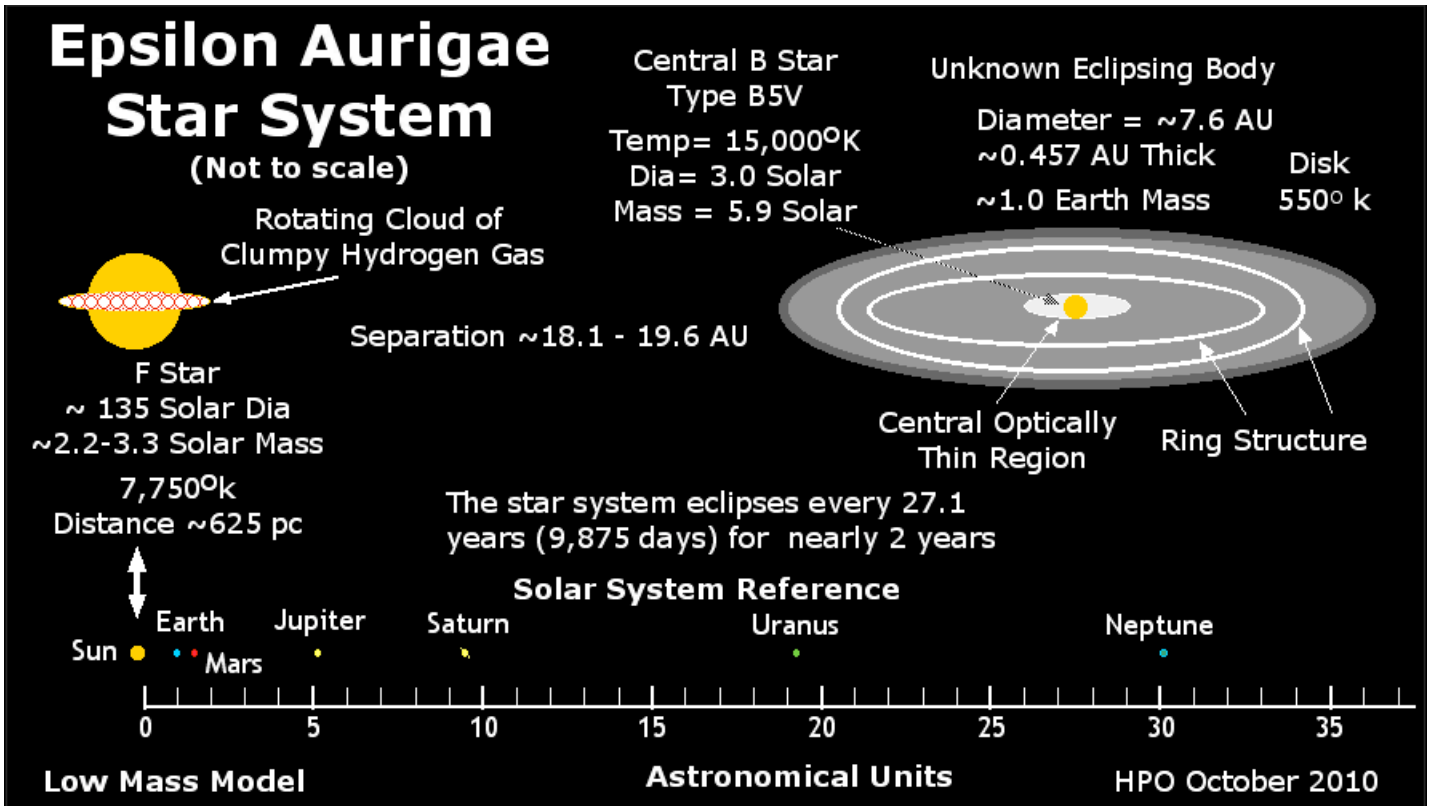
2009/2011
Epsilon Aurigae Eclipse
International Campaign Newsletter #22
Spring 2011 - Third Contact



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

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INTERESTING PAPERS:
Discovery of Strong Helium 10830A Absorption In The Mid-eclipse Disk Of Epsilon Aurigae

Accretion in the Disk of epsilon Aurigae: Results of Monte Carlo Radiative Transfer Modelling

Towards A Full Orbital Solution For Epsilon Aurigae

Regular High Resolution Full Visual Spectrum Monitoring of Epsilon Aurigae Throughout Its 2009-2011 Eclipse

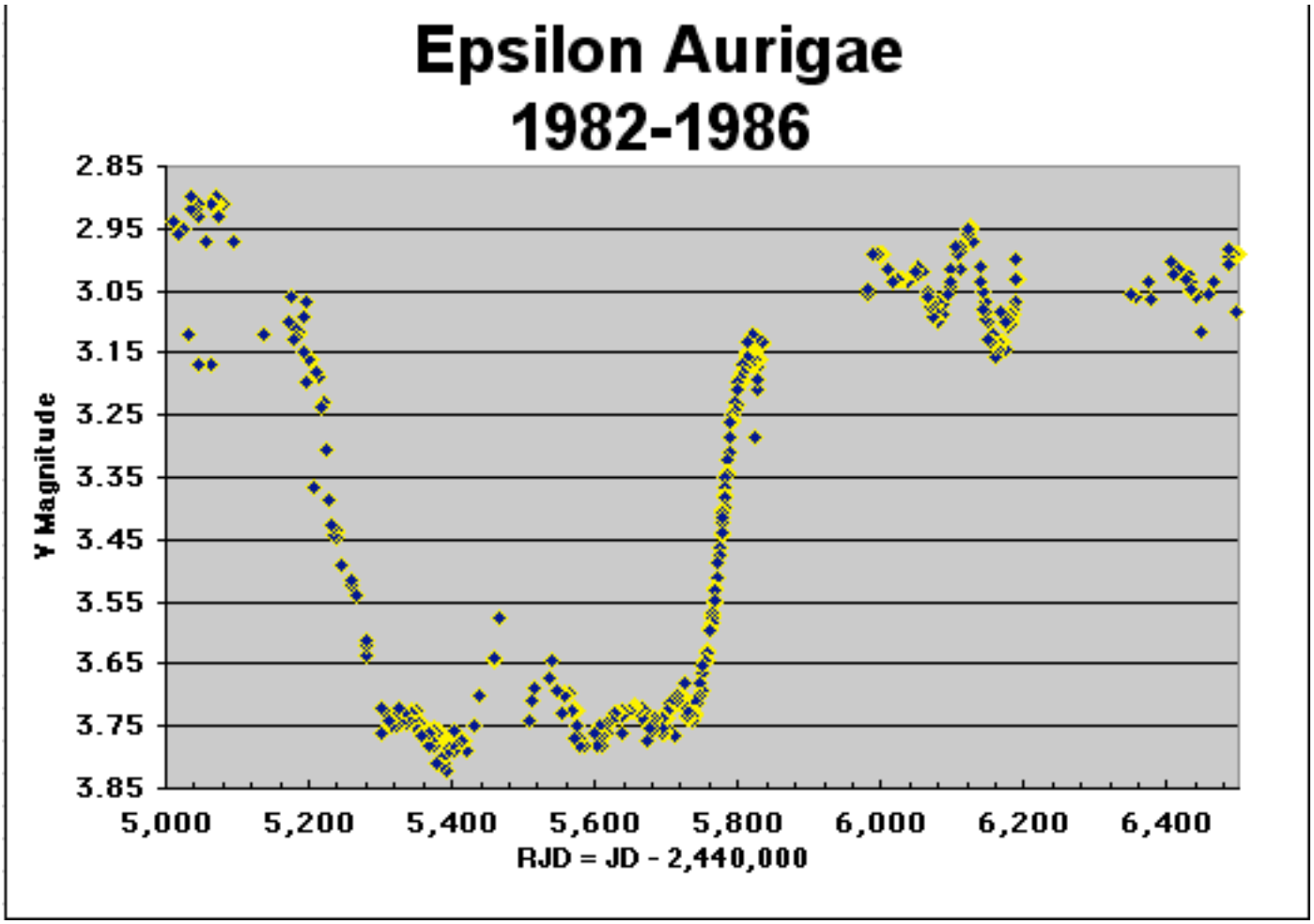
Editor's Remarks

Dear Colleagues,

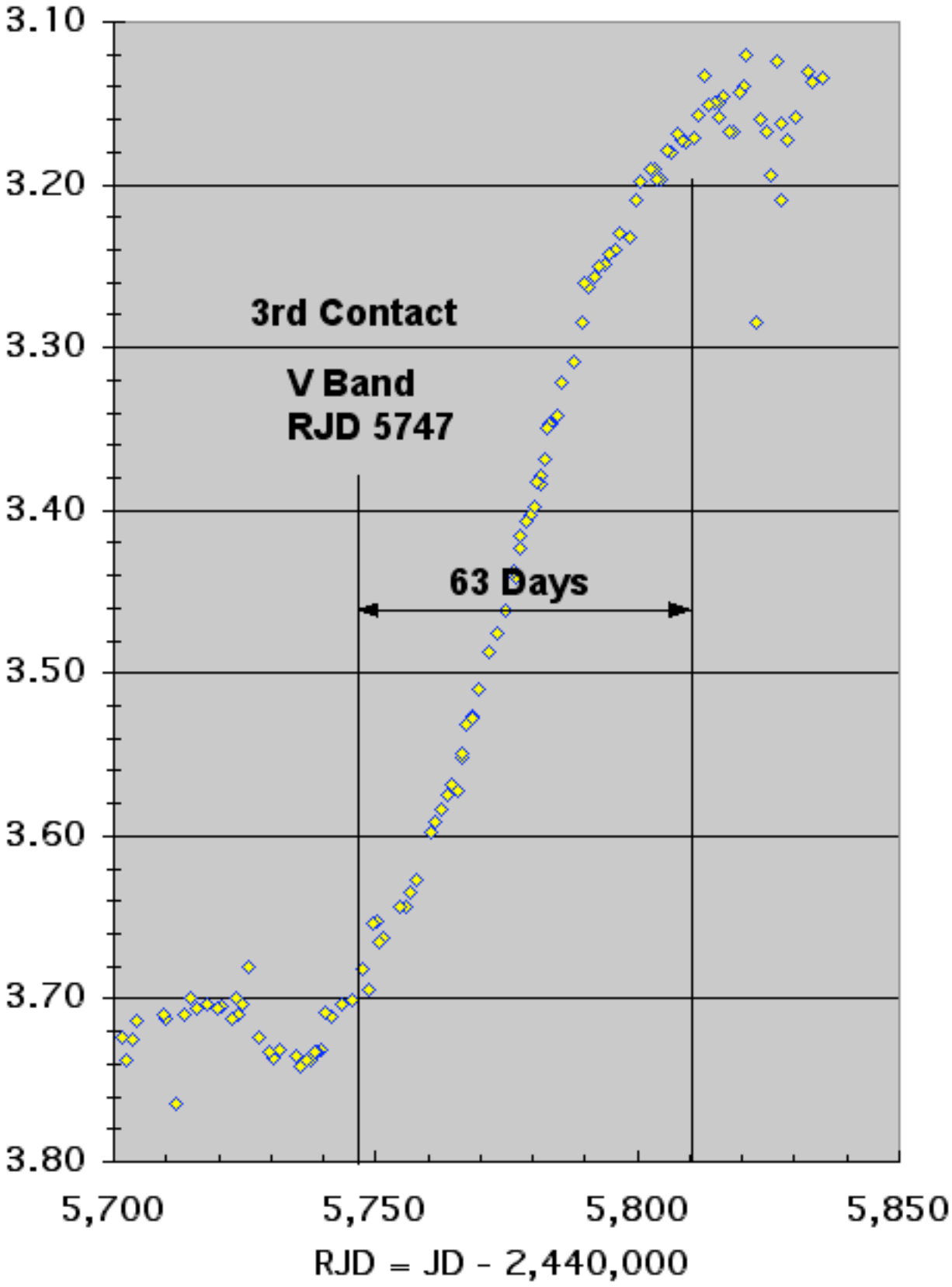
We now have over 3,100 total UBVRI observations during the eclipse with over 1,700 in the V band. A big thanks to all those making contributions. Thanks also to all the observers doing spectroscopy. This a new area where the smaller observatories have really shine and produce high quality profession spectra. More details in the Spectroscopy section by Robin Leadbeater.

We are fast approaching 4th Contact estimated around mid-May 2011. This will mark the end of the eclipse for 27 years, however continued observations are requested.

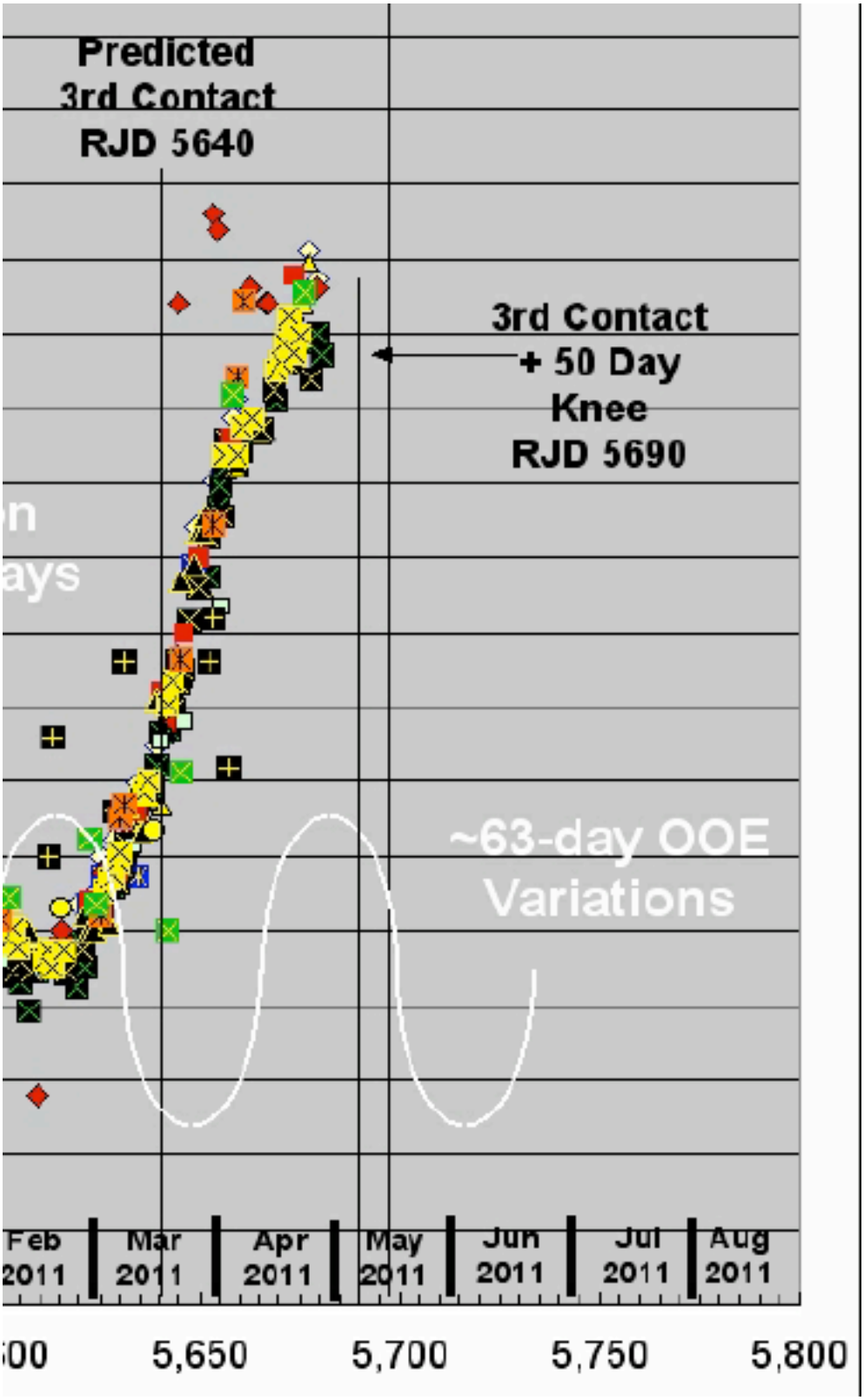
As seen from the 1982-1984 eclipse (see following plots) there were some very interesting variations around 4th Contact. Both during the last eclipse and the current one this period is during a time when observations are very difficult. Extra effort in getting data may prove very valuable. These variations may not be the OOE variations. The current eclipse is showing the same "knee" about 55 to 67 days after 3rd Contact. It shows up more significantly in the shorter wavelengths.



