2009 Epsilon Aurigae Eclipse
Campaign Newsletter #9
Fall/Winter 2008

Jeff Hopkins, Editor
Hopkins Phoenix Observatory

Campaign Web Site
http://www.hposoft.com/Campaign09.html

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In This Newsletter

Dear Colleagues,

The fall observing season for epsilon Aurigae is well under way. This season will be the last chance to get out-of-eclipse data prior to first contact. It is also the best time to refine techniques and fix problems.

As of 01 December 2008 epsilon Aurigae had brightened to V= 2.99.

The hydrogen alpha blue horn is at a maximum on 01 December 08 and has been increasing since this summer. The red horn has increased from nonexistence to a maximum around mid-November and is now retreating.

We have several photometric and spectroscopic observers so we should have excellent coverage. We also has some interesting observational techniques described.

Since some CCD and visual observers are using eta and zeta Aurigae as comparison stars, HPO has added those stars to the UBV data observations to see how stable they are. They will be observed throughout the eclipse of zeta Aurigae in March 2009. The following is a list of the data so far:

Eta Aurigae

UT Date	JD	V Mag	SD	B Mag	SD	U Mag	SD
05 Dec 08	4,805	3.2386	0.0087	3.2275	0.0094	2.6977	0.0230
03 Dec 08	4,803	3.2353	0.0032	3.2267	0.0170	2.6977	0.0090
01 Dec 08	4,801	3.2347	0.0049	3.2312	0.0022	2.6937	0.0210
30 Nov 08	4,800	3.2249	0.0047	3.2322	0.0014	2.6856	0.0140
24 Nov 08	4,794	3.2182	0.0087	3.1905	0.0372	2.6475	0.0569
19 Nov 08	4,789	3.2391	0.0023	3.2336	0.0037	2.6979	0.0150
17 Nov 08	4,787	3.2293	0.0058	3.2259	0.0018	2.6811	0.0043
15 Nov 08	4,785	3.2373	0.0010	3.2322	0.0018	2.6985	0.0110

Zeta Aurigae

UT Date	JD	V Mag	SD	B Mag	SD	U Mag	SD
05 Dec 08	4,805	3.7322	0.0145	4.8610	0.0105	5.1930	0.0170
03 Dec 08	4,803	3.7301	0.0022	4.8482	0.0188	5.2070	0.0110
01 Dec 08	4,801	3.7269	0.0113	4.8627	0.0070	5.2093	0.0130
30 Nov 08	4,800	3.7260	0.0048	4.8607	0.0014	5.1923	0.0180
24 Nov 08	4,794	3.7082	0.0458	4.8215	0.0652	5.1451	0.0890
19 Nov 08	4,789	3.7309	0.0050	4.8626	0.0051	5.2064	0.0060
17 Nov 08	4,787	3.7313	0.0074	4.8609	0.0039	5.1896	0.0109
15 Nov 08	4,785	3.7194	0.0036	4.8598	0.0024	5.1792	0.0105

Differential Photometry lambda Aurigae as Comparison star
V= 4.71; B= 5.34; U= 5.46
Note: JD is 2, 450,000 +, magnitudes are the average of 3 reduced magnitudes extinction corrected with nightly extinction coefficients determined.

Photometry Techniques

Please see Newsletter #8 for details on suggested means to submit photometric data.

DSLR Photometry and Epsilon Aurigae
08 November 2008

Des Loughney
Eclipsing Binary Secretary BAAVSS
desloughney@blueyonder.co.uk

For the past eighteen months I have been working on a technique to do V photometry with a DSLR. Below is the method that I now think will work best to make good V estimates of Epsilon Aurigae.

I use a Canon DSLR 450D with a 85 mm lens, undriven on a tripod. I use the camera to take RAW images of Epsilon Aur and the comparison Eta Aur (3.18V). Both stars are easily accommodated within the field of view of the 85 mm lens. The settings for the camera are ISO 200, F 4, and an exposure of 5 seconds. A set of ten images taken one after another are used to make an estimate. On every observing night a master dark frame is created using ten images with the same settings.

Using AIP4WIN each image is opened. From the image is subtracted a dark frame. Then, using AIP4WIN, the 'green channel' of each image is isolated and analysed with the AIP4WINs photometry tools. An estimate is made of the magnitude of eps Aur averaging the estimates of ten images (which covers a time period of 50 seconds). This estimate is what the AAVSO would call a CV estimate.

Through experimentation I have found that to arrive at a V estimate from the CV estimate I have to add a number which is a product of the difference in the B-Vs of eps Aur and eta Aur (0.685) times the transformation co-efficient of 0.16 which is probably specific to this model of camera (or specific to the Canon green microfilters that cover each pixel). I have to add 0.11 magnitude to my CV estimates to arrive at a V estimate.

Using this methodology I made three sets of estimates of eps Aur spread over 10 minutes on 2/11/08 between 0.56 UT and 1.06 UT. The V estimates are 3.06, 3.04 and 3.03. This shows that good observations are possible. The average of three sets of ten clearly give a better result although more tedious to analyse.

Comments and queries welcome.

News from our Campaign Members

25 October 2008
Neil Short
Following from our Committee meeting last Wednesday I can confirm that the NEAS will look to do photometry measurements, using (probably) the William Optics telescope, AtiK camera and R, V and B filters (will look into "I" filtering) and also will look to train up on spectroscopy through experimenting with a Star Analyser. We will in the near future start to plan and confirm our measurement process/technique to be sure we will achieve robust and valid results for onward transmission.

2008/2009 Season Photometry Data Summary

David Daiku Trowbridge
Comp stars 1 Aur, 2 Aur and Omega in order to average results I had obtained using Eta and Zeta on July 21 (I have no images of Lambda yet).

B	3.319	+/-0.12	V	3.134	+/-0.042
R	2.374	+/-0.139	I	2.062	+/-0.195

30 Nov 2008
Des Loughney
The settings for these sets were Canon DSLR, 200 ISO, f4, exposure 5 seconds, 85 mm lens. Eta Aurigae used as the comparison star at v= 3.18

Des Loughney Summary

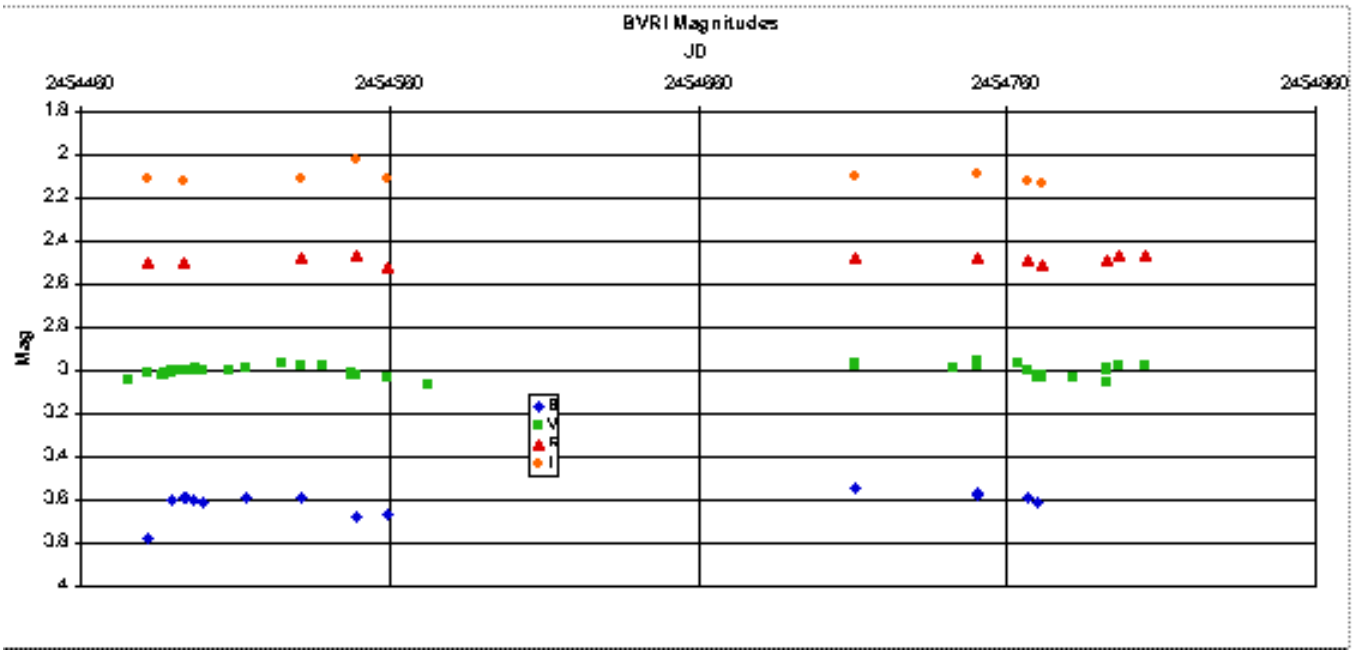
Epsilon Aurigae
30 November 2008 - 00.80 UT - 2.98V
28 November 2008 - 18.80 UT - 2.97V
23 November 2008 - 21.85 UT - 2.99V
24 November 2008 - 21.30 UT - 3.01V
24 November 2008 - 22.60 UT - 3.01V
24 November 2008 - 23.45 UT - 3.02V
19 November 2008 - 21.90 UT - 3.00V.
18 November 2008 - 22.55 UT - 3.06V
03 November 2008 - 00.20 UT - 3.06V
02 November 2008 - 21.80 UT - 3.03V

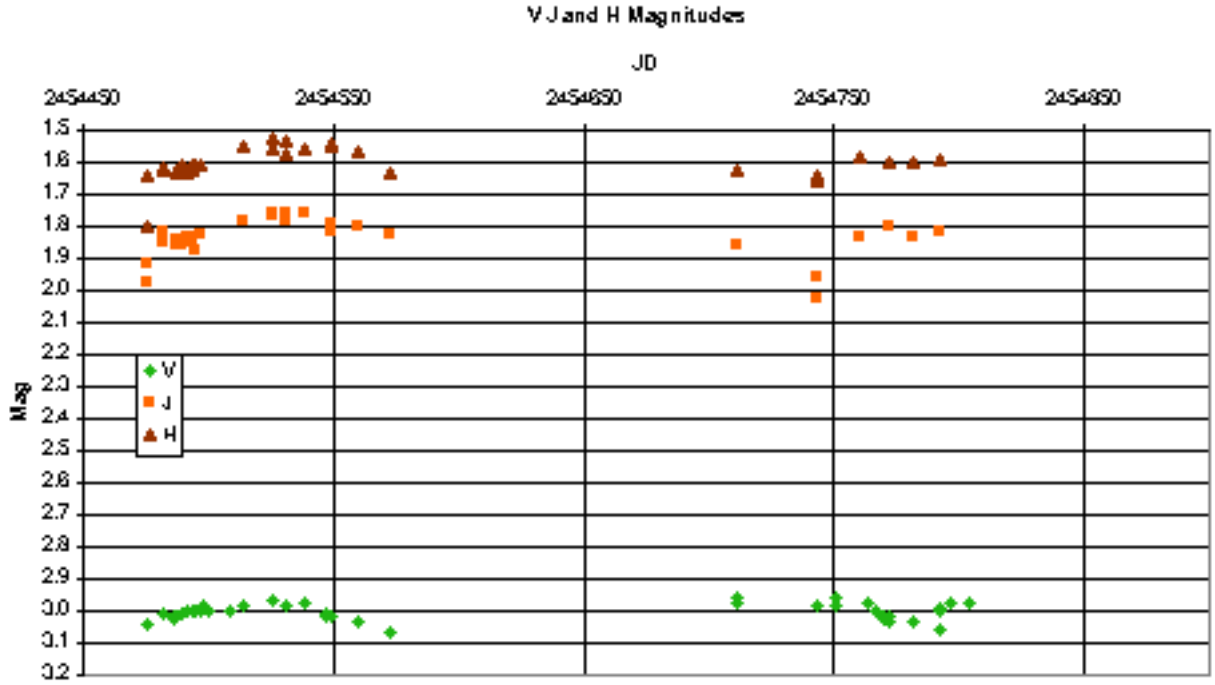
Zeta Aurigae
30 November 2008 - 00.80 UT - 3.72V
23 November 2008 - 21.85 UT - 3.71V
24 November 2008 - 21.30 UT - 3.72V
24 November 2008 - 22.60 UT - 3.73V
24 November 2008 - 23.45 UT - 3.73V

Brian E. McCandless
24 November 2008
Elkton, MD
Telescope: CGE1400
Detector *(BVRI): SSP-3
Detector (JH): SSP-4 @ T= - 40C
Comp = Lam Aur HD34411
B= 5.34 V= 4.71 R= 4.19 I= 3.88 J= 3.62 H= 3.33

JD	AM	B	Error	V	Error	Rc	Error	Ic	Error
2454804.54	1.077					2.469	0.005		
2454804.53	1.080			2.977	0.007				
2454796.66	1.077					2.469	0.003		
2454796.66	1.080			2.977	0.005				
2454792.73	1.005					2.485	0.003		
2454792.72	1.015			3.001	0.002				
2454792.59	1.350			3.060	0.006				
2454792.58	1.393			2.990	0.002				
2454781.67	1.154			3.030	0.003				
2454771.79	1.007			3.034	0.005				
2454771.72	1.091			3.017	0.010				
2454771.71	1.117							2.128	0.005
2454771.71	1.120					2.508	0.008		
2454770.00	1.072			3.018	0.008				
2454770.00	1.193			3.029	0.008				
2454770.00	1.198	3.609	0.015						
2454766.72	1.134							2.120	0.007
2454766.72	1.138					2.491	0.005		
2454766.70	1.172			3.001	0.005				
2454766.70	1.178	3.589	0.012						
2454763.69	1.256			2.971	0.010				
2454750.76	1.118	3.581	0.015						
2454750.76	1.121			2.959	0.006				
2454750.76	1.127							2.093	0.003
2454750.76	1.130					2.473	0.005		
2454750.73	1.212								
2454750.74	1.218								
2454710.86	1.148								
2454710.86	1.153								
2454710.83	1.246							2.096	0.015
2454710.83	1.260					2.473	0.015		
2454710.83	1.270	3.544	0.01						
2454710.82	1.292			2.977	0.012				
2454710.82	1.409			2.962	0.012				

