Eruptive stars spectroscopy
Cataclysmics, Symbiotics, Novae, Supernovae

ARAS Eruptive Stars
Information letter n° 16 #2015-04 08-05-2015
Observations of April 2015

Observing
Nova Sgr 2015B

The light curve continues to bounce around but this is still not unusual (just better covered) but if dust forms we're nearly at the critical stage and if there is no dust formation we will have learned a great deal! Even at the risk of losing some sleep, this is an important stage to follow (i.e. during this month).

Steve

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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

Authors :
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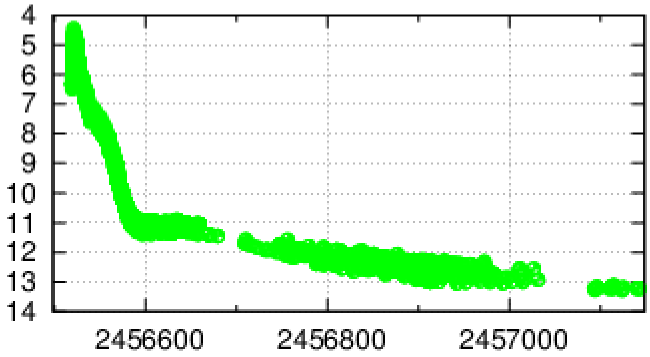
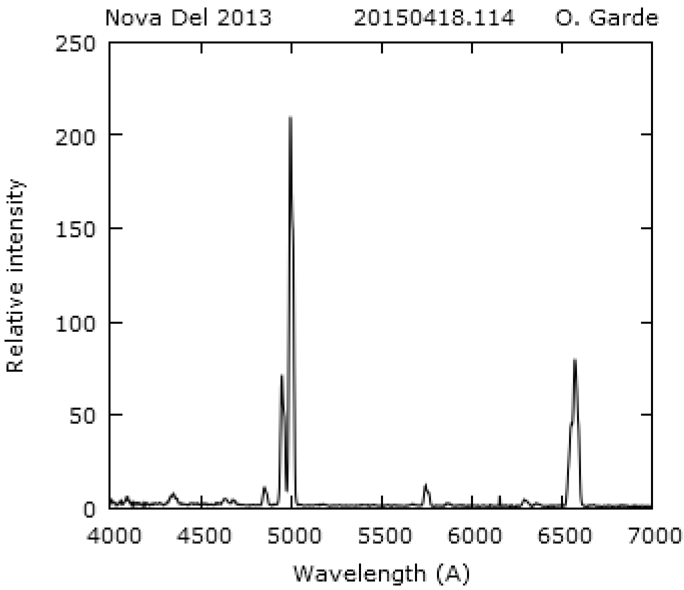
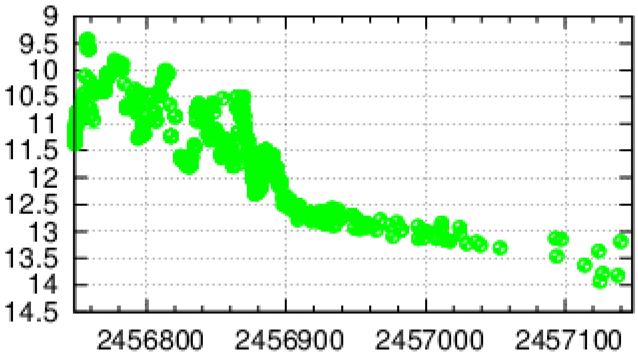
Status of current novae 1/2

Nova Del 2013	V339 Del
Maximum	14-08-2013
Days after maximum	594
Current mag V	13.2
Delta mag V	8.8

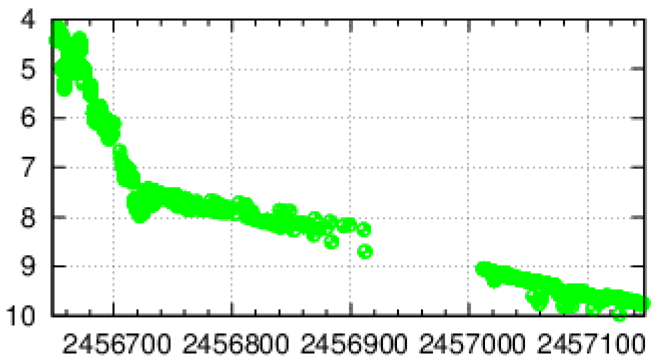




Nova Cyg 2014	V2659 Del
Maximum	09-04-2014
Days after maximum	356
Current mag V	13.5
Delta mag V	4.4



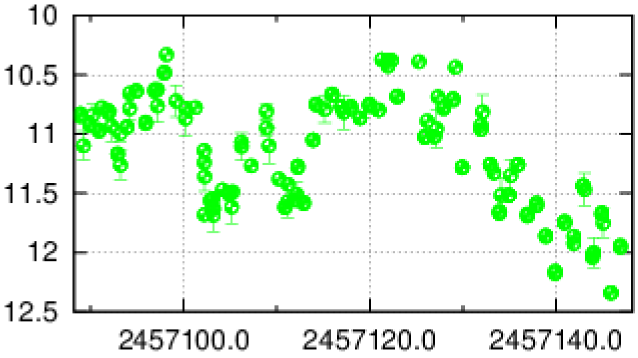
Nova Cen 2013	V1369 Cen
Maximum	14-12-2013
Days after maximum	472
Current mag V	9.8
Delta mag V	6.3



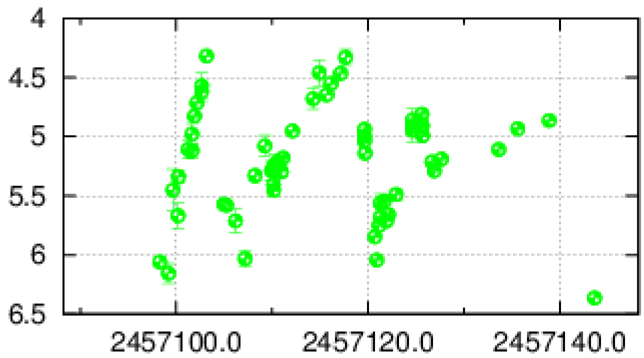
ARAS DATA BASE : http://www.astrosurf.com/aras/Aras_DataBase/Novae.htm

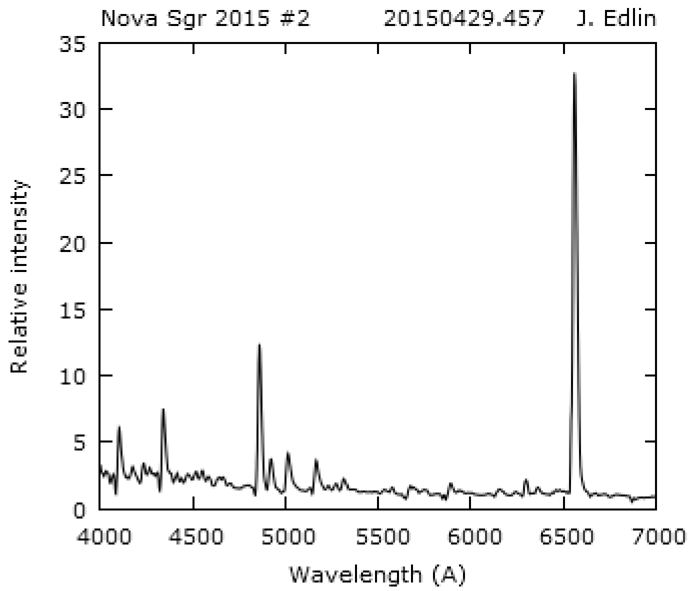
Status of current novae 2/2

NovaSgr 2015	
Maximum	15-02-2015
Days after maximum	44
Current mag V	10.9
Delta mag V	1.6

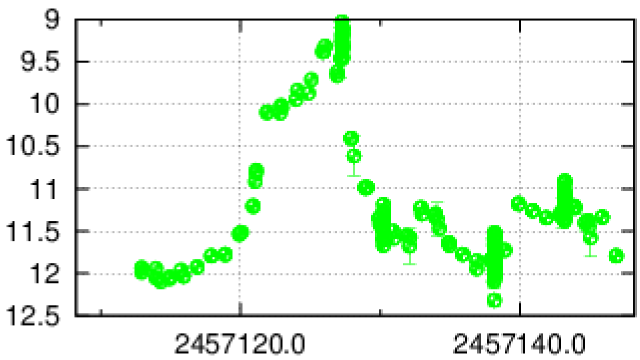


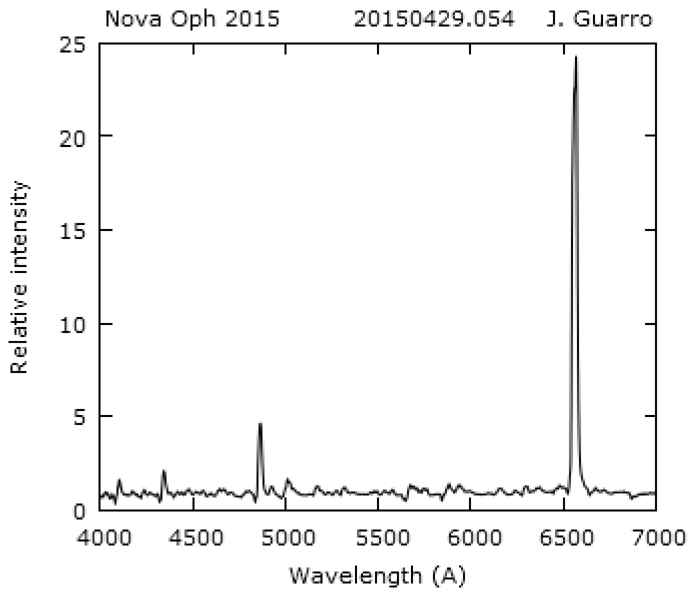
NovaSgr 2015 #2	
Maximum	21-03-2015
Days after maximum	10
Current mag V	5
Delta mag V	0.5





Nova Oph 2015	
Maximum	01-04-2015
Days after maximum	
Current mag V	
Delta mag V	



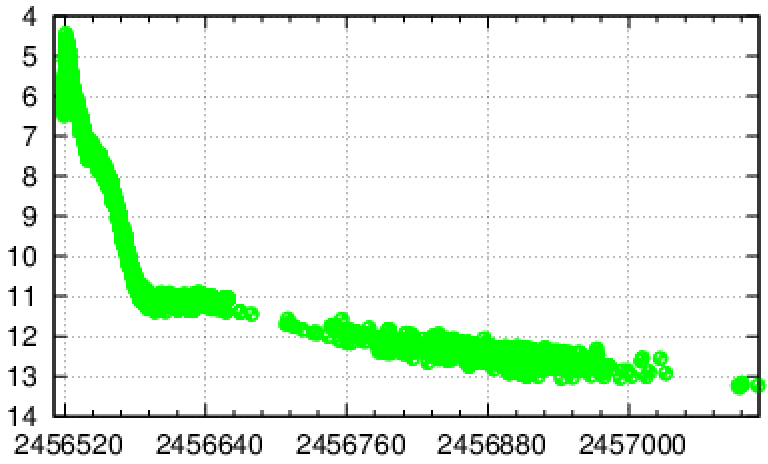


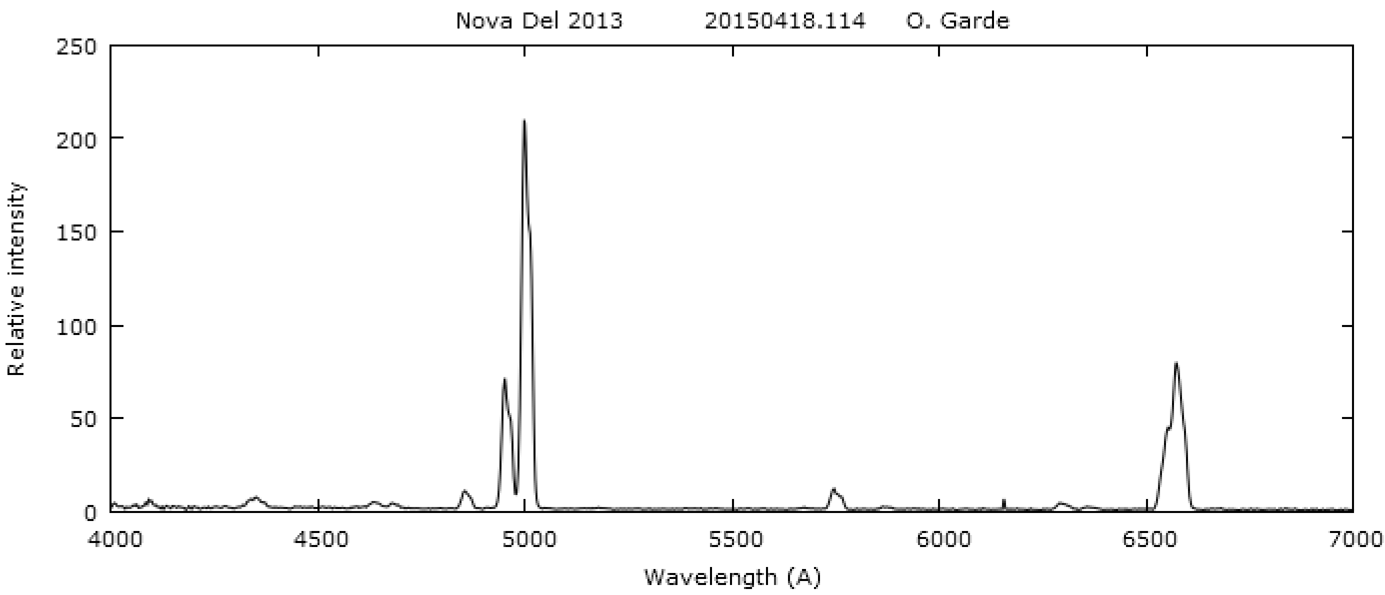
ARAS DATA BASE : http://www.astrosurf.com/aras/Aras_DataBase/Novae.htm

Nova Del 2013 = V339 Del

Luminosity
Mag V = 13.3 (31-03-2015)
Slow decline

Spectroscopy
Nova Cyg in nebular phase





Nova Oph 2015 (PNV J17291350-1846120)

Coordinates (2000.0)	
R.A.	17 29 13.5
Dec.	- 18 46 12

Nova Oph 2015 has been discovered by Y. Sakurai (Ibaraki-ken, Japan) on 2015 Mar. 29.766 UT at magnitude 12.2 and confirmed as a likely He/N classical nova (K Ayani, CBET 4086).

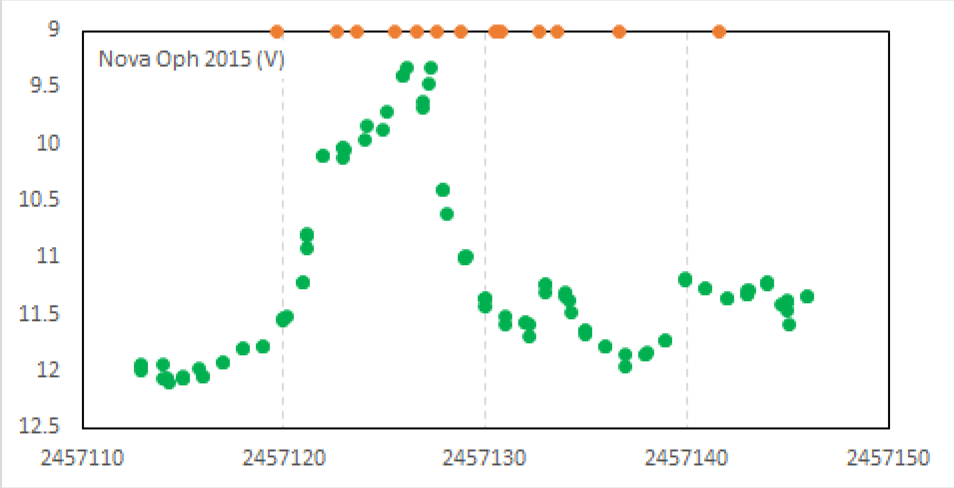
A spectrum acquired the 1th of april (**Danilet & al., ATel 7339**) classify the spectrum as He/N in the taxonomical classification (Williams, 1991, 1994) with numerous lines of He I, CII, NI, NII, NII but notes that "*the relatively lower velocities and sharply-peaked line profiles characterizing the outburst of Nova Oph 2015 are not consistent with that normally seen in He/N novae*" and concludes : "*The evolution of Nova Oph 2015 is likely to be unusual so additional observations are requested to monitor its behavior.*"

During the rise, the light curve shows a long premaximum halt of 8 days at 2.5 mag under the maximum luminosity.The maximum luminosity is observed the 13th of april at mag 9.3.

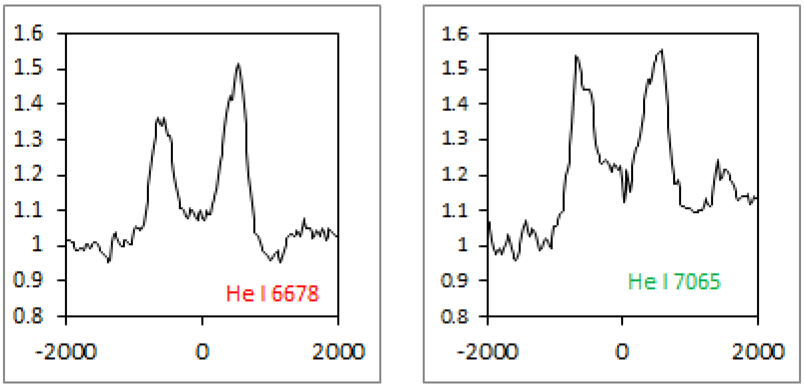
Munari & al. (**ATel 7367**) obtained a spectrum the 11th of april showing a classical Fe II nova and remind that William's classification is only valuable around maximum luminosity.

The luminosity declines fastly after maximum with T2 = 2.2 days.
During the decline, unusually strong double peaked He I lines appears (Banerjee & al., ATel 7367) : "*interesting developments. and seemingly an anomalous behavior, which warrants further observations.*"

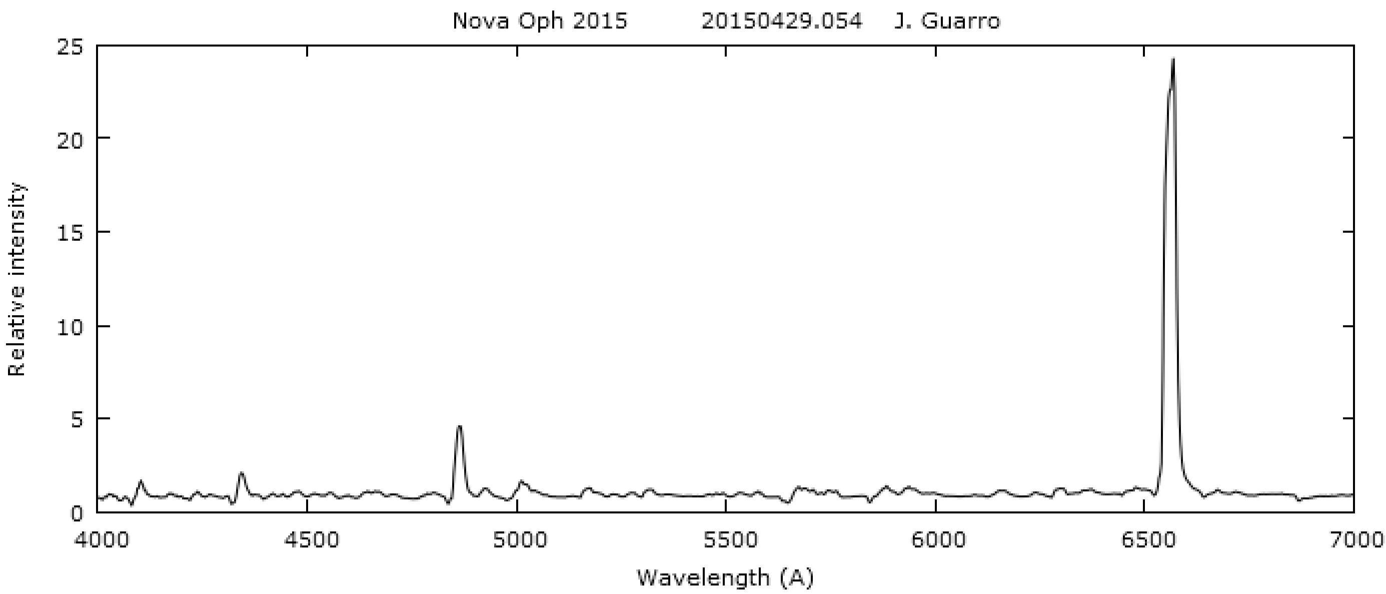
The spectra of ARAS database allows to follow nearly day by day the anomalous evolution of the He I lines.



The AAVSO light curve from 30th of march to 30th of april, 2015
Spectra of ARAS database : brown points



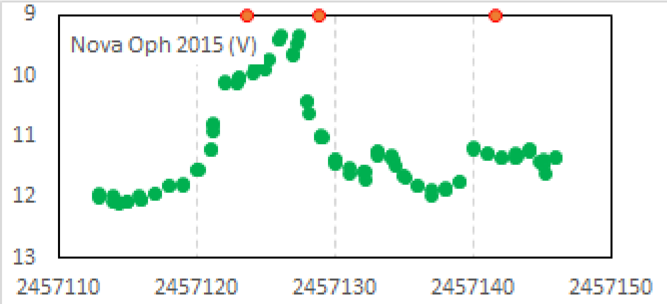
The double peaked profile of He I lines detected by Tim Lester in his spectrum of 16th of april

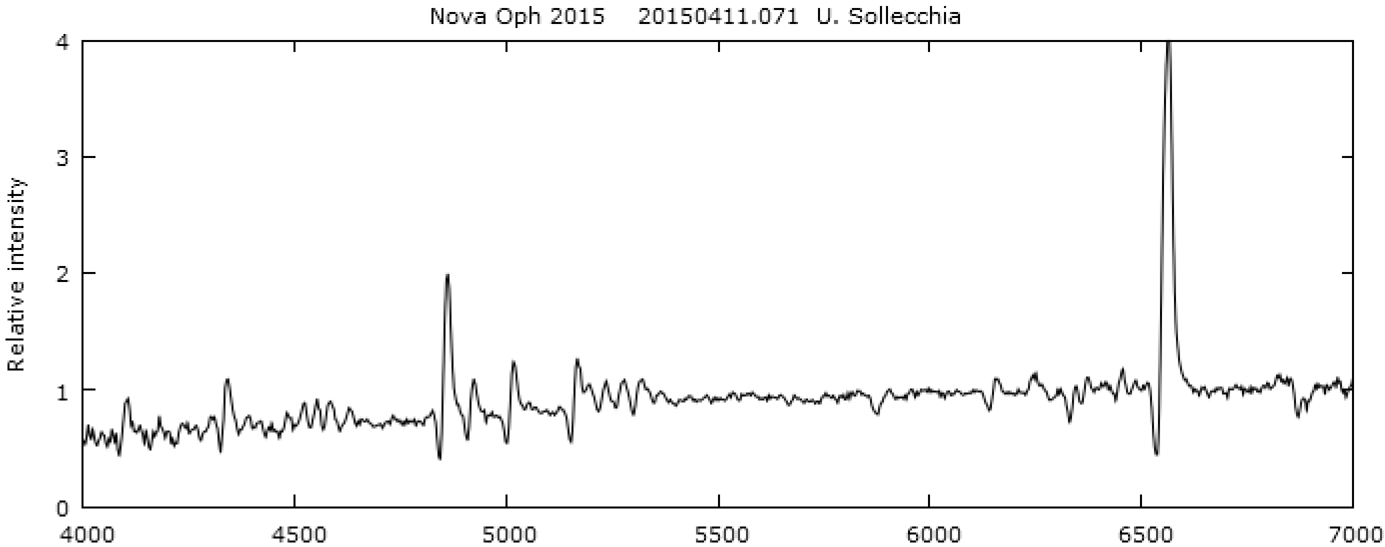


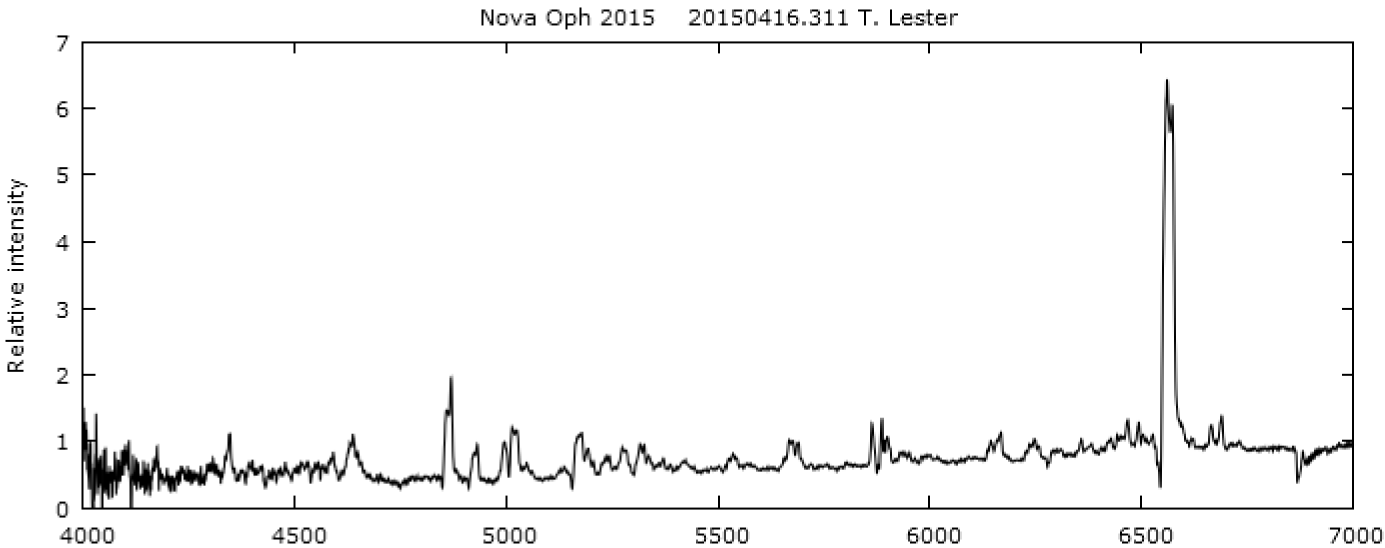
Last spectrum in ARAS data base obtained by Joan Guarro (R = 1000)
The nova enters nebular phase

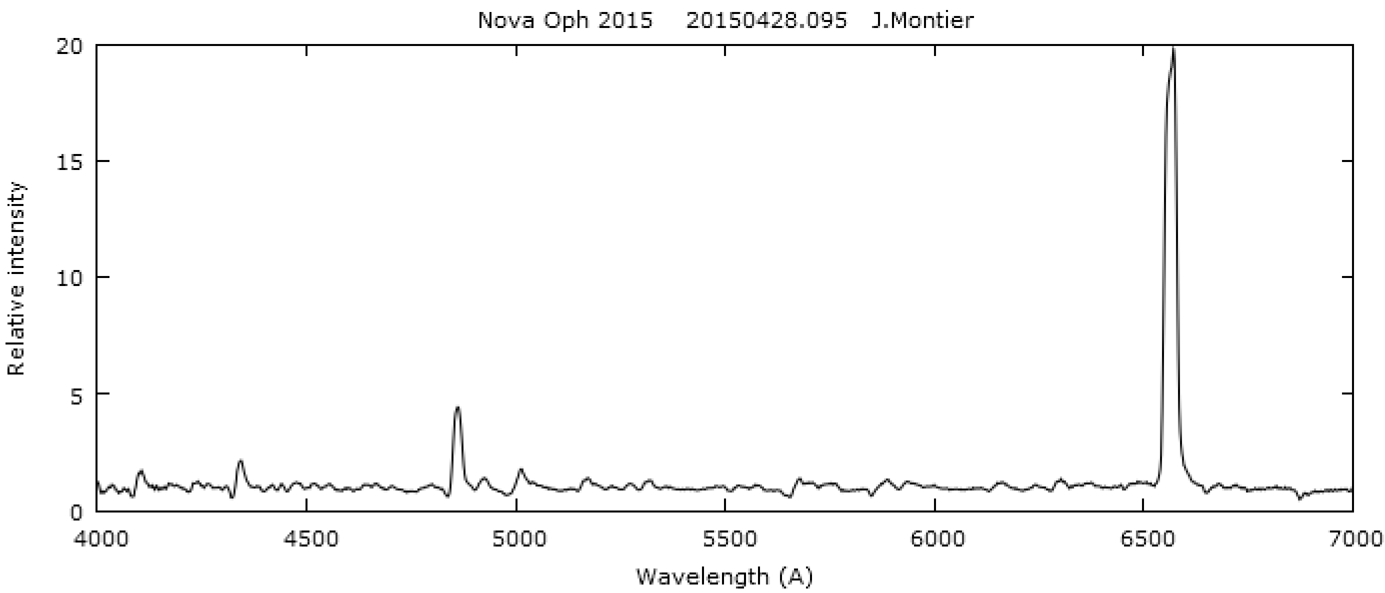
ARAS Data Base : 17 spectra : http://www.astrosurf.com/aras/Aras_DataBase/Novae/Nova-Oph-2015.htm

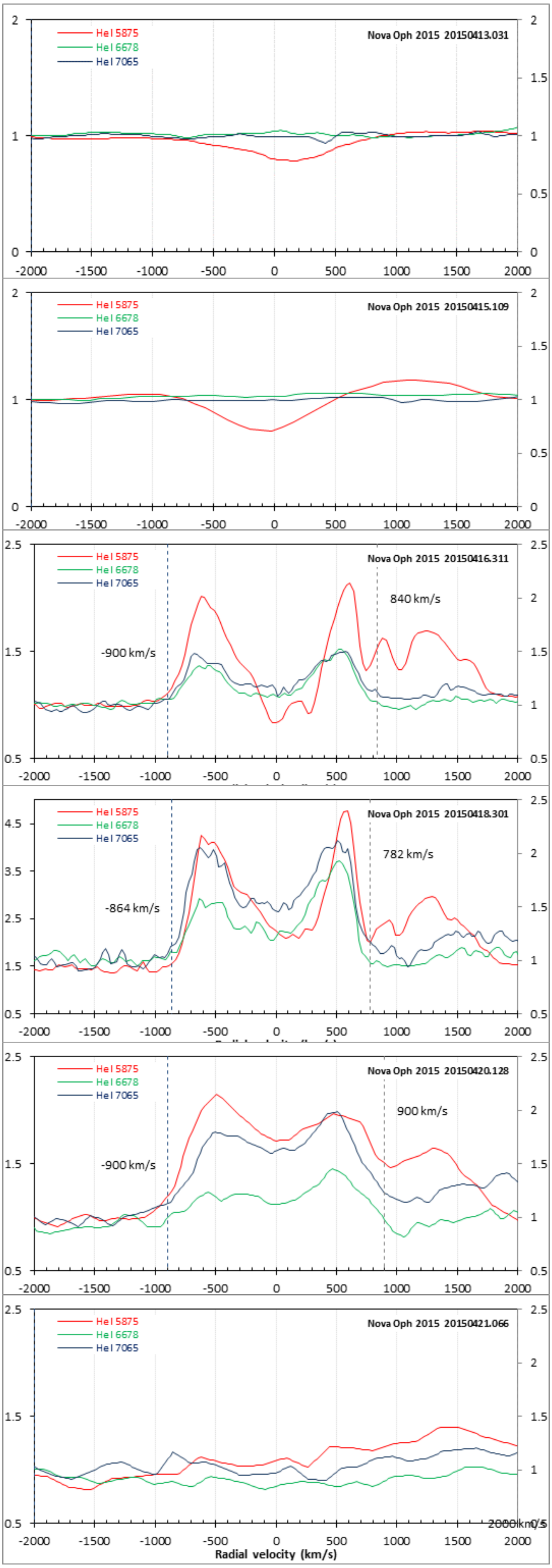
Nova Oph 2015
Evolution during the decline











The evolution of He I 5875, 6678, 7065 lines from spectra of ARAS database confims and precises the observations in Near IR.