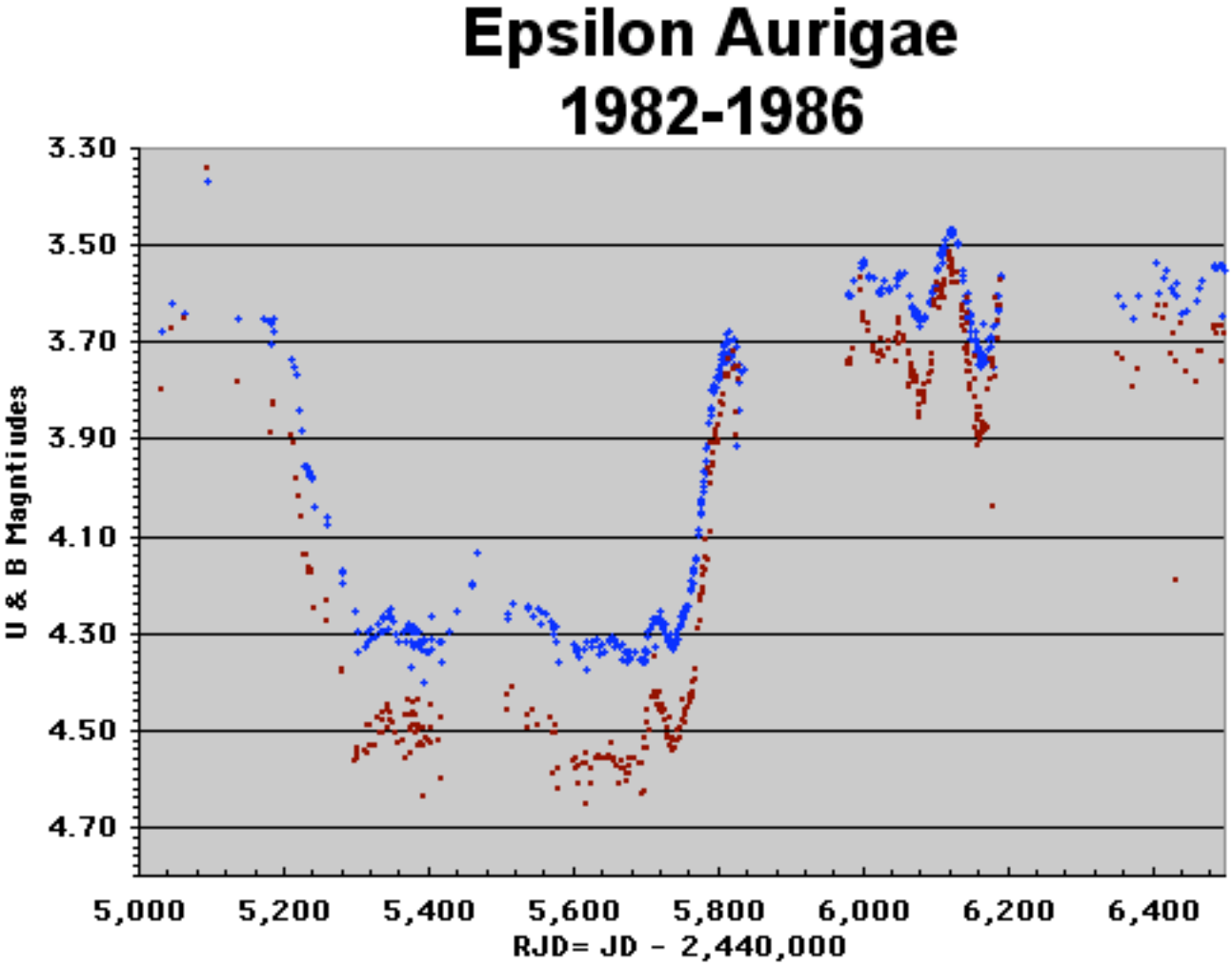
V Band Data for 1982 - 1986



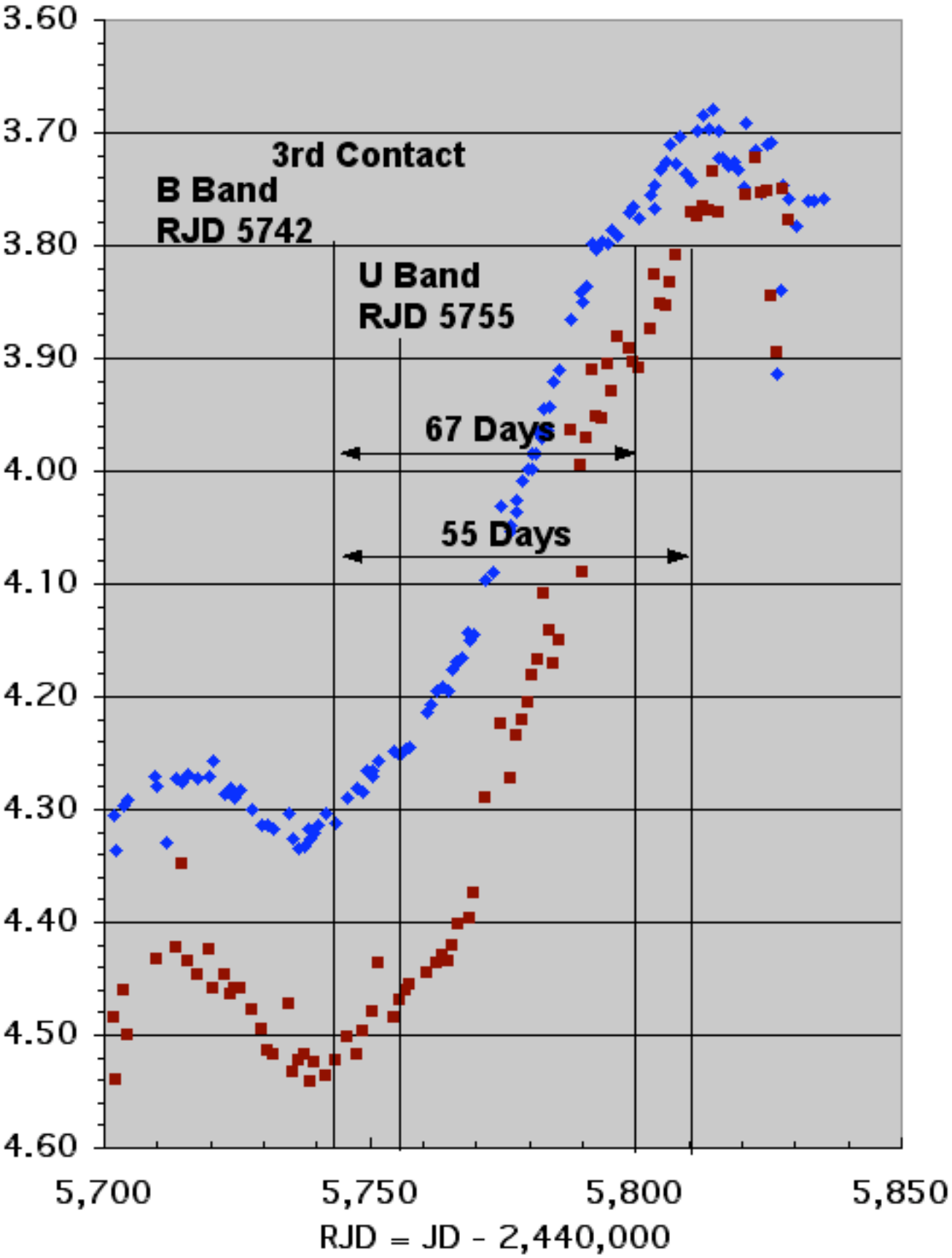
Detail of 1984 V Band Egress



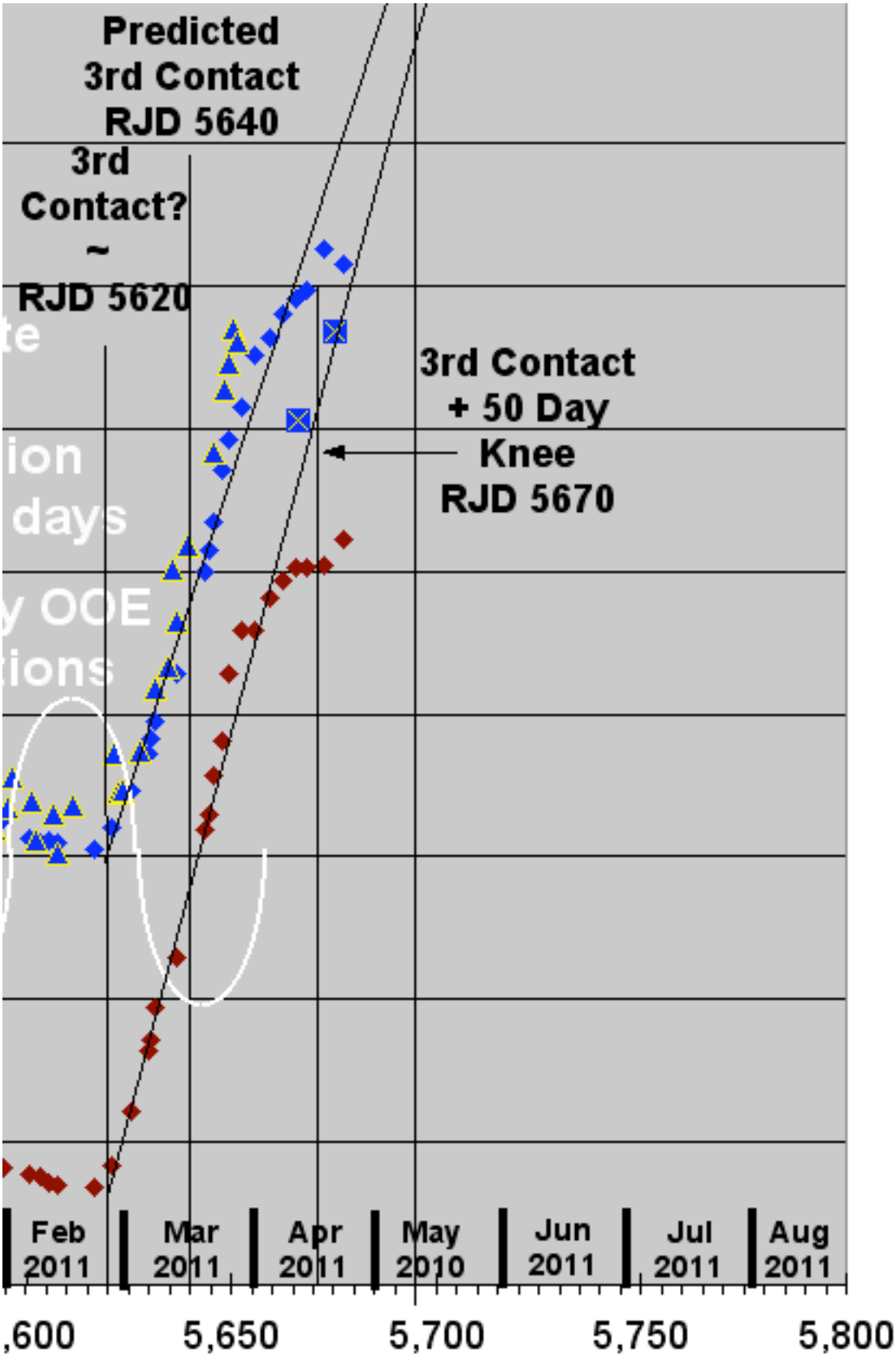
Detail of 2011 V Band Egress



U and B Band Data for 1982 - 1986



Detail of 1984 U & B Band Egress



Detail of 2011 U & B Band Egress

Dr. Bob and I are contemplating a second edition to our recent book on epsilon Aurigae. One thing that may make the book more valuable is that we plan to include a CD ROM with all the data archived, Newsletters, spectra and other information. This might prove very valuable for the next generation of observers when the next eclipse occurs in 2036. Suggestions for the book and CD ROM are most welcomed.

We plan at least one more Newsletter for this eclipse, probably mid-summer. For those who wish to continue observing out-of-eclipse, we may develop a continuing program. Details in the future. What many do not realize is there is a great deal still to be learned from data taken out-of-eclipse.

Over the next few months we plan to analysis the Campaign data in detail/ Because there is still interesting things going on even after 4th Contact, we encourage you to continue yor observations and suumit the data.

GREAT JOB EVERYONE!

Jeff

IMPORTANT NOTICES

Data Copyright

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

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Standard Deviation versus Standard Error

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

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

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

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

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Yahoo Epsilon Aurigae Chat List Forum

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

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

and sign up.

Photometry Report

by
Jeffrey Hopkins
Hopkins Phoenix Observatory

Summary of Data Point Observations by Observer

Obser	V Band	B Band	U Band	Rc Band	Rj Band	Ic Band	Ij Band	Total	Equip
CH -	78							78	DSLR
CO -	3							3	CCD
DES -	201							201	DSLR
EAO -	68							68	CCD
EGO -	81							81	DSLR
EUO -	1	39	9		40			89	PMT
FJM -	59							59	SSP-3
GHO -	149					145		294	CCD
GO -	19			19				38	CCD
GS -	161	160		165		163		649	CCD
GVO -	13	8			13		13	47	SSP-3
HPO -	147	209	209					565	PMT
JBO -	16	41			16		16	89	SSP-3
JESO-	34							34	
KO -	106							106	CCD
LO -	87							87	SSP-3
MSO -	3	3						6	CCD
NKO -	37							37	DSLR
NPO -	0				16		16	32	SSP-3
RES -	50							50	DSLR
RLO -	29							29	DSLR
SGGO-	64	17		59				140	CCD
TP -	86							86	DSLR
VO -	159							159	DSLR
WWC-	50	42						92	DSLR
Total	1701	519	218	243	85	308	45	3119	XX

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 3,100 total observations during the eclipse with the visual band having by far the most at over 1,700 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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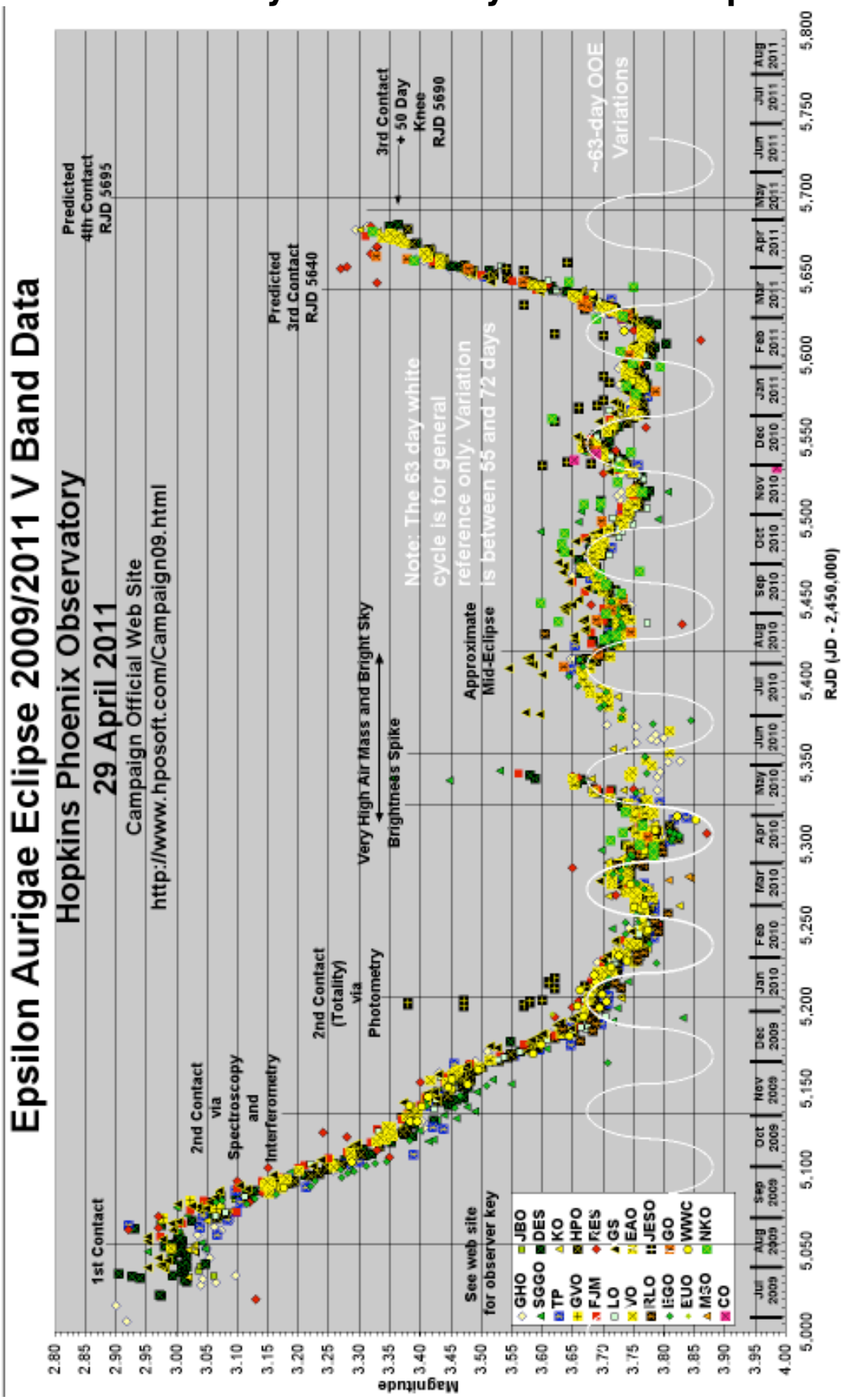
Note: Full resolution images of the photometric data plots can be seen at:

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

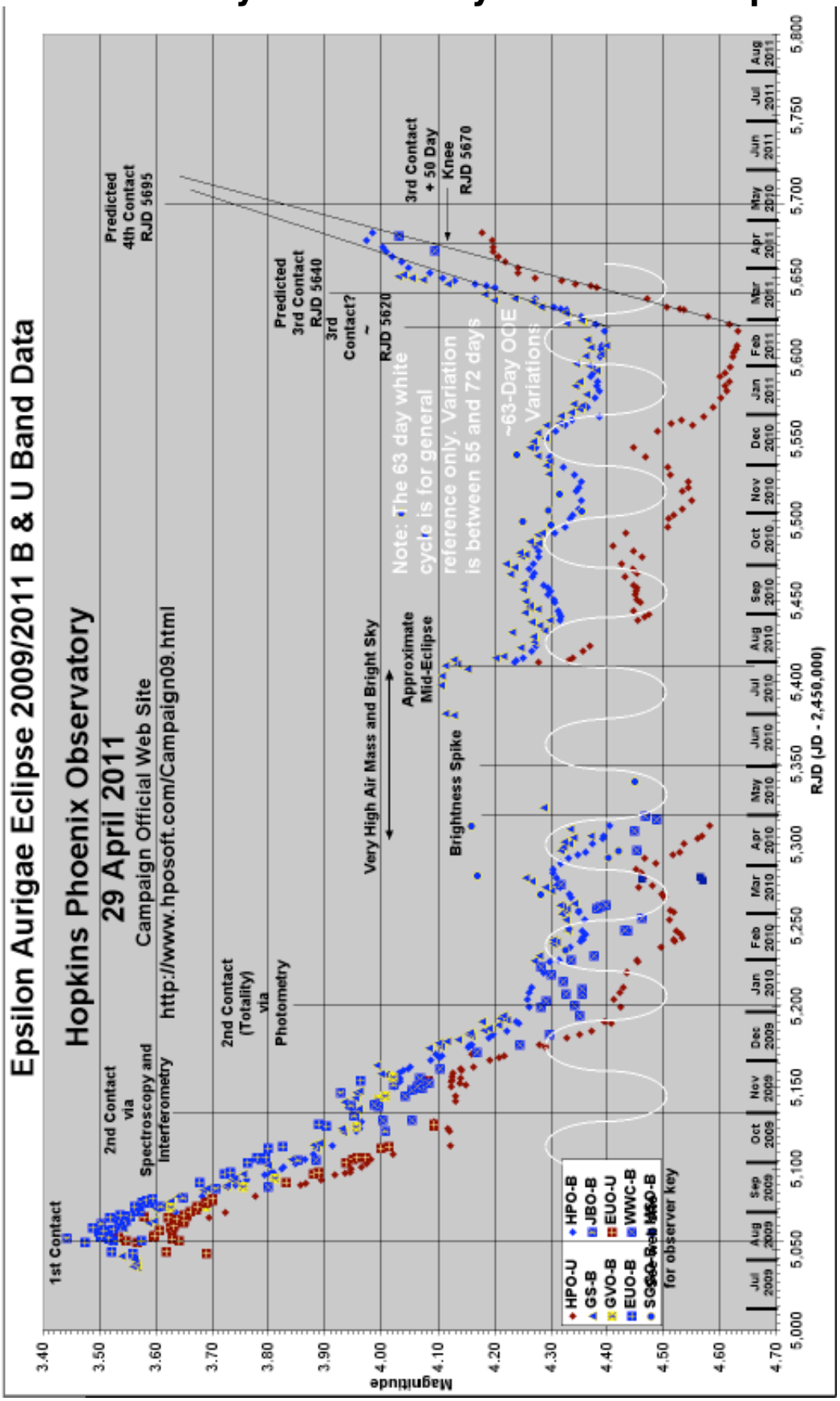
UB Band Plots:
http://www.hposoft.com/Plots09/UBFall09.jpg

