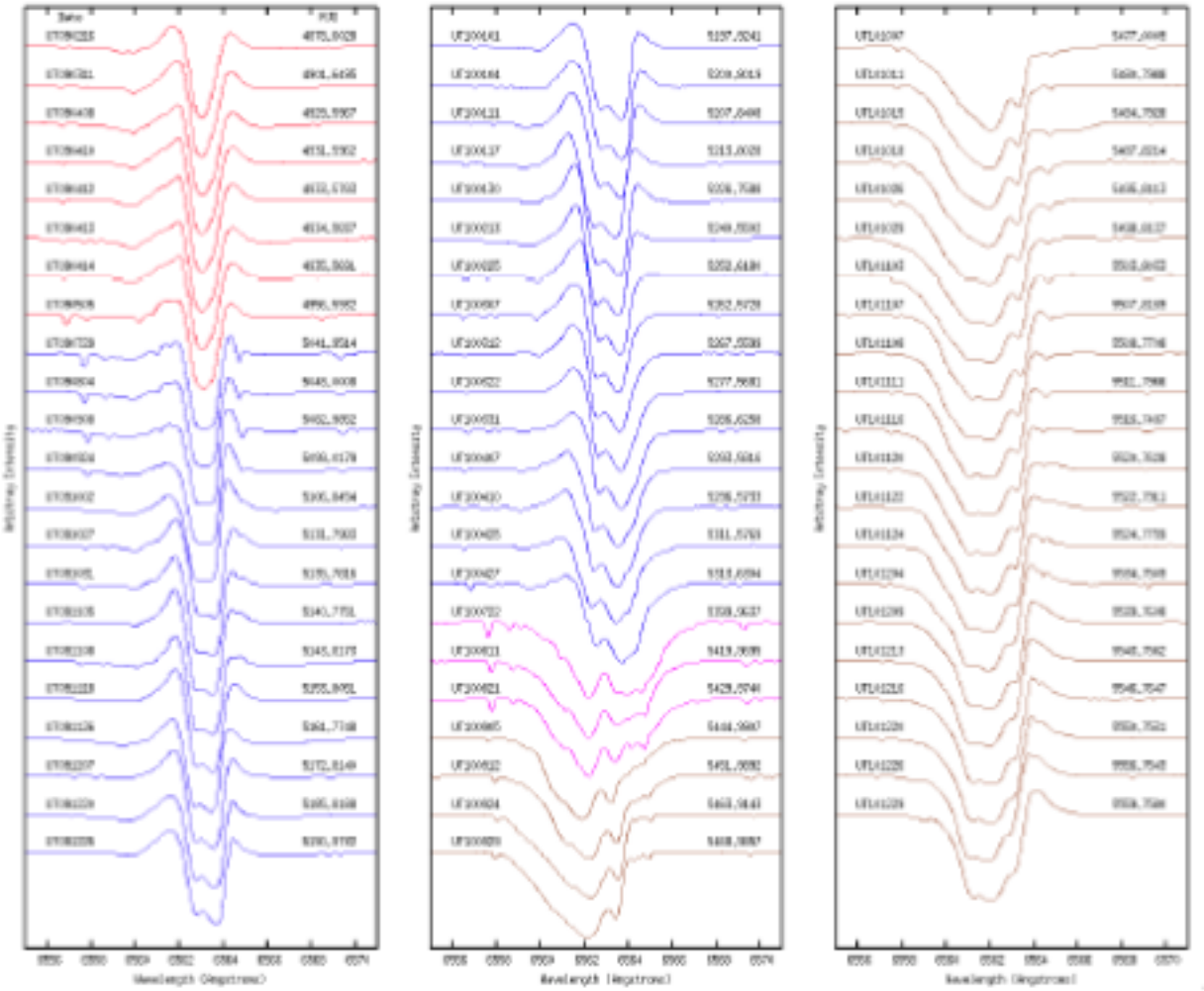


Figure 5

Figure 6 shows the changes in the line profiles of potassium I (KI 7699Å) with similar color coding to Figures 3 and 5.

