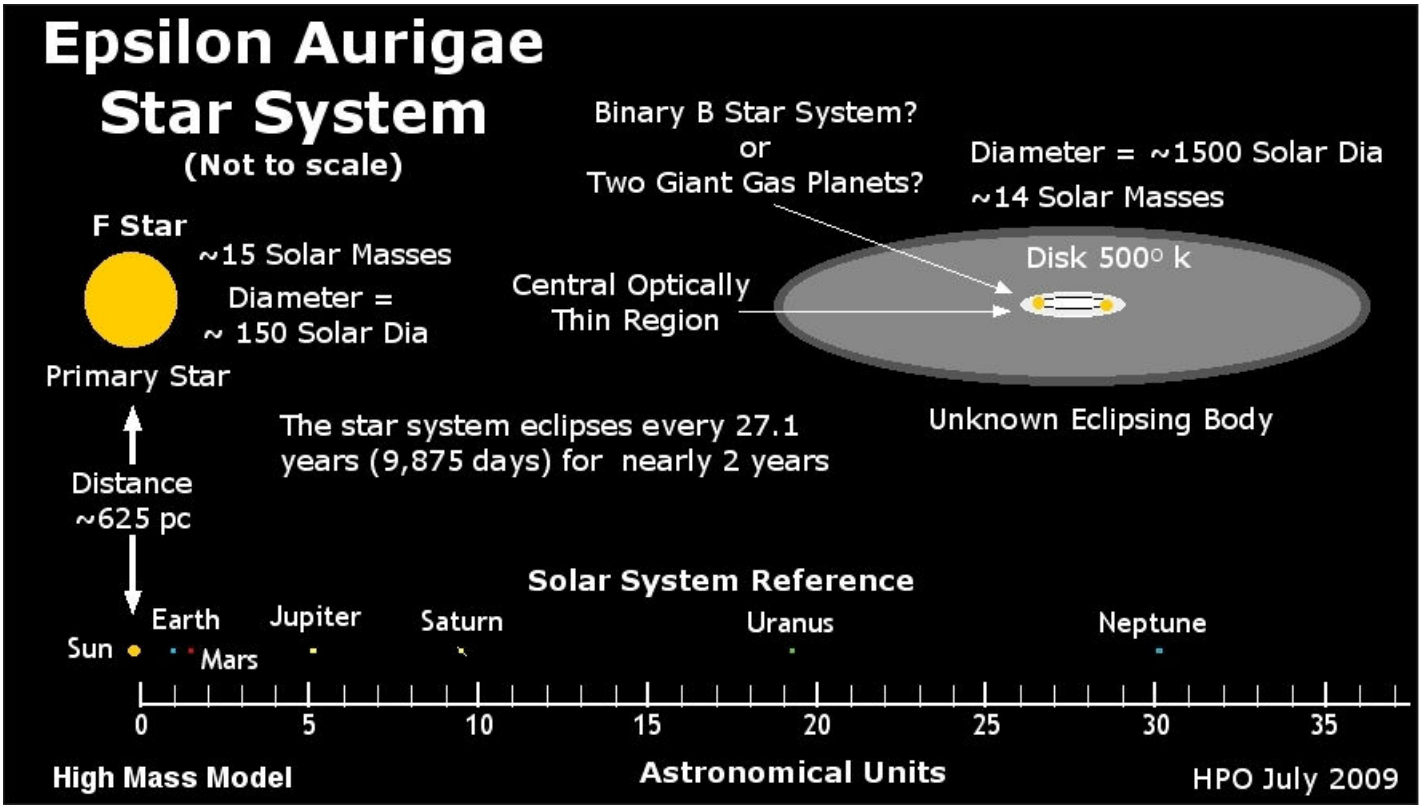
# 2009/2011
# Epsilon Aurigae Eclipse
## International Campaign Newsletter #18
## Summer 2010 - Totality





**Jeffrey L. Hopkins, Editor**
**Hopkins Phoenix Observatory**

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

**Robin Leadbeater, Co-editor**
**Three Hills Observatory**


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

# In This Newsletter

# Editor's Remarks

Dear Colleagues,

The next season for observing epsilon Aurigae has begun. I wish to thank all the faithful observers who provided super human efforts to observe between seasons. I know this was a monumental task and very much appreciated.

Did the mid-eclipse brightening happen? The mystery remains. A tantalizing set of observations at high air mass right around the predicted time showing a large spike in brightness would indicate something interesting as happened. This happened the last two weeks of May and first week of June (RDJ 5430 - 5350) with the spike about RDJ 5340. The spike was short lived and then the magnitude faded back to around what it was before then spike.

Because of the high air mass of the observations one might think that was responsible and the spike was not real. Or perhaps a bias on the part of the observer. Two things discount these. One, several observers made similar observations at different locations with different equipment. What I find most interesting is the SMEI satellite data which, while presented uncalibrated, shows a near identical spike in brightness and then fall back to previous dimmer levels. Did we catch epsilon Aurigae doing something wild? The previous eclipse showed something similar, but unlike now, no data were taken to see what happened after the initial spike.

From the first week of June until present the star system appears similar to out of eclipse. The OOE brightening variation is seen, but no large mid-eclipse brightening. What will be important is the continual observation during totality. I think there may be a good chance that if the initial spike in brightness was real, we should see a corresponding one before the end of totality. The great part of this is we will be well into the observing season and observing in multiple bands by many observers as well as great data from the Campaign's spectroscopy observers. Spectroscopy during such and event would most likely provide a wealth of information.

I will keep the Campaigned informed of any significant changes via the Campaign's Yahoo list Forum. If you have not signed up for it, I encourage you to do so.

Below are the predicted times of the end of the mid-eclipse brightening. These are derived from the 1982/84 eclipse and have an error of several days at best.

**Mid-Eclipse Brightening End**

| Band | RJD | UT Date |
|---|---|---|
| V | 55,485 | 15 October 2010 |
| B | 55,479 | 09 October 2010 |
| U | 55,494 | 24 October 2010 |

Good luck to all of you and please post any information, questions, comments and data to the Campaign List!

# 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**

Previous Newsletters listed ingress data and this Newsletter will list data beginning approximately just before second contact or RJD = 5180. This will help reduce the amount of data in the Newsletters. Data to date is planned to be made available as an on-line archive this summer (2010).

## Plot Observer Key

**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
**HGL** - Hans-Goran Lindberg, Skultuna, Sweden
**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
**LO** - Lindarberg Observatory, Snaevarr Gudmundsson, Hafnarfjordur, Iceland
**MSO** - Arvind Paranjpye, MVS IUCAA Observatory
**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 -** Roosbeek Lake Observatory, Hubert Hautecler, Boutersem Brabant, Belgium
**SGGO** - S. Giovanni Gatano al Observatory, Tiziano Colombo, Pisa, Italy
**VO** - Thomas Karlsson, Varberg Observatory, Varberg, Sweden
**TP** - Tom Pearson, Virginia Beach, Virginia, USA
**WWC**- Warren Wilson College, Ashville, North Carolina, USA

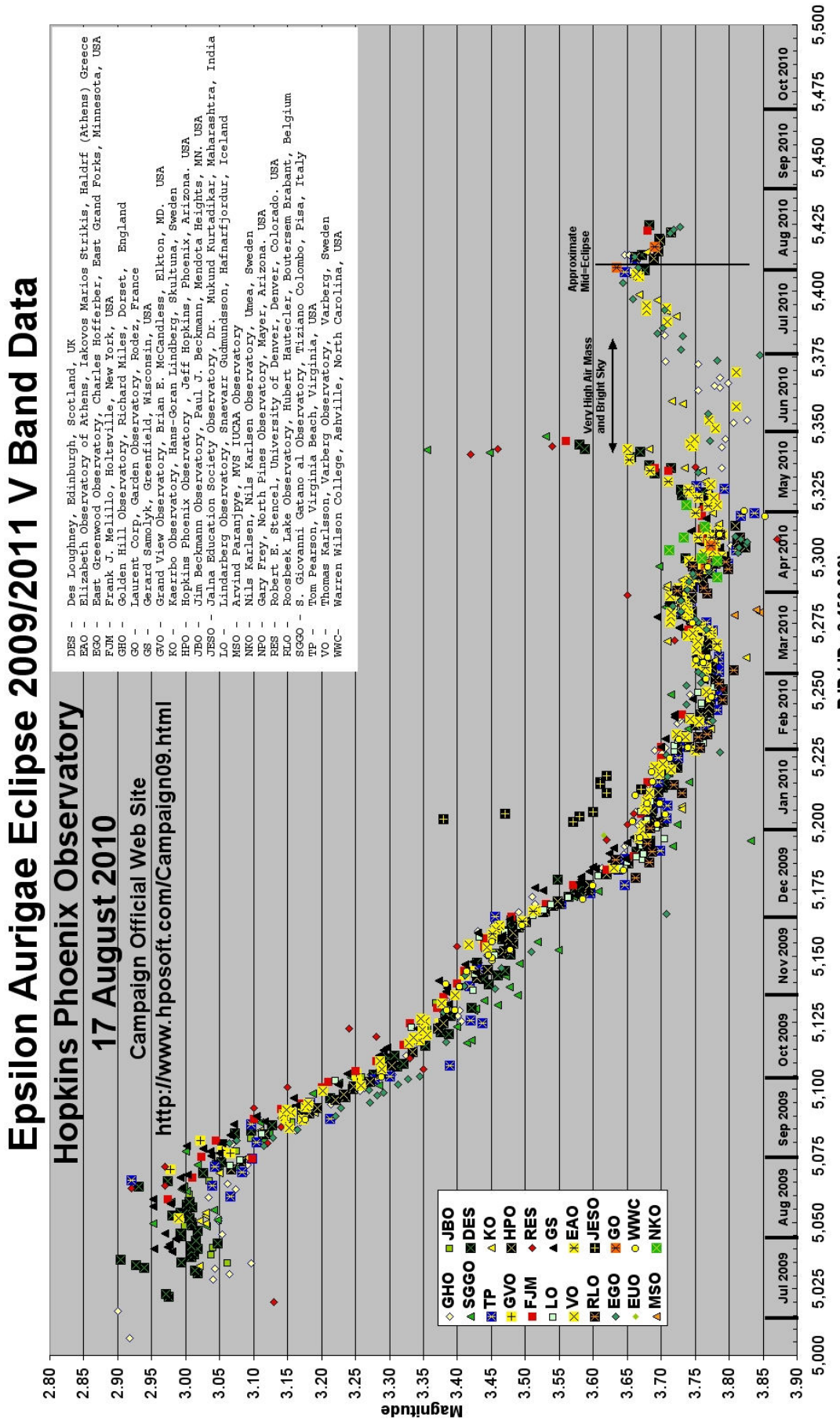
**Note:** Full resolution images of the following plots can be seen at:

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

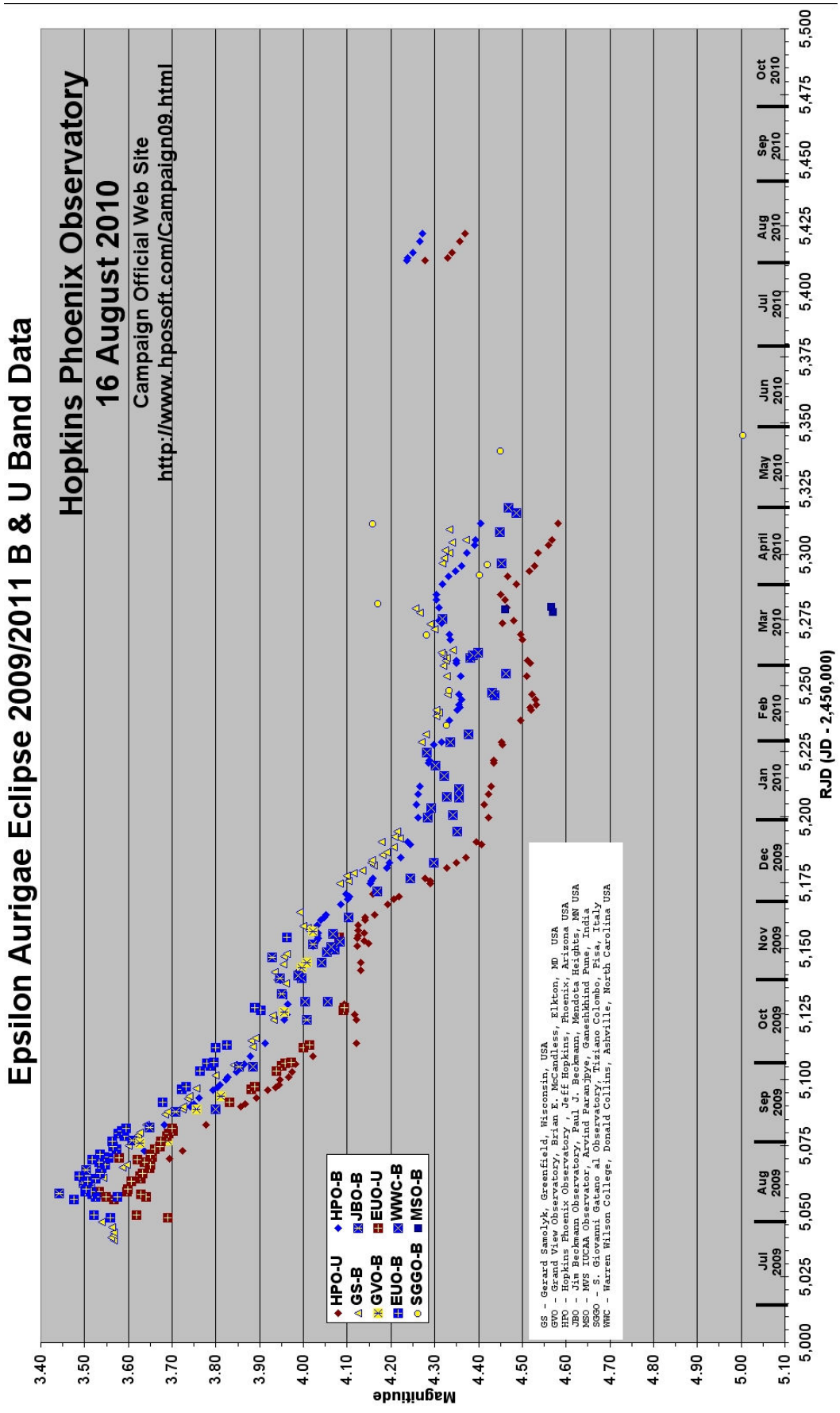
UB Band Plots:
**http://www.hposoft.com/Plots09/UBFall09.jpg**

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

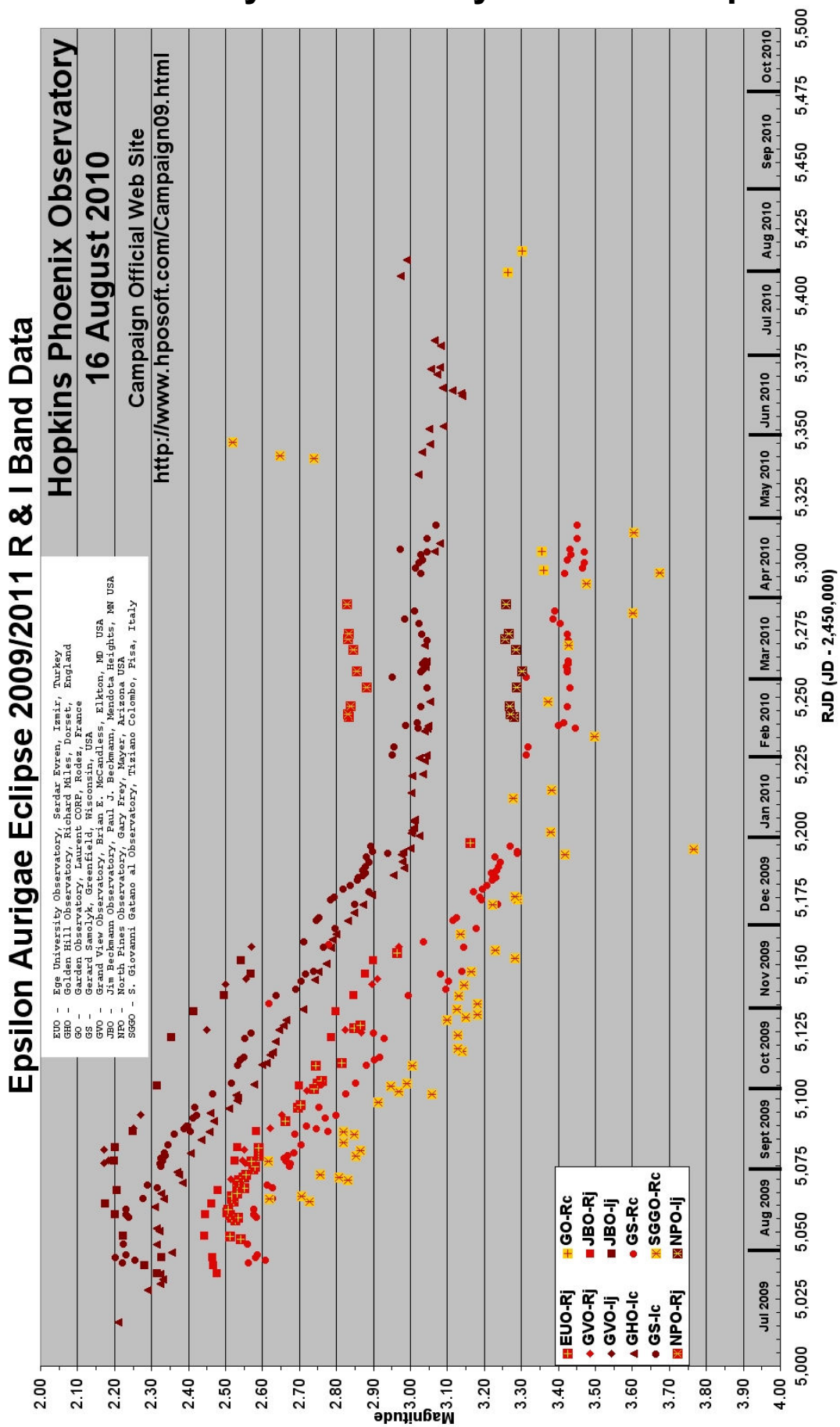
# Ingress and Totality Photometry V Data Composite Plot