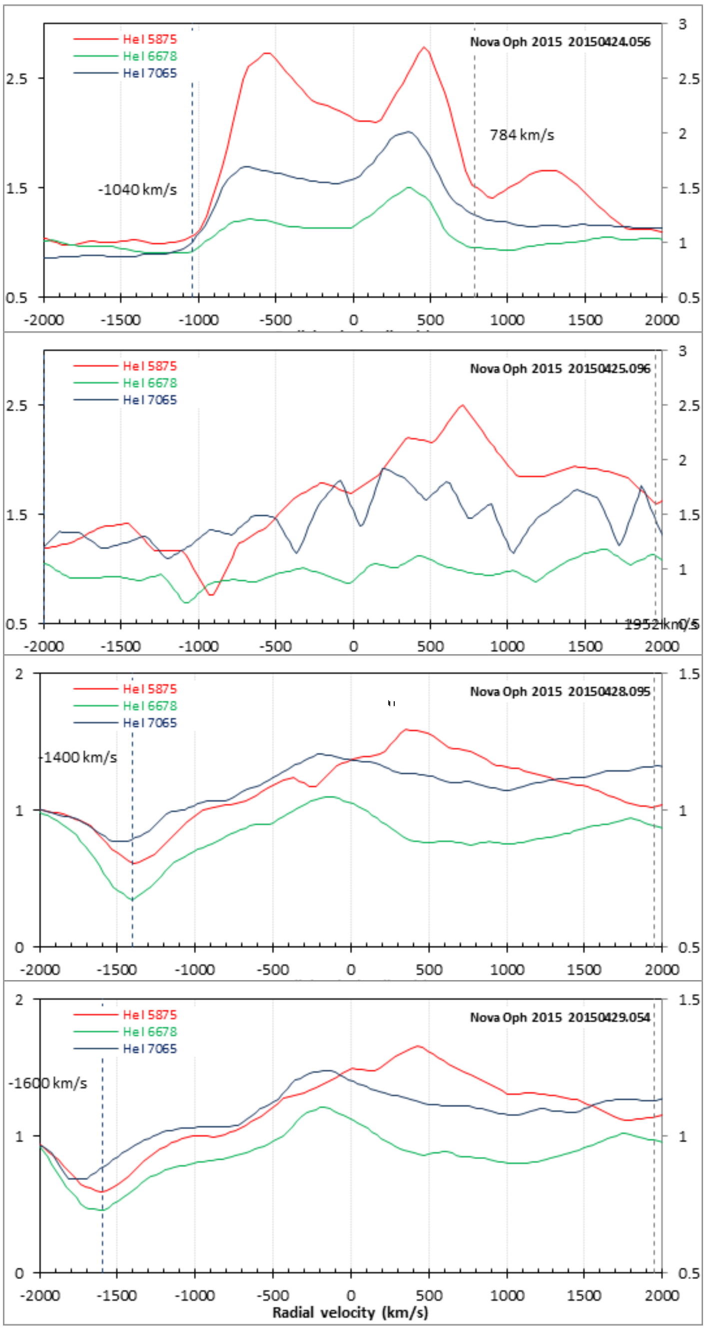
The doubled peaked He I lines appears during the first decline between 15,1 and 16.3 of april. The intensity at the center of the lines is very low. It increases in the latter spectra.

The lines disappears the 20th , during the first increase of V luminosity after the first decline and appears again the 24th of april.

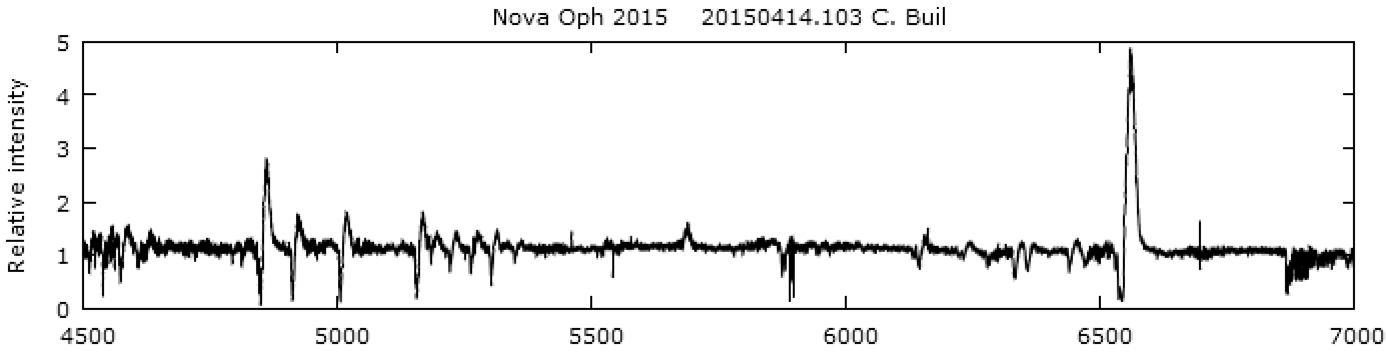
As the ejecta turns thin, the profiles becomes classical, sharply-peaked.

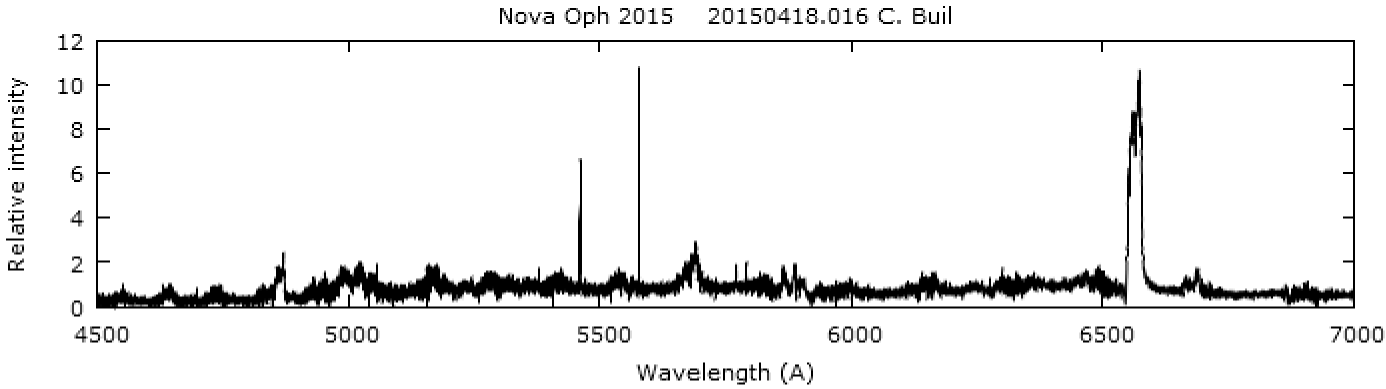
Sequence (with also [NII] and [OI]) :

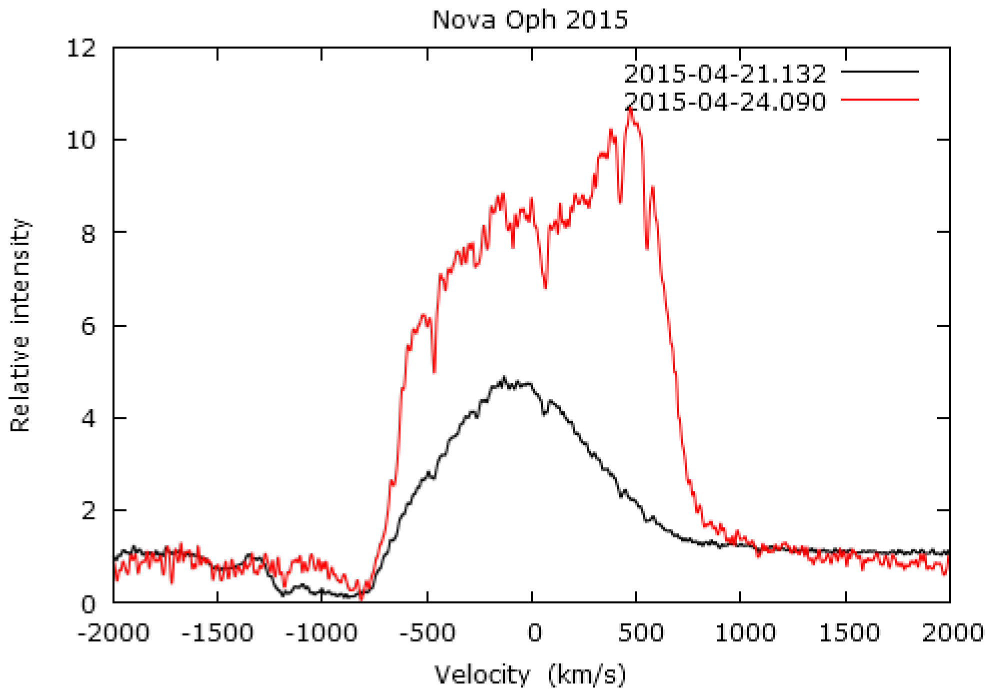
http://www.astrosurf.com/aras/Aras_DataBase/Novae/Temp/NovaOph2015_HeI/novaoph2015.html

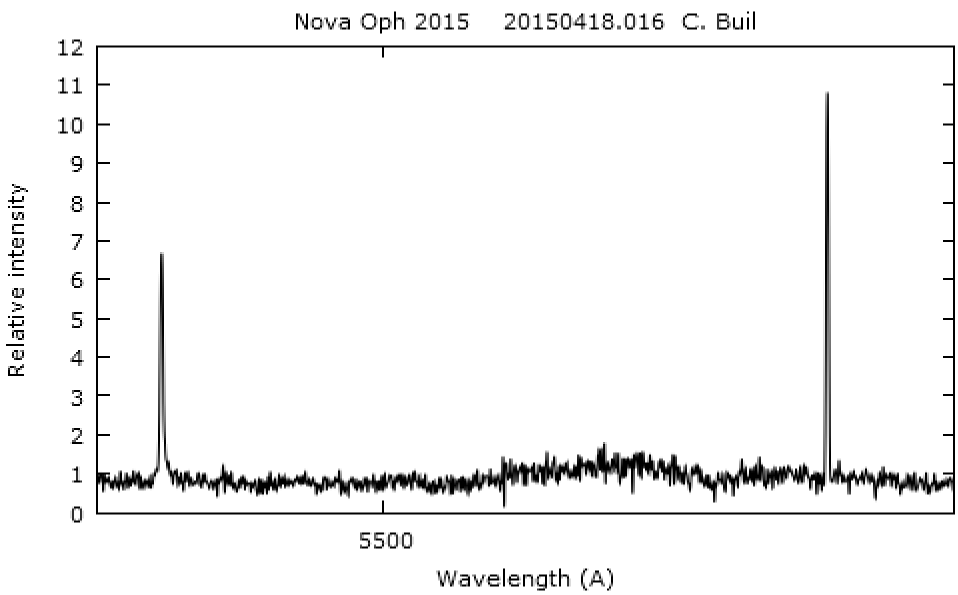


Nova Oph 2015
At hight resolution from C. Buil's spectra









In the spectrum obtained the 18th of april, appears bight narrow lines at 5460.7 and 5577.4 angströms (resp. FWHM = 30 and 25 km/s).
The second one is [O I] 5577

The Astronomer's Telegram

Optical Spectroscopy of Nova Ophiuchi 2015 (PNV J17291350-1846120)

ATel #7339

A. B. Danilet and T. W.-S. Holoien (Ohio State), R. M. Wagner (LBTO/OSU), C. E. Woodward (Minnesota), S. Starrfield (ASU), A. Wilber (ASU), F. Walter (SUNY), S. Shore (U. Pisa and INFN-Pisa)
on 2 Apr 2015; 17:21 UT

Following the discovery by Y. Sakurai (Ibaraki-ken, Japan) on 2015 Mar. 29.766 UT of a new stellar object of magnitude 12.2 in Ophiuchus (S. Nakano, CBET 4086) and its subsequent confirmation as a likely He/N classical nova (K Ayani, CBET 4086), we obtained a spectrum (range: 398-685 nm; resolution 0.3 nm) of Nova Oph 2015 on 2015 April 1.459 UT with the 2.4 m Hiltner telescope (+OSMOS) of the MDM Observatory on Kitt Peak.

In agreement with the spectroscopic results described by Ayani, our spectrum shows strong emission lines superposed on a flat continuum of the Balmer series of hydrogen (through Hδ with our spectral range), He I (443.8, 447.1, 471.3, 492.2, 501.5, 587.5, and 667.8 nm), C II (426.7 nm), Fe II (423.3, 430.3 nm and others), N I (648.6 nm), N II (500.1, 547.9, 567.9, and 593.8 nm), N III (451.7 and 463.8 nm), and Si II (634.7 and 637.1 nm). The Balmer and He I lines exhibit prominent P Cygni profiles with terminal velocities of about 2500 km/s. Hα, He I 587.5, and 667.8 nm lines show a detached absorption component. However, He I 447.1 nm shows no absorption component. The FWHM of Hα and Hβ emission is about 1000 km/s, while the FWZI of Hα emission is about 4000 km/s. We measure a Hβ emission equivalent width of 0.34 nm and an absorption equivalent width of about 0.3 nm. The line profiles show evidence of multiple components; however, the emission lines are sharply peaked as opposed to rectangular in profile.

Examination of the POSS2/UKSTU red images from the DSS shows at least 2-3 possible progenitors of Nova Oph 2015 with red magnitudes of about 18-19 near the outburst positions reported by Nakano and others (CBET 4086). The nearest of these candidates to the outburst positions is located at α = 17:29:13.47; δ = -18:46:14.50 (J2000). If so, the outburst amplitude was at least ~7 magnitudes.

Our spectrum of Nova Oph 2015 is reminiscent of the He/N class of classical novae in agreement with Ayani (CBET 4086). However, the relatively lower velocities and sharply-peaked line profiles characterizing the outburst of Nova Oph 2015 are not consistent with that normally seen in He/N novae which generally have broad lines with rectangular line profiles and generally few absorption features. Nova Oph 2015 may be similar to a small fraction of classical novae that are "hybrid" in that they show characteristics of both the Fe II and the He/N classes (cf., Williams 2012, AJ, 144, 98) and as they evolve, transition from one class to the other. A recent example includes V5558 Sgr (Tanaka et al. 2011, PASJ, 63, 911 and references therein). The evolution of Nova Oph 2015 is likely to be unusual so additional observations are requested to monitor its behavior.

Nova Oph 2015 is a FeII and not a He/N nova

ATel #7367

U. Munari, P. Ochner (INAF Padova), A. Siviero (Univ. Padova), S. Dallaporta and P. Valisa (ANS Collaboration)
on 11 Apr 2015; 10:55 UT

Nova Oph 2015 was discovered as PNV J17291350-1846120 by Y. Sakurai (CBET #4086) on March 29.766 UT at unfiltered 12.2 mag. M. Fujii (CBET #4086) on March 30.7 UT and K. Ayani (CBET #4086) on March 30.8 UT observed spectroscopically the transient and, upon finding several HeI, NII and NIII lines in emission, classified it as an He/N-type nova, at a time when the brightness of the nova was V=12.2 and still on the rise toward maximum, as evinced from the various sparse measurements listed in CBET #4086. Danilet et al. (Atel #7339) obtained a low-res spectrum of Nova Oph 2015 on April 1.459 UT when it was at V=12.0, and they too classified it as an He/N-type nova, noting however that the small FWHM and sharply peaked profile of the emission lines were unusual for He/N-type novae.

We are intensively monitoring the evolution of Nova Oph 2015 since its discovery, obtaining UBVRI photometry and Echelle spectroscopy with ANS Collaboration telescopes, low resolution spectra with the Asiago 1.22m telescope and high resolution Echelle spectra with the Asiago 1.82m telescope. Our photometric observations show that the He/N-type classifications reported in CBET #4086 and ATel #7339 where obtained before Nova Oph 2015 passed through the pre-maximum halt.

The nova is only now passing through maximum brightness, at the usual ~2 mag brighter than pre-maximum halt. Our latest measurement for April 10.112 UT gives V=9.942, B-V=0.913 V-R=0.580 V-I=1.154. Our latest spectrum of Nova Oph 2015 (3300-7900 Ang, 2.31 Ang/pix) was obtained with the Asiago 1.22m+B&C+CCD spectrograph on Apr 11.094 UT and it is a textbook example of a FeII-type nova at maximum brightness. It is dominated by a reddened strong continuum, with intense emission lines from Hydrogen Balmer, FeII (multiplets 27, 28, 37, 38, 42, 48, 49, 73, 74), CaII H&K and OI 7772 Ang, all showing deep P-Cyg absorptions (blue shifted by various amounts, from the -850 km/s of FeII-42, to 1000 km/s of OI, to 1165 km/s of Halpha). The integrated absolute flux of the Halpha emission component is 3.3x10(-11) erg cm-2 s-1, and its FWHM is 1050 km/s, a normal value for a FeII-type nova.

During their rise in brightness, the expanding photospheres of FeII-type novae cool from initial extremely high temperatures to the ~8000 K reached at the time of maximum, and in doing this they briefly pass through values characteristic of hotter He/N-type spectra (Seitter 1990, LNP 369, 79). Thus the He/N-type classification for Nova Oph 2015 reported in CBET #4086 and ATel #7339 seems to reflect the fact that at those times the nova was at least still 2 mag away from reaching true maximum brightness. The application of FeII or He/N classification introduced by Williams (1992, AJ 104, 725) is restricted to only maximum and early decline from it.

Near-IR observations of Nova Oph 2015

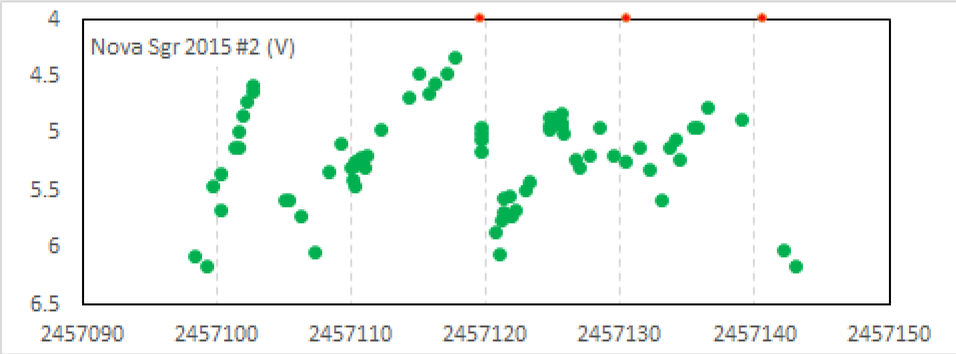
ATel #7446

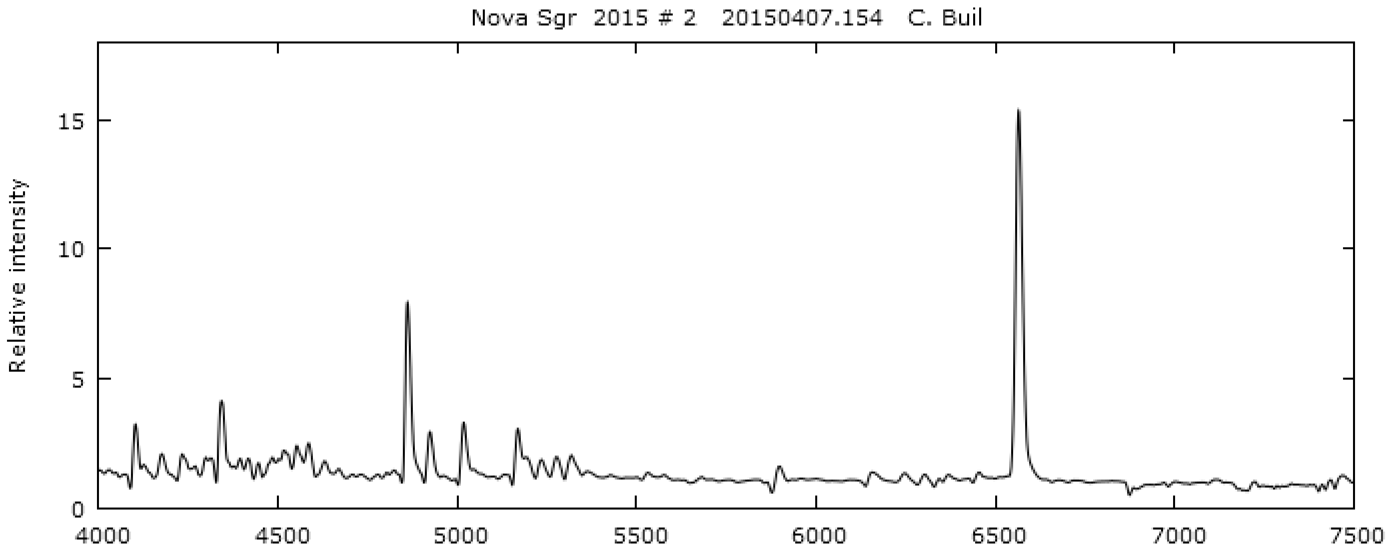
D. P. K. Banerjee, N. M. Ashok, V. Venkataraman and M. Srivastava (Physical Research Laboratory, Ahmedabad, India)
on 26 Apr 2015; 07:56 UT

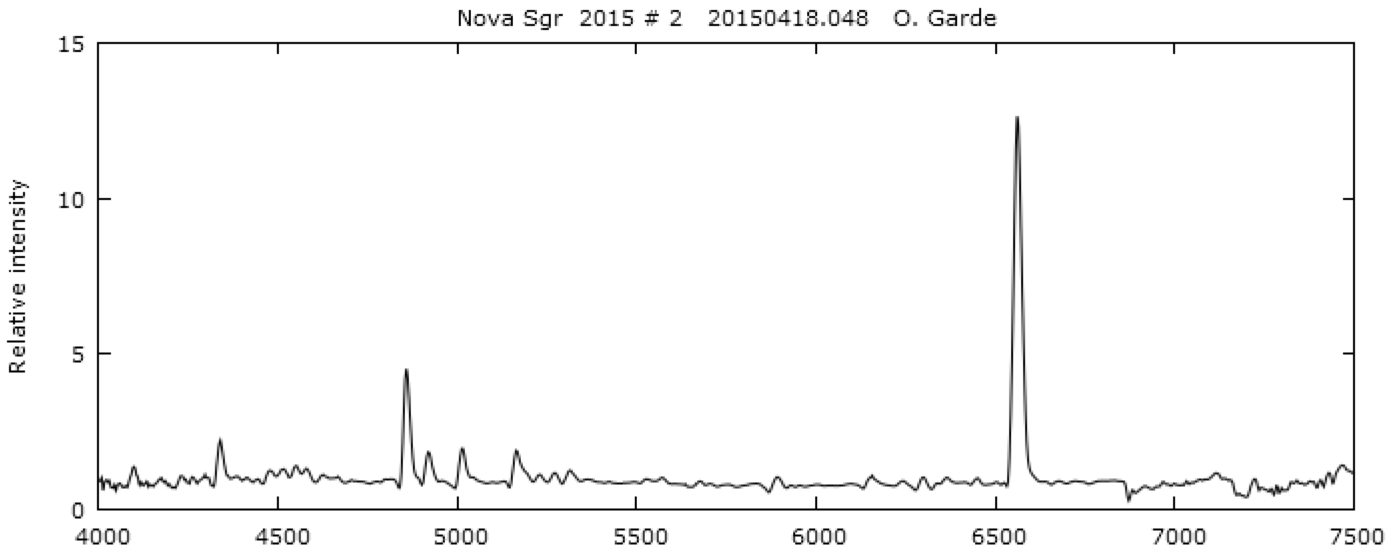
We report NIR spectra of Nova Oph 2015, discovered on March 29.766 UT, using the NIR camera/spectrograph (NICS) and the 1.2m Mount Abu telescope. This nova has shown He/N characteristics during the climb to maximum (ATel #7339) but had reverted to a Fe II class around maximum (ATel #7367; see spectrum description of April 11). Our spectra of 19, 21 and 25 April, at R ~ 1000 show the following traits. On 19 and 21 April the spectra are basically of the FeII class but the HeI 1.0831 and 2.0581 micron lines are unusually strong for a FeII type of nova. It is rare to see in a Fe II nova, so early during the decline phase, that the HeI 1.0831 and He 2.0581 lines are as strong as or stronger than Paschen beta (1.2818 micron) and Brackett gamma 2.1656 micron) respectively. In the April 25 spectrum, the He line strengths have suddenly dropped and they are now considerably weaker than the H recombination lines referred to above. Nova Oph 2015 is thus showing interesting developments. and seemingly an anomalous behavior, which warrants further observations. The HI lines are presently showing double peaked profiles compared to the sharply-peaked profiles reported earlier (ATel #7339). The Lyman beta fluoresced OI 1.1287 micron line is strong and