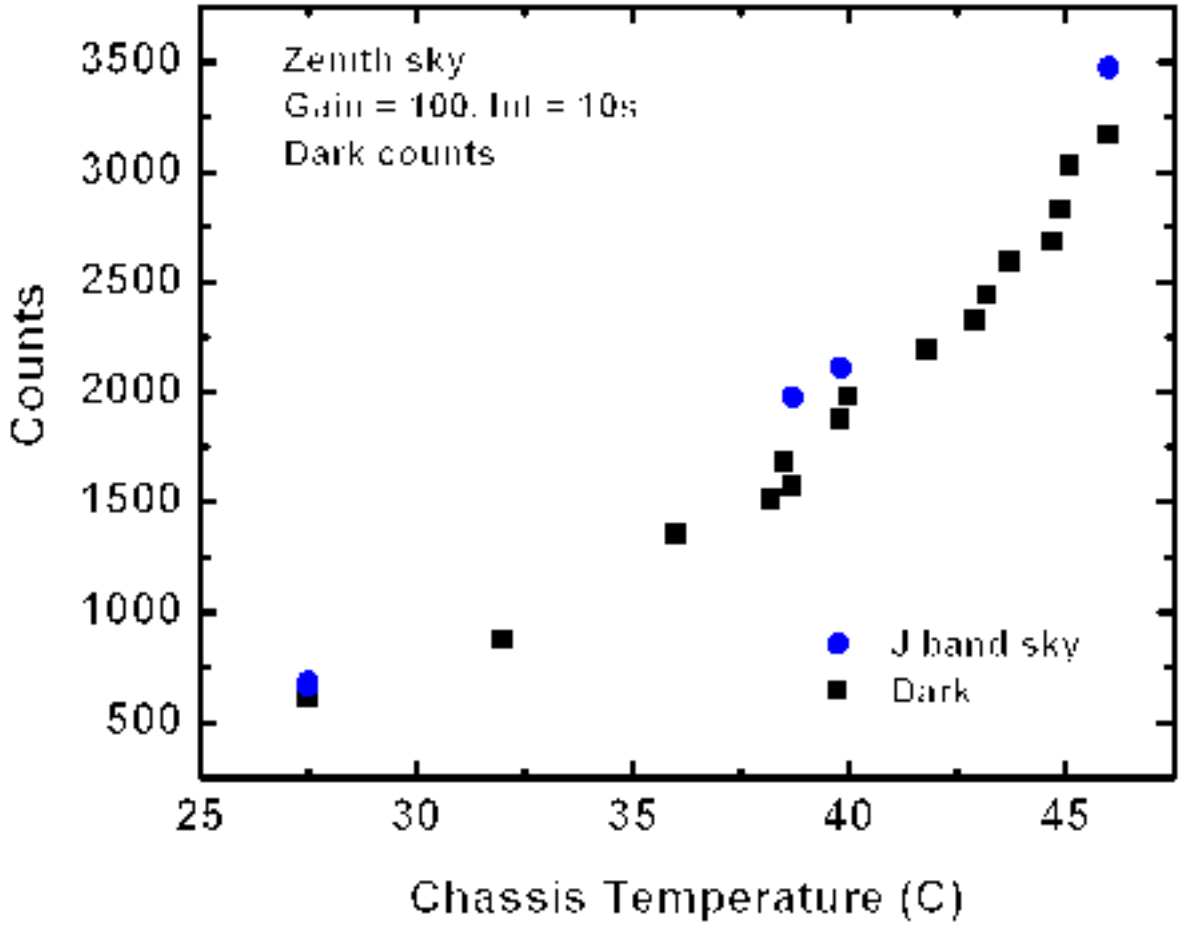
JD	AM	J	Error	H	Error
2454792.66	1.094			1.592	0.002
2454792.66	1.097	1.813	0.005		
2454781.66	1.172			1.604	0.008
2454781.66	1.176	1.836	0.005		
2454771.69	1.166			1.599	0.007
2454771.69	1.170	1.804	0.005		
2454760.69	1.250			1.582	0.010
2454760.69	1.253	1.833	0.004		
2454710.86	1.148	1.624	0.04		
2454710.86	1.153			1.860	0.05


BVRI Magnitudes
JD
2454480
2454580
2454680
2454780
2454880
Mag
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
B
V
R
I


V J and H Magnitudes
JD
2454450
2454550
2454650
2454750
2454850
Mag
1.5
1.6
1.7
1.8
1.9
2.0
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3.0
3.1
3.2
V
J
H

4 December 2008

As a follow-up to thermal issues with SSP4, I the following is a plot of the SSP4 dark and sky counts, taken at gain =100 and int = 10 sec, versus the chassis temperature. I bonded the thermocouple to the underside where the body meets the electronics housing. I only took a few sky points, with the telescope aimed at the zenith. This verifies for me that the increased dark current doesn't "swamp" signal, rather, it raises the baseline overall. I still find that stability is more a function of seeing than of the unit temperature.



12 September 2008
Dr. Tiziano Colombo

I made a further elaboration in my measurements of epsilon Aurigae, I made a comparison with the magnitude of a star considered not variable, rho Aurigae. In my previous e-mail I have forgotten to tell you my exposure time: 60 sec. you suggest for avoiding scintillation problems.

Magn. Eps AUR	N° meas.	Magn. Rho AUR	Hour UTC	Median J.D.
3.16	6	4.80	2:30	2454698.60416
3.17	5	4.82	2:00	2454705.58333
2.99	9	4.69	1:37	2454712.56736
3.21	7	4.72	3:10	2454713.63194
3.05	13	4.90	2:35	2454719.60763
3.25	6	4.70	2:42	2454720.63055

26 November 2008
Richard Miles
Golden Hill Observatory
Location: 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)
Filter Set: Johnson V, Cousins Ic
Detector: CCD Camera (Type: Starlight Xpress SXV-H9)
Observation Date: 25/26 November 2008 22:58 UT
JD: 2,454,796.4573

Johnson V magnitude: 2.989 +/-0.005
Cousins Ic magnitude: 2.206 +/-0.012
V-Ic magnitude: 0.783 +/-0.015

Comments: Mean, standard deviation of 4 determinations bracketed either side in time by Lambda Aurigae.

Assumes V=4.71, Ic=3.99 for Lambda Aurigae

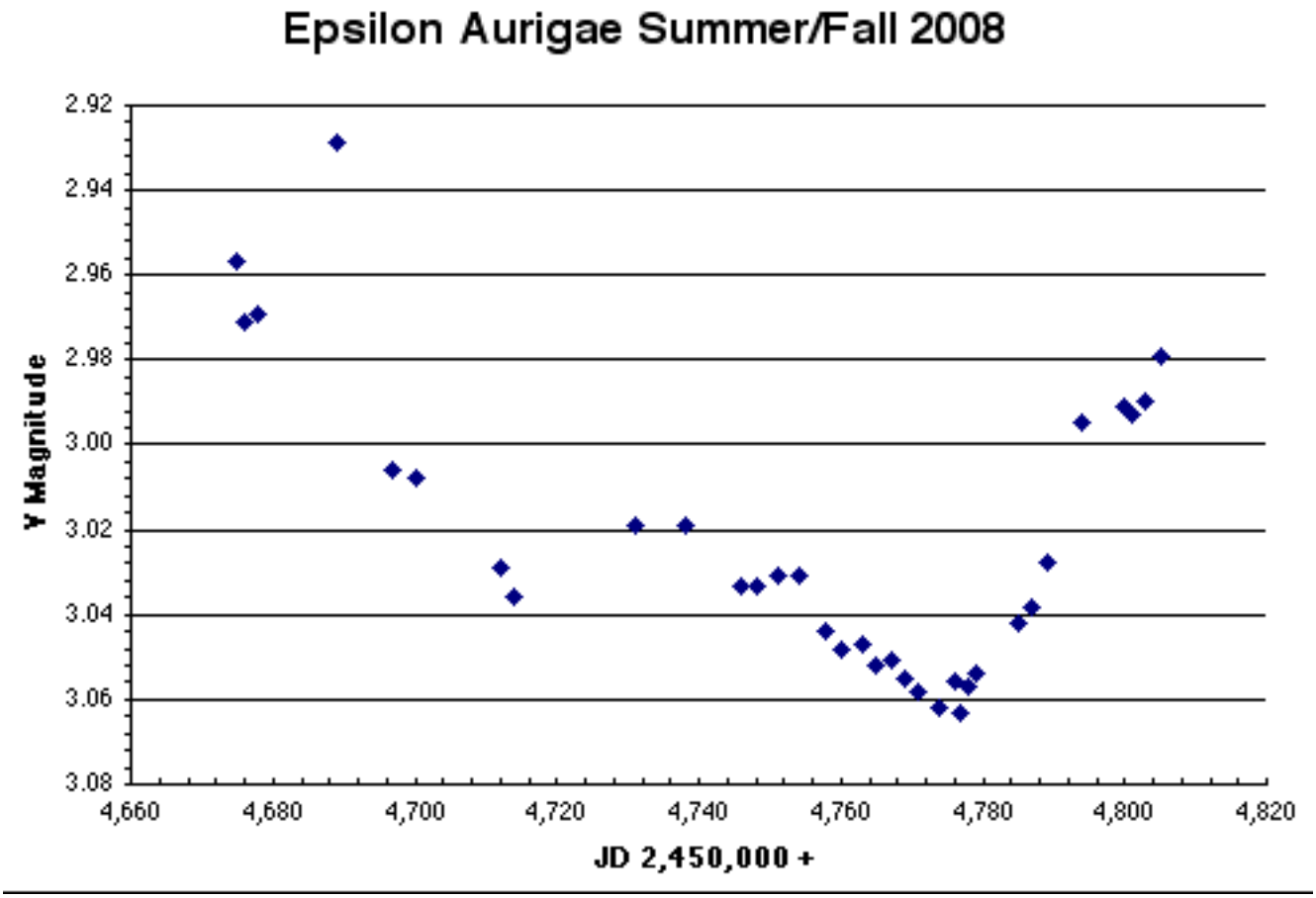
Each determination was an average of 50 frames.
Telescope was moved so that same area of CCD used to image both the variable and comparison star.

30 November 2008

Jeff Hopkins, Hopkins Phoenix Observatory
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

HJD	V	SD	B	SD	U	SD
2454805.6954	2.9789	.0044	3.5316	.0087	3.66265	.008
2454803.6954	2.9903	.0036	3.5306	.0242	3.6424	.021
2454801.7690	2.9930	.0007	3.5495	.0070	3.6719	.012
December 2008						
2454800.7420	2.9909	.0029	3.5586	.0038	3.6544	.021
2454794.7524	2.9949	.0365	3.5350	.0511	3.6520	.054
2454790.7649	3.0282	.0031	3.5938	.0034	3.7104	.008
2454787.7857	3.0378	.0039	3.6020	.0051	3.7292	.022
2454785.7697	3.0421	.0068	3.6113	.0045	3.7328	.012
2454779.7850	3.0540	.0039	3.6285	.0012	3.7731	.005
2454778.7864	3.0568	.0004	3.6329	.0068	3.7750	.009
2454777.8010	3.0625	.0023	3.6342	.0039	3.7680	.011
2454776.7850	3.0559	.0021	3.6332	.0023	3.7513	.012
2454774.7788	3.0619	.0031	3.6371	.0016	3.7667	.005
2454771.7857	3.0584	.0054	3.6363	.0059	3.7555	.013
November 2008						
2454769.7996	3.0548	.0046	3.6373	.0059	3.7523	.013
2454767.7808	3.0510	.0022	3.6234	.0054	3.7389	.006
2454765.8093	3.0519	.0006	3.6236	.0056	3.7580	.013
2454763.8134	3.0472	.0019	3.6164	.0039	3.7533	.017
2454760.8030	3.0479	.0039	3.6122	.0095	3.7309	.021
2454758.8162	3.0437	.0034	3.6193	.0037	3.7237	.013
2454754.8350	3.0309	.0063	3.6126	.0108	3.6967	.003
2454751.8732	3.0311	.0098	3.5974	.0025	3.7416	.016
2454748.8371	3.0329	.0054	3.5938	.0041	3.7023	.007
2454746.8190	3.0326	.0036	3.5892	.0027	3.6971	.015
October 2008						
2454738.8593	3.0189	.0031	3.5779	.0031	3.6640	.007
2454731.9002	3.0192	.0021	3.5794	.0044	3.6806	.011
2454714.9655	3.0362	.0012	3.5986	.0061	3.6935	.025
2454712.9454	3.0292	.0048	3.5941	.0050	3.6863	.013
September 2008						
2454700.9565	3.0080	.0009	3.5628	.0057	3.6348	.013
2454697.9634	3.0064	.0068	3.5519	.0016	3.6281	.013
2454689.9704	2.9289	.0219	3.4897	.0193	3.5766	.038
August 2008						
2454678.9551	2.9691	.0393	3.5190	.0373	3.5369	.070
2454676.9503	2.9709	.0128	3.5234	.0086	3.5577	.020
2454675.9621	2.9570	.0106	3.5088	.0099	3.5815	.010
July 2008						



Hopkins Phoenix Observatory V Data Plot July - December 2008

03 December 2008
Frank J. Melillo
#:CID #030
Holtsville, NY USA
Lat:+ 40d 40' Long: 73 W Elvation: 100'
Instrument: Optec SSP-3
Telescope: C-8 8"
Gate Time: 10 Seconds
Double Date: 2/3 December 2008
Conditions: 31 degrees F., no winds & clear

UT	Band	Magnitude	#	SD	Air Mass
5:30	V	+2.98	4		
5:50	V	+2.96	4		

Spectroscopy Techniques

Please see Newsletter #8 for details on how to submit spectroscopic data.