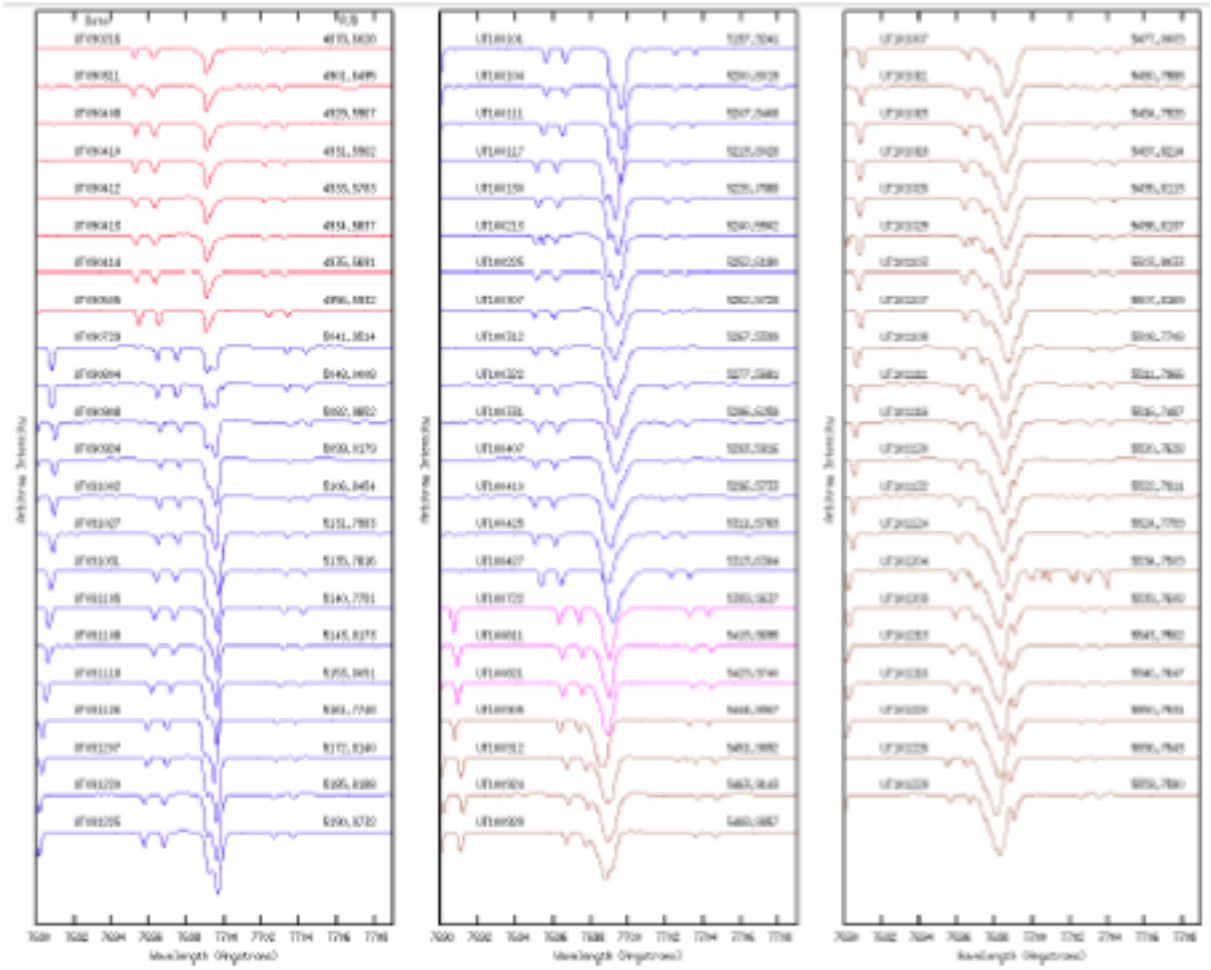


Figure 6

Figure 7 similarly to the techniques described for Figure 4 several methods to analyze the portion of the line profile for only the eclipsing body were employed to measure the radial velocity of the KI 7699 Å line. No correction was made for system velocity as was mentioned in Robin Leadbeater's excellent poster. Several fits were experimented to try to find the midpoint of the eclipse.

