Eruptive stars spectroscopy

Cataclysmics, Symbiotics, Novae, Supernovae

ARAS Eruptive Stars
Information letter n° 11 30-11-2014
Observations of October and November 2014

Contents

Acknowledgements :
V band light curves from AAVSO photometric data base

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ARAS Spectroscopy

ARAS Web page
http://www.astrosurf.com/aras/

ARAS Forum
http://www.spectro-aras.com/forum/

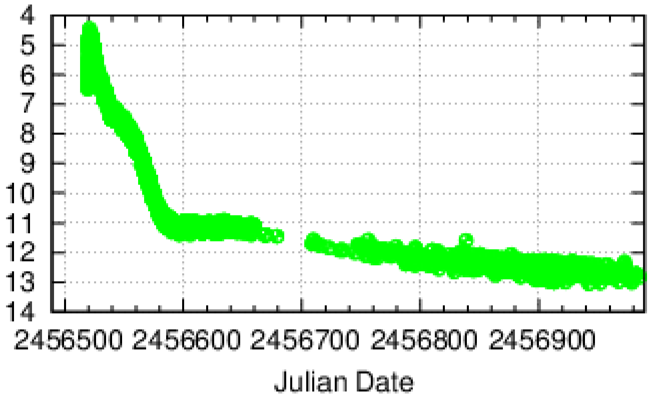
ARAS list
https://groups.yahoo.com/neo/groups/spectro-l/info

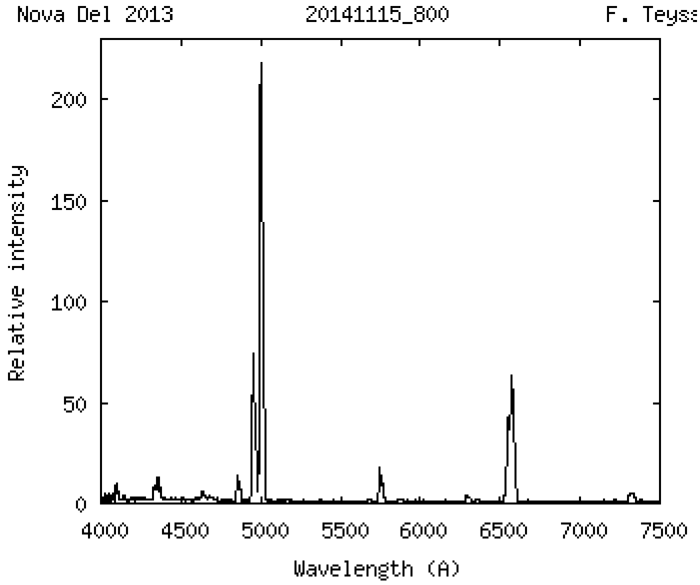
ARAS preliminary data base
http://www.astrosurf.com/aras/Aras_DataBase/DataBase.htm

ARAS BeAM
http://arasbeam.free.fr/?lang=en

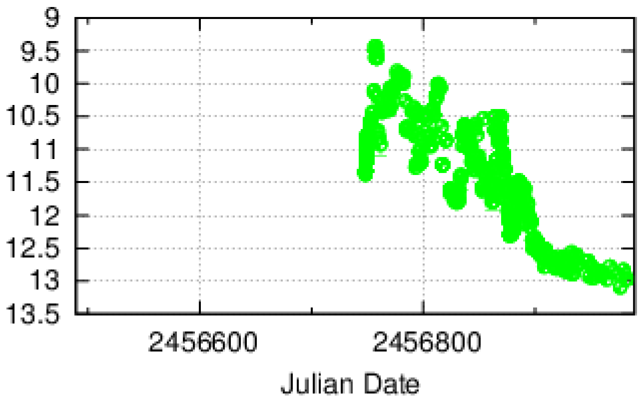
Status of current novae

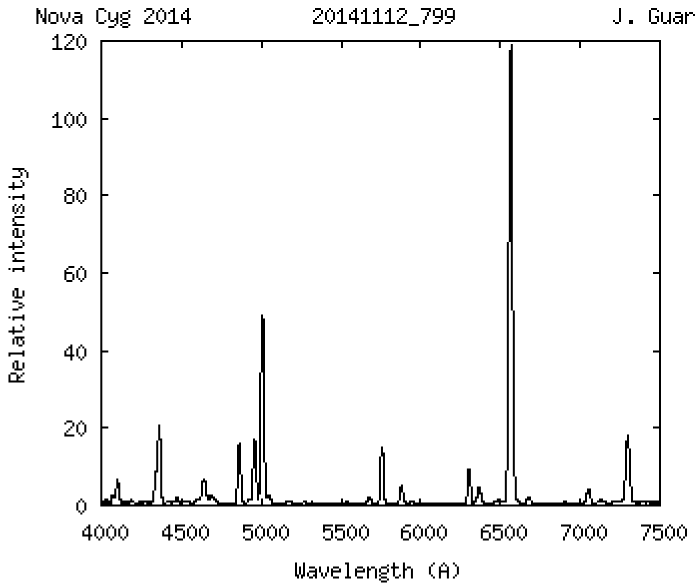
Nova Del 2013	V339 Del
Maximum	14-08-2013
Days after maximum	473
Current mag V	12.8
Delta mag V	8.4





Nova Cyg 2014	V2659 Del
Maximum	09-04-2014
Days after maximum	235
Current mag V	12.8
Delta mag V	3.4





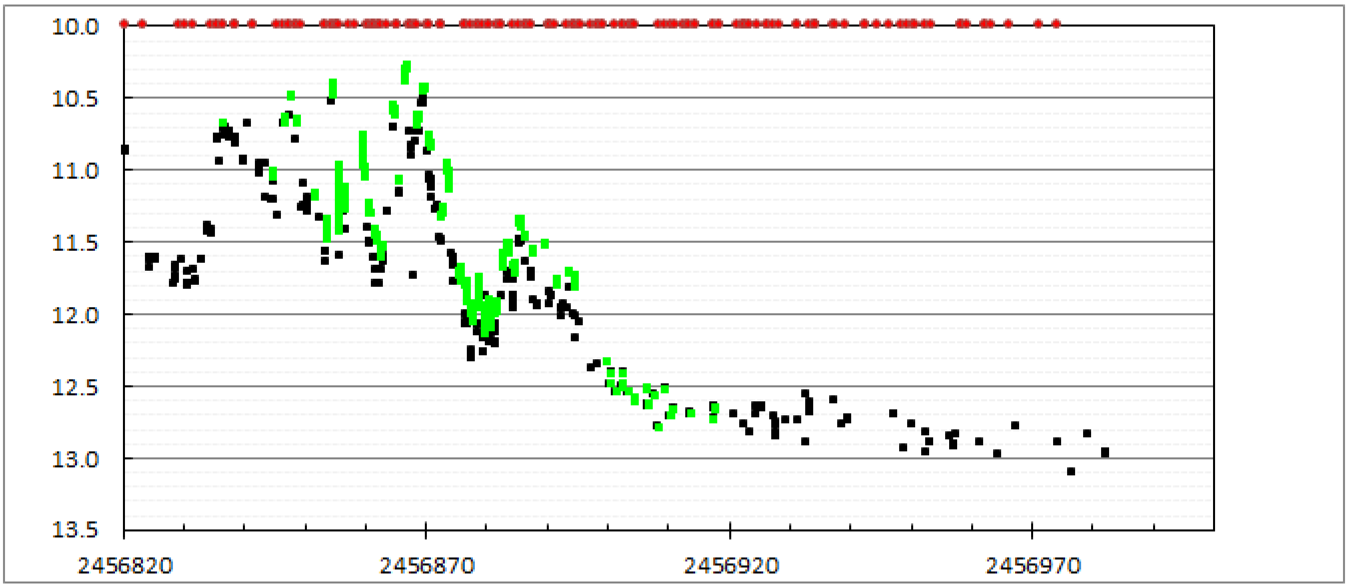
Nova Cyg 2014 = V2659 Cyg

Luminosity
Mag V = 12.8 (30-11-2014)
Slow decline

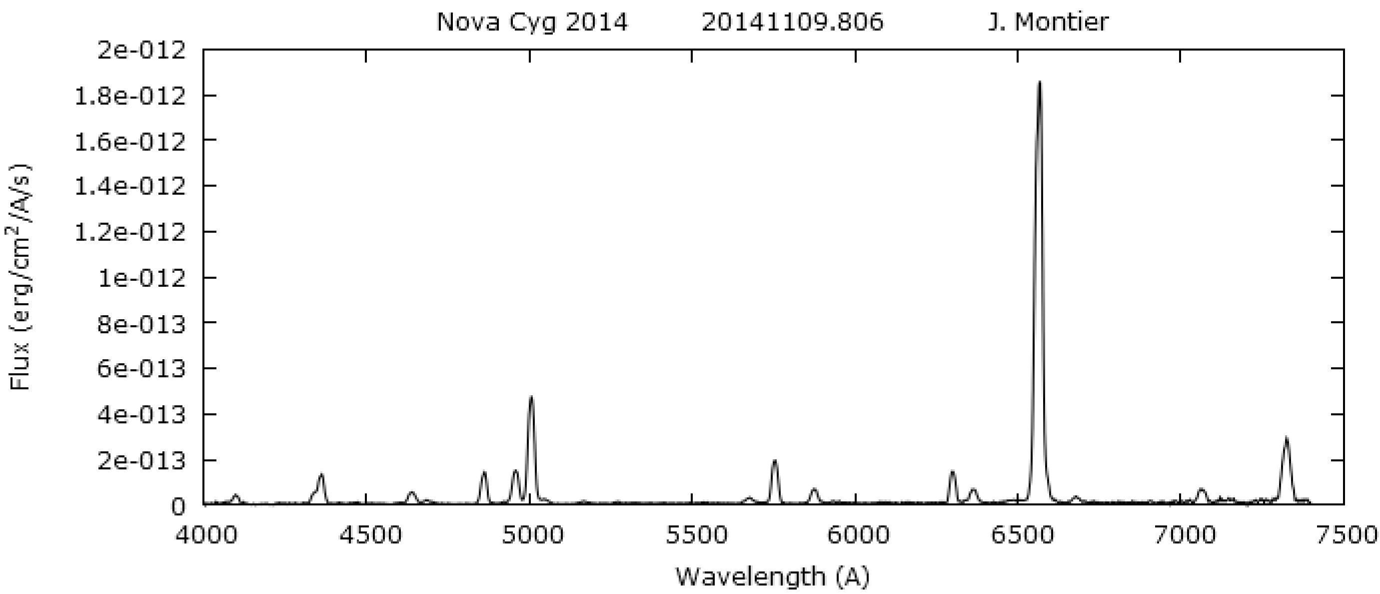
Spectroscopy
Nova Cyg in nebular phase

Observing : ungoing observations during nebular phase

Photometry
Slow decline during the nebular phase (0.4 mag / 100 days)
Dark squares : AAVSO
Green squares : Antonio Garcia and Paolo Berardi



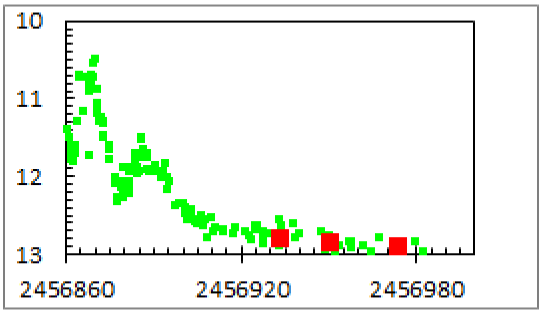
Spectroscopy
Nebular spectrum with noticelly [OII] intense

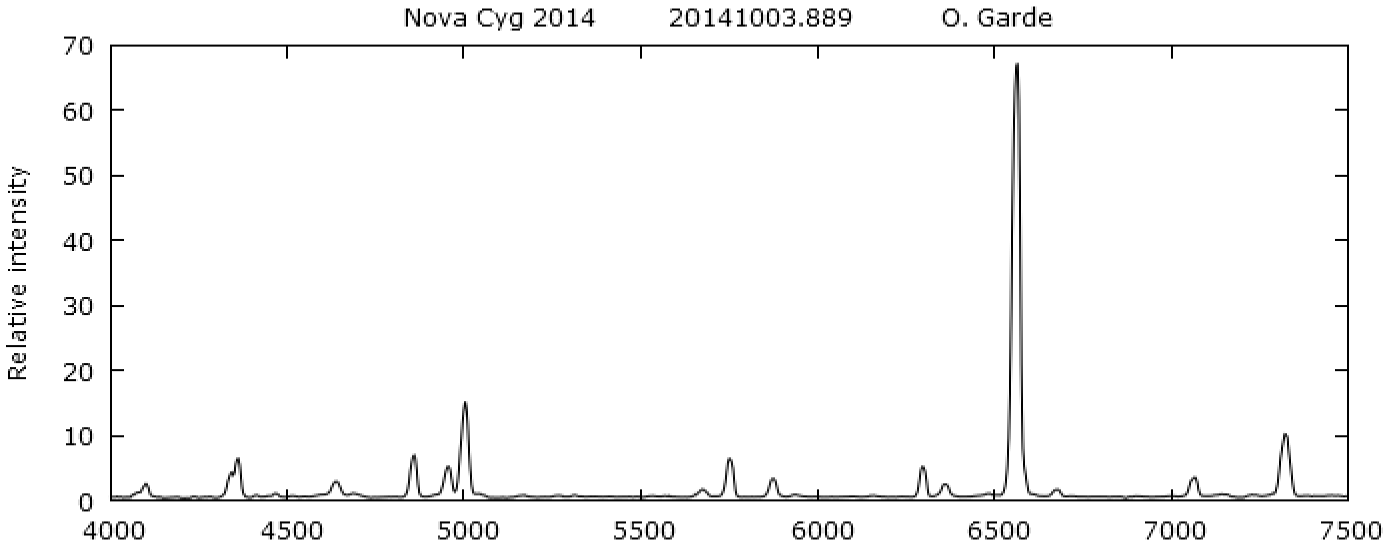


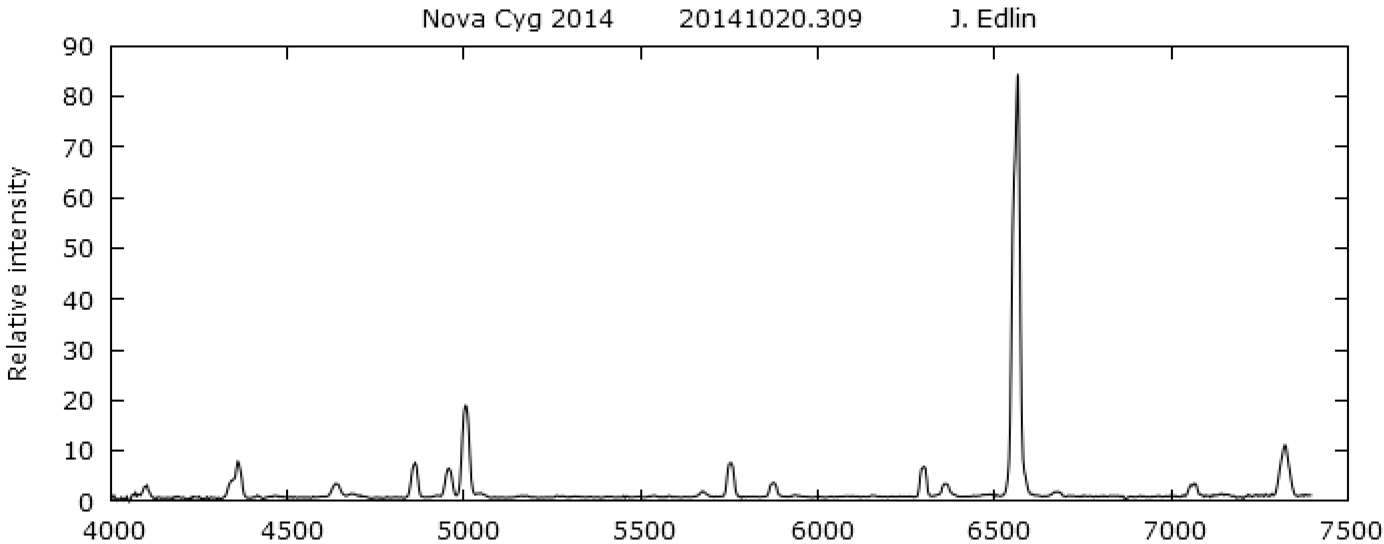
Observers : Tim Lester | Christian Buil | Paul Gerlach | Olivier Garde | François Teyssier | Jacques Montier | Antonio Garcia | Joan Guarro
Paolo Berardi | Franck Boubault | Peter Somogyi | Miguel Rodriguez | F. Boubault | O. Thizy

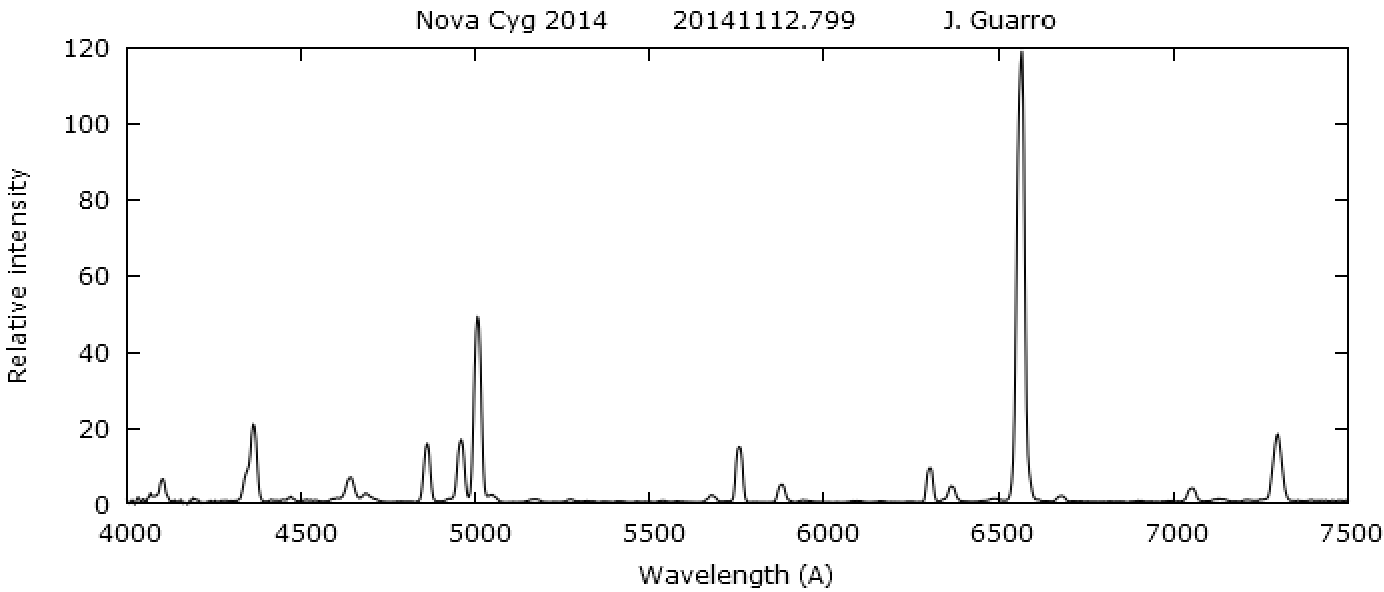
ARAS DATA BASE : 208 spectra http://www.astrosurf.com/aras/Aras_DataBase/Novae/Nova-Cyg-2014.htm
Web Page : http://www.astrosurf.com/aras/novae/NovaCyg2014.html

Nova Cyg 2014 evolution in October and November 2014



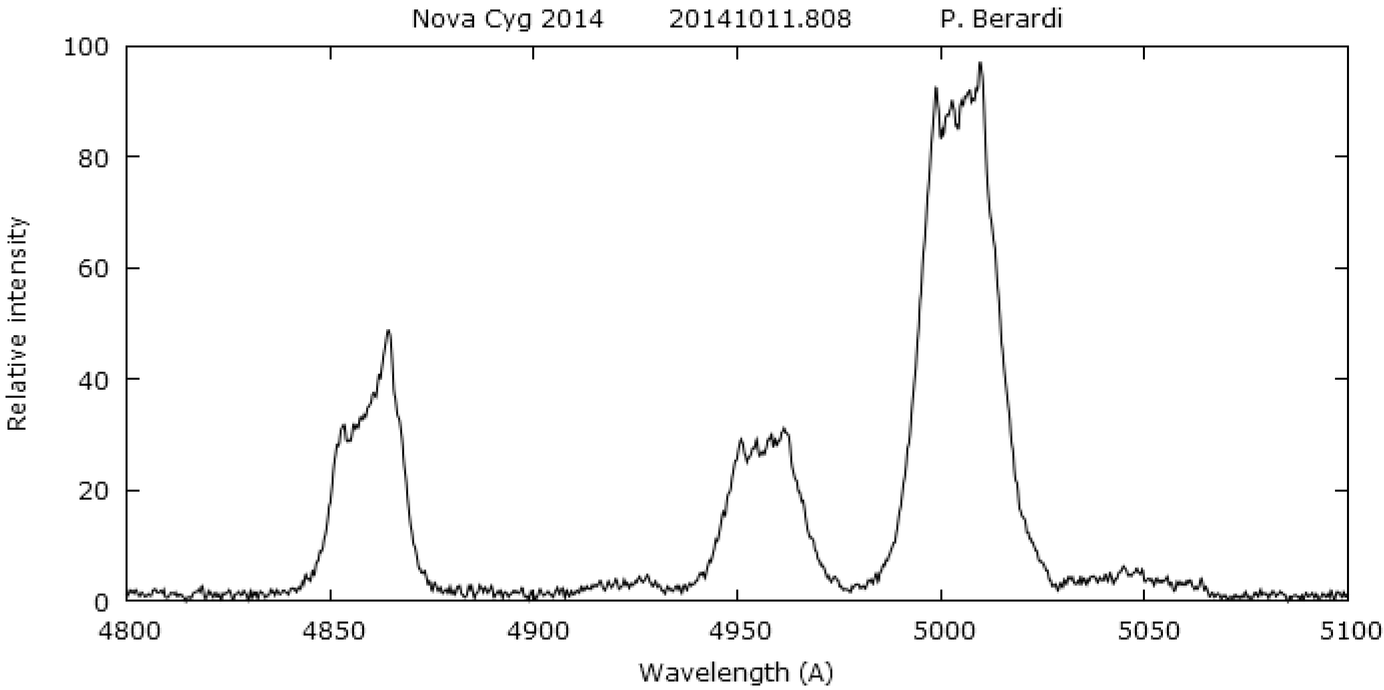




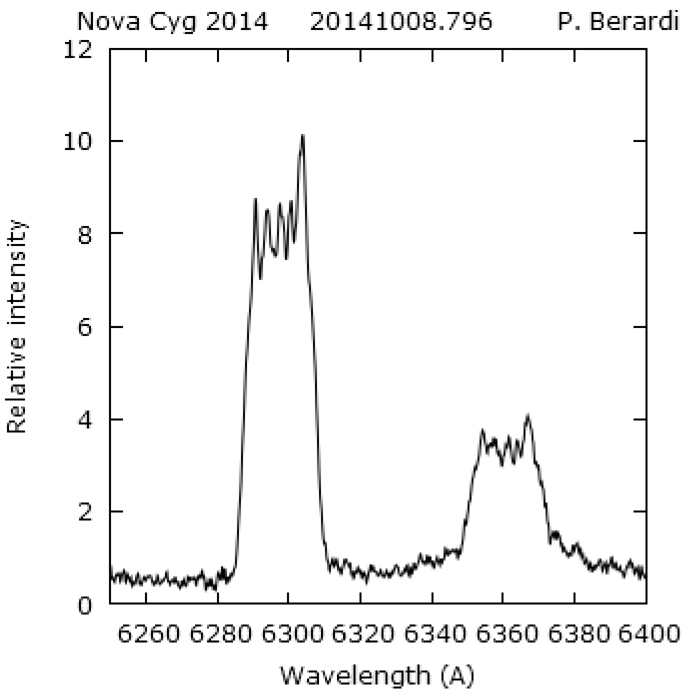


Nova Cygni 2014 at medium resolution
(R = 6000) by Paolo Berardi
(LHIRES III - 1200 l/mm)

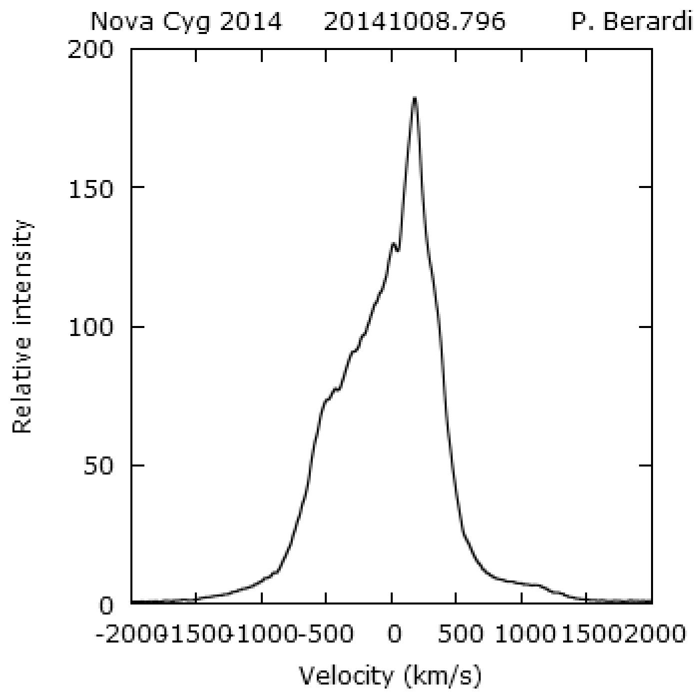
Note the strong asymmetry
of H alpha and probably [NII]
6586 in its red edge



Hβ - [OIII] 4559 - [OIII] 5007

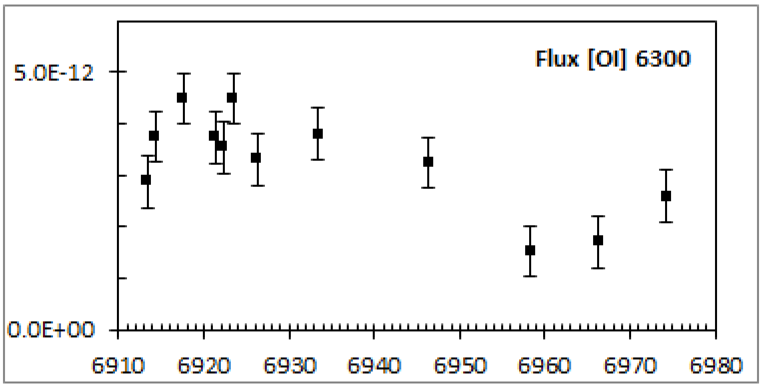


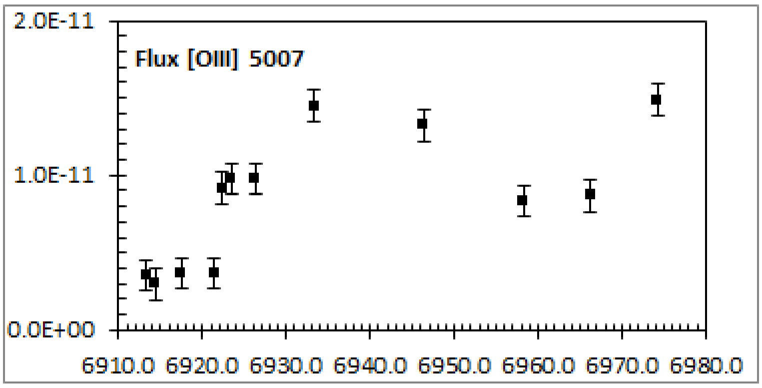
Hβ - [O I] 6300 - [O I] 6363

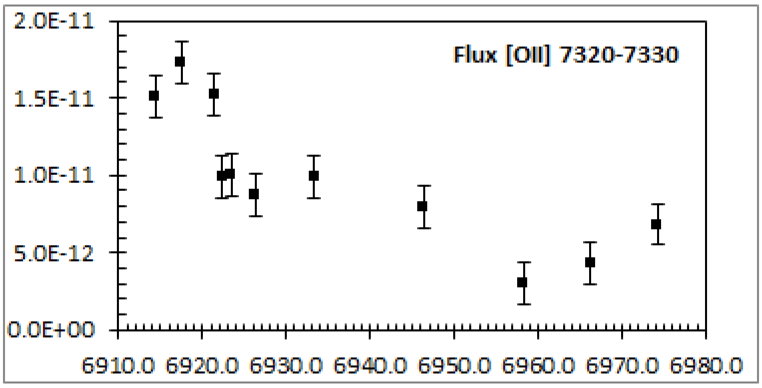


Hα

Flux in erg/s/cm2
The spectra are not dereddened
X scale : JD - 2450000







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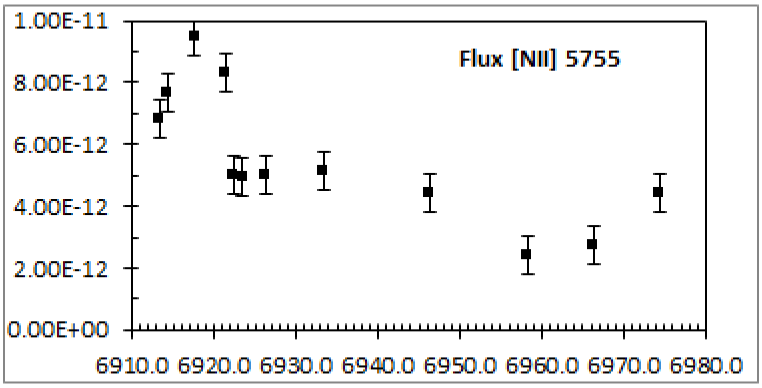
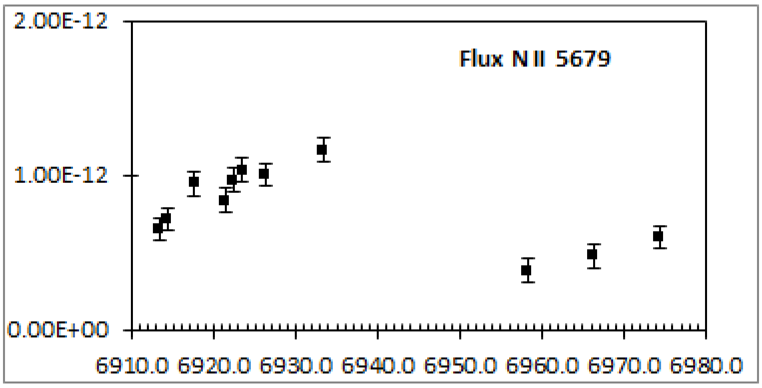
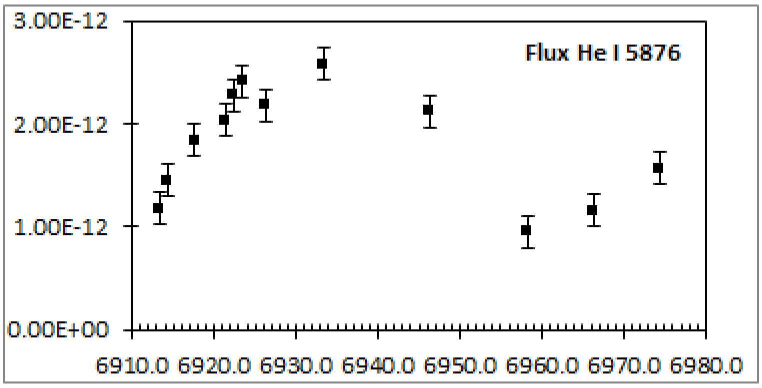
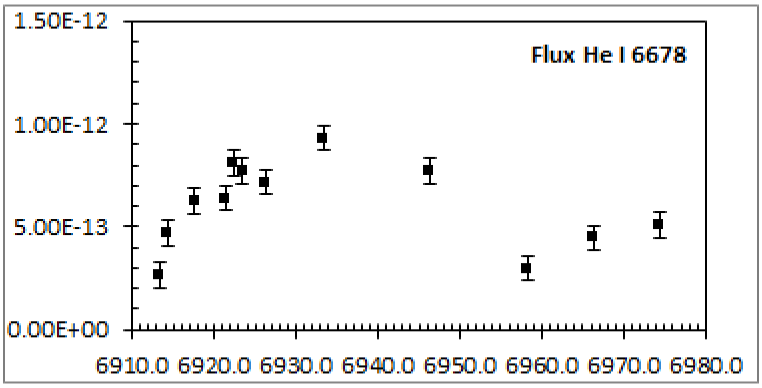