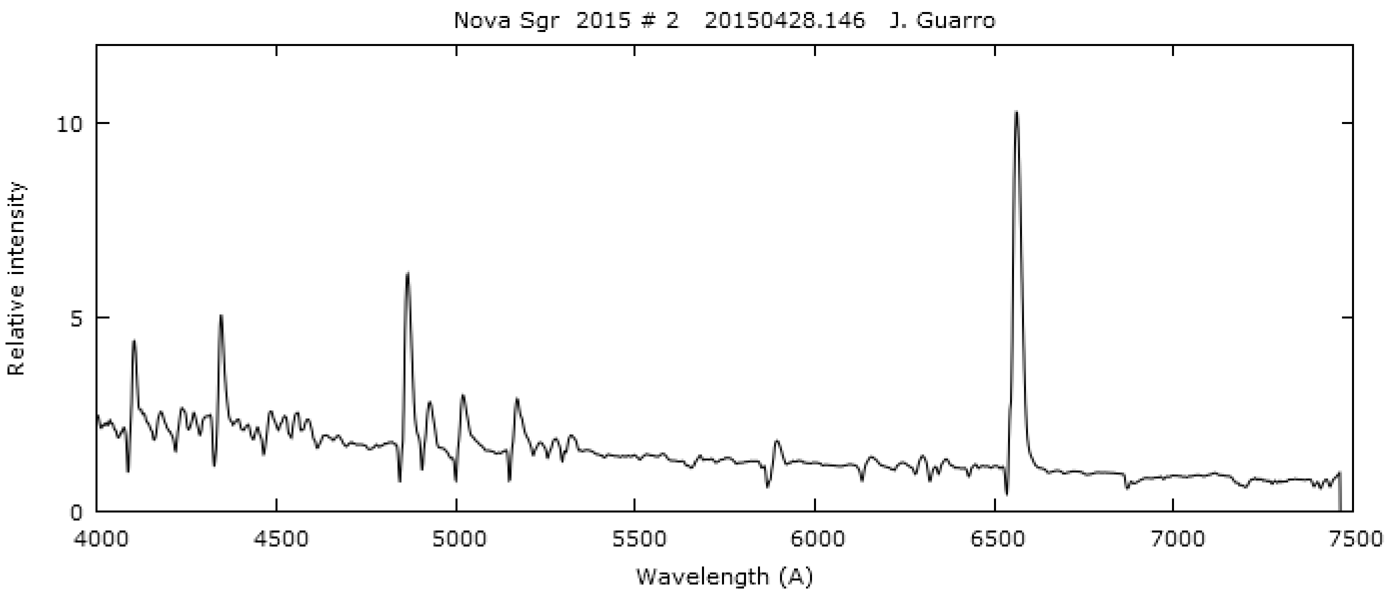
Nova Sgr 2015B

Another nova showing strong oscillation at maximum luminosity

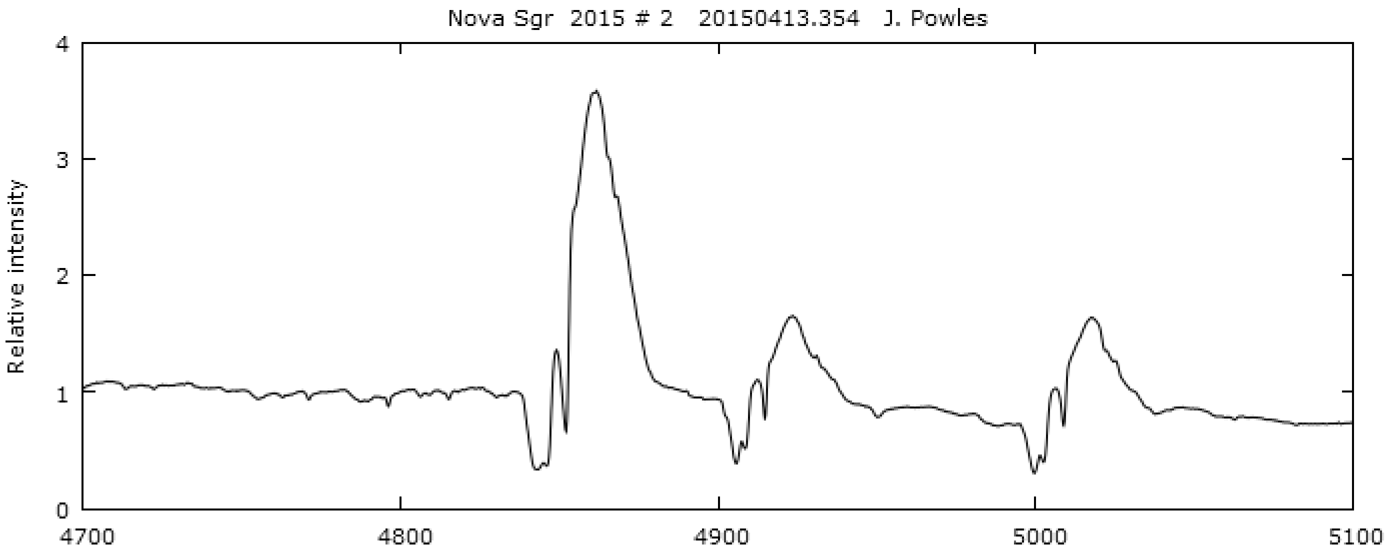


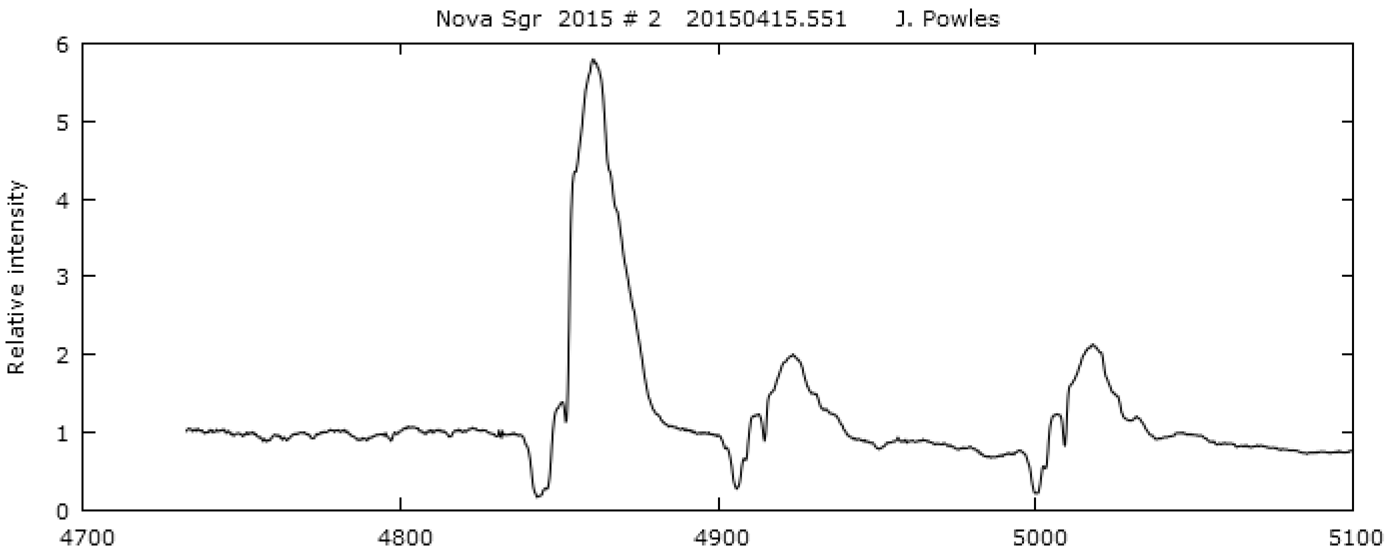


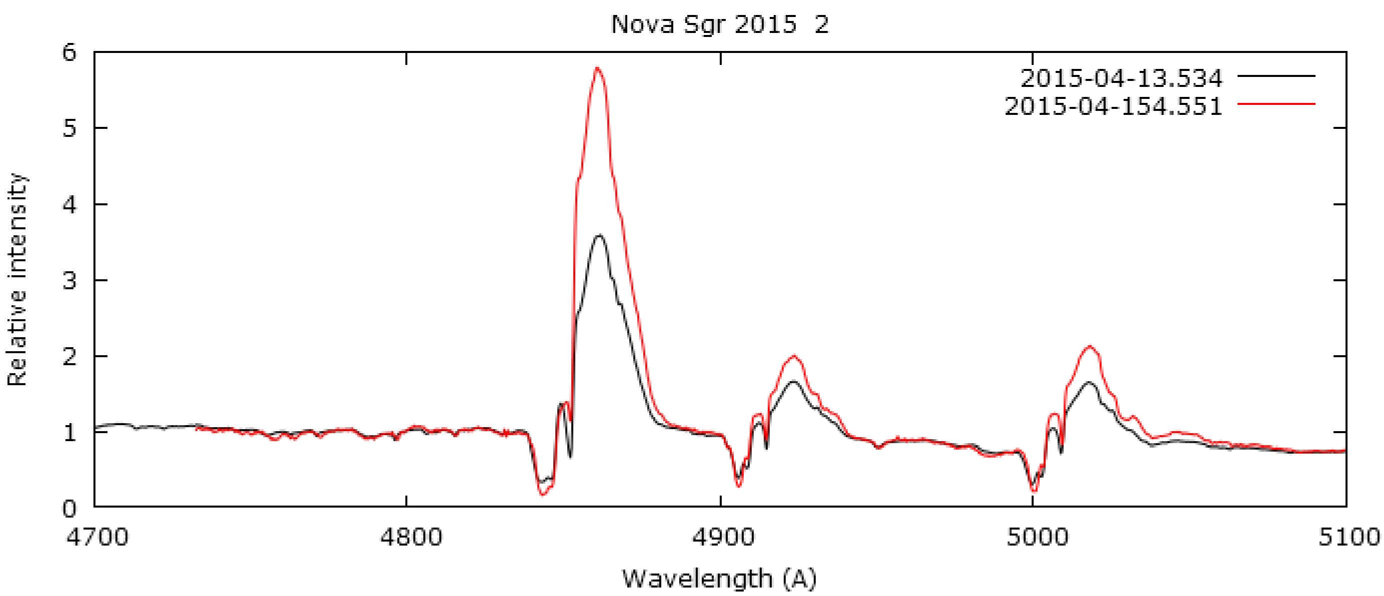




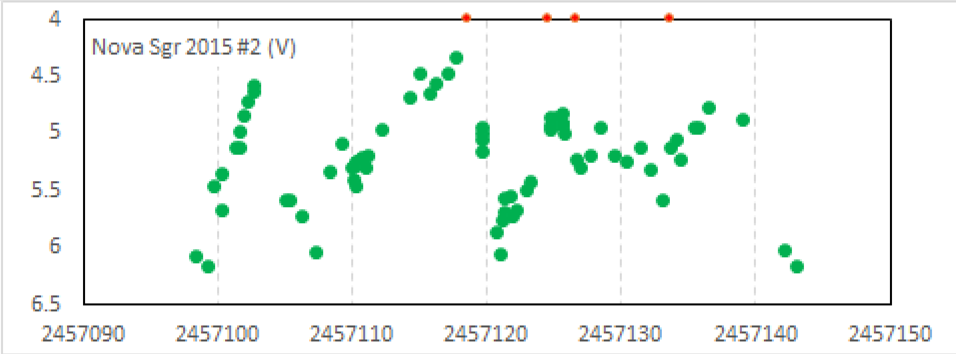
Evolution of Hβ and Fe II (42) 4924, 5018
Jonathan Powles L200

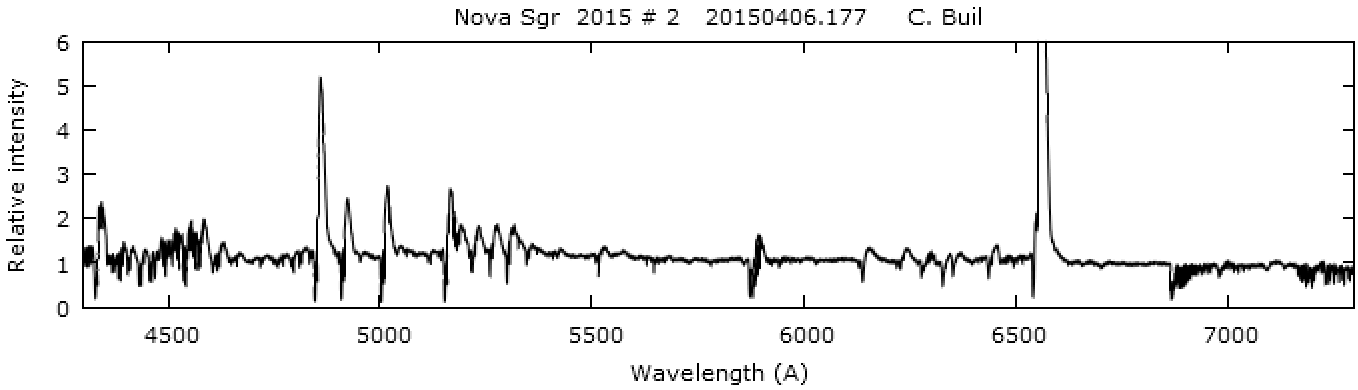


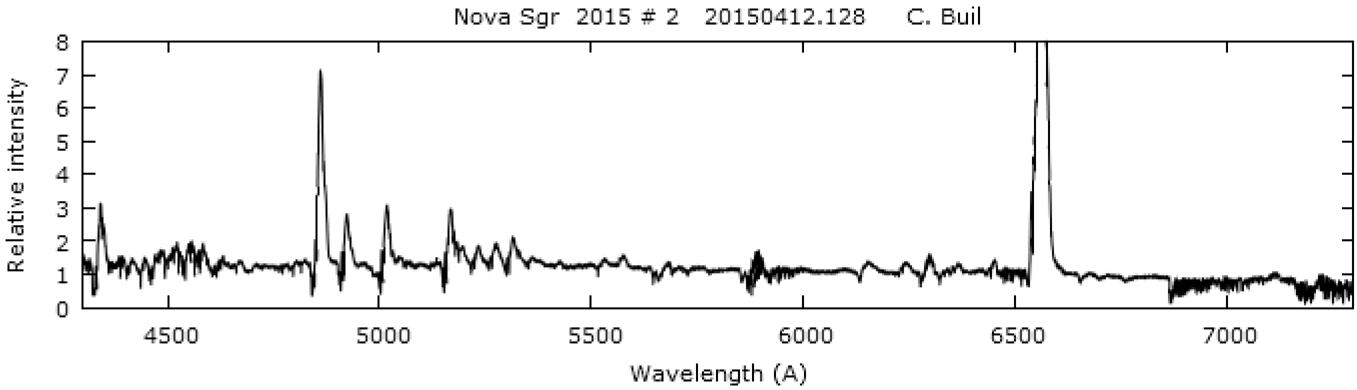


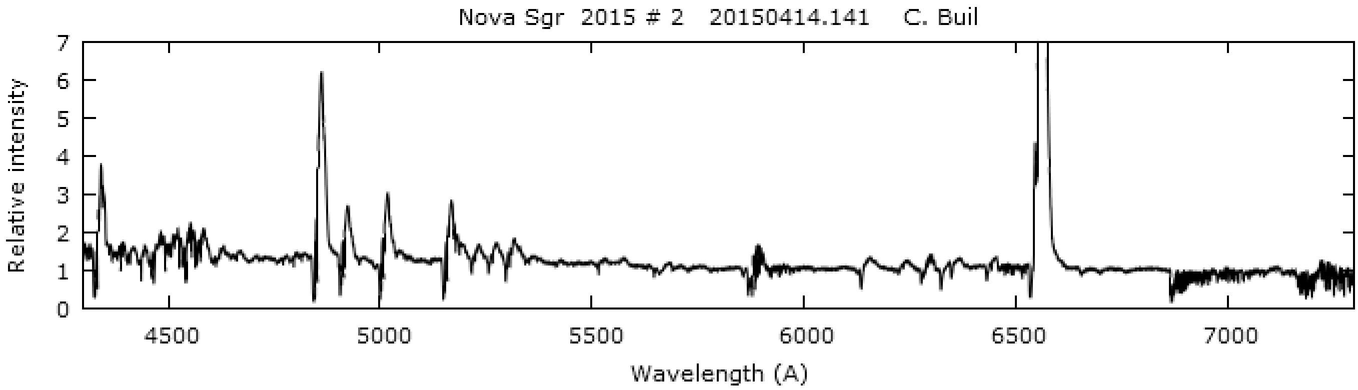


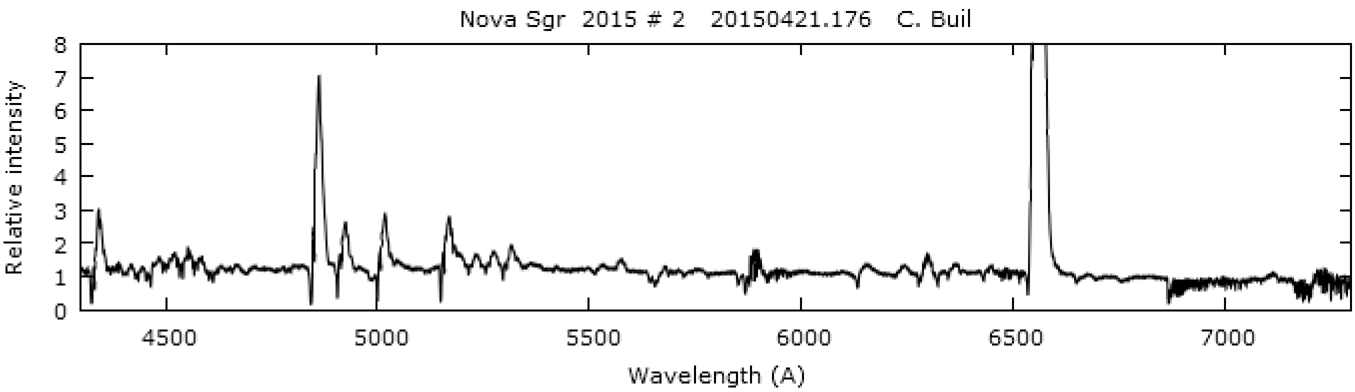
Nova Sgr 2015B

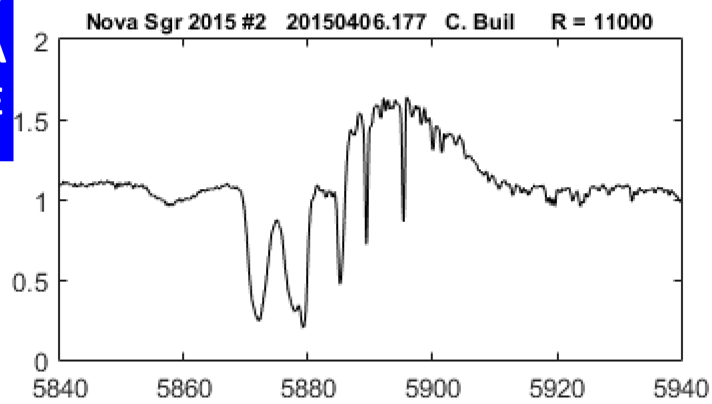








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0.5
1
1.5
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5860
5880
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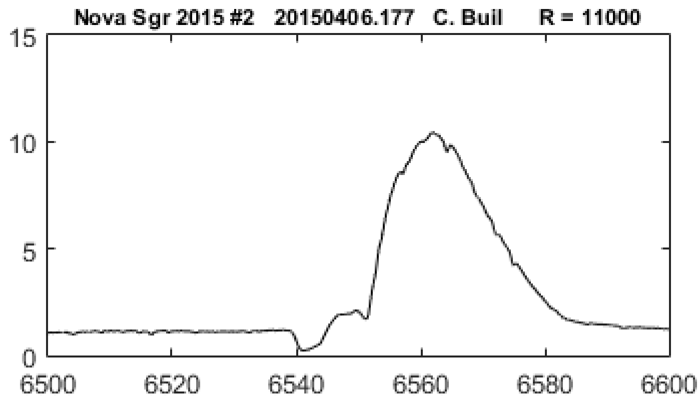
5920
5940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0
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10
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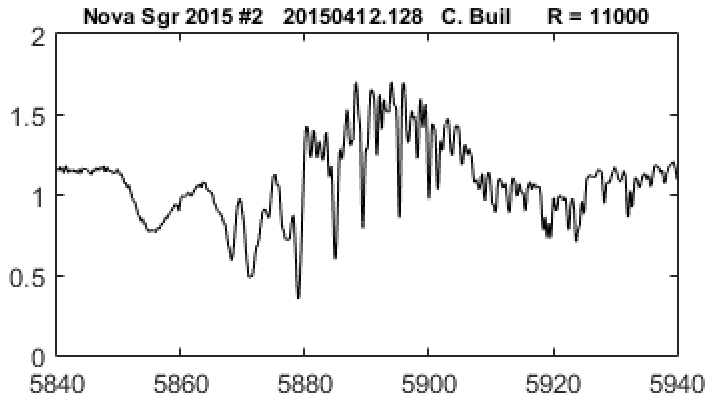
6600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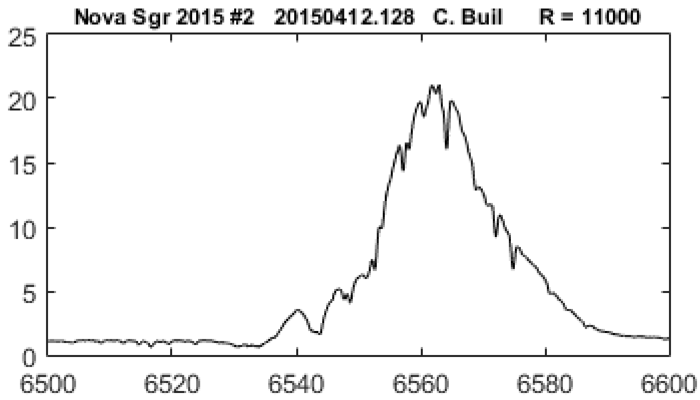
5940


Nova Sgr 2015 #2 20150412.128 C. Buil R = 11000
0
5
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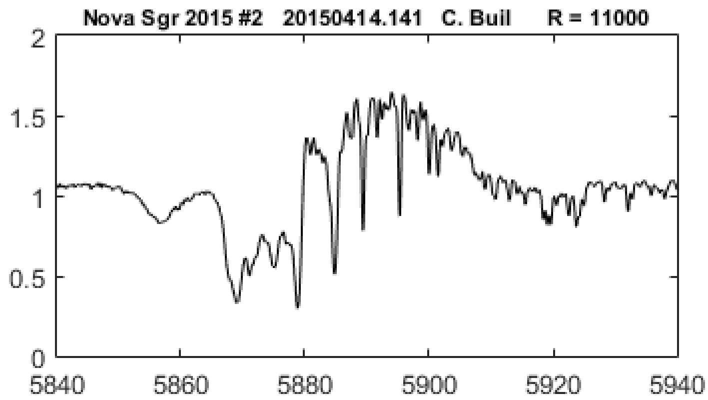
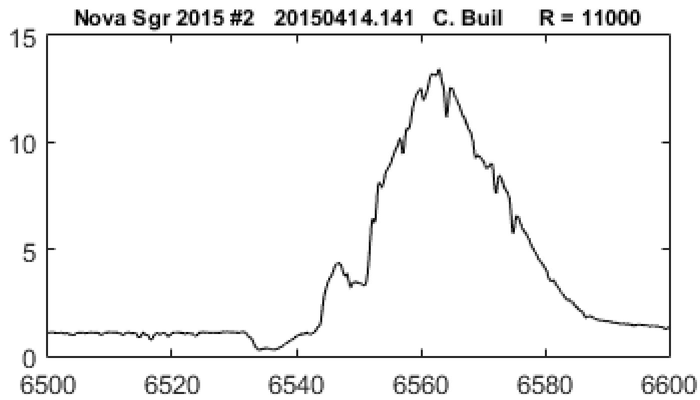
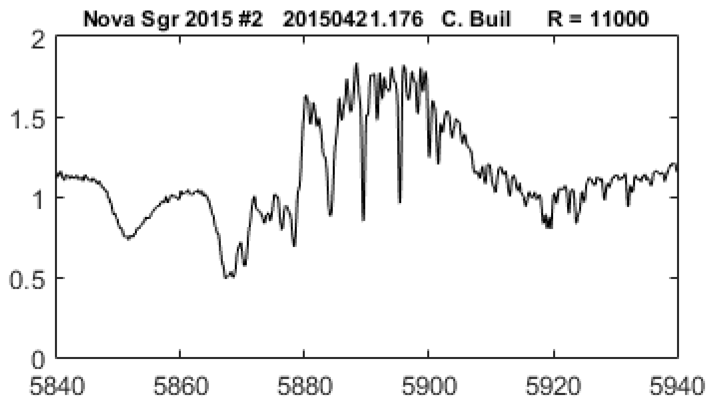
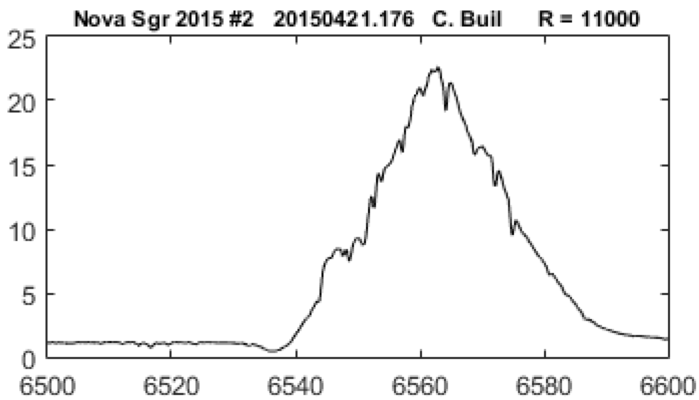
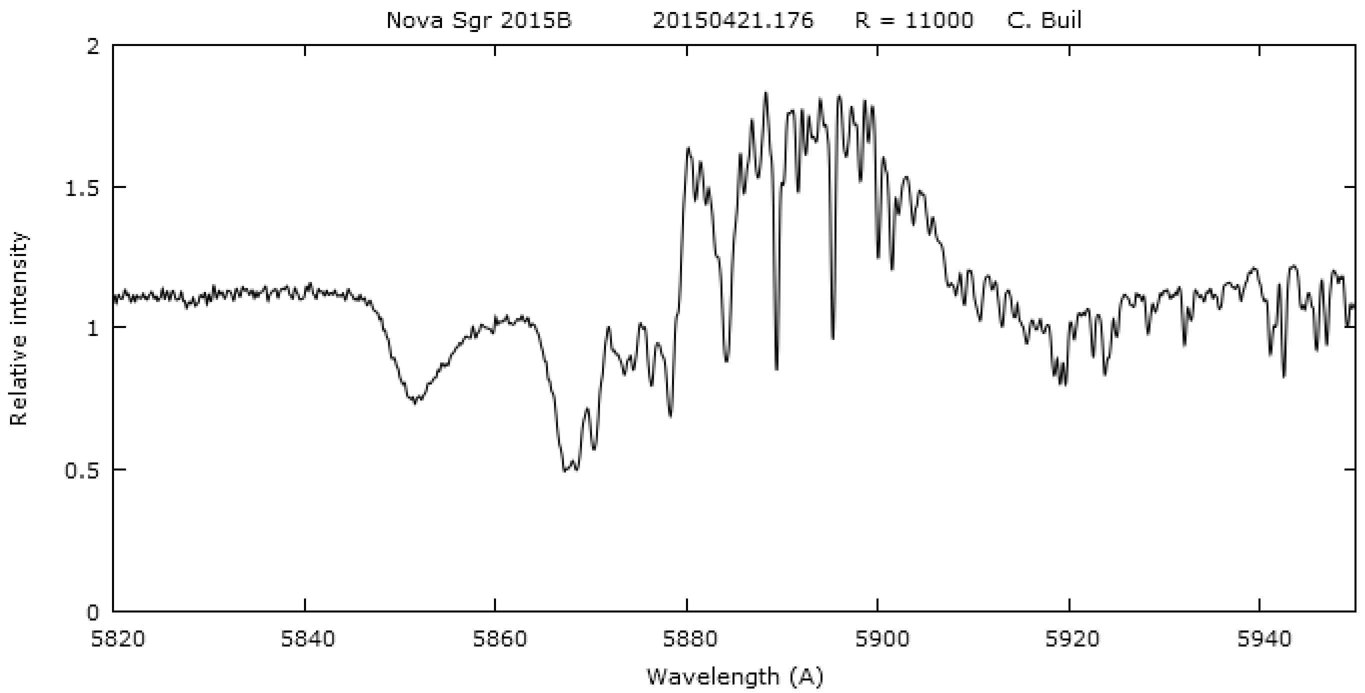
6580
6600


Nova Sgr 2015 #2 20150414.141 C. Buil R = 11000
0
0.5
1
1.5
2
5840
5860
5880
5900
5920
5940


Nova Sgr 2015 #2 20150414.141 C. Buil R = 11000
0
5
10
15
6500
6520
6540
6560
6580
6600


Nova Sgr 2015 #2 20150421.176 C. Buil R = 11000
0
0.5
1
1.5
2
5840
5860
5880
5900
5920
5940


Nova Sgr 2015 #2 20150421.176 C. Buil R = 11000
0
5
10
15
20
25
6500
6520
6540
6560
6580
6600



This especially low velocity is much more clearly resolved in a magnificent spectrum from Christian Buil from 26/4/2015. I have to express envy at the quality of this observation, especially the resolution of the Na I and He I 5876 lines. The most important observation, I think, is the detached He I components on both 5876 and 6678. This is the cleanest example I've seen of this phenomenon and the velocity is again about -1400 km.s^{-1}
Steve Shore (see page)

Log of observations

06/04/2015	03:49:06	2457118.666	cbuil	T200VHIRES_MOATIK	50000	5303 - 5337
12/04/2015	04:13:15	2457124.685	cbuil	T200VHIRES_MOATIK	50000	6577 - 6619
13/04/2015	12:49:00	2457126.076	JPowles	SpectraL200,254mm	3000	4679 - 5136
14/04/2015	03:23:08	2457126.65	cbuil	T200eShelAtik460E	11000	4278 - 7360
15/04/2015	02:06:55	2457127.591	OlivierGarde	C14LISAATIK460EX	505	3500 - 7400
15/04/2015	13:13:06	2457128.125	JPowles	SpectraL200,254mm		4733 - 5117
18/04/2015	01:09:20	2457130.553	OlivierGarde	C14LISAATIK460EX	525	4001 - 8096
21/04/2015	03:25:46	2457133.652	cbuil	C11VHIRES-MOATIK4	50000	6577 - 6619
21/04/2015	04:12:48	2457133.68	cbuil	t200eShelAtik460E	11000	4278 - 7360
24/04/2015	01:21:04	2457136.576	cbuil	T200VHIRES_MOATIK	50000	6546 - 6590
28/04/2015	03:30:13	2457140.649	J.Guarro	16REMOTATIK460EX	966	3709 - 7466
29/04/2015	03:22:10	2457141.647	J.Guarro	16REMOTATIK460EX	876	3725 - 7458
29/04/2015	10:58:10	2457141.958	JEdlin	CDK24(0.61m)-LISA-	790	3609 - 7409

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

Symbiotic stars

observed in April, 2015

Star	Nb. spectra
AG Dra	12
BF Cyg	12
BX Mon	2
CI Cyg	0
CH Cyg	17
NQ Gem	10
T CrB	9
Tx CVn	7
UV Aur	4
V443 Her	2
V934 Her	2
V694 Mon	6
V1016 Cyg	1
YY Her	1
ZZ CMi	6

Observing

CH Cygni campaign
Especially high resolution H alpha

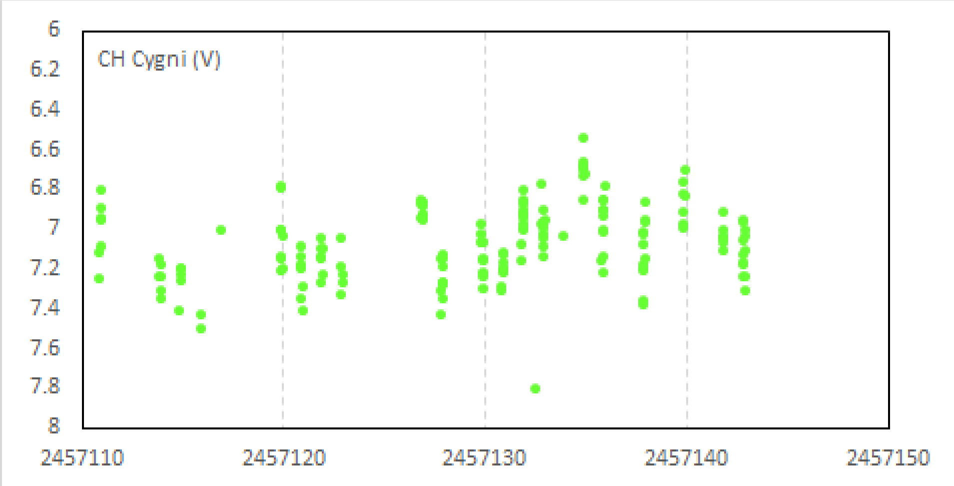
BF Cygni
(High resolution of H alpha)

In the morning sky :
AG Dra
T CrB
YY Her
V443 Her
CI Cyg

CH Cygni campaign

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

See :



AAVSO V band light curve in march and april, 2015
CH Cyg remains at a high level of luminosity

In April, the Ha profile is still characterised by strong multiple absorptions in the blue edge. (Black in figure 1.)
But, two of the spectra (12-04 and 22-04) show a classical profile. The evolution is very fast (less than one day) See the comparison between 21-04 and 22-04 spectra (Figure 1.)