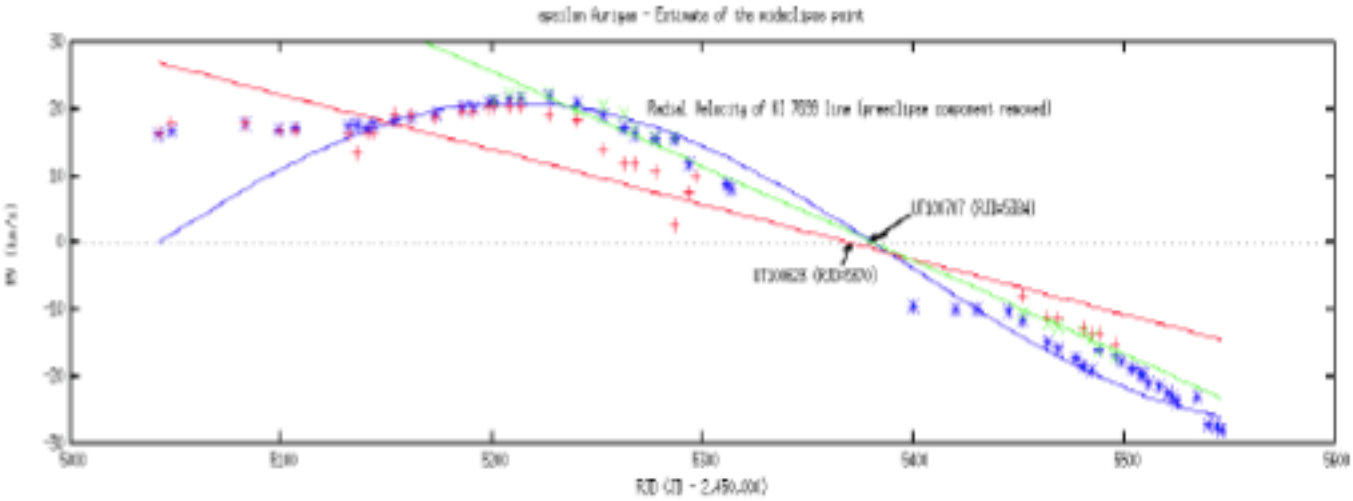


Figure 7

Figure 8 shows the morphology of the NIR lines out to 1.8 microns. There was no evidence in our data to the appearance post mid-eclipse of the CO (2.3 micron) line as was described in the last eclipse by Hinkle and mentioned by R. Stencel in his AAS poster. Some note worthy items about our data. Although our echelle spectra has a resolving power of R=31,500, the velocity resolution of this spectrograph is about 9 km/s. We have yet to do a proper telluric correction of our data.