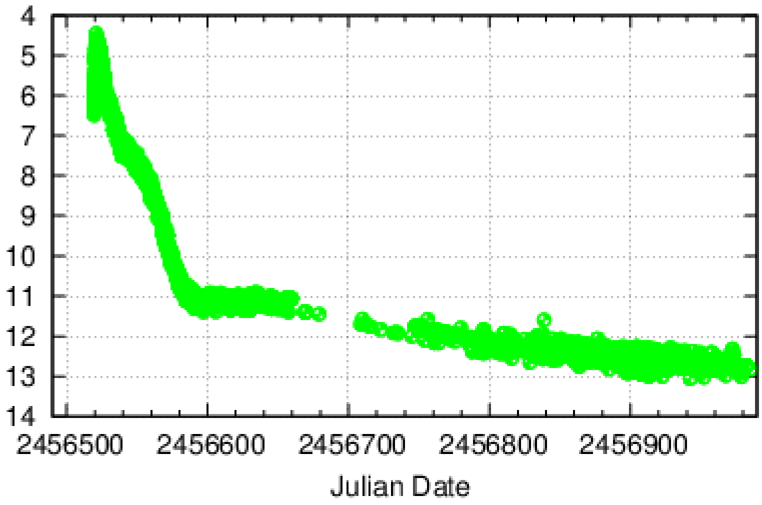


Nova Del 2013 = V339 Del

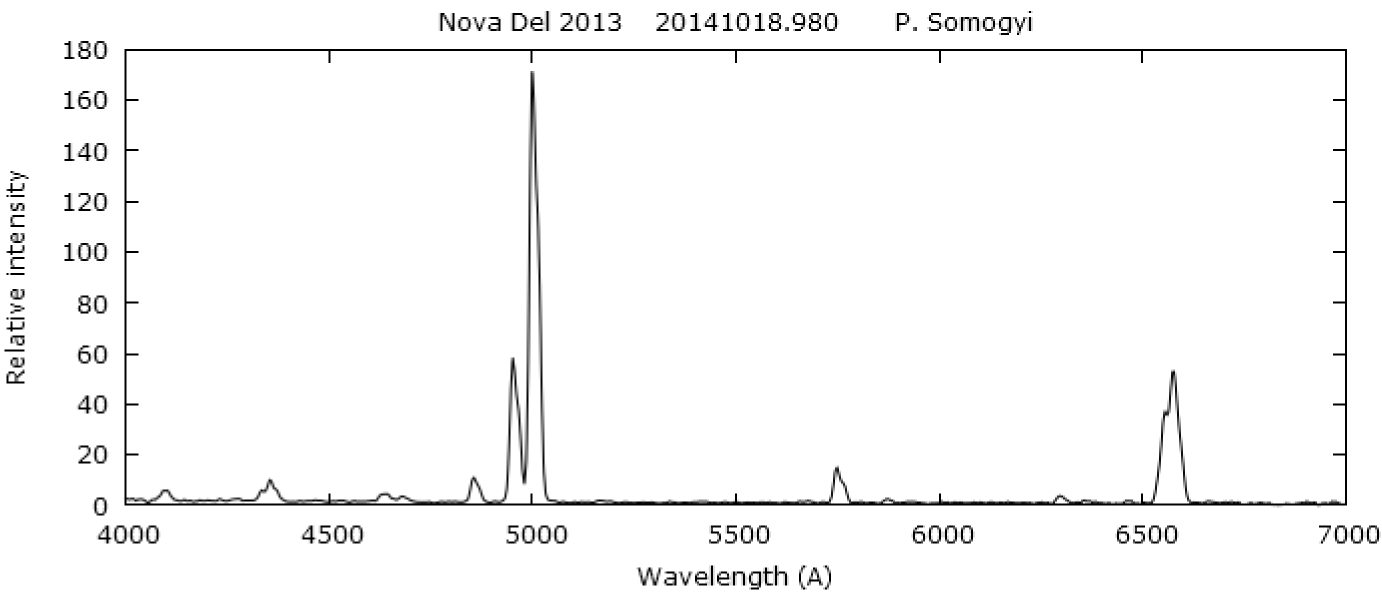
Luminosity
Mag V ~ 12.8 (30-11-2014)
Slowly declining

Observing
Spectra required (one a week)

Ungoing observations,
475 days after its outburst

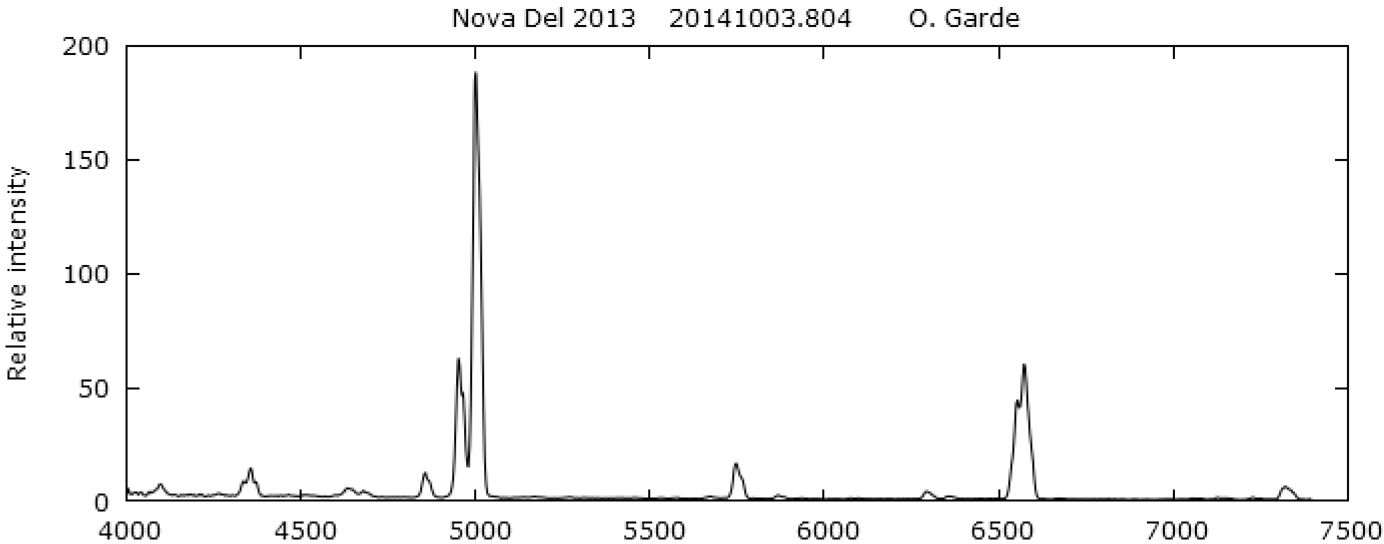


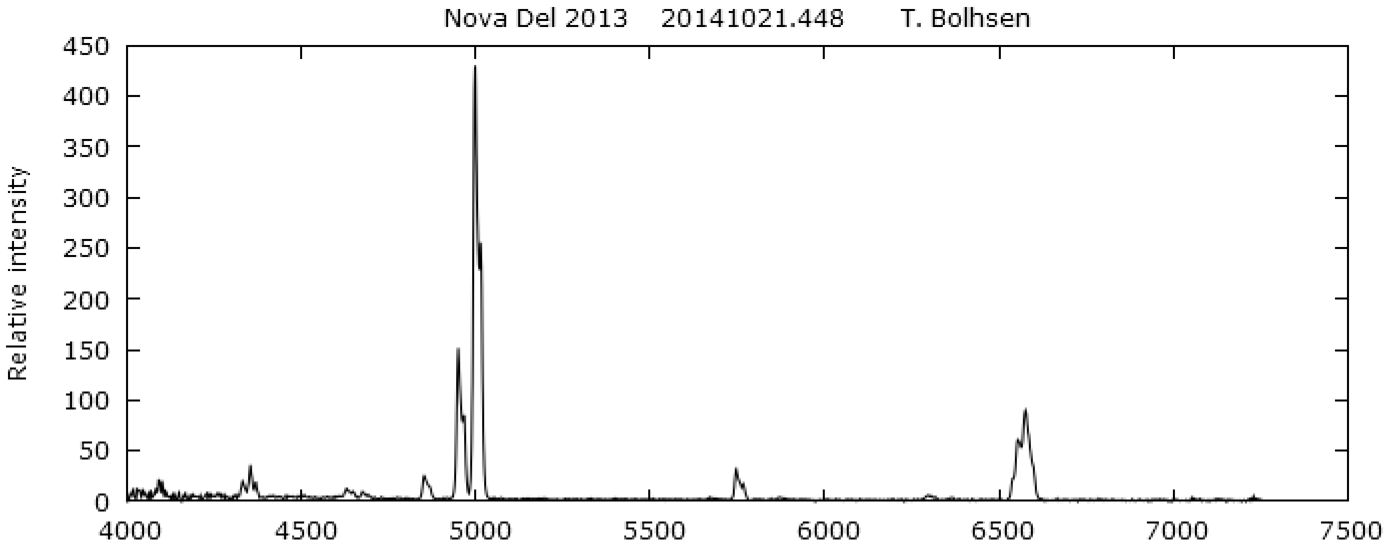
Very slow evolution during the nebular phase (1 year)

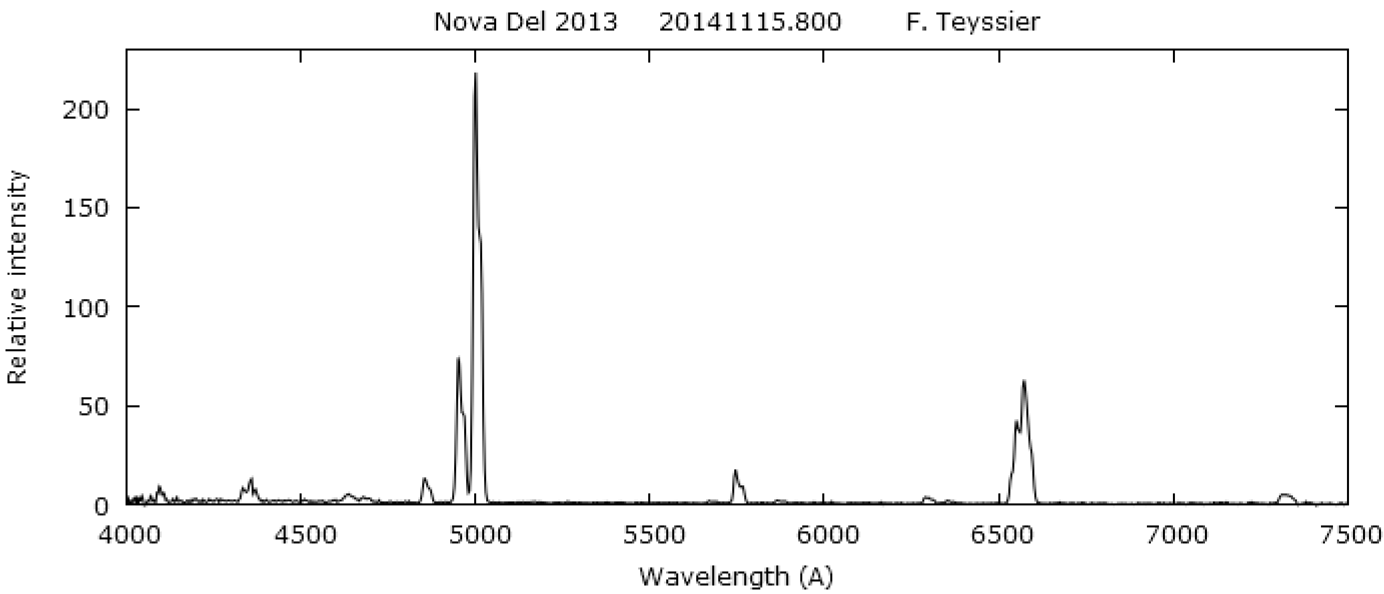


Observers (2014) : C. Buil - T. Lester - F. Teyssier - D. Boyd - A. Garcia O. Garde - T. Bohlsen - P. Berardi - M. Dubs - P. Dubreuil - J. Edlin - T. Bohlsen

ARAS DATA BASE 2014 | 34 spectra | http://www.astrosurf.com/aras/Aras_DataBase/Novae/Nova-Del-2013_2.htm
ARAS Web Page for Nova Del 2013 : http://www.astrosurf.com/aras/novae/Nova2013Del.html

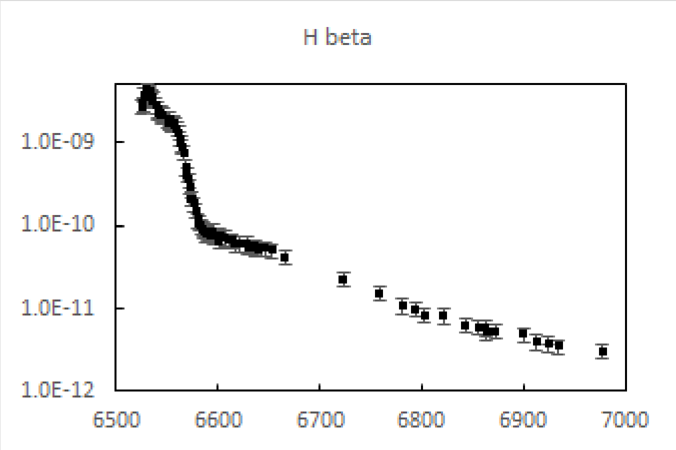

Nova Del 2013 20141003.804 O. Garde
Relative intensity
0
50
100
150
200
4000
4500
5000
5500
6000
6500
7000
7500

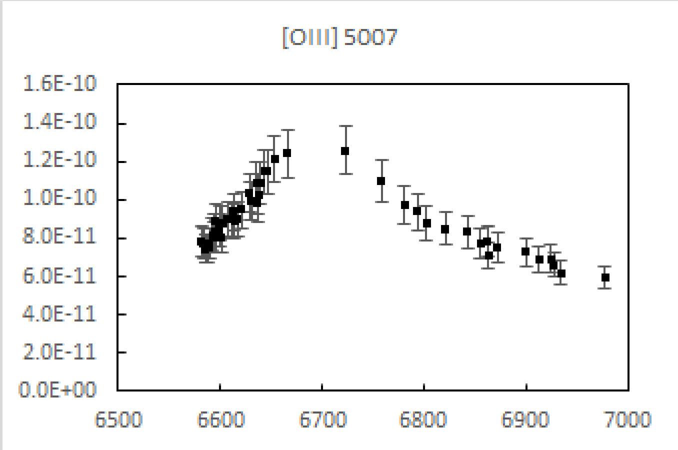

Nova Del 2013 20141021.448 T. Bolhsen
Relative intensity
0
50
100
150
200
250
300
350
400
450
4000
4500
5000
5500
6000
6500
7000
7500

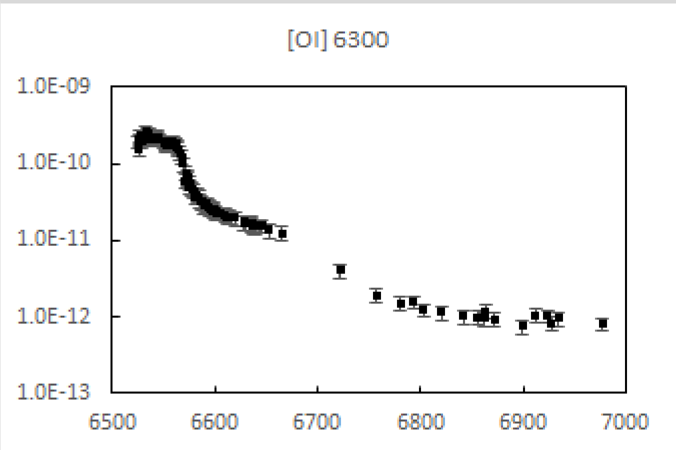

Nova Del 2013 20141115.800 F. Teyssier
Relative intensity
0
50
100
150
200
4000
4500
5000
5500
6000
6500
7000
7500
Wavelength (A)

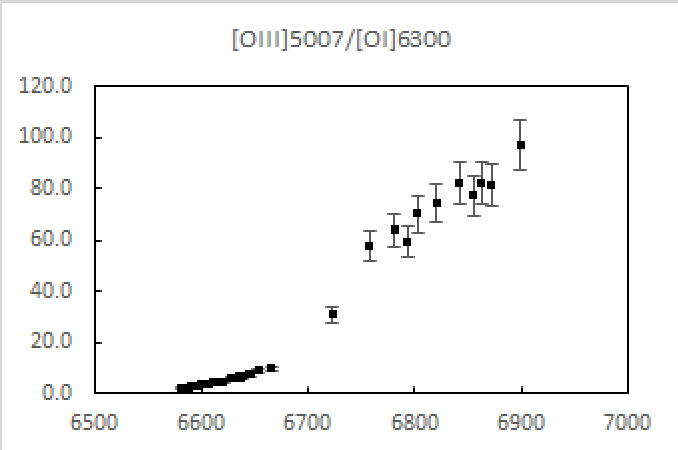
Nova Del 2013 = V339 Del
Flux evolution
F. Teyssier

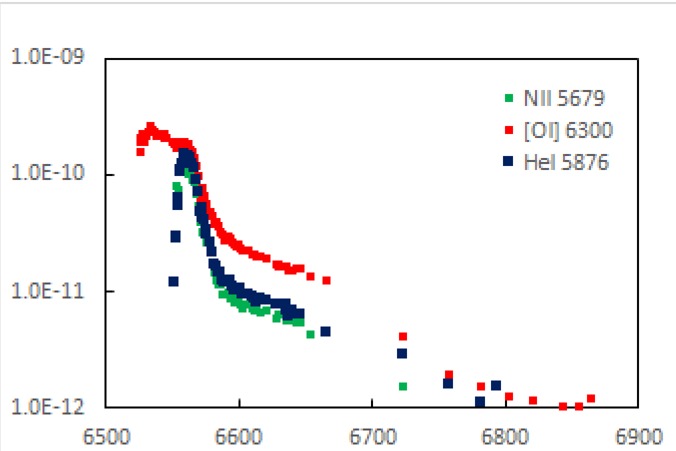
95 spectra from ARAS data base at R = 1000
Flux calibrated spectra, deredened with E(B-V) = 0.2 according Cardelli-O'Donnell law

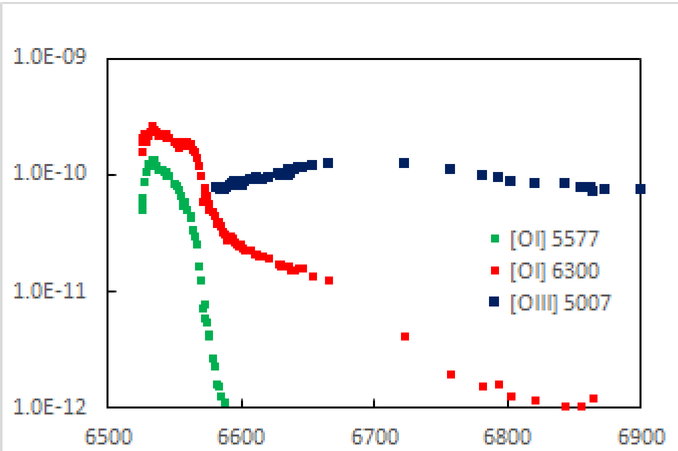


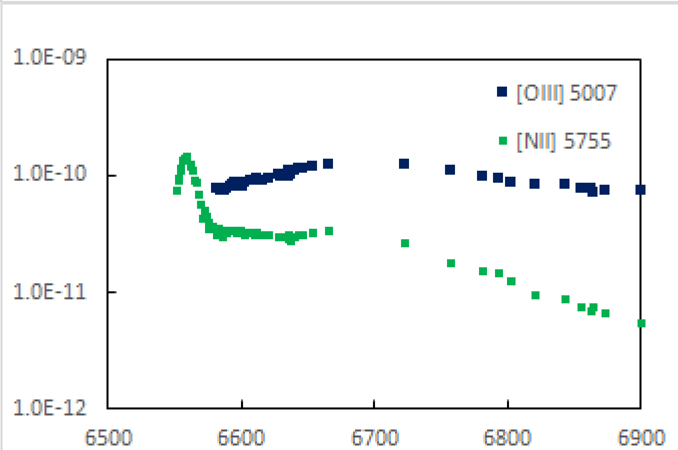












Selected list of bright symbiotics stars of interest

Target						Refrence Star					
#	Name	AD (2000)	DE (2000)	Mag V *	Interest	Name	AD (2000)	DE (2000)	Mag V	E(B-V)	Sp Type
1	AX Per	1 36 22.7	54 15 2.5	11.6	++	HD 6961	01 11 06.2	+55 08 59.6	4.33	0	A7V
2	UV Aur	5 21 48.8	32 30 43.1	10		HD 39357	05 53 19.6	+27 36 44.1	4.557		A0V
3	ZZ CMi	7 24 13.9	8 53 51.7	10.2		HD 61887	07 41 35.2	+03 37 29.2	5.955		A0V
4	BX Mon	7 25 24	-3 36 0	10.4	+	HD 55185	07 11 51.9	- 00 29 34.0	4.15		A2V
5	V694 Mon	7 25 51.2	-7 44 8	10.5	++	HD 55185	07 11 51.9	- 00 29 34.0	4.15		A2V
6	NQ Gem	7 31 54.5	24 30 12.5	8.2		HD 64145	07 53 29.8	+26 45 56.8	4.977		A3V
7	T CrB	15 59 30.1	25 55 12.6	10.4	++	HD 143894	16 02 17.7	+22 48 16.0	4.817	0	A3V
8	AG Dra	16 1 40.5	66 48 9.5	9.7	++	HD 145454	16 06 19.7	+67 48 36.5	5.439	0	A0Vn
9	RS Oph	17 50 13.2	-6 42 28.4	10.4	++	HD 164577	18 01 45.2	+01 18 18.3	4.439	0	A2Vn
10	YY Her	18 14 34.3	20 59 20	12.9	++	HD 166014	18 07 32.6	+28 45 45.0	3.837	0.02	B9.5V
11	V443 Her	18 22 8.4	23 27 20	11.3	++	HD 171623	18 35 12.6	+18 12 12.3	5.79	0	A0Vn
12	BF Cyg	19 23 53.4	29 40 25.1	10.8	++	HD 180317	19 15 17.4	+21 13 55.6	5.654	0	A4V
13	CH Cyg	19 24 33	50 14 29.1	7	+	HD 184006	19 29 42.4	+51 43 47.2	3.769	0	A5V
14	CI Cyg	19 50 11.8	35 41 3.2	10.5	++	HD 187235	19 47 27.8	+38 24 27.4	5.826	0.02	B8Vn
15	StHA 190	21 41 44.8	2 43 54.4	10.3	+	HD 207203	21 47 14.0	+02 41 10.0	5.631	0	A1V
16	AG Peg	21 51 1.9	12 37 29.4	8.6	++	HD 208565	21 56 56.4	+12 04 35.4	5.544	0	A2Vnn
18	Z And	23 33 39.5	48 49 5.4	9.65	++	HD 222439	23 40 24.5	+44 20 02.2	4.137	0	A0V
19	R Aqr	23 43 49.4	-15 17 4.2	9.9	++	HD 222847	23 44 12.1	- 18 16 37.0	5.235	0	B9V

Mag V * : 01-04-2014

Observations from 01-10 to 30-11

New spectra	
AG Dra	1
AG Peg	6
AX Per	10
BD Cam	1
BF Cyg	1
BX Mon	1
CH Cyg	16
CI Cyg	6
EG And	1
NQ Gem	1
R Aqr	5
StHa 190	1
UV Aur	5
V694 Mon	4
Z And	7

Observing

CH Cygni campaign
See p. to
Results p. to

AX Per returning to quiescent state

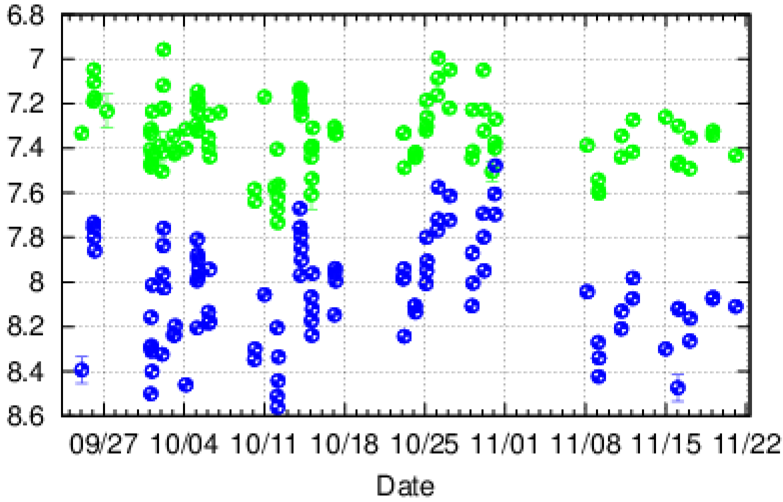
Detect high state of V694 Mon in the morning sky