Simple bright star spectroscopy using just a Star Analyser and DSLR

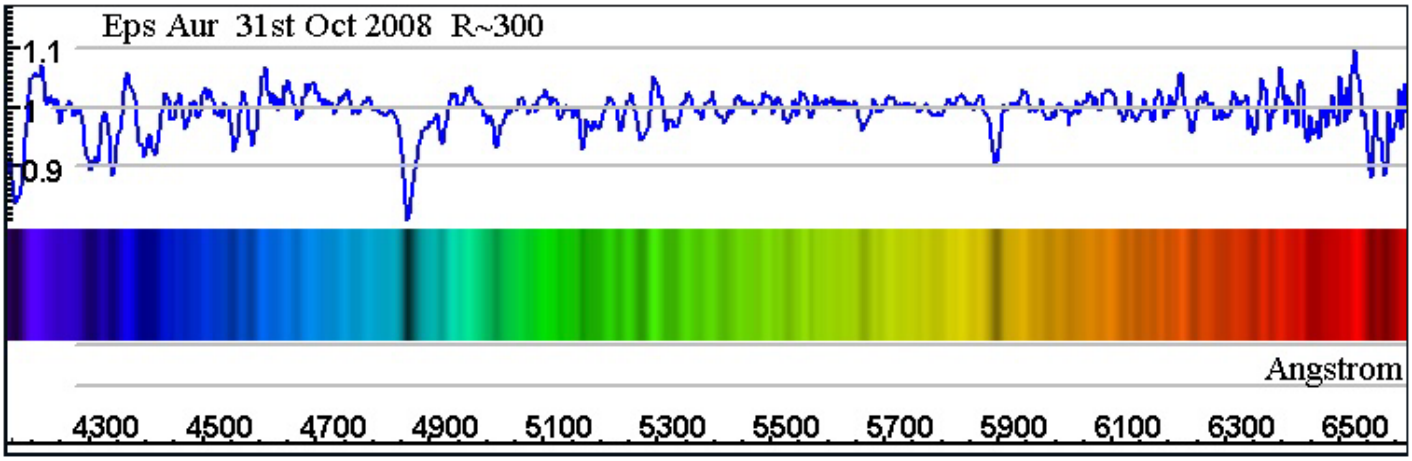
by
Robin Leadbeater
robin@leadbeaterhome.fsnet.co.uk
13 November 2008

I have been looking for simple ways to increase the resolution of spectra of Epsilon Aurigae produced using the Star Analyser and have developed a technique using the SA mounted in front of a digital camera fitted with a telephoto lens. The results with bright stars are very good, giving a resolution of 15A. This is 2-3 times better than with the SA mounted between the telescope and the camera. The attached spectrum is of Eps Aur with an ELODIE spectrum filtered to the same resolution for comparison.

Although the Eps Aur campaign was the original application, I think it has great potential as an educational tool, giving perhaps the simplest possible introduction to practical astronomical spectroscopy and the spectral classification of stars.

There are more details on the technique and processing on my website here
http://www.threehillsobservatory.co.uk/astro/spectroscopy_11.htm

Best Regards
Robin



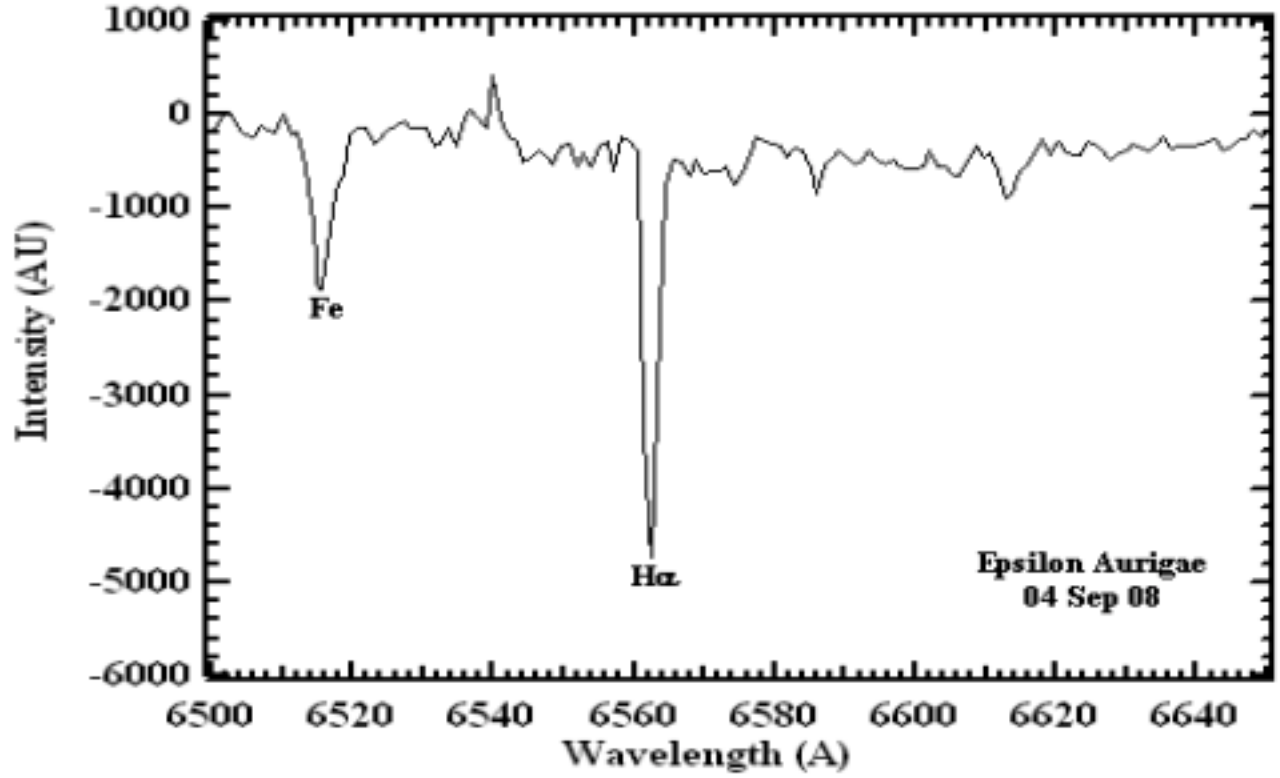
Epsilon Aurigae Spectrum using new Star Analyser Technique

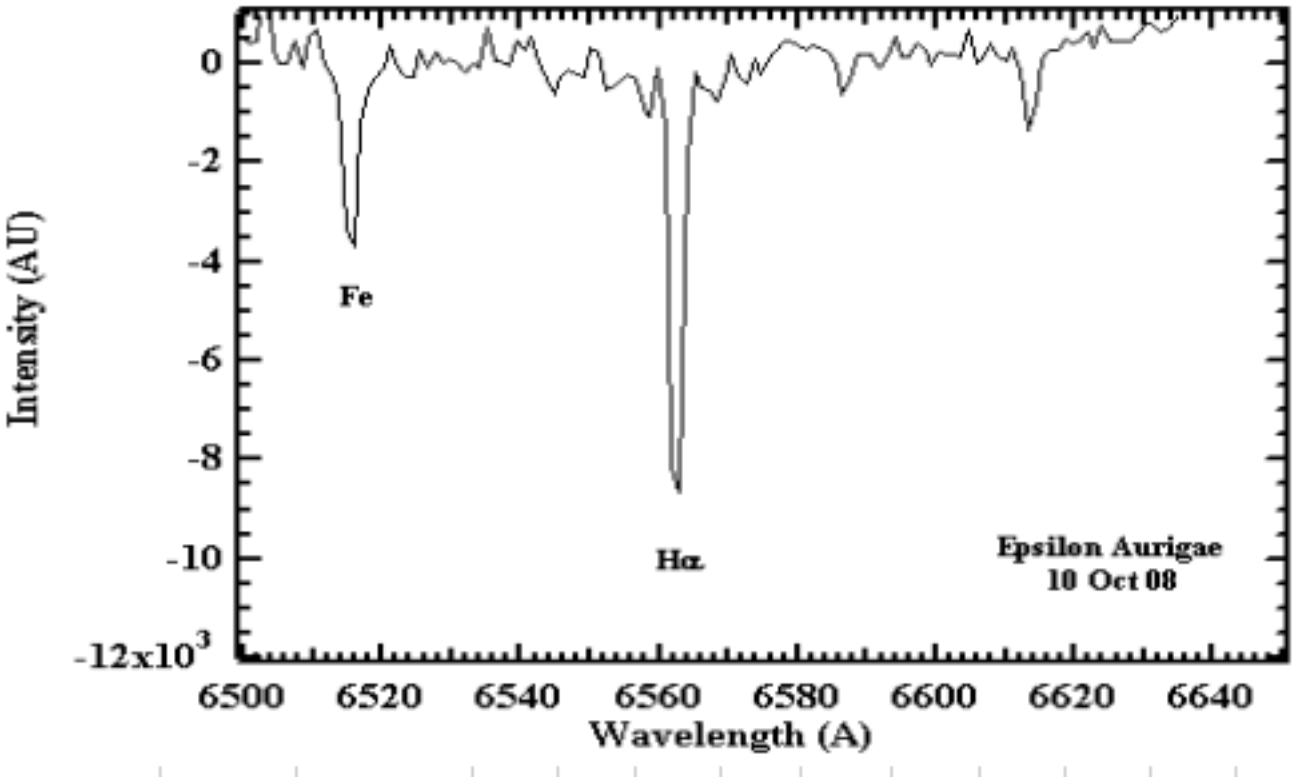
Star Analyser mounted in Lens Cap of DSLR Camera