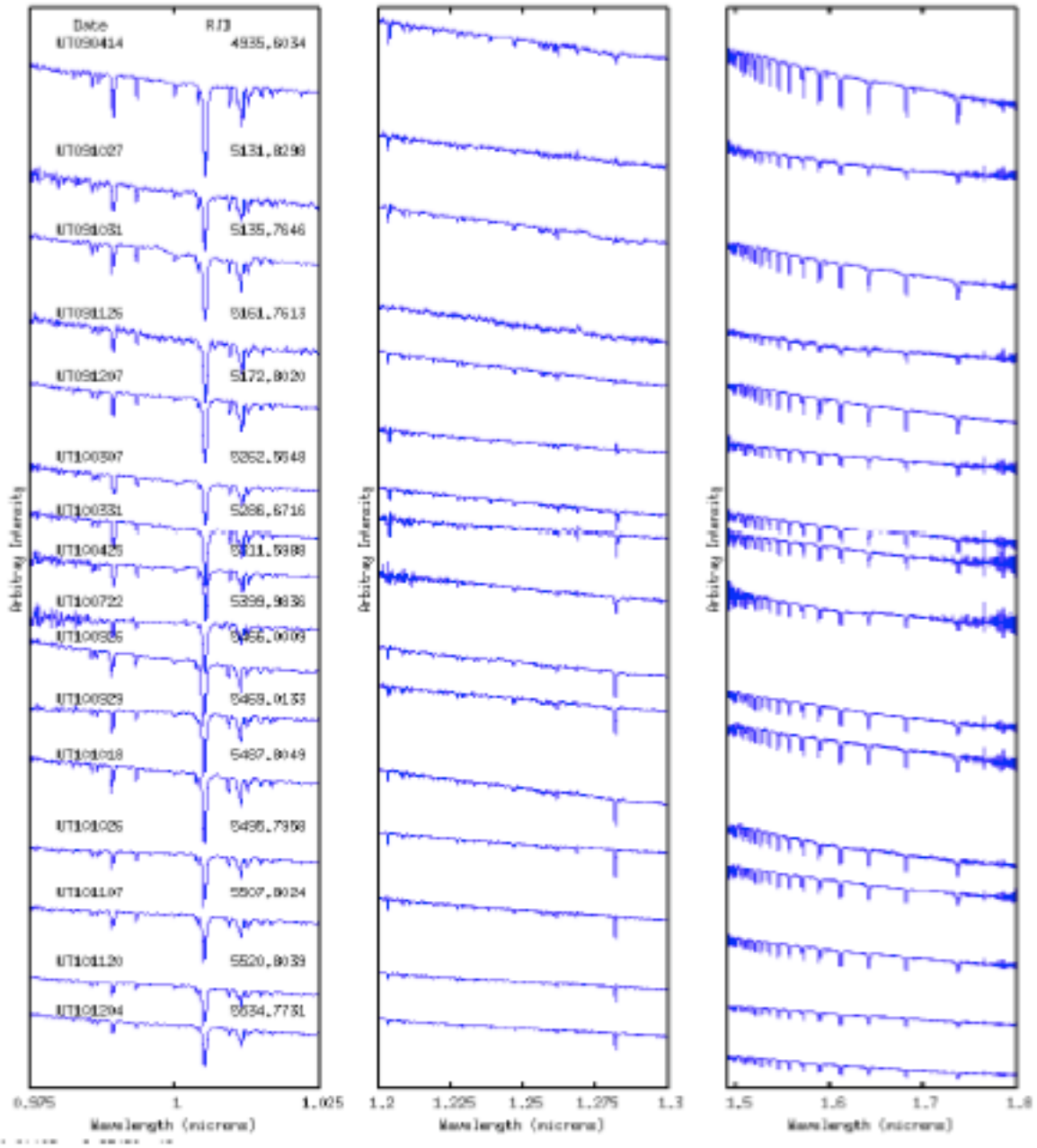


Figure 8

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From Dr. Bob

Dr. Robert E. Stencel . Co- Editor
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https://twitter.com/epsilon_Aurigae

Before summarizing some facets of the Seattle meeting of the American Astronomical Society and commenting on the remaining weeks of eclipse, it seems timely to report a recent cyber-conversation between Edward Guinan (Prof. Astronomy, Villanova University) and Bradley Schaefer (Prof. Astronomy, Louisiana State University). Both have studied ancient star catalogs for years as part of their research into the lives of stars. Ed Guinan, in a 1990 conference paper reported the following records for visual estimates of epsilon Aurigae over time:

Era	Visual mag.	Sources
130BC	4 - 3	Hipparchus Catalog (Ptolemy)
960CE	4	Al Sufi
1437	4	Ulugh Beg
1590	4	Tycho

The same 4th mag was recorded during 1600, 1700 and early 1800. Both Guinan and Bradley indicate that uncertainties of +/- 0.5 mag are likely for these records, suggesting a slim but non-zero chance the star was systematically fainter back when. By the time of Schmidt and Argelander (1880), the value given was 3.3. It seems odd that the ancient catalogs would systematically record the modern eclipse brightness (3.8). Could it be possible that the star was engulfed in extra opacity during the past 2 millennia? If so, what would be the present-day observable consequences? Observers familiar with delta Sco and R CrB have witnessed this kind of behavior, albeit on more rapid time scales.