Follow R Aqr during a pulse period of the Mira

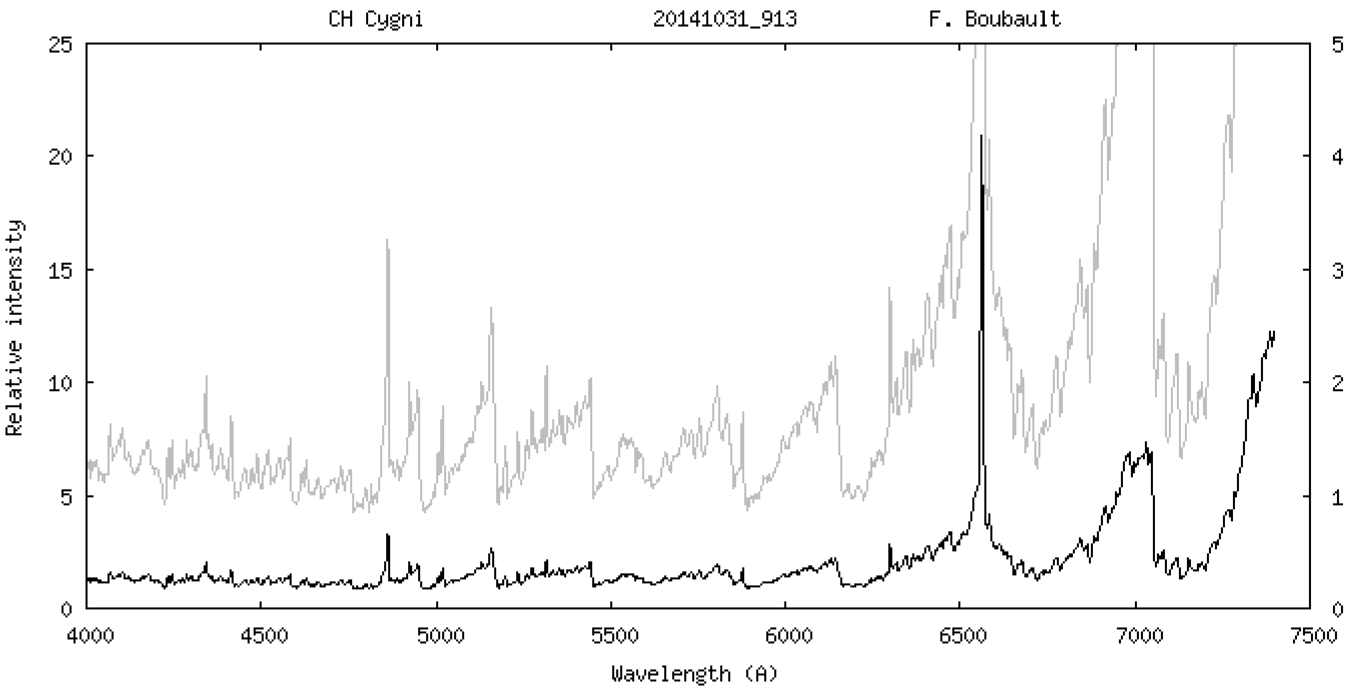
ARAS DATA BASE | http://www.astrosurf.com/aras/Aras_DataBase/Symbiotics.htm

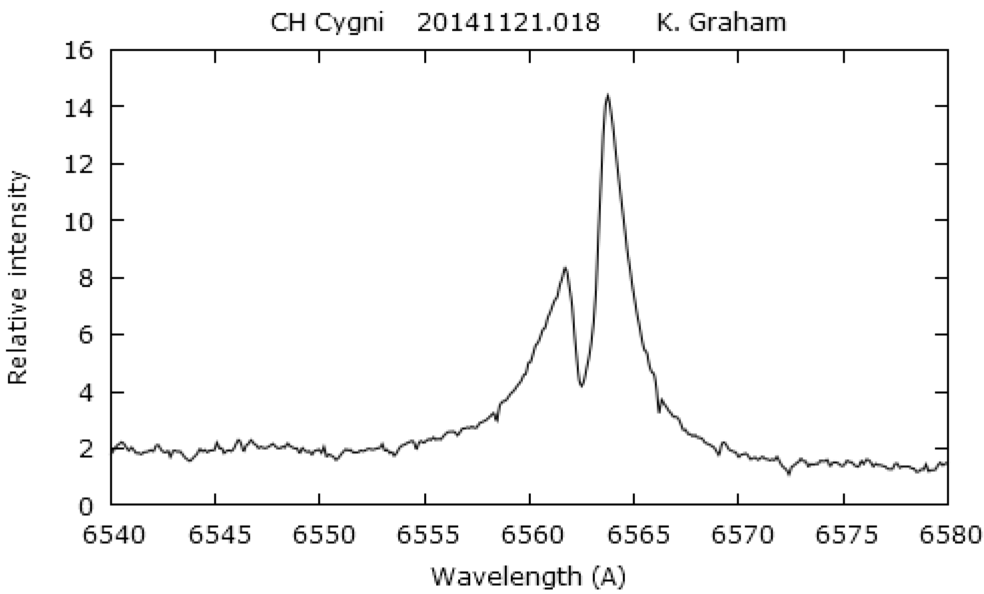
CH Cygni campaign

Coordinates (2000.0)	
R.A.	19 24 33.0
Dec.	+50 14 29.1



B and V light curves in AAVSO database

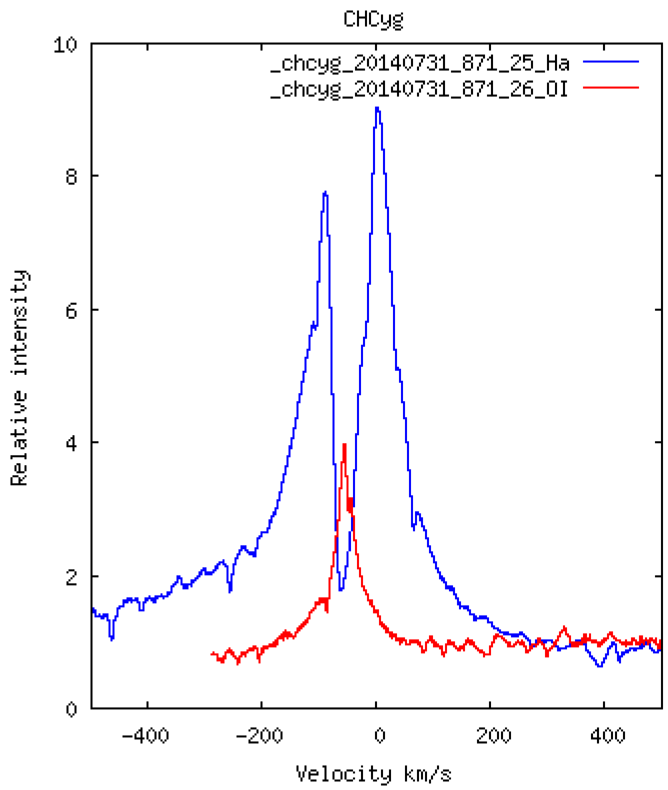


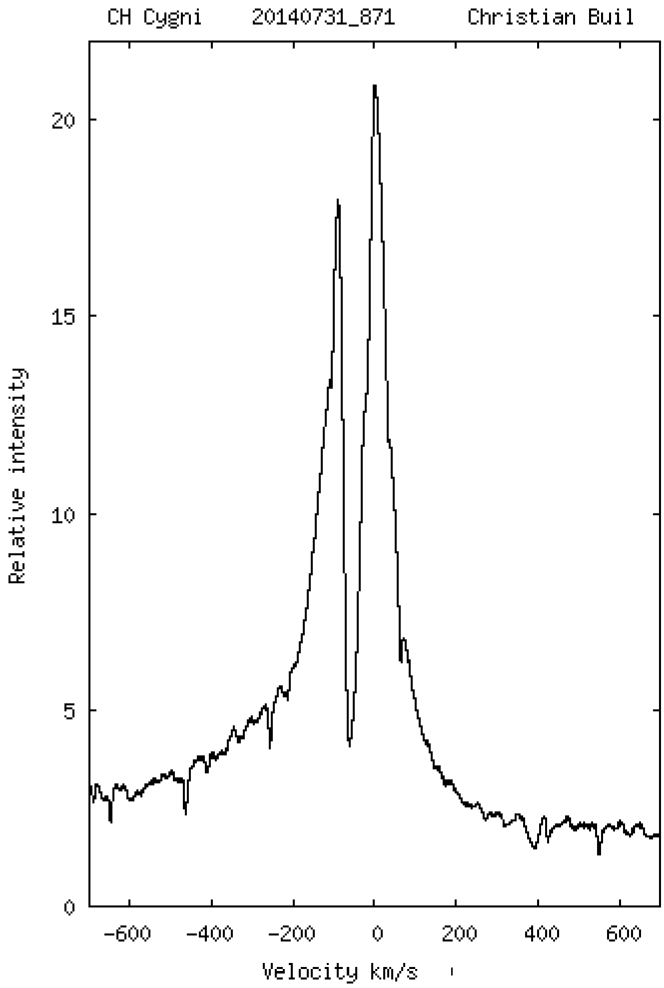


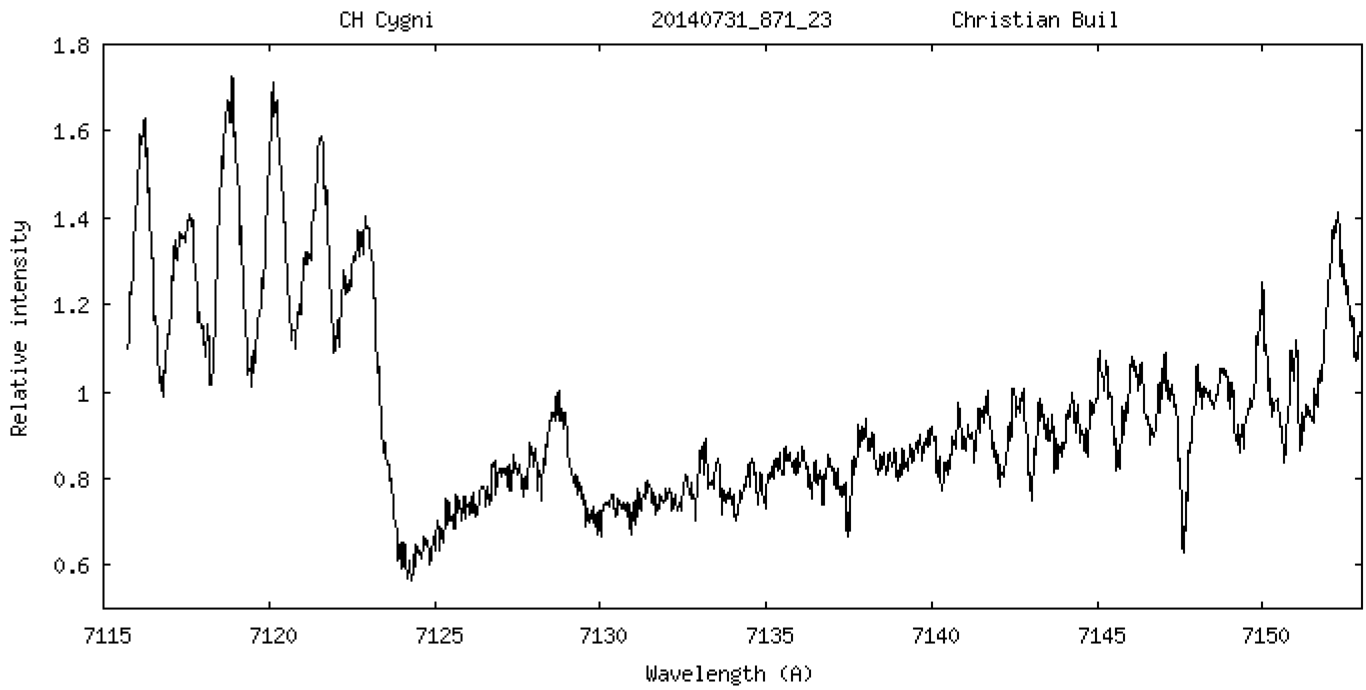
H alpha profile
by Keith Graham, using a LHIRES III 2400 l/mm
R ~ 12000

An example of result required for the campaign.
The wavelenght calibration must by be particularly accurate

Spectra of CH Cygni obtained by Christian Buil with the prototype of a very high resolution spectrograph (R = 50,000) and 28 cm scope

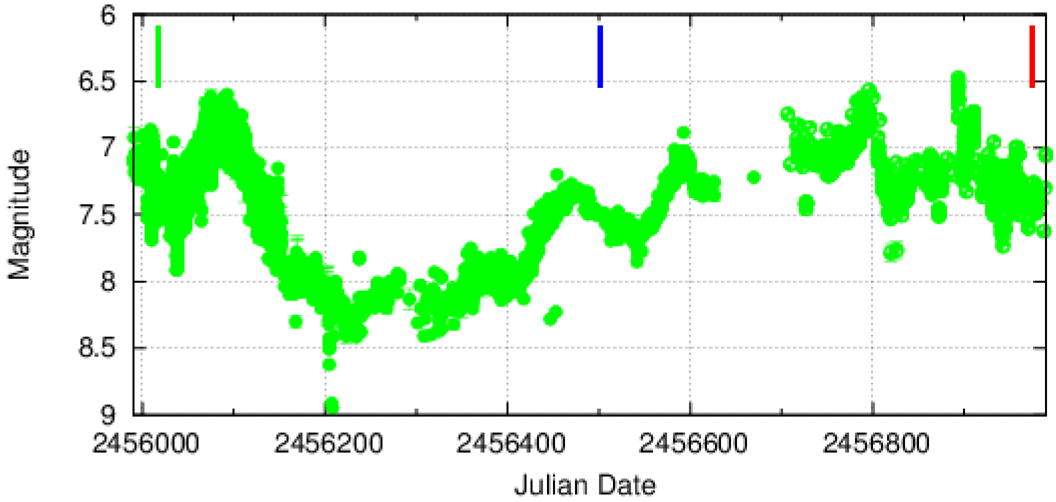




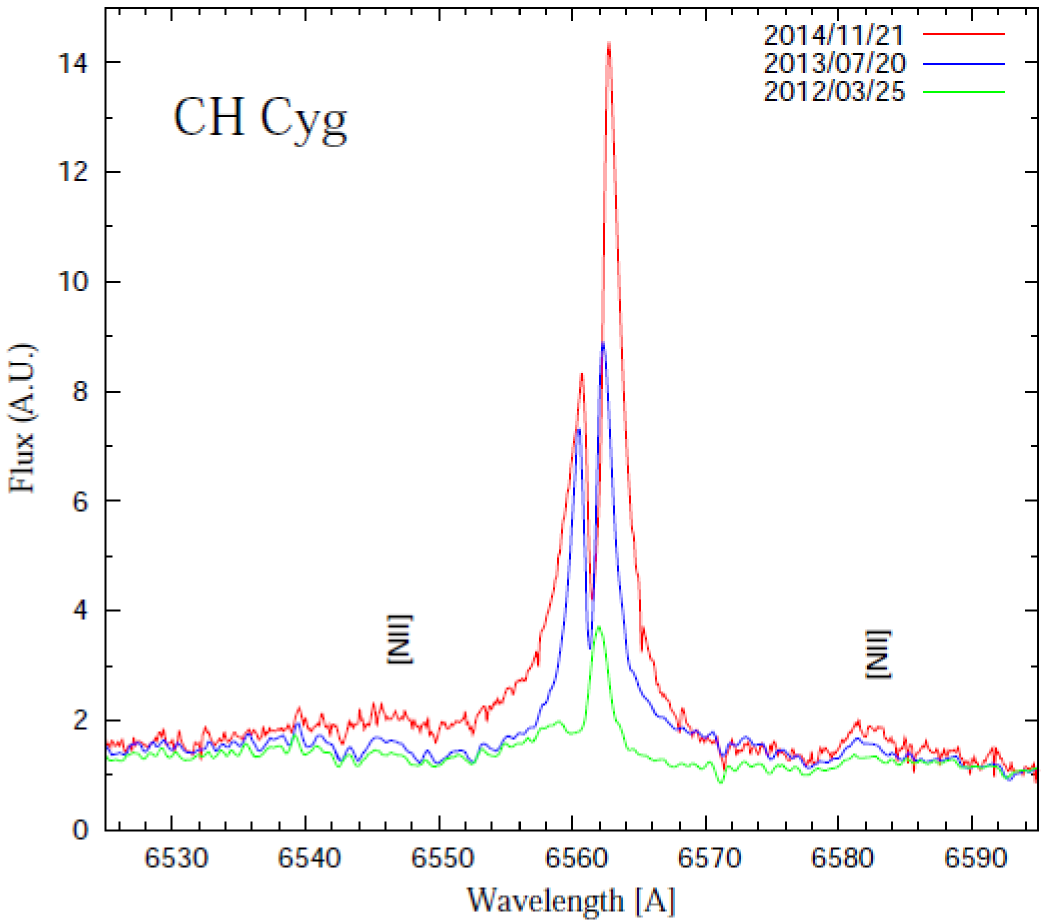


CH Cygni campaign

Dr Augustin Skopal



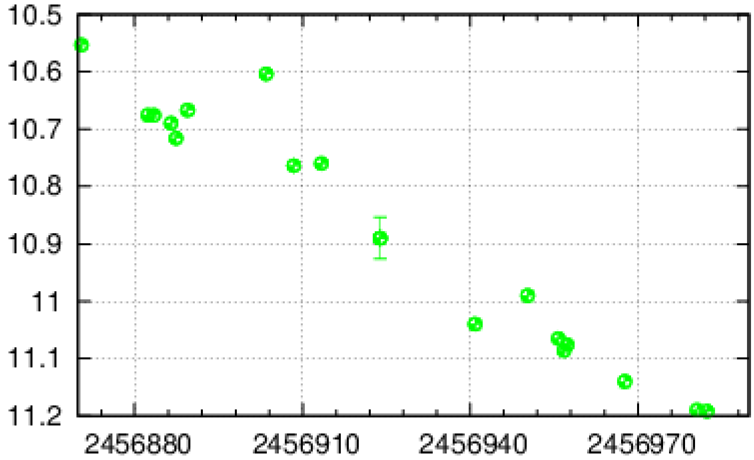
The figure shows spectra from March 25, 2012 (by Stephane Charbonnel), July 20, 2013 (Christian Buil) and November 21, 2014 (Keith Graham). Although the spectra are in arbitrary units, scaled to the same continuum level, variation in the profile with an increasing flux is clearly seen.



Advice :
« to measure the radial velocity, we have to be sure with the wavelength calibration »

AX Per Outburst

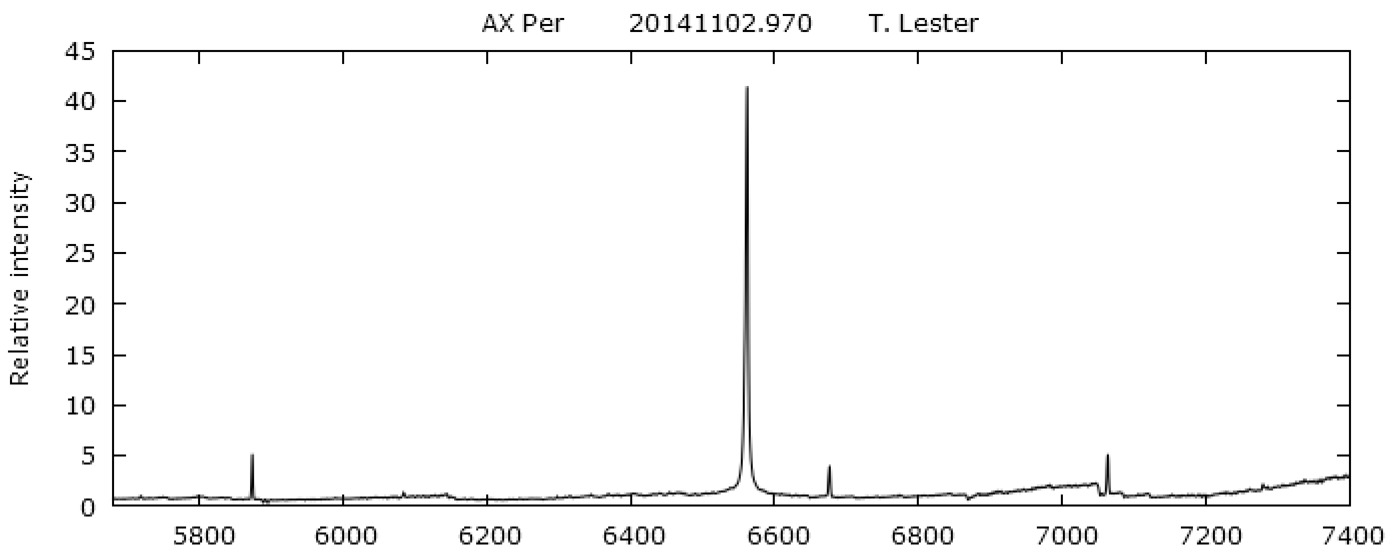
The prototype Symbiotic **AX Per** has been detected in outburst in august 2014 by ANS collaboration See ATel #6382
The current mag is about 10.9 (declining)
Spectra of this event are welcome for ARAS data base Data Base AX Per
Aras topic for exchanges Forum

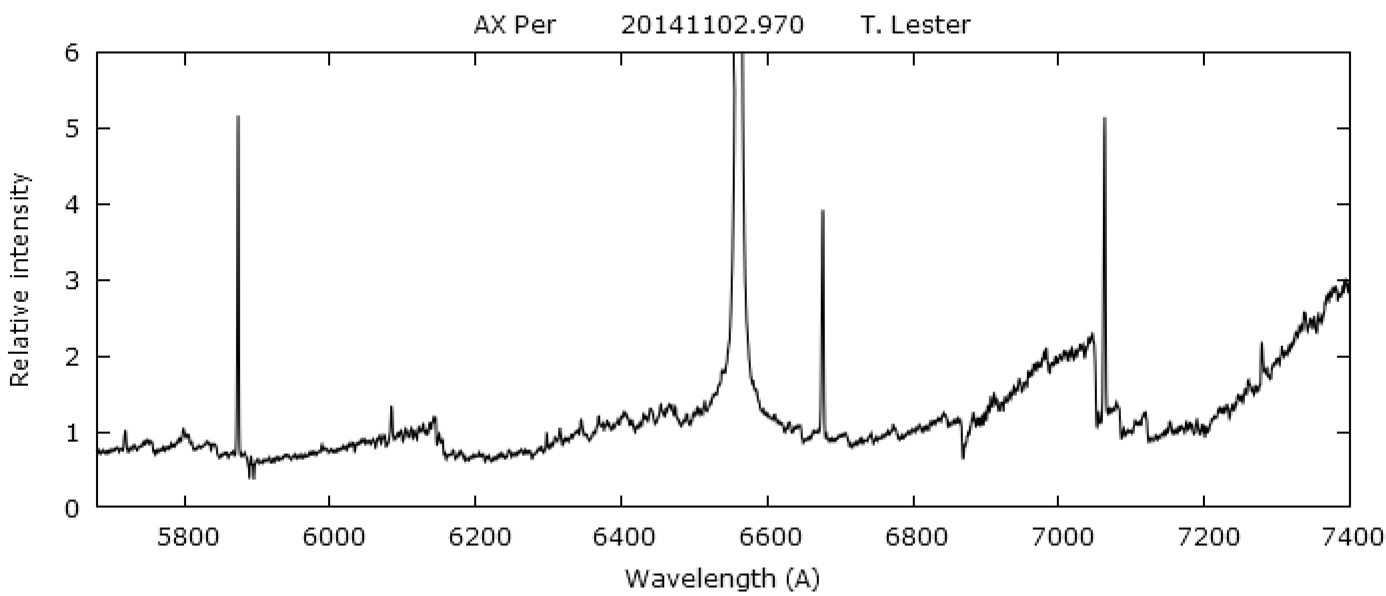


Mag ~ 11.2 30-11-2014

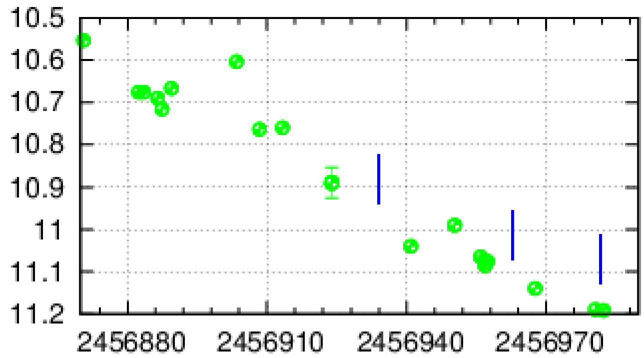
Coordinates (2000.0)	
R.A.	01 h 36 m 22.7 s
Dec.	+54° 15’ 2.5”

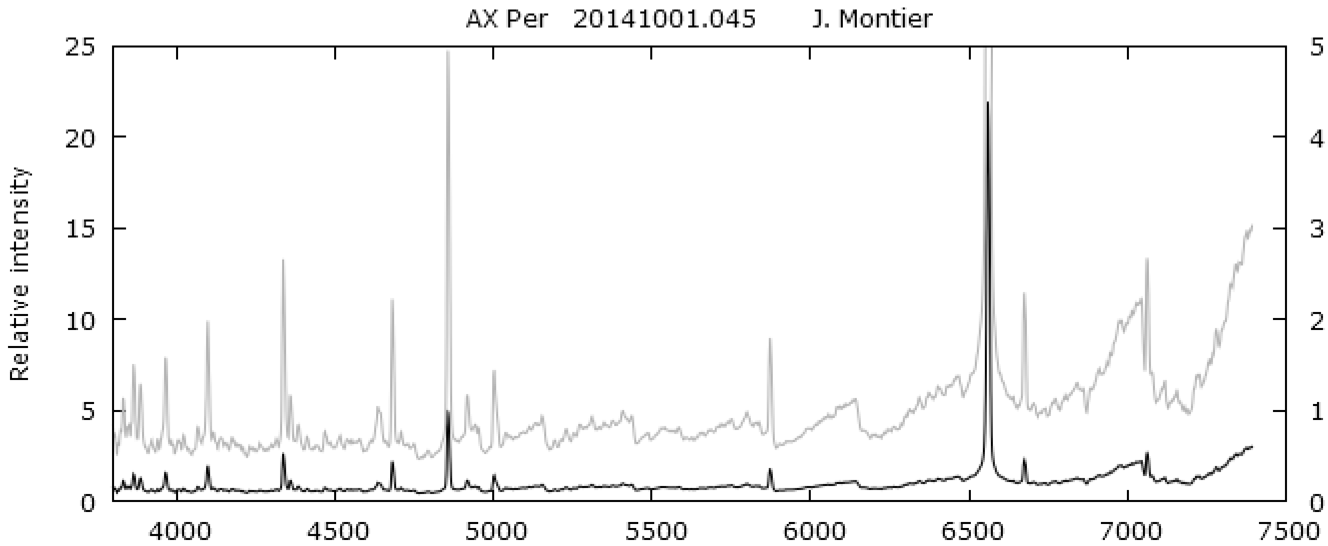
Spectrum of Tim Lester, with its home built spectroscop (1200 l/mm)
Note the faint [Fe VII] 5721, 6087 lines

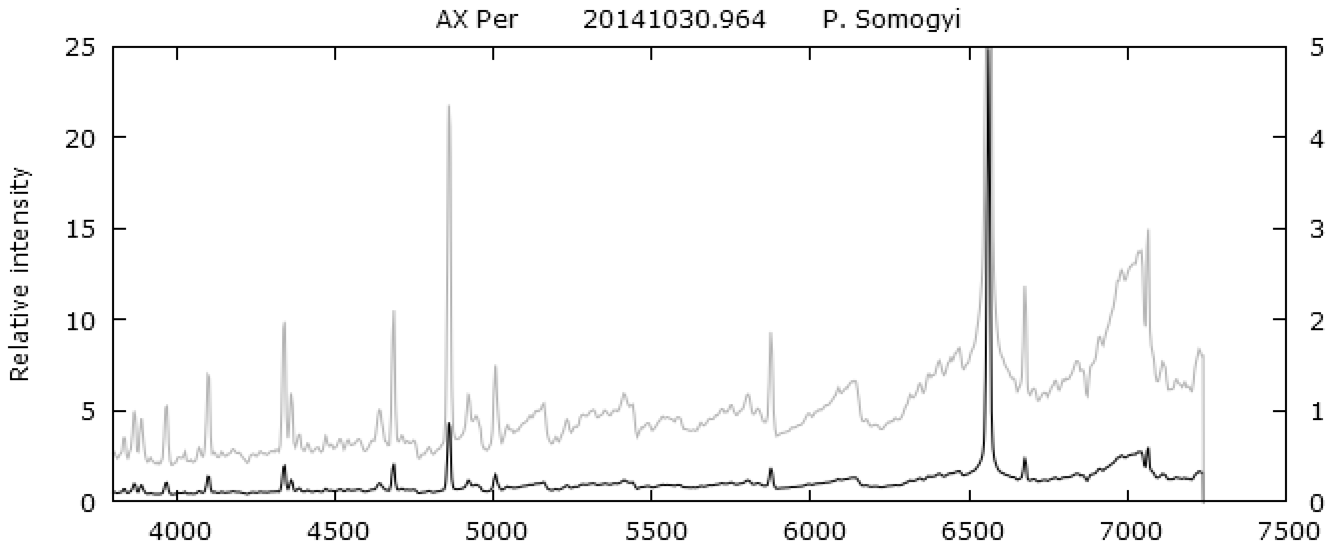


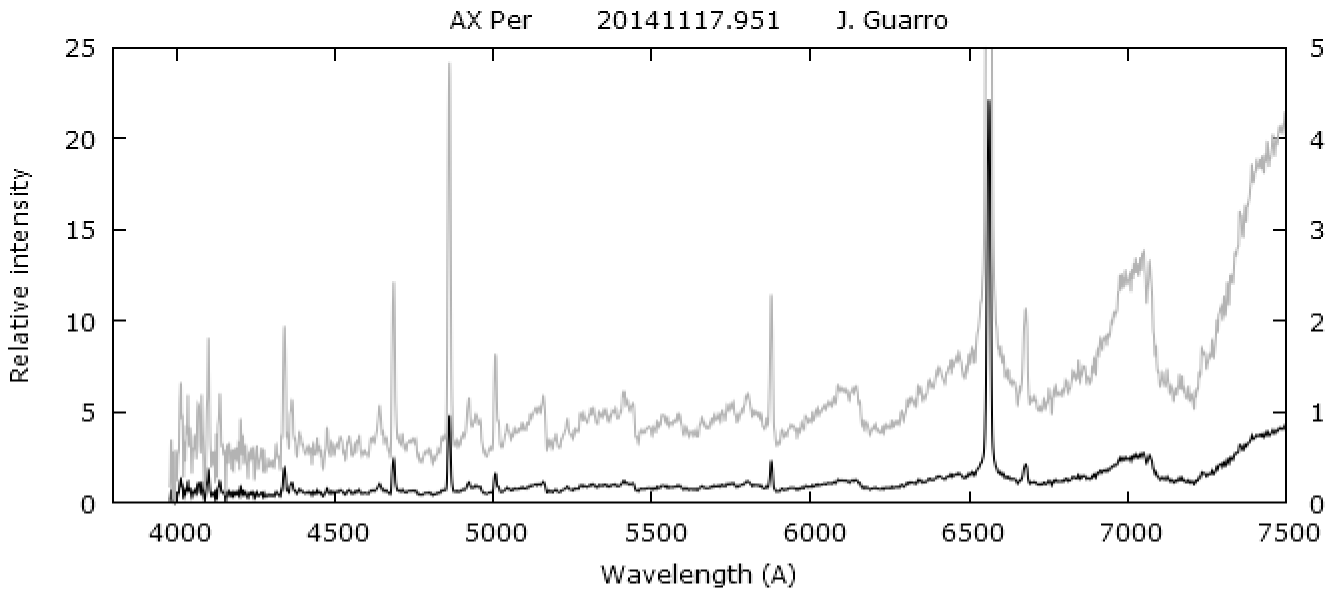


Evolution in oct.-Nov. 2014 with low resolution spectroscops at R = 600









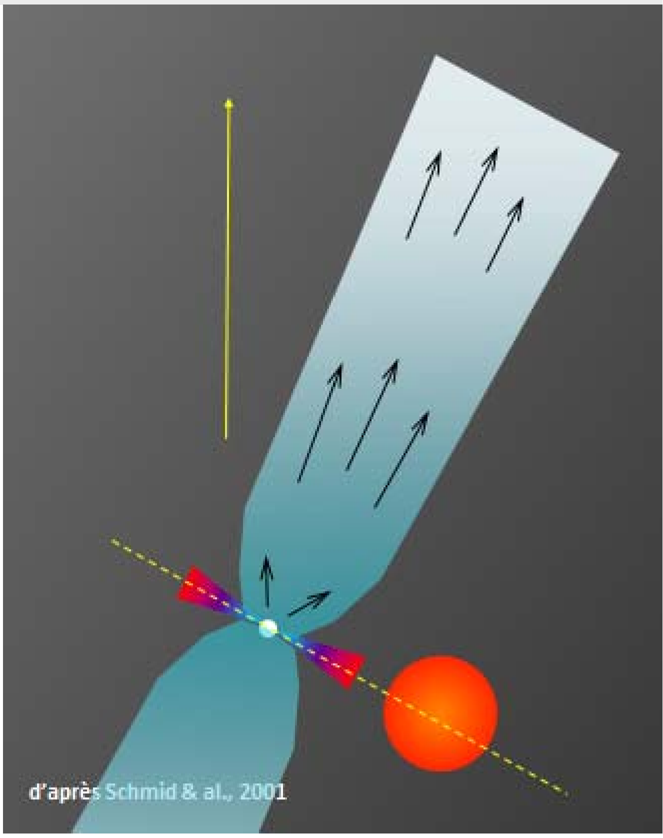
V694 Mon = MWC 560

Coordinates (2000.0)	
R.A.	07 h 25 m 51.2 s
Dec.	-07° 44' 08"