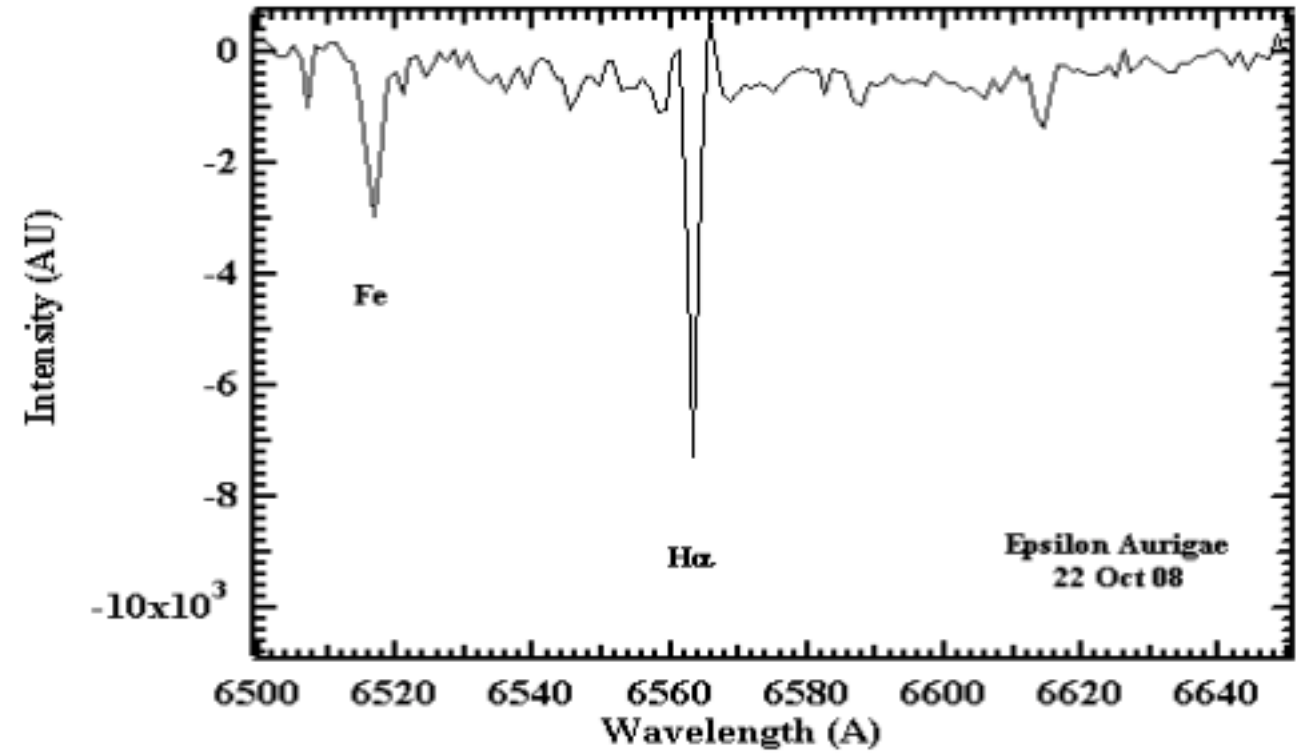
2008/2009 Season Spectroscopy Summary

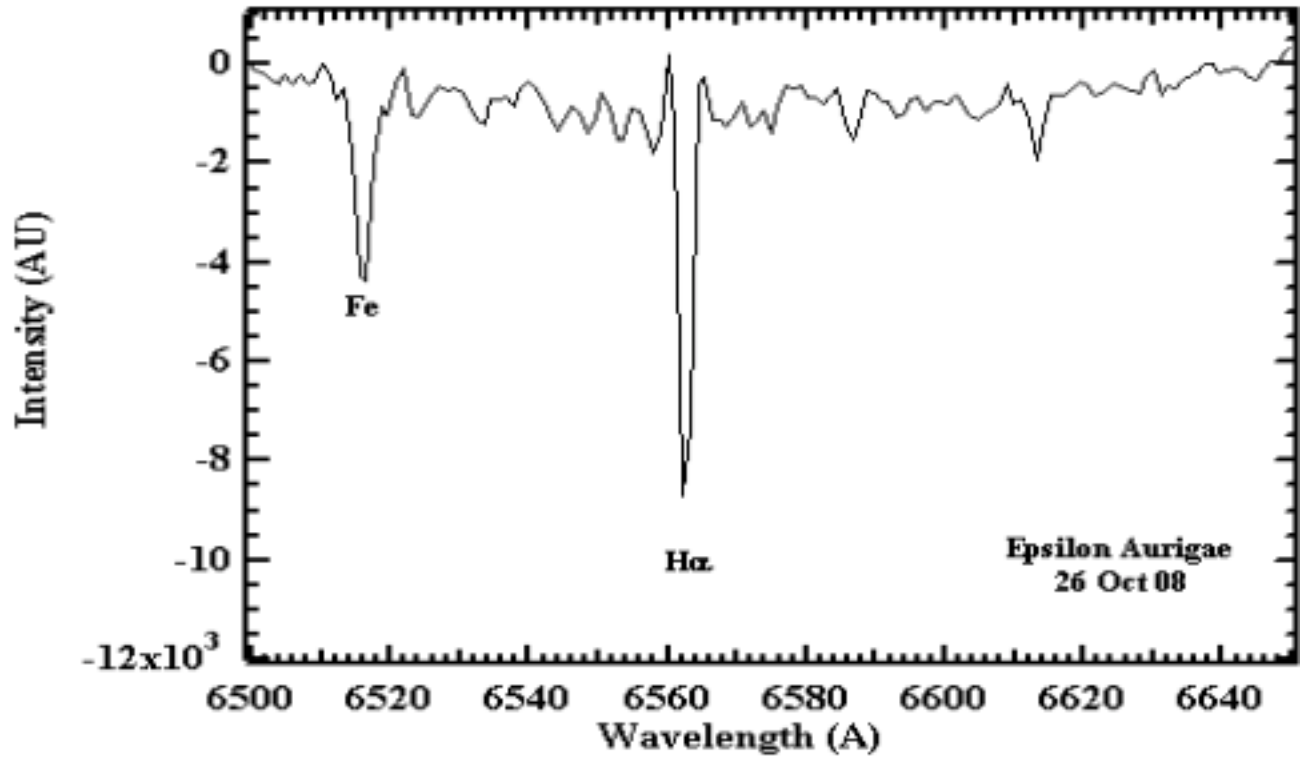
24 November 2008

Brian E. McCandless






0
-2
-4
-6
-8
-10x10^3
Intensity (AU)
Fe
Hα
Epsilon Aurigae
22 Oct 08
6500
6520
6540
6560
6580
6600
6620
6640
Wavelength (A)


0
-2
-4
-6
-8
-10
-12x10^3
Intensity (AU)
Fe
Hα
Epsilon Aurigae
26 Oct 08
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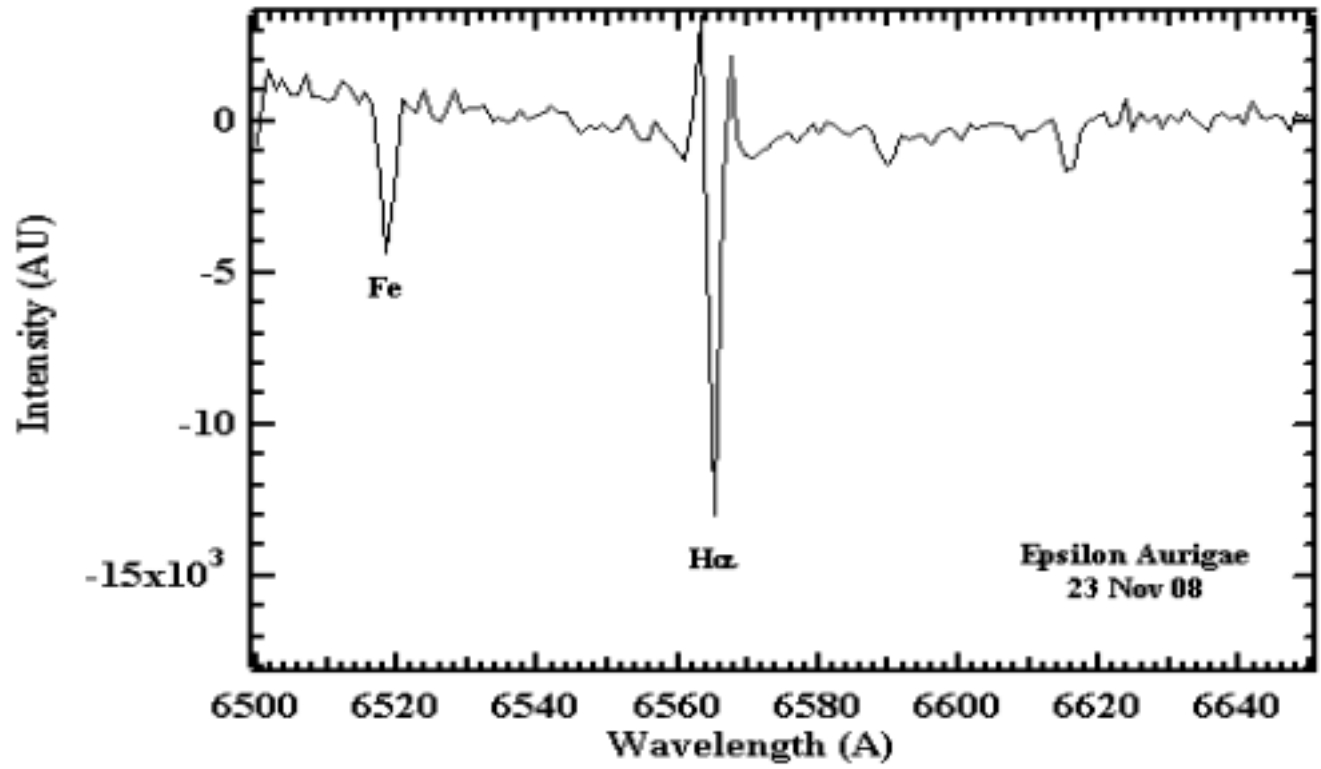
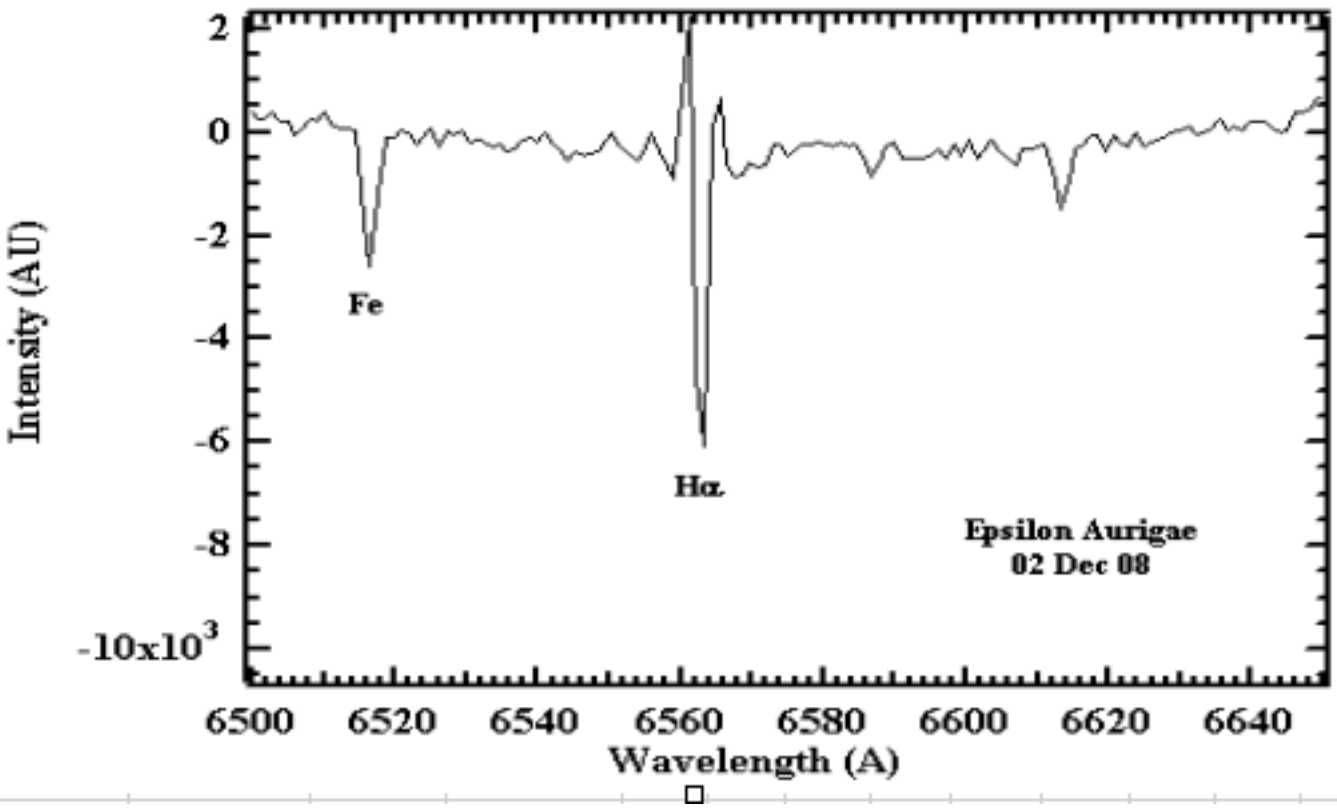
6540
6560
6580
6600
6620
6640
Wavelength (A)


0
-5
-10
-15x10^3
Intensity (AU)
Fe
Hα
Epsilon Aurigae
23 Nov 08
6500
6520
6540
6560
6580
6600
6620
6640
Wavelength (A)

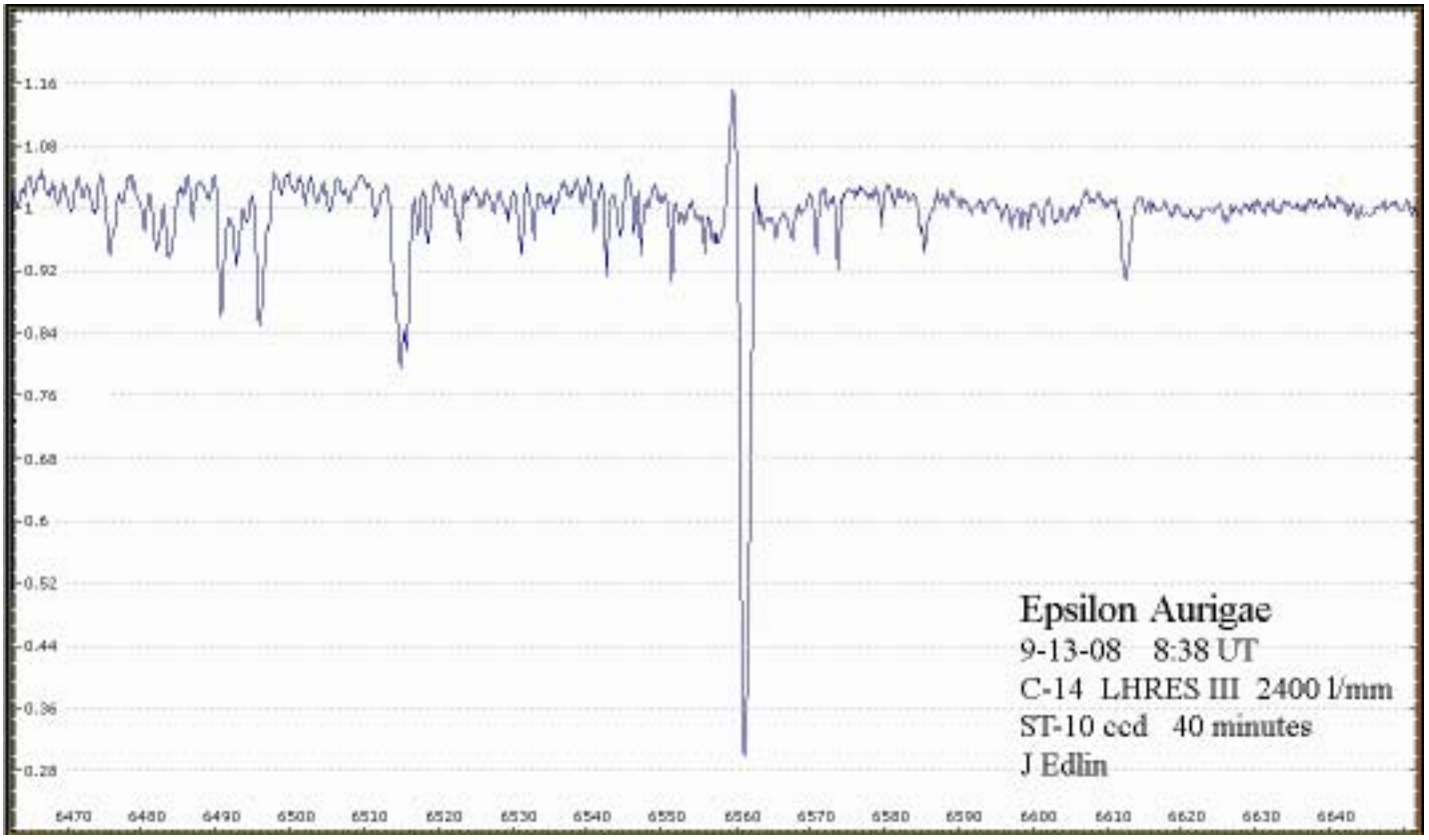

2
0
-2
-4
-6
-8
-10x10^3
Intensity (AU)
Fe
Hα
Epsilon Aurigae
02 Dec 08
6500
6520
6540
6560
6580
6600
6620
6640
Wavelength (A)

On 18 Sep 2008
Jim Edin

On the subject of Epsilon Aurigae, I made this observation of it on 9-13-08 with the LHRES III at 2400 l/mm centered on Ha line. It is calibrated and instrument response corrected and normalized to 1.