The 217th meeting of the American Astronomical Society held in Seattle during early January featured a special session of talks and posters about progress with the recent eclipse of epsilon Aurigae.

Ed Guinan provided an historical review of eclipse campaigns, commented on recent orbital solutions by Stefanik and Chadima, and reviewed some historical models for the system.

Jeff Hopkins presented a summary of the campaign and presented the up to date light curves.
The next speaker, John Clover, provided an update on the SMEI instrument monitoring of epsilon Aurigae (and thousands of other bright stars). SMEI is designed to watch coronal mass ejections from the Sun and uses wide angle cameras to gain a nearly all sky view every 103 minutes. Although this instrument like most suffers calibration issues, the composite light curve is impressive despite a few

gaps. Most notable is the argument it has prompted again, concerning the fabled mid-eclipse brightening. The best light curve we have from the 1983 eclipse was generated by Jeff Hopkins, and it shows a pre-mid-eclipse minimum (3.8) near JD 2,445,500, quite consistent with the current pre-mid-eclipse minimum (also 3.8) near JD 2,455,300 or 9800 days later. For both eclipses, the post-mid-eclipse level has been brighter (circa 3.7), giving the impression of a mid-eclipse brightening. Of course, both eclipses have been interrupted by the June solar conjunction, making precise photometry difficult.

The next speaker, Elizabeth Griffin from the Dominion Astrophysical Observatory (DAO), reported on her studies of archival spectroscopic materials, including Mt. Wilson and DAO photographic and newer digital high dispersion work. She reported that her goals include:
(a) to monitor H alpha from different eclipses, to see what repeats - and if anything clearly does NOT repeat then to try to understand what changes can be taking place; and
(b) to study the behaviour of those narrow spikes which appear most prominently during ingress and egress, and (again) to see if their behaviour alters from one eclipse to another. We look forward to learning progress on this.

Next came Bill Ketzeback of Apache Point Observatory and the ARC telescope, where he has been using the optical spectrograph and a near-IR one called TripleSpec to monitor the eclipse. His remarks are presented elsewhere in this newsletter, so we don't need to repeat everything here.

Following him was Brian Kloppenborg of the University of Denver, my graduate student, reporting on the latest high resolution images of the transiting disk obtained at the CHARA Array with the MIRC beam combiner. His own summaries of the dissertation work can be found at www.citizensky.org under the Blog postings, so again no need to be detailed here, except to say these images provide very unique constraints on orbital solutions, and possibly tie-breakers for the distance and component mass problems that have too long been unresolved.

Finally, I spoke about the overall state of the art based on the eclipse to date and thanked all the participants and audience for their continued interest.

Of course, eclipse is not quite over, and some spectroscopic and polarimetric facets are anticipated to persist all year - so observers are still needed!

Interesting Papers

Spectral and photometric analysis of the eclipsing binary epsilon Aurigae prior and during the 2009-2010 eclipse,

by
P. Chadima[1], P. Harmanec[1], P. D. Bennett[2], B. Kloppenborg[3], R. Stencel[3], S. Yang[4],
H. Bozic[5], M. Slechta[6], L. Kotkova[6], M. Wolf1, P. Skoda[6], V. Votruba[6], J.L. Hopkins[7], C. Buil[8], and D. Sudar[5]

submitted to Astronomy & Astrophysics, 2011 Feb.

Abstract:
A series of 353 red electronic spectra (most of them covering the region of 6300 to 6700 Å) from three observatories, secured between 1994 and 2010 and of 171 UBV photometric observations from the phase of the 2010 total eclipse from two observatories were analyzed in an effort to contribute to the understanding of ε Aur, the well known eclipsing binary with the longest orbital period. The main results are:

1) An attempt to disentangle the spectra of both binary components failed but we were able to disentangle the spectrum of telluric lines and a mean spectrum of the F primary. The latter was then compared to a grid of synthetic spectra for a number of plausible values of Te
and log g but no good match could be found. We infer that the observed spectrum corresponds to a low gravity star.