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

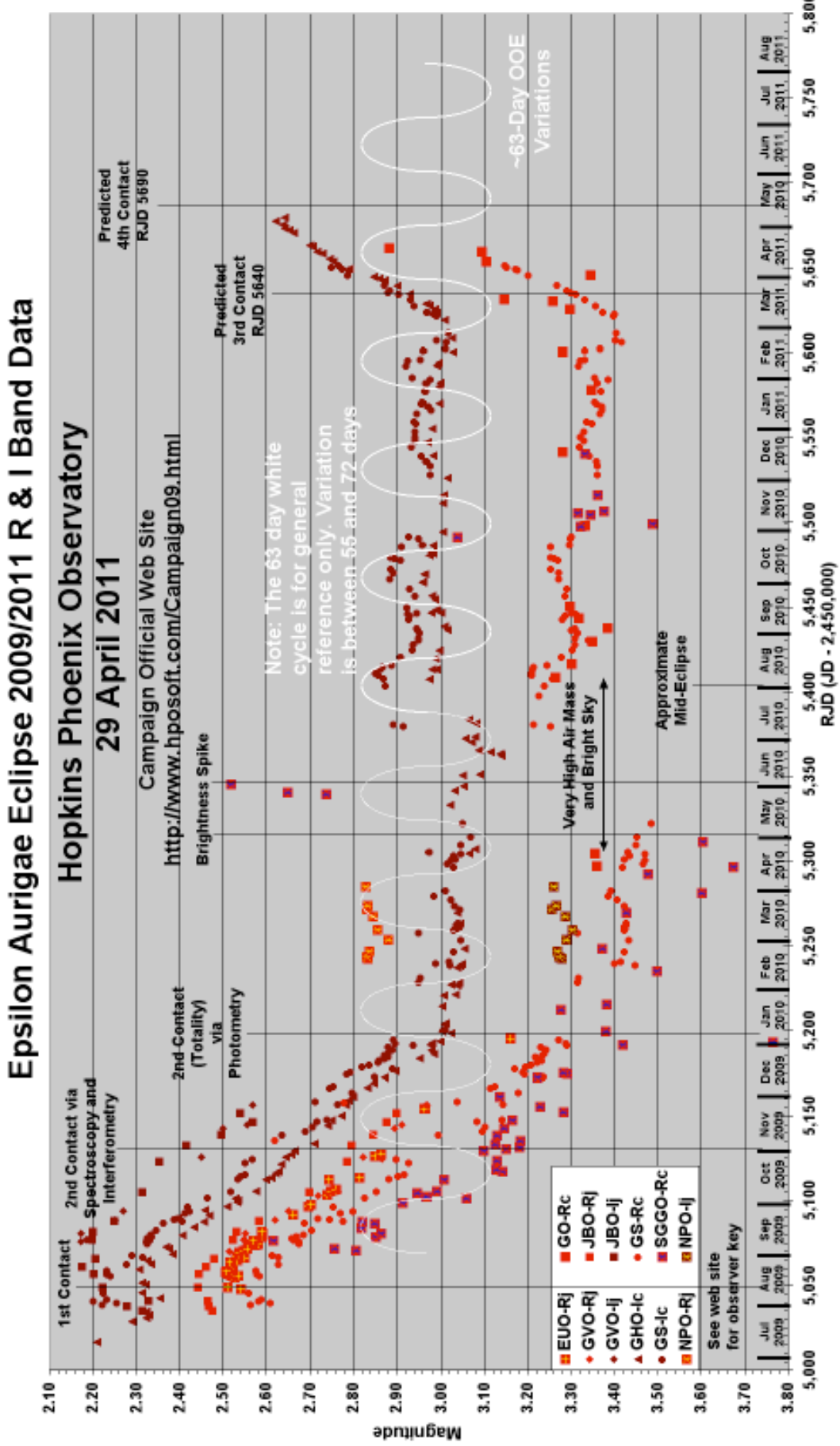
Ingress and Totality Photometry V Data Composite Plot



Ingress and Totality Photometry UB Data Composite Plot



Ingress and Totality Photometry RI Data Composite Plot



Photometric Observers

Data are data submitted since Newsletter #21.

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
23/24 February 2011	5616.408	3.779	0.020
26/27 February 2011	5619.367	3.787	0.013
27/28 February 2011	5620.394	3.757	0.012
28 Feb/01 Mar 2011	5621.288	3.775	0.017
01/02 March 2011	5622.436	3.746	0.021
02/03 March 2011	5623.317	3.747	0.015
07/08 March 2011	5628.41	3.720	0.010
10/11 March 2011	5631.39	3.701	0.012
17/18 March 2011	5638.377	3.655	0.029
18/19 March 2011	5639.394	3.639	0.019
19/20 March 2011	5640.452	3.617	0.006
21/22 March 2011	5642.398	3.614	0.021
22/23 March 2011	5643.367	3.589	0.019
23/24 March 2011	5644.343	3.570	0.006
24/25 March 2011	5645.352	3.579	0.020
31 Mar/01 Apr 2011	5652.338	3.513	0.017
02/03 April 2011	5654.348	3.466	0.011
03/04 April 2011	5655.340	3.452	0.009
04/05 April 2011	5656.360	3.440	0.007
07/08 April 2011	5659.377	3.738	0.031
08/09 April 2011	5660.363	3.429	0.014
17/18 April 2011	5669.369	3.395	0.016
23/24 April 2011	5675.373	3.355	0.020
27/28 April 2011	5679.392	3.350	0.029
28/29 April 2011	5680.373	3.365	0.011

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
5595.5017	4.366	0.027	3.736	0.017	3.321	0.006	2.927	0.018
5596.4974	4.344	0.019	3.735	0.012	3.332	0.013	2.955	0.006
5601.5124	4.362	0.032	3.754	0.013	3.331	0.011	2.962	0.026
5602.5259	4.388	0.021	3.730	0.010	3.367	0.008	3.012	0.004
5606.6159	4.371	0.022	3.750	0.013	3.417	0.016	3.014	0.026
5607.5964	4.398	0.028	3.752	0.015	3.402	0.012	2.990	0.013
5611.6199	4.365	0.032	3.763	0.017	3.404	0.007	3.018	0.010
5621.5442	4.328	0.025	3.740	0.020	3.398	0.011	2.991	0.013
5622.5546	4.355	0.035	3.750	0.016	3.400	0.009	2.984	0.015
5623.6148	4.354	0.020	3.750	0.010	3.373	0.013	2.970	0.030
5627.5454	4.326	0.053	3.746	0.018	3.357	0.030	2.940	0.017
5631.5372	4.283	0.017	3.667	0.008	3.331	0.004	2.933	0.014
5634.5608	4.267	0.027	3.652	0.015	3.311	0.014	2.906	0.010
5635.6221	4.199	0.012	3.684	0.046	3.298	0.043	2.881	0.055
5636.6143	4.235	0.038	3.658	0.030	3.290	0.009	2.884	0.029
5639.5757	4.182	0.024	3.595	0.009	3.267	0.010	2.873	0.007
5645.5597	4.117	0.039	3.516	0.009	3.202	0.021	2.788	0.014
5648.5526	4.073	0.034	3.506	0.016	3.176	0.007	2.792	0.016
5649.5549	4.055	0.015	3.484	0.015	3.173	0.006	2.774	0.019
5650.5573	4.030	0.022	3.484	0.008	3.152	0.013	2.750	0.012
5651.5577	4.039	0.023	3.472	0.018	3.148	0.005	2.766	0.011

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
22/23 February 2011	5615.5264	3.76	0.020
01/02 March 2011	5622.6915	3.73	0.031
08/09 March 2011	5629.6931	3.71	0.030
13/14 March 2011	5634.5972	3.67	0.025
19/20 March 2011	5640.6972	3.59	0.040
24/25 March 2911	5645.6960	3.55	0.024
28/29 March 2011	5649.7027	3.20	0.031
05/06 April 2011	5657.6565	3.42	0.023
21/22 April 2011	5673.6354	3.31	0.034

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)
Note: as of 01 January 2010 all previous data has been corrected. The following data is an updated list of the correct data. Some V band data was calculated using lambda Aurigae and some HD32655. It appears HD32655 may be variable. For data 94 August 2010 and after the comparison stars used were HD 72328 for V band with magnitude V= 7.64 and HD 32655 for Ic band with Ic= 5.65.

Date	RJD	V mag	SD	Ic	SD
15/16 February 2011	5608.466	3.762	0.005	3.025	0.007
26/27 February 2011	5619.325	3.732	0.004	3.009	0.002
02/03 March 2011	5623.325	3.727	0.005	2.991	0.004
04/05 March 2011	5625.351	3.708	0.004	2.986	0.004
06/07 March 2011	5627.329	3.704	0.003	2.973	0.004
07/08 March 2011	5628.410	3.688	0.004	2.968	0.004
13/14 March 2011	5634.309	3.651	0.005	2.931	0.002
18/19 March 2011	5639.327	3.626	0.004	2.902	0.003
21/22 March 2011	5642.419	3.587	0.008	2.872	0.006
22/23 March 2011	5643.342	3.590	0.009	2.860	0.004
23/24 March 2011	5644.326	3.565	0.007	2.847	0.008
27/28 March 2011	5648.863	3.505	0.006		
28/29 March 2011	5649.353	3.479	0.004	2.792	0.002
01/02 April 2011	5653.355	3.449	0.006	2.755	0.002
03/04 April 2011	5655.403	3.441	0.004	2.746	0.003
06/07 April 2011	5658.362	3.406	0.007	2.730	0.002
07/08 April 2011	5659.369	3.394	0.005	2.717	0.004
10/11 April 2011	5662.360	3.406	0.008	2.706	0.002
11/12 April 2011	5663.336	3.406	0.010	2.701	0.006
18/19 April 2011	5670.370	3.376	0.005	2.664	0.007
20/21 April 2011	5672.397	3.348	0.007	2.653	0.008
21/22 April 2011	5673.386	3.353	0.012	2.642	0.009
23/24 April 2011	5675.379	3.350	0.012	2.639	0.009
25/26 April 2011	5677.4447	3.295	0.009	2.622	0.012
27/28 April 2011	5679.4190	3.314	0.007	2.642	0.006

RJD = JD - 2,450,000

Dr. Mukund Kurtadikar, Jalna Education Society Observatory (JESO)
Maharashtra, India
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.
19/20 February 2011	5612.3173	3.70	0.008
20/21 February 2011	5613.3504	3.62	0.016
07/08 March 2011	5628.3328	3.67	0.033
08/09 March 2011	5629.4083	3.67	0.012
10/11 March 2011	5631.3698	3.57	0.008
31/01 March 2011	5652.3945	3.57	0.035
01/02 April 2011	5653.3920	3.54	0.039
05/06 April 2011	5657.3839	3.64	0.074

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
04/05 March 2011	5625.3698	3.740	0.002	3.296	0.002
09/10 March 2011	5630.3680	3.674	0.002	3.257	0.002
10/11 March 2011	5631.3372	3.666	0.002	3.146	0.002
24/25 March 2011	5645.3605	3.5680	0.002	3.3442	0.002
01/02 April 2011	5653.3216	3.4784	0.002	3.1036	0.002
07/08 April 2011	5659.3213	3.3784	0.002	3.0945	0.002
09/10 April 2011	5661.3226	3.3283	0.002	2.8836	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
23/24 February 2011	5616.6673	4.6320	0.0010	4.3953	0.0040	3.7779	0.0027
27/28 February 2011	5620.6659	4.6167	0.0031	4.3797	0.0029	3.7628	0.0051
04/05 March 2011	5625.6107	4.5782	0.0028	4.3532	0.0066	3.7408	0.0067
08/09 March 2011	5629.6337	4.5356	0.0026	4.3273	0.0021	3.7178	0.0044
09/10 March 2011	5630.6253	4.5285	0.0014	4.3178	0.0058	3.7071	0.0037
10/11 March 2011	5631.6219	4.5056	0.0108	4.3058	0.0042	3.6922	0.0023
15/16 March 2011	5636.6274	4.4711	0.0035	4.2710	0.0020	3.6625	0.0027
22/23 March 2011	5643.6392	4.3806	0.0040	4.2007	0.0187	3.6017	0.0047
23/24 March 2011	5644.6330	4.3698	0.0132	4.1856	0.0056	3.5841	0.0038
24/25 March 2011	5645.6316	4.3425	0.0063	4.1650	0.0009	3.5755	0.0063
26/27 March 2011	5647.6330	4.3189	0.0027	4.1284	0.0072	3.5421	0.0073
28/29 March 2011	5649.6358	4.2712	0.0114	4.1070	0.0083	3.5202	0.0012
31 Mar/ 01 Apr 2011	5652.6378	4.2417	0.0031	4.0844	0.0051	3.4864	0.0046
03/04 April 2011	5655.6378	4.2412	0.0107	4.0482	0.0145	3.4725	0.0007
07/08 April 2011	5659.6371	4.2191	0.0039	4.0357	0.0039	3.4337	0.0094
10/11 April 2011	5662.6365	4.2060	0.0086	4.0201	0.0005	3.4216	0.0052
13/14 April 2011	5665.6344	4.1978	0.0025	4.0088	0.0164	3.4143	0.0026
16/17 April 2011	5668.6448	4.1979	0.0100	4.0030	0.0129	3.3872	0.0033
20/21 April 2011	5672.6434	4.1957	0.0181	3.9743	0.0180	3.3698	0.0038
25/26 April 2011	5677.6476	4.1776	0.0481	3.9840	0.0033	3.3800	0.0105

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 = JD - 2,450,000**

RJD	CV
5597.3333	3.757
5598.3361	3.750
5604.3611	3.767
5606.3618	3.768
5608.3625	3.767
5616.3750	3.768
5626.3201	3.726
5629.3528	3.713
5634.3521	3.681
5636.3535	3.672
5640.3542	3.667
5651.3549	3.521
5658.3750	3.44
5659.3396	3.44
5660.3535	3.43
5665.3958	3.418
5666.3958	3.415
5668.4479	3.373
5672.4396	3.343
5673.4264	3.335
5676.4146	3.331
5677.4146	3.302

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
18/19 February 2011	5611.4039	3.773		0.006	1.08
09/10 March 2011	5630.3987	3.700		0.000	1.13
12/13 March 2011	5633.4014	3.693		0.032	1.14
19/20 March 2011	5640.4134	3.623		0.006	1.20
25/26 March 2011	5646.4487	3.610		0.028	1.34
03/04 April 2011	5655.4724	3.533		0.029	1.53

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

Date	RJD	V mag	SD
01/02 March 2011	5622.2768	3.688	0.104
03/04 March 2011	5624.2708	3.733	0.066
21/22 March 2011	5642.2500	3.750	0.104
24/26 March 2011	5645.2500	3.644	0.175

06/07 April 2011	5658.3750	3.391	0.092
24/25 April 2011	5676.3750	3.322	0.104

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
5666.62	3.33	0.06
5662.64	3.32	0.06
5653.63	3.27	0.08
5636.64	3.65	0.15
5625.69	3.71	0.01
5615.71	3.75	0.04
5609.71	3.86	0.22
5603.71	3.76	0.03
5597.71	3.76	0.02
5643.69	3.61	0.03
5644.69	3.33	0.05
5654.60	3.28	0.08
5662.64	3.32	----
5666.84	3.33	0.06
5679.65	3.32	0.05

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
22/23 February 2011	5615.6215	3.762	0.011
01/02 March 2011	5622.6604	3.733	0.023
05/06 March 2011	5625.5618	3.714	0.022
12/13 March 2011	5633.5486	3.679	0.019
14/14 March 2011	5634.6236	3.714	0.020
27/28 March 2011	5648.5819	3.506	0.013

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
23/24 February 2011	5616.2604	3.763	0.020
05/06 March 2011	5626.3271	3.724	0.009
06/07 March 2011	5627.3229	3.715	0.009
07/08 March 2011	5628.4458	3.713	0.005
08/09 March 2011	5629.3187	3.703	0.002
09/10 March 2011	5630.3083	3.698	0.006
15/16 March 2011	5636.3368	3.656	0.018
16/17 March 2011	5637.3007	3.649	0.008
21/22 March 2011	5642.3167	3.598	0.008
22/23 March 2011	5643.3271	3.582	0.013
04/05 April 2011	5656.3306	3.431	0.031
07/08 April 2011	5659.3396	3.431	0.012
08/09 April 2011	5660.3535	3.412	0.006
11/12 April 2011	5663.3368	3.406	0.006
17/18 April 2011	5669.3549	3.374	0.016
18/19 April 2011	5670.3708	3.368	0.010
19/20 April 2011	5671.3569	3.355	0.013
20/21 April 2011	5672.3819	3.338	0.015
21/22 April 2011	5673.3597	3.363	0.011
23/24 April 2011	5675.3583	3.351	0.022