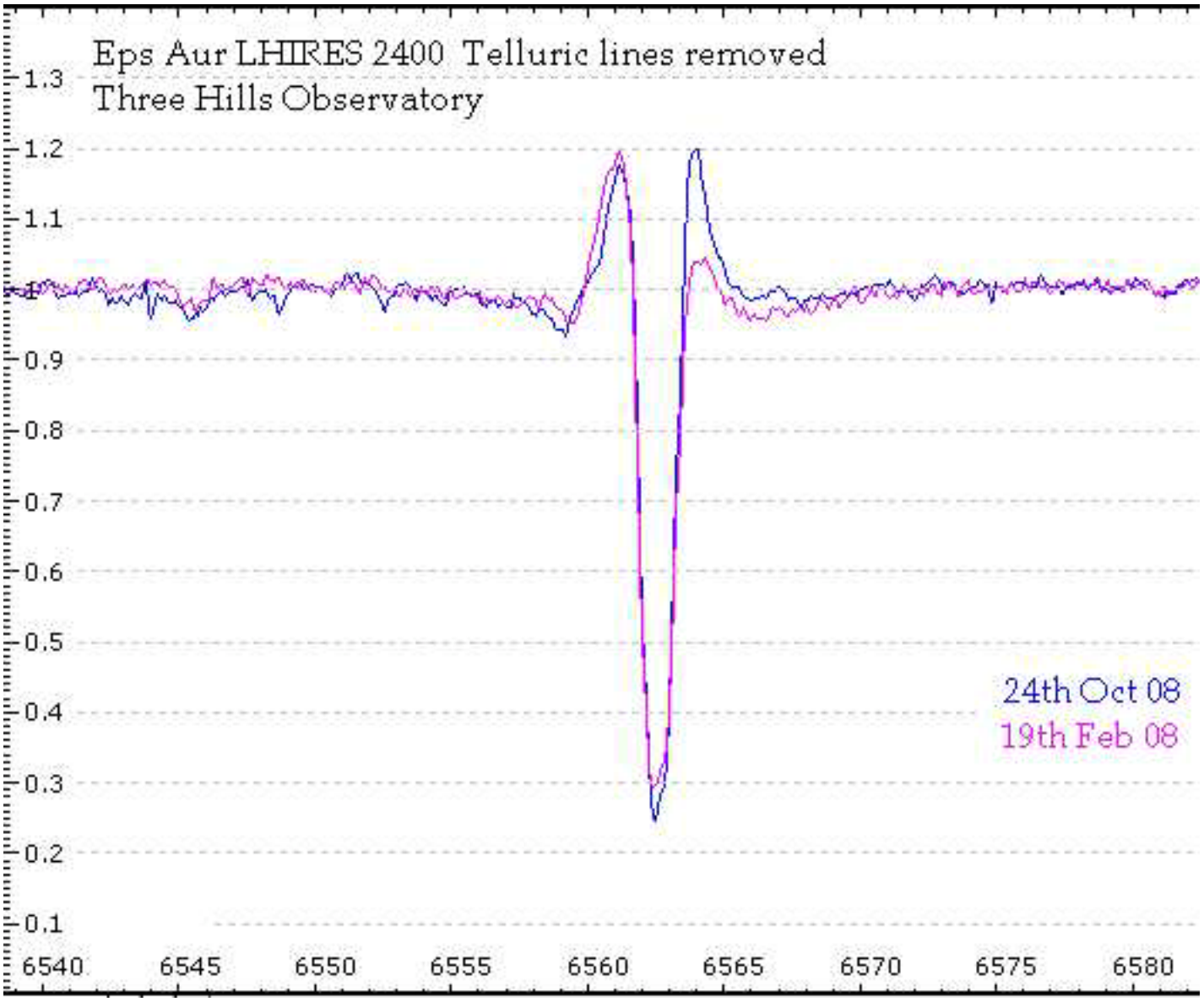
If we are to follow it, how often should we observe it??? Is there need to cover the whole spectrum or just concentrate on Ha?

Jim
"James Edlin" <jedlin@cableone.net>



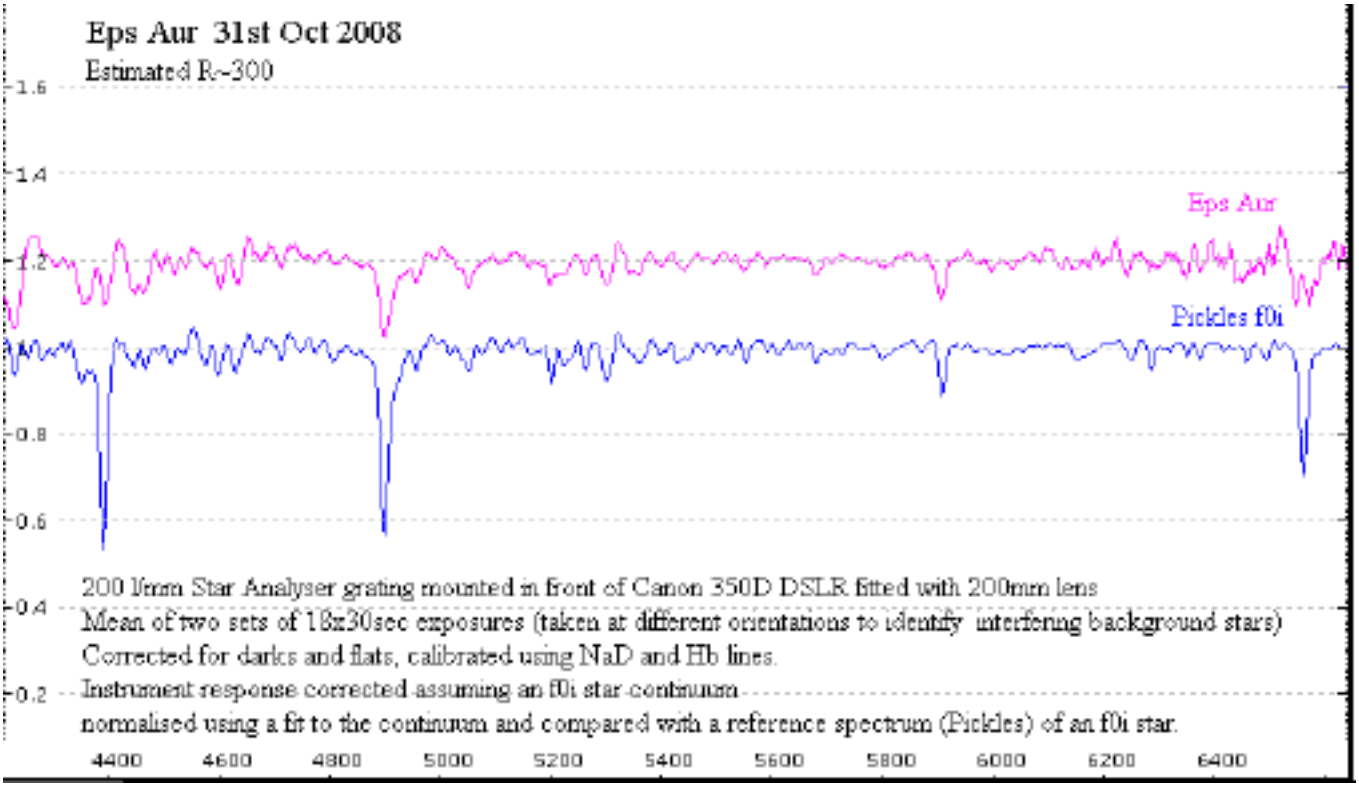
27 October 2008
Robin Leadbeater

Here is my result from 24th Oct compared with my previous result from 19th Feb. (The latest result is more noisy than I would like and taken at high humidity so the H2O line subtraction is not perfect.)



01 November 2008

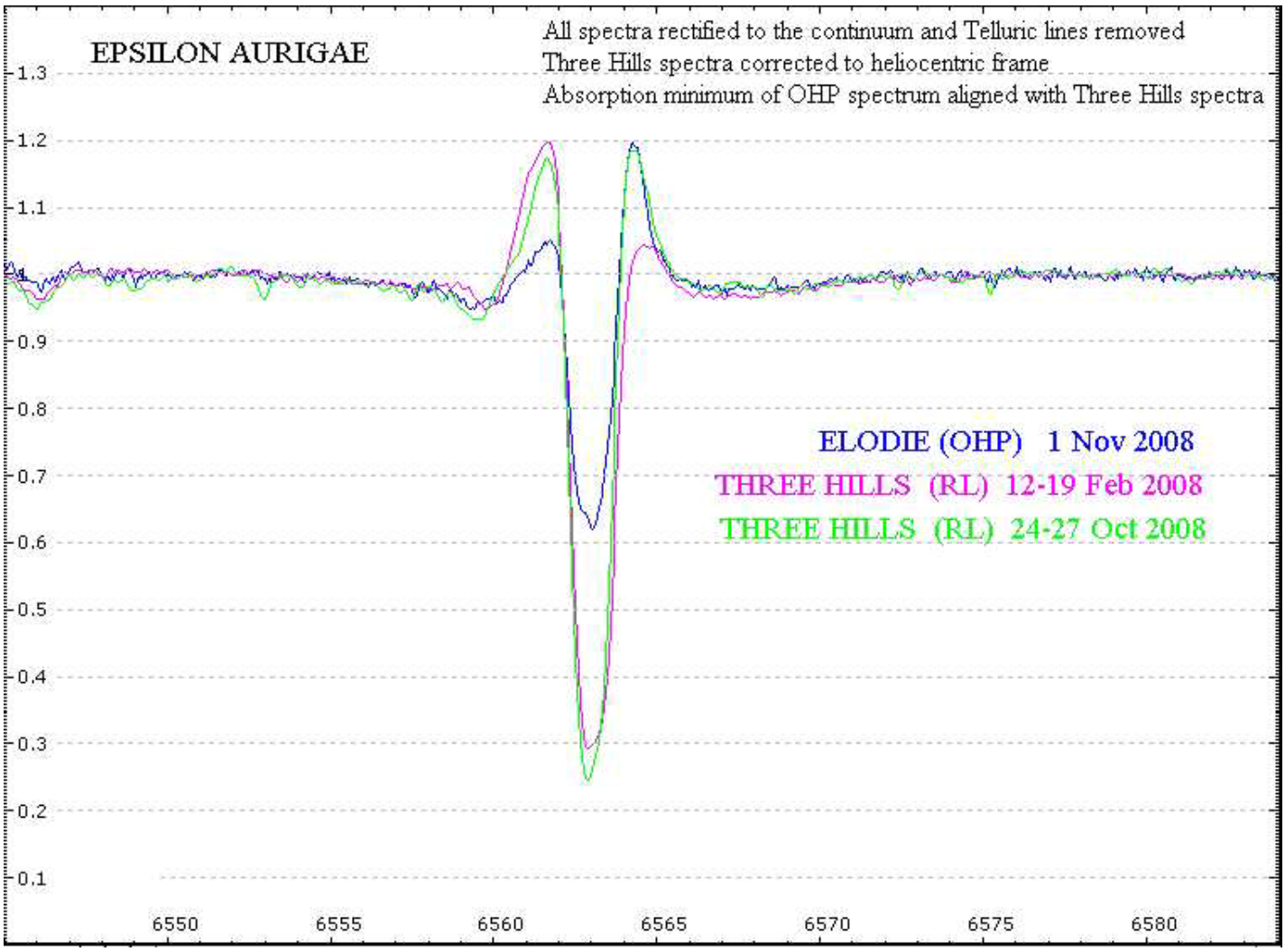
I have been doing a bit of work to see if there is a possibility of coaxing a little more resolution out of the Star Analyser while still keeping it relatively simple. Because Eps Aur is so bright, putting the grating in front of a camera lens is a possibility, instead of the standard arrangement in the converging beam before the CCD camera . This gets rid of the aberrations which limit the resolution of the standard setup. Initial results look promising but are limited in wavelength range by the sensitivity of the DSLR camera. A proper astro CCD camera would be better but the CCD in my astro camera is not big enough for this application. I managed to get a resolution of 15-20A, some 2-3 x higher than the standard arrangement. I am not sure if even this will show any significant changes during the eclipse other than perhaps the reddening seen in photometric measurements though.



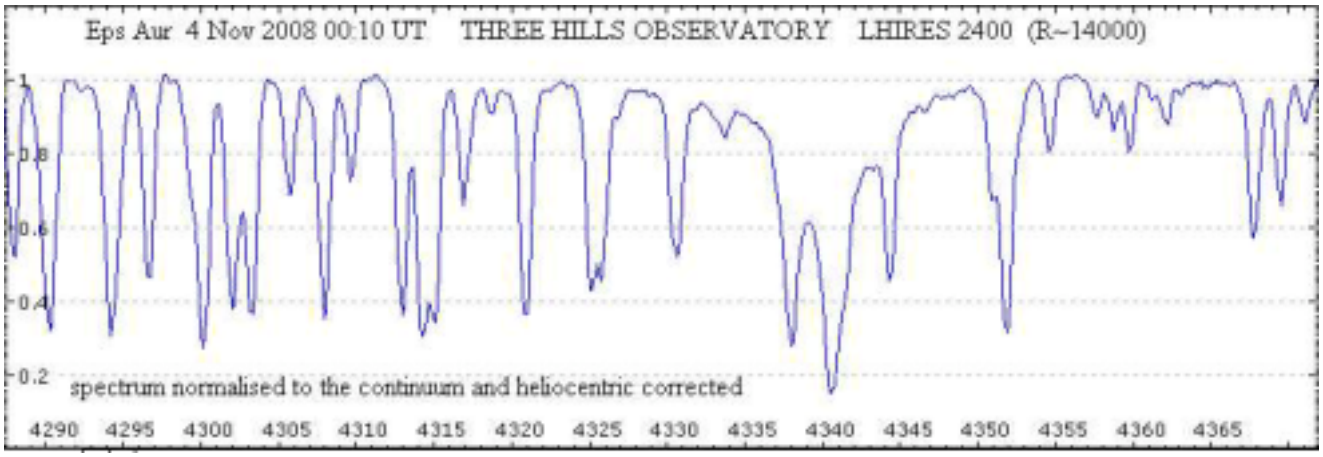
6 November 2008

I checked the ELODIE archive and found one Eps Aur spectrum from November 2003 which Lothar Schanne included in the IBVS 5747 data.