Current V mag ~ 10.5

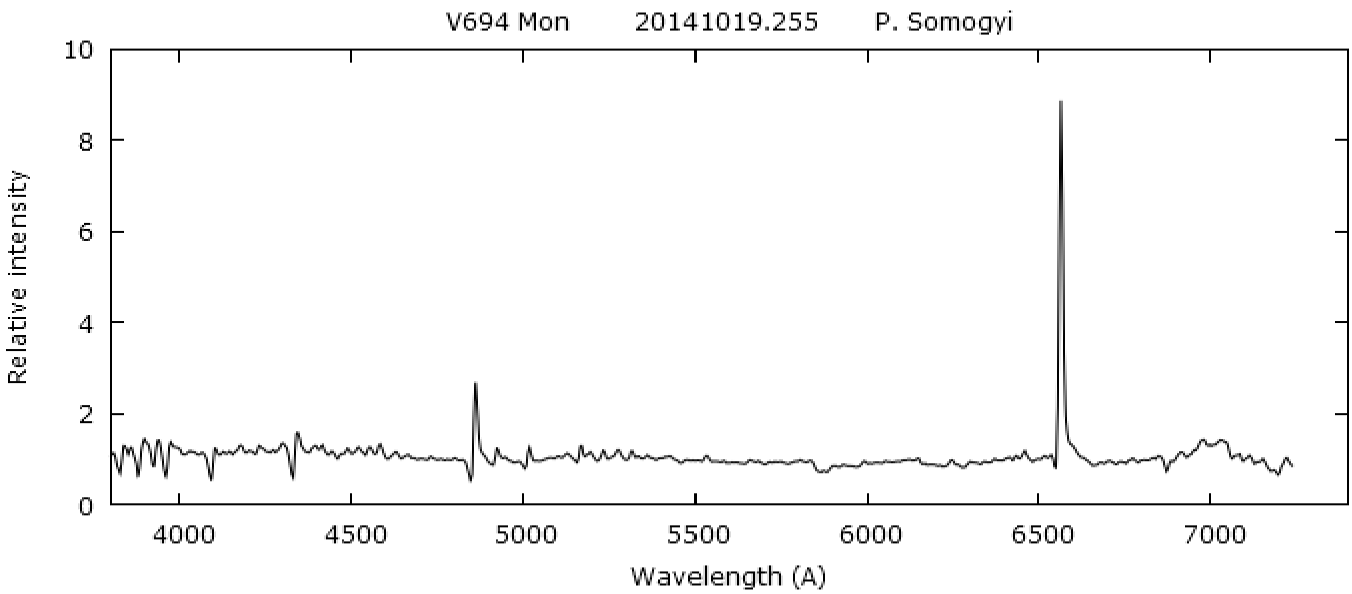
Description of V694 Mon (Gromadzki & al., 2007)

Discovered by Merrill & Burwell (1943) as a star with strong emission lines, MWC 560 (V694 Mon) is an enigmatic symbiotic system with a very active hot component. Its optical spectrum is always characterized by highly variable absorption features, blue-shifted by 1000–6000 km s−1. These originate from H I, He I, Ca II and Fe II, and are detached from the stationary, narrow emission lines. The blue-shifted absorption features can be explained by a jet outflow along the line of sight (Tomov et al. 1990)



Schematic view of V694, adapted from Schmid & al., 2001

The last active phase occurred in 2011, with outflow velocity of 7000 km/ s
See : http://www.astronomie-amateur.fr/feuilles/Spectroscopie/SyS/V694Mon.html



V694 Mon, observed by Peter Somogyi with an Alpy 600, R = 600, (11-10, 19-10, 03-11, 15-11-2014) in stable state, with outflow velocity (v_{max}) of about 1700 km.s^{-1}

On the nature of the cool component of MWC 560
Gromadzki, M.; Mikołajewska, J.; Whitelock, P. A.; Marang, F.
Astronomy and Astrophysics, Volume 463, Issue 2, February IV 2007

Spectroscopic monitoring of the jet in the symbiotic star MWC 560. I.
Schmid, H. M.; Kaufer, A.; Camenzind, M.; Rivinius, Th.; Stahl, O.; Szeifert, T.; Tubbesing, S.; Wolf, B.
Astronomy and Astrophysics, v.377, p.206-240 (2001)

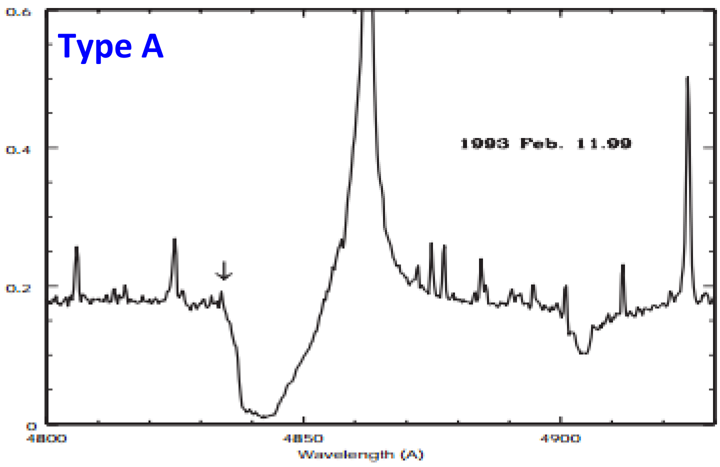
ARAS DATA BASE | http://www.astrosurf.com/aras/Aras_DataBase/Symbiotics/V694Mon.htm

Stable and active stages

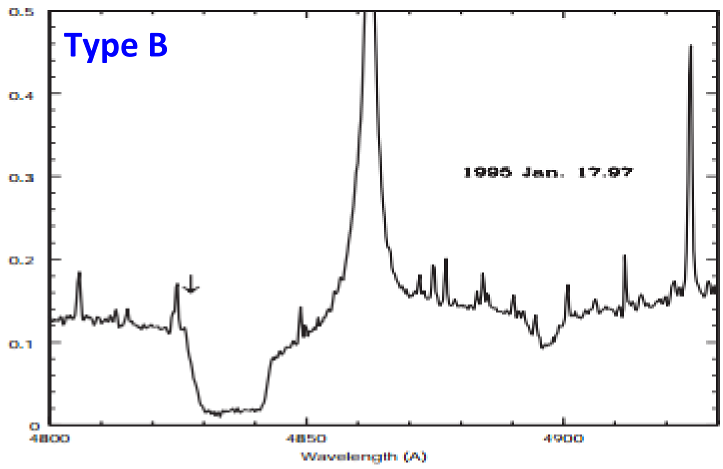
Iijima (2002) classified the spectra in four types,
according to the continuum between emission and absorption and defined Stable and Active stages :

Stable stage : Type A and B : no flat continuum **and** an outflow velocity between -1800 and -2400 km.s^{-1}
Active stage : Type C and D : flat continuum **or** a outflow velocity largely different (roughly more than 300 km s−1) from that of the stable stage

Stable Stage - No flat continuum between the absorption and emission components

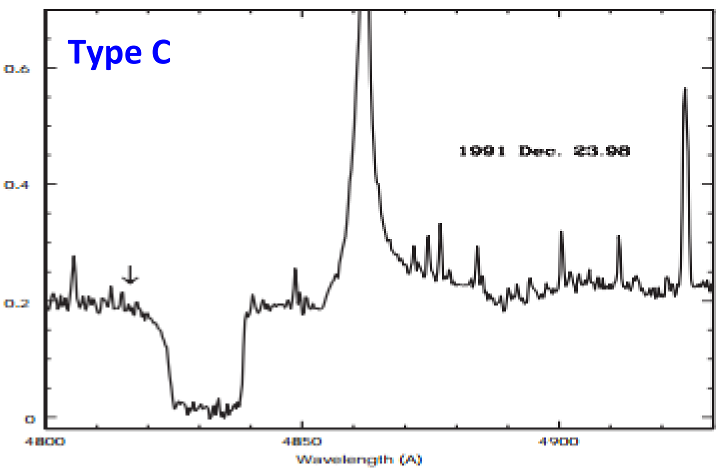


No flat continuum between the absorption and emission components, and the blue side is steeper than the red side

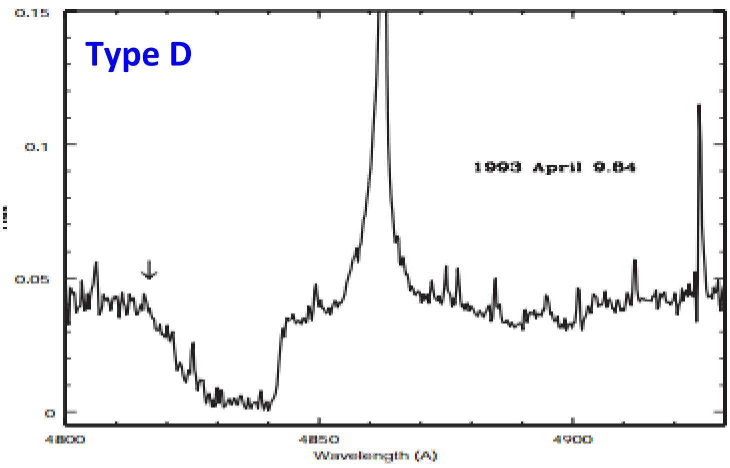


No flat continuum between the absorption and emission components, but a part of the red side is as steep as the blue

Active Stage - Flat continuum between the absorption and emission components



Flat continuum between the absorption and emission components, and both blue and red sides are steep



Flat continuum between the absorption and emission components The red side is steeper than the blue side

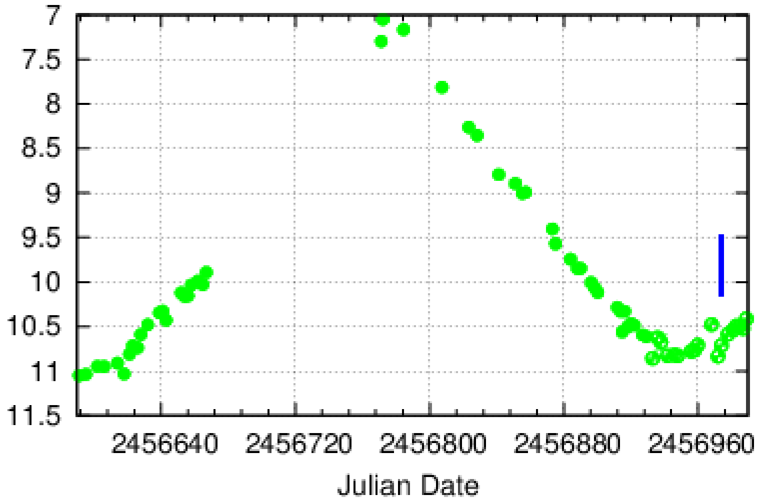
Reference :
MWC 560: An SS 433 type object with a white dwarf
Iijima, Astronomy and Astrophysics, v.391, p.617-623 (2002)
http://adsabs.harvard.edu/abs/2002A%26A...391..617I

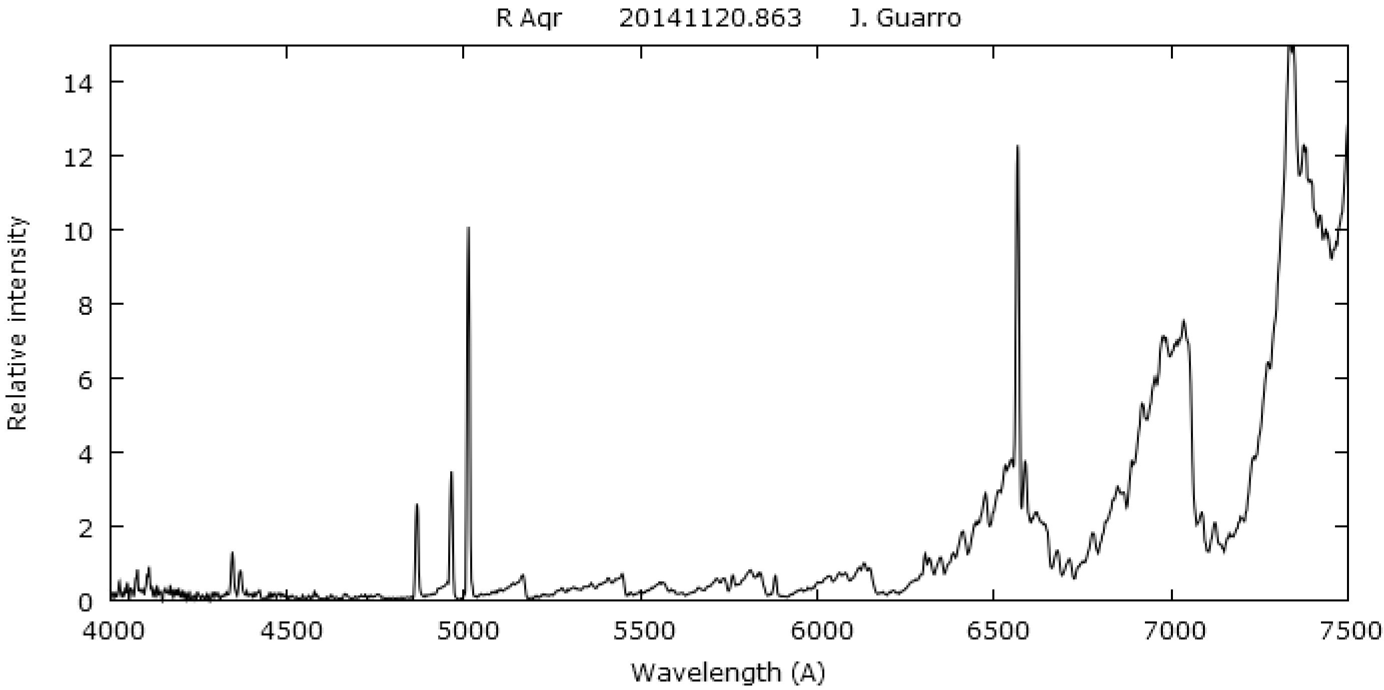
Coordinates (2000.0)	
R.A.	07 h 25 m 51.2 s
Dec.	-07° 44' 08"

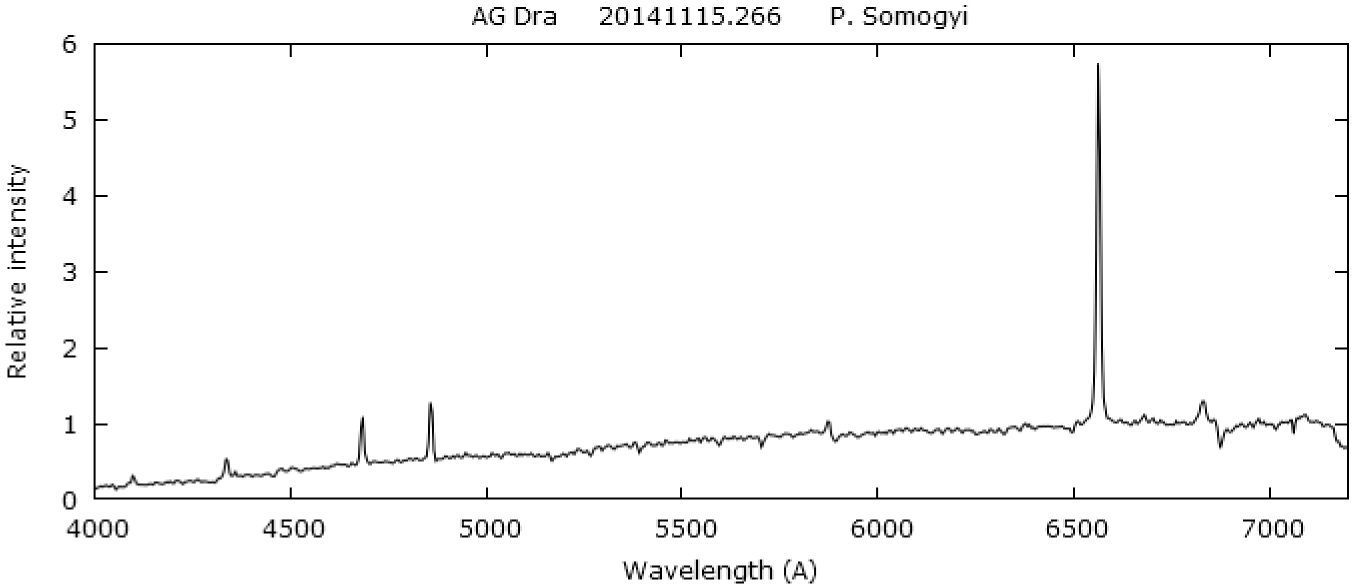
Mag V = 7 to 11
Period (Mira) = 387 d

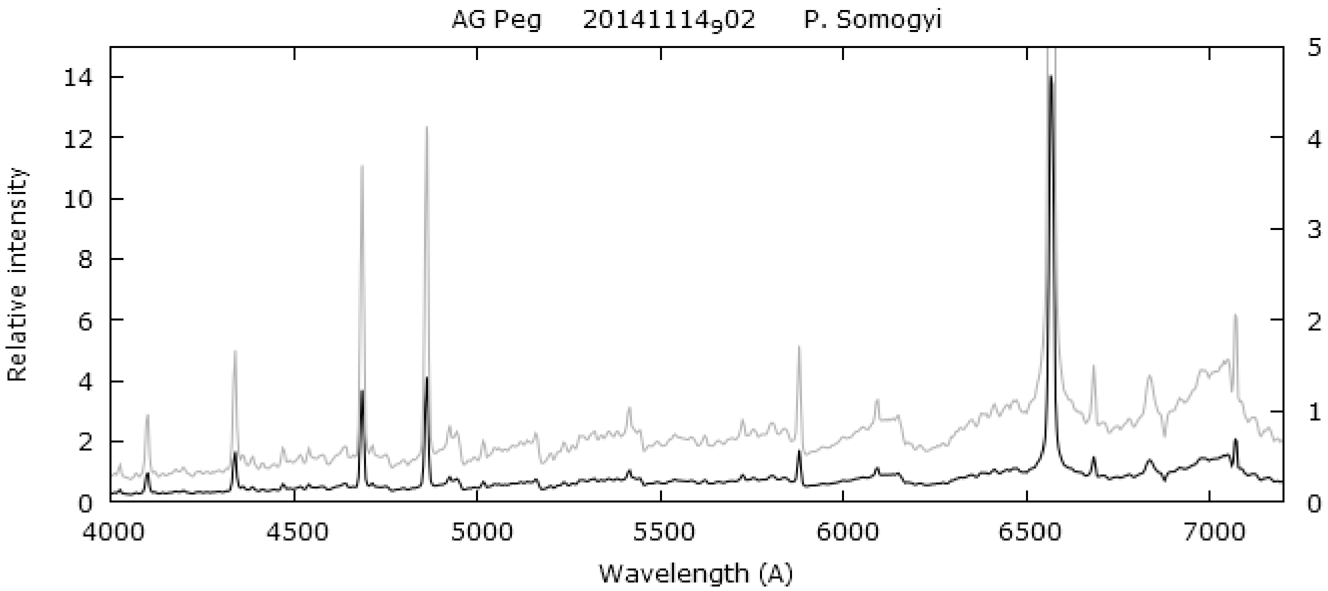
Current V mag = 10.4

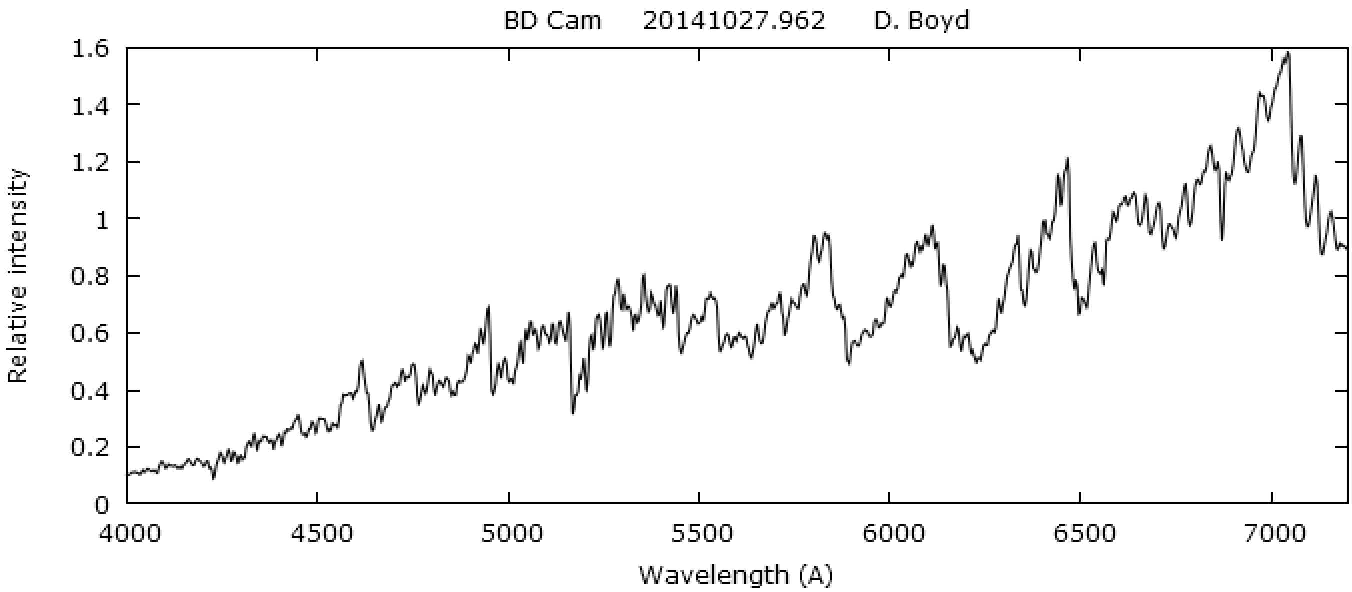
Observing : along a Mira pulsation

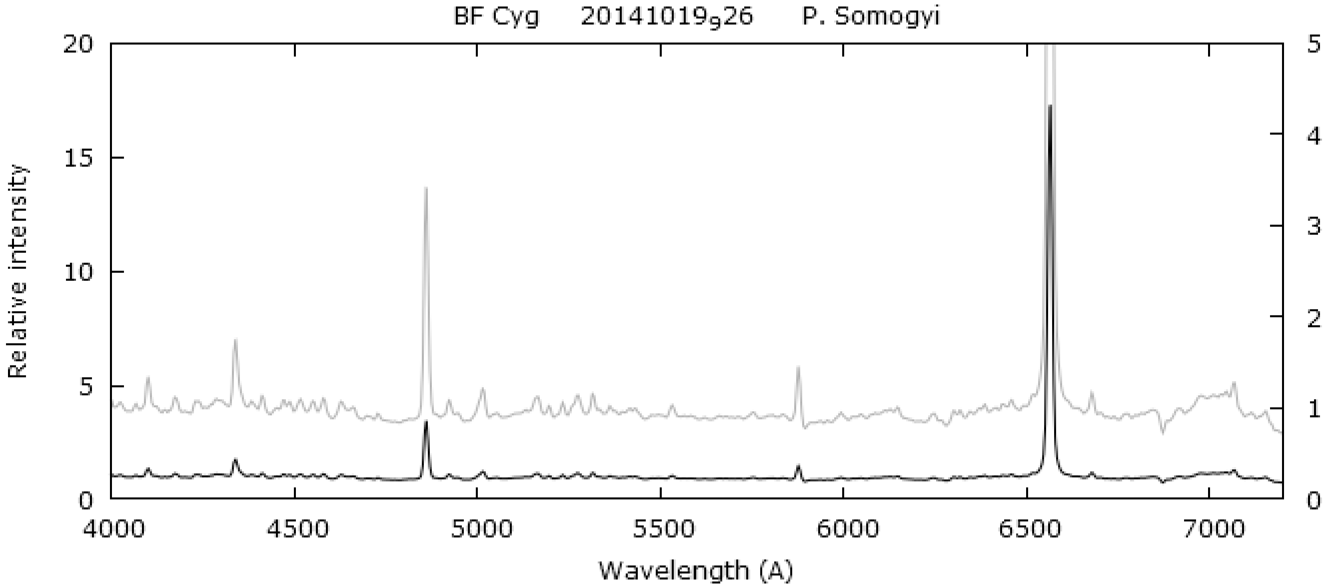


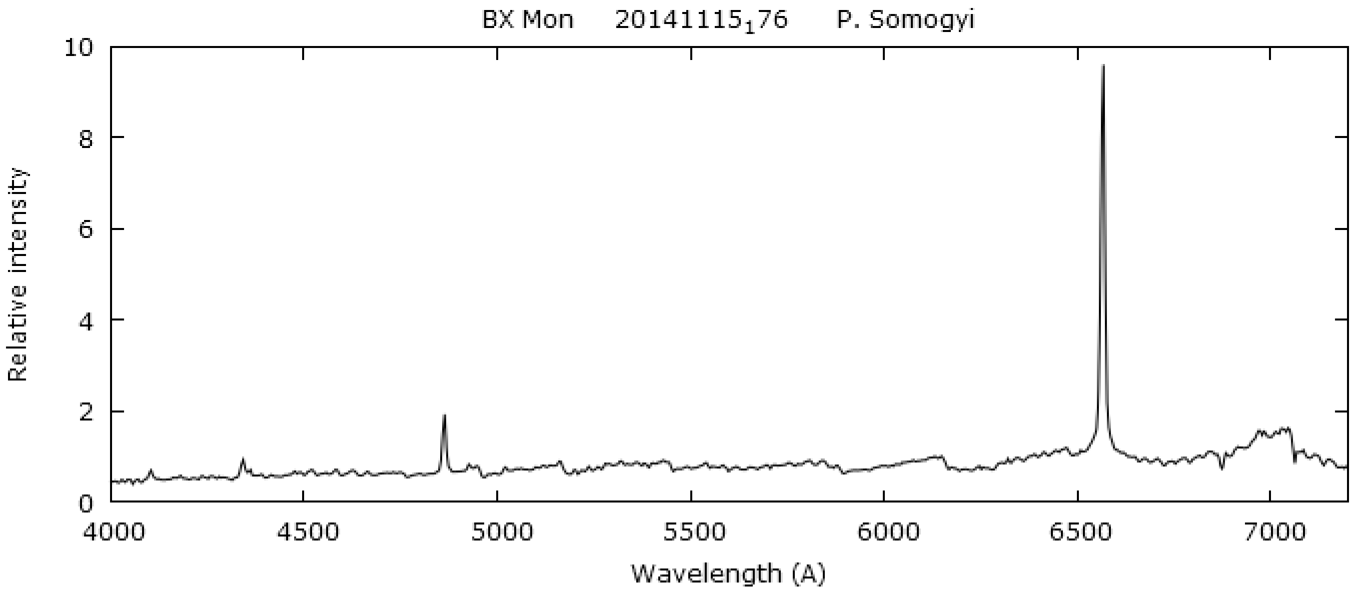


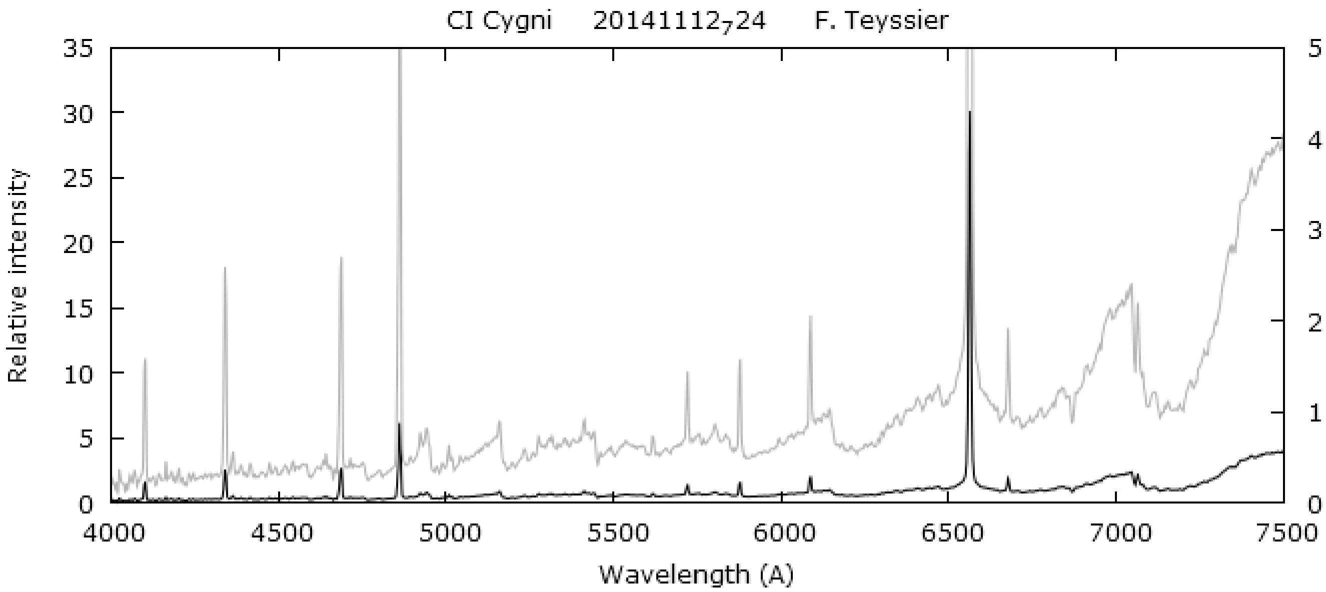

AG Dra 20141115.266 P. Somogyi
Relative intensity
Wavelength (A)