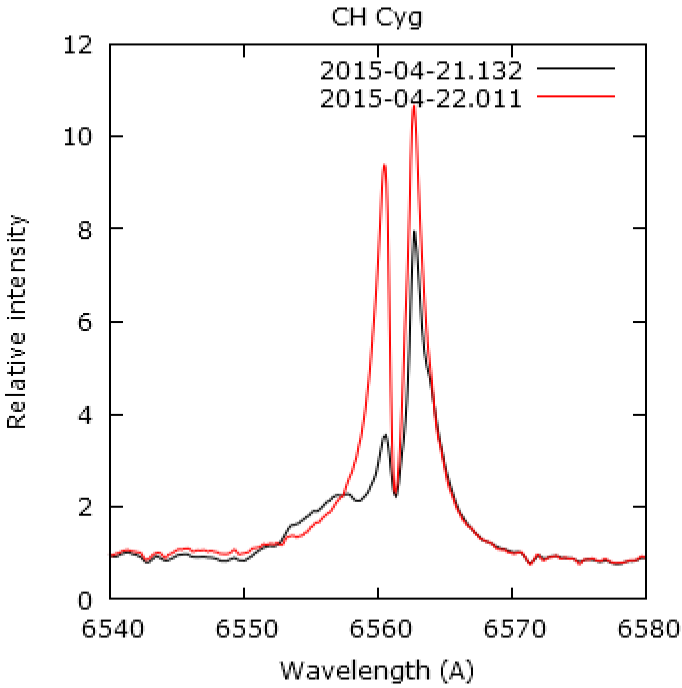
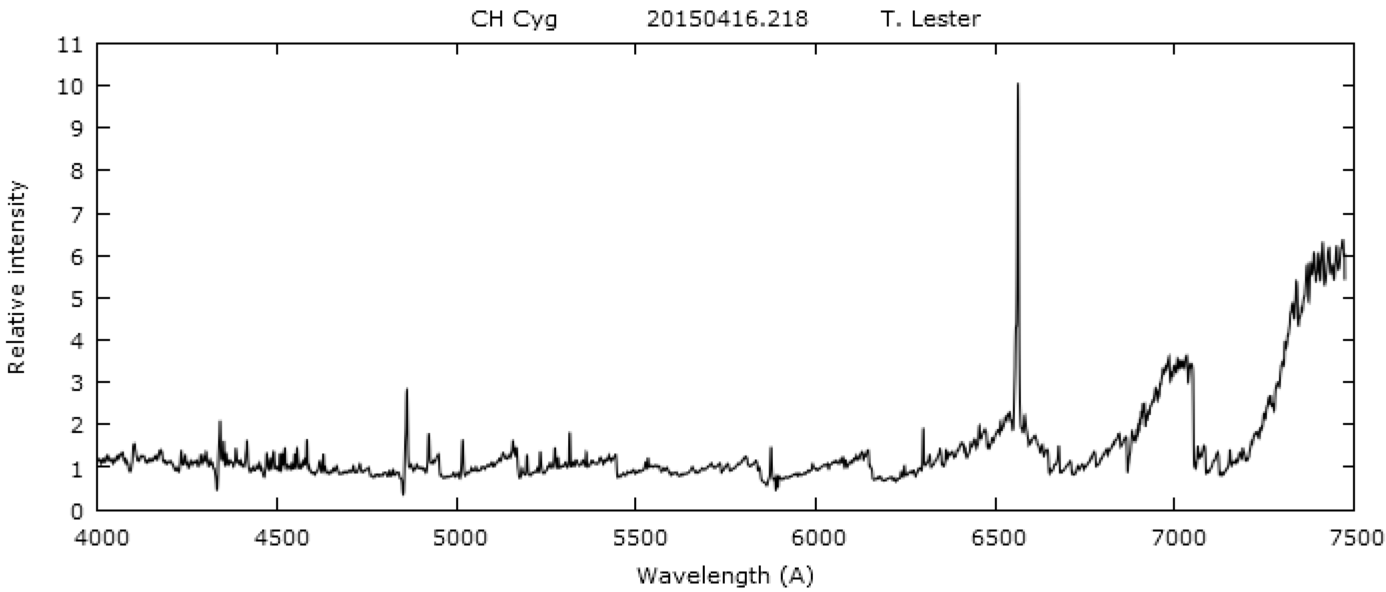
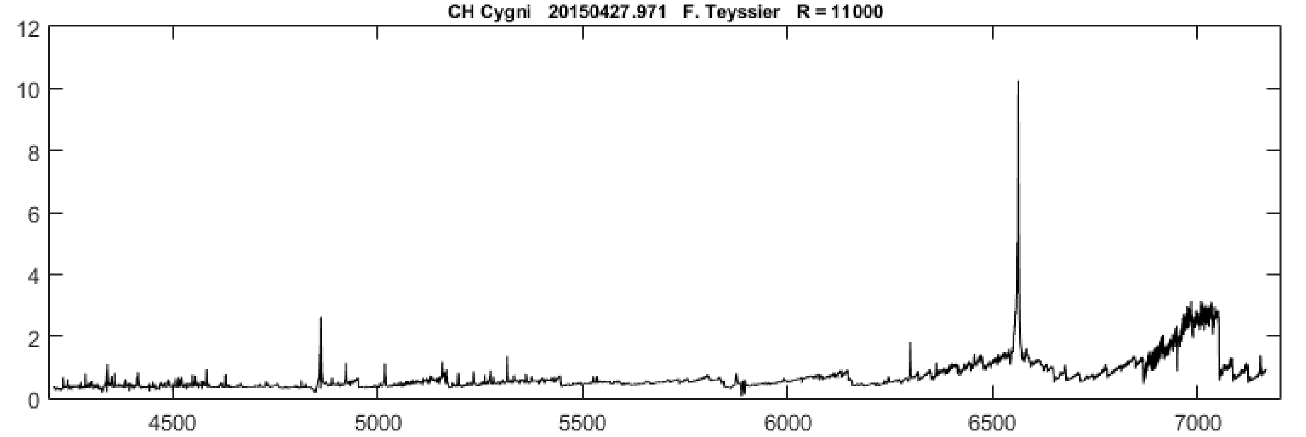


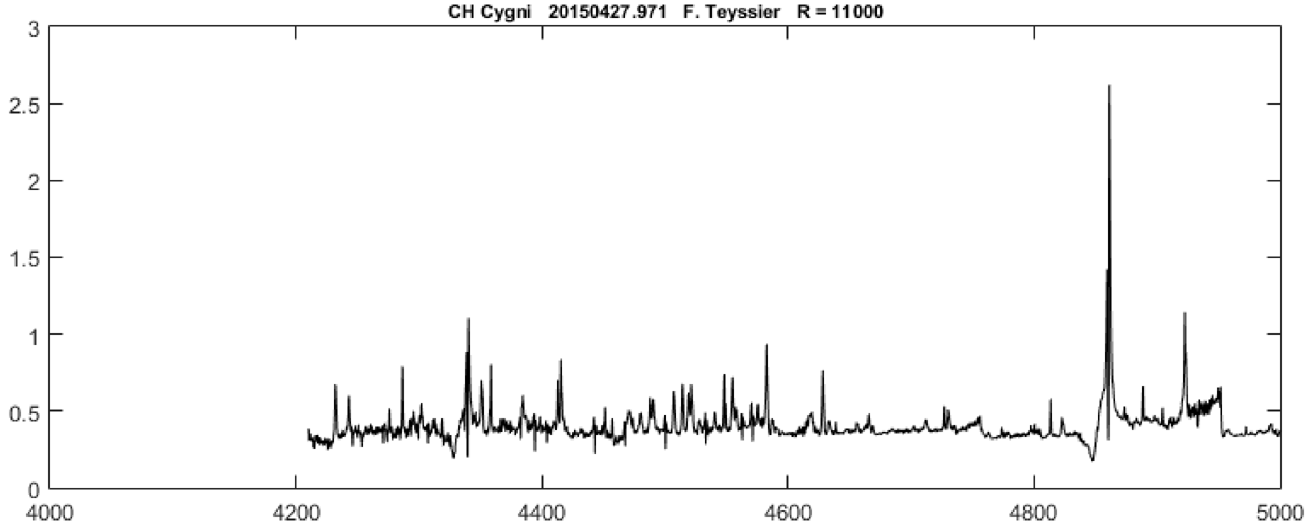
Figure 1. Evolution of Ha in less than one day
21-04 : F. Teyssier eShel R = 11000
22-04 : P. Somogyi Lhires III R = 13000

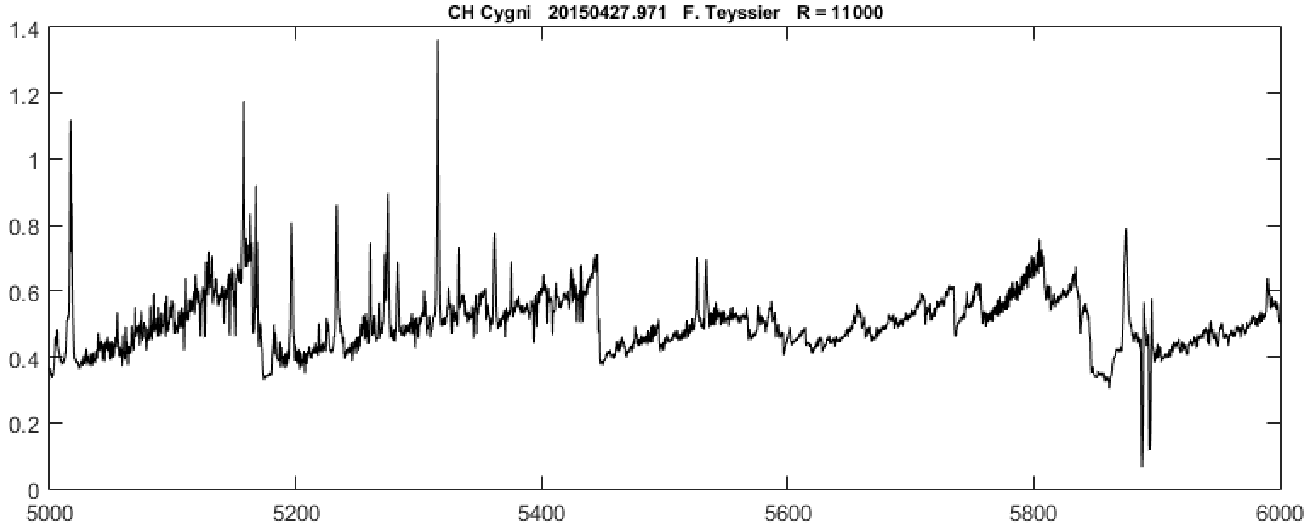


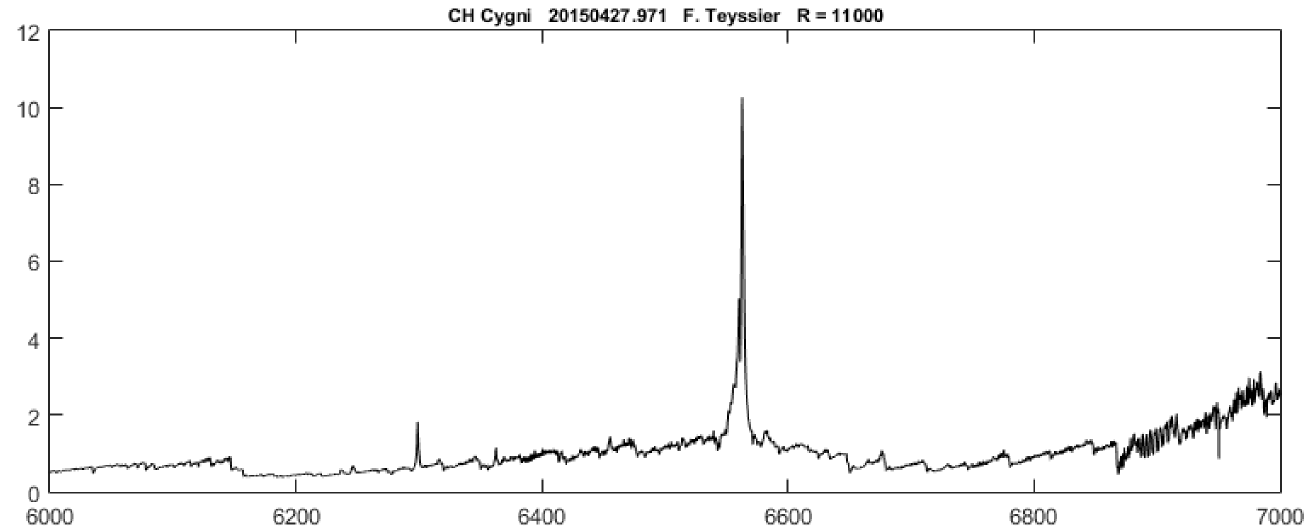
ARAS DATA BASE | http://www.astrosurf.com/aras/Aras_DataBase/Symbiotics/CHCyg.htm

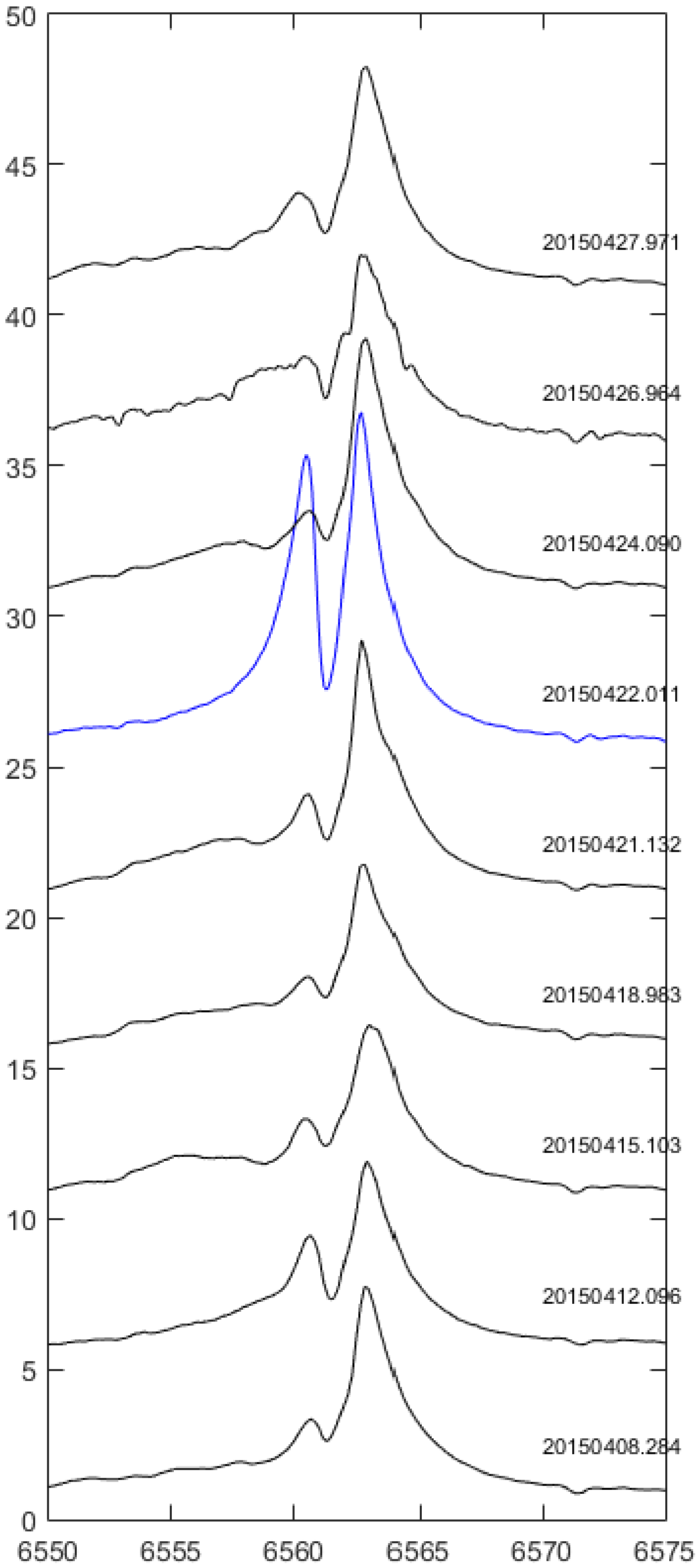
CH Cygni campaign - The spectrum at R = 11000









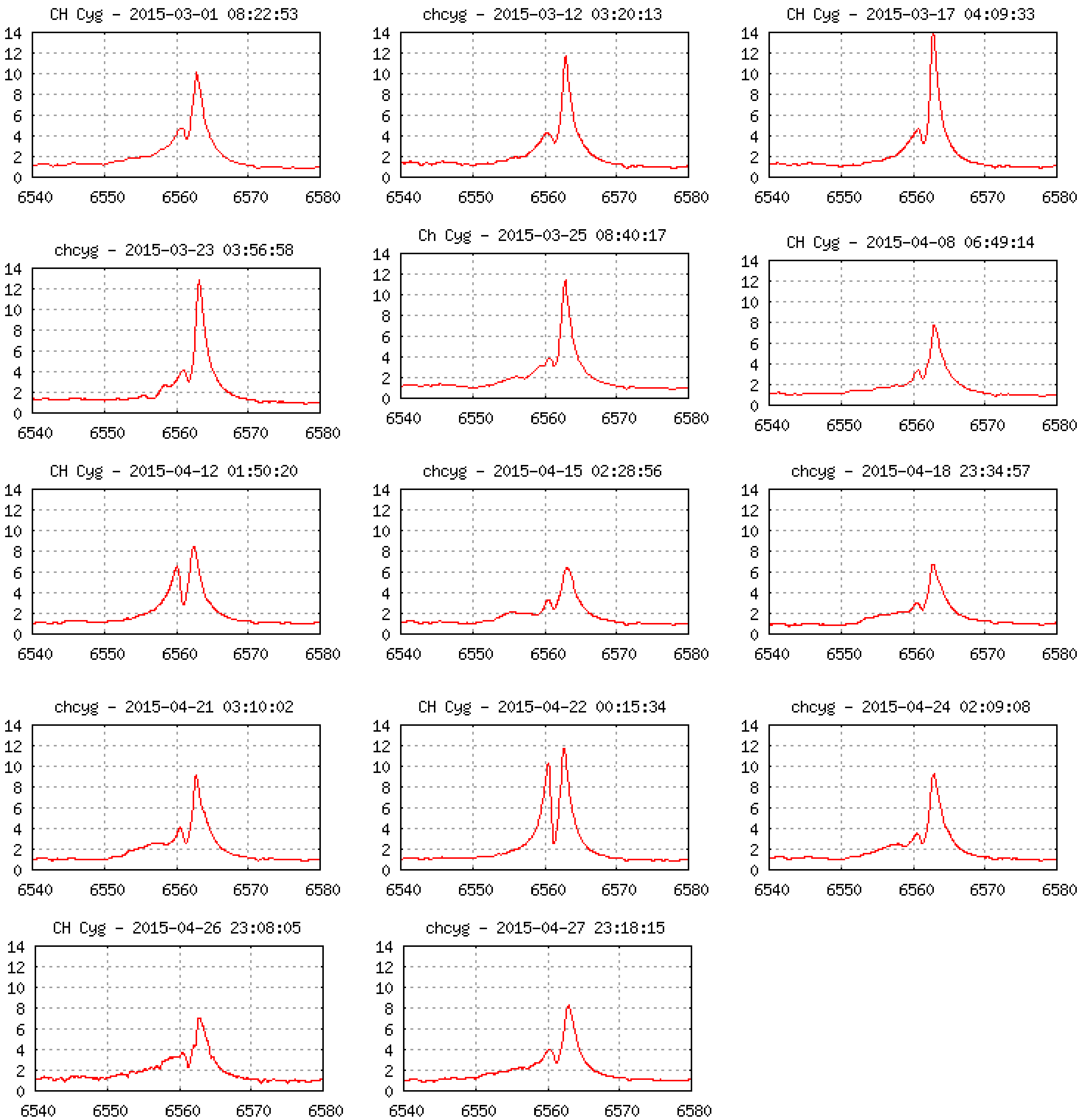


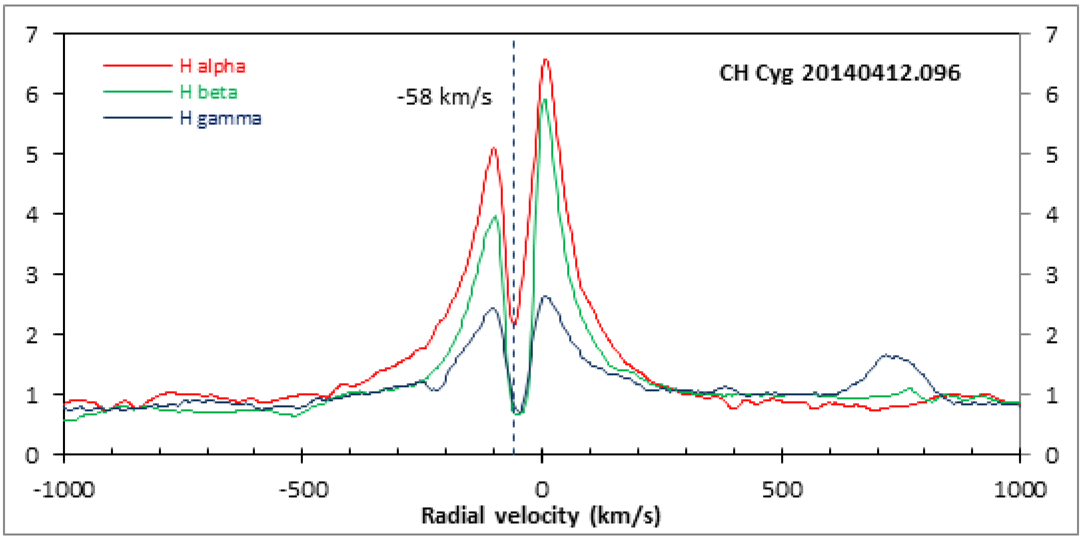
Evolution of H alpha line in april at resolution from 9000 to 15000.

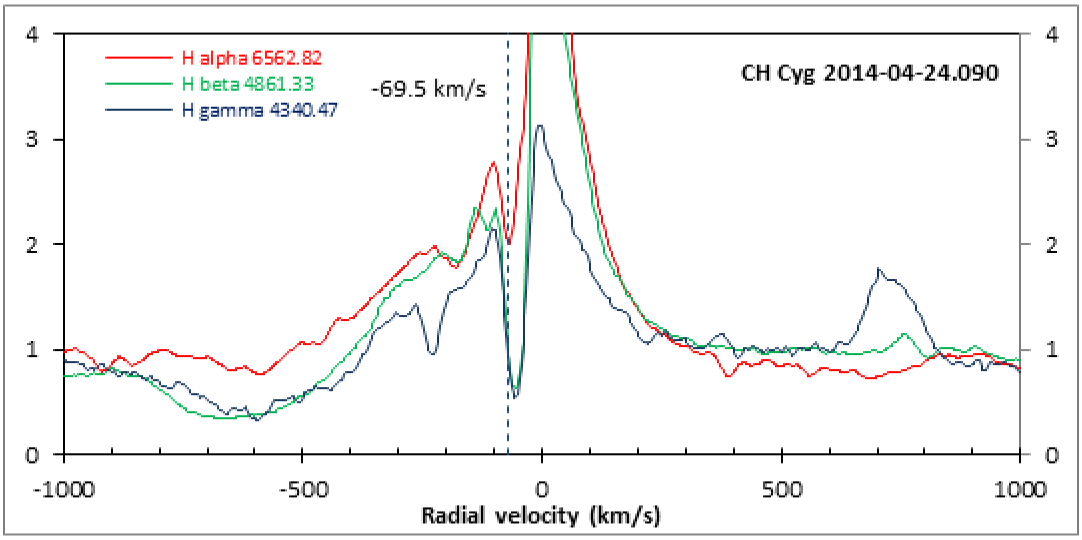
Resolution of spectra for 24th and 26th are given at R = 21000 (Lhires III, 2400 l/mm, slit 15 mcm).

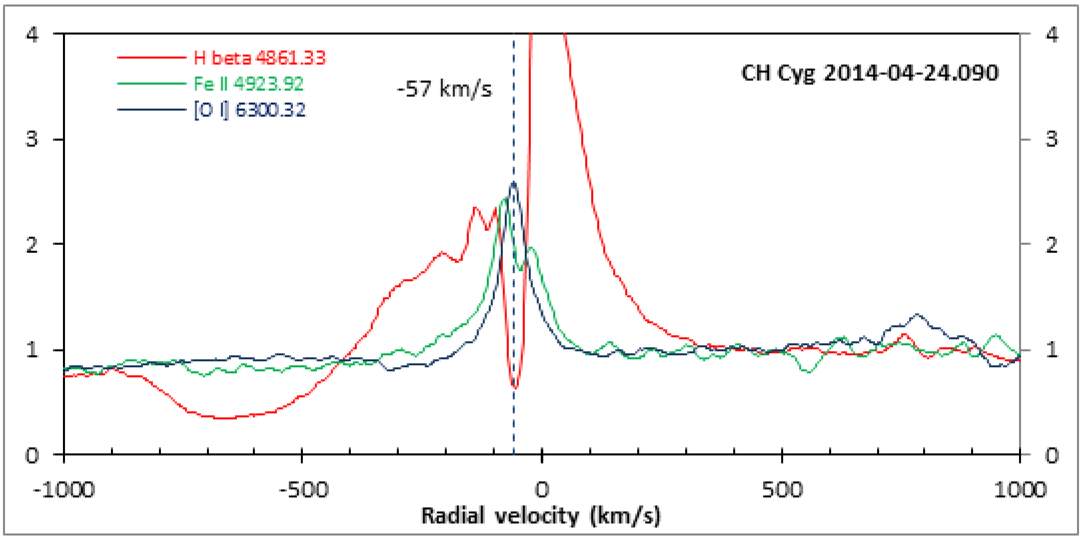
Note the spectrum of April 24th (in blue)

Ha profile in March and April, 2015
Spectra obtained by T. Lester, P. Somogyi, c. Buil, F. Teyssier at R from 9000 to 15000

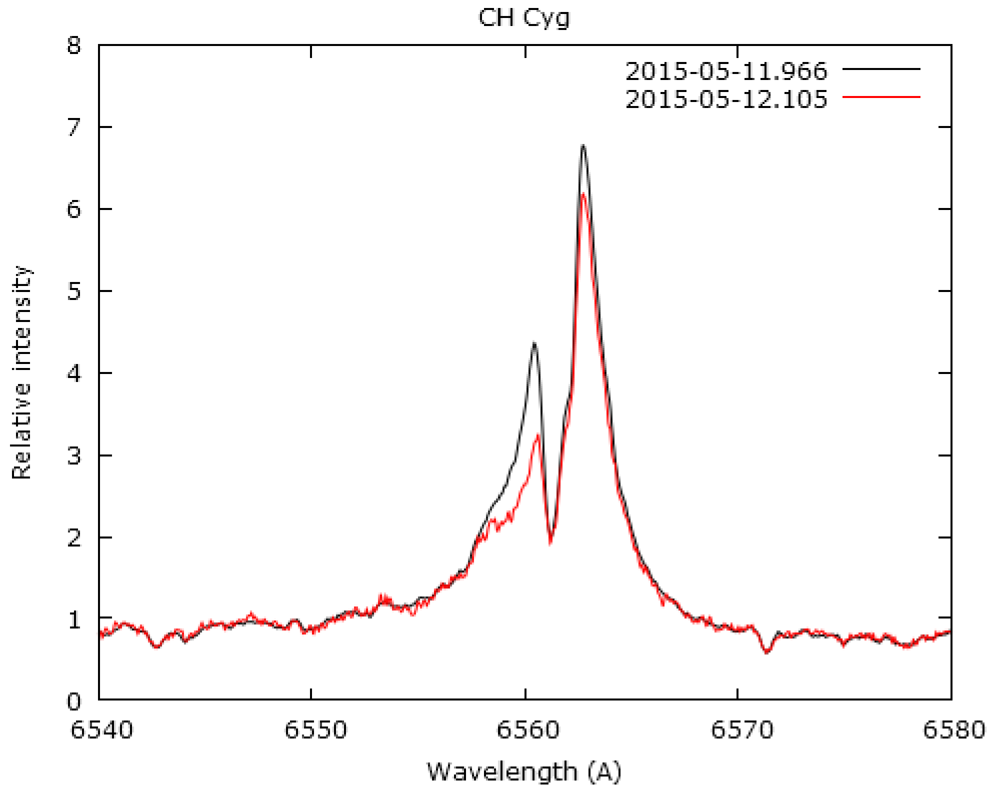



H alpha
H beta
H gamma
-58 km/s
CH Cyg 20140412.096
Radial velocity (km/s)


H alpha 6562.82
H beta 4861.33
H gamma 4340.47
-69.5 km/s
CH Cyg 2014-04-24.090
Radial velocity (km/s)


H beta 4861.33
Fe II 4923.92
[O I] 6300.32
-57 km/s
CH Cyg 2014-04-24.090
Radial velocity (km/s)

Last minute



Variation of H alpha in less than 4 hours
By Peter Somogyi - Lhires III - 2400 l/mm - R = 15000

Log of observations in April

#	date	time	JD	Observer	Resolution	Range
71	08/04/2015	06:49:14	2457120.796	tlester	8990	6004 - 7106
72	12/04/2015	01:50:20	2457124.594	cbuil	11000	4279 - 7360
73	12/04/2015	02:18:53	2457124.618	FTeyssier	11000	4210 - 7163
74	15/04/2015	02:28:56	2457127.613	FTeyssier	11000	4211 - 7163
75	15/04/2015	23:18:11	2457128.488	UmbertoSollecchia	600	3560 - 7380
76	16/04/2015	05:13:13	2457128.722	tlester	1990	4001 - 7475
77	18/04/2015	23:34:57	2457131.496	FTeyssier	11000	4211 - 7163
78	20/04/2015	01:19:11	2457132.56	JacquesMontier	600	3720 - 7383
79	21/04/2015	03:10:02	2457133.64	FTeyssier	11000	4211 - 7163
80	22/04/2015	00:15:34	2457134.514	psomogyi	13374	6501 - 6613
81	24/04/2015	02:09:08	2457136.598	FTeyssier	11000	4210 - 6730
83	24/04/2015	23:18:34	2457137.475	psomogyi	21446	6499 - 6611
84	26/04/2015	23:08:05	2457139.474	psomogyi	21077	6500 - 6612
85	27/04/2015	23:18:15	2457140.479	FTeyssier	11000	4210 - 7167
86	28/04/2015	01:22:04	2457140.563	JacquesMontier	642	3647 - 7390
87	06/05/2015	02:13:45	2457148.613	FTeyssier	11000	4210 - 7167

A note on applicability of low-resolution spectra of CH Cyg.