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

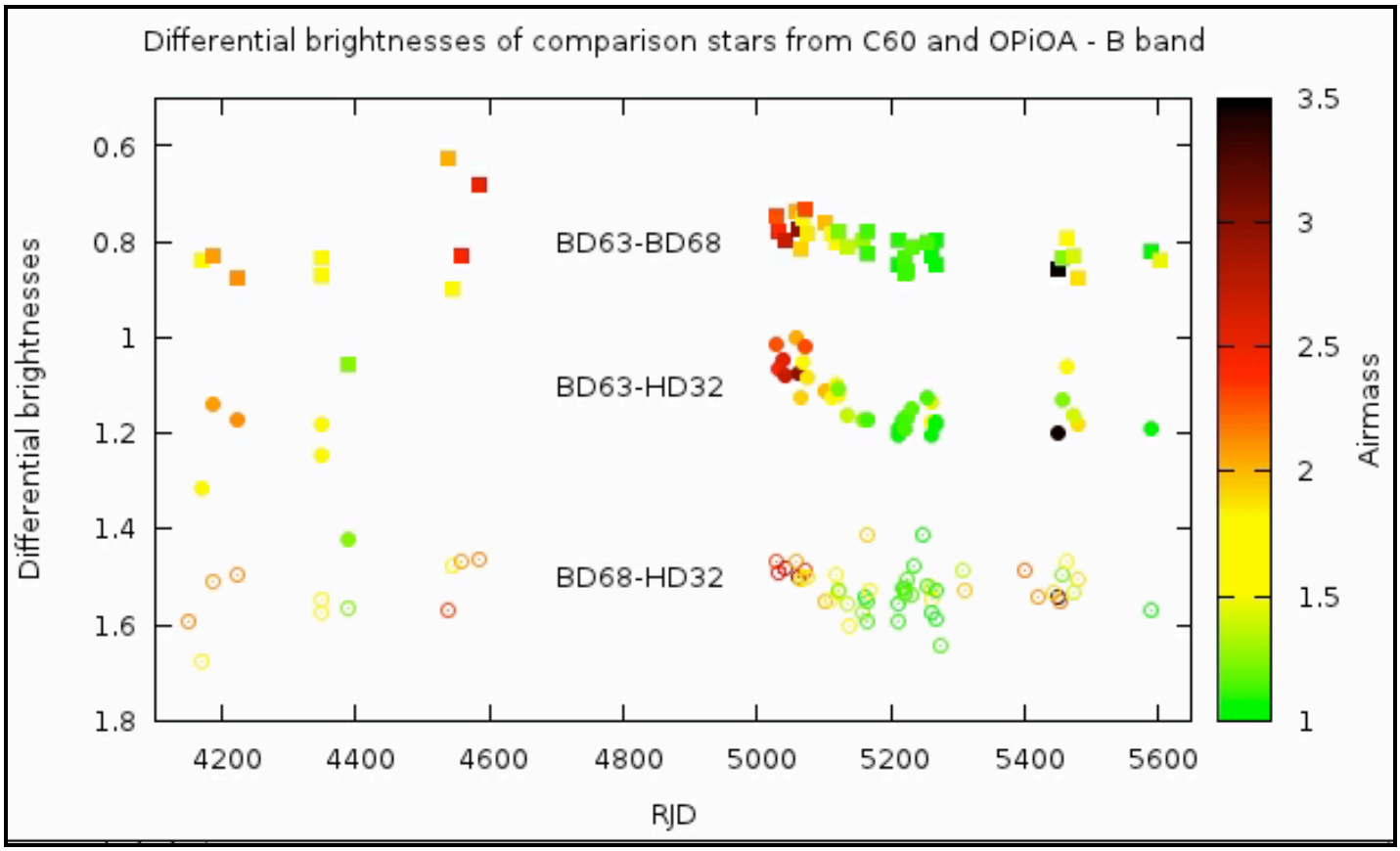
Date	RJD	V mag	SD	B mag	SD
17/18 March 2011	5638.5397	3.683	0.023		
02/03 April 2011	5654.5523	3.526	0.022		
05/06 April 2011	5657.5465	3.494	0.034		
10/11 April 2011	5662.5608	3.457	0.026		
14/15 April	5666.5400	3.436	0.010	4.094	0.033
23/24 April 2011	5675.5497	3.394	0.040	4.032	0.041

RJD = JD - 2,450,000

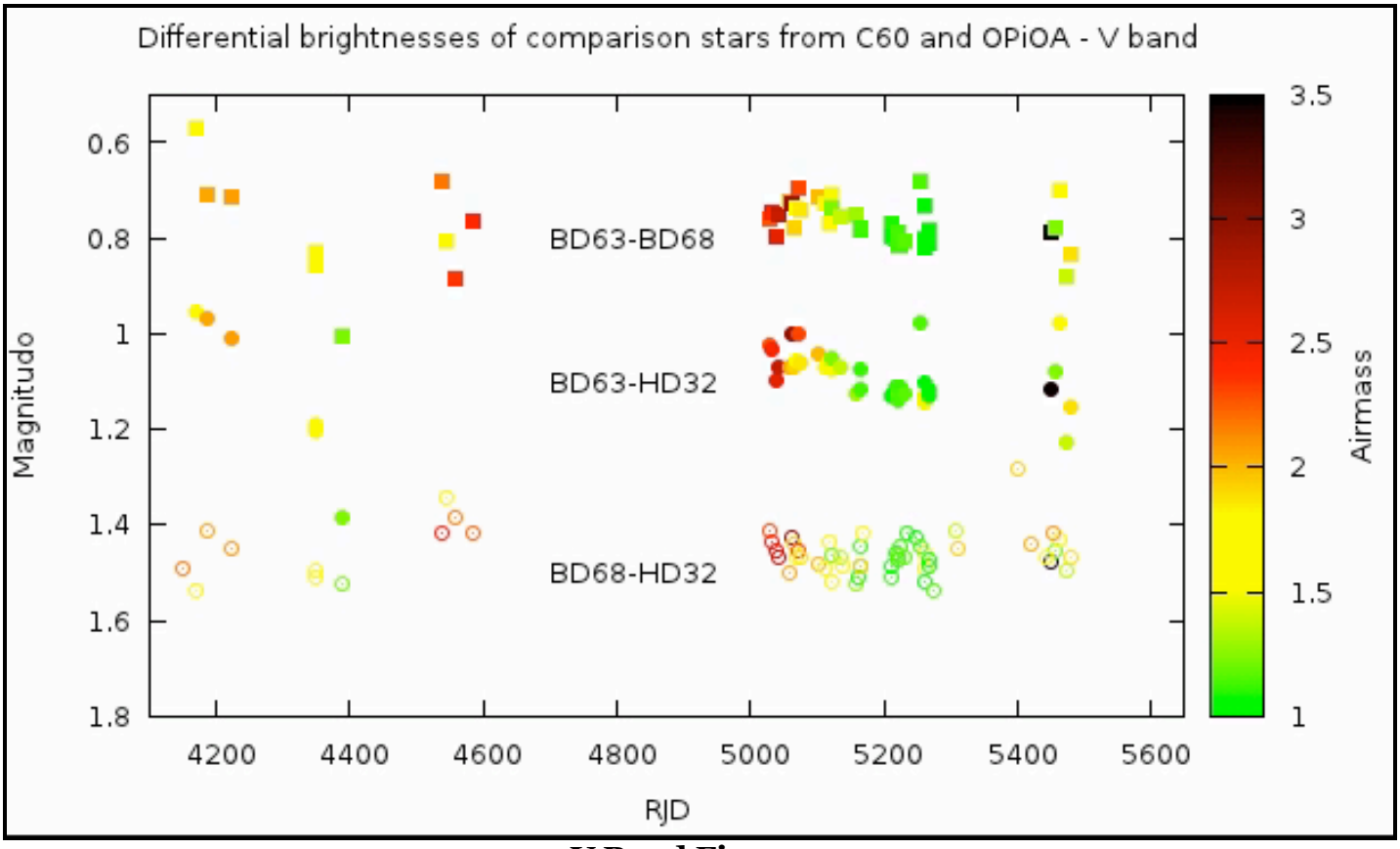
Piotr Wychudzki (PW)
Torun/Olsztyn
Kujawsko-Pomorskie, Poland
Telescope: 24" F/12.5
CCD camera SBIG ST-1001E on 24" telescope and SBIG ST-8XE on 2" telescope.
Telescope: 10" F/10
CCD camera SBIG ST8-XMEI

As you know, observation of epsilon Aurigae is not the easiest task. On the beginning I have to point out that our data are not transformed to the standard system. Hence there will be some shifts in relation to your data. There is no a single explanation of inconsistency between our data. This discrepancies must be explained depending on the circumstance of observation.

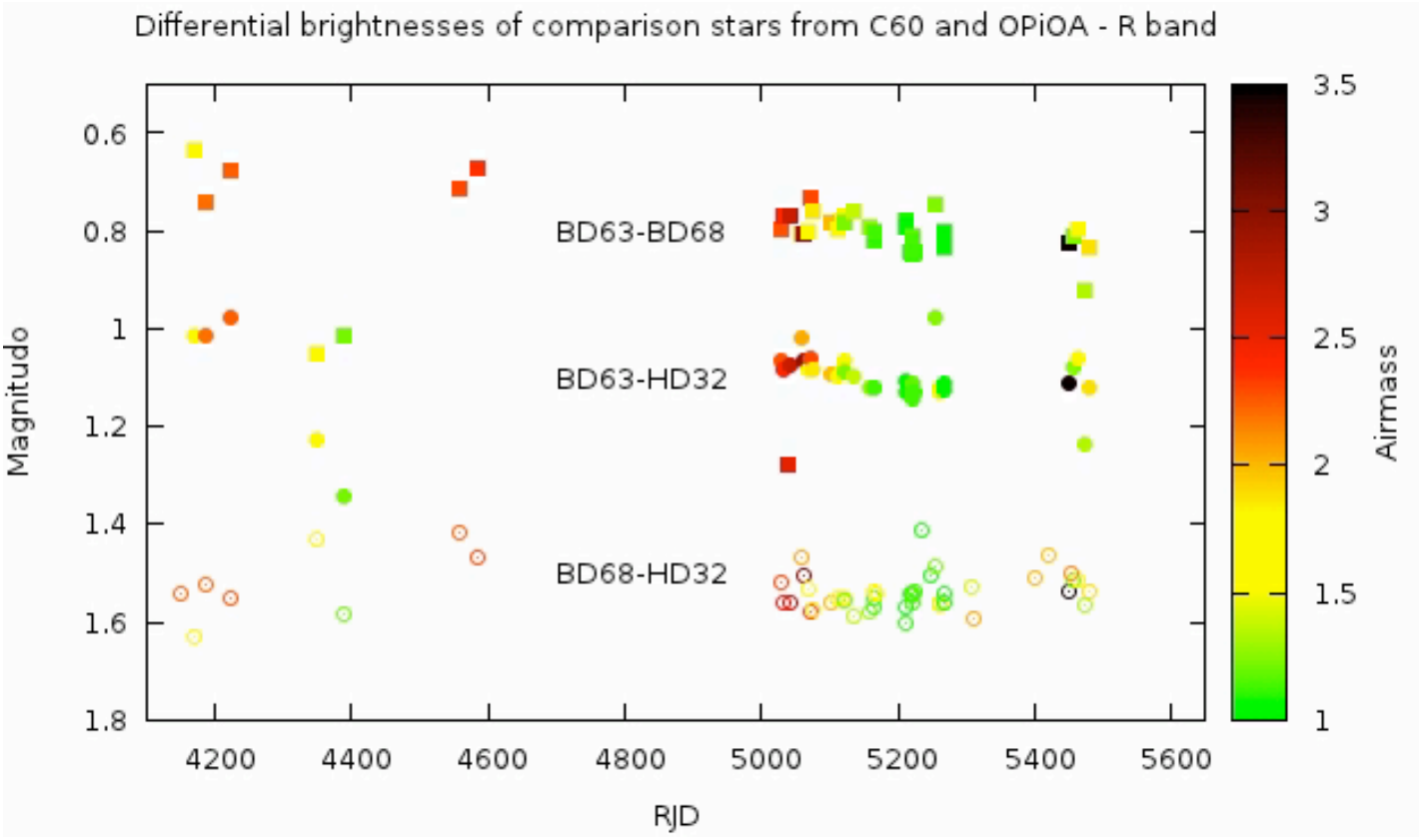
One of main reasons of discrepancies between light curves of epsilon Aurigae created from different comparison stars for observations from C60 and OPiOA are instrumental effects. Observed stars are on the edges of linearity range of the CCD. In addition to that the comparison stars are poorly known and their catalog brightnesses may not be good. Maybe one of them is variable but from our observation this is hard to determine. Also, the accuracy of our photometry is not very good due to instrumental effects. Sometimes the scattering of differential brightnesses of comparison stars is even 0.1 mag. The graphs of differential brightnesses of comparison stars for C60 and OPiOA are attached on the Figures 1, 2 and 3.



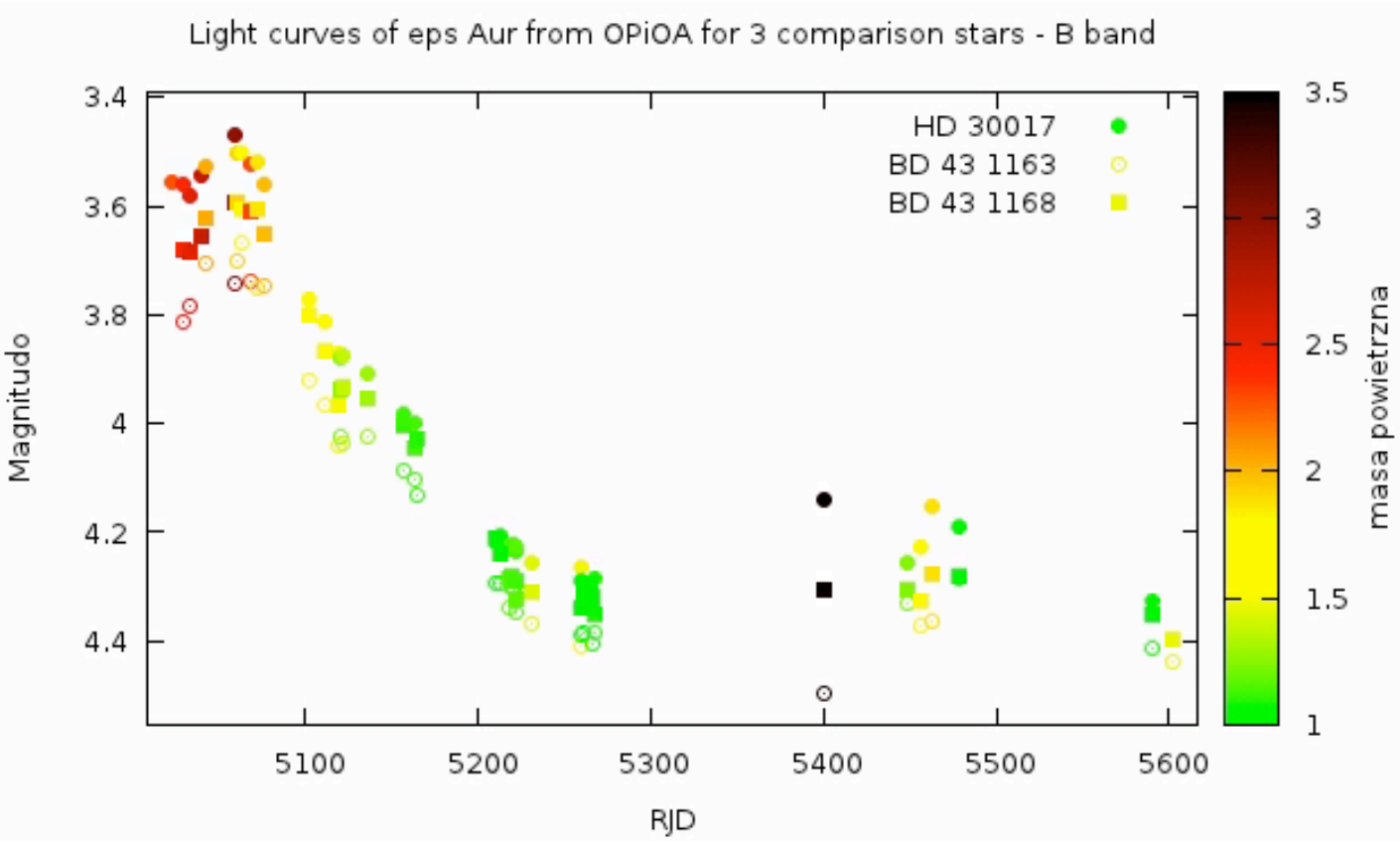
B Band Figure 1



V Band Figure 2



R Band Figure 3



B Band Figure 4

The data from C60 and OPiOA are not corrected for the impact of atmospheric extinction. In several cases influence of atmospheric extinction is clearly visible (Figure 4 and 5). For example the effect of curved differential brightness of comparison stars from RJD 5000 to RJD 5200 (Figure 1,2 and 3), or observation near RJD 5400 (Figure 4 and 5). In case of observations from MK the data were corrected only due to average, first row extinction.

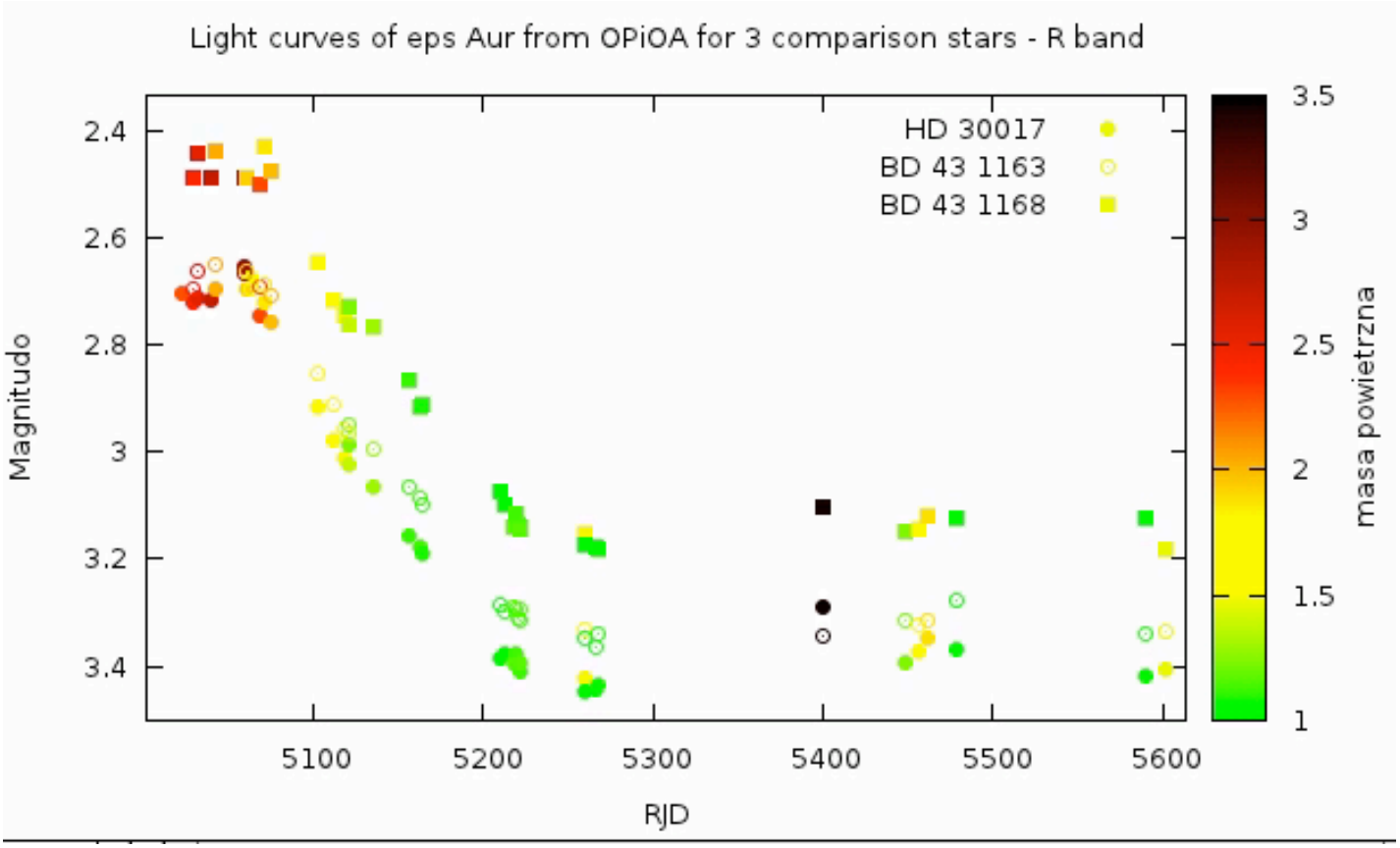


Figure 5

Unfortunately, there are observations that could be done wrong, as these from MK between RJD 5200 and RJD 5300 (Figure 6).