# Ingress and Totality Photometry UB Data Composite Plot



# Ingress and Totality Photometry RI Data Composite Plot



# Photometric Observers

**Note:** Bold data are data submitted since the last Newsletter.

**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 |
|---|---|---|
| 5333.64 | 3.75 | 0.32 |
| 5338.65 | 3.42 | 0.16 |
| 5340.65 | 3.46 | 0.16 |
| 5341.66 | 3.54 | 0.16 |
| 5378.92 | 3.69 | 0.05 |
| 5392.91 | 3.67 | 0.12 |
| 5416.94 | 3.62 | 0.15 |

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 |
|---|---|---|---|---|---|
| 30/31 July 2010 | 5408.6329 | 3.635 | 0.001 | 3.263 | 0.001 |
| 07/08 August 2010 | 5416.6153 | 3.696 | 0.001 | 3.301 | 0.001 |

RJD = JD - 2,450,000

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

| Double Date | RJD | V | # | SD | X |
|---|---|---|---|---|---|
| 16/17 February 2010 | 5244.4471 | 3.760 | 3 | 0.000 | 1.10 |
| 18/19 February 2010 | 5245.3728 | 3.760 | 3 | 0.000 | 1.12 |
| 21/22 February 2010 | 5249.3796 | 3.755 | 3 | 0.006 | 1.07 |
| 22/23 February 2010 | 5230.4699 | 3.763 | 3 | 0.006 | 1.08 |
| 23/24 February 2010 | 5251.4296 | 3.778 | 3 | 0.010 | 1.12 |
| 18/19 March 2010 | 5274.4815 | 3.753 | 3 | 0.019 | 1.39 |
| 25/26 March 2010 | 5280.4366 | 3.722 | 3 | 0.004 | 1.30 |
| 26/27 March 2010 | 5281.4619 | 3.720 | 3 | 0.021 | 1.40 |
| 28/29 March 2010 | 5284.4977 | 3.733 | 3 | 0.036 | 1.57 |
| 30/31 March 2010 | 5286.4797 | 3.720 | 3 | 0.018 | 1.52 |
| 03/04 April 2010 | 5290.4443 | 3.746 | 3 | 0.005 | 1.42 |
| 04/05 April 2010 | 5291.4373 | 3.744 | 3 | 0.009 | 1.40 |
| 07/08 April 2010 | 5294.4629 | 3.756 | 3 | 0.009 | 1.54 |

RJD = JD - 2,450,000

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

| Observation Date | RJD | V mag | SD | Ic | SD |
|---|---|---|---|---|---|
| 05/06 March 2010 | 5261.3370 | 3.763 | 0.002 | 3.040 | 0.004 |
| 07/08 March 2010 | 5263.3090 | 3.767 | 0.004 | 3.044 | 0.004 |
| 13/14 March 2010 | 5269.4210 | 3.761 | 0.005 | 3.039 | 0.008 |
| 17/18 April 2010 | 5304.3450 | 3.803 | 0.008 | 3.065 | 0.007 |
| 20/21 April 2010 | 5307.3460 | 3.812 | 0.009 | 3.079 | 0.008 |
| 16/17 May 2010 | 5333.3760 | 3.789 | 0.019 | 3.021 | 0.034 |
| 24/25 May 2010 | 5341.4140 | 3.789 | 0.043 | 3.032 | 0.060 |
| 27/28 May 2010 | 5344.4230 | 3.794 | 0.009 | 3.053 | 0.027 |
| 02/03 June 2010 | 5350.4080 | 3.806 | 0.012 | 3.051 | 0.009 |
| 03/04 June 2010 | 5351.4110 | 3.827 | 0.016 | 3.086 | 0.030 |
| 14/15 June 2010 | 5362.493 | 3.754 | 0.050 | 3.140 | 0.055 |
| 15/16 June 2010 | 5363.474 | 3.787 | 0.039 | 3.137 | 0.096 |
| 16/17 June 2010 | 5364.478 | 3.779 | 0.034 | 3.114 | 0.043 |
| 17/18 June 2010 | 5365.491 | 3.799 | 0.026 | 3.088 | 0.023 |
| 19/20 June 2010 | 5367.461 | 3.786 | 0.037 | | |
| 22/23 June 2010 | 5370.530 | | | 3.072 | 0.056 |
| 24/25 June 2010 | 5372.498 | 3.754 | 0.055 | 3.056 | 0.010 |
| 25/26 June 2010 | 5373.488 | 3.706 | 0.037 | 3.079 | 0.018 |
| 03/04 July 2010 | 5381.465 | | | 3.081 | 0.038 |
| 05/06 July 2010 | 5383.457 | 3.705 | 0.057 | 3.065 | 0.023 |
| 29/30 July 2010 | 5407.523 | 3.654 | 0.037 | 2.974 | 0.018 |
| 04/05 August 2010 | 5413.4600 | 3.647 | 0.008 | 2.990 | 0.010 |

RJD = JD - 2,450,000

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

| UT Date | RJD | V | SD |
|---|---|---|---|
| 12/13 April 2010 | 5299.3368 | 3.783 | 0.003 |
| 13/14 April 2010 | 5300.3403 | 3.789 | 0.003 |
| 18/19 April 2010 | 5305.3021 | 3.780 | 0.003 |
| 20/21 April 2010 | 5307.3479 | 3.775 | 0.003 |
| 23/24 April 2010 | 5310.3438 | 3.766 | 0.003 |
| 29/30 April 2010 | 5316.3563 | 3.751 | 0.003 |

| | | | |
|---|---|---|---|
| 02/03 May 2010 | 5319.3368 | 3.769 | 0.003 |
| 05/06 May 2010 | 5322.3451 | 3.754 | 0.003 |
| 07/08 May 2010 | 5324.3403 | 3.743 | 0.003 |
| 08/09 May 2010 | 5325.3458 | 3.740 | 0.003 |
| 11/12 May 2010 | 5328.3472 | 3.710 | 0.003 |
| 15/16 May 2010 | 5332.3507 | 3.684 | 0.003 |
| 19/20 May 2010 | 5336.3451 | 3.653 | 0.003 |

RJD = JD - 2,450,000

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

| RJD | CV |
|---|---|
| 5322.4167 | 3.773 |
| 5323.4236 | 3.771 |
| 5324.4208 | 3.769 |
| 5327.4583 | 3.768 |
| 5328.4514 | 3.765 |
| 5332.4576 | 3.761 |
| 5333.4722 | 3.734 |
| 5340.4583 | 3.682 |
| 5357.4993 | 3.732 |
| 5358.4931 | 3.716 |
| 5390.4861 | 3.723 |
| 5392.4688 | 3.708 |
| 5396.4958 | 3.674 |
| 5398.4986 | 3.668 |
| 5405.4993 | 3.659 |
| 5414.4988 | 3.678 |
| 5415.4956 | 3.697 |

RJD = JD - 2,450,000

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

| RJD | B Mag | SD | V Mag | SD | Rc Mag | SD |
|---|---|---|---|---|---|---|
| 5339.3403 | 4.450 | 0.200 | 3.447 | 0.200 | 2.738 | 0.200 |
| 5340.3403 | | | 3.356 | 0.200 | 2.648 | 0.200 |
| 5345.3438 | 5.004 | 0.200 | 3.530 | 0.200 | 2.519 | 0.200 |

RJD = JD - 2,450,000

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

| RJD | UT Date | UT | V Mag | SD | X |
|---|---|---|---|---|---|
| 5325.5444 | 08/09 May 2010 | 01:04 | 3.793 | 0.027 | 2.4906 |

| | | | | | |
|---|---|---|---|---|---|
| 5326.5368 | 09/10 May 2010 | 00:53 | 3.752 | 0.042 | 2.3842 |
| 5406.8979 | 28/29 July 2919 | 09:33 | 3.646 | 0.022 | 1.3200 |
| 5411.8833 | 02/03 August 2010 | 09:12 | 3.661 | 0.024 | 1.4564 |

RJD = JD - 2,450,000

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

| RJD | Date UT | V Mag | SD |
|---|---|---|---|
| 5323.419 | 06/07 May 2010 | 3.731 | 0.022 |
| 5324.398 | 07/08 May 2010 | 3.761 | 0.005 |
| 5325.4012 | 08/09 May 2010 | 3.729 | 0.024 |
| 5331.41 | 14/15 May 2010 | 3.691 | 0.002 |
| 5333.409 | 16/17 May 2010 | 3.714 | 0.027 |
| 5334.406 | 17/18 May 2010 | 3.683 | 0.032 |
| 5337.41 | 20/21 May 2010 | 3.656 | 0.019 |
| 5339.415 | 22/23 May 2010 | 3.669 | 0.035 |
| 5340.413 | 23/24 May 2010 | 3.588 | 0.023 |
| 5342.41 | 25/26 May 2010 | 3.579 | 0.005 |
| 5407.609 | 29/30 July 2010 | 3.676 | 0.017 |
| 5413.613 | 04/05 August 2010 | 3.672 | 0.007 |
| 5419.61 | 10/11 August 2010 | 3.697 | 0.014 |
| 5424.5691 | 16/17 August 2010 | 3.683 | 0.038 |