By Augustin Skopal

During quiescent phases, the spectrum of symbiotic stars usually consists of three basic components of radiation. The optical region is dominated by the radiation from the giant and the nebular radiation produced by the ionized part of the giant's wind.
As the white dwarf (WD) is as hot as ~ 1E+5 K, its contribution to the optical is negligible with respect to those from the giant and the nebula, because its maximum lies in the extreme ultraviolet, while the optical is covered only by its very faint Rayleigh-Jeans tail. During active phases, a significant change concerns to the radiation from the WD, which temperature rapidly decreases, having its maximum in the optical or near-UV. As a result, its contribution is well recognizable in the spectrum. Depending on system and the level of activity, the light from the warm WD's pseudophotosphere, the nebula and the giant are rivaling each other within the optical spectrum.

During the recent quiescent phase of CH Cyg, from ~2007 to ~2013, its optical spectrum was strongly dominated only by the giant (see Fig. 3 in Wallerstein at al. 2010. PASP, 122, 12). However, during 2014, a warm WD's pseudophotosphere started to be well recognizable in the spectrum, rivaling the contribution From_the giant for wavelengths < ~ H-beta. Figure 1 shows example of this case on the spectrum made by D. Boyd on July 25 2014, scaled to the simultaneous UBV photometry. Temperature of the WD's pseudophotosphere was around 8000 K (the blue line), while the nebular continuum was rather uncertain, because the spectrum starts at ~ 3700 A, and thus the region prior to the Balmer jump from its blue side, where the nebula is relatively strong, is not covered. Following observations showed a variable contributions from both the giant and the WD with an increasing trend of the WD's pseudophotosphere. Figure 2 shows the latest observation from April 15 2015 made by Umberto Sollecchia.

Here the model of the spectral energy distribution demonstrates a significant contribution from the WD's pseudophotosphere dominating the giant to ~ 6000 A. So, its size considerably enlarged and its temperature decreased to ~ 7000 K. In this case the spectrum was exposed from 3560 A, that allows us to adjust the nebular contribution more accurately. Thus, modelling the low-resolution spectra allow us to map the evolution of the hot component in CH Cyg during its transition from quiescence to the present (2014-15) active phase, and thus to explore the accretion process in this system.

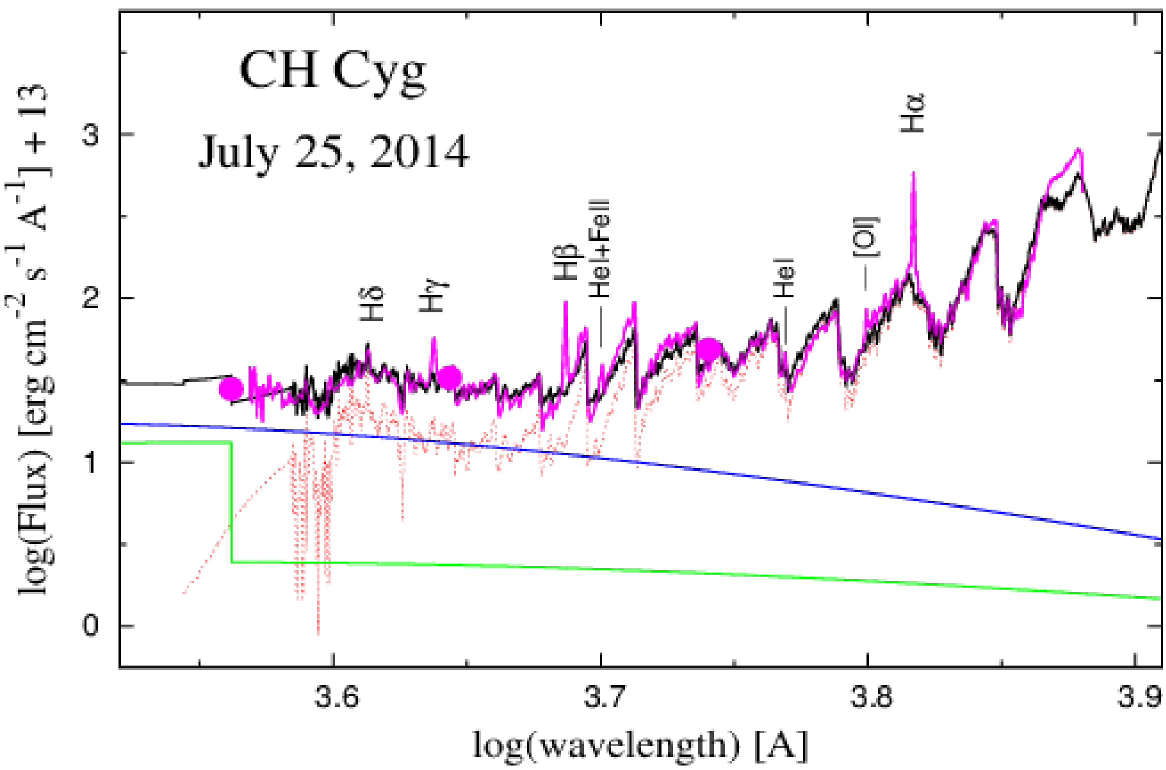


Figure 1. Comparison of the observed spectrum (magenta line) scaled to photometric UBV flux-points (full circles) and its model (black line). The model is given by a superposition of the radiation from the WD pseudophotosphere (blue line) and the nebula (green line). Spectrum was made by D. Boyd on July 25, 2014.

A note on applicability of low-resolution spectra of CH Cyg.

By Augustin Skopal

Another important impact of the low-resolution spectra is determination of the continuum radiation, which is in the case of CH Cyg particularly complex being affected by the sharp molecular bands discontinuities in the giant spectrum.

Your medium-resolution spectra show dramatic variations in the hydrogen line profiles. Strong absorption/emission features observed mainly on the blue side of the Balmer lines, evolving on a time-scale of days or even shorter, reflect the complex mass ejection by the WD in CH Cyg as in a slow-motion movie. This is a great opportunity to follow the process of the mass ejection From_the active WD in more detail than in the case of the abrupt and violent nova outbursts. To obtain the accurate information on what is happening in the line, we have to subtract the profile of the underlying continuum, which is determined by modelling the low-resolution spectrum. Figure 3 shows example of the medium-resolution spectrum around the H-alpha line made by Christian Buil on March 17 2015. The model continuum here was adapted from the model showed in Fig. 2. In this way we can distinguish the light emitted by the line transition from that of the continuum, and thus determine parameters of the absorbing and emitting material ejected by the WD.

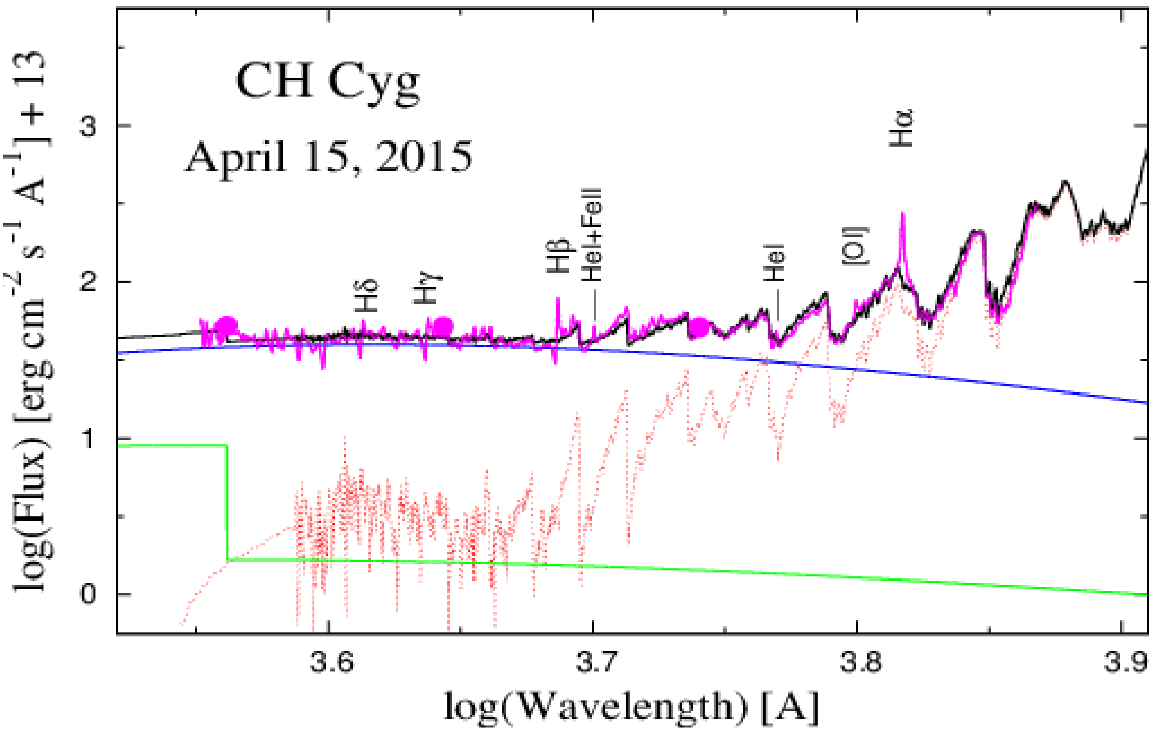


Figure 2. As in Fig. 1, but for the spectrum made by Umberto Sollecchia on April 15 2015.

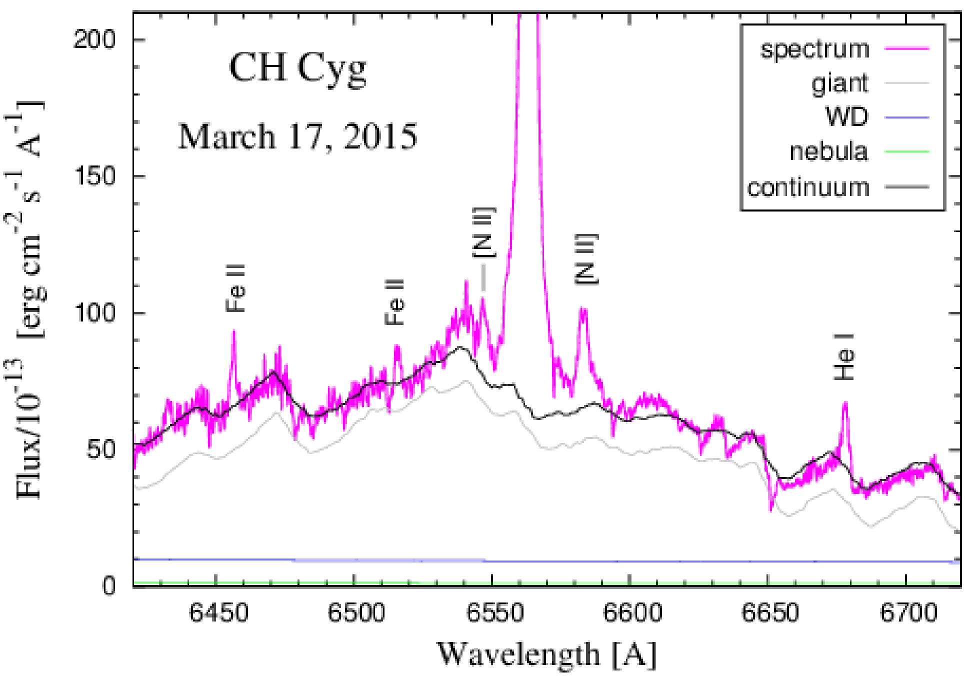
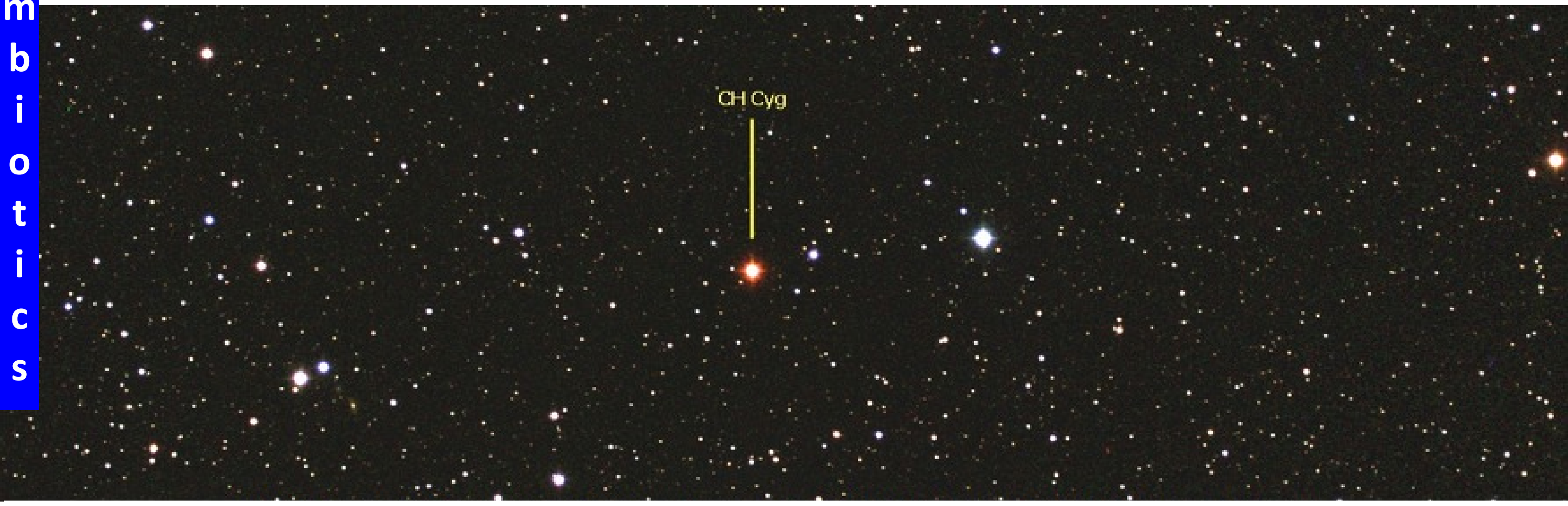


Figure 3. Example of the medium-resolution spectrum covering the H-alpha region with the model of the underlying continuum (black line). Here, the contribution from the giant is depicted by the grey line. The spectrum was acquired by Christian Buil on March 17 2015.

Request for observations of the symbiotic star CH Cygni (Dr A. Skopal)



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)
Spectra should be corrected for heliocentric velocity

Send spectra

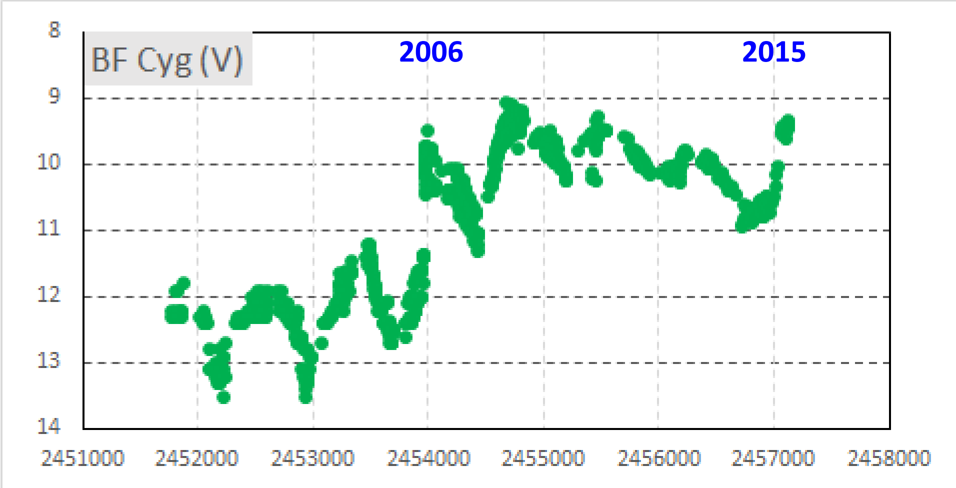
To francoismathieu.teyssier at bbox.fr

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

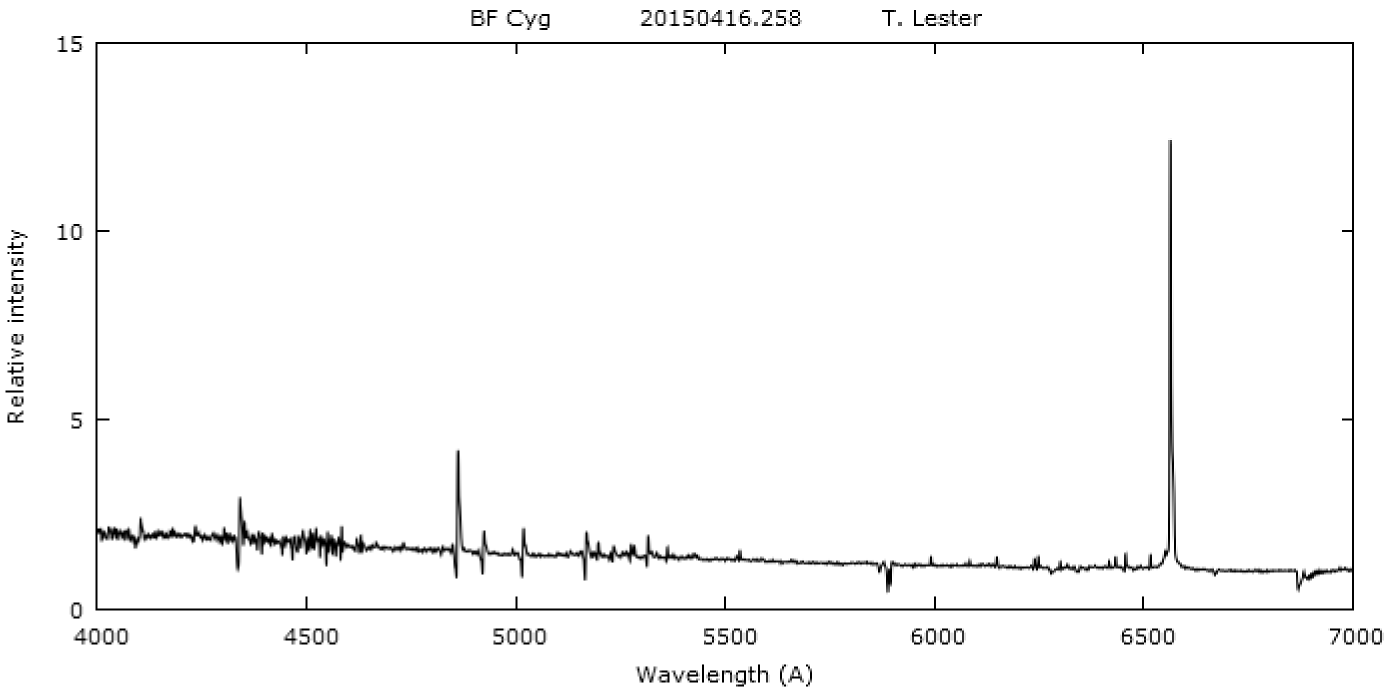
Coordinates (2000.0)	
R.A.	19 23 53.5
Dec.	+29 40 29.2

Nice coverage in high resolution

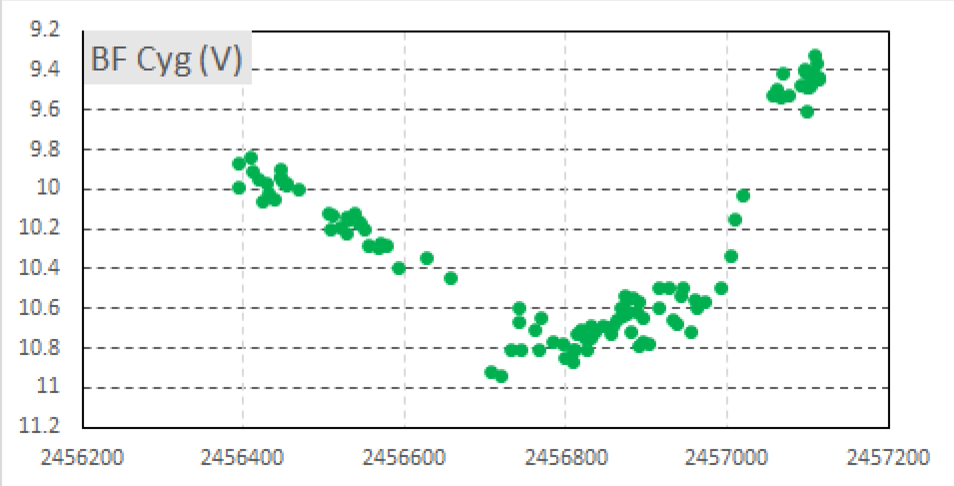


In December 2014/January 2015, Munari & al. detected a large flare with large changes in the spectrum (ATel # 7013)

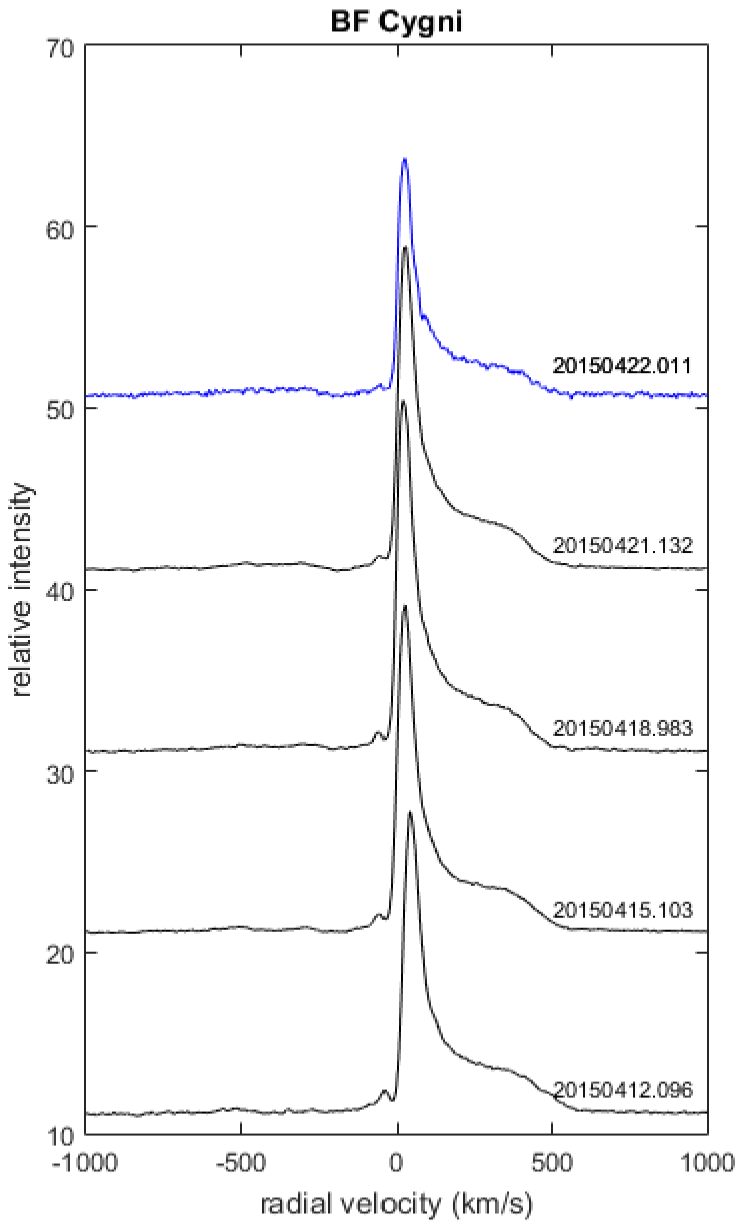
AAVSO V band light curve since 2000



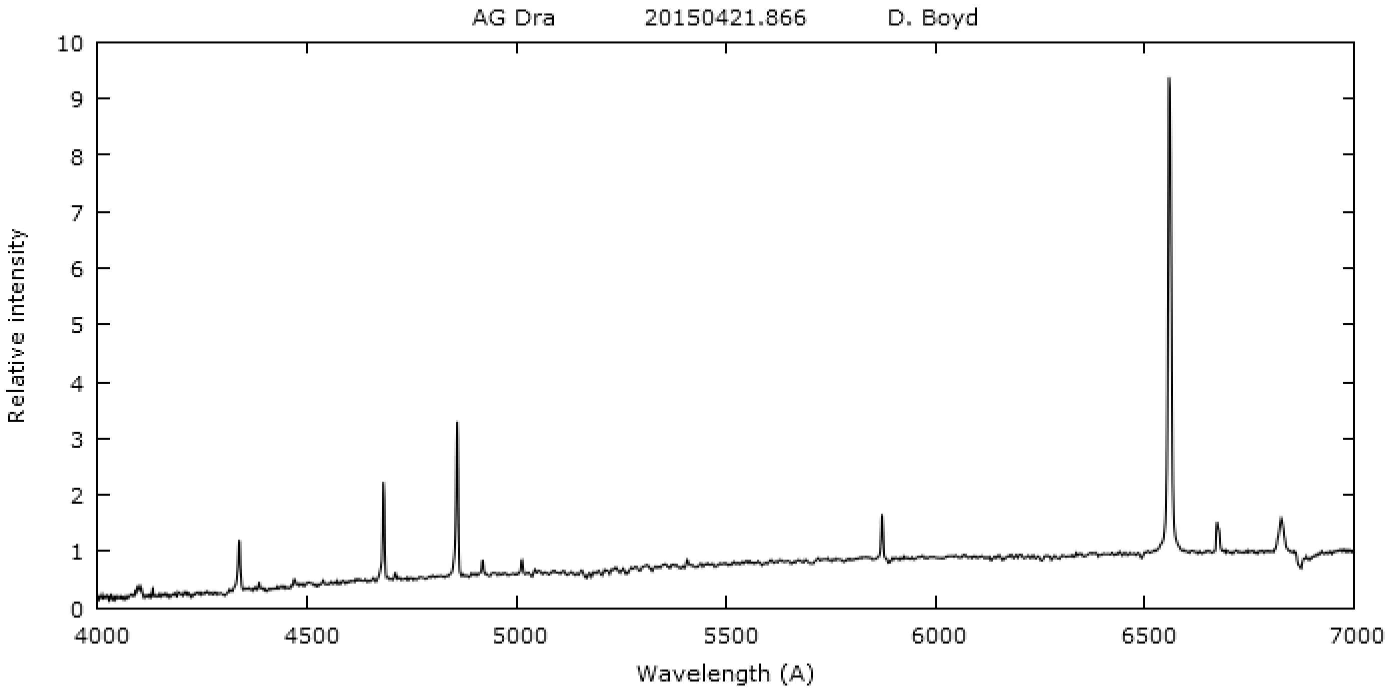
The AAVSO V band light showing the current outburst



H alpha line in April, 2015
Still the broad emission in the red part of the line



Coordinates (2000.0)	
R.A.	16 01 41.0
Dec.	+66 48 10.1
Mag V	9.7



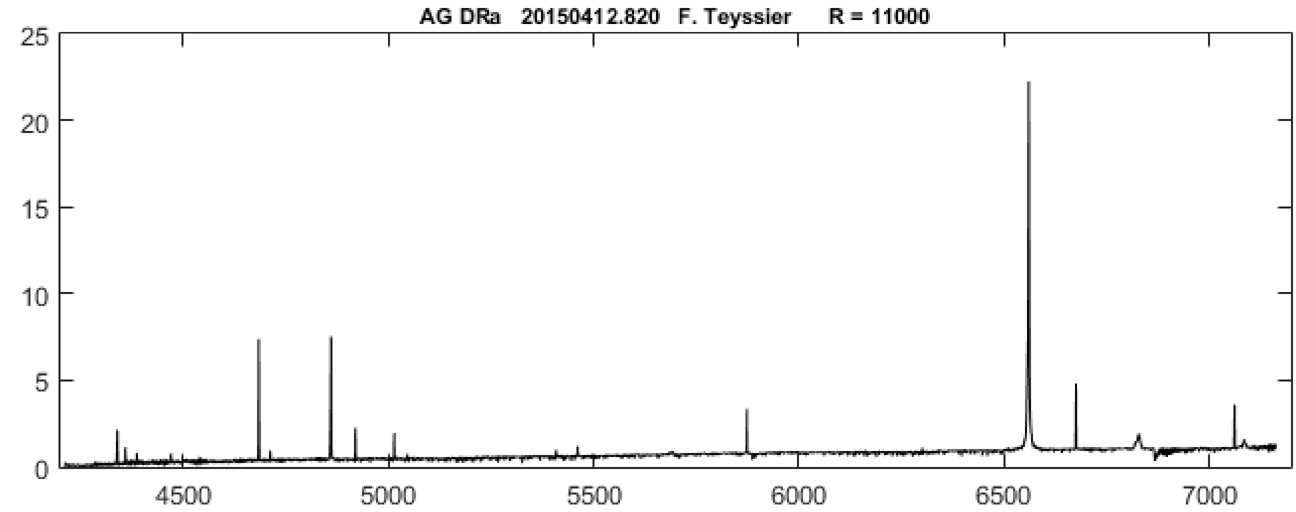
Selected lectures about AG Dra

The Long-Term Spectroscopic Misadventures of AG Dra with a Nod toward V407 Cyg: Degenerates Behaving Badly
Shore, S. N.; Genovali, K.; Wahlgren, G. M.
Baltic Astronomy, Vol. 21, p. 139-149
http://adsabs.harvard.edu/abs/2012BaltA..21..139S

The spectroscopic evolution of the symbiotic star AG Draconis. I. The O VI Raman, Balmer, and helium emission line variations during the outburst of 2006-2008
Shore, S. N.; Wahlgren, G. M.; Genovali, K.; Bernabei, S.; Koubsky, P.; Šlechta, M.; Škoda, P.; Skopal, A.; Wolf, M.
Astronomy and Astrophysics, Volume 510
http://adsabs.harvard.edu/abs/2010A%26A...510A..70S