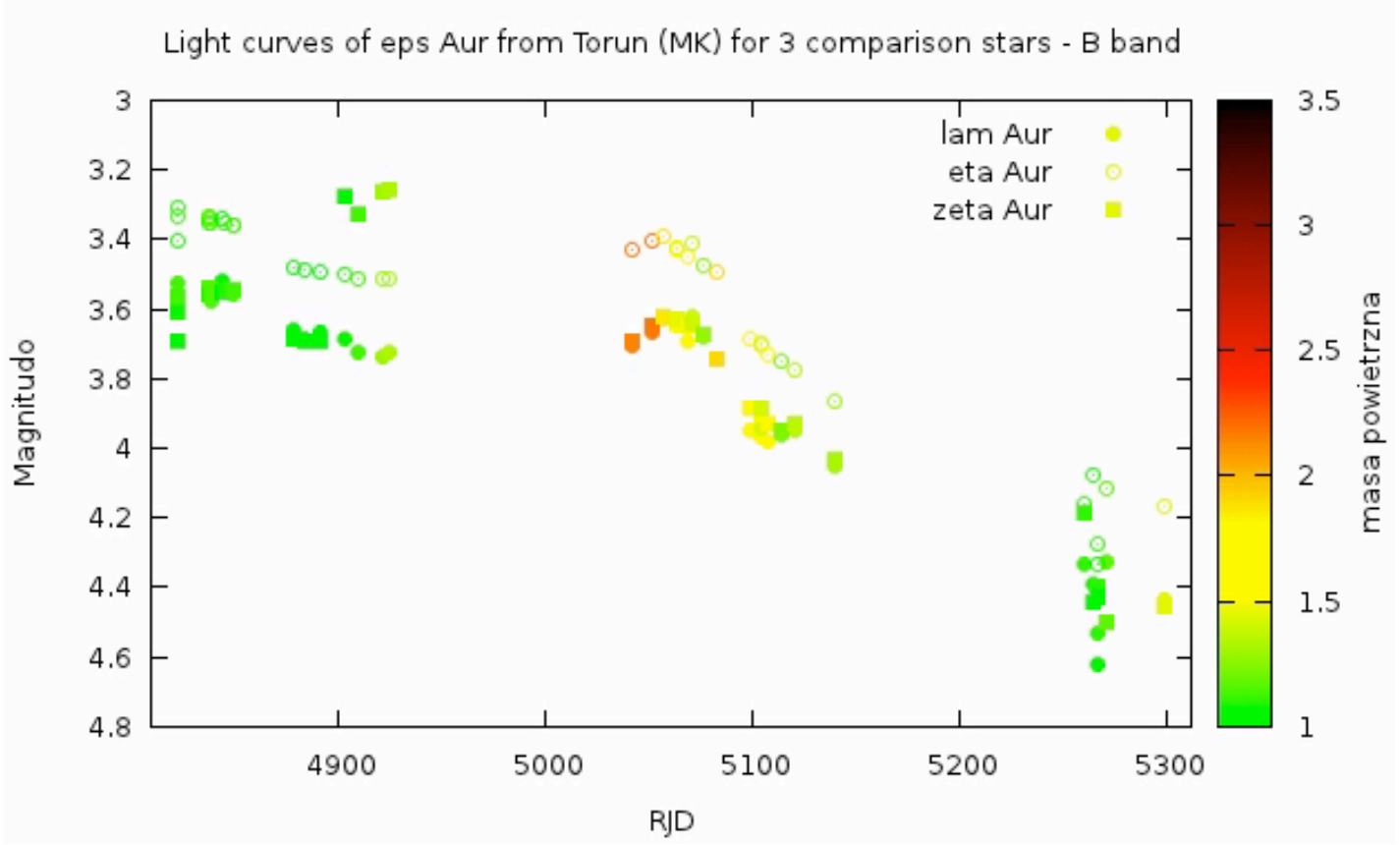


Figure 6

Eventually for C60 and OPiOA we decided to choose BD +43 1168 as comparison star and I am sending data obtained on its basis.

BD 43 1168:
U=10.510 - Hiltner N. A., 1956, ApJS, 2, 389
B=10.310 - Hiltner N. A., 1956, ApJS, 2, 389
V=9.480 - Fernie J. D., 1983, ApJS, 52, 7
R=8.630 - Fernie J. D., 1983, ApJS, 52, 7
I=7.910 - Fernie J. D., 1983, ApJS, 52, 7

For MK was chosen lambda Aurigae, but I am also sending light curves obtained on zeta Aurigae basis due to observed eclipse near RJD 4900.

Lambda Aurigae:
B=5.34 - Simbad
V=4.71 - Simbad
R=4.32 - USNO - B1.0 Catalog (Monet + 2003)

Zeta Aurigae:
B=4.927 Simbad
V=3.769 - transformation from The Tycho - 2 Catalogue (Hog+ 2000)
R=3.105 - USNO - B1.0 Catalog (Monet + 2003)

I am aware that our observations are far from ideal but i think that they can still be useful. If you have additional questions please let me know. I will answer them as soon as I can.

Regards
Piotr Wychudzki

Note: The following data has not been color or extinction corrected and has thus not been included in the photometric plots. The data are listed as received.

RJD	U	SD	B	SD	V	SD	R	SD	I	SD	OBSR	OBSY
February 2007												
4148.5321	3.787	.017	3.393	.021	3.097	.022	2.910	.021	2.254	.018	CG	TCANCU
4148.5321	3.798	.004	3.507	.008	3.055	.014	2.660	.019	2.157	.023	CG	TCANCU
March 2007												
4170.4228	3.700	.045	3.552	.03	3.064	.018	2.668	.023	2.437	.022	CG	TCANCU
4170.4228	3.712	.018	3.282	.033	2.985	.018	2.814	.028	2.155	.028	CG	TCANCU
4170.4228	3.804	.004	3.481	.014	2.985	.015	2.654	.025	2.049	.032	CG	TCANCU
April 2007												
4186.4221			3.697	.023	2.979	.015	2.648	.015	2.398	.015	CG	TCANCU
4186.4221	3.683	.029	3.418	.023	3.039	.019	2.898	.021	2.282	.015	CG	TCANCU
4186.4221	3.737	.006	3.450	.007	2.914	.011	2.630	.018	2.235	.021	CG	TCANCU
4221.3270	3.830	.038	3.771	.014	3.064	.008	2.724	.008	2.459	.009	CG	TCANCU
4221.3270	3.771	.018	3.534	.016	3.128	.01	2.912	.013	2.186	.015	CG	TCANCU
4221.3270	3.815	.006	3.554	.006	3.040	.007	2.671	.011	2.264	.018	CG	TCANCU
September 2007												
4348.4576	3.913	.049	3.787	.023	3.106	.015	2.505	.022			CG	TCANCU
4348.4576	3.865	.019	3.548	.026	3.287	.025	3.064	.027			CG	TCANCU
4348.4576	3.825	.007	3.644	.011	3.263	.016	2.704	.026			CG	TCANCU
4348.4643			3.815	.028	3.001	.019					CG	TCANCU
4348.4643			3.538	.028	3.209	.03					CG	TCANCU
4348.4643			3.609	.013	3.170	.019					CG	TCANCU
October 2007												

4389.4426	3.899	.047	3.534	.029	2.770	.017	2.435	.015	2.079	.011	CG	TCANCU
4389.4426	3.806	.019	3.480	.024	3.129	.024	2.957	.021	2.287	.015	CG	TCANCU
4389.4426	3.838	.005	3.567	.007	3.119	.012	2.749	.016	2.325	.022	CG	TCANCU
March 2008												
4536.4599	3.841	.04	3.153	.031	3.024	.031					CG	TCANCU
4536.4818			3.638	.024	2.992	.018					CG	TCANCU
4536.4818	3.799	.011	3.343	.029	3.063	.037					CG	TCANCU
4536.4818			3.434	.009	2.945	.015					CG	TCANCU
4543.3895	3.882	.044	3.768	.038	2.973	.025					CG	TCANCU
4543.3895	3.980	.017	3.522	.041	3.222	.038					CG	TCANCU
4543.3895	3.829	.01	3.523	.017	3.031	.026					CG	TCANCU
4543.4110	3.915	.015	3.555	.029	3.133	.026					CG	TCANCU
4557.4044	4.341	.052	3.849	.025	3.029	.034	2.727	.017			CG	TCANCU
4557.4044	3.804	.027	3.500	.043	3.107	.01	2.939	.032			CG	TCANCU
4557.4044	3.856	.005	3.492	.01	2.955	.011	2.565	.032			CG	TCANCU
4557.4327			3.570	.029	3.267	.032	2.950	.03			CG	TCANCU
April 2008												
4585.3309			3.936	.01	3.046	.015	2.796	.012			CG	TCANCU
4585.3309			3.533	.014	3.203	.023	3.005	.036			CG	TCANCU
4585.3309	3.852	.008	3.521	.007	3.083	.018	2.682	.016			CG	TCANCU
4585.3598			3.509	.011	3.164	.03	2.980	.028			CG	TCANCU
December 2008												
4822.2981			3.329	.017	2.949	.014	2.911	.154			*	TCANCU
4822.2981			3.465	.031	2.926	.013	2.728	.383			*	TCANCU
4822.2981			3.553	.025	2.933	.014	2.958	.137			*	TCANCU
4822.3242			3.305	.024	2.922	.022	2.523	.026			*	TCANCU
4822.3242			3.519	.024	2.916	.016	2.461	.061			*	TCANCU
4822.3242			3.596	.018	2.895	.016	2.709	.056			*	TCANCU
4822.3388					2.943	.029	2.647	.042			*	TCANCU
4822.3388							2.547	.051			*	TCANCU
4822.3388			3.680	.101	2.929	.03	2.727	.031			*	TCANCU
January 2009												
4837.2453			3.333	.008	2.931	.01	2.607	.015			*	TCANCU
4837.2453			3.475	.002	2.910	.009	2.539	.013			*	TCANCU
4837.2453			3.525	.008	2.909	.005	2.684	.015			*	TCANCU
4837.2718			3.336	.006	2.938	.01	2.583	.009			*	TCANCU
4837.2718			3.488	.006	2.919	.006	2.533	.009			*	TCANCU
4837.2718			3.539	.004	2.914	.008	2.684	.01			*	TCANCU
4837.2908			3.349	.007	2.934	.006	2.598	.015			*	TCANCU
4837.2908			3.486	.007	2.910	.005	2.536	.011			*	TCANCU
4837.2908			3.544	.007	2.905	.005	2.686	.009			*	TCANCU
4838.2279			3.338	.007	2.943	.004	2.593	.01			*	TCANCU
4838.2279			3.507	.005	2.931	.005	2.546	.007			*	TCANCU
4838.2279			3.542	.003	2.905	.009	2.702	.008			*	TCANCU
4838.2467			3.352	.006	2.943	.008	2.592	.015			*	TCANCU
4838.2467			3.516	.006	2.936	.007	2.525	.02			*	TCANCU
4838.2467			3.545	.004	2.906	.01	2.705	.013			*	TCANCU
4844.3101			3.339	.005	2.949	.009	2.609	.009			*	TCANCU
4844.3101			3.456	.004	2.915	.009	2.556	.014			*	TCANCU
4844.3101			3.538	.005	2.930	.013	2.711	.01			*	TCANCU
4845.2553			3.350	.002	2.890	.005	2.548	.004			*	TCANCU
4845.2553			3.476	.002	2.893	.002	2.500	.003			*	TCANCU
4845.2553			3.533	.002	2.874	.005	2.628	.005			*	TCANCU
4849.2182			3.355	.006	2.926	.012	2.587	.009			*	TCANCU
4849.2182			3.496	.005	2.926	.011	2.560	.008			*	TCANCU
4849.2182			3.528	.006	2.888	.006	2.661	.008			*	TCANCU
4849.2236			3.359	.007	2.988	.02	2.574	.012			*	TCANCU
4849.2236					2.911	.007	2.540	.012			*	TCANCU
4849.2236			3.530	.005	2.924	.024	2.656	.009			*	TCANCU
February 2009												
4878.2895			3.478	.004	3.070	.003	2.678	.004			*	TCANCU
4878.2895			3.596	.004	3.060	.004	2.619	.003			*	TCANCU
4878.2895			3.675	.004	3.052	.004	2.778	.004			*	TCANCU
4884.2826			3.486	.004	3.105	.006	2.698	.003			*	TCANCU

4884.2826	3.625	.003	3.125	.004	2.636	.004	* TCANCU
4884.2826	3.677	.003	3.071	.005	2.783	.004	* TCANCU
4891.2363	3.489	.003	3.058	.005	2.709	.003	* TCANCU
4891.2363	3.605	.002	3.026	.002	2.654	.003	* TCANCU
4891.2363	3.677	.003	3.027	.003	2.786	.002	* TCANCU
March 2009							
4903.2630	3.494	.003	3.087	.031	2.793	.019	* TCANCU
4903.2630	3.624	.004	3.082	.028	2.742	.02	* TCANCU
4903.2630	3.263	.004	2.899	.038	2.785	.018	* TCANCU
4909.2763	3.511	.006	3.072	.004	2.754	.004	* TCANCU
4909.2763	3.662	.005	3.062	.003	2.690	.003	* TCANCU
4909.2763	3.311	.005	2.871	.003	2.760	.004	* TCANCU
4921.2998	3.508	.006	3.055	.005	2.708	.006	* TCANCU
4921.2998	3.675	.004	3.080	.005	2.698	.005	* TCANCU
4921.2998	3.251	.006	2.863	.005	2.704	.005	* TCANCU
April 2009							
4924.2987	3.511	.006	3.066	.003	2.703	.002	* TCANCU
4924.2987	3.660	.007	3.068	.003	2.683	.002	* TCANCU
4924.2987	3.243	.006	2.866	.002	2.700	.002	* TCANCU
July 2009							
5022.5581	3.557	.016	3.076	.01	2.704	.017	PW OPAO
5029.5287	3.558	.006	3.049	.009	2.720	.012	PW OPAO
5032.5119	3.581	.012	3.073	.022	2.712	.022	PW OPAO
5039.4842	3.543	.008	3.074	.013	2.716	.016	PW OPAO
5041.5250	3.430	.019	3.019	.015	2.655	.018	* TCANCU
5041.5250	3.644	.008	3.028	.014	2.593	.019	* TCANCU
5041.5250	3.676	.02	3.021	.011	2.750	.015	* TCANCU
5042.5237	3.527	.008	3.052	.012	2.695	.015	PW OPAO
August 2009							
5049.4973			2.987	.011	2.617	.013	* TCANCU
5049.4973			2.999	.012	2.604	.012	* TCANCU
5049.4973					2.726	.009	* TCANCU
5051.4955	3.401	.012	2.968	.006	2.604	.006	* TCANCU
5051.4955	3.603	.008	2.967	.006	2.561	.008	* TCANCU
5051.4955	3.634	.009	2.980	.007	2.737	.009	* TCANCU
5057.5071	3.388	.005	2.981	.005	2.641	.008	* TCANCU
5057.5071	3.565	.005	2.994	.008	2.618	.008	* TCANCU
5057.5071	3.608	.005	2.985	.005	2.759	.008	* TCANCU
5059.4158	3.470	.01	3.013	.013	2.656	.018	PW OPAO
5060.4853	3.502	.005	3.037	.006	2.696	.015	PW OPAO
5063.5308	3.501	.009	3.031	.019	2.676	.011	PW OPAO
5063.5368	3.424	.004	3.008	.007	2.663	.005	* TCANCU
5063.5368	3.582	.004	3.023	.006	2.648	.008	* TCANCU
5063.5368	3.627	.004	2.999	.007	2.773	.006	* TCANCU
5063.5464	3.420	.004					* TCANCU
5063.5464	3.578	.005					* TCANCU
5063.5464	3.615	.005					* TCANCU
5068.4312	3.524	.006	3.048	.006	2.745	.008	PW OPAO
5068.5066	3.443	.004	3.017	.006	2.687	.004	* TCANCU
5068.5066	3.628	.004	3.054	.004	2.699	.004	* TCANCU
5068.5066	3.631	.003	3.007	.003	2.787	.004	* TCANCU
5071.4616	3.519	.006	3.016	.02	2.720	.015	PW OPAO
5071.5356	3.410	.006	3.004	.004	2.672	.005	* TCANCU
5071.5356	3.561	.005	3.033	.005	2.665	.004	* TCANCU
5071.5356	3.625	.005	3.016	.004	2.796	.004	* TCANCU
5075.4377	3.560	.007	3.087	.008	2.759	.008	PW OPAO
September 2009							
5076.5512	3.469	.007	3.030	.007	2.713	.007	* TCANCU
5076.5512	3.617	.007	3.058	.008	2.667	.008	* TCANCU
5076.5512	3.660	.008	3.047	.007	2.817	.007	* TCANCU
5082.4352	3.490	.008	3.079	.01	2.718	.01	* TCANCU
5082.4352	3.679	.005	3.110	.009	2.704	.013	* TCANCU
5082.4352	3.731	.009	3.088	.01	2.853	.011	* TCANCU
5099.4106	3.682	.005	3.265	.009	2.859	.007	* TCANCU