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 |
|---|---|---|---|
| 05/06 May 2010 | 5322.4132 | 3.777 | 0.013 |
| 10/11 May 2010 | 5327.4000 | 3.773 | 0.010 |
| 23/24 May 2010 | 5340.4687 | 3.650 | 00000 |
| 24/25 May 2010 | 5341.4674 | 3.746 | 0.038 |
| 25/26 May 2010 | 5342.4521 | 3.742 | 0.010 |
| 27/28 Mat 2010 | 5344.4604 | 3.749 | 0.021 |
| 31/01 May/June 2010 | 5348.4674 | 3.780 | 0.039 |
| 03/04 June 2010 | 5351.4583 | 3.770 | 0.027 |
| 08/09 June 2010 | 5356.4604 | 3.810 | 0.036 |
| 21/22 June 2010 | 5369.3958 | 3.810 | 0.032 |
| 10/11 July 2010 | 5388.4576 | 3.709 | 0.028 |
| 14/15 July 2010 | 5392.4618 | 3.678 | 0.019 |
| 15/16 July 2010 | 5393.4383 | 3.708 | 0.020 |
| 16/17 July 2010 | 5394.4556 | 3.679 | 0.030 |
| 26/27 July 2010 | 5405.4569 | 3.668 | 0.013 |
| 27/28 July 2010 | 5406.4576 | 3.664 | 0.012 |

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 |
|---|---|---|---|---|---|---|---|
| 02/03 August 2010 | 5411.9753 | 4.2775 | 0.0394 | 4.2364 | 0.0166 | 3.6890 | 0.0105 |
| 03/04 August 2010 | 5412.9531 | 4.3304 | 0.0108 | 4.2377 | 0.0112 | 3.6626 | 0.0108 |
| 05/06 August 2010 | 5414.9461 | 4.3387 | 0.0118 | 4.2503 | 0.0128 | 3.6956 | 0.0055 |
| 09/10 August 2010 | 5418.9517 | 4.3570 | 0.0058 | 4.2657 | 0.0119 | 3.6981 | 0.0192 |
| 12/13 August 2010 | 5421.9503 | 4.3695 | 0.0168 | 4.2725 | 0.0032 | 3.7147 | 0.0013 |

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 | UT | V Mag | #SD | |
|---|---|---|---|---|---|
| 5322.5645 | 05/06 May 2010 | 01:35 | 3.78 | 17 | 0.020 |
| 5332.5711 | 15/16 May 2010 | 01:40 | 3.71 | 13 | 0.037 |
| 5333.5711 | 16/17 May 2010 | 01:40 | 3.69 | 13 | 0.040 |
| 5343.5528 | 26/27 May 2010 | 01:15 | 3.56 | 5 | 0.283 |
| 5422.8239 | 13/14 August 2010 | 07:75 | 3.68 | 16 | 0.012 |

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

| RJD | V mag | SD | B mag | SD | X |
|---|---|---|---|---|---|
| 5296.5418 | 3.769 | 0.061 | 4.452 | 0.061 | 1.3442 |
| 5308.5583 | 3.786 | 0.032 | 4.448 | 0.041 | 1.7305 |
| 5315.5557 | 3.855 | 0.055 | 4.487 | 0.084 | 1.9435 |
| 5317.5500 | 3.823 | 0.020 | 4.468 | 0.063 | 1.9146 |

RJD = JD - 2,450,000

**Wasatonic and Guinan**

| UT Date | RJD | V mag | SD | Wing C Mag | SD |
|---|---|---|---|---|---|
| 07/08 August 2010 | 5416.83 | 3.579 | 0.006 | 2.561 | 0.008 |

**Charles Hofferber, East Greenwood Observatory (EGO)**
East Grand Forks, Minnesota, USA
Nikon D100 DSLR , 50mm F1.4 stopped down, Sky Light filter to improve TC
8 sec exposures averaged, Lambda Epsilon V 4.705 / Eta Epsilon V 3.172 comparison.

| Double Date | RJD | V | SD | # |
|---|---|---|---|---|
| 14/15 May 2010 | 5331.6454 | 3.754 | 0.010 | |
| 26/27 May 2010 | 5343.6514 | 3.772 | 0.050 | |
| 05/06 June 2010 | 5353.6699 | 3.769 | 0.040 | |
| 25/26 June 2010 | 5373.8430 | 3.782 | 0.047 | |
| 27/28 June 2010 | 5375.8513 | 3.845 | 0.014 | |
| 29/30 June 2010 | 5377.8591 | 3.729 | 0.027 | |
| 04/05 July 2010 | 5382.8643 | 3.732 | 0.032 | |
| 05/06 July 2010 | 5383.8648 | 3.695 | 0.005 | |
| 07/08 July 2010 | 5385.8667 | 3.702 | 0.005 | |
| 14/15 July 2010 | 5392.8834 | 3.705 | 0.011 | |
| 18/19 July 2010 | 5396.8769 | 3.658 | 0.020 | |
| 24/25 July 2010 | 5402.8666 | 3.644 | 0.012 | |
| 30/21 July 2010 | 5408.8623 | 3.667 | 0.013 | |
| 03/04 August 2010 | 5412.8968 | 3.661 | 0.009 | |
| 07/08 August 2010 | 5416.8970 | 3.689 | 0.007 | |
| 12/13 August 2010 | 5421.7909 | 3.713 | 0.011 | |
| 13/14 August 2010 | 5422.8345 | 3.719 | 0.016 | |
| 14/15 August 2010 | 5423.8506 | 3.728 | 0.012 | |

RJD = JD - 2,450,000

# Spectroscopy Report
**by**

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

**Overview**

Since the last newsletter a further 61 amateur spectra have been submitted to the campaign. These are listed in the table below and are accessible on line via the campaign list of spectra.
http://www.threehillsobservatory.co.uk/epsaur_spectra.htm

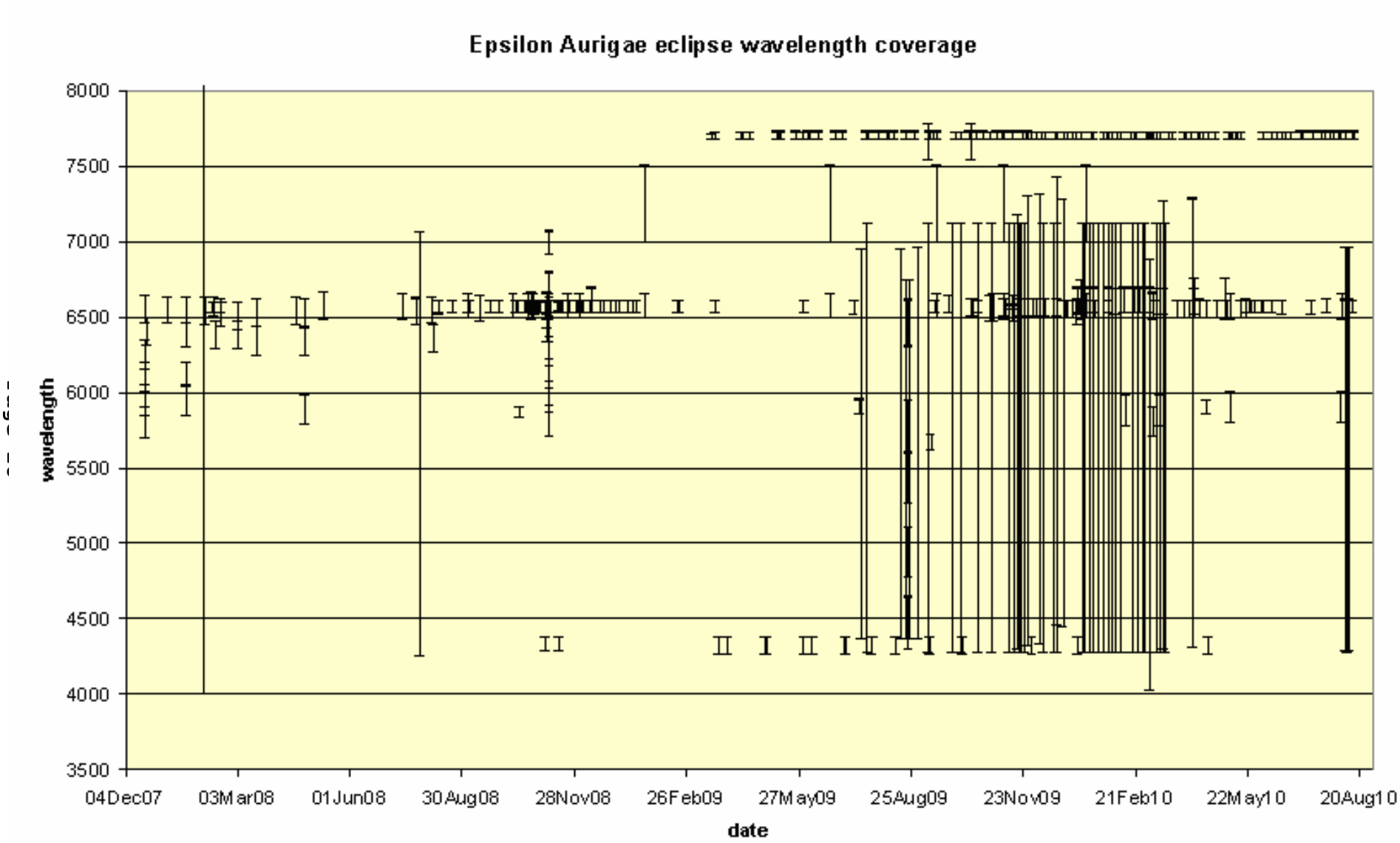
Further information for observers wanting to contribute spectra or researchers wishing to use the data can be found here on the main campaign website http://www.hposoft.com/EAur09/Robin.html