The origin of the supersoft X-ray-optical/UV flux anticorrelation in the symbiotic binary AG Draconis
Skopal, A.; Sekeráš, M.; González-Riestra, R.; Viotti, R. F.
Astronomy and Astrophysics, Volume 507, Issue 3, 2009, pp.1531-1539
http://adsabs.harvard.edu/abs/2009A%26A...507.1531S

Emission lines in the spectrum of the symbiotic star AG Draconis from 1997 to 2003
Leedjärv, L.; Burmeister, M.; Mikołajewski, M.; Puss, A.; Annuk, K.; Gałan, c.
Astronomy and Astrophysics, v.415, p.273-282 (2004)
http://adsabs.harvard.edu/abs/2004A%26A...415..273L


AG DRa 20150412.820 F. Teyssier R = 11000
0
5
10
15
20
25
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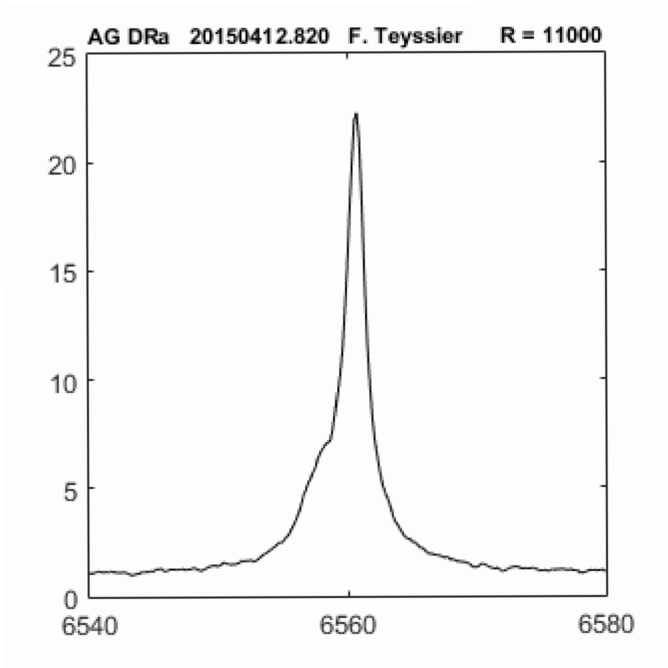
5000
5500
6000
6500
7000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10
15
20
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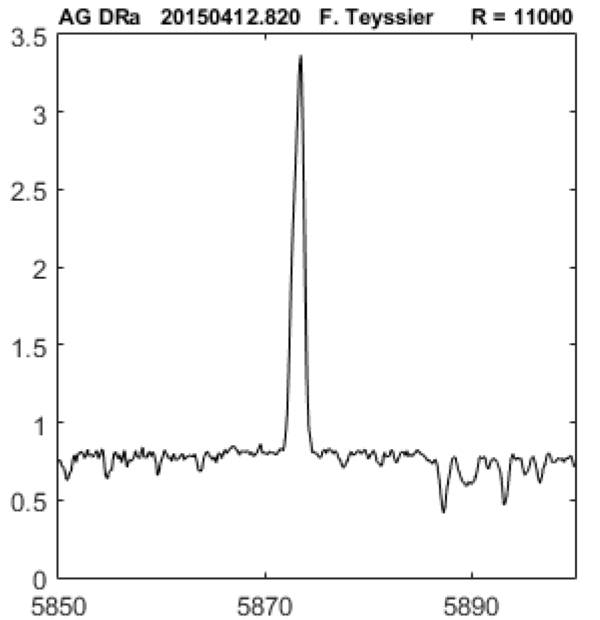
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2
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3
3.5
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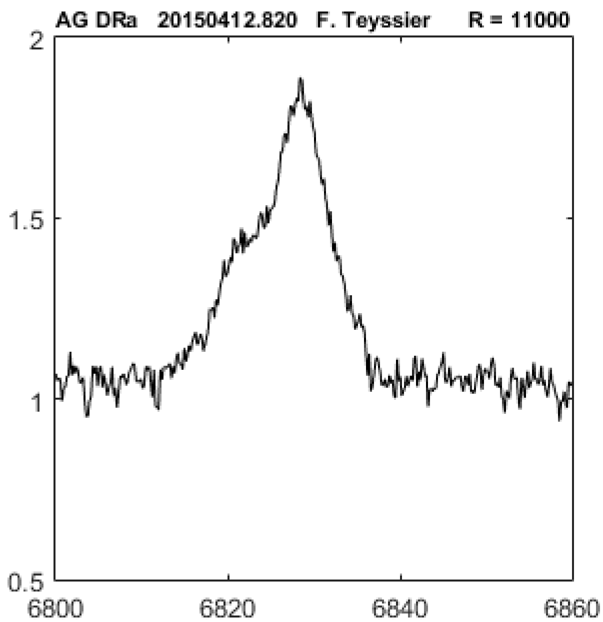
5890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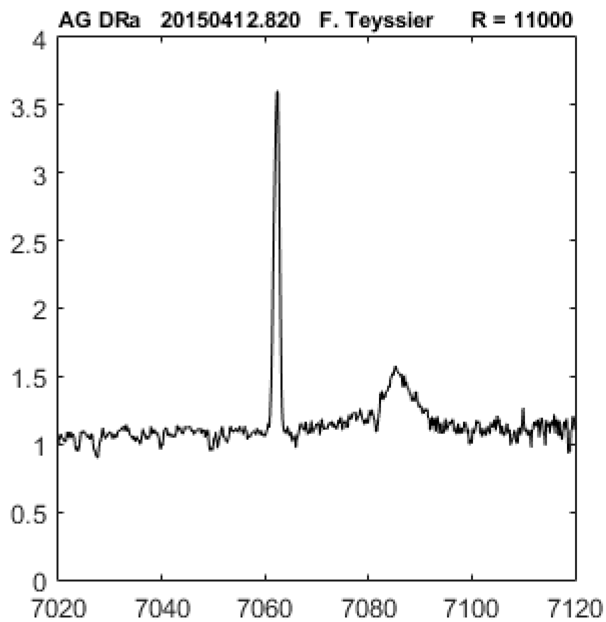
1
1.5
2
6800
6820
6840
6860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3
3.5
4
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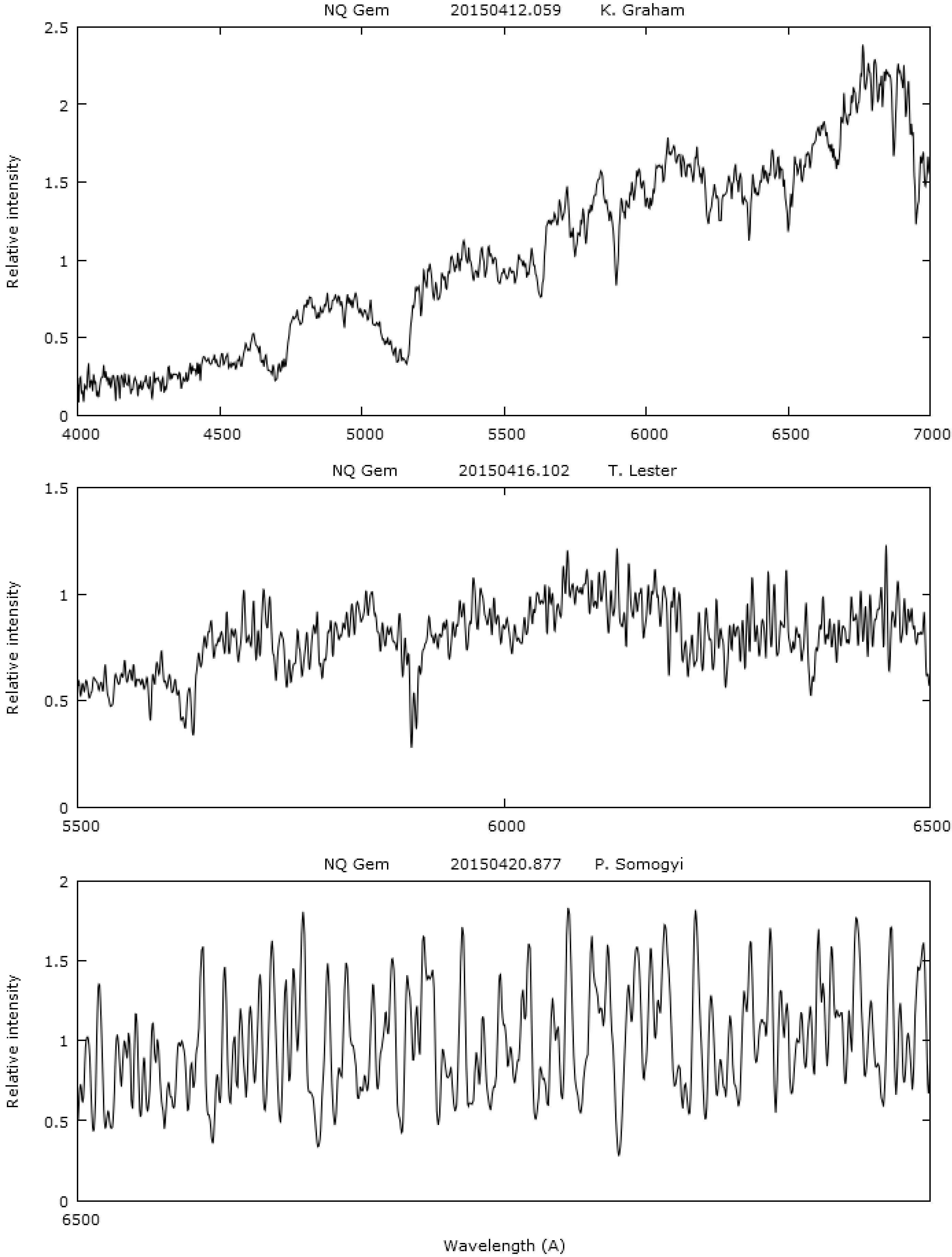
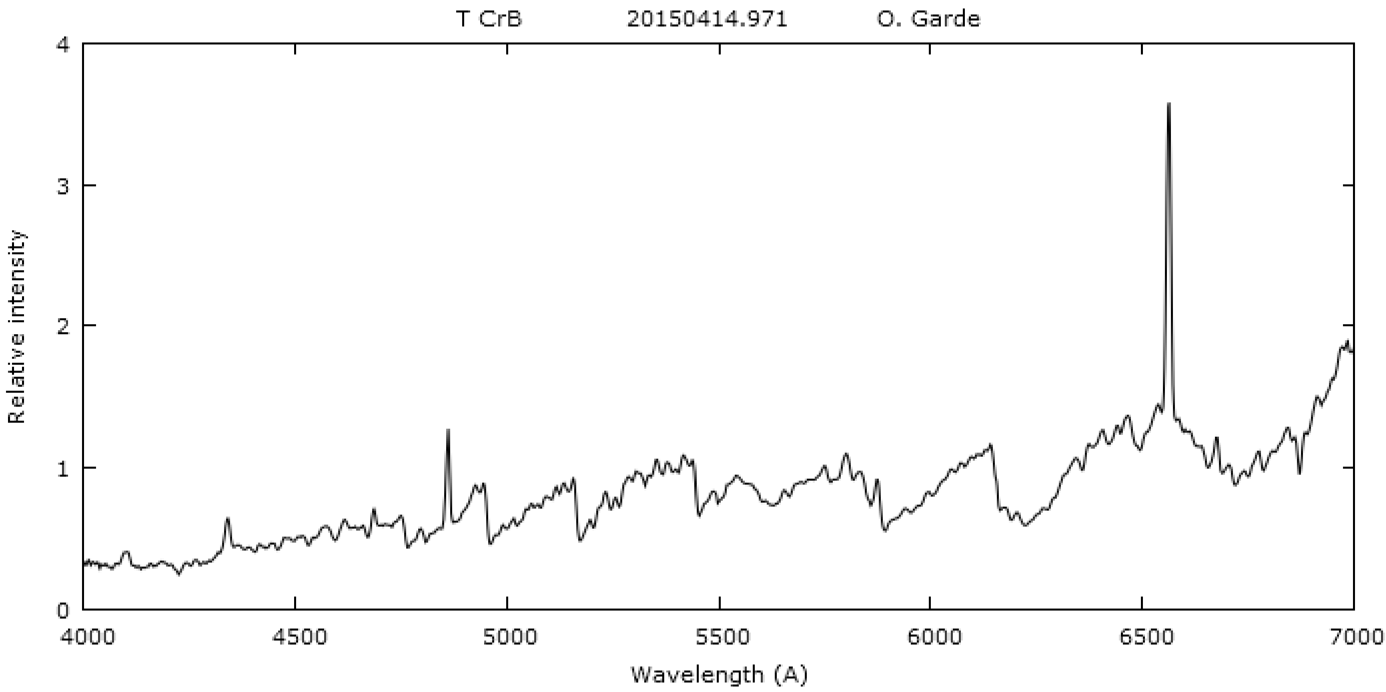
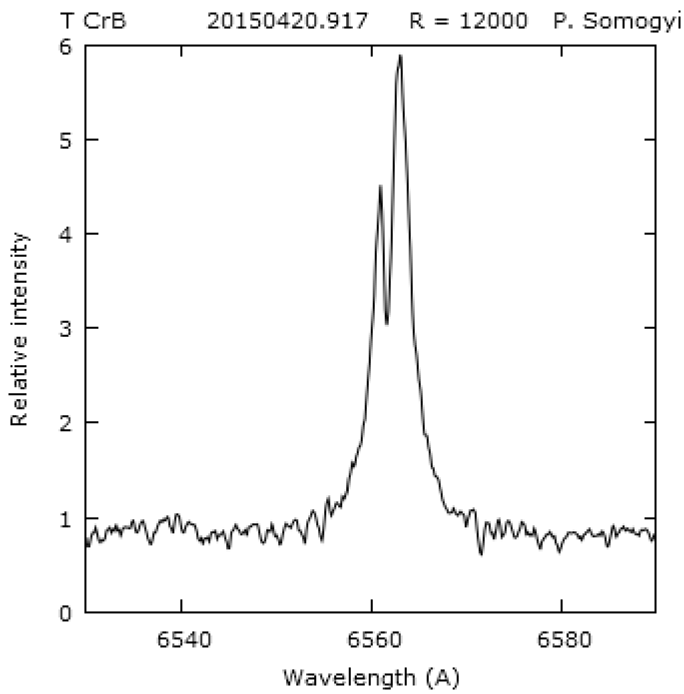
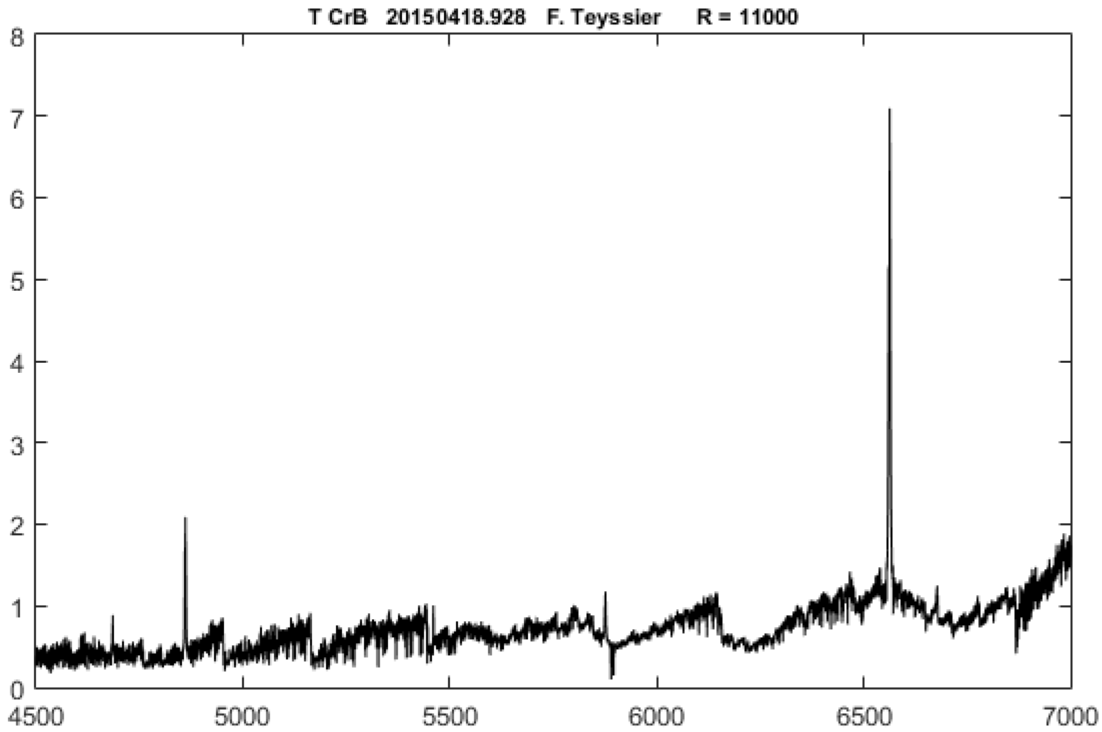
7060
7080
7100
7120


NQ Gem 20150412.059 K. Graham
Relative intensity
2.5
2
1.5
1
0.5
0
4000
4500
5000
5500
6000
6500
7000
NQ Gem 20150416.102 T. Lester
Relative intensity
1.5
1
0.5
0
5500
6000
6500
NQ Gem 20150420.877 P. Somogyi
Relative intensity
2
1.5
1
0.5
0
6500
Wavelength (A)

Coordinates (2000.0)	
R.A.	15 59 30.16
Dec.	+25 55 12.6
Mag	10.2






T CrB 20150418.928 F. Teyssier R = 11000
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1
2
3
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5
6
7
8
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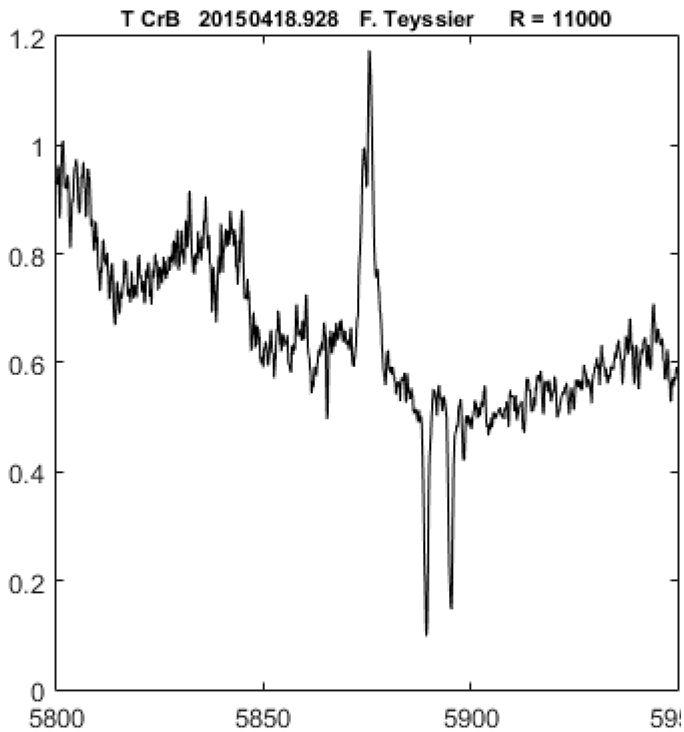
5500
6000
6500
7000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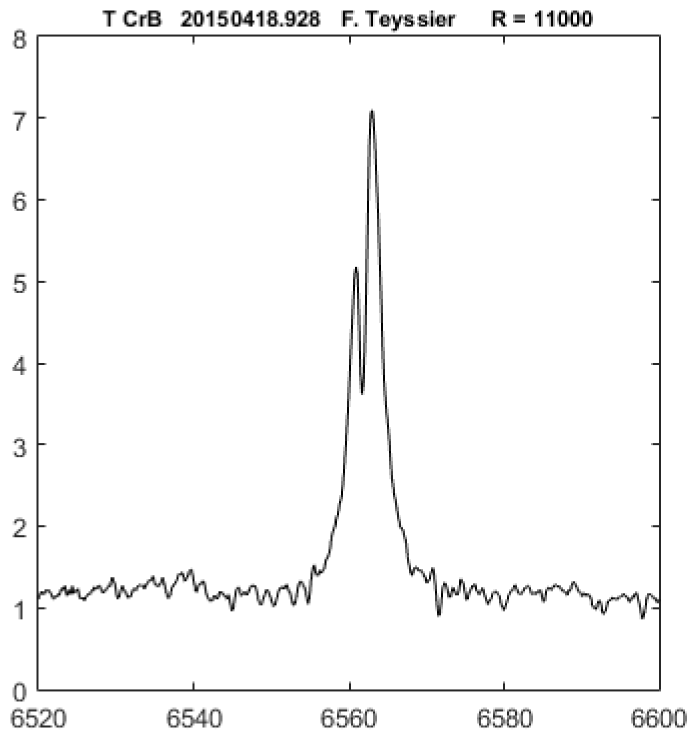
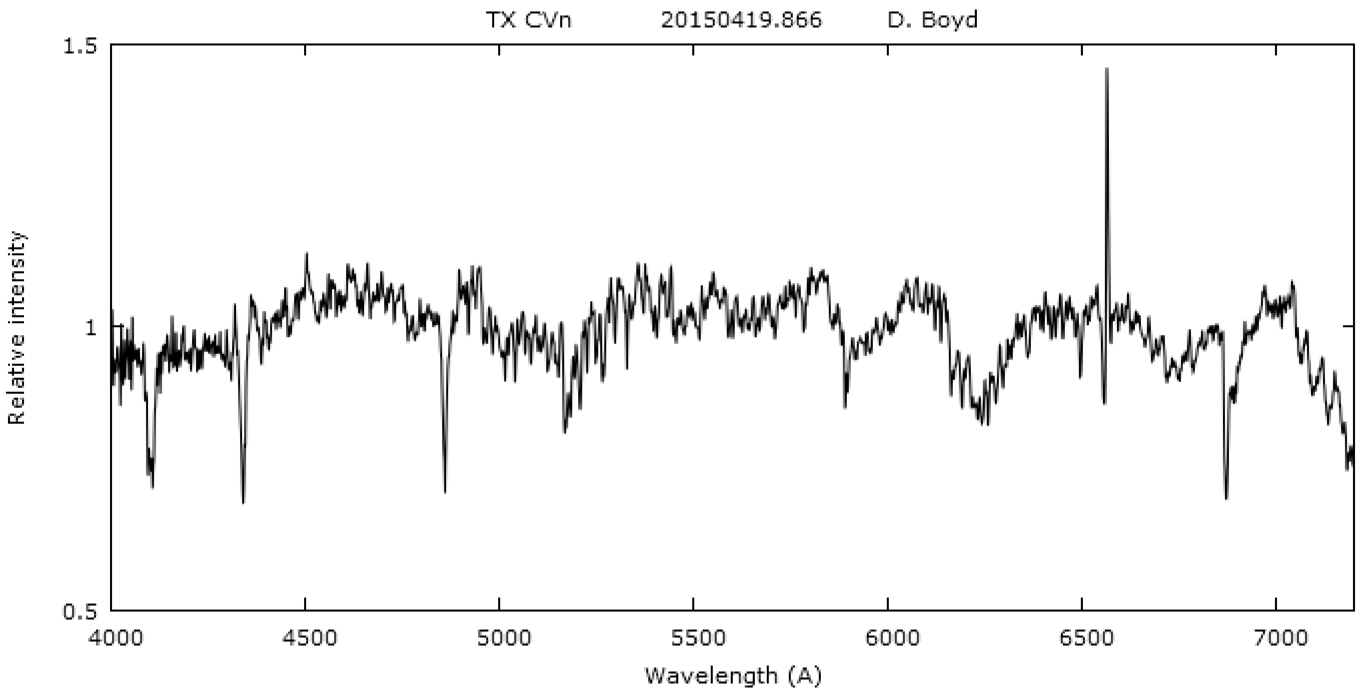
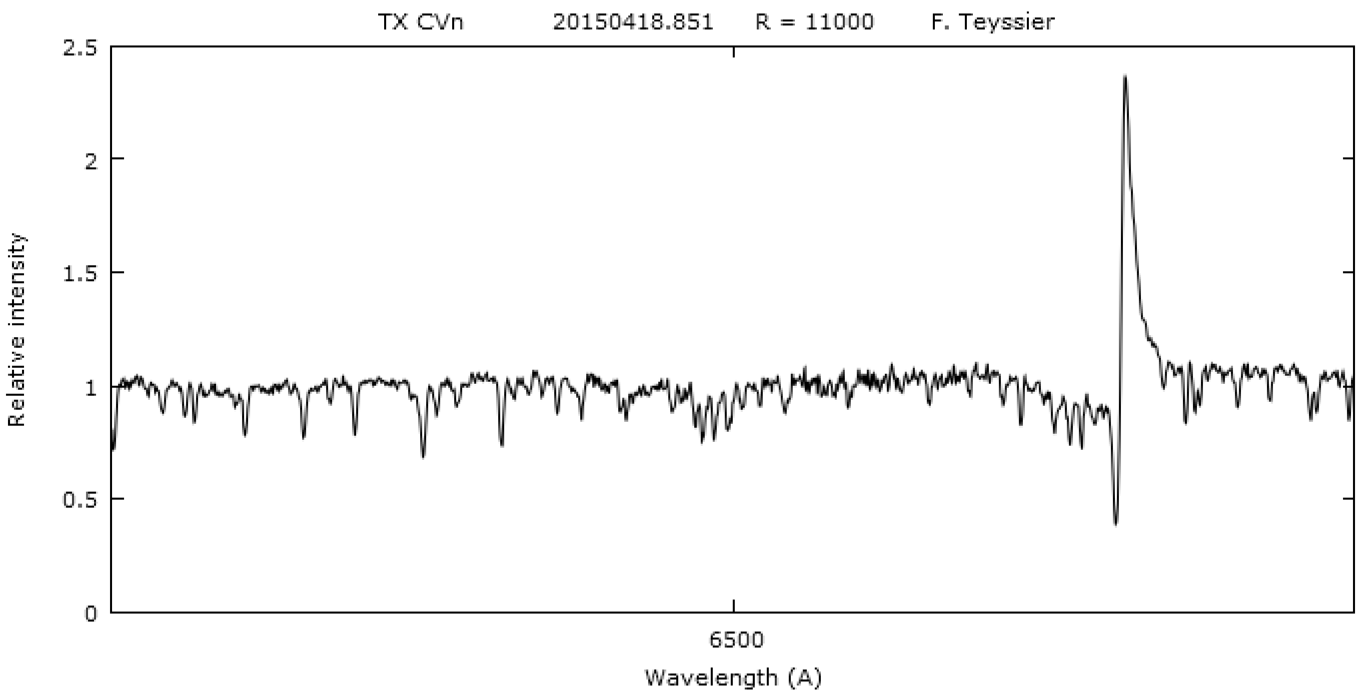
0.4
0.6
0.8
1
1.2
5800
5850
5900


T CrB 20150418.928 F. Teyssier R = 11000
0
1
2
3
4
5
6
7
8
6520
6540
6560
6580
6600

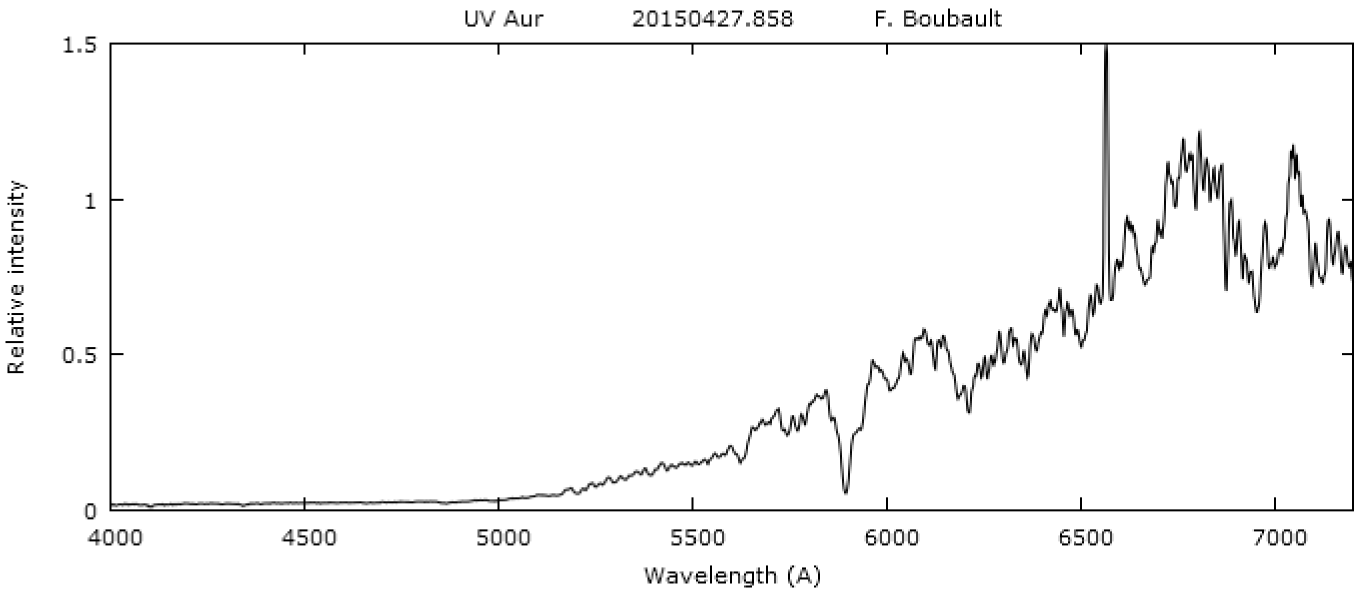
Coordinates (2000.0)	
R.A.	12 44 42.0
Dec.	+36 45 50.6
Mag V	9.8