Perhaps not surprisingly, the blue and red emission peaks are different again from those measured this year, but what I found particularly interesting is the much reduced absorption core then compared with now.

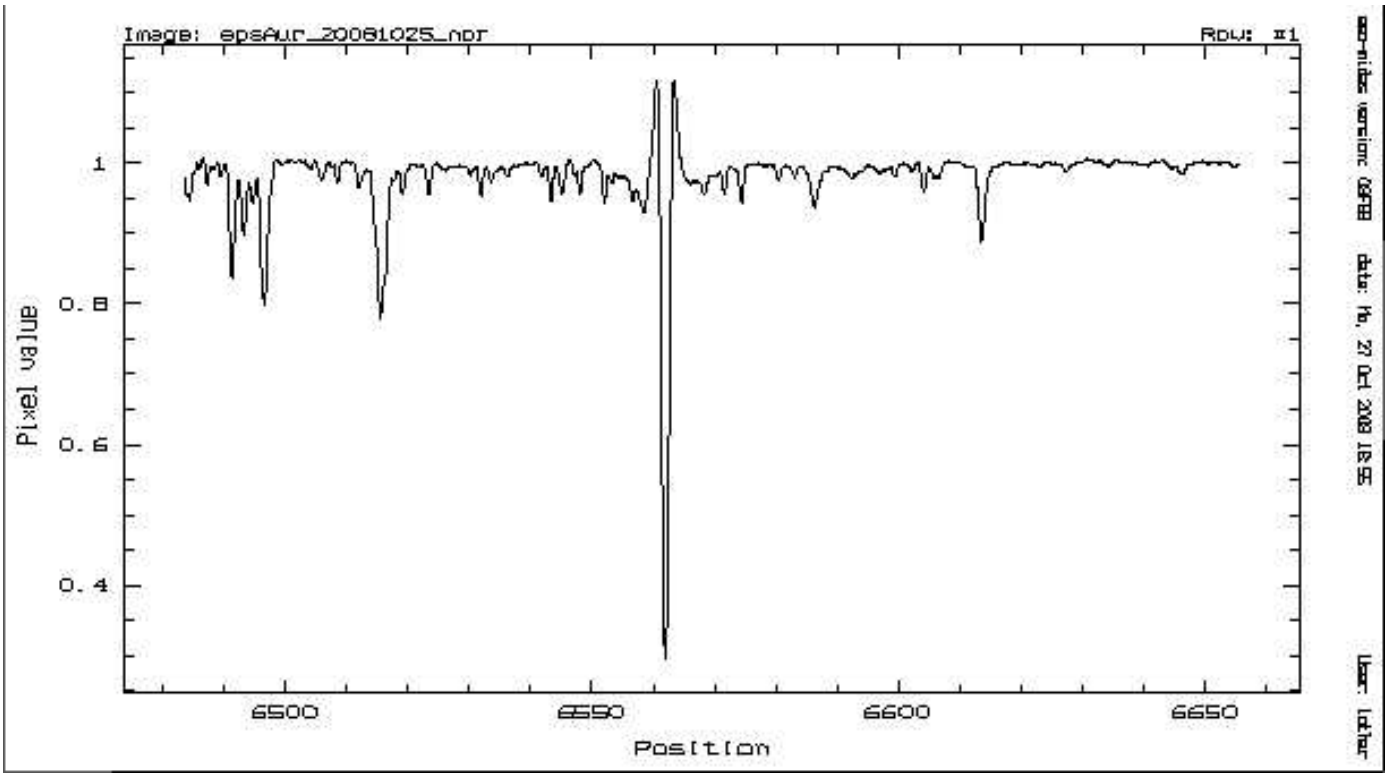


According to Ferluga, http://adsabs.harvard.edu/abs/1991A&A...243..230F it should be possible to see changes in the Eps Aur spectrum around H gamma over the next 3 years due to the eclipsing object. The LHIRES 2400 plus ATK16-IC camera worked ok in this area with good sensitivity but the doublet needed significant refocussing as it is beyond the range the achromat is corrected for. Wavelength calibration was done using Ar I lines in the neon lamp spectrum. Resolution is R ~14000 based on FWHM of the neon lines

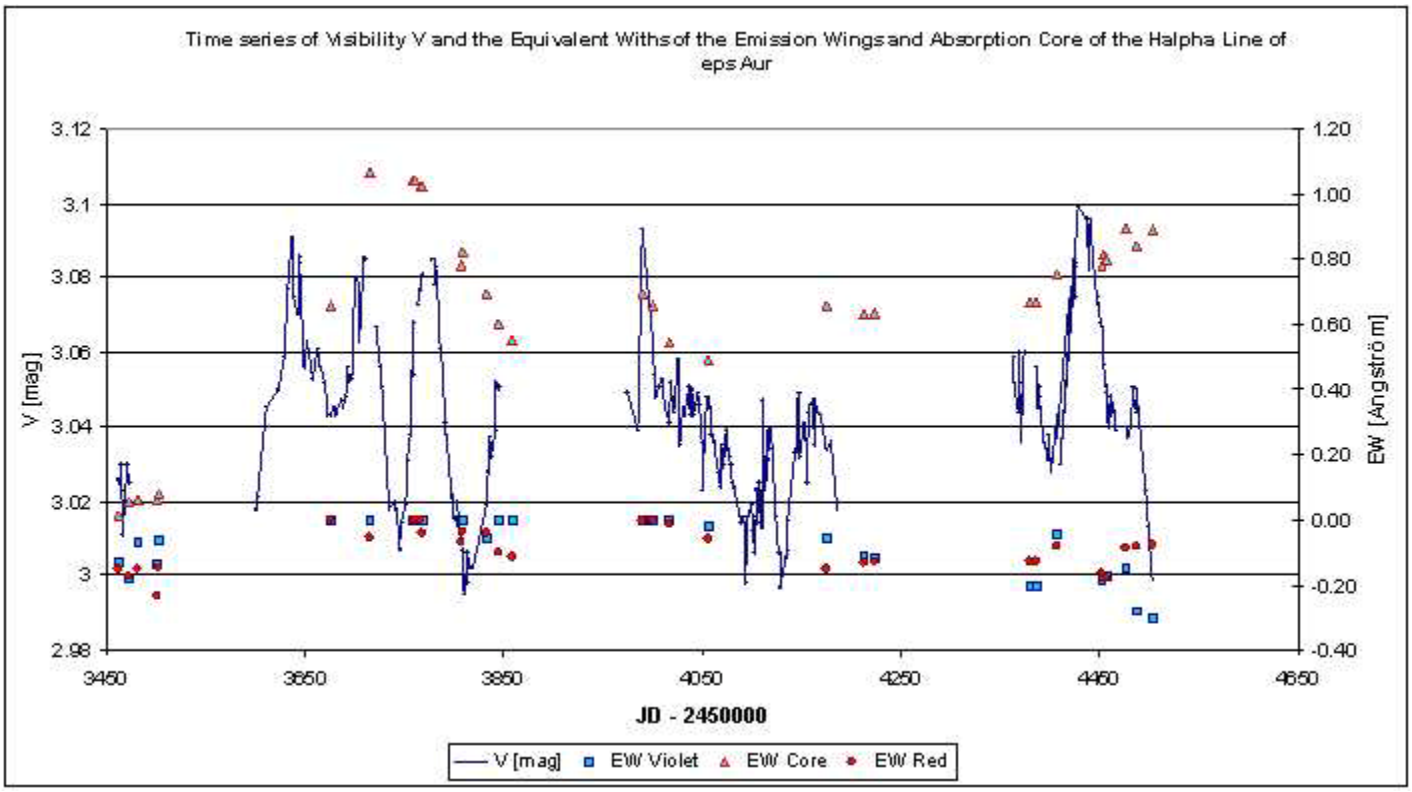


27 October 2008
Lothar Schanne

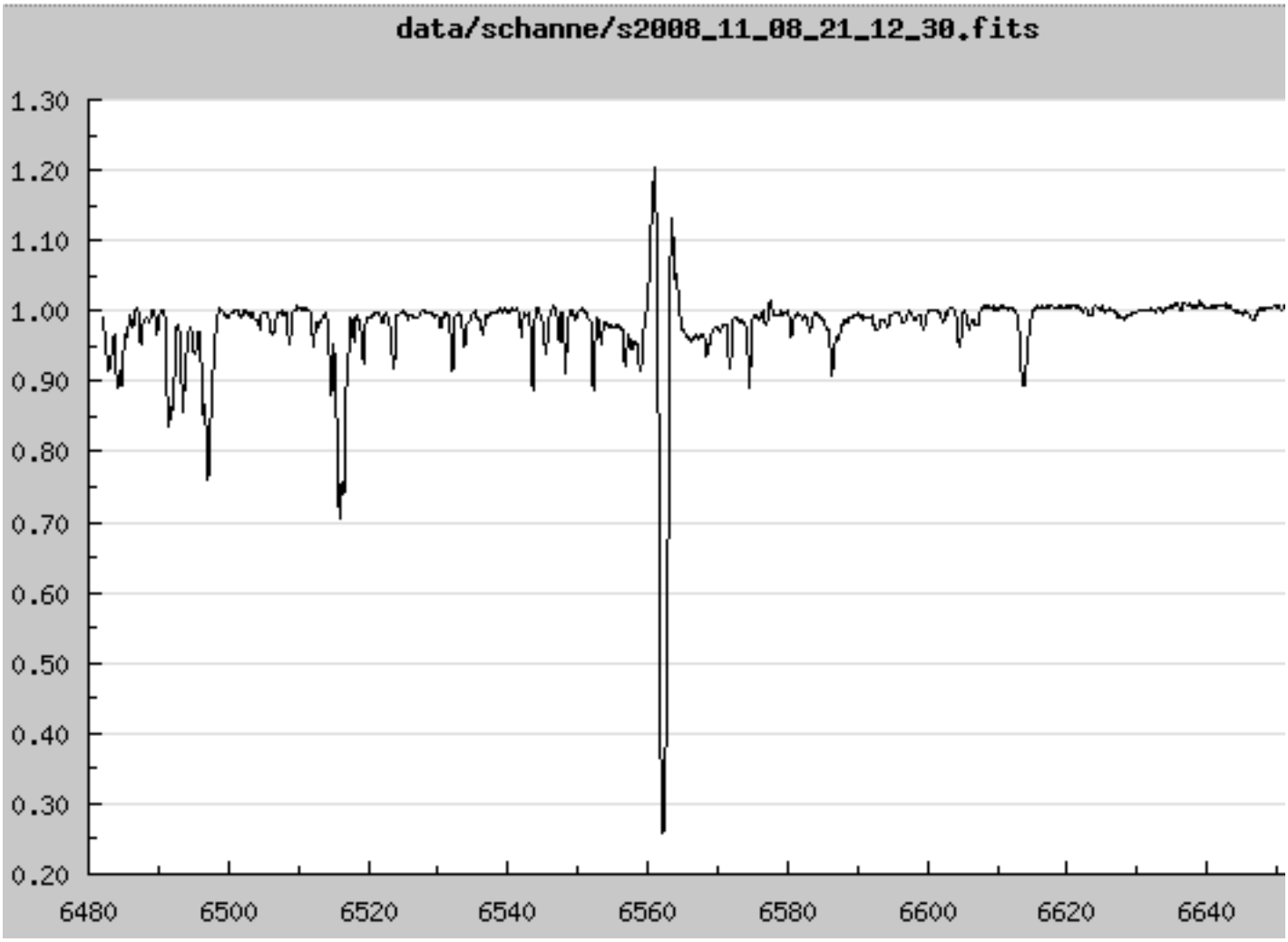
In the annex my spectrum of 25 October 2008. 60 min exposition (6x10min). Neon line calibrated. Normalized. No water line correction. The equivalibility of the "horns" is evident.