AG Peg 20141114$_{9}$02 P. Somogyi
Relative intensity
Wavelength (A)

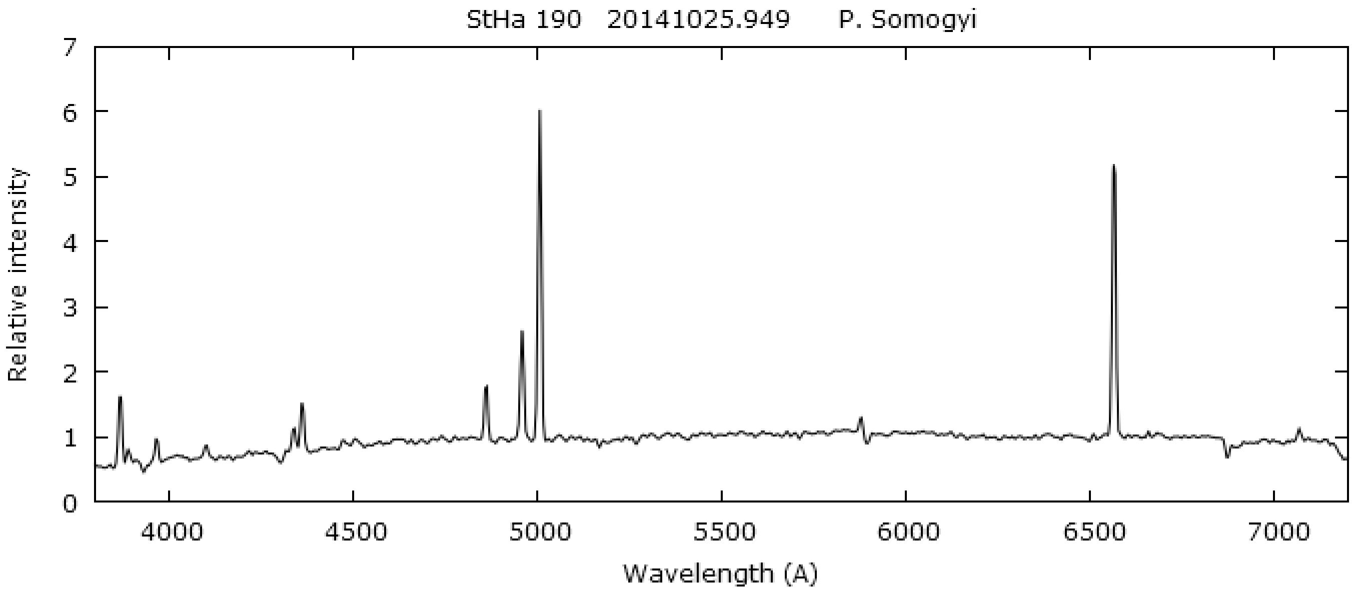

BD Cam 20141027.962 D. Boyd
Relative intensity
Wavelength (A)

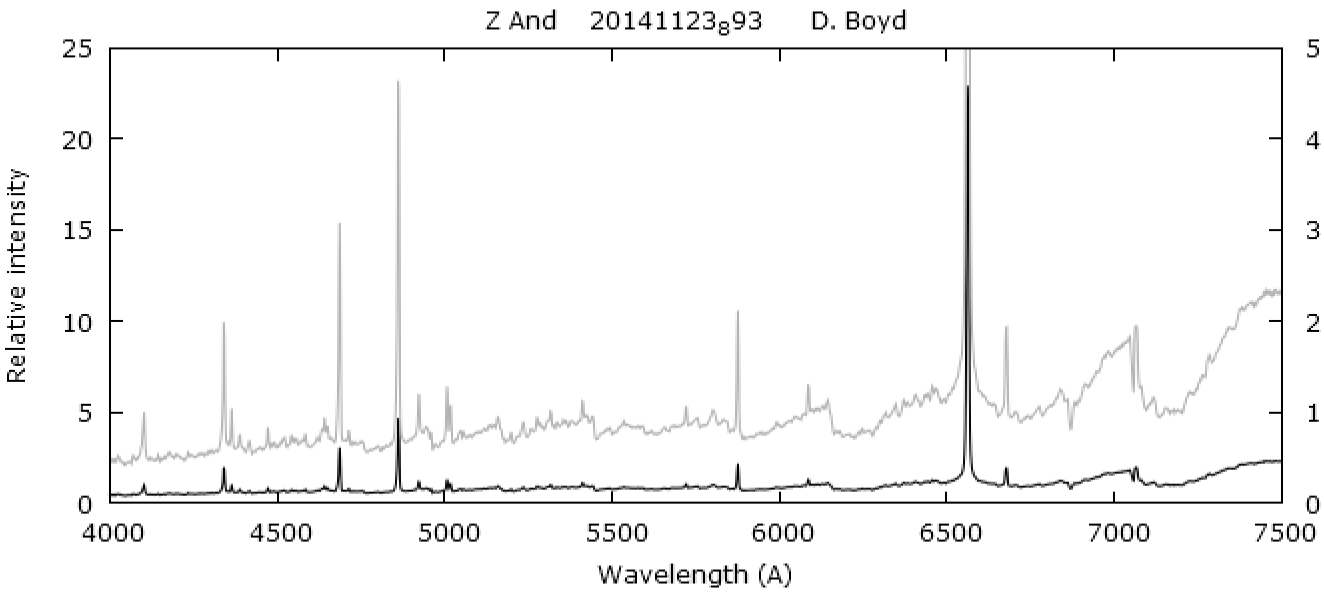


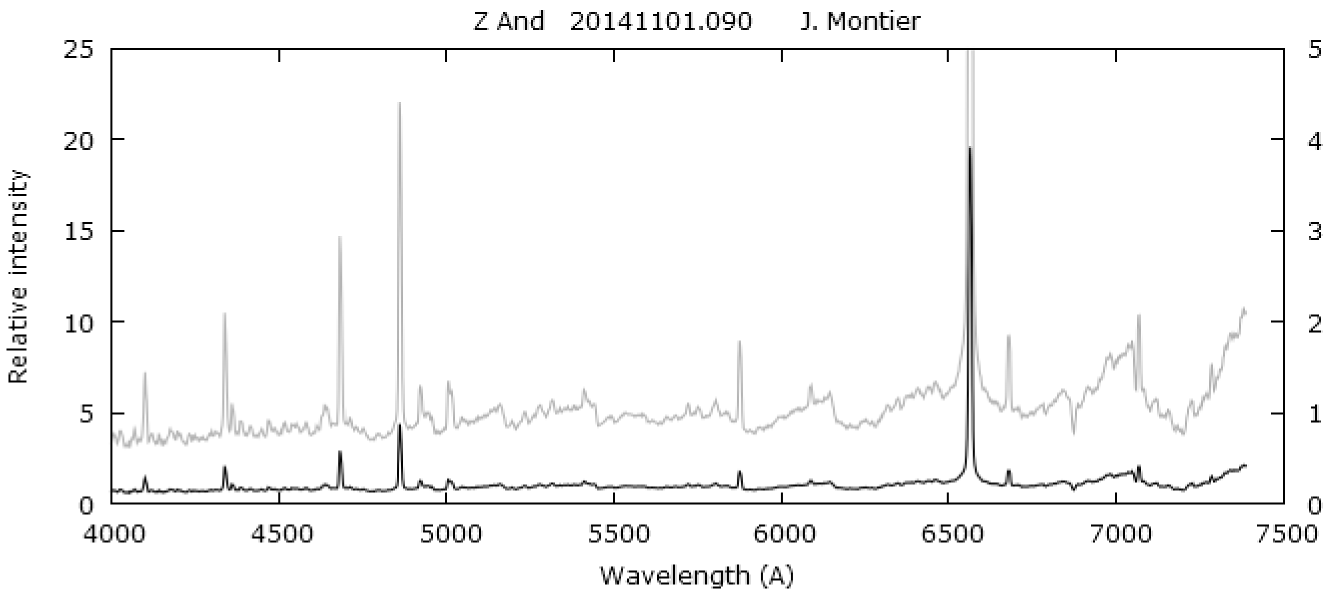




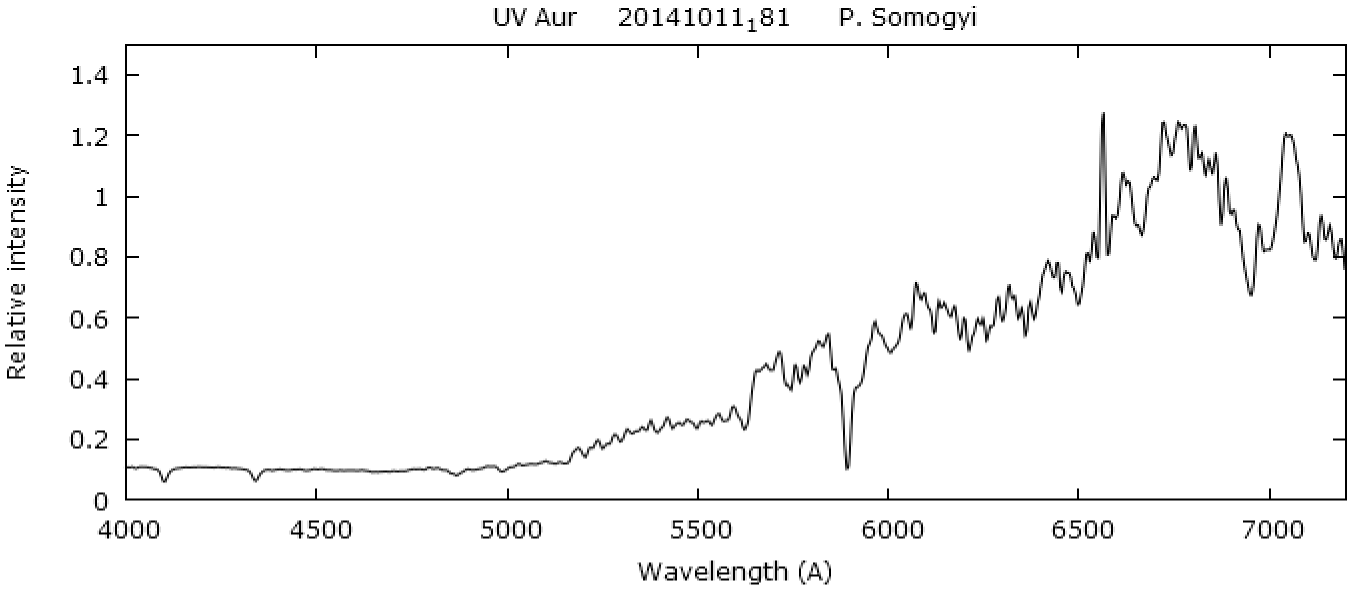
ARAS DATA BASE | http://www.astrosurf.com/aras/Aras_DataBase/Symbiotics.htm

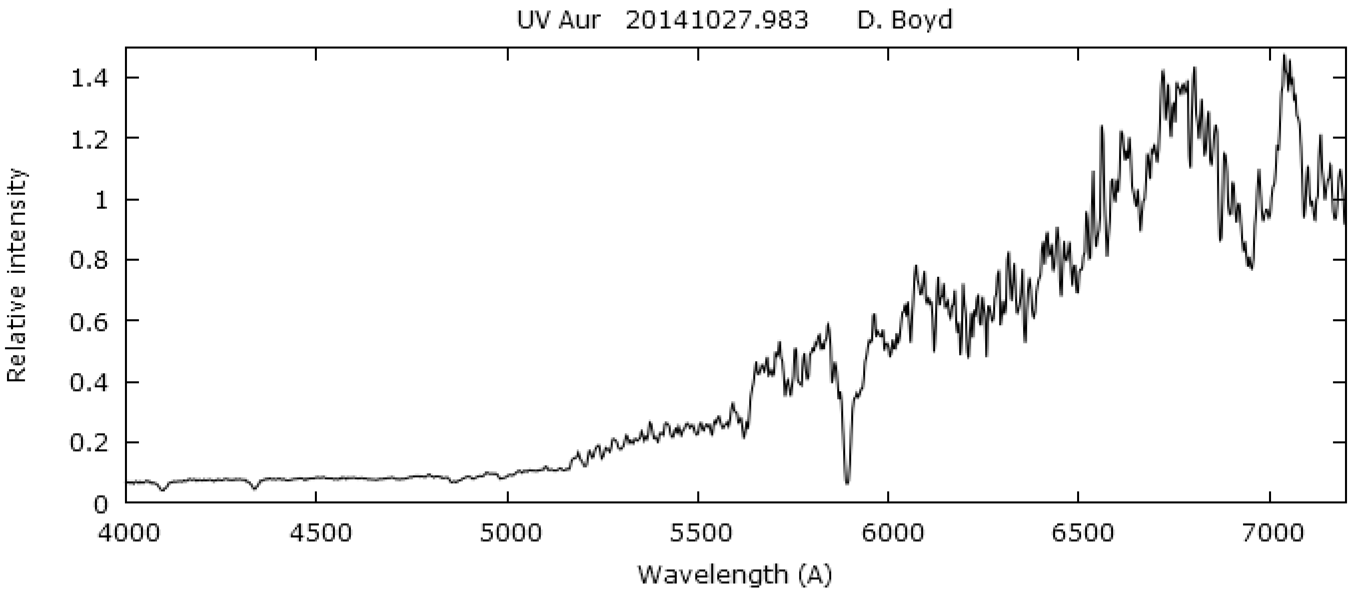

StHa 190 20141025.949 P. Somogyi
Relative intensity
Wavelength (A)
0
1
2
3
4
5
6
7
4000
4500
5000
5500
6000
6500
7000


Z And 20141123₈93 D. Boyd
Relative intensity
Wavelength (A)
0
5
10
15
20
25
0
1
2
3
4
5
4000
4500
5000
5500
6000
6500
7000
7500

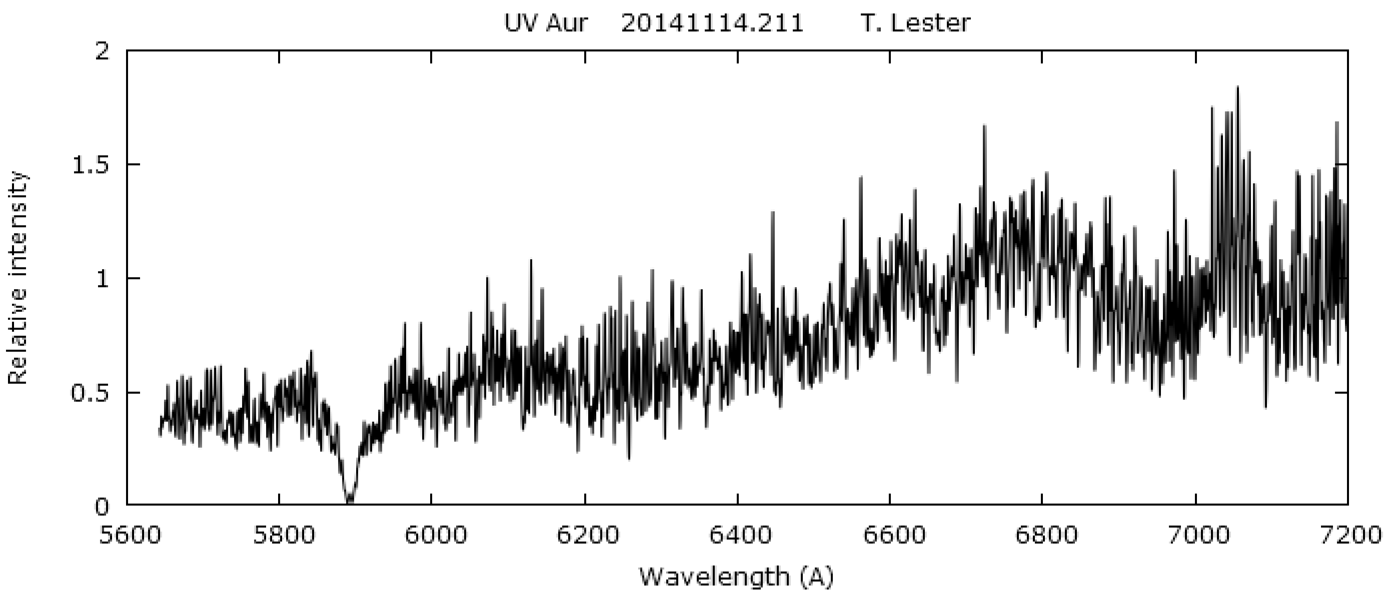

Z And 20141101.090 J. Montier
Relative intensity
Wavelength (A)
0
5
10
15
20
25
0
1
2
3
4
5
4000
4500
5000
5500
6000
6500
7000
7500

UV Aur at 3 different resolutions : Alpy600 - R = 600 | Lisa R = 1000 | Home built spectroscop R = 4500

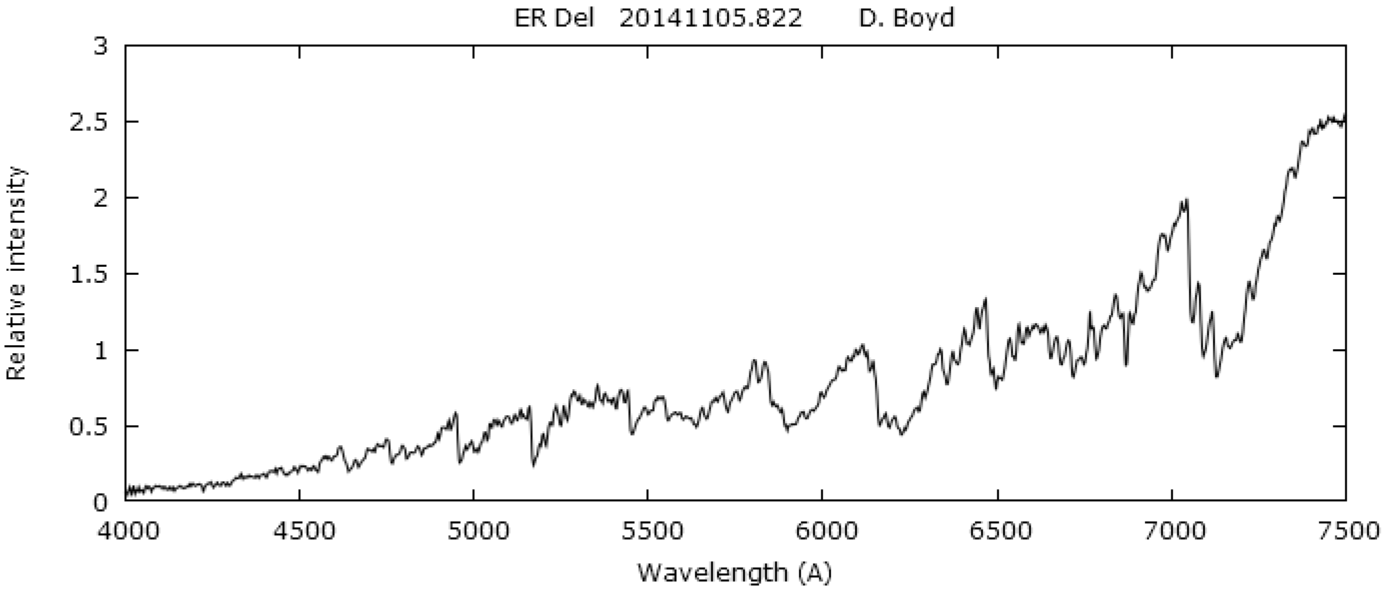


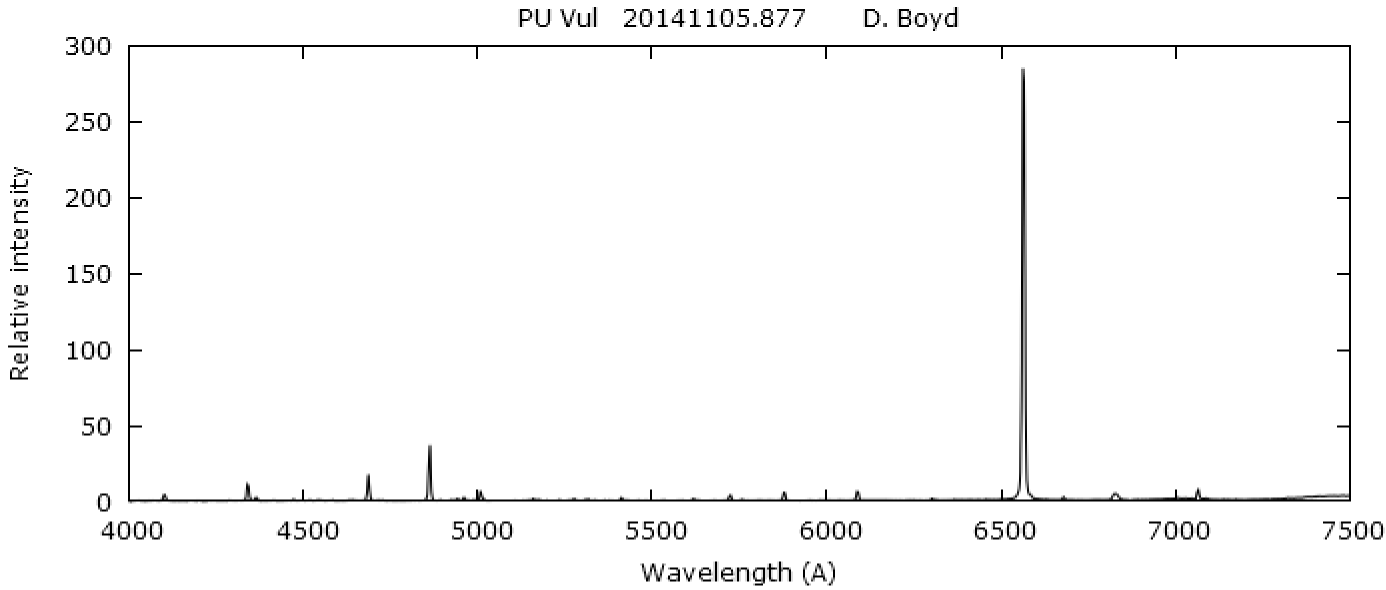


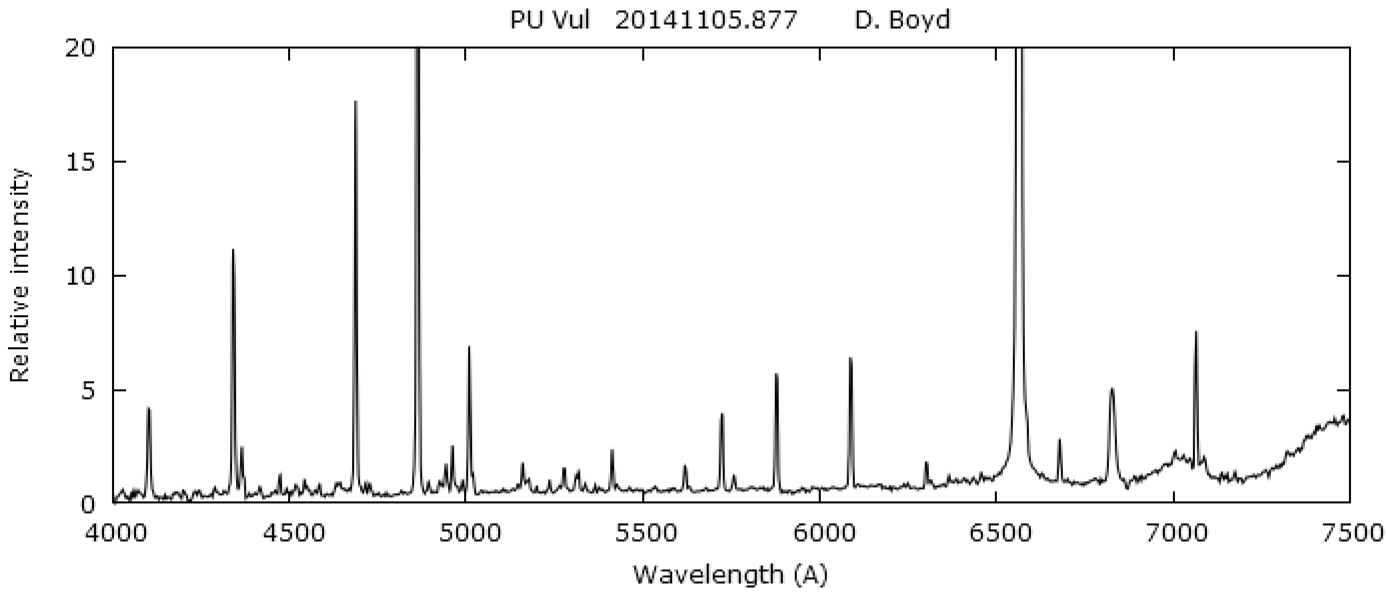
Note the rapid evolution of H alpha



The two lines of Na I D appears


ER Del 20141105.822 D. Boyd
Relative intensity
Wavelength (A)
3
2.5
2
1.5
1
0.5
0
4000
4500
5000
5500
6000
6500
7000
7500

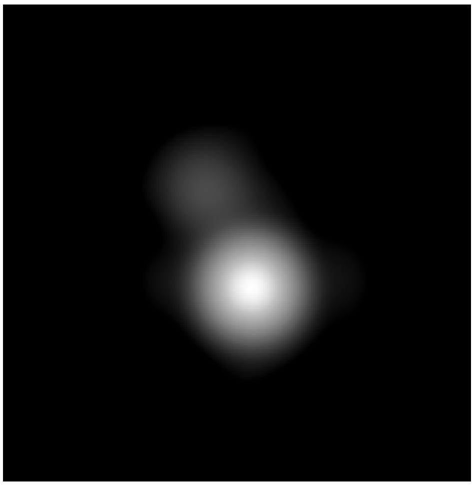

PU Vul 20141105.877 D. Boyd
Relative intensity
Wavelength (A)
300
250
200
150
100
50
0
4000
4500
5000
5500
6000
6500
7000
7500


PU Vul 20141105.877 D. Boyd
Relative intensity
Wavelength (A)
20
15
10
5
0
4000
4500
5000
5500
6000
6500
7000
7500

Request for observations of the symbiotic star CH Cygni

By Dr Augustin Skopal

CH Cyg is the most intriguing symbiotic star among other objects of this type of interacting binaries. In spite that it is a bright object (< 10 mag) with known distance (270 pc), we still are not sure even with its basic configuration (a triple or binary system?).
CH Cyg shows activity from harder X-rays (2-10 keV) to the radio with occasional detection of a jet-like outflow during/after active phases. From this point of view, CH Cyg is a very attractive object for observations also with small telescopes.