2) We found that the variations of the complex Hα profile prior and during the eclipse can better be understood if a mean disentangled Hα profile from the spectra obtained before the beginning of the eclipse (properly shifted in radial velocity) is subtracted from all eclipse spectrograms. We propose that the dark disk around the invisible component has an extended atmosphere which manifests itself via blue- and red-shifted 'shell' Hα absorptions projected against the F star. A notable finding is that the Hα shell line appeared three years before first contact of the optical eclipse when the system was still almost in elongation.

3) Analyses of radial velocities, central intensities and equivalent widths of several stronger and unblended spectral lines and UBV photometry led to the detection of probably multiperiodic changes during the total eclipse, with a principal period of 66: d21 and a well-defined mutual phase shifts in various studied observables. This finding strongly supports our earlier suggestion that the idea of a central brightening due to a hole in the disk should be abandoned. Although variability on similar time scales is also seen in the spectra and photometry outside the eclipse, including previously published data, we were unable to find a coherent periodicity in these data. This seems to rule out regular stellar pulsations as the cause of these changes.

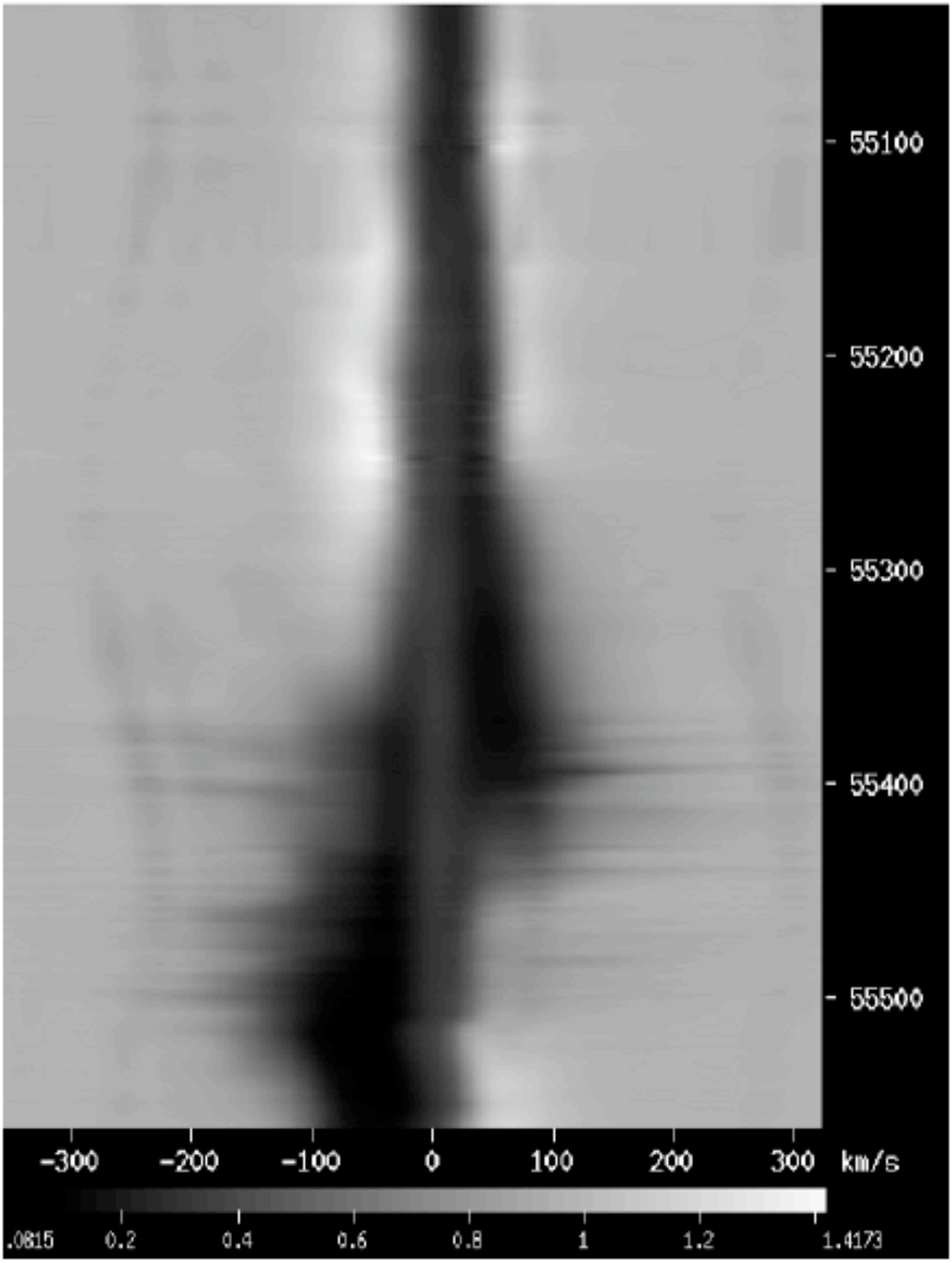


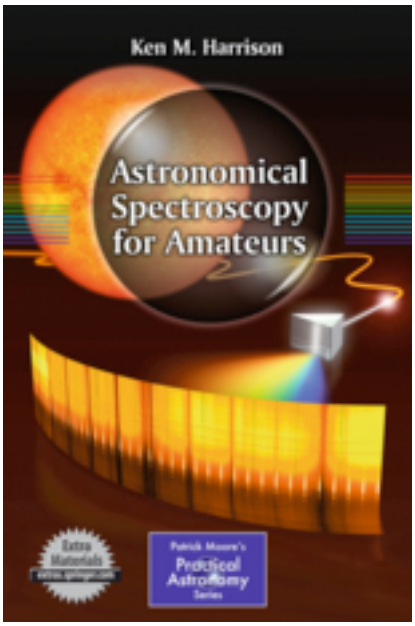
Fig.3
An evolution of the Hα profile during the current eclipse. Interpolation between spectra was used to get a smooth image.

New Book

Astronomical Spectroscopy for Amateurs

Series: Patrick Moore's Practical Astronomy Series
Harrison, Ken M.
1st Edition., 2011, XIII, 241 p. 193 illus., 35 in color. With online files/update., Softcover
ISBN: 978-1-4419-7238-5

http://www.springer.com/astronomy/astronomy%2C+observations+and+techniques/book/978-1-4419-7238-5



$34.95

ABOUT THIS BOOK_
AUTHORS & EDITORS_