6 November 2008



21 November 2008



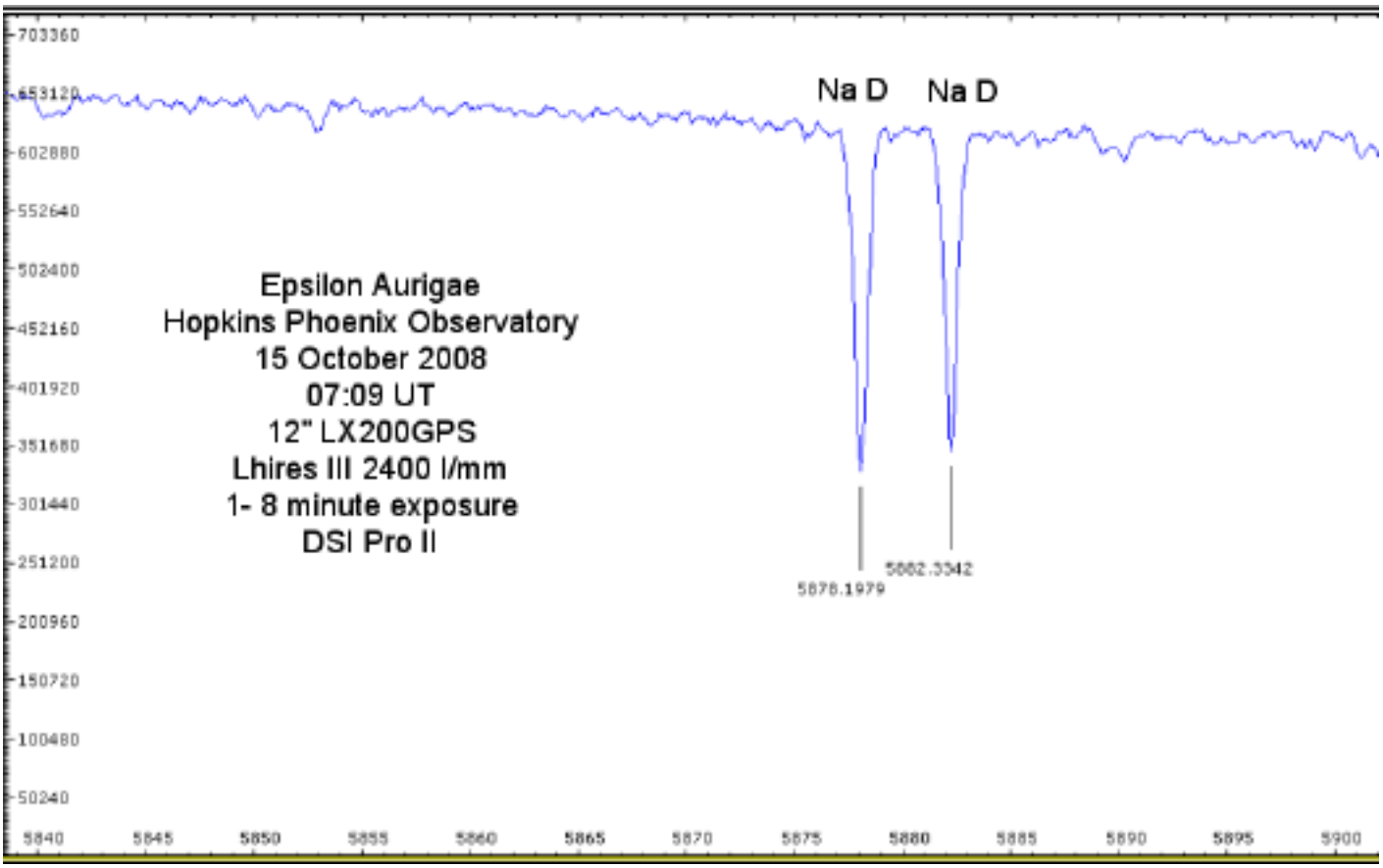
28 Nov 2008

A new series of spectra (R = ca. 10.000) between 5700 and 6655 A you can find in our data bank http://stahl.homelinux.org:8000/otmar/specdb/

04 December 2008
Jeff Hopkins
Hopkins Phoenix Observatory

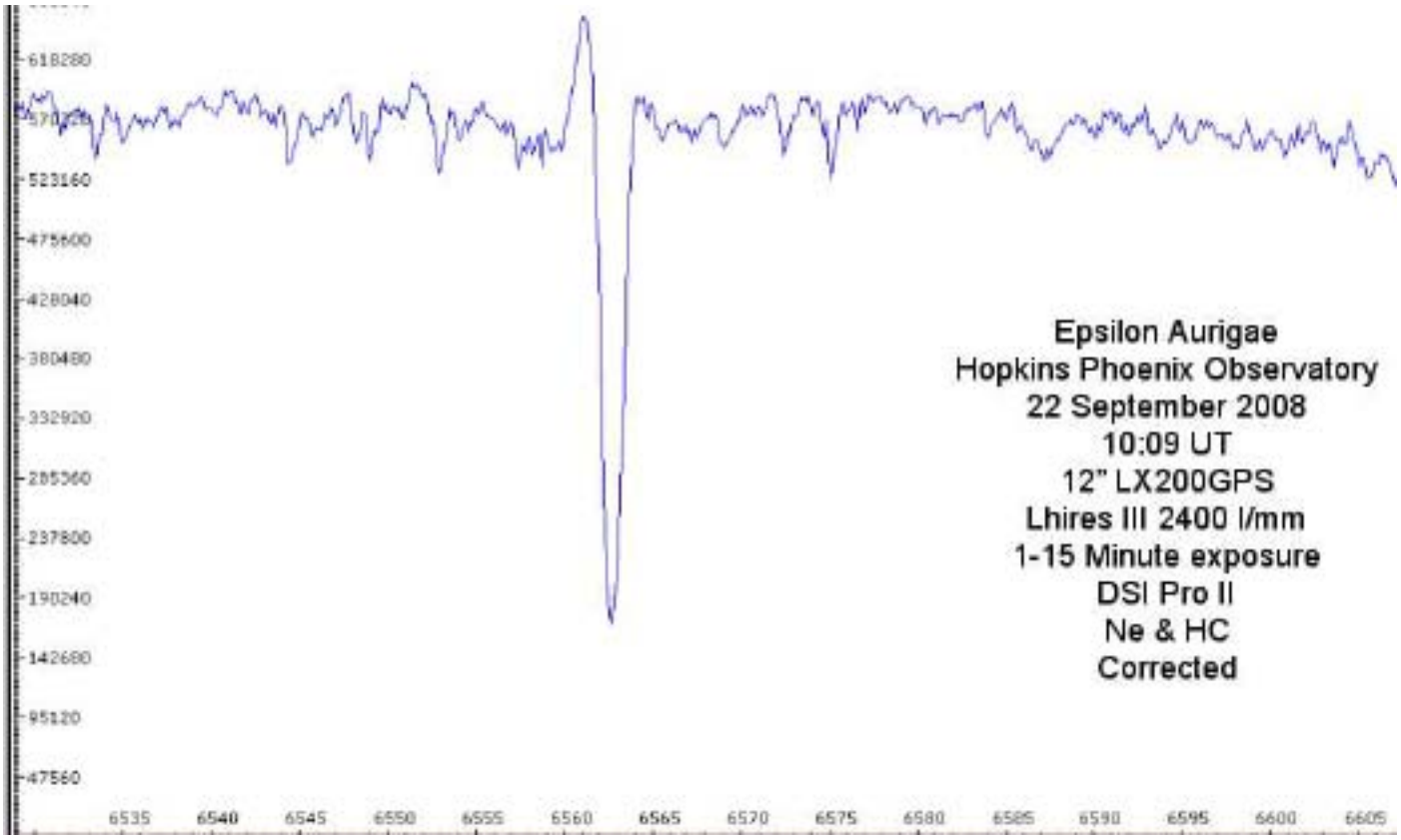
At the Hopkins Phoenix Observatory spectroscopy began in August of this year with a Lhires III using a 2,400 line per millimeter grating with a DSI Pro camera for guiding and DSI Pro II camera for imaging . A 12" LX200 GPS telescope in a roll off roof observatory is used with the Lhires III.

A spectrum of epsilon Aurigae's sodium D lines was taken on 15 October 2008 to provide a reference for spectra in this region during the eclipse.

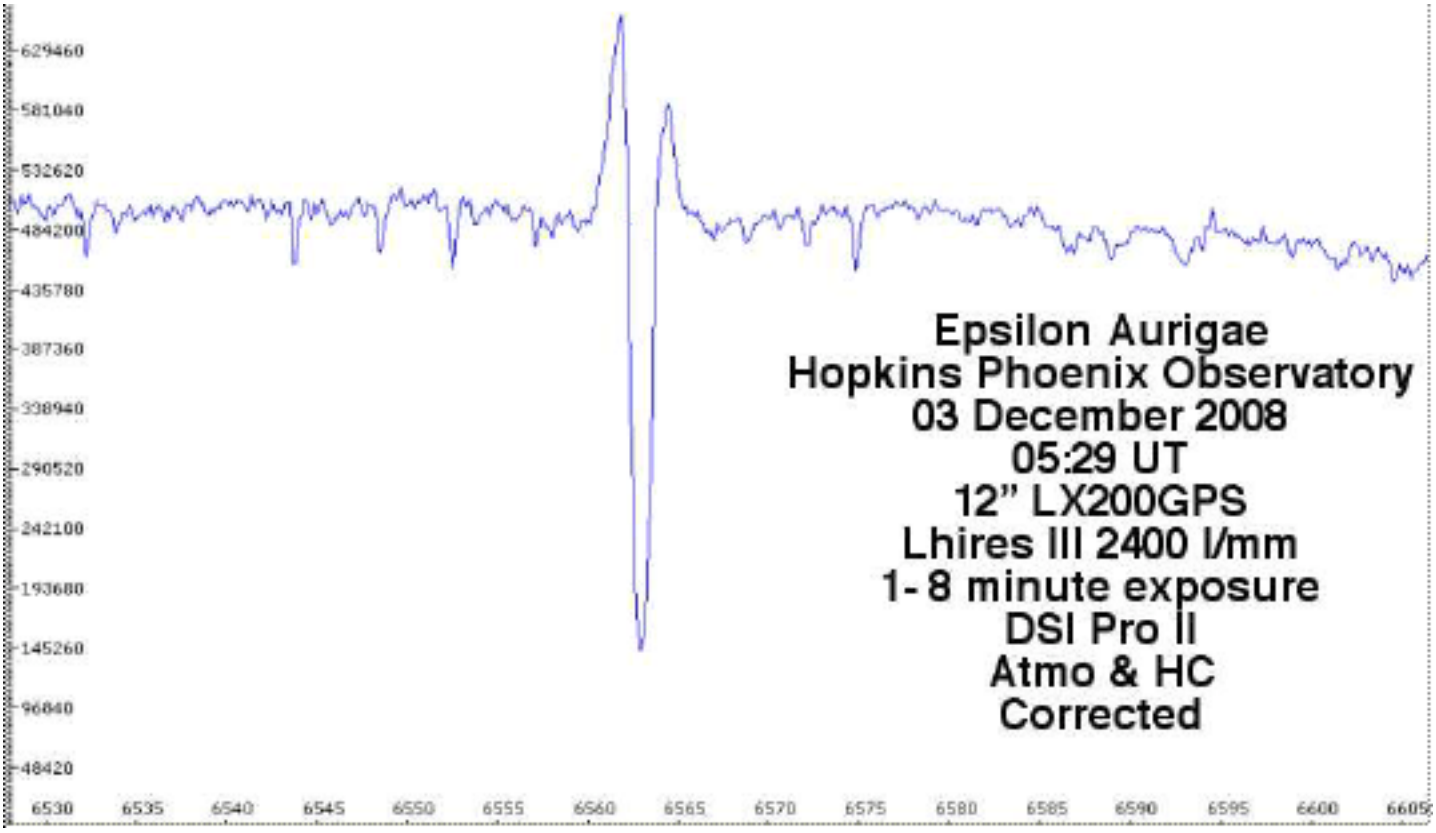


The primary spectral region if interest at the Hopkins Phoenix Observatory is the hydrogen alpha region. Spectroscopy of epsilon Aurigae hydrogen alpha was stated in August of 2008. The epsilon Aurigae hydrogen alpha region has three lines, an absorption line bracketed by two emission lines. While I prefer to call the emission lines horns (because they look like horns) some observers call them wings. The horn that is Doppler shifted toward the shorter wavelength is referred to as the blue horn and the one Doppler shifted toward the longer wavelength as the red horn.

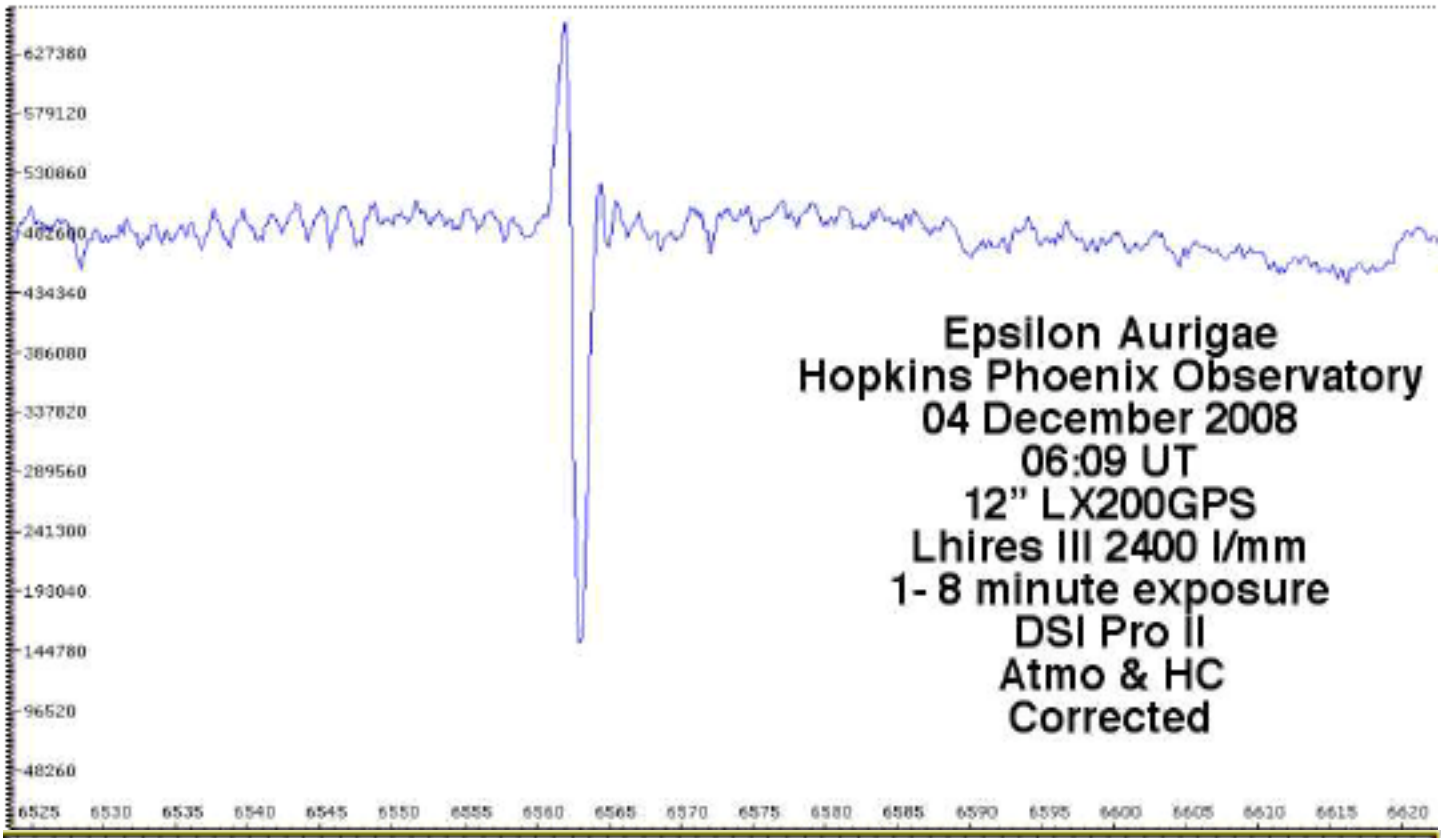
Initial spectra were more learning than of any scientific value. A spectrum taken on 22 September 2008 showed a prominent blue horn and large absorption line, but little or no red emission horn.