First spatial resolution of the stellar components of the interacting binary CH Cygni
Mikolajewska & al., 2010

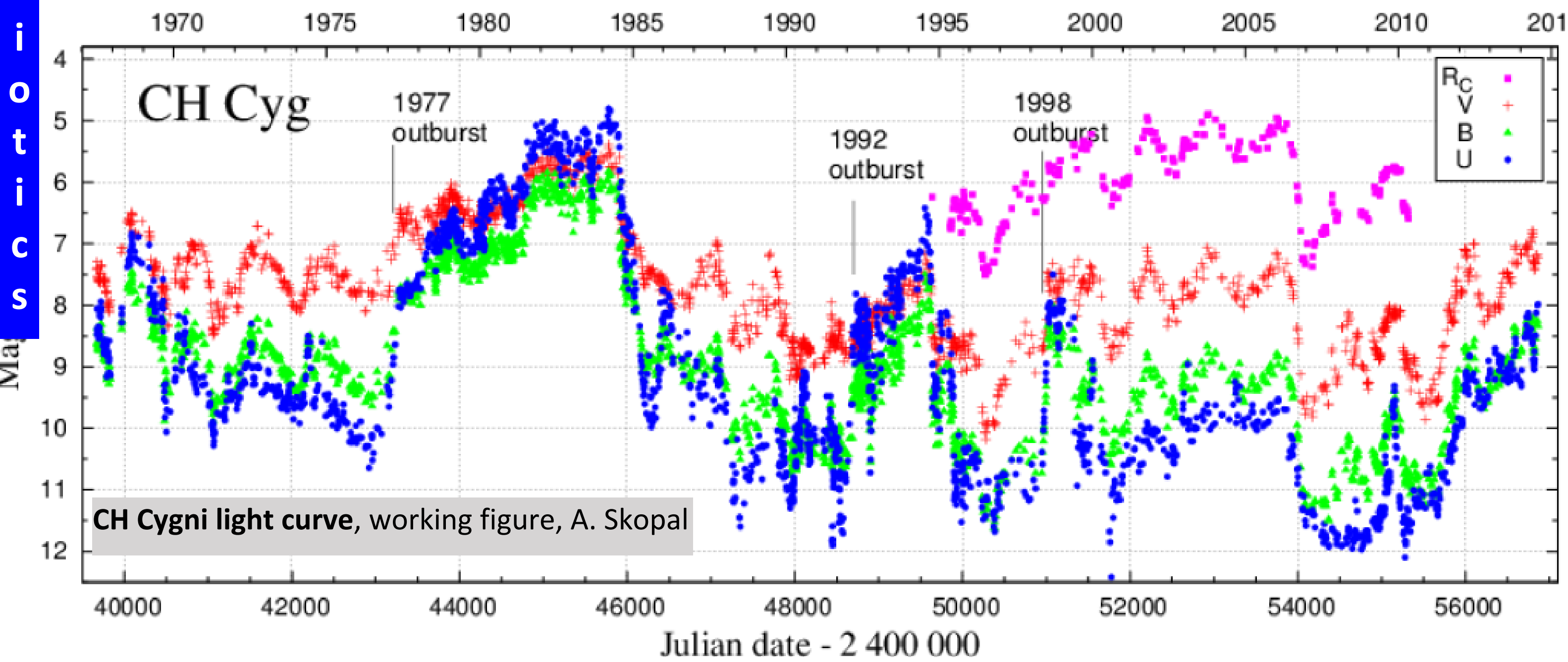
I would like to inform you about the current active phase of the symbiotic star CH Cyg, and a suggestion for spectroscopic observations.

- The blue continuum is gradually increasing from U ~ B ~ 11.0 mag in 2011 to the present values of 7 - 8 mag (see working figure, p. 2).
Also reported in the recent IBVS 6117.
- A significant rapid variability in U and B on the timescale of minutes to hours is well pronounced, being within ~0.6 mag in U during our 4-5 hours monitoring on Oct. 27. and 28.
(see also ATel#6560).
- An increase of the H-alpha flux as documented by the recent ARAS observations (see p. 2)
- The active phase seems to have an increasing trend.

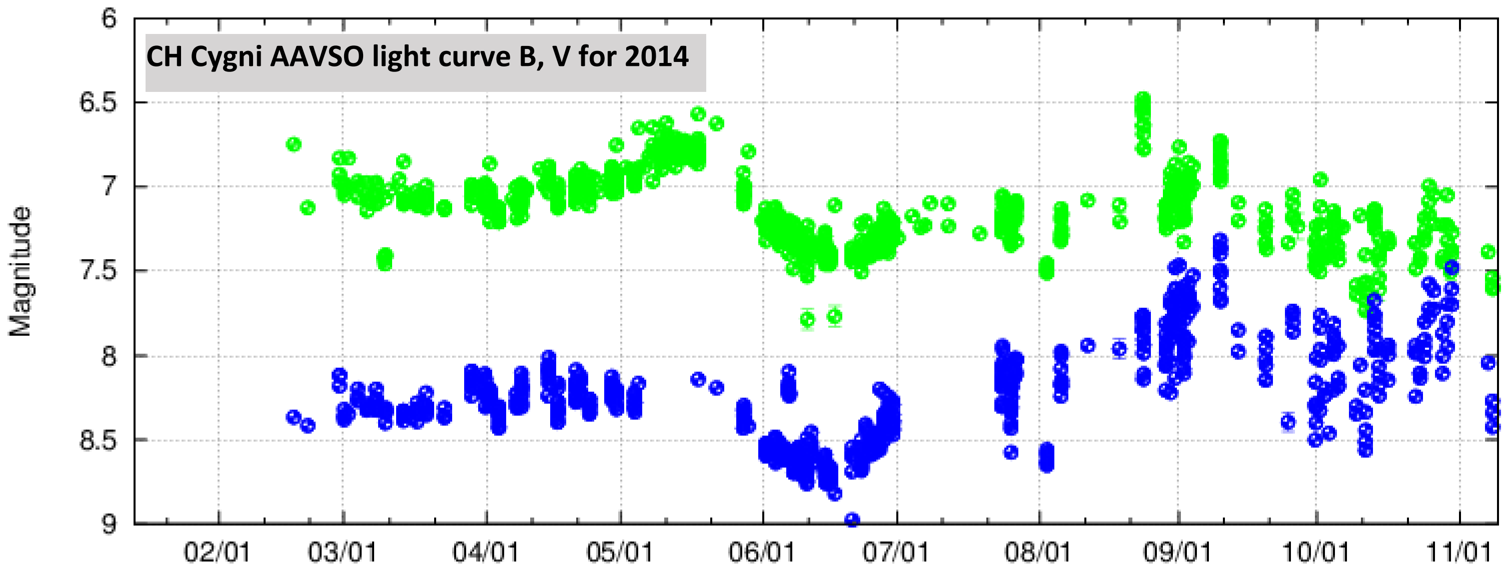
Accordingly, spectra at a medium resolution (R ~ 10000, or higher) would help much to get information about the kinematics of the circumstellat material around the WD. In particular, radial velocity of the central absorption of hydrogen lines should reflect the orbital motion of the active WD and not the wind from the giant as indicated during quiescent phases for other symbiotics.

Observations at a higher R ~ 10000 (or more) are important.
However, low-resolution spectra are also appreciated, e.g. for modelling the SED, mainly if they can be exposed from shorter wavelengths (approx. 3600 A).
Cadence : at least 1 - 2 spectra a month should be satisfactory.

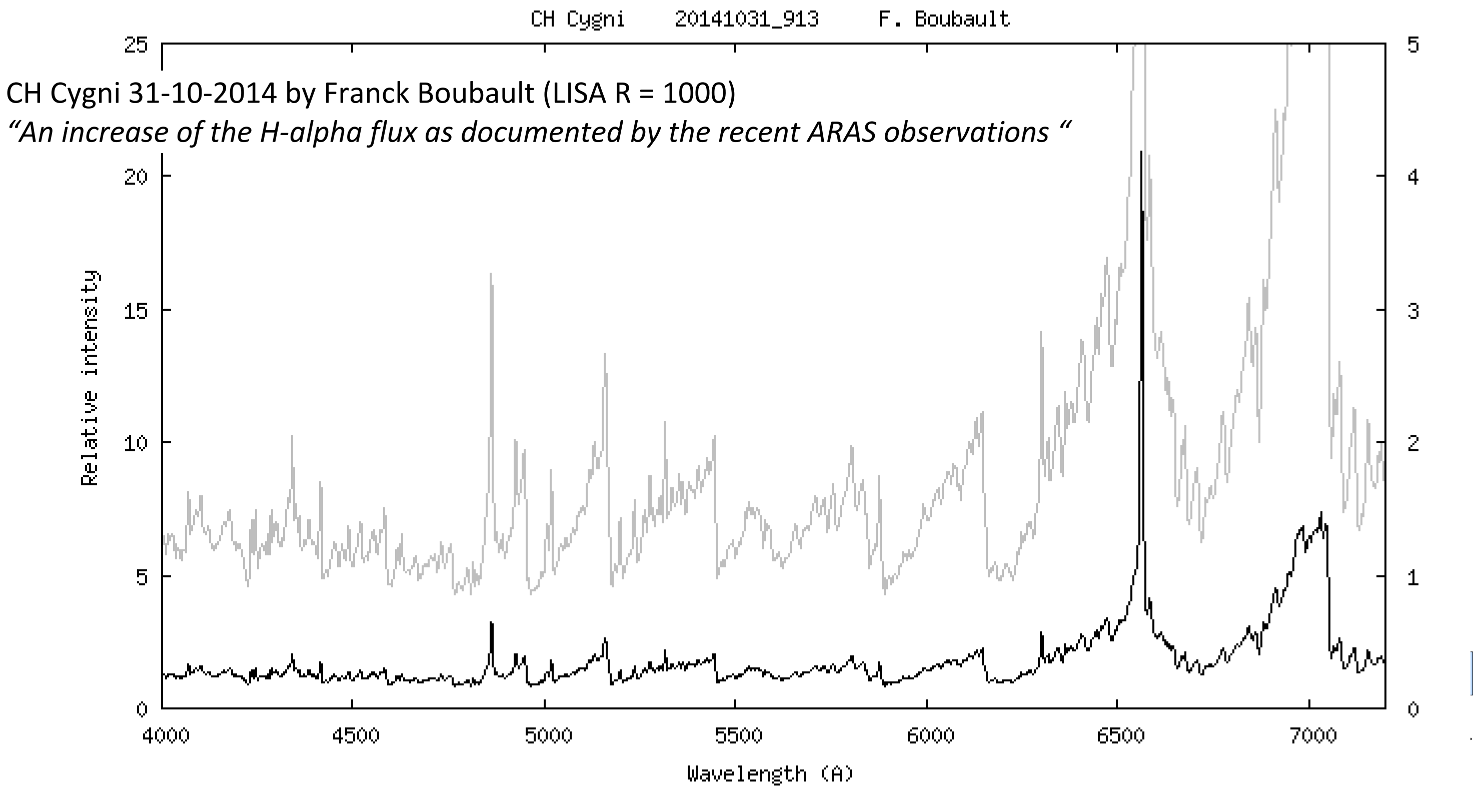
Request for observations of the symbiotic star CH Cygni



CH Cygni light curve, working figure, A. Skopal



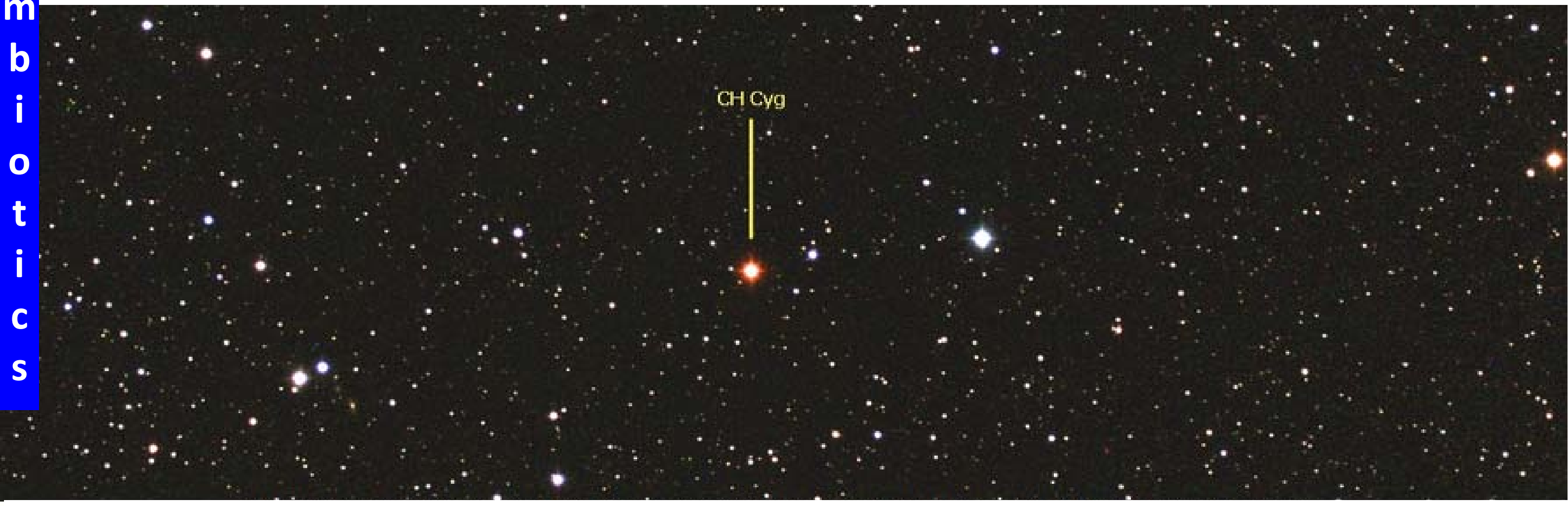
CH Cygni AAVSO light curve B, V for 2014



CH Cygni 31-10-2014 by Franck Boubault (LISA R = 1000)

"An increase of the H-alpha flux as documented by the recent ARAS observations "

Request for observations of the symbiotic star CH Cygni



Field of CH Cygni - Christian Buil - 15-03-2012

CH Cygni

Coordinates (2000.0)	
R.A.	19 24 33
Dec.	+54 14 29.1

Current magnitude V = 7.4 to 7.6
(Flickering)

Reference stars

MILES Standart for high resolution spectra

Name	RA (2000)	Dec (20002)	Sp. Type	Mag. V	E_{B-V}
HD 192640	20:14:31.9	+36:48:22.7	A2V	4.96	0.026

Reference for low resolution spectra

Name	RA (2000)	Dec (20002)	Sp. Type	Mag. V	E_{B-V}
HD 183534	19:27:42	+52:19:14	A1V	5.7	0

Observing

High resolution spectra
Eshel
LHIRES III 2400 l/mm (H alpha)

Low resolution spectra (minimum R = 600)

Send spectra

To francoismathieu.teyssier at bbox.fr

File name : _chcygni_aaaammdd_hhh.fit
And _chcygni_aaaammdd_hhh.zip for eShel

ARAS Data Base for CH Cygni
http://www.astrosurf.com/aras/Aras_DataBase/Symbiotics/CHCyg.htm
See also former campaign :
www.astrosurf.com/aras/surveys/chcyg/index.html

CH Cygni campaign
Selected references

The Spectrum and Light Curve of CH Cygni during its Recent Broad Minimum
Wallerstein, George; Munari, U.; Siviero, A.; Dallaporta, S.; Dalmeri, I.
Publications of the Astronomical Society of the Pacific, Volume 122, issue 887, pp. 12-16
http://adsabs.harvard.edu/abs/2010PASP..122...12W

CH Cygni: new brightening in 2014
Rspaev, F.; Kondratyeva, L.; Aimuratov, E.
Information Bulletin on Variable Stars, 6117, 1
http://adsabs.harvard.edu/abs/2014IBVS.6117....1R

Reappearance of the optical flickering from the symbiotic star CH Cyg
Stoyanov, K.; Latev, G.; Nikolov, G.; Zamanov, R.; Sokoloski, J. L.
The Astronomer's Telegram, #6560
http://adsabs.harvard.edu/abs/2014ATel.6560....1S

Optical flickering from the symbiotic star CH Cygni is still missing
Stoyanov, K.; Zamanov, R.; Sokoloski, J. L.
The Astronomer's Telegram, #4316
http://adsabs.harvard.edu/abs/2012ATel.4316....1S

Cessation of optical flickering from the symbiotic star CH Cygni
Sokoloski, J. L.; Zamanov, R.; Stoyanov, K.; Bryson, S.; Still, M.
The Astronomer's Telegram, #2707
http://adsabs.harvard.edu/abs/2010ATel.2707....1S

First spatial resolution of the stellar components of the interacting binary CH Cygni
Mikołajewska, Joanna; Balega, Yuri; Hofmann, Karl-Heinz; Weigelt, Gerd
Monthly Notices of the Royal Astronomical Society: Letters, Volume 403, Issue 1, pp. L21-L25
http://adsabs.harvard.edu/abs/2010MNRAS.403L..21M

A Precessing Jet in the CH Cyg Symbiotic System
Karovska, Margarita; Gaetz, Terrance J.; Carilli, Christopher L.; Hack, Warren; Raymond, John C.; Lee, Nicholas P.
The Astrophysical Journal Letters, Volume 710, Issue 2, pp. L132-L136 (2010)
http://adsabs.harvard.edu/abs/2010ApJ...710L.132K

The Spectrum and Light Curve of CH Cygni during its Recent Broad Minimum
Wallerstein, George; Munari, U.; Siviero, A.; Dallaporta, S.; Dalmeri, I.
Publications of the Astronomical Society of the Pacific, Volume 122, issue 887, pp. 12-16
http://adsabs.harvard.edu/abs/2010PASP..122...12W

Spectroscopy of the symbiotic binary CH Cygni from 1996 to 2007
Burmeister, M.; Leedjärv, L.
Astronomy and Astrophysics, Volume 504, Issue 1, 2009, pp.171-180
http://adsabs.harvard.edu/abs/2009A%26A...504..171B

Spectral Features of the Symbiotic Variable Star CH Cygni in 2005 - 2006
Yoo, Kye Hwa; Yoon, Tae Seog
Journal of the Korean Astronomical Society, vol. 42, no. 4, pp. 93-103
http://adsabs.harvard.edu/abs/2009JKAS...42...93Y

CH Cygni. I. Observational Evidence for a Disk-Jet Connection
Sokoloski, J. L.; Kenyon, S. J.
The Astrophysical Journal, Volume 584, Issue 2, pp. 1021-1026
http://adsabs.harvard.edu/abs/2003ApJ...584.1021S

CH Cygni. II. Optical Flickering from an Unstable Disk
Sokoloski, J. L.; Kenyon, S. J.
The Astrophysical Journal, Volume 584, Issue 2, pp. 1027-1034
http://adsabs.harvard.edu/abs/2003ApJ...584.1027S

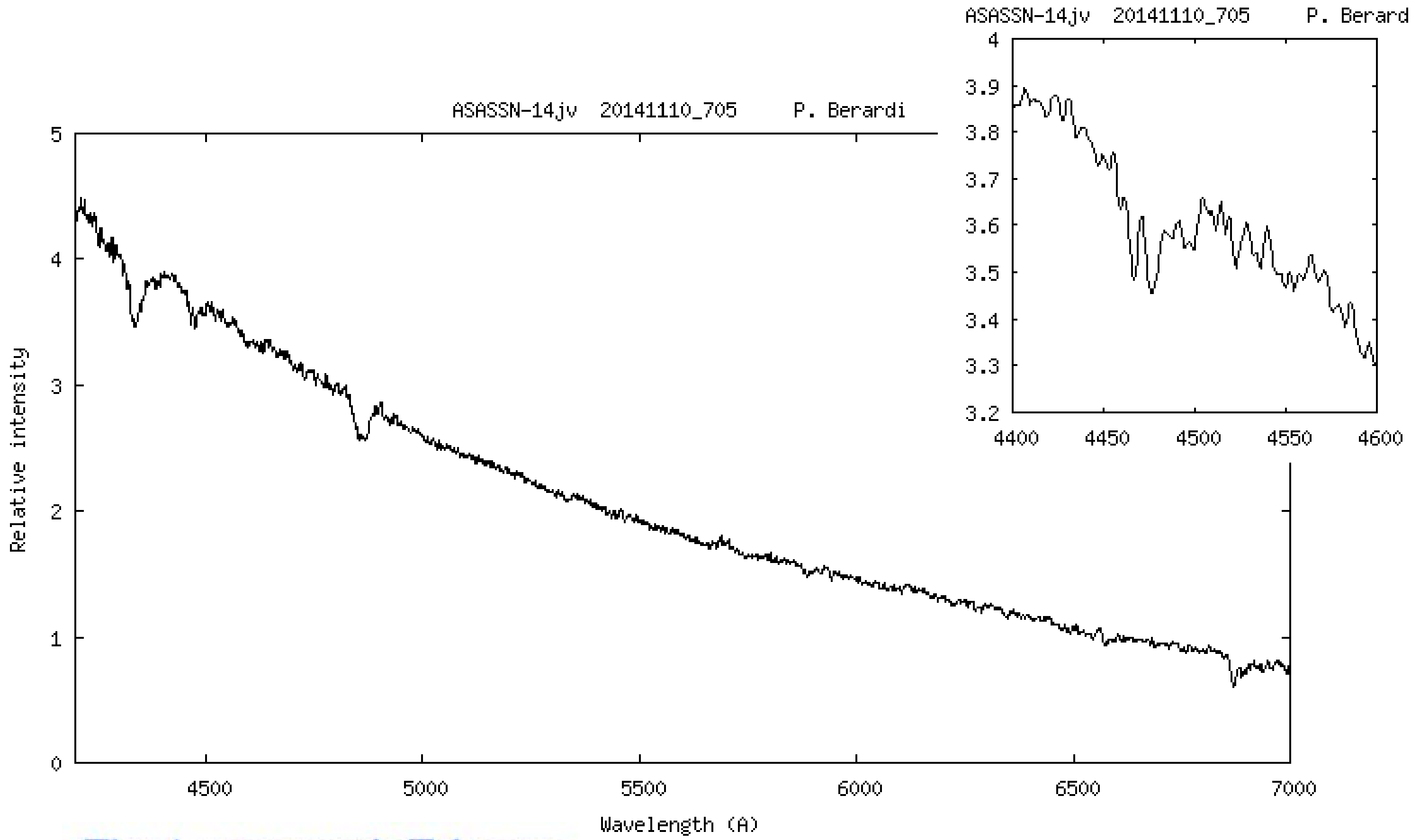
A New Outburst Stage of the Symbiotic Triple-Star System CH Cygni
Skopal, A.; Bode, M. F.; Eyers, S. P. S.; Errico, L.; Teodorani, M.; Vittone, A. A.; Elkin, V.; Crocker, M. M.; Davis, R. J.
in: T. Gull, S. Johanson and K. Davis (editors), 2000 - ASP Conference Series, Vol. 242, San Francisco, pp. 371-375.
http://adsabs.harvard.edu/abs/2001ASPC..242..371S

Eclipses in the symbiotic system CH CYG
Skopal, A.; Bode, M. F.; Lloyd, H. M.; Tamura, S.
Astronomy and Astrophysics, v.308, p.L9-L12
http://adsabs.harvard.edu/abs/1996A%26A...308L...9S

ASASSN-14jv identified as a cataclysmic in outburst by Paolo Berardi

Coordinates (2000.0)	
R.A.	18:53:28.87
Dec.	+42:03:43.59

ASASSN-14jv has been detected by ASASSN program on 9th, november at mag 11.3 (ATel #6676).
Paolo Berardi got a spectrum on Novenber 10.7, identifying the transcient as a ctaclysmic star in outburst (strong blue continuum, H alpha in narrow and faint emission, broad absorption for the other Balmer lines (with a very faint and narrow emission in H béta)
He I 4471 shows an emission in the broad absortion.



The Astronomer's Telegram

Spectroscopic classification of ASASSN-14jv as a cataclysmic variable in outburst

ATel #6684; *Paolo Berardi (ARAS)*
on 10 Nov 2014; 22:44 UT
Credential Certification: Krzysztof Stanek (stanek.32@osu.edu)

We report an optical spectrogram of ASASSN-14jv (ATel #6676, #6680), obtained on November 10.7 UT with a 23 cm Schmidt-Cassegrain telescope and Lhires III spectrograph configured for low-resolution (range 420-710 nm, resolution 1 nm). The strong blue continuum, a weak and narrow emission for H-alpha and other Balmer lines in broadened absorption suggest that the transient is a dwarf nova outburst.

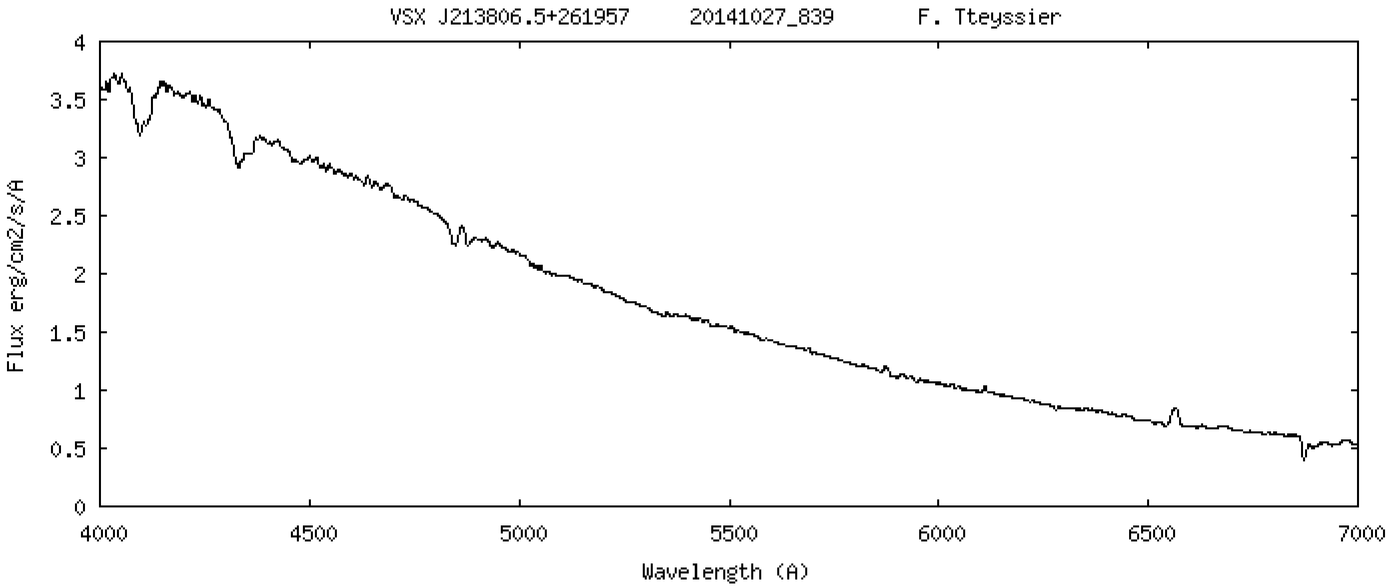
http://www.astronomerstelegram.org/?read=6684

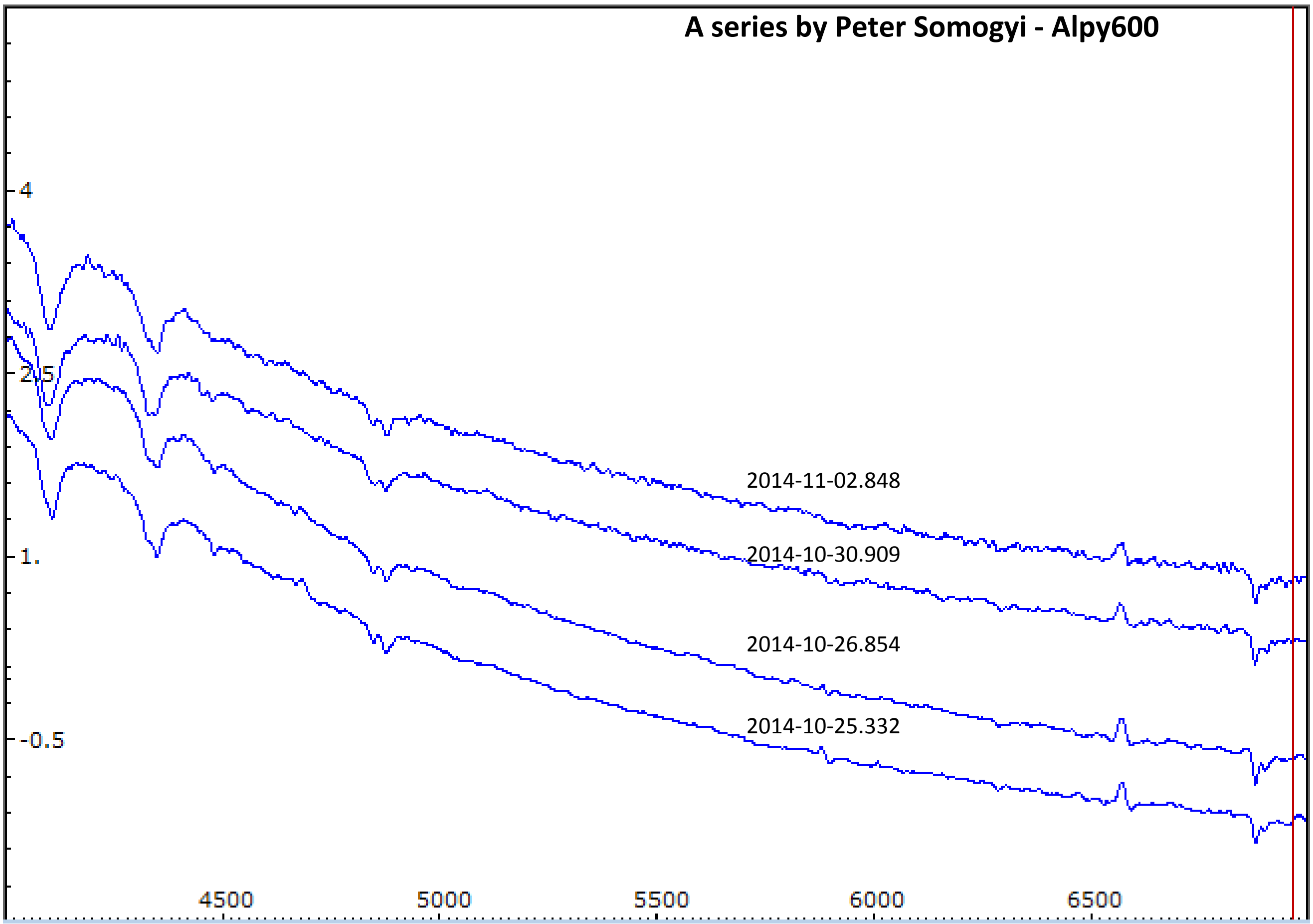
See also :
http://www.astronomerstelegram.org/?read=6676
http://www.astronomerstelegram.org/?read=6680

Coordinates (2000.0)	
R.A.	21 38 06.68
Dec.	+26 19 56.6

Carey Chiselbrook (Georgia, United States; AAVSO observer code CCY) observed the WZ Sge-type dwarf nova VSX J213806.5+261957 in outburst at a visual magnitude of 9.7 on 2014 October 22.0590 (JD 2456952.55903) by Carey Chiselbrook (Georgia, United States; AAVSO observer code CCY).