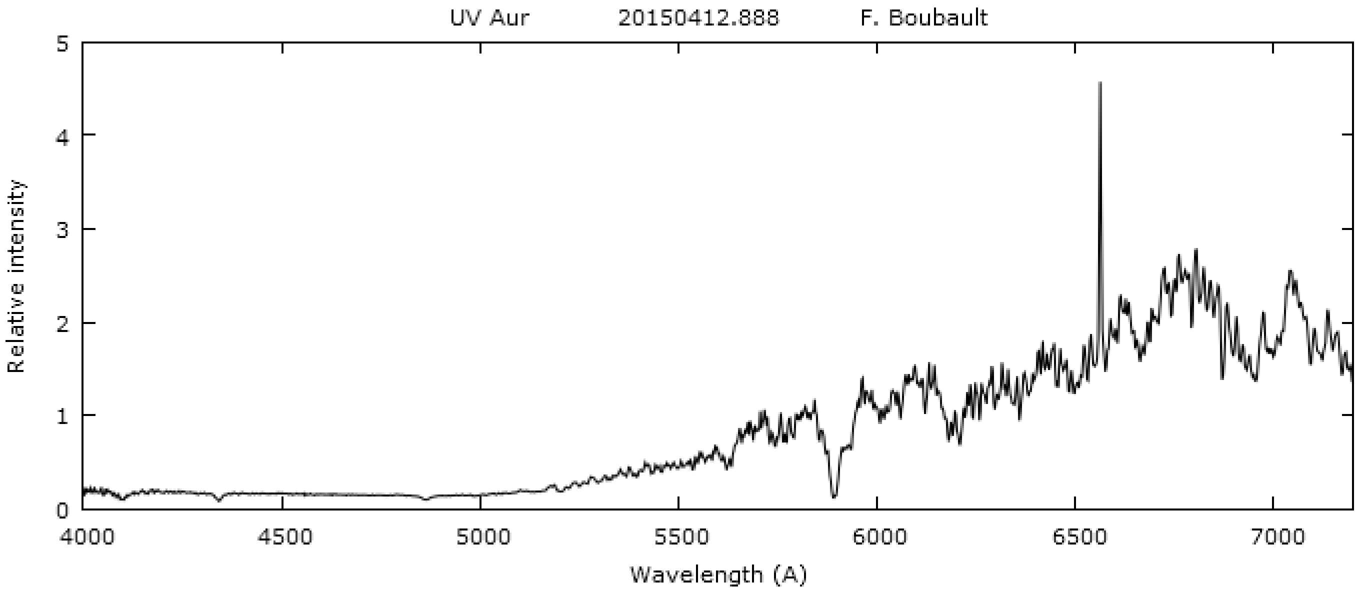
BX Mon

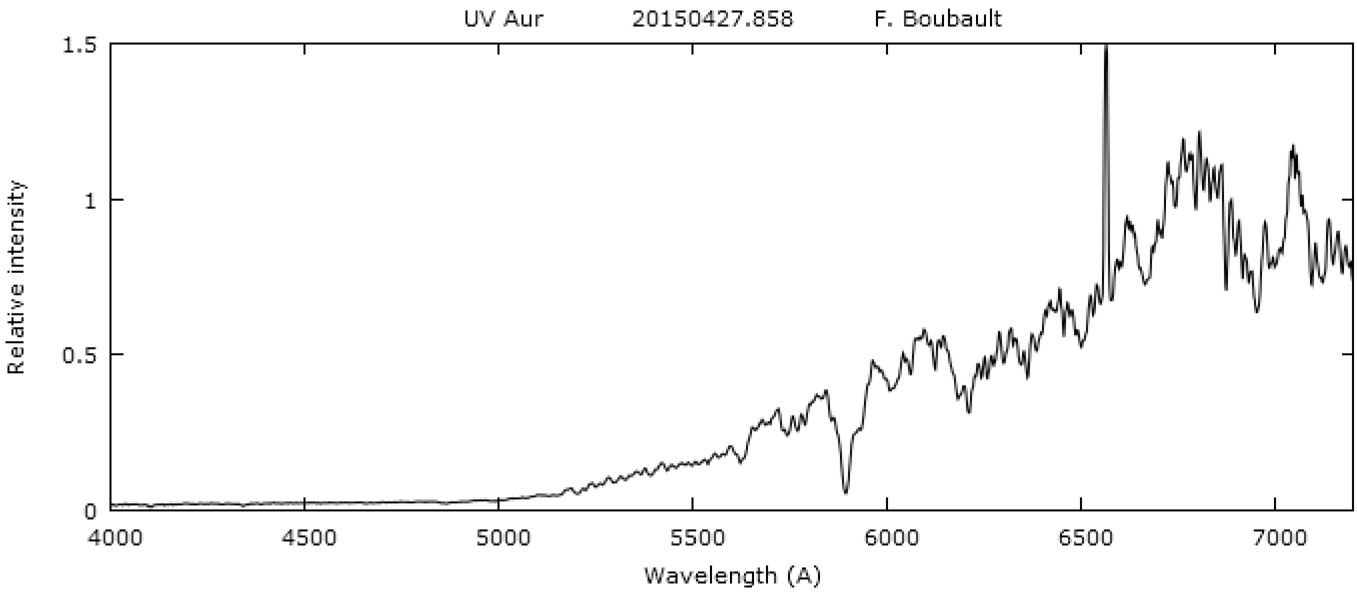
Coordinates (2000.0)
R.A.
Dec.
Mag V



UV Aur

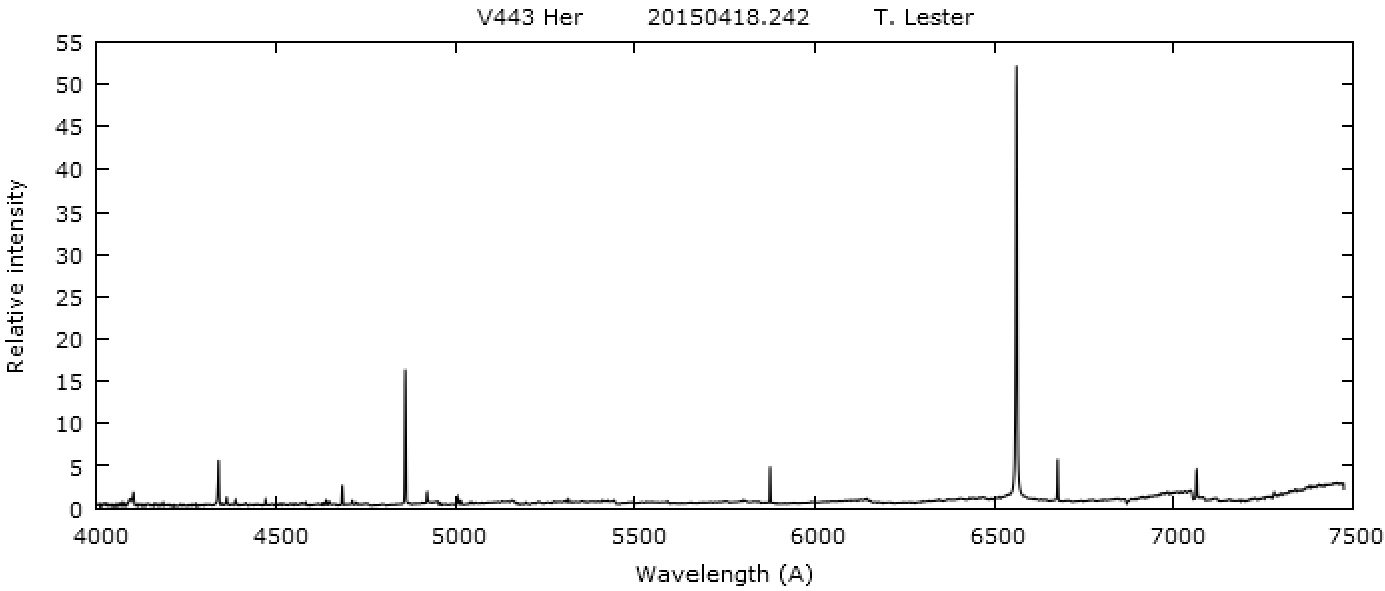
Coordinates (2000.0)	
R.A.	5 21 48.8
Dec.	+32 30 43.1
Mag V	~10

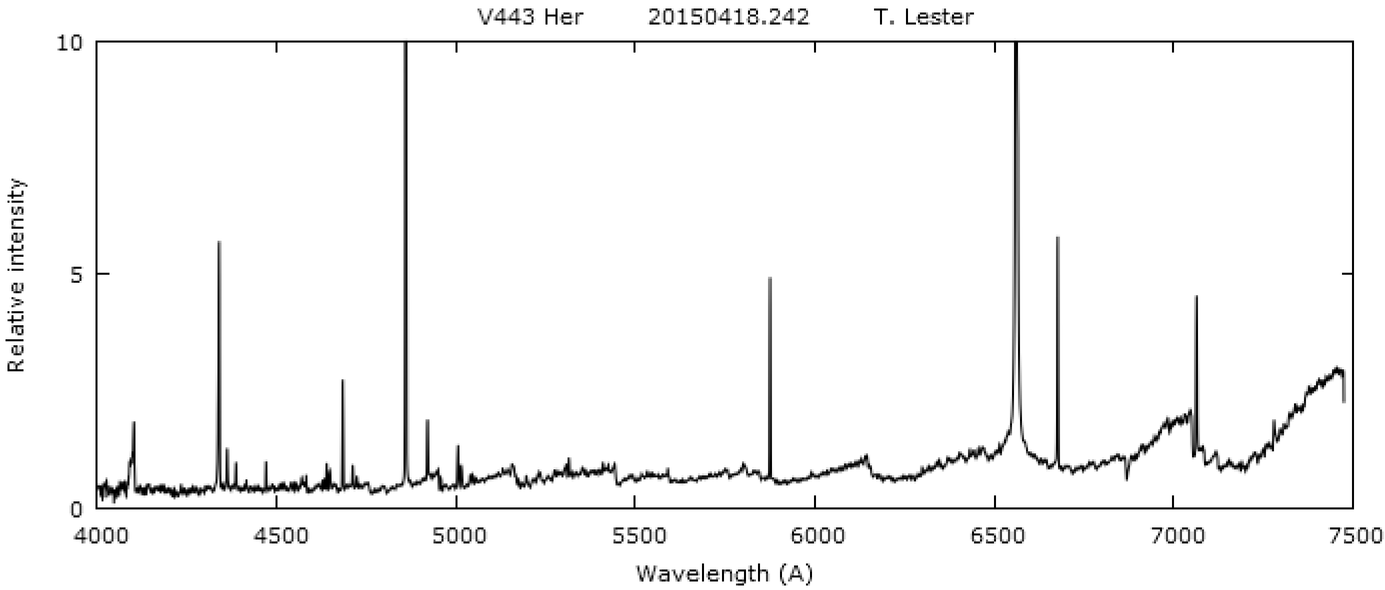




Coordinates (2000.0)	
R.A.	18 22 08.4
Dec.	+23 27 20.0
Mag V	~11.5

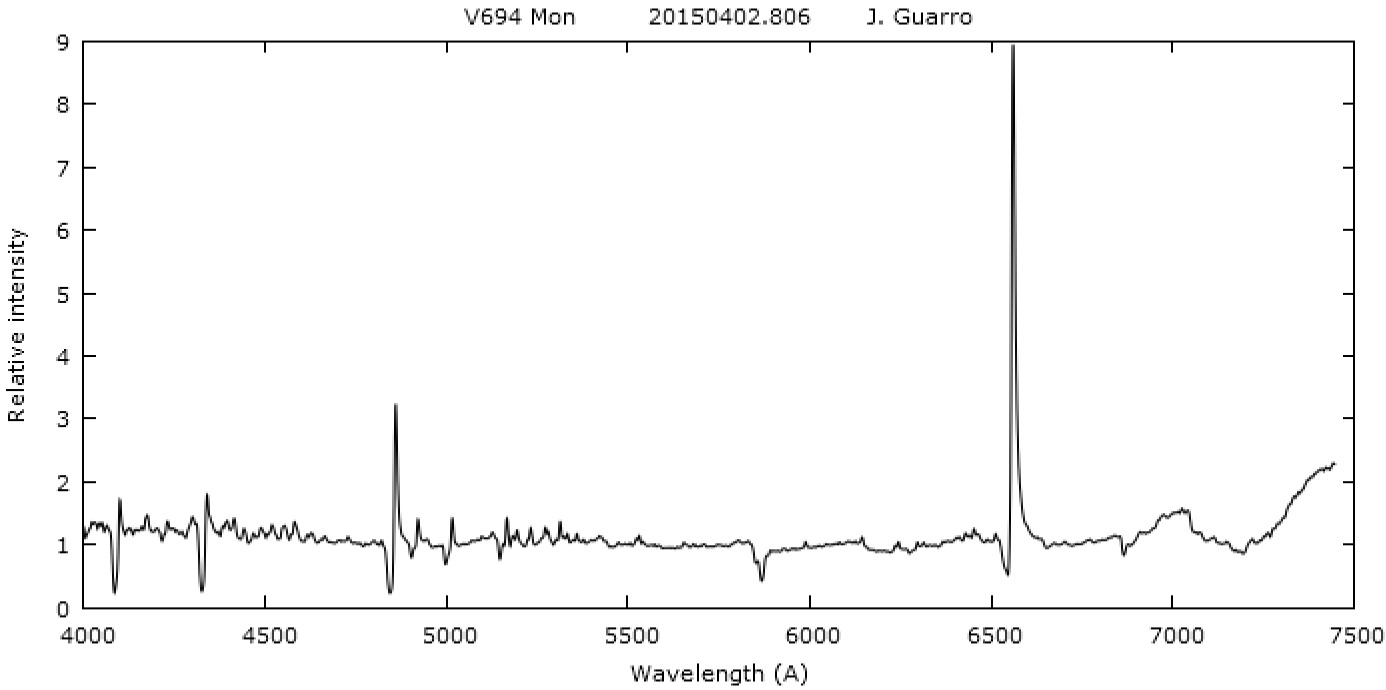
18 22 08.4	+23 27 20.0

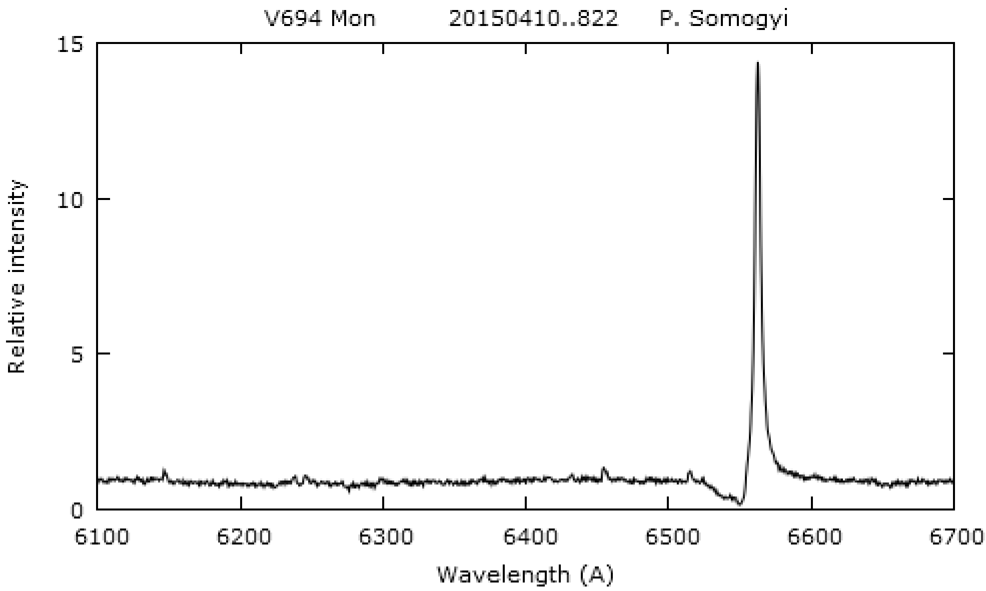




Coordinates (2000.0)	
R.A.	7 25 51.2
Dec.	-07 44 08.0
Mag V	10.0 to 10.7

44 spectra of V694 Mon since October 2014

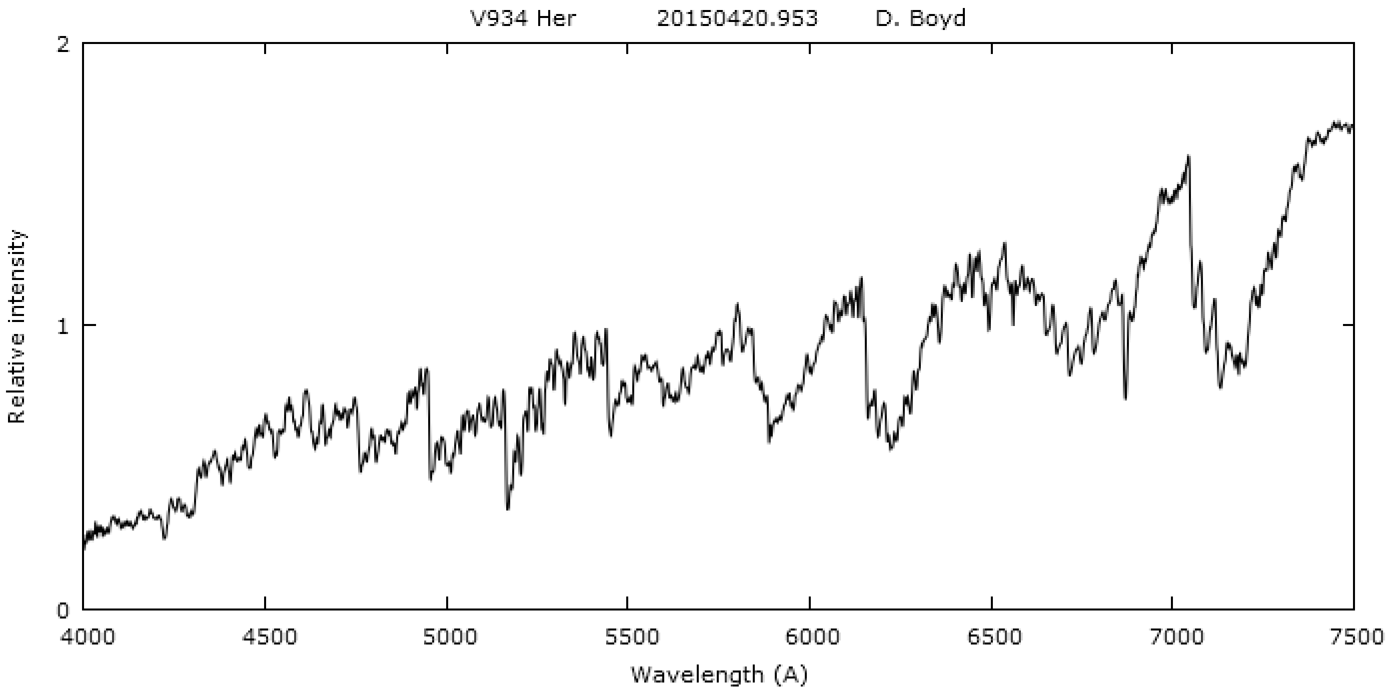




R = 3600
Lhires III 600 l/mm

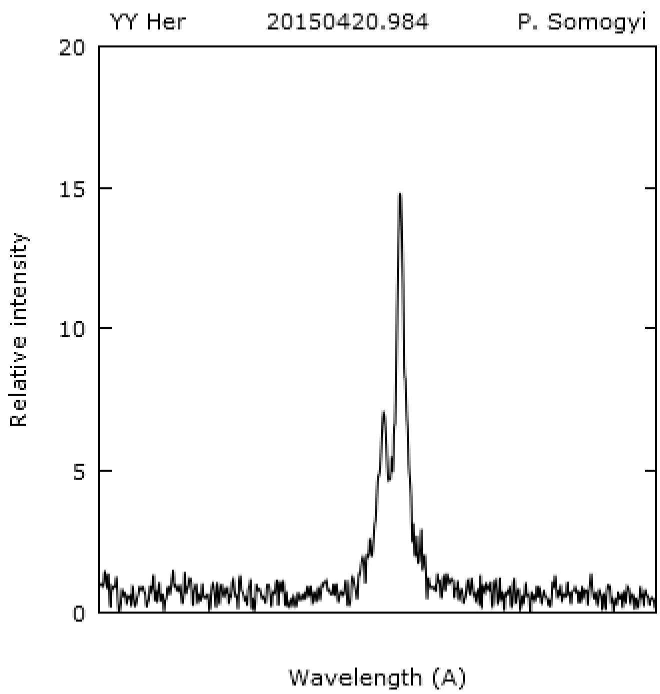
http://www.astrosurf.com/aras/Aras_DataBase/Symbiotics/V694Mon.htm

Coordinates (2000.0)	
R.A.	17 06 34.5
Dec.	+23 58 18.5
Mag V	~7.8



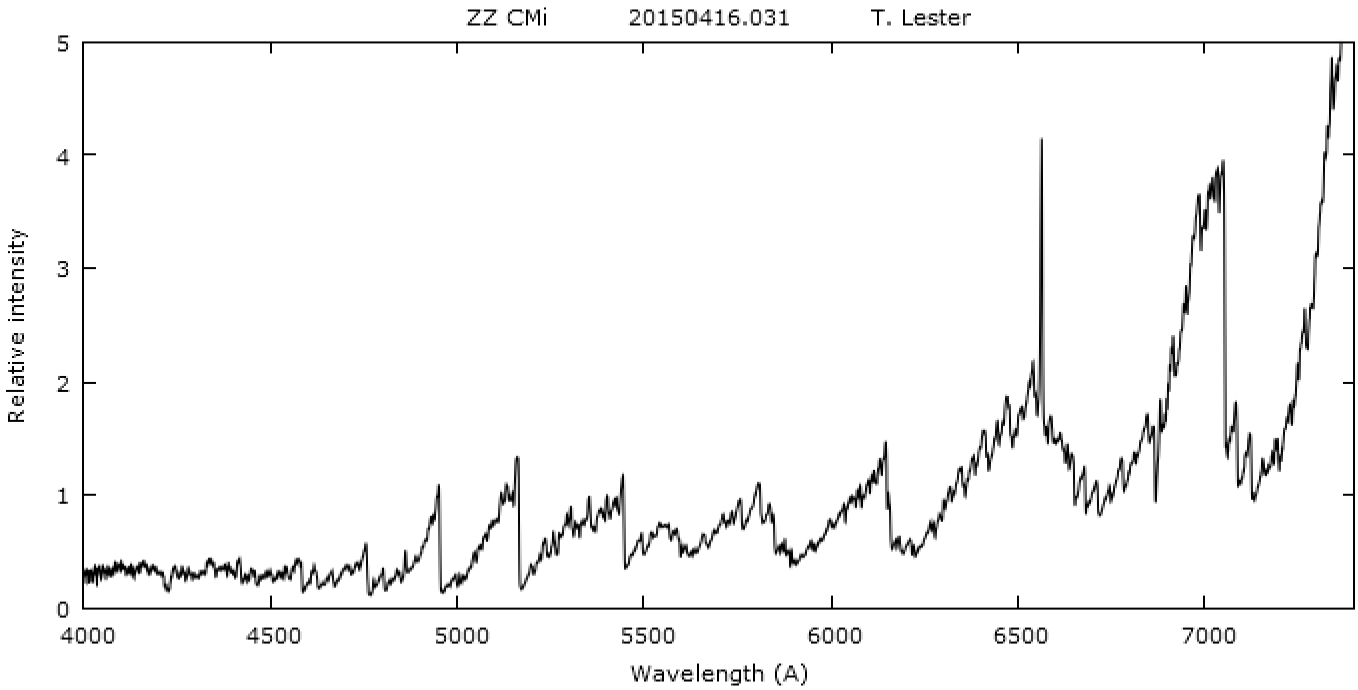
Coordinates (2000.0)	
R.A.	18 14 34.2
Dec.	+20 59 21.3
Mag V	12.8

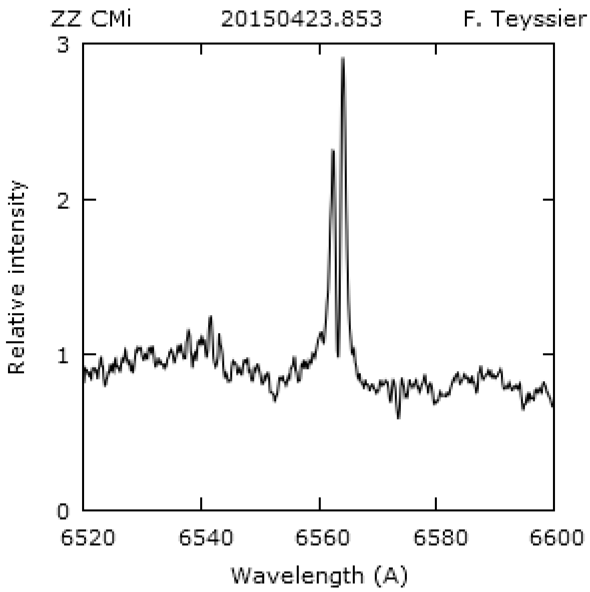
YY Her is a faint classical nova (mag V ~13)
Peter Somogyi obtained a spectrum of H alpha line with a SC 254 mm and a LHIRES III at R = 13000.

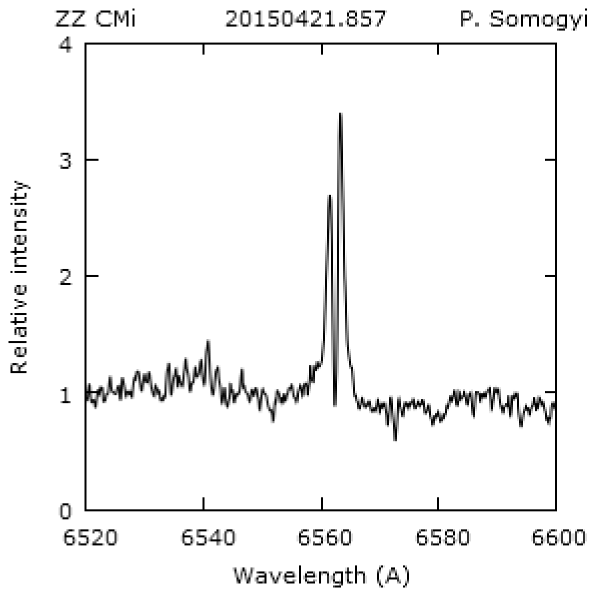


ZZ CMi

Coordinates (2000.0)	
R.A.	7 24 13.9
Dec.	+08 53 51.7
Mag V	10.2





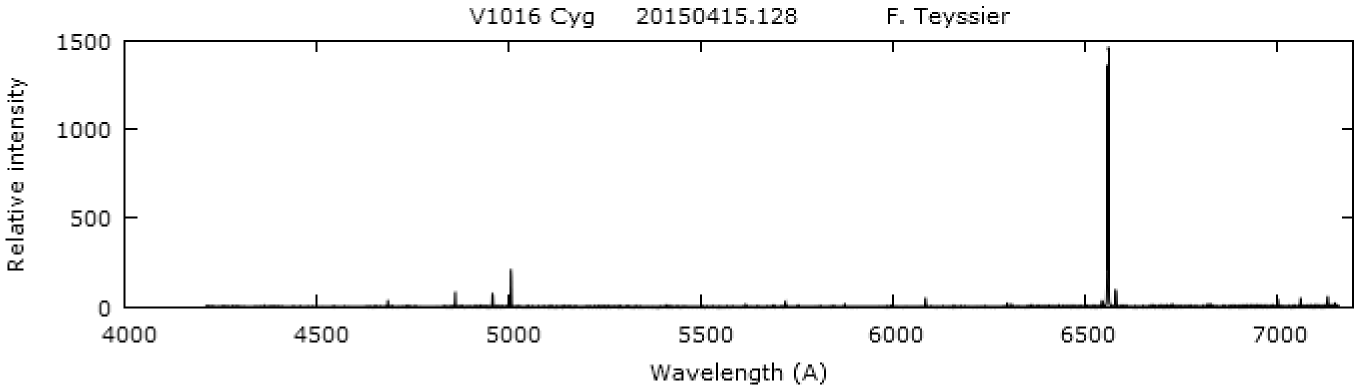


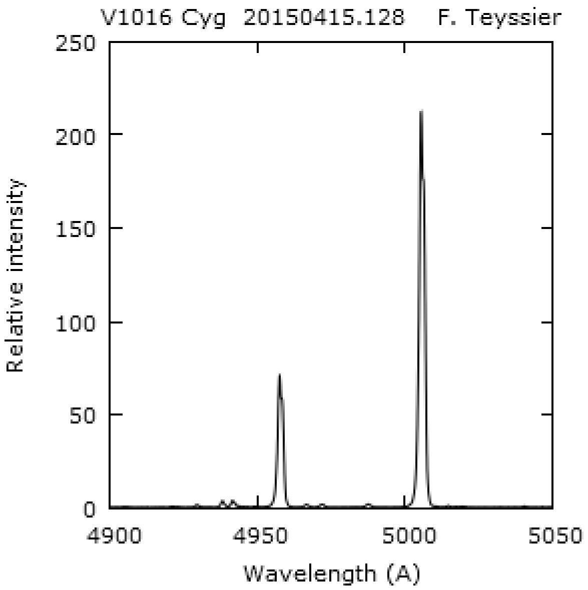
H alpha line at R = 11 000

V1016 Cyg

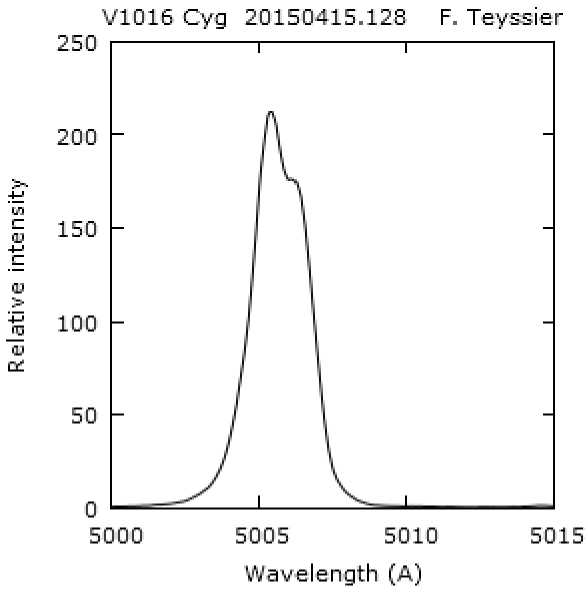
Coordinates (2000.0)	
R.A.	19 57 05.03
Dec.	+39 49 36.3
Mag V	12