# Spectra 9th April – 15 August 2010

| | | | WAVELENGTH | | | | |
|---|---|---|---|---|---|---|---|
| JD | DATE | TIME | START | END | RANGE | | OBSERVER |
| (2400000+) | | (UT) | (A) | (A) | (A) | (A/pixel) | |
| | | | | | | | |
| 55423.535 | 15-Aug-10 | 00:50 | 7674 | 7725 | 51 | 0.13 | Leadbeater |
| 55422.535 | 14-Aug-10 | 00:50 | 7674 | 7725 | 51 | 0.13 | Leadbeater |
| 55422.500 | 14-Aug-10 | | 6563 | | | | Desnoux |
| 55422.500 | 14-Aug-10 | | 6529 | 6603 | 74 | 0.06 | Hansen |
| 55420.626 | 12-Aug-10 | 03:01 | 6500 | 6610 | 110 | | Garrel |
| 55420.548 | 12-Aug-10 | 01:09 | 4282 | 6953 | 2671 | 0.1 | Thizy |
| 55418.584 | 10-Aug-10 | 02:01 | 4279 | 6953 | 2674 | 0.1 | Thizy |
| 55417.589 | 09-Aug-10 | 02:08 | 6500 | 6610 | 110 | | Garrel |
| 55417.571 | 09-Aug-10 | 01:42 | 7674 | 7725 | 51 | 0.13 | Leadbeater |
| 55416.557 | 08-Aug-10 | 01:22 | 4281 | 6954 | 2673 | 0.1 | Thizy |
| 55414.900 | 06-Aug-10 | 09:36 | 6485 | 6651 | 166 | | Gorodenski |
| 55414.381 | 05-Aug-10 | 21:08 | 7675 | 7725 | 50 | 0.13 | Leadbeater |
| 55413.940 | 05-Aug-10 | 10:33 | 5798 | 5996 | 198 | | Gorodenski |
| 55413.387 | 04-Aug-10 | 21:17 | 7675 | 7725 | 50 | 0.13 | Leadbeater |
| 55407.612 | 30-Jul-10 | 02:42 | 7675 | 7725 | 50 | 0.13 | Leadbeater |
| 55405.397 | 27-Jul-10 | 21:31 | 7675 | 7725 | 50 | 0.13 | Leadbeater |
| 55401.619 | 24-Jul-10 | 02:51 | 6529 | 6613 | 84 | 0.11 | Ribeiro |
| 55400.612 | 23-Jul-10 | 02:41 | 7675 | 7725 | 50 | 0.13 | Leadbeater |
| 55399.413 | 21-Jul-10 | 21:54 | 7675 | 7725 | 50 | 0.13 | Leadbeater |
| 55390.608 | 13-Jul-10 | 02:35 | 7676 | 7725 | 49 | 0.13 | Leadbeater |
| 55390.439 | 12-Jul-10 | 22:32 | 6523 | 6606 | 83 | 0.11 | Leadbeater |
| 55383.440 | 05-Jul-10 | 22:33 | 7676 | 7725 | 49 | 0.13 | Leadbeater |
| 55382.421 | 04-Jul-10 | 22:06 | 7676 | 7725 | 49 | 0.13 | Leadbeater |
| 55373.447 | 25-Jun-10 | 22:43 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55369.476 | 21-Jun-10 | 23:26 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55367.495 | 19-Jun-10 | 23:53 | 6523 | 6603 | 80 | 0.11 | Leadbeater |
| 55366.483 | 18-Jun-10 | 23:35 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55363.482 | 15-Jun-10 | 23:34 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55359.495 | 11-Jun-10 | 23:53 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55358.478 | 10-Jun-10 | 23:28 | 6525 | 6605 | 80 | 0.11 | Leadbeater |
| 55352.322 | 04-Jun-10 | 19:44 | 6530 | 6600 | 70 | 0.17 | Garrel |
| 55351.511 | 04-Jun-10 | 00:16 | 6525 | 6605 | 80 | 0.11 | Leadbeater |
| 55350.510 | 03-Jun-10 | 00:14 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55350.329 | 02-Jun-10 | 19:54 | 6530 | 6600 | 70 | 0.17 | Garrel |
| 55345.332 | 28-May-10 | 19:58 | 6530 | 6600 | 70 | 0.17 | Garrel |
| 55342.325 | 25-May-10 | 19:48 | 6530 | 6600 | 70 | 0.08 | Garrel |
| 55340.327 | 23-May-10 | 19:51 | 6530 | 6600 | 70 | 0.08 | Garrel |
| 55338.369 | 21-May-10 | 20:51 | 6530 | 6610 | 80 | | Ribeiro |
| 55338.335 | 21-May-10 | 20:02 | 6497 | 6607 | 110 | 0.17 | Garrel |
| 55334.382 | 17-May-10 | 21:10 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55334.317 | 17-May-10 | 19:36 | 6497 | 6607 | 110 | 0.17 | Garrel |
| 55331.389 | 14-May-10 | 21:20 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55329.382 | 12-May-10 | 21:10 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55327.386 | 10-May-10 | 21:16 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55325.619 | 09-May-10 | 02:51 | 6480 | 6650 | 170 | | Gorodenski |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 55325.390 | 08-May-10 | 21:22 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55324.632 | 08-May-10 | 03:10 | 5805 | 5995 | 190 | 0.13 | Gorodenski |
| 55324.382 | 07-May-10 | 21:10 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55323.325 | 06-May-10 | 19:48 | 6497 | 6607 | 110 | 0.17 | Garrel |
| 55321.391 | 04-May-10 | 21:23 | 6490 | 6750 | 260 | | Ribeiro |
| 55315.308 | 28-Apr-10 | 19:24 | 6497 | 6607 | 110 | 0.17 | Garrel |
| 55313.397 | 26-Apr-10 | 21:32 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55308.389 | 21-Apr-10 | 21:20 | 7674 | 7723 | 49 | 0.06 | Leadbeater |
| 55307.421 | 20-Apr-10 | 22:06 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55306.760 | 20-Apr-10 | 06:14 | 4266 | 4378 | 112 | 0.15 | Leadbeater |
| 55306.310 | 19-Apr-10 | 19:26 | 6497 | 6607 | 110 | 0.17 | Garrel |
| 55305.670 | 19-Apr-10 | 04:04 | 5853 | 5947 | 94 | 0.12 | Leadbeater |
| 55303.369 | 16-Apr-10 | 20:52 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55301.374 | 14-Apr-10 | 20:59 | 7674 | 7723 | 49 | 0.13 | Leadbeater |
| 55300.356 | 13-Apr-10 | 20:33 | 6497 | 6609 | 112 | 0.17 | Garrel |
| 55299.417 | 12-Apr-10 | 22:01 | 7674 | 7723 | 49 | 0.13 | Leadbeater |