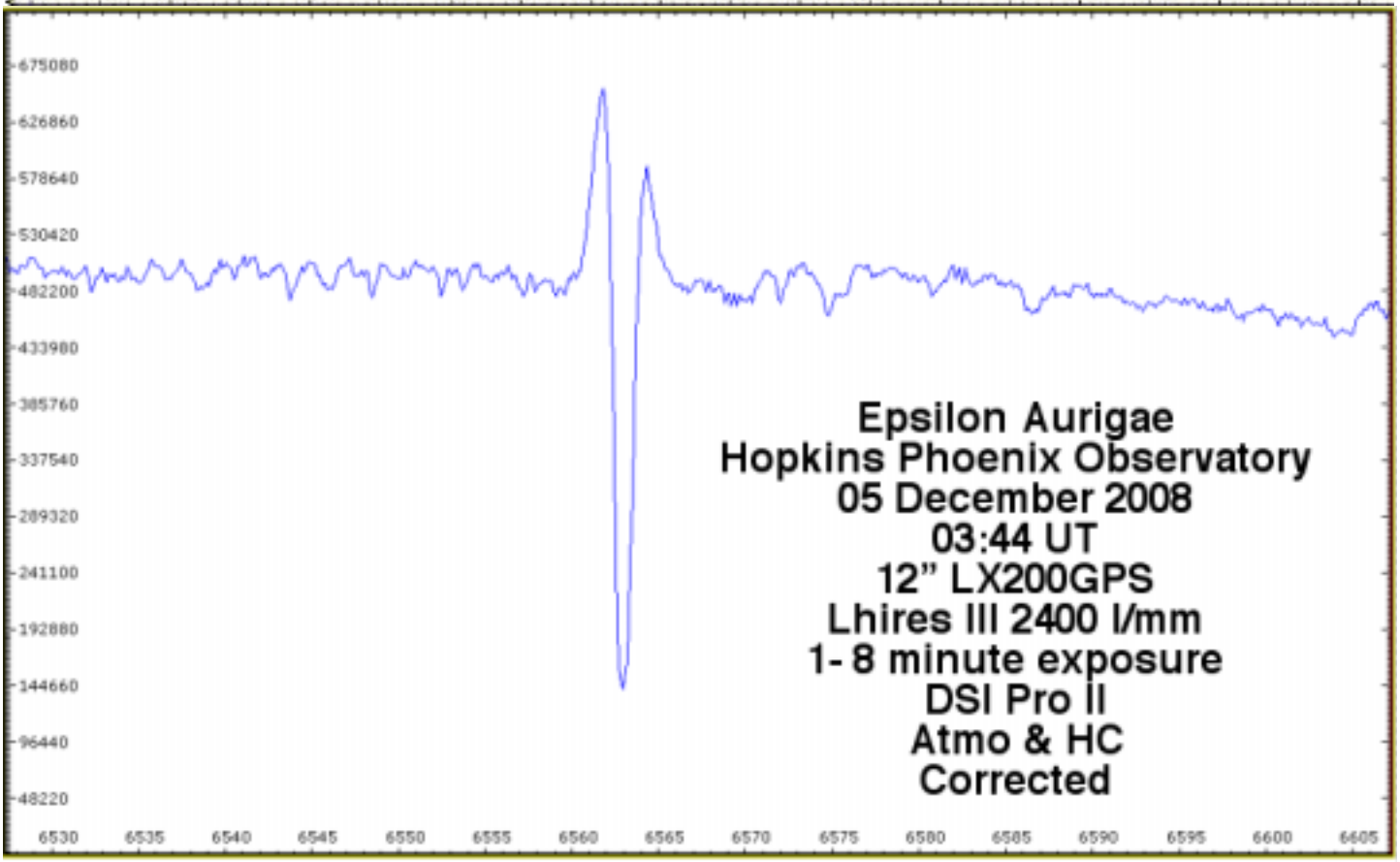


Spectra taken from late September to 3 December 2008 show a significant red horn. The red horn tended to vary a fair amount, but was always prominent.



While the spectrum taken 03 December 2008 showed a significant red horn, a spectrum taken just 24 hours later on 04 December shows the red horn essentially gone. On 05 December the red horn is back.





UT Date 2008	Blue Horn		Absorption		Red Horn	
	EW	Center λ Å	EW	Center λ Å	EW	Center λ Å
08/11	0.424	6,561.3978	-1.009	6,563.1077	0.001	6,564.7693
08/22	0.273	6,561.5203	-1.056	6,563.1004	0.000	
09/03	0.292	6,561.3262	-0.904	6,563.1091	-0.023	6,564.7608
09/05	0.342	6,561.5125	-0.887	6,563.1476	-0.118	6,565.2872
09/22	0.265	6,561.1194	-0.993	6,562.8485	0.059	6,564.5903
09/29	0.163	6,560.7093	-1.327	6,565.5004	0.009	6,564.1222
10/12	0.225	6,560.5245	-1.003	6,562.1402	0.138	6,563.4827
10/14	0.378	6,560.6200	-1.127	6,561.9833	0.108	6,563.2498
10/15	0.343	6,561.2796	-1.002	6,562.9844	0.328	6,564.7789
10/19	0.256	6,561.6593	-1.088	6,563.4063	0.080	6,564.7593
10/19	0.268	6,561.3191	-1.070	6,562.9504	0.220	6,564.7161
10/21	0.342	6,561.3240	-1.011	6,563.0071	0.223	6,564.6527
10/21	0.262	6,561.5048	-1.015	6,563.1595	0.130	6,564.8250
10/24	0.396	6,560.1378	-0.881	6,561.6064	0.275	6,563.0207
10/26	0.341	6,561.4131	-1.051	6,563.0688	0.207	6,564.5645
10/28	0.359	6,561.2978	-1.025	6,562.9785	0.243	6,564.5925
10/30	0.305	6,561.3082	-0.992	6,563.0608	0.256	6,565.0644
11/01	0.136	6,561.5021	-1.046	6,562.9444	0.091	6,564.2025
11/04	0.203	6,561.5381	-1.027	6,563.1266	0.142	6,564.5385
11/06	0.317	6,561.5188	-1.007	6,563.0287	0.267	6,564.6141
11/07	0.451	6,561.3351	-0.966	6,562.9734	0.186	6,564.6481
11/09	0.309	6,561.1547	-0.882	6,562.7936	0.129	6,565.4320
11/15	0.432	6,561.4236	-0.911	6,562.8626	0.361	6,564.3547
11/17	0.545	6,561.5102	-0.944	6,563.0296	0.320	6,564.5967
11/19	0.578	6,561.6205	-0.892	6,563.0867	0.255	6,564.5330
11/24	0.477	6,565.4438	-0.924	6,562.9020	0.273	6,564.4018
11/30	0.479	6,561.6164	-0.926	6,563.0356	0.222	6,564.6310
12/01	0.547	6,565.5750	-0.949	6,563.0643	0.199	6,564.5535
12/03	0.423	6,561.6100	-0.949	6,563.0340	0.235	6,564.5394
12/04	0.659	6,561.7096	-0.828	6,563.1293	0.030	6,564.3809
12/05	0.376	6,561.5982	-0.907	6,563.0482	0.273	6,564.5582

Spectral Data Summary of Hopkins Phoenix Observatory

From Dr. Bob

POLARIMETRY REPORT (R. Stencel, University of Denver)
The only published polarimetry data and analysis of the 1982-84 eclipse was by Jack Kemp and collaborators (1985, 1986). Their data showed a ~100 day low amplitude variation in integrated light plus a secular decrease in polarization asymmetric about the eclipse center. Interesting for asteroseismic analysis, Kemp noted the presence of "stochastic changes" on timescales of 0.5 to 5 days. They modeled the polarization changes in terms of a dark disk passing in front of the F supergiant (Huang model) but the asymmetry in the polarization requires the disk be tilted by ~5 degrees relative to the orbital plane, implying strong precession torques and a prediction for a strong central brightening during the 2010 eclipse due to exposure of a central disk gap. A number of discussions have occurred with groups having instrumentation and telescopes capable of pursuing this type of observation, but so far, no new observations have been reported.

INTERFEROMETRY REPORT (R. Stencel, University of Denver)
In an Astrophysical Journal Letter, published this month (2008 Dec.), we report new and archival K-band interferometric uniform disk diameters obtained with the Palomar Testbed Interferometer [PTI] for the eclipsing binary star epsilon Aurigae, in advance of the start of its eclipse in 2009. The observations were intended to test whether low amplitude variations in the system are connected with the F supergiant star (primary), or with the intersystem material connecting the star with the enormous dark disk (secondary) inferred to cause the eclipses. Cepheid-like radial pulsations of the F star are not detected, nor do we find evidence for proposed 6% per decade shrinkage of the F star (Saito and Kitamura, 1986). The measured 2.27plus/minus 0.11 milli-arcsecond K band diameter is consistent with a 300 times solar radius F supergiant star at the Hipparcos distance of 625 pc. These results and the low amplitude light variation changes even more strongly point to an active core of the disk-like secondary, and provide an improved context for observations during the 2009-2011 eclipse. Additional observations are being collected during autumn of 2008 on multiple baselines in an effort to extend these results.

Reference: Interferometric Studies of the extreme binary, epsilon Aurigae: Pre-eclipse Observations, by R.Stencel, M. Creech-Eakman, A. Hart, J. Hopkins, B.Kloppenborg & D.Mais [2008 Dec. 20 ApJ Letters]. Link: http://arxiv.org/abs/0810.5382

While the 2 telescope PTI diameter measurements are important, we have embarked on 4 telescope imaging interferometry with the Michigan IR Combiner (Monnier et al. 2006) on the CHARA interferometer at Mt. Wilson, with approved observing time starting 2008 December. The important difference between the 4 telescope system at CHARA and the 2 telescope PTI, is "phase closure" – which provides much better coverage of the u-v plane and hence, superior image reconstruction, as opposed to simple diameters. The goal of this first observation is to establish pre-eclipse shape constraints for the primary F supergiant star, in the extreme long period eclipsing binary, epsilon Aurigae, which is about to begin one of its once-per-27 year eclipse

events after mid-2009. The preferred model for this system (Huang, 1965 and updates thereto) suggests that a massive thin disk will bisect the F star beginning in summer 2009, and persisting for nearly 2 years. The system brightness K=1.5, its 2.2 milli-arcsec K band uniform disk diameter, and long-running research controversy surrounding epsilon Aurigae, make it an ideal target for CHARA - to confirm or disprove the basic model in a DIRECT TEST, and to further demonstrate the potential for imaging interferometry to advance astrophysics in general.

Reminder: Original paper copies of the 1985 eps Aur Workshop Proceedings are available on request, free, if interested parties will provide me with a snail mail address. A collector's item! Whiles supplies last.

Dr. Robert Stencel
University of Denver Astronomy Program
<rstencel@du.edu>

Interesting Papers

Spectrophotometry of Epsilon Aurigae

D.T. Thimpson, B.L. Lutz and G.W. Lockwood
Lowell Observatory
and
J.R. Sowell University of Michigan

The Astrophysical Journal, 321:450-458, 1987 October 1

Abstract

Four- and eight-A resolution spectrophotometric observations were performed over the range of 3295-8880 Å of the peculiar eclipsing binary Epsilon Aurigae during the 1982-1984 eclipse. The observations reveal a reddening of E(B-V) = 0.30 mag and, by comparison with published spectral atlases, a spectrophotometric spectral type in the MK region of F3-F4 Ia. The behavior of several absorption lines during eclipse is described. The observations suggest the presence of neutral sodium, potassium, hydrogen, and the molecule CH in the eclipsing body.

and

INTERFEROMETRIC STUDIES OF THE EXTREME BINARY ε AURIGAE: PRE-ECLIPSE OBSERVATIONS

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Department of Physics and Astronomy, University of Denver, Denver, CO 80208
Dale E. Mais
Palomar Community College, Valley Center, CA 92082
The Astrophysical Journal, 689: L137–L140, 2008 December 20

Abstract

We report new and archival *K*-band interferometric uniform disk diameters obtained with the Palomar Testbed Interferometer for the eclipsing binary star e Aurigae, in advance of the start of its eclipse in 2009. The observations were intended to test whether low-amplitude variations in the system are connected with the F supergiant star (primary), or with the intersystem material connecting the star with the enormous dark disk (secondary) inferred to cause the eclipses. Cepheid-like radial pulsations of the F star are not detected, nor do we find evidence for proposed 6% per decade shrinkage of the F star. The measured mas *K*-band diameter is consistent 2.27 0.11 with a 300 solar radius F supergiant star at the *Hipparcos* distance of 625 pc. These results provide an improved context for observations during the 2009–2011 eclipse.

BOOK
(Now Available)

Epsilon Aurigae A Mysterious Star System

by

Hopkins and Stencel

This is a 287 page soft cover book covering the history of epsilon Aurigae and the observations both in and out of eclipse as well as the different techniques used.

For more information

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

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Anyone wishing to contribute to the Newsletter, is most welcome. Please send contributions to me at phxjeff@hposoft.com.

Anyone desiring not to receive the Newsletter announcements, please e-mail me and I will remove your name from the mailing list.

Clear Skies!

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