Describes exciting astronomical spectroscopic projects that can be realistically carried out by amateurs

Provides clear step-by-step instructions to allow the first-time user to record and analyze stellar spectra

Contains full do-it-yourself construction details for both simple and complex stellar spectroscopes

Astronomical Spectroscopy for Amateurs is a complete guide for amateur astronomers who are looking for a new challenge beyond astrophotography. The book provides a brief overview of the history and development of the spectroscope, then a short introduction to the theory of stellar spectra, including details on the necessary reference spectra required for instrument testing and spectral comparison. The various types of spectroscopes available to the amateur are then described. Later sections cover all aspects of setting up and using various types of commercially available and home-built spectroscopes, starting with basic transmission gratings and going through more complex

models, all the way to the sophisticated Littrow design. The final part of the text is about practical spectroscope design and construction. This book uniquely brings together a collection of observing, analyzing, and processing hints and tips that will allow the amateur to build skills in preparing scientifically acceptable spectra data. It covers all aspects of designing, constructing, testing, calibrating, and using a spectroscope and enables the average amateur astronomer to successfully build and use a homemade spectroscope for a fraction of the current commercial cost. As Professor Chris Kitchin said, “If optical spectroscopy had not been invented then fully 75 percent of all astronomical knowledge would be unknown today, and yet the subject itself receives scant attention in astronomical texts.” This book answers that need. It is the practical spectroscopy book that amateur astronomers have been waiting for!

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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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