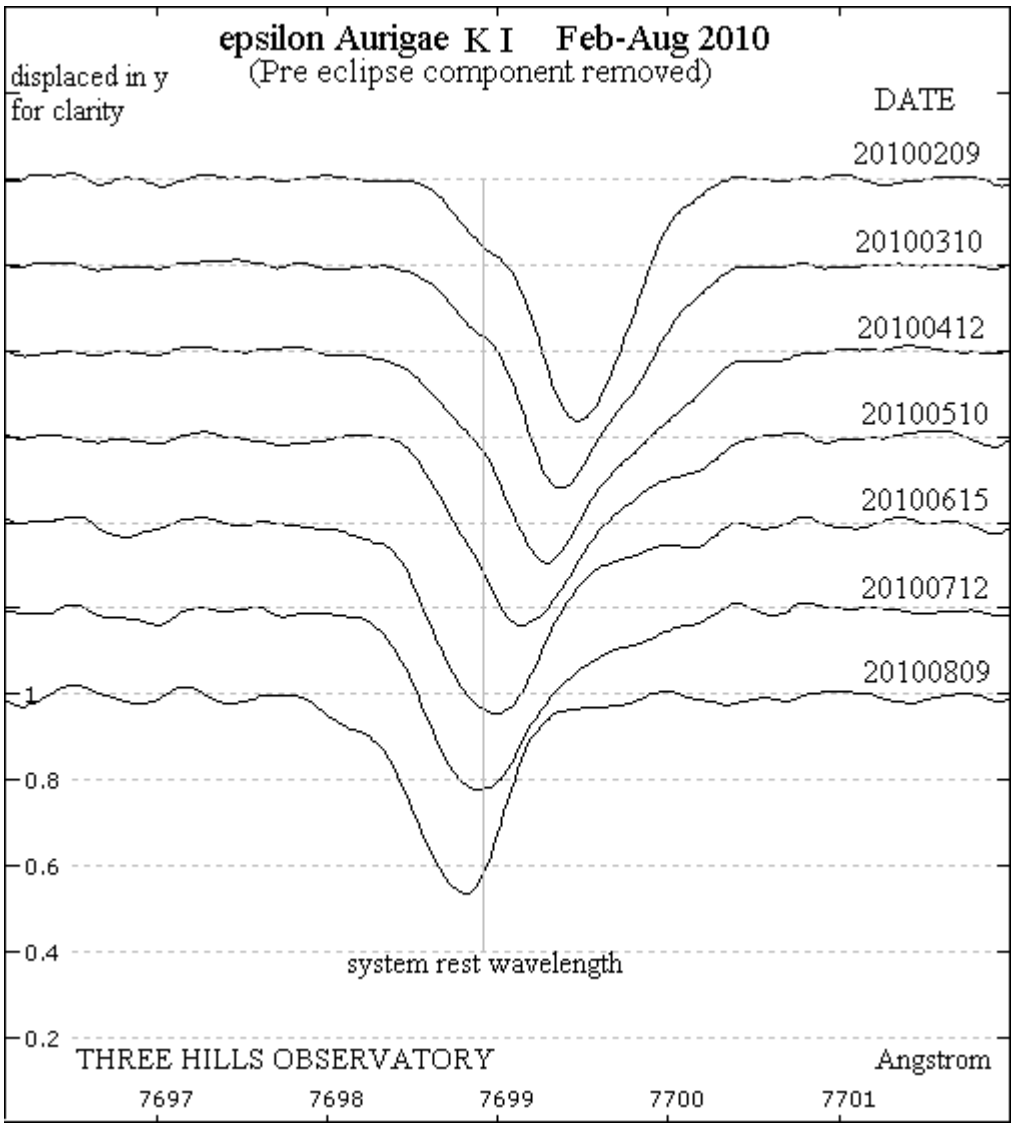
Continuous coverage through solar conjunction was achieved at hydrogen alpha and 7699 Å Potassium wavelengths. A mid eclipse datum point was established at other wavelengths thanks to a number of observations, including several broad coverage echelle spectra obtained during the amateur spectroscopy workshop at the Observatoire Haute Provence. A graph showing the coverage at different wavelengths during the campaign is shown below. This level of coverage is far higher than was achieved in previous eclipses. The graph is regularly updated on line, accessible from the list of spectra


Epsilon Aurigae eclipse wavelength coverage
wavelength
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
04Dec07
03Mar08
01Jun08
30Aug08
28Nov08
26Feb09
27May09
25Aug09
23Nov09
21Feb10
22May10
20Aug10
date

A general trend seen over the past 4 months in all three major lines being monitored (sodium D, hydrogen alpha, potasium I 7699) was a movement away from the red shift seen during ingress towards the rest wavelength as mid eclipse approached. The detailed evolution of the lines showed significant differences however.

**The 7699 Å Potassium line**

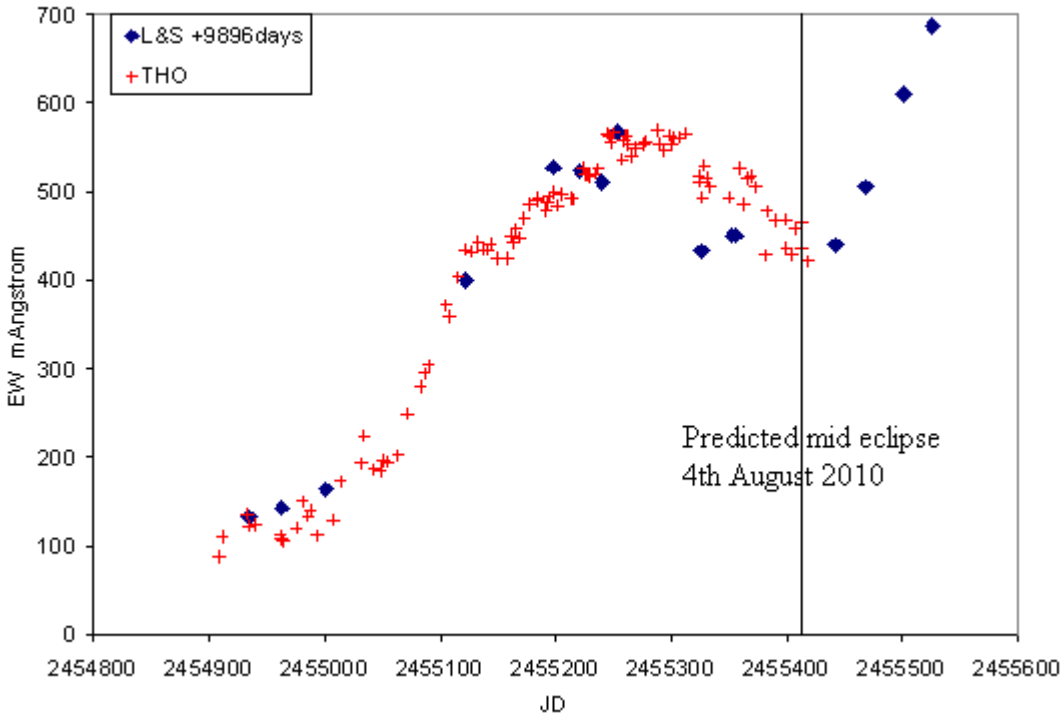
The Neutral Potassium line at 7699 Å shows the effect of the eclipsing object most clearly as it is not affected by the variability of the F star and the constant interstellar component seen outside eclipse can be subtracted




During totality from February to mid July the core of the line moved steadily to the blue and became shallower. The red edge of the line however remained essentially in the same place leading to a broadening of the line. The net effect was that the total intensity (Equivalent Width) declined. In late

July, as the core of the line became centred on the system rest wavelength (-2 km/s radial velocity), the red wing weakened significantly while the blue wing began to grow. A point of symmetry was reached near the end of July when the blue and red wings were symmetric and the line core was centred over the rest wavelength. This was approximately 10 days before the predicted 4th August mid eclipse date

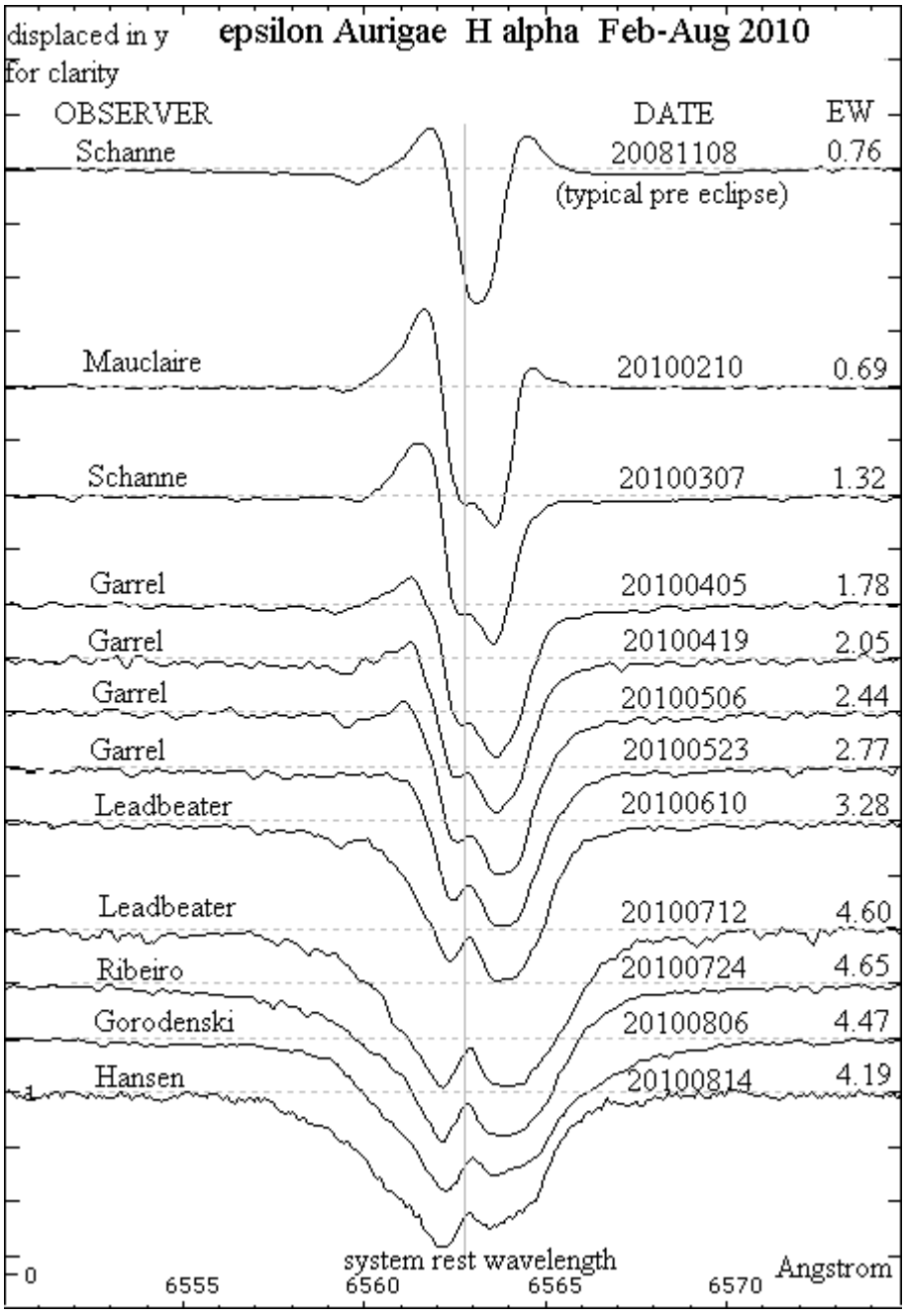
The graph below shows the total line strength (i.e., including the pre eclipse component) for comparison with data produced by Lambert and Sawyer last eclipse