5099.4106			3.882	.005	3.305	.008	2.822	.007	* TCANCU
5099.4106			3.869	.003	3.225	.008	2.952	.006	* TCANCU
5102.4172			3.771	.005	3.249	.007	2.914	.013	PW OPAO
5104.4115			3.703	.005	3.261	.004	2.875	.004	* TCANCU
5104.4115			3.905	.005	3.305	.005	2.852	.004	* TCANCU
5104.4115			3.892	.005	3.251	.006	2.979	.004	* TCANCU
5104.4430			3.694	.005	3.253	.005	2.870	.003	* TCANCU
5104.4430			3.877	.005	3.287	.005	2.845	.004	* TCANCU
5104.4430			3.871	.006	3.241	.004	2.973	.004	* TCANCU
October 2009									
5107.4032			3.728	.004	3.287	.003	2.895	.004	* TCANCU
5107.4032			3.919	.004	3.307	.004	2.842	.004	* TCANCU
5107.4032			3.914	.004	3.267	.003	3.005	.004	* TCANCU
5111.3667			3.811	.005	3.316	.005	2.977	.004	PW OPAO
5113.4611			3.750	.003	3.299	.008	2.933	.009	* TCANCU
5113.4611			3.897	.004	3.293	.005	2.882	.01	* TCANCU
5113.4611			3.933	.004	3.283	.004	3.034	.009	* TCANCU
5118.3831			3.870	.007	3.342	.008	3.012	.008	PW OPAO
5120.4109			3.770	.008	3.304	.035	3.001	.009	* TCANCU
5120.4109			3.886	.009	3.297	.007	2.960	.005	* TCANCU
5120.4109			3.914	.007	3.283	.029	3.132	.01	* TCANCU
5120.4377			3.881	.007	3.353	.01	2.986	.013	PW OPAO
5121.3973			3.874	.009	3.365	.01	3.025	.01	PW OPAO
5135.3784			3.908	.004	3.393	.006	3.064	.008	PW OPAO
November 2009									
5138.2956	4.201	.026	3.798	.027	3.499	.023			CG TCANCU
5138.2956	4.224	.014	3.921	.011	3.449	.021			CG TCANCU
5139.3680			3.866	.005	3.389	.008	3.021	.01	* TCANCU
5139.3680			3.985	.007	3.350	.007	3.040	.011	* TCANCU
5139.3680			4.016	.007	3.357	.009	3.165	.012	* TCANCU
5156.3839			3.984	.002	3.515	.004	3.157	.009	PW OPAO
5162.4408	4.122	.022	3.867	.02	3.387	.024			CG TCANCU
5162.4408	4.180	.004	3.933	.006	3.362	.009			CG TCANCU
5163.3571			4.001	.003	3.510	.007	3.178	.004	PW OPAO
5164.2099	4.142	.017	4.045	.025	3.514	.034	3.401	.017	CG TCANCU
5164.2099	4.202	.02	3.981	.01	3.464	.009	3.150	.01	CG TCANCU
5164.3766			4.033	.011	3.532	.009	3.191	.005	PW OPAO
December 2009									
5168.4942	4.284	.015	3.988	.038	3.609	.015	3.400	.03	CG TCANCU
5168.4942	4.310	.006	4.040	.012	3.492	.013	3.154	.023	CG TCANCU
January 2010									
5210.3614			4.218	.005	3.712	.003	3.385	.011	PW OPAO
5212.3953			4.205	.003	3.724	.003	3.377	.002	PW OPAO
5218.4454			4.229	.004	3.732	.004	3.393	.005	PW OPAO
5219.4219			4.223	.003	3.724	.003	3.374	.006	PW OPAO
5220.4190			4.223	.003	3.723	.004	3.404	.003	PW OPAO
5221.4126			4.235	.004	3.756	.002	3.412	.003	PW OPAO
5222.4284			4.228	.003	3.733	.005	3.394	.008	PW OPAO
February 2010									
5231.4776			4.257	.005	3.775	.008			PW OPAO
5233.2105	4.646	.014	4.224	.009	3.796	.011	3.689	.011	CG TCANCU
5233.2105	4.595	.041	4.225	.003	3.677	.005	3.312	.01	CG TCANCU
5248.2321	4.847	.033	4.335	.014	3.859	.017	3.724	.007	CG TCANCU
5248.2321	4.589	.005	4.269	.005	3.749	.008	3.437	.007	CG TCANCU
5253.2897	4.505	.034	4.551	.019	3.811	.009	3.41	.007	CG TCANCU
5253.2897	4.639	.03	4.244	.02	3.845	.016	3.664	.011	CG TCANCU
5253.2897	4.591	.005	4.287	.007	3.755	.005	3.359	.009	CG TCANCU
March 2010									
5259.4095			4.266	.004	3.788	.006	3.422	.005	PW OPAO
5260.2332			4.289	.003	3.793	.003	3.446	.004	PW OPAO
5260.3047			4.158	.04	3.772	.092	3.374	.03	* TCANCU
5260.3047			4.270	.028	3.835	.141	3.485	.034	* TCANCU
5260.3047			4.174	.04	3.748	.081	3.568	.023	* TCANCU
5261.2553			4.298	.004	3.805	.011			PW OPAO

5264.2699			4.074	.013	3.765	.013	3.455	.009			*	TCANCU
5264.2699			4.326	.011	3.750	.008	3.398	.009			*	TCANCU
5264.2699			4.428	.017	3.753	.01	3.521	.01			*	TCANCU
5266.2339			4.312	.003	3.797	.006	3.445	.008			PW	OPAO
5266.2867			4.272	.002	3.772	.003	3.261	.003			*	TCANCU
5266.2867			4.469	.003	3.835	.004	3.459	.004			*	TCANCU
5266.2867			4.386	.002	3.750	.004	3.506	.003			*	TCANCU
5267.2484			4.329	.008	3.835	.003	3.404	.007			*	TCANCU
5267.2484			4.559	.005	3.734	.003	3.544	.005			*	TCANCU
5267.2484			4.414	.005	3.801	.003	3.587	.007			*	TCANCU
5267.2611			4.285	.003	3.789	.003	3.434	.005			PW	OPAO
5271.3038			4.111	.024	3.827	.008	3.526	.009			*	TCANCU
5271.3038			4.266	.014	3.710	.006	3.349	.006			*	TCANCU
5271.3038			4.487	.025			3.560	.01			*	TCANCU
5274.2774	4.460	.026	4.040	.027	3.685	.024					CG	TCANCU
5274.2774	4.537	.006	4.205	.006	3.685	.011					CG	TCANCU
April 2010												
5299.2975			4.165	.007	3.776	.006	3.301	.006			*	TCANCU
5299.2975			4.369	.008	3.785	.005	3.454	.008			*	TCANCU
5299.2975			4.444	.006	3.777	.004	3.566	.007			*	TCANCU
5307.2504	4.665	.029	4.261	.014	3.853	.02	3.591	.019			CG	TCANCU
5307.2504	4.650	.006	4.268	.004	3.731	.012	3.330	.015			CG	TCANCU
5311.3134	4.648	.019	4.225	.011	3.846	.011	3.639	.013	3.052	.013	CG	TCANCU
5311.3134	4.667	.006	4.275	.005	3.759	.008	3.440	.011	2.978	.018	CG	TCANCU
June 2010												
5399.5444	4.448	.029	4.155	.027	3.755	.024	3.624	.027			CG	TCANCU
5399.5444	4.464	.006	4.166	.011	3.503	.017	3.345	.029			CG	TCANCU
July 2010												
5400.4600			4.138	.011	3.638	.018	3.290	.023	2.924	.02	PW	OPAO
August 2010												
5419.4961	4.522	.029	4.086	.017	3.783	.017	3.703	.012			CG	TCANCU
5419.4961	4.471	.009	4.153	.006	3.689	.012	3.378	.01			CG	TCANCU
September 2010												
5441.4596	4.615	.013	4.206	.012	3.826	.023					CG	TCANCU
5441.4596	4.560	.006	4.263	.013	3.758	.011					CG	TCANCU
5448.5371			4.255	.004	3.743	.005	3.394	.007	2.978	.007	PW	OPAO
5452.4017	4.352	.036	4.142	.034	3.822	.017	3.666	.016			CG	TCANCU
5452.4017	4.515	.01	4.217	.012	3.702	.013	3.378	.018			CG	TCANCU
5456.4334	4.530	.008	4.225	.003	3.713	.004	3.371	.006	2.916	.006	PW	OPAO
5462.3898	4.527	.006	4.151	.005	3.620	.007	3.346	.008	2.847	.011	PW	OPAO
October 2010												
5473.4442	4.399	.048	4.438	.019	3.487	.013	3.183	.009			CG	TCANCU
5473.4442	4.526	.02	4.156	.023	3.718	.015	3.615	.013			CG	TCANCU
5473.4442	4.501	.005	4.213	.005	3.679	.009	3.391	.01			CG	TCANCU
5478.6443	4.560	.004	4.190	.005	3.715	.006	3.369	.006	2.943	.006	PW	OPAO

*** CG, PD, MG, PW**
CG - Cezary Galan
PD - Pawel Dobierski
MG - Marcin Gladkowski
PW - Piotr Wychudzki
RJD = JD - 2,450,000

Spectroscopy Report
by

Robin Leadbeater
Three Hills Observatory
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Overview
Since the last newsletter a further 86 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), 35 from Jim Edlin covering 2008 to the present which will help to establish a pre eclipse baseline for the hydrogen alpha line, some from Bethold Stober with his impressive new self built Echelle spectrograph and some from Valerie Desnoux who chose epsilon Aurigae as first light for her new roof terrace observatory in the center of Paris!

http://valerie.desnoux.free.fr/paris saint-charles/Paris_obs_en.html

I am also pleased to report that my observatory at Three Hills is fully operational again after the storm damage and thanks to Lothar Schanne we now have two spectrographs capable of tracking the 7699Å potassium line. 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)	(Å)	(Å)	(Å)	(Å/pixel)	
55675.378	23-Apr-11	21:04	7674	7725	51	0.13	Leadbeater
55674.399	22-Apr-11	21:34	7674	7725	51	0.13	Leadbeater
55672.565	21-Apr-11	01:33	6456	6630	174	0.08	Graham
55671.369	19-Apr-11	20:51	7674	7725	51	0.13	Leadbeater
55669.374	17-Apr-11	20:59	7674	7725	51	0.13	Leadbeater
55668.367	16-Apr-11	20:49	7674	7725	51	0.13	Leadbeater
55667.401	15-Apr-11	21:38	6500	6680	180	0.09	Ribeiro
55665.624	14-Apr-11	02:58	6480	6650	170	0.08	Graham
55664.583	13-Apr-11	02:00	6480	6650	170	0.12	Graham
55664.364	12-Apr-11	20:44	7674	7725	51	0.13	Leadbeater
55662.370	10-Apr-11	20:53	7674	7725	51	0.13	Leadbeater
55661.339	09-Apr-11	20:08	6275	6940	665	0.41	Desnoux
55660.363	08-Apr-11	20:43	6375	6715	340	0.25	Sarrazin
55660.333	08-Apr-11	19:59	6275	6940	665	0.41	Desnoux
55659.813	08-Apr-11	19:31	7619	7719	100	0.07	Schanne
55659.360	07-Apr-11	20:38	7674	7725	51	0.13	Leadbeater
55658.333	06-Apr-11	20:00	6275	6940	665	0.41	Desnoux
55657.334	05-Apr-11	20:01	4300	7150	2850	0.10	Thizy
55656.472	04-Apr-11	23:20	6520	6680	160	0.12	Mauclaire
55656.354	04-Apr-11	20:30	4300	7150	2850	0.10	Thizy
55656.315	04-Apr-11	19:33	6275	6940	665	0.41	Desnoux
55655.341	03-Apr-11	20:11	7674	7725	51	0.13	Leadbeater
55655.282	03-Apr-11	18:46	4300	7150	2850	0.10	Thizy
55654.500	03-Apr-11		6520	6600	80	0.12	Graham
55654.302	02-Apr-11	19:15	4300	7150	2850	0.10	Thizy
55653.800	02-Apr-11	19:12	7619	7719	100	0.07	Schanne
55653.426	01-Apr-11	22:13	4300	7150	2850	0.10	Thizy
55652.295	31-Mar-11	19:05	6500	6610	110	0.17	Garrel
55649.800	29-Mar-11	19:12	7619	7719	100	0.07	Schanne
55649.354	28-Mar-11	20:30	7674	7725	51	0.13	Leadbeater
55647.331	26-Mar-11	19:56	6520	6680	160	0.12	Mauclaire
55646.369	25-Mar-11	20:52	7674	7725	51	0.13	Leadbeater
55645.800	25-Mar-11	19:12	7619	7719	100	0.07	Schanne
55645.294	24-Mar-11	19:03	6500	6610	110	0.17	Garrel
55643.667	23-Mar-11	04:01	5798	5990	192	0.13	Gorodenski
55643.407	22-Mar-11	21:46	6500	6610	110	0.17	Garrel
55642.818	22-Mar-11	19:38	7619	7719	100	0.07	Schanne
55642.346	21-Mar-11	20:18	6275	6940	665	0.41	Desnoux
55641.440	20-Mar-11	22:34	6520	6680	160	0.12	Mauclaire
55640.803	20-Mar-11	19:16	7619	7719	100	0.07	Schanne
55639.331	18-Mar-11	19:56	7674	7725	51	0.13	Leadbeater
55638.359	17-Mar-11	20:37	7674	7725	51	0.13	Leadbeater
55637.500	17-Mar-11		6520	6600	80	0.12	Graham
55631.304	10-Mar-11	19:18	4300	7150	2850	0.10	Thizy
55630.697	10-Mar-11	04:44	5798	5990	192	0.13	Gorodenski
55630.427	09-Mar-11	22:15	4300	7150	2850	0.10	Thizy

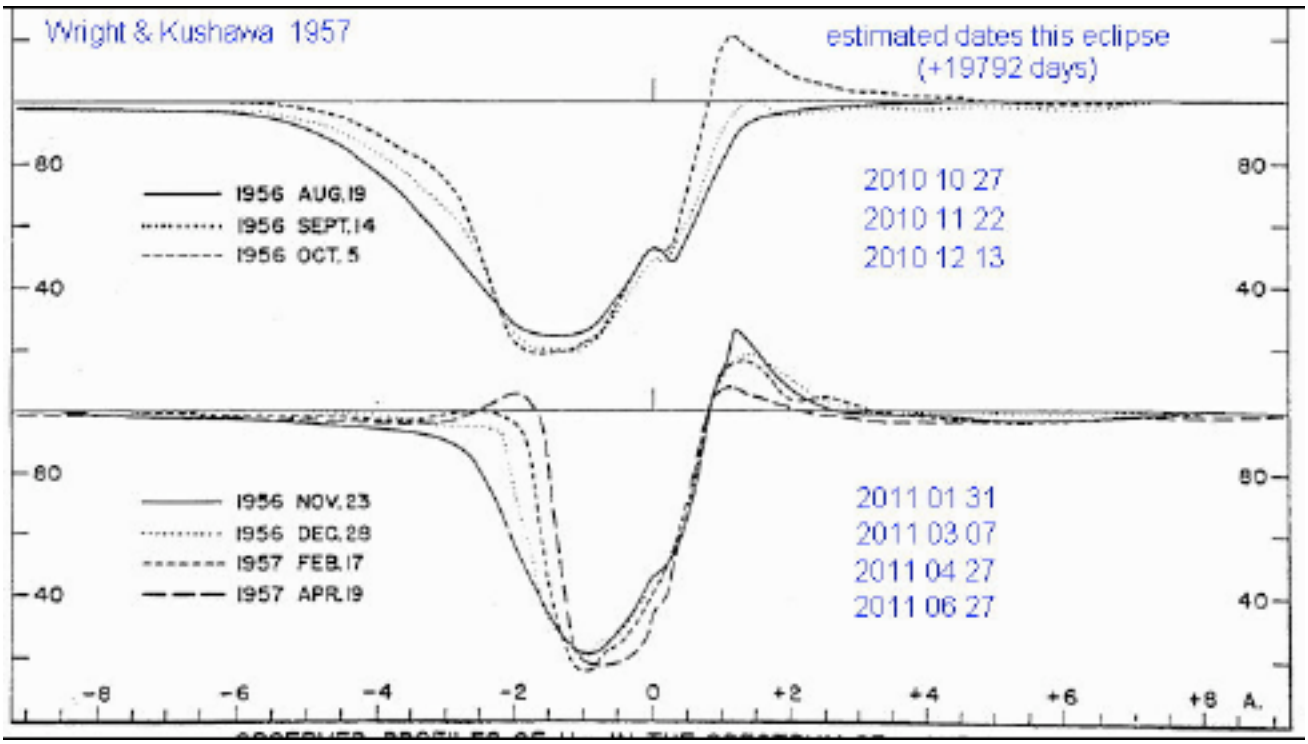
55630.359	09-Mar-11	20:37	6520	6680	160	0.12	Mauclaire
55629.349	08-Mar-11	20:22	4300	7150	2850	0.10	Thizy
55628.780	08-Mar-11	18:43	7619	7719	100	0.07	Schanne
55627.789	07-Mar-11	18:56	7619	7719	100	0.07	Schanne
55627.458	06-Mar-11	23:00	6520	6680	160	0.12	Mauclaire
55625.673	05-Mar-11	04:09	5798	5990	192	0.13	Gorodenski
55615.720	23-Feb-11	05:16	6466	6633	167	0.17	Edlin
55610.640	18-Feb-11	03:21	6466	6632	166	0.17	Edlin
55608.580	16-Feb-11	01:55	6466	6629	163	0.17	Edlin
55603.610	11-Feb-11	02:38	6466	6636	170	0.17	Edlin
55590.720	29-Jan-11	05:16	6466	6635	169	0.17	Edlin
55584.570	23-Jan-11	01:40	6466	6634	168	0.17	Edlin
55567.610	06-Jan-11	02:38	6466	6654	188	0.17	Edlin
55564.600	03-Jan-11	02:24	6473	6655	183	0.17	Edlin
55558.710	28-Dec-10	05:02	6468	6653	186	0.17	Edlin
55557.660	27-Dec-10	03:50	6466	6652	186	0.17	Edlin
55555.600	25-Dec-10	02:24	6466	6651	185	0.17	Edlin
55547.810	17-Dec-10	07:26	6468	6654	186	0.17	Edlin
55536.630	06-Dec-10	03:07	6467	6652	185	0.17	Edlin
55521.830	21-Nov-10	07:55	6467	6655	189	0.17	Edlin
55502.680	02-Nov-10	04:19	6466	6650	184	0.17	Edlin
55497.630	28-Oct-10	03:07	6467	6654	188	0.17	Edlin
55491.640	22-Oct-10	03:21	6467	6650	184	0.17	Edlin
55456.890	17-Sep-10	09:21	6471	6656	186	0.17	Edlin
55429.880	21-Aug-10	09:07	6467	6656	189	0.17	Edlin
55424.860	16-Aug-10	08:38	6467	6655	189	0.17	Edlin
55321.640	05-May-10	03:21	6475	6655	181	0.17	Edlin
55290.720	04-Apr-10	05:16	6470	6655	185	0.17	Edlin
55275.710	20-Mar-10	05:02	6485	6655	170	0.17	Edlin
55267.700	12-Mar-10	04:48	6466	6650	184	0.17	Edlin
55266.690	11-Mar-10	04:33	6466	6651	185	0.17	Edlin
55264.650	09-Mar-10	03:36	6466	6647	182	0.17	Edlin
55259.660	04-Mar-10	03:50	6466	6648	183	0.17	Edlin
55257.650	02-Mar-10	03:36	6466	6648	182	0.17	Edlin
55250.850	23-Feb-10	08:24	6468	6655	187	0.17	Edlin
54848.700	17-Jan-09	04:48	6477	6655	178	0.17	Edlin
54795.690	25-Nov-08	04:33	6479	6656	177	0.17	Edlin
54792.680	22-Nov-08	04:19	6479	6656	177	0.17	Edlin
54788.690	18-Nov-08	04:33	6477	6656	178	0.17	Edlin
54770.670	31-Oct-08	04:04	6474	6656	182	0.17	Edlin
54728.740	19-Sep-08	05:45	6467	6651	184	0.17	Edlin
54722.830	13-Sep-08	07:55	6467	6651	184	0.17	Edlin