The first outburst was observed in May 2010 : the recurrence time is less than 5 years, notable among WZ Sge stars.





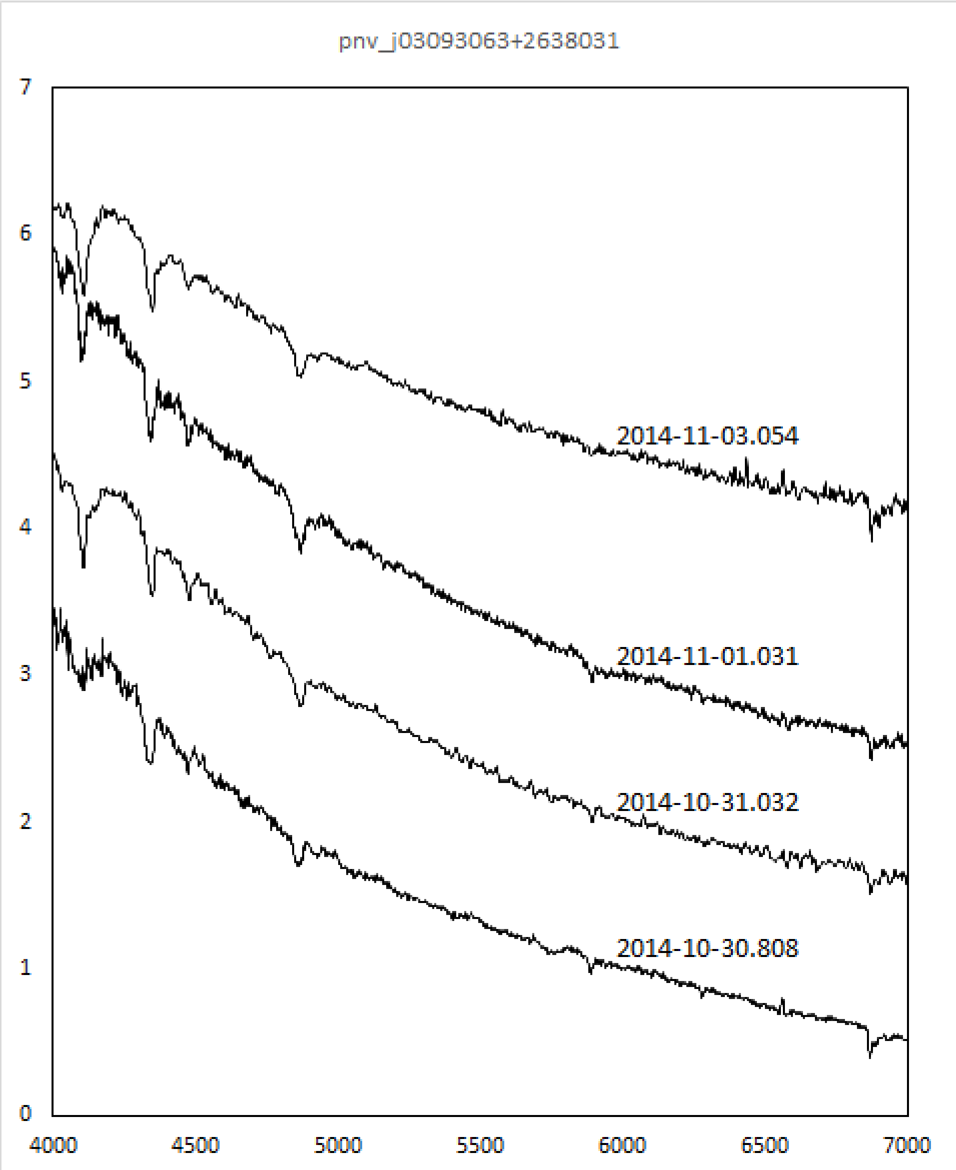
See also : http://www.aavso.org/aavso-special-notice-388

ARAS DATA BASE | http://www.astrosurf.com/aras/Aras_DataBase/DwarfNovae.htm

PNV 03093063+2638031

Coordinates (2000.0)	
R.A.	03 09 30.6
Dec.	+ 26 38 03.1

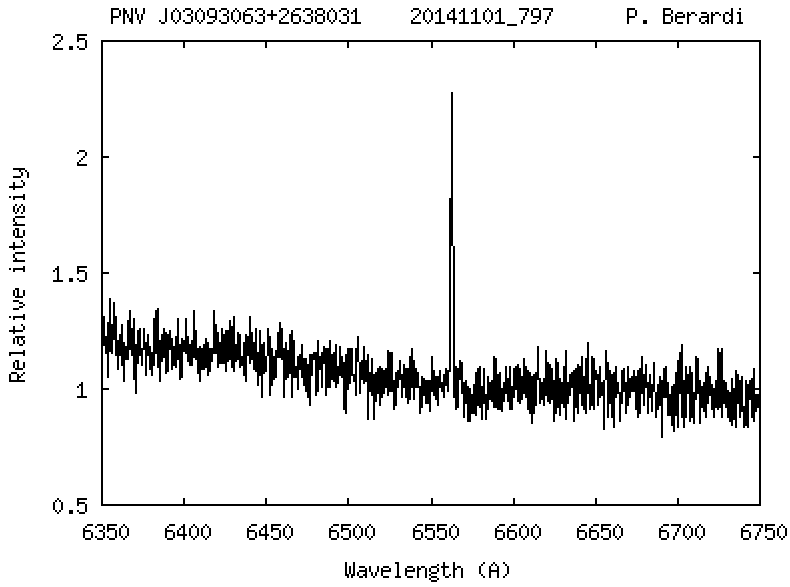
This PNV has been detected by S. Ueda (Japan) on October 29.630 at mag 11. Paolo Berardi identified this object as a cataclysmic in outburst with a spectrum obtained on October, 30.808 (Lhires III, 150 l/mm)

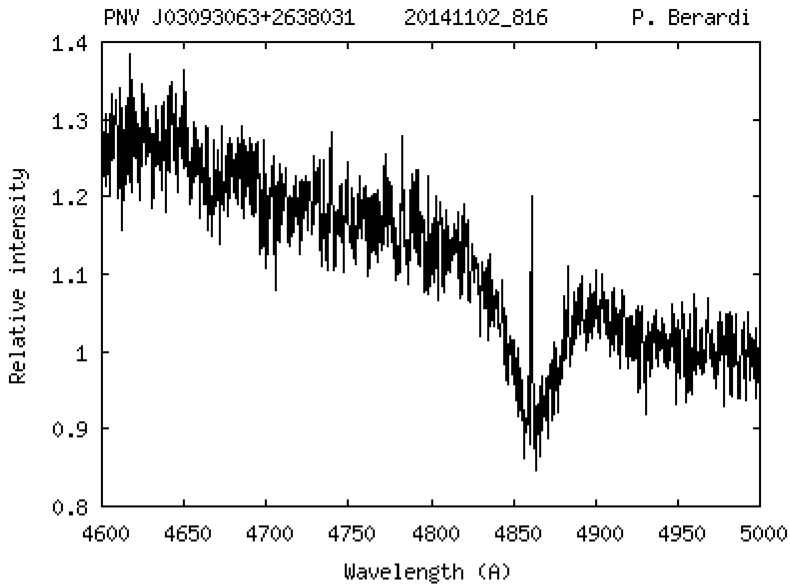


See : CBAT "Transient Object Followup Reports"
http://www.cbat.eps.harvard.edu/unconf/followups/J03093063+2638031.html

ARAS Observers : P. Berardi, F. Boubault, J. Montier, P. Somogyi

ARAS DATA BASE | http://www.astrosurf.com/aras/Aras_DataBase/DwarfNovae.htm





Ha and Hb lines at a resolution of ~ 6000 Paolo Berardi (Lhires III - 1200 l/mm)

The emission are very narrow : 55 km/s for Ha and 75 km/s for Hb, while the half

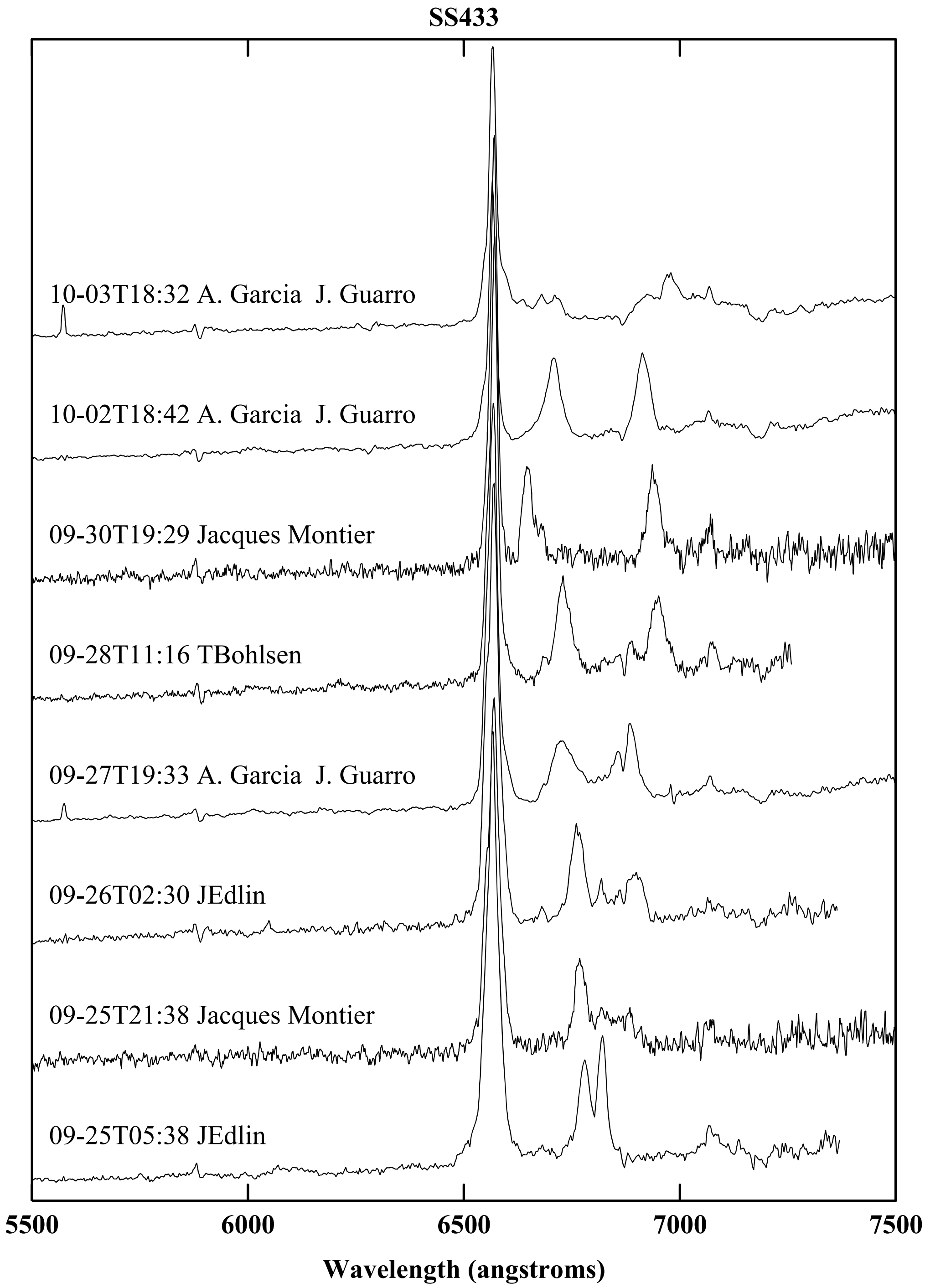
See : CBAT "Transient Object Followup Reports"
http://www.cbat.eps.harvard.edu/unconf/followups/J03093063+2638031.html

SS 433 (V1343 Aql) : a nearly daily coverage of SS 433 after its september flare

Compilation of spectra by Peter Somogyi

Coordinates (2000.0)	
R.A.	19 11 49.57
Dec.	+04 58 57.8

Mag V = 13.8 to 15.1
in oct./Nov. 2014

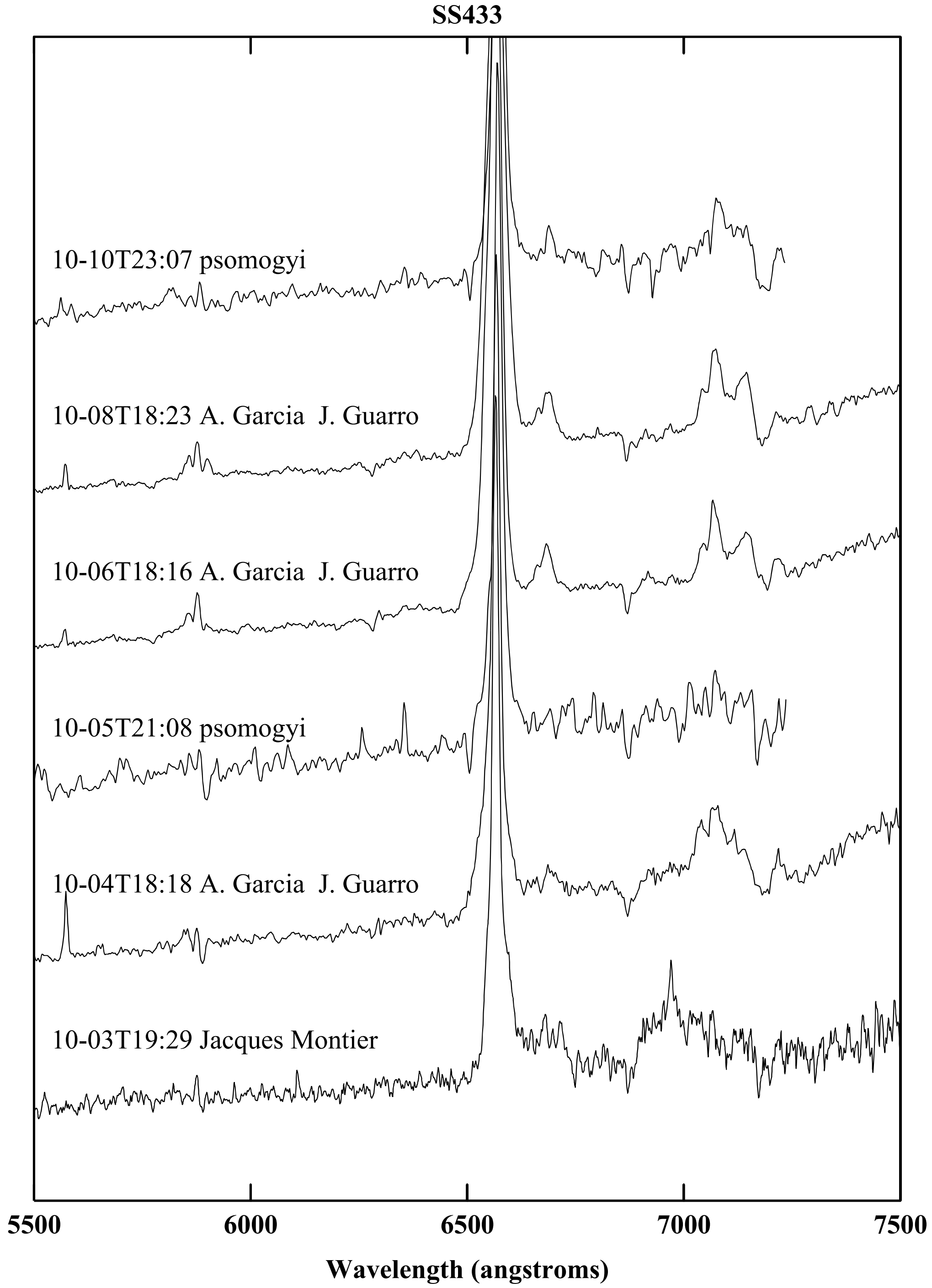


See ARAS Forum topic :http://www.spectro-aras.com/forum/viewtopic.php?f=5&t=875

ARAS DATA BASE | http://www.astrosurf.com/aras/Aras_DataBase/MicrosQuasars/SS443.htm

SS 433 (V1343 Aql) : a nearly daily coverage of SS 433 after its september flare

Compilation of spectra by Peter Somogyi



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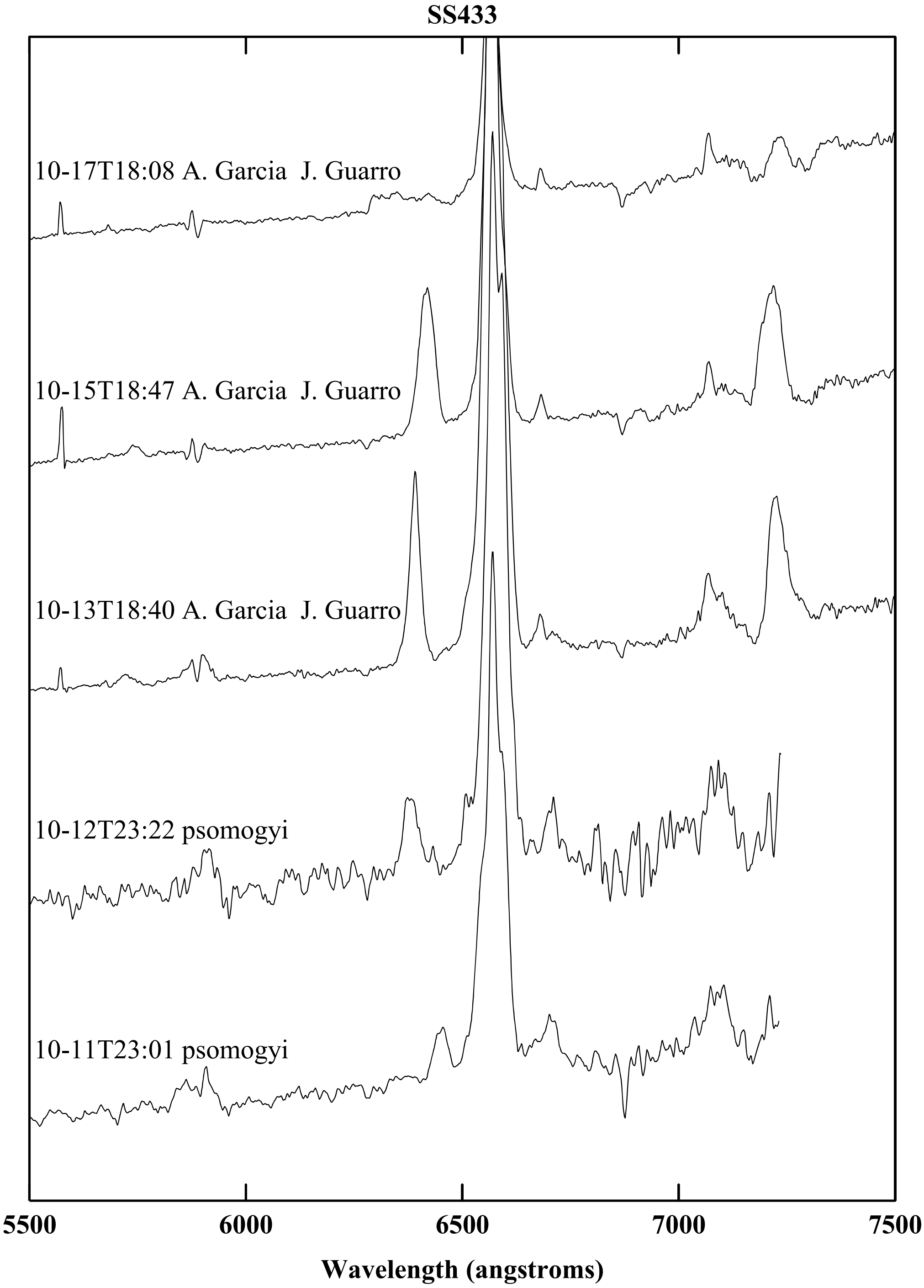

See ARAS Forum topic :http://www.spectro-aras.com/forum/viewtopic.php?f=5&t=875

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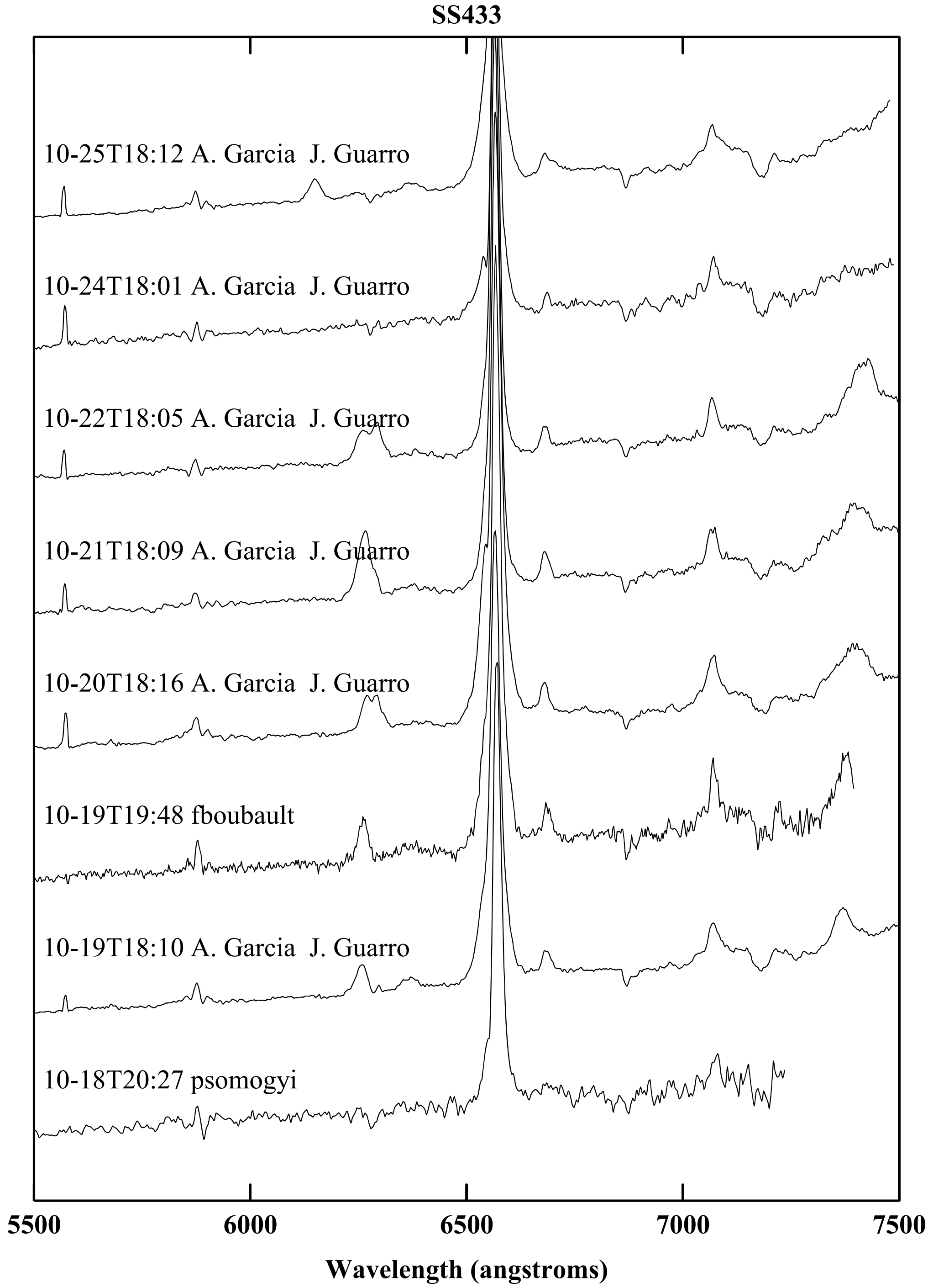

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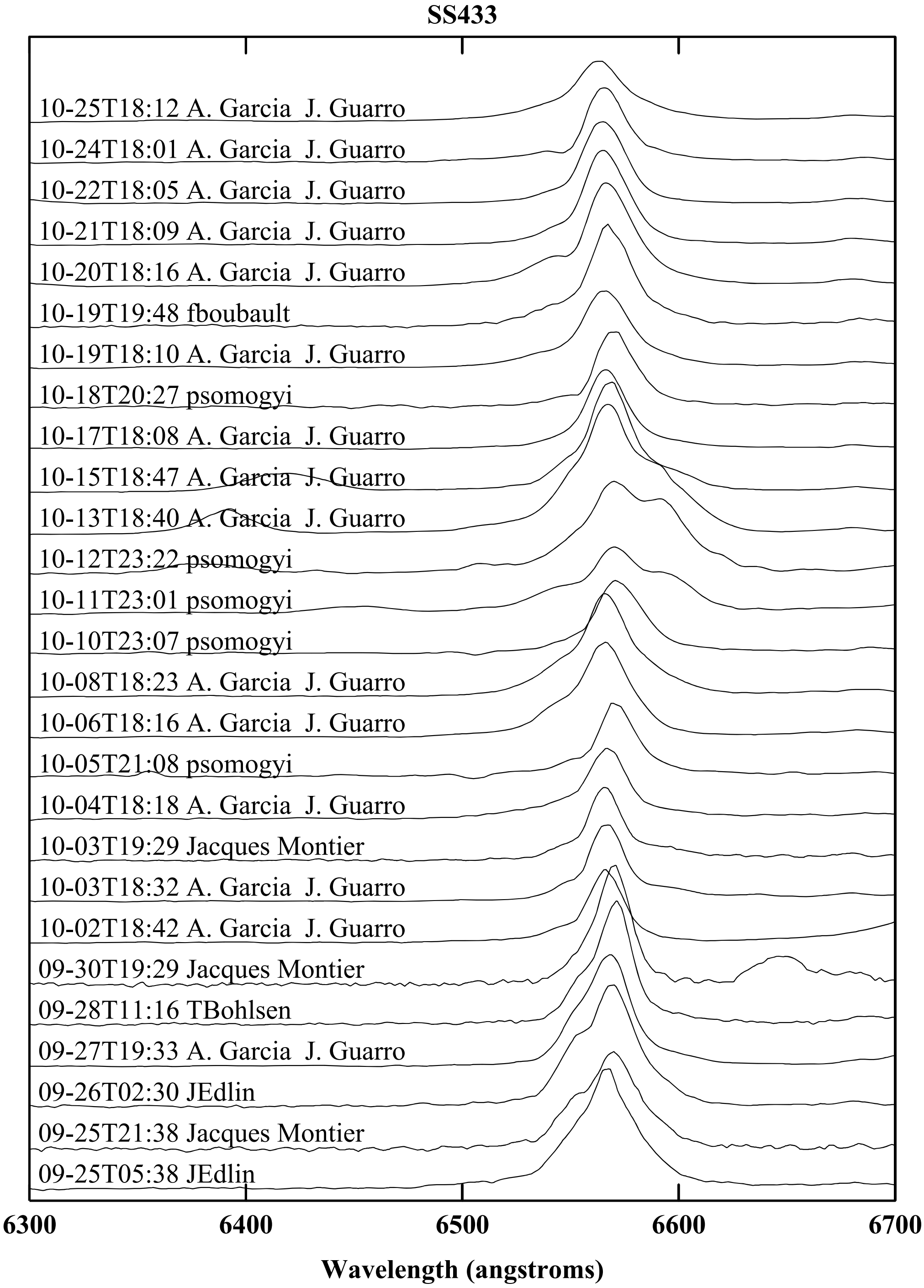