The scatter in the data points increased as the EW started to decline. It is not clear if this is a real effect or a measurement issue due to the shallower but wider nature of the line profile. It is clear however that the behaviour during totality on the approach to mid eclipse has deviated from what was seen last eclipse, although the level has now returned to that seen mid eclipse last time. It is interesting to speculate if this is connected in some way to the apparent suppression of the mid eclipse brightening phase this eclipse. If the trend follows that seen last time round then the line strength should start growing rapidly within the next few weeks.

**The hydrogen alpha line**

The hydrogen alpha line data was supplied by a number of different observers which when combined gives a clear picture of the evolution of this complex line. A high degree of consistency was achieved between the observers even through the difficult period around solar conjunction.

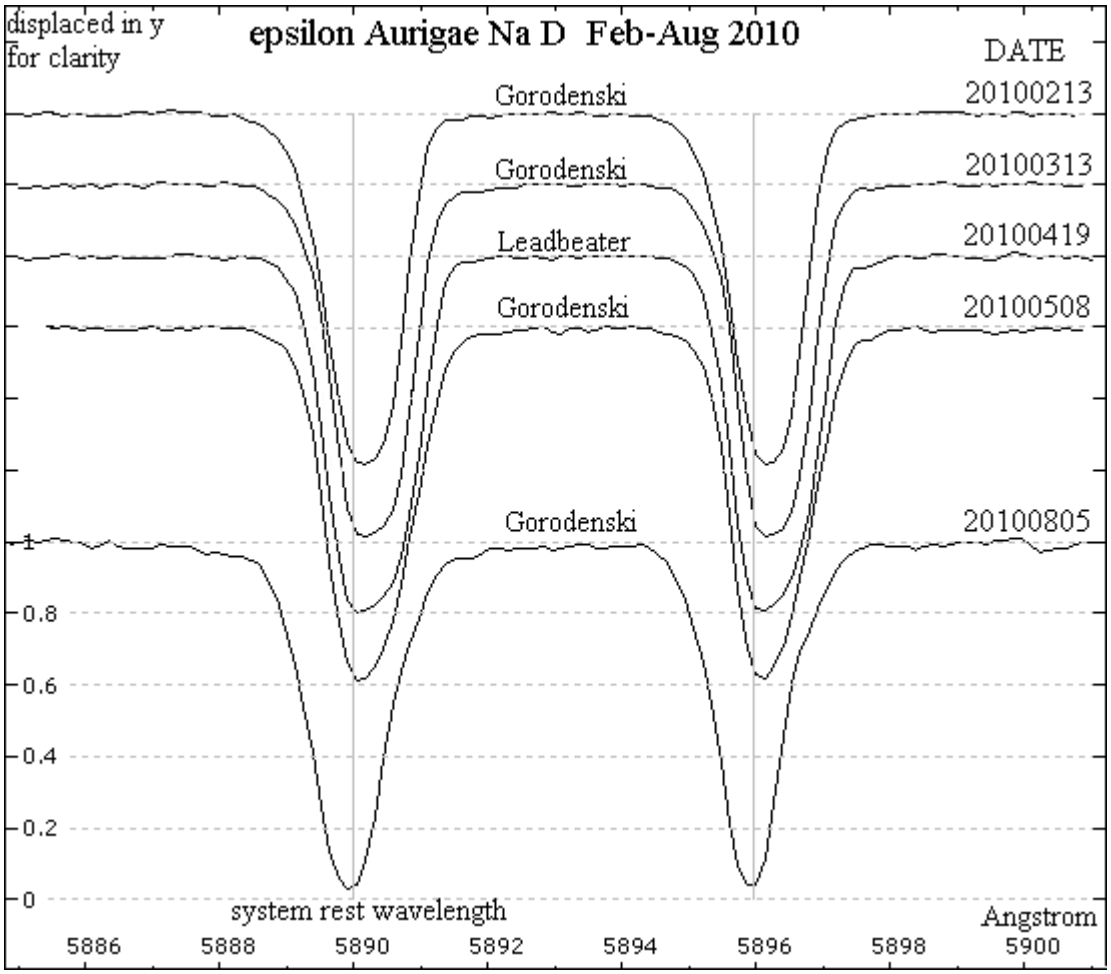



The interpretation of the hydrogen alpha line is complicated by the out of eclipse emission wing features, which vary in magnitude. The absorption core depth is also variable outside eclipse. The additional absorption from the eclipsing disc however dominates on the approach to mid eclipse, first engulfing the red wing and then the blue. In contrast to the KI 7699 Å line, the total hydrogen alpha line strength increased significantly during totality, reaching a maximum in mid July. There are now

signs of it reducing though as we move into the second half of the eclipse. Note the appearance of a curious peak in the absorption core centred close to the system rest wavelength.

**The Sodium D lines**

The Na D lines are dominated by the strong component from the F star photosphere.




The influence of the component from the eclipsing object is clear on the red edge initially though, moving to become superimposed symmetrically on top of the F star line at mid eclipse.

**Looking forward**

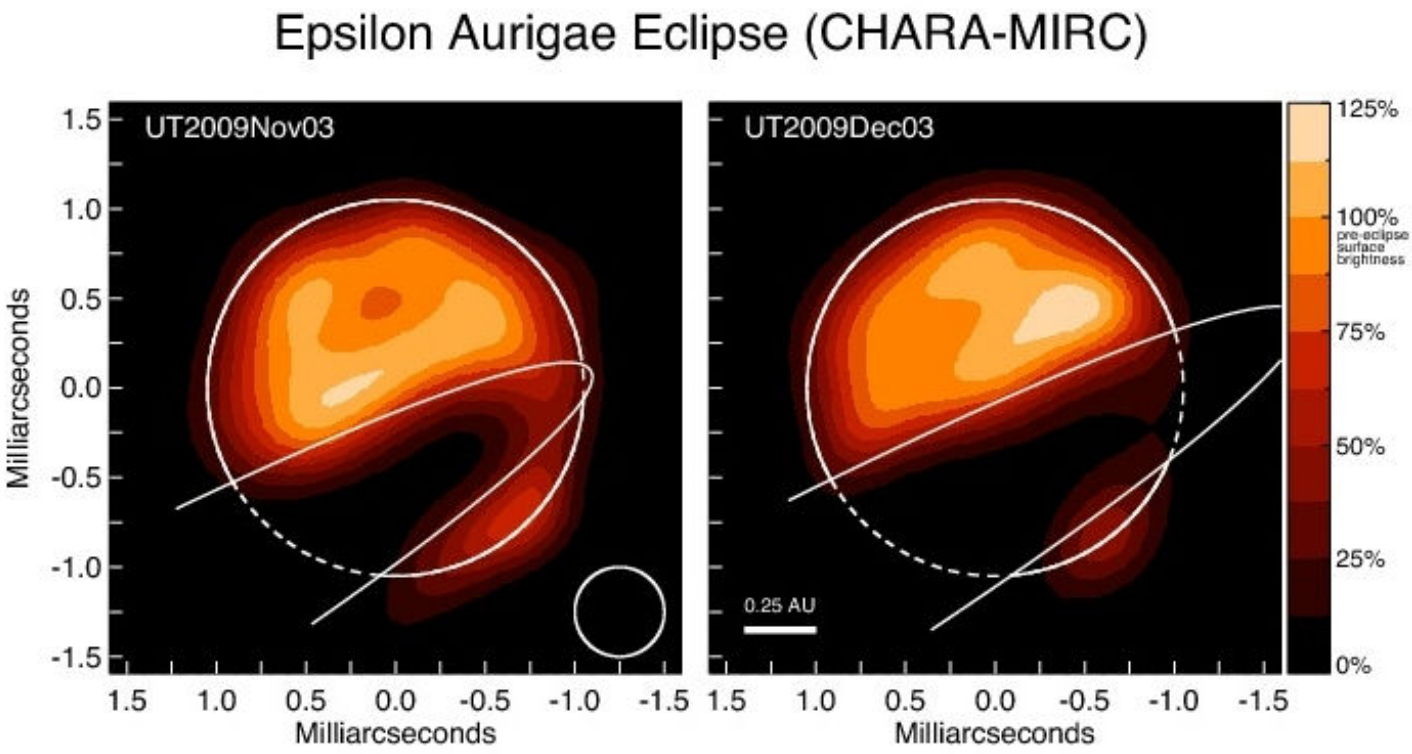
In the second half of the eclipse, the trailing half of the disc which is rotating towards us dominates producing a blue shifted component in the line profiles. In previous eclipses the strength of this component and the radial velocities were significantly higher than in the first half for reasons which are not fully understood. Perhaps observations this time round will provide some clues to the origin of this asymmetry.