Follow up of items from Newsletter 21

Firstly a big thank you to Jeff for standing in for me and completing the spectroscopy section for the last news letter. Firstly a follow up on couple of items :-

Hydrogen alpha blue edge emission component

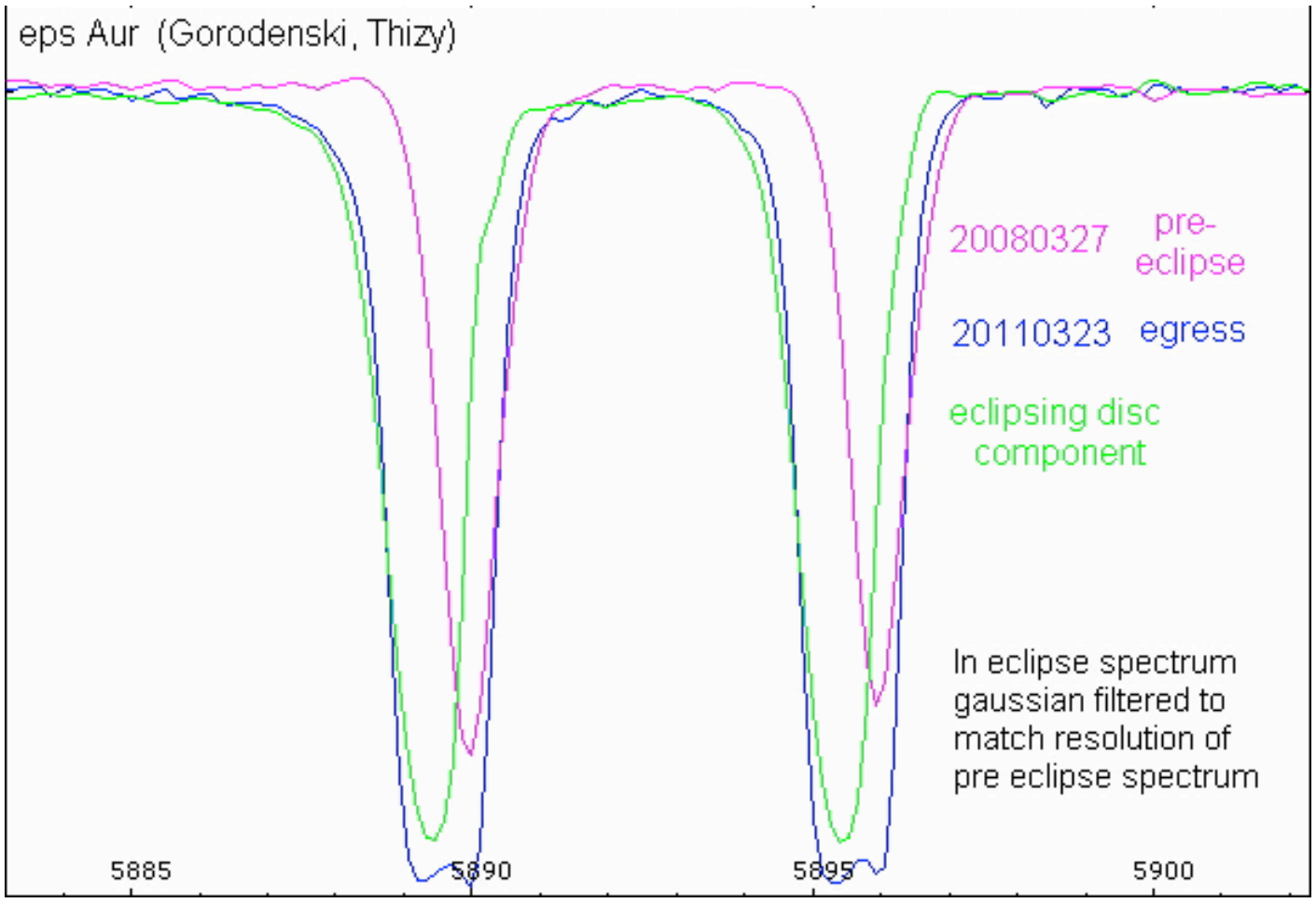
There was mention made in the previous newsletter of a possible return of the blue edge emission component. This turned out to be a false alarm and currently (15 April 2011) there is no emission in the blue wing yet. This is not unexpected. One of the best records of the development of the H alpha line around this phase comes from measurements by Wright and Kushawa during the 1957 eclipse which show the emission returning between observations made February and April 1957, corresponding to 27 April and 27 June 2011 for this eclipse (see below).



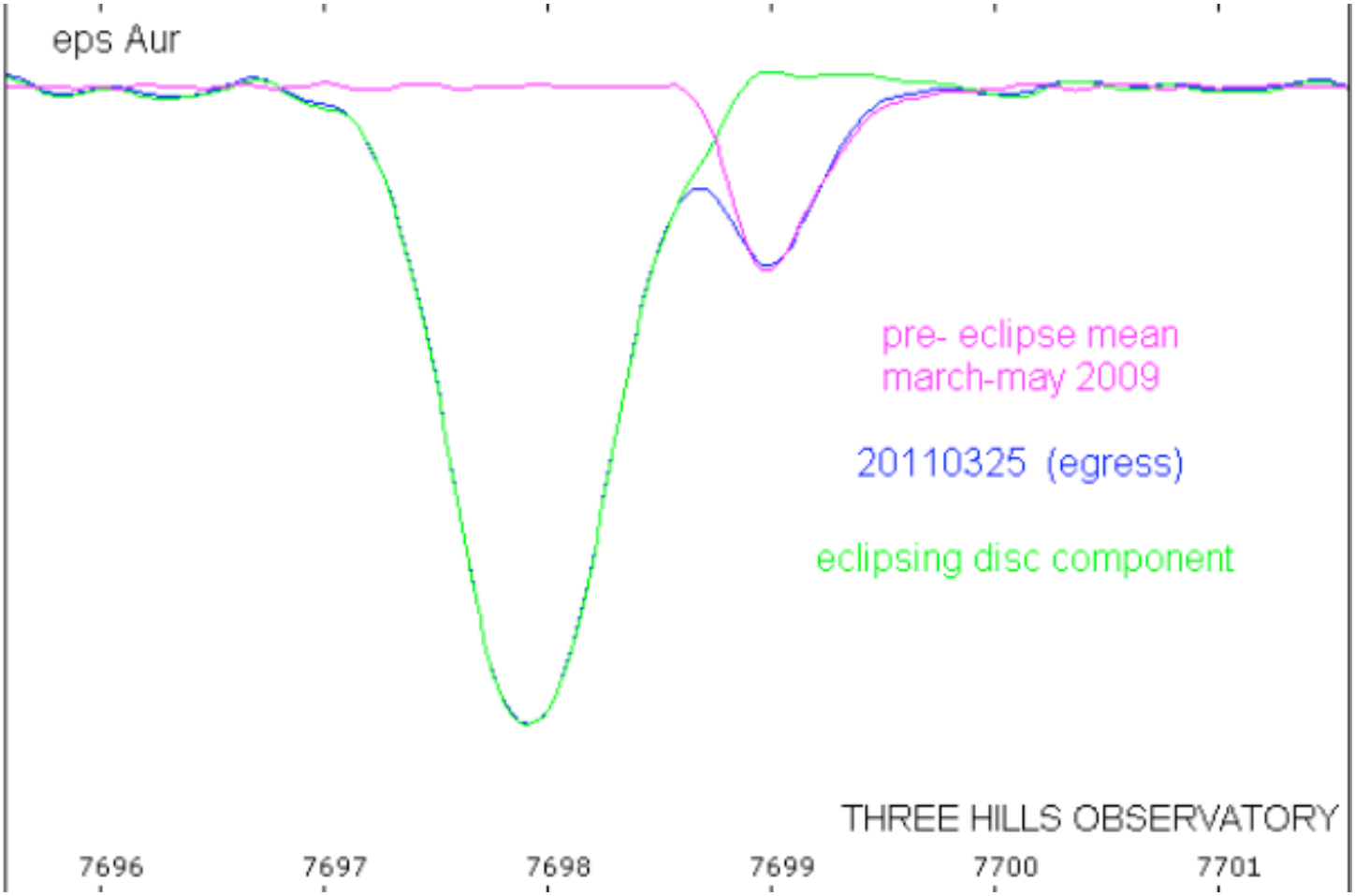
The emission component in the Sodium D lines

An emission component was reported, visible in the core of the Sodium D lines. This was also seen around this time during the last eclipse by Barsony at al, but is in fact more simply explained as a developing gap between the stationary outside eclipse component and the component originating in the eclipsing disc (which moves from red to blue during the eclipse). This currently lies to the blue of the outside eclipse component and is narrowing as we see the rotation of the outer parts of the disc become increasingly closer to the direction of our line of sight, revealing the split between the two components.

Stan Gorodenski's latest spectrum of this line shows this split becoming increasingly clear.



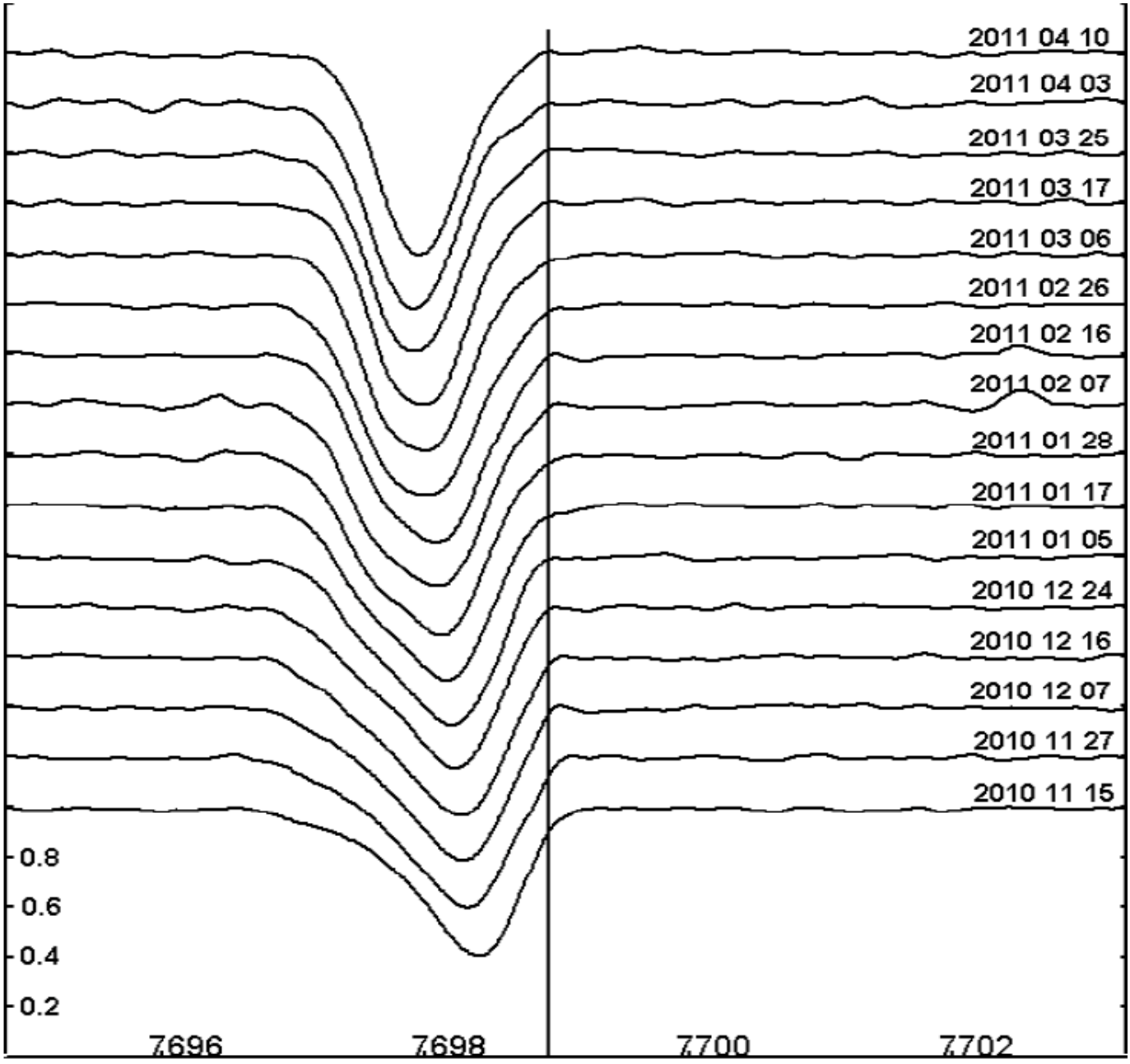
The same effect is also seen in the 7699Å Potassium line where the pre eclipse component is smaller.



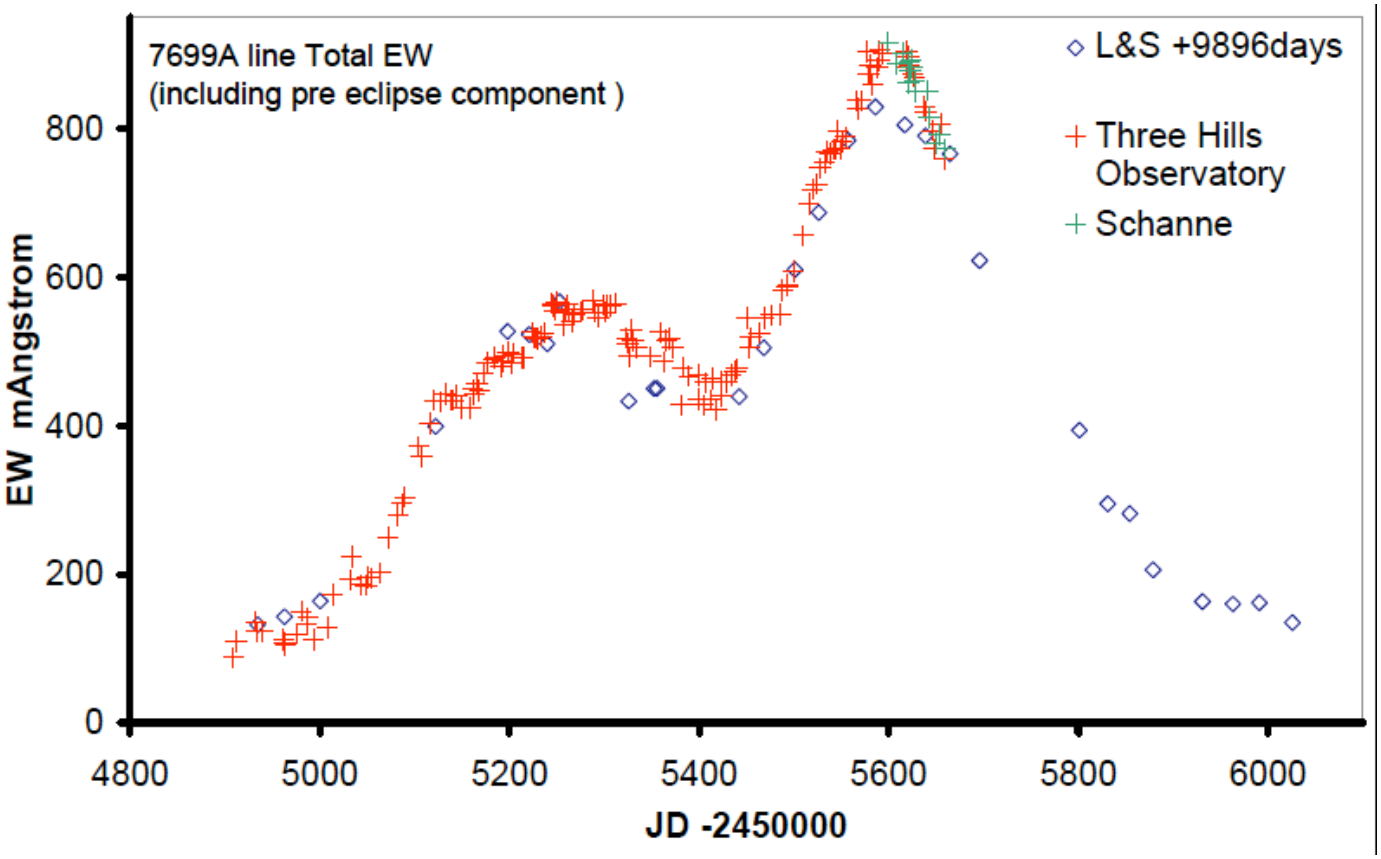
If the Na D line trend follows that seen last eclipse then we can expect to detect Sodium from the disc until at least the end of 2011. In fact the final lingering signs of the eclipsing object before it leaves us until next time may well be seen in this line.

The 7699Å Potassium line

The total Equivalent Width (EW) of the 7699Å Potassium line reached a maximum of 910 mÅ at RJD 5610 (17 Feb 2011) and then started decreasing, returning to levels seen by Lambert and Sawyer during the previous eclipse by RJD 5650 (29 Mar 2011). The maximum absorption measured in the line core however continues to be high at over 80% absorption, the reduction of EW coming mainly from a narrowing of the line.