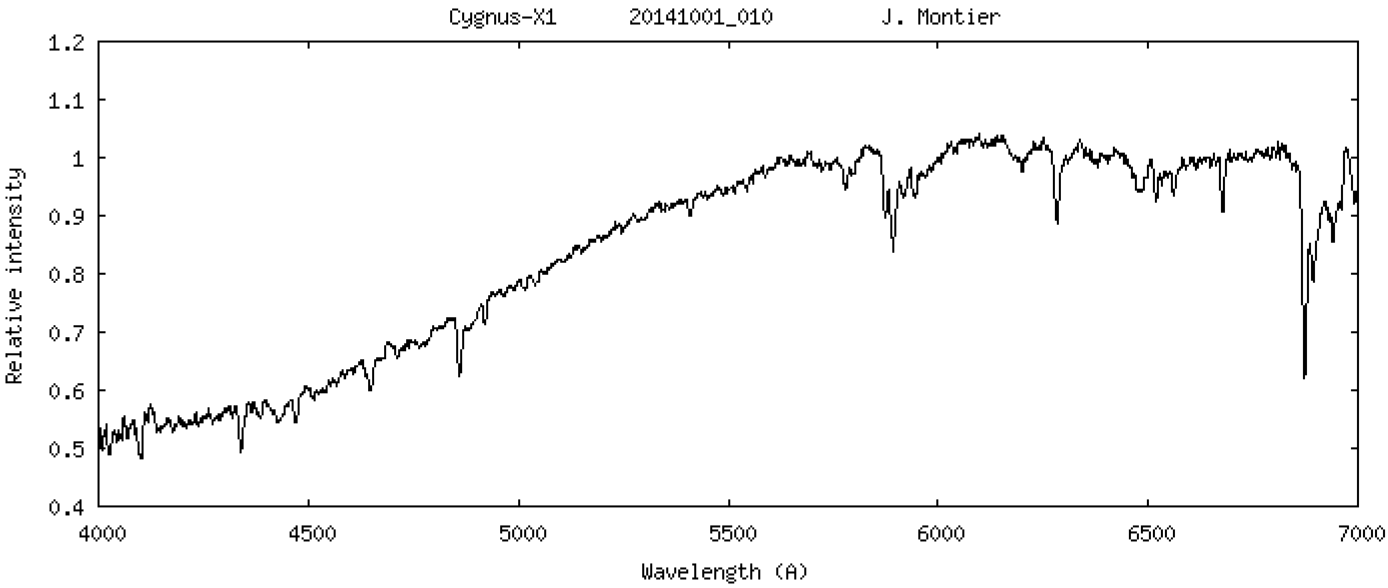
ARAS Observers : A. Garcia, J. Guarro, J. Montier, J. Edlin, P. Somogyi, F. Boubault, Terry Bolhsen

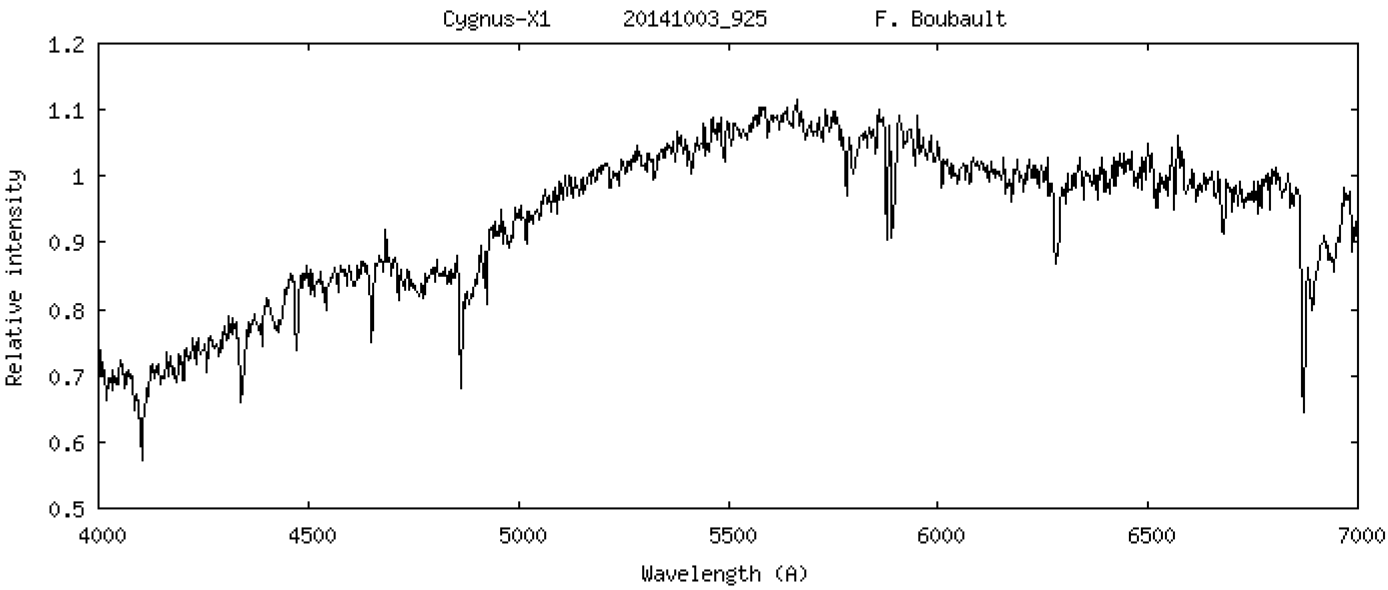
See ARAS Forum topic :http://www.spectro-aras.com/forum/viewtopic.php?f=5&t=875

ARAS DATA BASE | http://www.astrosurf.com/aras/Aras_DataBase/MicrosQuasars/SS443.htm

Coordinates (2000.0)	
R.A.	19 58 21.7
Dec.	+35 12 05.8

Mag V ~ 9





SS 433 = V1343 Aql: The prototypical Galactic jet source

Steve Shore

In the past year, many of you have been following a very particular source, SS 433, whose bizarre and fascinating behavior signals a range of unique physical processes, mainly linked to the relativistic jet outflows from the source. To place this work in context, I'll start with a bit of background and then we can jump to a discussion of the recent observations.

The source known as SS 433 was first identified as a spectroscopically anomalous star in a catalog by Sanduleak and Stephenson:

http://adsabs.harvard.edu/abs/1977ApJS...33..459S

of emission line objects found on objective prism plates. This isn't a formal catalog, rather it is the list of stars that had not been included in the Luminous Stars survey and the previous CWRU/Warner and Swasey Obs. catalogs of emission line stars. The remark is important -- ``He I 6678 emission?'' -- because the line is *not* normally visible at such low resolution (the plates were designed to find mainly Balmer emission lines so with R ~ 200 (in older catalogs, using photographic plates, the dispersions are cited as Å/mm and the plate grains gave a resolution element of about 50 μm). Although there were other observations noted in the catalog footnotes, there's no mention of any variability in either the lines or the photometry (although the other plates should have been objective prism as well).
The star first came to anyone's attention with its identification with a variable radio source in the supernova remnant (SNR) W50

http://www.cbat.eps.harvard.edu/iauc/03200/03256.html

(an indication of how few deep catalogs existed in the late '70s) and it was given the name SS 433, which has stuck (although its real name is V1343 Aql from the GCVS). The follow-up Xray observations not only confirmed the high energy aspect of the source but added to the picture that this was not a pulsar or a normal X-ray binary:

http://www.cbat.eps.harvard.edu/iauc/03300/03314.html\#Item2

The observations of the spectrum, still in the photographic era, were difficult and produced some weird line identifications, although it was clear that it didn't fit into any standard categories. The breakthrough came with the discovery of the moving lines,

http://adsabs.harvard.edu/abs/1979ApJ...230L..41M

and the identification of the source in a supernova remnant

http://adsabs.harvard.edu/abs/1978Natur.276...44C

Now the main issue is that to find a point-like source in a SNR, even so long ago, wasn't unexpected - the pulsars in Vela and the Crab were already known - but this one showed an effect that couldn't otherwise be explained. The moving lines span over 30,000 km.s-1 when followed over years and are *periodic* in their displacement over 164 days.
The star was quickly shown to also be a spectroscopic binary with a period of about 13 days, similar to Cyg X-1 that was already well known to have a black hole source and high energy phenomena (e.g. XRs, radio emission). But that is in a binary with an O star while SS 433 looks like it's paired with a much more evolved companion.

The moving lines are explained as jets, with mildly relativistic velocities of about 0.26c. Mildly is a strange word, I know, since there are very few sources known that have such high *observed* speeds (others can be inferred from superluminal motions of emission knots, for example in quasars and blazars) but here it was an optical Balmer line measurement. That is its importance for our discussions.
This is the *only* known relativistic outflow that is so tightly collimated -- as determined from the emission line profiles -- and so well constrained in velocity -- since these are emission lines of a trivially familiar ion -- that there is no dynamical ambiguity in interpreting its structure. Let me expand on this. If a flow is launched from a central source and is completely ionized, as we see in radio galaxies, the only emission (aside from thermal bremsstrahlung, which is continuum emission from a fully ionized medium) is synchrotron. To see that in the optical requires moderate magnetic fields and very (!!) high energy electrons, like those in the Crab nebula. The synchrotron emission comes from electrons spiraling in the magnetic field as they advect (flow

outward, in this case) and the beaming produces an enhancement in the brightness of the source and strong polarization. The spectrum is a power law because the electron energy distribution is like that of cosmic rays, for which the low energy end is at a few MeV and the high energy end is above TeV energies. Clearly, this can't be thermal. But in this source, SS 433, the emission from the jets is in lines. These are primarily optically thin although there are several components, and that requires some energization mechanism. Either the ionization is from the launching site or it is maintained by radiation from the central object. We'll return to this in a moment.

At its most basic level, the spectrum of SS 433 shows two sets of lines: essentially stationary and moving. Those of the first type are associated with the binary itself, the accetion disk and the binary motion. There's been a push to identify a third component, a circumbinary disk, with a line component that remains stationary relative to the center of mass of the binary; more on this in a moment.
The binary motion is not clean, and that is an important issue for the picture. These the most complete studies I know of the binary properties:

http://adsabs.harvard.edu/abs/2008ApJ...676L..37H
http://adsabs.harvard.edu/abs/2010ApJ...709.1374K

that show the *absorption* spectrum of the mass losing star. The second reference is particularly useful for the discussion of the mass determinations based on the velocity curves. The key to the masses is the mass function, given by the period and radial velocity amplitude.
This just follows from Kepler's law but, in the absence of eclipses (as here), the mass ratio is the only way to determine the individual values (since that gives the ratio of the center of mass distance of each component, hence its mass). This is the ambiguous part of the picture and why there is -- after 30 years! - still a debate about whether the gainer can be a massive neutron star or is clearly a stellar mass black home.

It's been known for some time that the spectrum is not that of either a Wolf-Rayet star (as earlier thought and is true for a few systems) nor an O star. A number of Be-XR binaries, those that have Be star like characteristics according to some spectra and also strong, hard XR emission, seem to be mainly wind accreters (and some are also very high energy sources, e.g. LSI +61°303 or LS 5039 (by the way, the LS is ``Luminous Stars in the Milky Way'' for which some plates furnished the spectrum of SS 433). This is also why the system is so important.
Here we see a clean pair of jets emerging from the central object and there are direct correlations between the flares of the central source (in He II 4686 Å knot of radio emission. The jets show a corkscrew structure projected against the plane of the sky, one that agrees with a jet whose direction is fixed in some axisymmetric frame that is inclined to the line of sight (in three dimensions) and which precesses about that fixed direction on the 162 day period. The jet itself isn't emitting all the time but it is dynamically stable. It's also very ``rigid'' in maintaining its outflow direction without distorting while wobbling (precessing). *If* SS 433 is a neutron star, as in the Crab nebula, then the absence of a pulsar wind nebula would be explained by the dense accretion-induced environment. That would connect the jet with what's seen in the Crab (the XR and optical imaging of the central wind-jet). And a massive neutron star will have a radius quite close to a stellar mass black hole, although the latter would clearly be more massive. The available mechanical energy (and electromagnetic flux) to drive a relativistic outflow *and* collimate it is not very different between the two.

The core issue in, then, how does the jet form and launch? In this sense, SS 433 and the related black hole accreters are thought to be miniature analogs of the central engines in quasars and other active galactic nuclei. In one sense that's not a bad point: once near the Schwarzschild radius (a small multiple of which is the inner boundary for a stable orbit in general relativity) the amount of energy released by fall is the same whether a $10^9 M_\odot$ BH or one of stellar dimensions. And if you're in a binary system there's a feeder, a companion. In SS 433, this probably fills its Roche surface (although without being able to see eclipses it is almost impossible to tell that) and with an obviously evolved star (if the spectrum is right) or, at least, one so optically think, there's no obvious single photospheric temperature that gives the radius. The distance, ~ 5.5 kpc, is debatable without some parallax (this should be one of the results to come out of Gaia if everything works right, the geometric parallax and proper motions) but with that the source should be emitting near its Eddington limit to obtain such a high rate of mass loss by the jet. The picture of a jet driven outward from the center of an accretion disk by either radiation pressure or magnetic acceleration (called Poynting flux but actually just the electromagnetic momentum flux due to a wound up magnetic field in the inner disk). If it's radiation, the inner disk `funnel'' is a sort of hose created by the inner disk boundary zone. To explain, because this is a generic result, the innermost disk region around a relativistic object is extremely thin and the region surrounding it, further out, is puffed by by the difference in the equations of state when the density and temperature change. So the inner disk is a sort of plane while the outer one is more like a classical cataclysmic disk. There are different problems related to the corona and outer rim of the disk itself, but the essence is that the high luminosity of the inner region coupled with the scattering at the inner ``eyewall'' (like a hurricane) produces an outflow hat, depending on the luminosity (hence the mass accetion rate) reaches relativistic speeds to attain the escape velocity. This produces a highly ionized, collimated jet that streams away with small divergence from the center. But for the thermal component, why we see the Balmer and helium lines attached to the jet, that's a separate question that isn't well addressed in any (!) Current studies. Some of this is obviously entrained from the environment, from the wind around the companion, for instance, but how isn't understood. There's X-ray emission from the central source that modulates on the orbital timescale but this is also an indication of shocks in the nner jet. The jet never seems to turn off, nor do the emission lines, but they vary enormously in strength even over hours.

Keep in mind, though, that on timescales of days the two sizes of the jet are decoupled so any correlations must come from the central engine fluctuating (a tailpipe on a car that doesn't run well).

If there's no jet (and it's really marginal for some sources, e.g. V404 Cyg and Cyg X-1) this doesn't mean there's no outflow, just that it's not seen. Even period changes don't help here, those could/can be from mass loss in general. The other peculiarity of the SS 433 jet, like the disk in HZ Her = Her X-1, is its precession. That can *only* happen for a mis-alignment of something related to spin angular momentum, like spin angular momentum (!), and the orbital angular momentum (real, the two poles aren't alighed) *or* that the disk is not aligned and everything else is (that there's a waggle of the stream or a change in the accretion rate systematically, or whatever you can think of yourselves). In HZ Her, the neutron star has a distortion due to the magnetic field that may produce disk precession. At any rate, any system that's not aligned in all angular momenta will precess, in general relativity or classical (it's just that there's a natural version of free precession in GRT that is known as Lens-Thirring, a sort of relativistic component of the tidal acceleration in a binary).

The variability of the radio is on timescales of days or weeks, the same with the sequences you have for the jet and central source.

Looking at these one is struck by the rapidity of the changes, these must involve regions no more about $10^4 R_\odot$, which is really very small (about the same as the orbital radius in a symbiotic system like V407 Cyg or a very long period).

One thing, as a theorist: the timing of the discovery of the radio jets and the moving lines couldn't have been better for theory. The Blandford-Rees mechanism, the explanation of double lobed radio sources (those with cores and companion emission regions) had appeared in 1974 (MNRAS) and was being hotly debated. It requires jets to emerge from the central region but without a clear driving mechanism. What you're seeing -- on short timescales and manageable velocities and lines – is the same process on the stellar scale. In principle, the emission lines (those from the disk and from the jet) permit the timing and dynamics (and, perhaps, even the mass ejection rate) to be determined over time. This is a wonderful prospect, the one chance to see what the process is ike deep down. When you work on hour timescales you're seeing things from the disk (and the launch site) and nothing of the environment.

History repeats itself with the extragalactic ``ultra-luminous'' X-ray source NGC 5408 X-1:

http://adsabs.harvard.edu/abs/2003Sci...299..365K
http://adsabs.harvard.edu/abs/2010ApJ...725.2480F
http://adsabs.harvard.edu/abs/2013MNRAS.435.2896C

and a wonderful survey paper of the ULX binaries in general:

http://adsabs.harvard.edu/abs/2013ApJS..206...14G
(http://arxiv.org/abs/1303.1213)

Steve Shore
30-11-2014

One suggestion: please always plot the profiles *only* in velocity and also use the plots to show the comparative profiles of He II 4686, He I 5876, 6678, 7065, and Hα and Hβ whenever you can.

The wavelengths are misleading since the lines are formed by relativistic flows. It would also be interesting to see how the line profiles change as they alter in line of sight, and also as they move outward from the center on short times-cales (the real dynamics of the ejection). It is important, I think, to NOT try fitting the profiles, but instead note the velocity ranges in which there are changes.

Forget about gaussians, that's for desperate people. Work in velocity slices (say every 100 km/s or so) to get an idea of how the profile is actually varying -- and how with time on the different components and species.

Novae

The expanding fireball of Nova Delphini 2013
G. H. Schaefer, T. ten Brummelaar, D. R. Gies, C. D. Farrington, B. Kloppenborg, O. Chesneau, J. D. Monnier, S. T. Ridgway, N. Scott, I. Tallon-Bosc, H. A. McAlister, T. Boyajian, V. Maestro, D. Mourard, A. Meilland, N. Nardetto, P. Stee, J. Sturmann, N. Vargas, F. Baron, M. Ireland, E. K. Baines, X. Che, J. Jones, N. D. Richardson, R. M. Roettenbacher, L. Sturmann, N. H. Turner, P. Tuthill, G. van Belle, K. von Braun, R. T. Zavala, D. P. K. Banerjee, N. M. Ashok, V. Joshi, J. Becker & P. S. Muirhead
Nature 515, 234–236 (13 November 2014)
http://www.nature.com/nature/journal/v515/n7526/full/nature13834.html

Binary orbits as the driver of gamma-ray emission and mass ejection in classical novae
Laura Chomiuk, Justin D. Linford, Jun Yang, T. J. O'Brien, Zsolt Paragi, Amy J. Mioduszewski, R. J. Beswick, C. C. Cheung, Koji Mukai, Thomas Nelson, Valerio A. R. M. Ribeiro, Michael P. Rupen, J. L. Sokoloski, Jennifer Weston, Yong Zheng, Michael F. Bode, Stewart Eyres, Nirupam Roy, Gregory B. Taylor
Nature, Volume 514, Issue 7522, pp. 339-342 (2014)
http://arxiv.org/abs/1410.3473

A Light Curve Analysis of Classical Novae: Free-free Emission vs. Photospheric Emission
Izumi Hachisu (Univ. of Tokyo), Mariko Kato (Keio Univ.)
http://arxiv.org/pdf/1410.7888.pdf

Binary orbits as the driver of gamma-ray emission and mass ejection in classical novae
Laura Chomiuk, Justin D. Linford, Jun Yang, T. J. O'Brien, Zsolt Paragi, Amy J. Mioduszewski, R. J. Beswick, C. C. Cheung, Koji Mukai, Thomas Nelson, Valerio A. R. M. Ribeiro, Michael P. Rupen, J. L. Sokoloski, Jennifer Weston, Yong Zheng, Michael F. Bode, Stewart Eyres, Nirupam Roy, Gregory B. Taylor
http://arxiv.org/pdf/1410.3473.pdf

Pre-outburst Chandra Observations of the Recurrent Nova T Pyxidis
Solen Balman (METU)
http://arxiv.org/pdf/1410.2758.pdf

Outburst-related Period Changes of Recurrent Nova CI Aquilae
Wilson, R. E.; Honeycutt, R. K.
The Astrophysical Journal, Volume 795, Issue 1, article id. 8, 6 pp. (2014)
http://adsabs.harvard.edu/abs/2014ApJ...795....8W

Cataclysmics

Optical Dual-Band Photometry and Spectroscopy of the WZ Sge-Type Dwarf Nova EZ Lyn during the 2010 Superoutburst
Mizuki Isogai, Akira Arai, Atsunori Yonehara, Hideyo Kawakita, Makoto Uemura, Daisaku Nogami
http://arxiv.org/pdf/1410.5822.pdf

Symbiotics

Wind mass transfer in S-type symbiotic binaries I. Focusing by the wind compression model
Augustin Skopal, Zuzana Carikova
http://arxiv.org/pdf/1410.7674.pdf

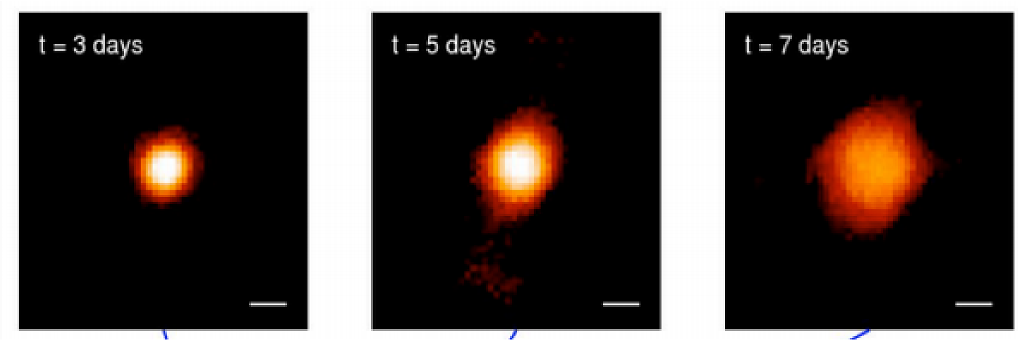
Chemical abundance analysis of symbiotic giants - II. AE Ara, BX Mon, KX Tra, and CL Sco
Cezary Galan, Joanna Mikolajewska, Kenneth H. Hinkle
http://arxiv.org/pdf/1410.2760.pdf

Supernovae

Standardization of type Ia supernovae
Rodrigo C. V. Coelho, Maurício O. Calvão, Ribamar R. R. Reis, Beatriz B. Siffert
http://arxiv.org/pdf/1411.3596.pdf

The expanding fireball of Nova Delphini 2013

G. H. Schaefer & al.
Nature 515, 234–236 (13 November 2014)
http://www.nature.com/nature/journal/v515/n7526/full/nature13834.html

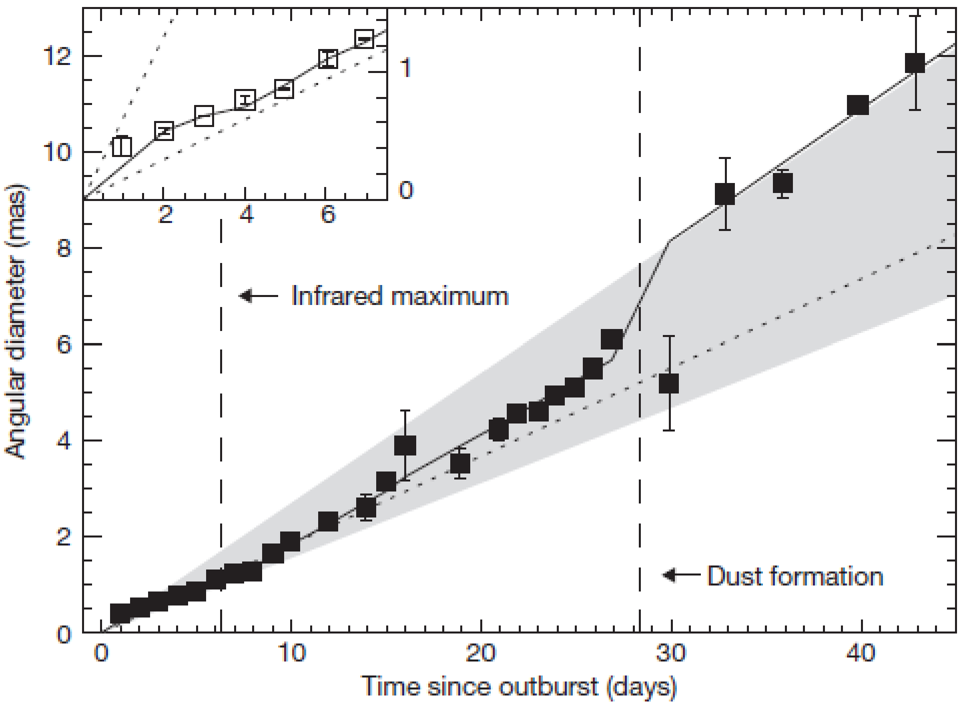


The “image” of the outburst showing a bright core surrounded by a less luminous ring
The ejecta is slightly elliptic

For the first time, CHARA (near IR interferometric observation from 6 telescopes) resolved the expanding fireball from a nova in the first days of the outburst.
The analysis used ARAS observations.

About CHARA:
http://www.chara.gsu.edu/

Animation of Fireball expansion : http://www.chara.gsu.edu/NovaDelMovie.gif



Extract from the publication

The angular diameters were measured by fitting a circular disk to the interferometric data. The dotted line shows a linear fit for days 0–27. The inset panel zooms in during the first week and shows dotted lines with velocities of 613 km/s and 2,500 km/s at a distance of 4.54 kpc. The apparent deceleration during the first week, along with the jump in size during the last week, can be explained by a two-component model consisting of a circular core surrounded by a ring where the flux ratio changes over time. The grey region shows the expansion rate of the core (lower edge) and the ring (upper edge).

About the usefullness of ARAS observations gathered in the database
Acknowledgments of the authors to ARAS

"We downloaded six spectra with a high resolving power (R = 10,000) obtained over the first week by O. Garde from the archive of the Astronomical Ring for Access to Spectroscopy and transformed them to a unit continuum on a heliocentric wavelength grid"

“These changes are consistent with the spectral evolution of Nova Del 2013 (see http://www.astrosurf.com/aras/novae/Nova2013Del.html)”

From the archive of the Astronomical Ring for Access to Spectroscopy, we estimated the outflow speed near the continuum-forming layer to be $V_{ejection}$ 613 +/- 79km/s. Combining this velocity with the angular expansion rate, we derived a distance of 4.54 +/- 0.59 kpc to Nova Del 2013.

"We acknowledge the variable star observations from the AAVSO International Database contributed by observers worldwide and used in this research. We thank O. Garde and other members of the Astronomical Ring for Access to Spectroscopy for use of their archive of Nova Del 2013 spectra. "

About ARAS initiative

Astronomical Ring for Access to Spectroscopy (ARAS) is an informal group of volunteers who aim to promote cooperation between professional and amateur astronomers in the field of spectroscopy.

To this end, ARAS has prepared the following roadmap:

• Identify centers of interest for spectroscopic observation which could lead to useful, effective and motivating cooperation between professional and amateur astronomers.
• Help develop the tools required to transform this cooperation into action (i.e. by publishing spectrograph building plans, organizing group purchasing to reduce costs, developing and validating observation protocols, managing a data base, identifying available resources in professional observatories (hardware, observation time), etc.
•Develop an awareness and education policy for amateur astronomers through training sessions, the organization of pro/am seminars, by publishing documents (web pages), managing a forum, etc.
• Encourage observers to use the spectrographs available in mission observatories and promote collaboration between experts, particularly variable star experts.
• Create a global observation network.

By decoding what light says to us, spectroscopy is the most productive field in astronomy. It is now entering the amateur world, enabling amateurs to open the doors of astrophysics. Why not join us and be one of the pioneers!

Be Newsletter for October

Previous issues :
http://www.astrosurf.com/aras/surveys/beactu/index.htm

Searching for new Be Stars

Andrew Smith and Thierry Lemoult
http://www.spectro-aras.com/forum/viewforum.php?f=32

New ARAS Page
http://www.astrosurf.com/aras/be_candidate/auto-be-candidate.html

Contribution to ARAS data base

From 01-10 to 30-11-2014

P. Berardi
T. Bohlsen
F. Boubault
D. Boyd
C. Buil
J. Edlin
J. Jacquinot
A. Garcia
J. Guarro
T. Lester
J. Montier
P. Somogyi
F. Teyssier

Submit your spectra

Please :
- respect the procedure
- check your spectra BEFORE sending them
Resolution should be at least R = 500
For new transcients, supernovae and poorly observed objects,
SA spectra at R = 100 are welcomed

1/ reduce your data into BeSS file format
2/ name your file with: _novadel2013_yyyymmdd_hhh_Observer
novadel2013: name of the nova, fixed for this object

Exemple: _chcyg_20130802_886_toto.fit

3/ send you spectra to
Novae, Symbiotics : François Teyssier
Supernovae : Christian Buil
to be included in the ARAS database

Further information :
Email francoismathieu.teyssier at bbox.fr

Download previous issues :
http://www.astrosurf.com/aras/novae/InformationLetter/InformationLetter.html