# INTERFEROMETRY REPORT

**by**
**Dr. Robert Stencel**
**University of Denver**

Round 2 of interferometric imaging at CHARA ( www.chara.gsu.edu/CHARA/ ): we at Denver U are scheduled for 4 sessions between August 2010 and January 2011 - fires and mudslides permitting – watch these newsletters for updates. While there is a chance of seeing a central opening, the lack of mid-eclipse brightening argues against that. Moreover, the nearly edge-on elliptical disk as seen during ingress, can be expected to provide an opaque barrier in our line of sight through egress. However, spectroscopic observers are reporting changes and as usual, epsilon Aurigae is capable of surprising us at every turn.

For those who might have missed the results of Round 1, we reproduce the images as they appeared earlier this year - see http://arxiv.org/pdf/1004.2464



# POLARIMETRY REPORT

**By**
**Dr. Robert Stencel**
**University of Denver**

Very few reports have been received, except for the mention of Andrei Berdyugin's efforts in NL17, and ongoing efforts by Gary Cole, Gary Henson and Nadine Manset.

Gary Cole (Starphysics Observatory, Reno) reported on his polarimeter instrument development at the SAS spring 2010 meeting, and his data-taking on epsilon Aurigae. Between 2009 Nov and 2010 Feb, he saw a steady 2.3 +/- 0.1% polarization, consistent with that reported by Jack Kemp during the last eclipse. Further reports are anticipated from him soon.

Gary Henson (East Tennessee State University) and student Shannon Hall reported at the Jan 2010 AAS meeting about their plans to monitor epsilon Aurigae polarimetrically, stating "The polarimeter will initially be used as a dedicated instrument in an ongoing project to monitor the eclipsing binary star, Epsilon Aurigae" - see http://adsabs.harvard.edu/abs/2010AAS...21544121H . We look forward to updates on this.

Nadine Manset (Canada-France-Hawaii Telescope) and collaborators Jeff Kuhn and David Harrington reported HiVIS spectropolarimeter and ESPaDOnS spectropolarimeter measurements that included epsilon Aurigae ( http://arxiv.org/pdf/0809.3849v2 Table 4 page 34, and page 42 where they state "Epsilon Aurigae (HR1605, HD31964) is an Algol-type eclipsing binary of spectral type A8Iab (Simbad). The hydrogen alpha line for this star has a complex shape with evidence for emission and overlying absorption. There is good quality archival ESPaDOnS data from February 7th and 8th 2006 also showing a strong and complex H-alpha signature. The polarization change is mostly symmetric about line-center and spans the entire width of the absorptive component of the line. The polarization has an amplitude of roughly 1% almost exactly at line-center."). They intended to pursue additional observations. Manset's review, provides a nice introduction to this topic "Polarimetry of Binary Stars" http://www.aspbooks.org/publications/343-0389.pdf .

# From Dr. Bob

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

First, let me thank all the observers who are making this campaign the most successful in the history of epsilon Aurigae eclipse observing. Keep up the good work!

Here we are, just past predicted mid-eclipse. It's been a remarkable first half of eclipse, with many revelations and even more contributed observations! Among these are:

First contact appeared pretty much on schedule near JD 2,455,060;

Judging from the V band light curve, ingress showed several “bumps in the road” the origin for which is still unclear (out of eclipse variations, versus eclipsing body structure, versus ???);

The spectral energy distribution (SED) analysis has provided a revised system model – details at http://arxiv.org/pdf/1003.3694v1 ;

Robin Leadbeater's remarkable monitoring of the neutral potassium line strength (7699A) showed plateaus during ingress, the nature of which deserves further study (for details, see http://arxiv.org/pdf/1003.3617 );

Interferometric imaging clearly showed the silhouette of a dark, elliptical object advancing across the face of the F star, fully consistent with the disk hypothesis (see http://arxiv.org/pdf/1004.2464 for details ) and constraining the mass ratio to be ~2:1 in favor of the disk's central B star (see http://arxiv.org/pdf/1003.3694 );

Despite solar conjunction, photometric monitoring continued, but little evidence for Mid-Eclipse Brightening has been produced thus far (http://www.hposoft.com/Plots09/VBand.JPG); in fact, a first minimum during totality was reached near RJD 55250 (V ~ 3.8), then slowly rising toward mid-eclipse values close to V ~ 3.6. If the trends seen in the 1929 (Gussow, 1936) and 1955 (Gyldenkerne, 1970) eclipses hold true, we can expect another decline toward/past V ~3.8 over the next 200 days prior to egress;

The open questions include the nature of material in the dark disk, and the evolutionary status of the system overall.

During summer, we've attempted to acquire daytime J&H band photometry with the Hopkins Phoenix Observatory's Optec-SSP4 instrument and the 28 inch telescope atop Mt.Evans, Colorado. The high altitude (14,148 ft) gives us a chance to get dark near-infrared skies during daytime, and hence minimal airmass corrections. The best days of the season thus far were:

| | | | |
|---|---|---|---|
| 07/26/2010 | RJD 55404.04 | J=2.7 +/- 0.1 | H=2.4 +/- 0.1 |
| 08/03/2010 | RJD 55412.08 | J=2.6 +/- 0.1 | H=2.5 +/- 0.1 |
| 08/05/2010 | RJD 55414.06 | J=2.6 +/- 0.1 | H=2.2 +/- 0.1 |
| 08/11/2010 | RJD 55420.08 | J=2.6 +/- 0.1 | H=2.3 +/- 0.1 |

where these preliminary magnitudes and errors are dominated by the calibrators; confirmation welcome. These values compare to late March 2010 in-eclipse data reported by Brian McCandless, when J=2.6 and H=2.3.

During second half of eclipse, we hope observers will continue to put forth the effort to provide the most detailed light curve in the history of study of this system. In particular, along with VRI, more U & B measurements, along with J & H, would be welcome. Similarly, spectra of H-alpha, sodium D and potassium will continue to provide important facts about egress. In terms of observational plans with larger telescopes, here's a list of my collaborative programs and proposals in the works, and reasons why these might help shed light on the dark disk and the big but lightweight "green F star":

--interferometric imaging, round 2: see Interferometry report, above & watch the twitter feed for news: http://www.twitter.com/epsilon_Aurigae - no login account needed.

--infrared spectra (near, mid and far): several thrusts continue in this regard, including IRTF SpeX near-IR spectra during the same autumn timeframe, to detect re-appearance of the CO bands seen after mid-eclipse last eclipse cycle; Spitzer IRAC camera near-IR photometry to sense whether heating of the 550K disk is seen as warmed portions of the disk rotate into view; Whipple 8 meter telescope mid-IR spectra with MIRAC to examine whether silicate dust features appear after mid-eclipse; SOFIA airborne telescope (proposed) far infrared measurements in search of water, HCN and OH lines arising from the heated disk; and Herschel 4 meter orbiting telescope, PACS and SPIRE far-IR imaging (proposed) to complete the spectral energy distribution coverage of the cold disk described in http://arxiv.org/pdf/1003.3694 ). The proposed observations won't occur any sooner than 2011, but as the eclipse ends, heated portions of the disk should rotate into view and elevated temperatures could result in comet-like sublimation processes, resulting in these spectral features.

Again. we thank all the observers who are helping to make this campaign the best ever.

# Interesting Papers

http://arxiv.org/pdf/1005.0285

***A new ephemeris and an orbital solution of epsilon Aurigae***
Authors: Pavel Chadima, Petr Harmanec, Stephenson Yang, Phillip D. Bennett, Hrvoje Bo?i?, Domagoj Ru?djak, Davor Sudar, Petr ?koda, Miroslav ?lechta, Marek Wolf, Martin Lehk?, Pavol Dubovsk?

Comments: accepted and published in IBVS (paper No. 5937); uses similar data to Stefanik et al & reaches similar results.

**ABSTRACT:** The bright star epsilon Aur (7 Aur, HD 31964, HR 1605; Vmax = 3m.0; F0Ia+?) is an unusual eclipsing binary with a very long orbital period of 27.1 years (see Guinan & Dewarf 2002 for a recent review). Its primary eclipse started in the summer 2009 and has naturally attracted the interest of many astronomers all over the world. The aim of this paper is to present our analysis of an extensive collection of archival and new photometry, and radial velocities (RVs), and provide a new, more precise ephemeris and orbital solution for the prediction of the current and future primary eclipses and a (not yet observed) secondary eclipse. Just prior to submission of this paper, Stefanik et al. (2010; hereafter ST - see NL17 & http://arxiv.org/pdf/1001.5011 ) published their analysis of a comparable dataset for this same star. ST presented a new orbital solution and improved ephemeris for the binary but because the data analysis approach presented here is significantly different and may provide a more accurate ephemeris, we have proceeded to publish our results also.

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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!

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