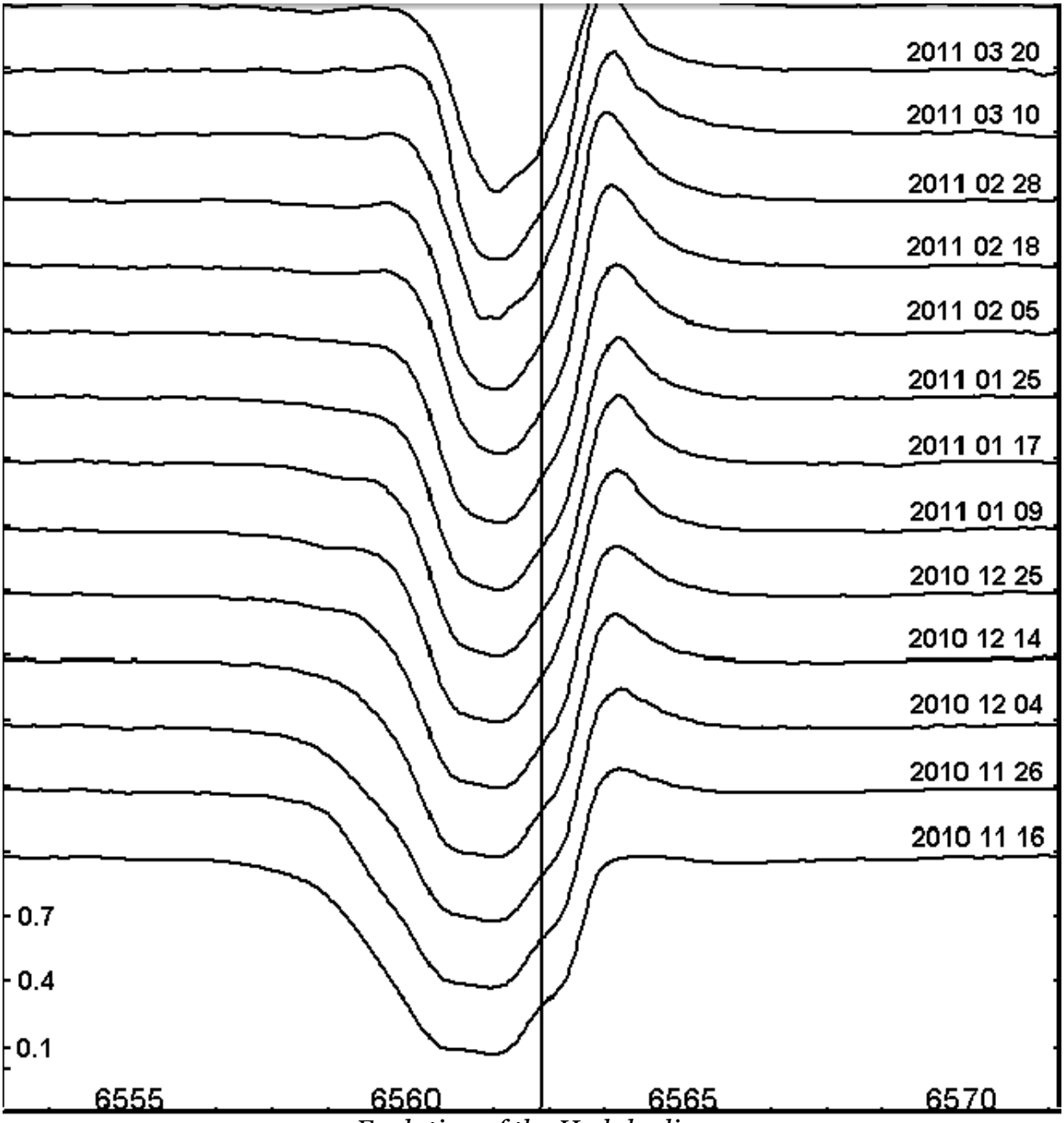
Recent evolution of the 7699A neutral potassium line after removal of the interstellar component seen outside eclipse. Leadbeater, Schanne



The 7699A neutral potassium line strength(including the interstellar component seen outside eclipse) Leadbeater, Schanne

The Hydrogen alpha Line

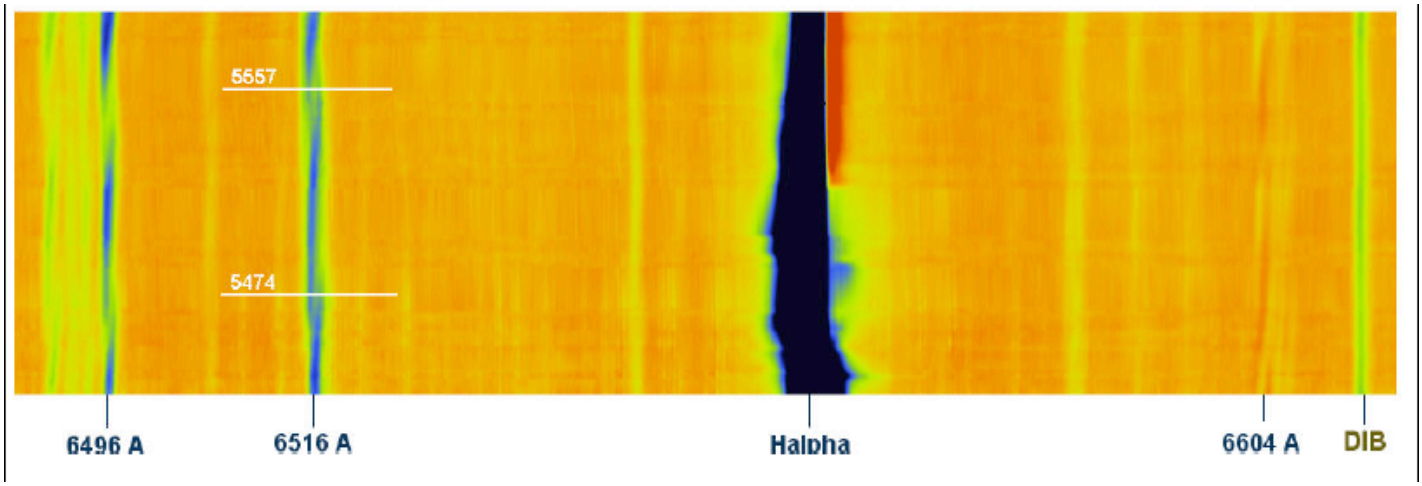
The absorption contribution from the eclipsing object has recently been narrowing from the blue edge and now sits over the position where the blue emission component is normally seen outside eclipse. This component is expected to return in the next few weeks as the eclipsing disc object moves away.



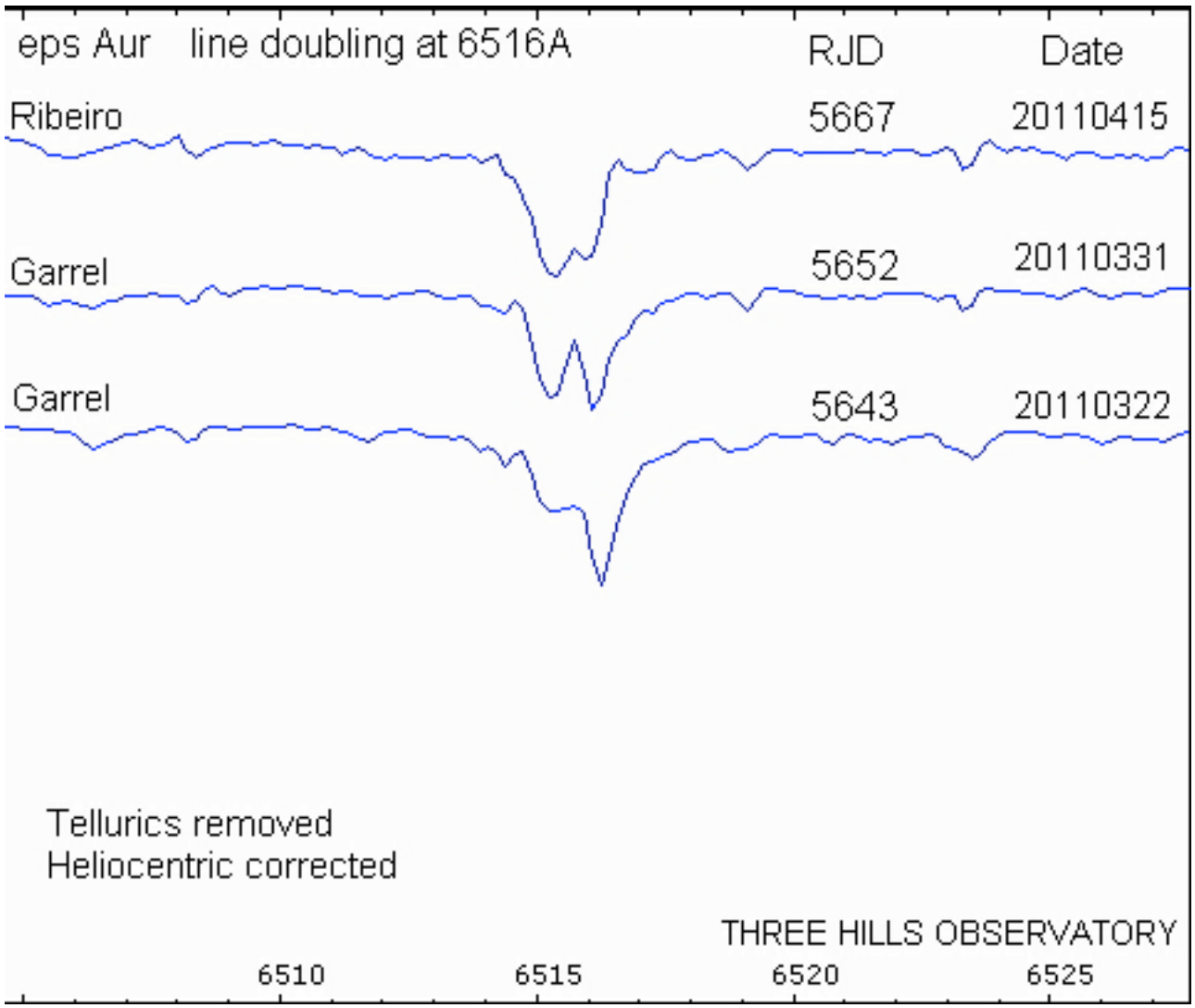
Evolution of the H alpha line
(from campaign database, various observers)

Transient line doubling

Following the incidence of line doubling seen by Christian Buil in various lines in the hydrogen alpha region and reported in the campaign poster presented at the Seattle AAS meeting in January, Buil reported a second instance 86 days later.



Although epsilon Aurigae is currently not visible from Buil's observatory, checks on spectra of this region from other observers show that a further instance of line doubling occurred in the 6504Å line approximately 100 days later.



There are also currently reports of activity in the complex emission component at 6616Å which appears from Buil's data to vary in step with the 6504 line doubling but at a different phase.

The Future

Although photometrically the system will return to normal brightness over the next month or so, there will be evidence of the eclipsing object in the spectrum long after photometric 4th contact and a post eclipse base line is also needed so observers are encouraged to continue taking spectra regularly until at least the end of 2011 and at longer intervals during 2012.

From Dr. Bob

Dr. Robert E. Stencel . Co- Editor
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<robert.stencel@du.edu>
https://twitter.com/epsilon_Aurigae

Having arrived at egress, the cadence of observations had slowed – in part due to sun angle, and in part due to eclipse data overload - until the April light curve plateau caught everyone but Jeff by surprise. While I'm grateful to each and every observer who braved all conditions to make this the most well documented eclipse in history, the backlog of un-examined data is substantial and will require years to digest. However, the ease of Internet communication has allowed everyone to participate in a real-time commentary on the meaning of each light variation, and each new spectral change. Interferometric imaging has decisively shown that the eclipsing body is disk-like. One of the most optimistic interpretations of the eclipse data is that we can continue to track the disk, outside of eclipse, with sufficiently far-into-the-infrared methods, or in the cores of selected optical spectral lines of hydrogen and helium. As Robin points out, some optical spectral lines may show eclipse effects until late 2011.

For the record, during 2011 to date, the following additional observations were collected by Denver observers and collaborators, on major telescopes:

RJD*	Cal.Date	Telescope, Mode
55565	04 Jan 2011	GeminiN+GNIRS, 2.3 micron high res spectra
55567	06 Jan	IRTF+SpeX, 1-5 micron med-res spectra
55637	17 Mar	HST+COS, 1150-1800Å spectra (3rd epoch)
55649	29 Mar	IRTF+SpeX, 1-5 micron med-res spectra
55649	29 Mar – 4 Apr	CHARA + CLIMB, 3T interferometry
55650	30 Mar	GeminiN+GNIRS, 2.3 micron high res spectra
55663	12 April	IRAC, 3.5 & 4.5 micron photometry
55663	12 April	GeminiN+GNIRS, 2.3 micron high res spectra
55678	25 April	IRTF + MIRSI, 10 micron photometry
55682	29 April	IRAC, 3.5 & 4.5 micron photometry plus Herschel Space Observatory time (approved for 2011, not yet scheduled).

What do these observations show? GNIRS and SpeX showed the CO features near 2.3 microns persisted during this egress interval; the HST/COS spectra continue to show a hot continuum plus emission lines in the UV; the CHARA+CLIMB data are still being processed, but we hope they will show the egress side of the disk (the CLIMB instrument mode differs from prior observations, as

MIRC was out of service); the IRAC data are part of an effort to detect the warmer side of the disk coming into view as eclipse ends. A series of papers are in preparation.

Some very good news from Gary Cole. His polarimetric observations have continued and show amplitude and variations similar to those seen by Kemp and Henson during the second half of the last eclipse. Gary's report for the 2011 May SAS Symposium was in preparation at this time of this writing.

Interesting Papers

Four interesting papers are scheduled for presentation at the Boston meeting of the American Astronomical Society, May 22-25, 2011:

Discovery of Strong Helium 10830A Absorption In The Mid-eclipse Disk Of Epsilon Aurigae

Robert E. Stencel1, B. Kloppenborg1, M. Sitko2, J. Rayner3, A. Tokunaga3
1-Univ. of Denver, 2-Univ. of Cincinnati, 3-NASA IRTF.

Abstract: During the 2010 eclipse of the enigmatic binary, epsilon Aurigae (F0p + B5?), we obtained a series of near-infrared spectra with the SpeX instrument at NASA's IRTF, primarily to detect the re-appearance of CO (2-0) at 2.29 microns after nominal mid-eclipse, 2010 August 4 (JD 2,455,400). To our surprise, the well-known He I 10830A line appeared in absorption, in the spectrum closest to mid-eclipse (Aug.24, RJD 55433), persisting in spectra Sep.27 (55467), Oct.24 and 29 (55494, 55499). The line weakened by Nov.12 (55513), and was gone Dec.7 (55537) and 2011 Jan.7 (55569). The extra absorption, up to 6A equivalent width, appeared atop a weaker, persistent 1A equivalent width feature. With Van de Kamp's distance (580 pc) and orbital velocities during eclipse phase, the duration of the extra absorption implies a region 1.0 +/- 0.2 AU in radial extent, in the middle of the eclipse-causing dark disk with its 3.8 +/- 0.2 AU radius. He I 10830 arises from a metastable triplet from a lower level at 19.82 volts, representing plasma in excess of 25,000K. If the disk-center star were B5V type and experiencing a modest amount of accretion, it would create a 1 AU Stromgren He+ sphere. This assumes a mean gas density of 10^{10} cm^{-3}, which is the lower limit to the column density established by non-detection of soft Xrays. This heated region could represent the presence of an upper main sequence object and accretion onto the hidden star inside the disk, in analogy to Be stars, symbiotics, zeta Aurs and YSOs. This work was supported in part by the bequest of William Herschel Womble in support of astronomy at the University of Denver, by NSF grant 1016678 and JPL RSA 1414715 to the University of Denver, and by NASA ADP grant NNX09AC73G to the University of Cincinnati.

A*ccretion in the Disk of epsilon Aurigae: Results of Monte Carlo Radiative Transfer Modelling*

Naomi Pequette1, R. Stencel1, B. Whitney2 -
1University of Denver, 2Space Science Institute.

Abstract: Epsilon Aurigae is a mysterious eclipsing binary system that has been observed for more than 175 years. Current theory remains undecided whether the system is made up of a massive F-supergiant star and an equally massive, but hidden, companion, or a post-AGB F-star and a binary companion made up of a B5V which is surrounded by a transitional or debris disk. We used a Monte Carlo Radiative Transfer Model (MCRTM, written by Barbra Whitney of the Space Sciences Institute) to model the B-star and surrounding disk. By using this model, our goal was to reproduce the observed Spectral Energy Distribution (SED, Hoard, Howell and Stencel, HHS, 2010) of the B-star and disk components of the epsilon Aurigae System. Our initial parameters utilized the results of HHS. The initial run of MCRTM did not result in matching the observed SED. Subsequently, we explored previously unknown disk parameters, most importantly disk mass and accretion rate. We found that to reproduce the observed 10:1 ratio of IR to Far-UV flux, we must have a non-zero rate of accretion occuring in the disk. To avoid depleting the disk too quickly, our simulations find that a more massive disk becomes too opaque due to increased scattering and does not reproduce the observed SED. Thus, we propose the extra mass might be in the form of planetesimals. The high accretion rate also implies dust mass replinishment, possibly due to a high rate of collisional interaction among planetesimals embedded in the disk. This work was supported in part by the bequest of William Herschel Womble in support of astronomy at the University of Denver, by NSF grant 1016678 and JPL RSA 1414715 to the University of Denver.

Towards A Full Orbital Solution For Epsilon Aurigae

Brian K. Kloppenborg1, P. Hemenway1, E. Jensen2, W. Osborn3, R. Stencel1
1University of Denver, 2Swarthmore College, 3Central Michigan University.

Abstract: Epsilon Aurigae is an eclipsing binary with a 27-year period that has baffled investigators for almost two centuries. The data from present and prior eclipses have strengthened our understanding of the system, but a comprehensive understanding of it's evolutionary state has remained illusive. There are presently two competing views: (1)the F-star primary is a supergiant of ~15 Mo with a companion that is equally massive, yet obviously much smaller, that has yet to evolve off the MS or (2)the F-star is a post-AGB object of ~4 Mo with a MS companion of ~6-7 Mo that is enshrouded in an accretion disk of debris from the F-star. Deciding between the two models depends on having an accurate distance to the system. Published parallaxes all agree within their formal uncertainties, but have error bars larger than the nominal value. We have found that all astrometric results either neglected orbital motion or relied on orbital elements that are not congruent with spectroscopy (Stefanik et al. 2010) and with the recent in-eclipse interferometric observations (Kloppenborg et al. 2010). For example, all astrometric orbital solutions (van de Kamp 1978, Strand 1959, Heintz and Cantor 1994) assumed an eccentricity that does not agree with present value, e = 0.22-0.26 (Stefanik et al. 2010, Chadima et al. 2010), rather than solving for it. Likewise the HIPPARCOS parallax used Heintz's orbit that we argue is incorrect. We are deriving new orbital solutions for both components in the system. The solution for the F-star will use radial velocity and astrometric observations. The solution for the eclipsing object comes from the relative motion of the components implied by interferometric imaging. The University of Denver participants are grateful for support under NSF grant 10-16678 and the bequest of William Hershel Womble in support of astronomy at the University of Denver.

Regular High Resolution Full Visual Spectrum Monitoring of Epsilon Aurigae Throughout Its 2009-2011 Eclipse

John C. Martin1, J. O'Brien1
1U of Illinois Springfield.

Abstract: Over the past two years the star Epsilon Aurigae has dimmed as a companion with a thick

dusty disk eclipses it. Throughout this event we have taken regular biweekly high resolution Echelle spectroscopy to record changes in the absorption profiles. Measurements of the features introduced into the stellar spectrum by the intervening disk map its structure and physical parameters. While others have focused their high-resolution spectroscopy efforts on narrow ranges of wavelength targeting specific well-studied absorption features, our data covers from 970 nm - 315 nm allowing us to discover additional features in the spectrum that vary during the eclipse.

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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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