The symbiotic nova V1016 Cyg at R = 11 000

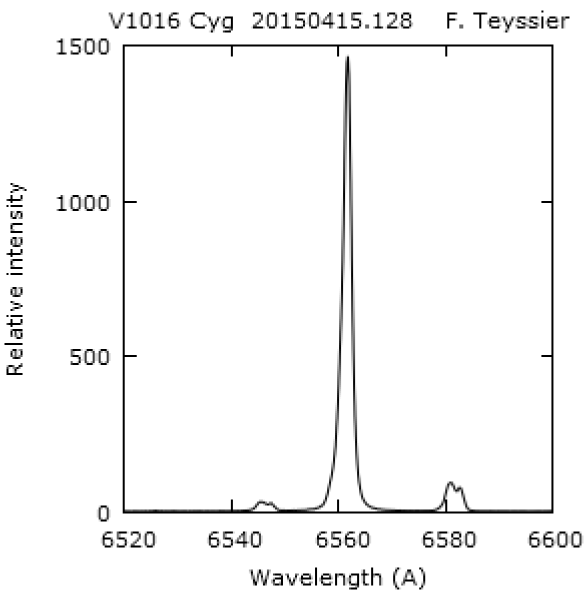




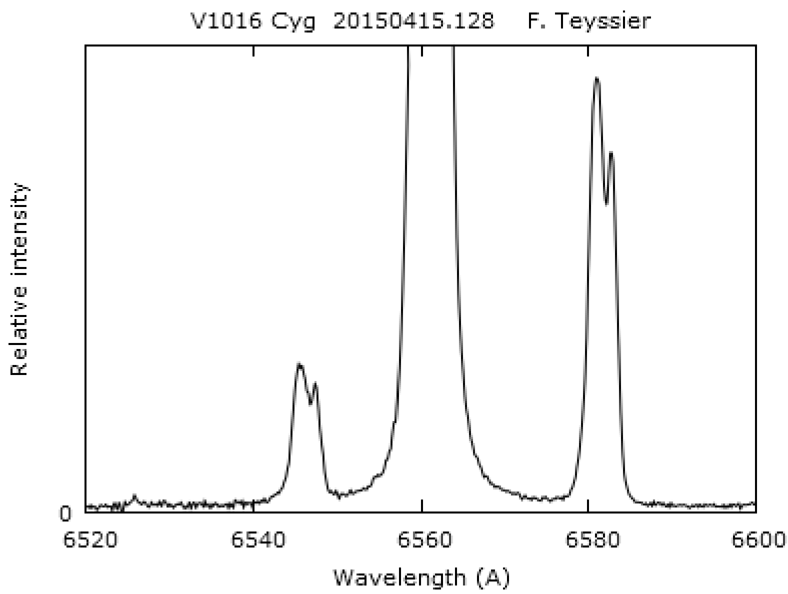
[O III] 4959, 5007



Crop on [O III] 5007



Hα and [N II] 6548, 6583

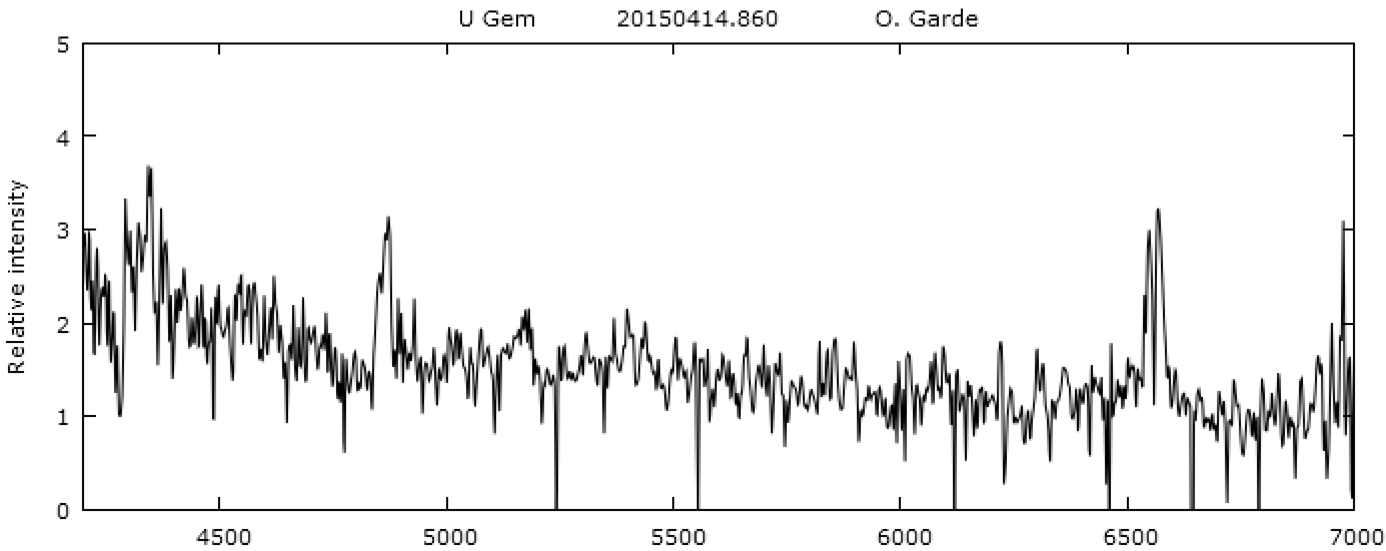


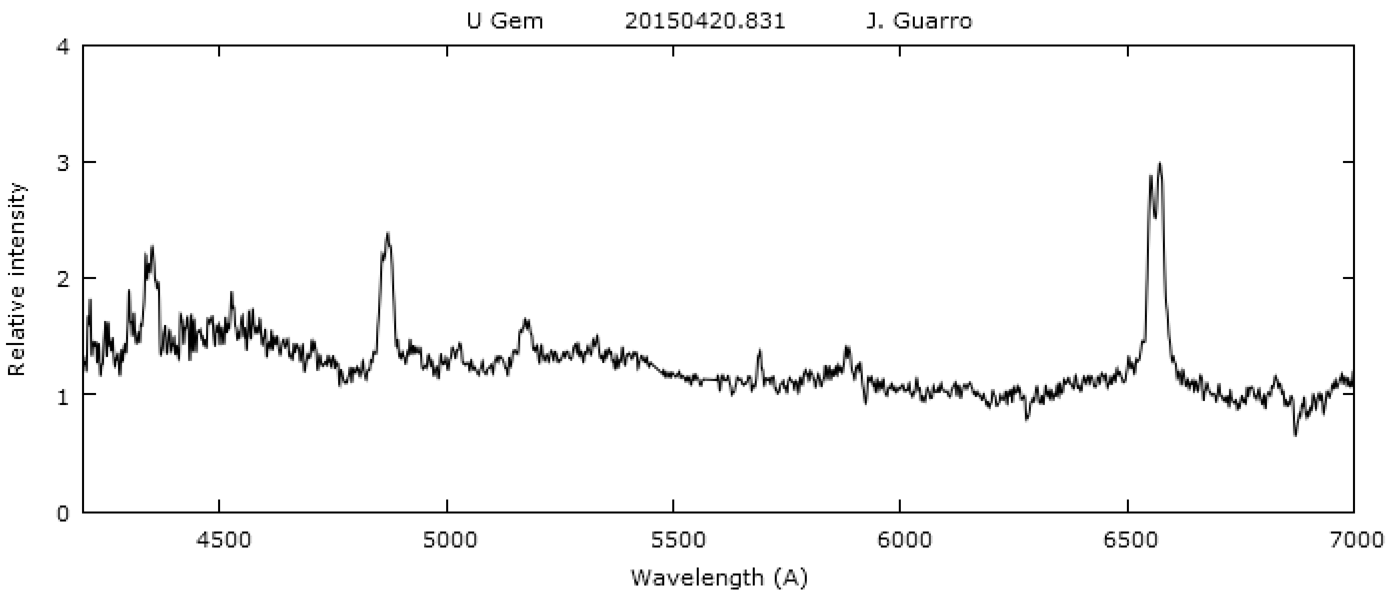
Crop on [N II] 6548, 6583

U Gem

Coordinates (2000.0)	
R.A.	07 55 05.2
Dec.	+22 00 05
V Max	9.1
V Min	15.2
Period	0.1769 d
Tn	102 d

After the outburst of February/March 2015, Joan Guarro and Olivier Garde obtained spectra of the prototype of dwarf novae in quiescence



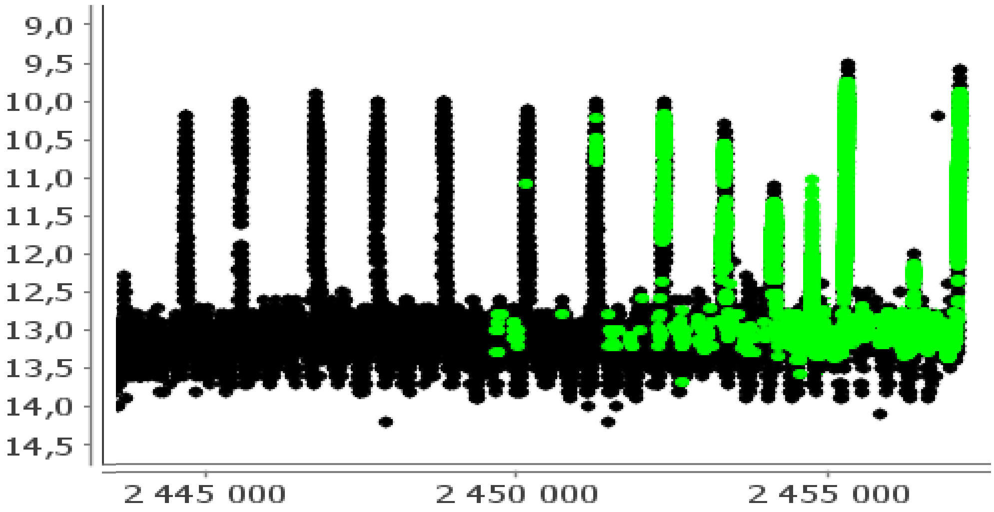


Spectra :
http://www.astrosurf.com/aras/Aras_DataBase/DwarfNovae.htm

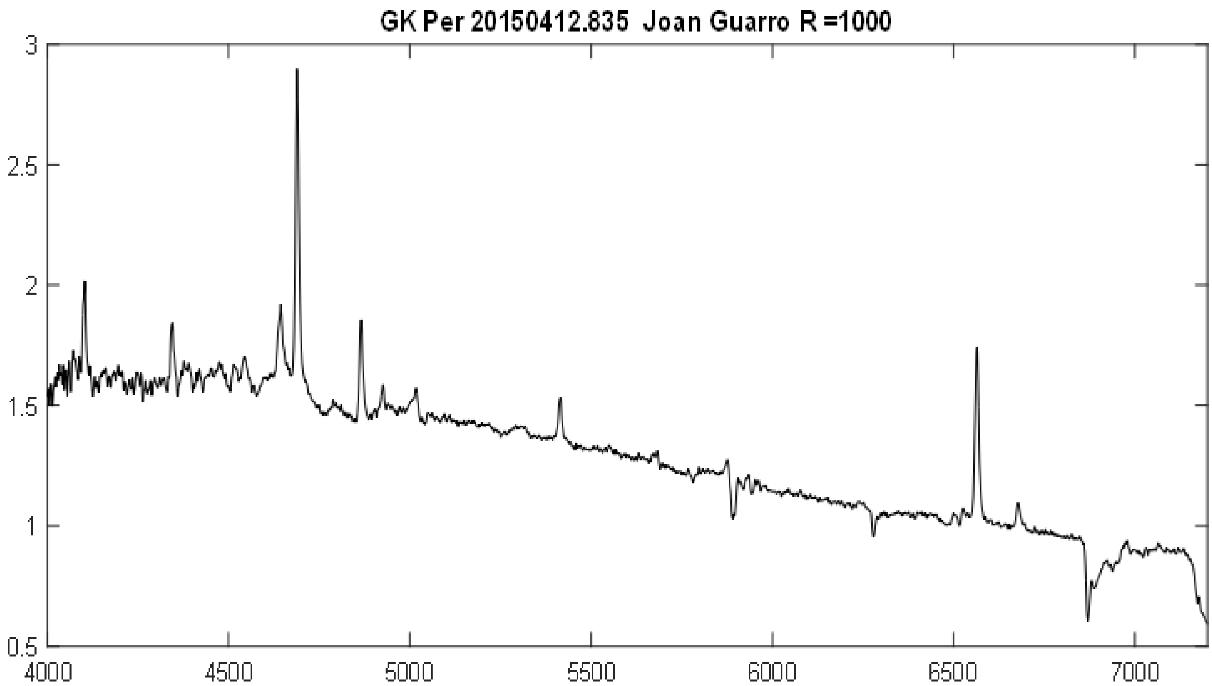
GK Per

Coordinates (2000.0)	
R.A.	42094.508333333
Dec.	+43 54 15.48
V Max	9.5
V Min	13.2

GK Per (Nova Per 1901) in outburst in april.



From July 1978 to now



Optical Spectroscopy of GK Per (Nova Per 1901) during the 2015 Outburst

ATel #7217; A. Wilber (ASU), M. Neric (ASU), S. Starrfield (ASU), R. M. Wagner (LBTO/OSU), C. E. Woodward (Minnesota)
on 13 Mar 2015; 04:32 UT

http://www.astronomerstelegram.org/?read=7217

On 2015 March 6.84 UT, Dubovsky (VSNET-ALERT 18388) and Schmeer (VSNET-ALERT 18389) discovered that the old nova and intermediate polar cataclysmic variable GK Per (Nova Per 1901) was in outburst at a magnitude of 12.8. GK Per undergoes dwarf nova outbursts on time scales of 1-2 years with optical amplitudes of 2-3 magnitudes that last several months. Previous outbursts were recorded in 2006 (ATEL #965) and 2010 (ATEL #2466) as well as a weak outburst in 2013. An analysis of the optical and X-ray outbursts of GK Per was recently presented by Šimon (2015, A&A, 575, A65).

We obtained an optical spectrum (range: 398-685 nm; resolution 0.3 nm) of GK Per during the current outburst on 2015 March 10.326 UT with the 2.4 m Hiltner Telescope (+OSMOS) of the MDM Observatory on Kitt Peak. Our spectrum shows strong, single-peaked emission lines of the Balmer series of hydrogen; He I 447.1, 471.3, 492.1, 501.5, 587.5, and 667.8 nm; He II 468.6 and 541.1 nm; and N III 464.0 nm. In addition, the absorption lines of Na I D are prominent. He II 468.6 nm emission is quite strong with an equivalent width of 1.2 nm and with an intensity ratio with respect to Hβ of about 1.8. The resolution-corrected FWHM of He II 468.6 nm and Hα are about 650 km/s and 507 km/s respectively.

A comparison of our spectrum of GK Per with the spectra presented by Reinsch (1994, A&A, 281, 108) as well as a spectrum (range: 320-670 nm; resolution 0.5 nm) obtained in quiescence by some of us in October 1995 at the 4.5 m MMT typically show that the intensity ratio of He II 468.6 nm to Hβ is about 0.4-0.5. These spectra also exhibit absorption lines arising from the K2-type secondary star which contributes about 1/3 of the total light of the system at optical wavelengths (see Reinsch 1994 and references therein). Our spectrum obtained during the outburst shows no evidence of the secondary star since the system is brighter at the present time. Additional photometric, spectroscopic, and X-ray observations are encouraged during the current outburst.

Some comments on the currents beasts

Steve Shore

Nova Sgr 2015B

(*a notation I'll adopt instead of Nr. 2 although the IAU is ambiguous on this point*)

The latest spectra, from Joao Guarro show that the ultraviolet Fe curtain remains very strong, that we're not yet out of completely recombined state and the Na I D1,2, Balmer, and Fe II lines all still display detached absorption features extending to about -1200 $km.s^{-1}$. This especially low velocity is much more clearly resolved in a magnificent spectrum from Christian Buil from 26/4/2015. I have to express envy at the quality of this observation, especially the resolution of the Na I and He I 5876 lines. The most important observation, I think, is the detached He I components on *both* 5876 and 6678. This is the cleanest example I've seen of this phenomenon and the velocity is again about -1400 $km.s^{-1}$. In V339 Del, *precisely the same profile* was displayed, it's clearly not Na I, and the He I 576 now also shows the detached absorption at about -1500 km/s.

The developments in Nova Sgr 2015B over the last weeks has been interesting but, except for the infrared CO and C I emission, not really that unusual. The appearance of the He I lines was interesting at the start, the end of the fireball phase is marked by the first recombinations that star the growth of the neutral atomic lines and de-excite the inner parts of the ejecta. hence,as your spectra show, the He I and related strong lines, those arising from excited states (e.g. O I 8446) show detached P Cyg troughs at near the maximum velocity seen from other transitions. The Na I absorption is stronger in this nova than V705 Cas (the one for which there's also UV data, most dust forming novae weren't obtained shortward of 3000A).

The light curve continues to bounce around but this is still not unusual (just better covered) but if dust forms we're nearly at the critical stage and if there is no dust formation we will have learned a great deal! Even at the risk of losing some sleep, this is an important stage to follow (i.e. during this month).

Nova Oph 2015

This one is strange but not bizarre. The first spectra showed strong He I and N II. The light curve is also fluctuating, although not to the levels seen in Sgr 2015B. The latest in the database, again from Joan Guarro (7/5/2015) show both Balmer and He I detached so not all that different. The velocities are higher, and [O I] 6300 is stronger (and more structured) than Sgr 2015B but -- and this is also true for [N II] 5755 -- the evolution is normal while stll being distinctive.

What these demonstrate, as Francois Teyssier commented in an email a short time ago, is that one size does not fit all. The nova explosion is always treated (theoretically) as a single event without including the ``cosmic dispersion''. This phrase, co-opted from cosmology, is another way of saying ``variation intrinsic to the phenomenon'' or simply ``inherent difference''. The important feature of explosions that makes them essentially different from winds or other types of accelerated outflows is the complete decoupling of the ejecta and the explosion site once the event ends, and the rapid evolution when it starts. Structure and orientation shape the line profiles. So do they alter the photometry and, some day, the spectropolarimetry.

News of HST/STIS and other related observations

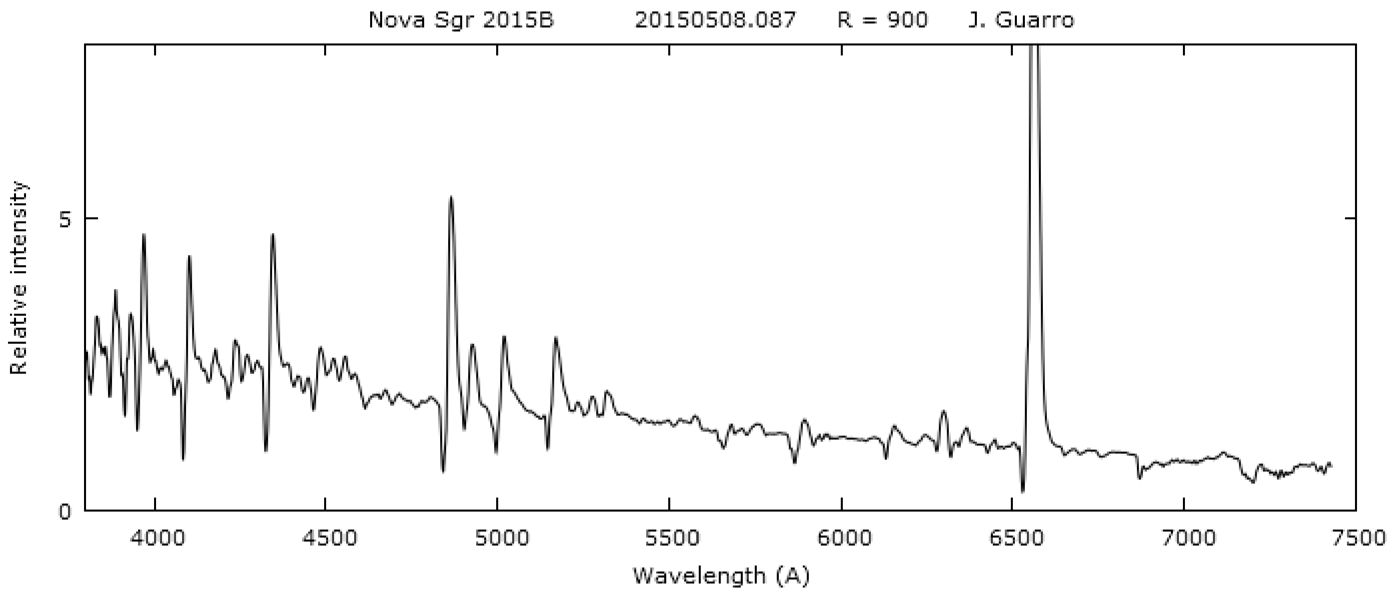
We have an HST/STIS observation of V339 Del for the week of 11 May (almost as I write this) and the next V1369 Cen data will be during the summer. Then another V339 Del sequence comes in the fall. NOT observations are being scheduled now to coincide with the HST epoch. This is part of the Legacy project, to observe these two novae for as long as possible. The project description is HST proposal 13388 (for observations with STIS) searchable on the MAST site (www.stsci.edu) for anyone who might be interested.

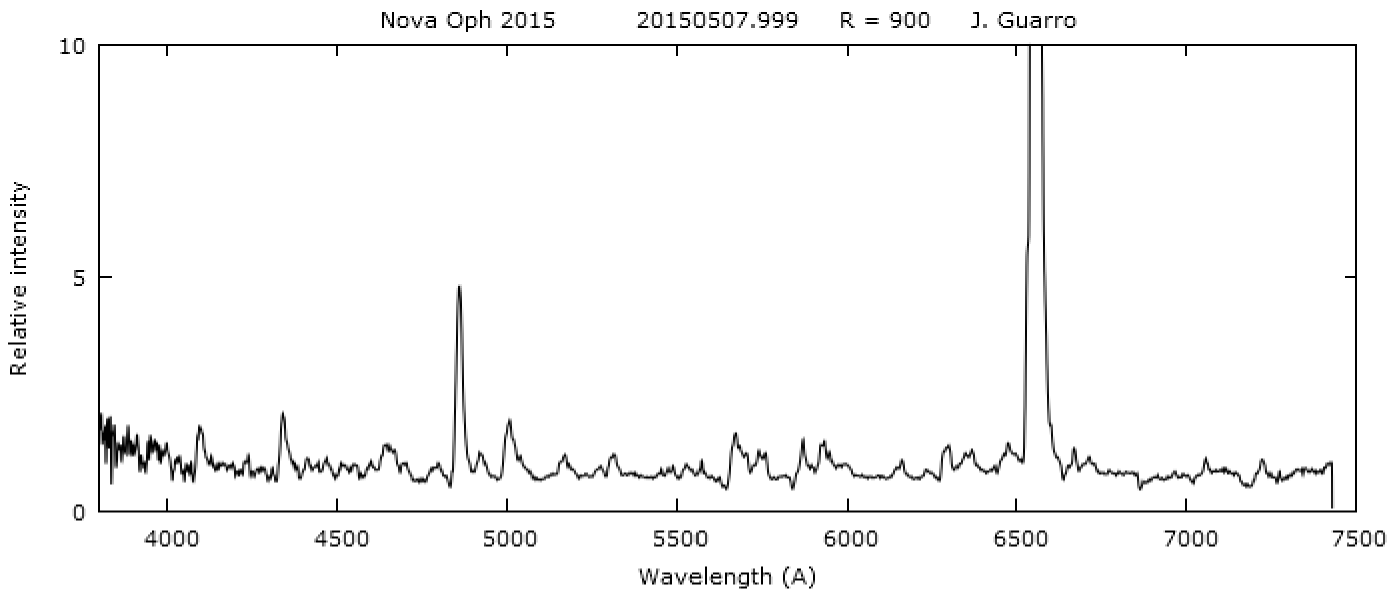
Some comments on the currents beasts

Steve Shore

The feature that is emerging from all of your hard work, these wonderful archives that now surpass anything previously obtained in a systematic, controlled fashion for novae, is the astonishing regularity of many of the spectral features. These were only hinted at in the earlier time series, especially the studies in the 1960s by McLaughlin http://adsabs.harvard.edu/abs/1965POMic...9..113M for Nova Gem 1912 that had many features you're now routinely seeing in both the spectroscopic and photometric variations. I'll also mention a very pretty historical study by Thomas Sauer, a historian on the Einstein project (the collected papers), http://link.springer.com/article/10.1007\%2Fs00407-007-0008-4\#page-1 on the origin of gravitational lensing (which Einstein thought might be an explanation for this nova). It's not that the idea was wrong, in fact just the opposite. This illustrates how a physicist is supposed to work, maintaining a broad intellectual base. I mention DN Gem specifically because the McLaughlin paper, really his ultimate observational study, is so detailed that you can use it as a guide for interpretation (and acquisition) of new data.

Steve Shore
11-05-2015





Now back to the discussions of winds and lines

Steve Shore

Last installment got a bit heavier than intended so I'd like to step back and use a few graphics. First, recall that a wind is a driven flow. Envelopes once ejected -- or when the driver turns off -- can freely expand and change their dynamics by interaction with a background and internal differential motions. For instance, shells having been expelled continue to expand if above the escape velocity (depending on where they form this can be far lower than at the surface). If not, they can fall back. This reversal of the velocity is well known from one extreme class of massive stars, the *Luminous Blue Variables:* LBVs. I've hardly discussed these but they are a sort of ``nova in slow motion''. They 're not explosive, just incredibly luminous $10^5 L_\odot$ and massive (>40 $M_\odot$ at least as infered, and may be >100 $M_\odot$). Two prototypes, which in this case means first discovered and also well studied, S Dor (in the LMC) and AG Car (in the Galaxy) are both southern hemisphere stars. Those in the north have P Cyg itself, and α Cyg (Deneb, that is also extremely luminous (although it is not as highly variable as others in the true LBV class). The class is far more heterogeneous than novae, the same effects can emerge from a range f causes. By this I mean the brightening in the optical by many magnitudes on time scales of years. No rapid, flickering like emission is detected but the lines show complex, multi-component absorption and both absorption and emission (i.e. P Cyg structure). The main difference between these stars and nova (and related explosions) is well illustrated in S Dor, http://adsabs.harvard.edu/abs/1990A\%26A...235..340W - inverse P Cyg profiles. You see this also in Herbig Ae/Be stars and T Tau stars, accretion. This can, and often des, occur in the same spectrum that evinces outflow. The idea, first proposed for the LBVs, is that the wind doesn't completely escape when the system shuts off, or when there are cycles of expansion and fall-back. A simpler possibility, again not seen in novae, is a companion that transfers mass, some of which escapes and some accretes. But since the explosion is only limited by the sound speed, which in the thermonuclear zone never exceeds a few hundred km.s^{-1}, there's no reason why fallback doesn't happen in the optically thick stages of novae. The difference is whether you can see it. In nova ejecta, since their optical depth is so large at the start of the fireball, the inner portions are invisible. Nonetheless, fallback could provoke additional instabilities, such as shell fluctuations, that might be involved in the photometric variations during maximum (and, maybe, afterwards).

To continue, though, we have to reconsider the notion of driving. Outflows happen because there's a net outward pressure that exceeds that provided by the local gravitational compression of the layers of the envelope and atmosphere. Normally, mechanical balance is achieved when the weight of any overlying layer is balanced by the gradient of the gas pressure. Radiation complicates this because it increases the pressure by transferring momentum to the atoms from photon absorption and scattering. Ionization is very inefficient in this sense, the electron leaves with some additional momentum (above the ionization threshold) so it gives a reaction kick to the atom. But photons can be absorbed or scattered through lines without this effect and that makes them very efficiently coupled to the gas and in a way that depends on the flux and the absorption cross section, not on the temperature and density as an ideal gas would. The flux is, in turn, set by whatever processes produce photons in the deeper interior. So the driving i only weakly dependent on the local conditions and is more sensitive to the rate at which nuclear processes release energy. The higher the flux, the greater the momentum carried by the radiation (linearly, in fact) and the higher the absorption (scattering) cross section, the higher the rate of momentum transfer. The outer envelope of a star, --or in the case of a nova, the layers overlying the TNR zone -- are cooler than the nuclear site and have higher opacity. This makes the layer unstable to an outward kick and it can accelerate. As the luminosity of the TNR increases, so does the radiative driving and the two couple to rapidly accelerate the outer layers.

Now back to the discussions of winds and lines

Steve Shore

But this won't be a wind, not in this time development, but an additional kick at the start of the process.

For luminous stars, the same thing happens but in steady state. The deep interior is fully ionized so the only scattering is from free electrons. This has a very low cross section., in fact, it's the smallest value the medium can have, about 0.4 $cm^2 g^{-1}$. In contrast, for normal abundances, the outer cooler layers have opacities at least two orders of magnitude higher and, if the luminosity is high enough and the matching between the flux spectral peak and the opacity is good, the radiation will drive an outflow. This starts from rest and accelerates to the sound speed, which is reached when the radiative and gravitational accelerations are equal. From there outward, the gas can't again find a static state, it's flowing and continues to accelerate outward as the driving continues. The only thing that eventually changes this is when the gas reaches its terminal velocity, which is higher than escape by a factor of a few, and the outward gradient of the velocity gradually decreases, as illustrated in the cartoon.

The inner region, where the velocity is rapidly changing with radius, is also the densest part and the zone from which the absorption lines arise. But these extend to the terminal velocity. You're used, now, to seeing this as a slowly decreasing blue edge absorption to some maximum (negative) radial velocity. That's because in novae, the ejecta don't form a usual limiting velocity since they are explosively ejected. Winds are different because the mass is constantly being supplied to the largest distances and that's ehere the change with radius becomes increasingly small. The lines saturate and form a sort of radiative wall at the maximum velocity. For resonance lines, those that have no dependence on the temperature and -- if they come from the dominant ionization state -- don't depend on the local radiation field, the lines are formed along a very long line of sight. From the outer portions, photons have a hard time escaping to infinity because they never Doppler shift out of the core of the line in the overlying layer. This feature is a very important feature of any continuous outflow, it's also true for jets (e.g. SS 433). The emission comes from whatever portion of the wind is velocity shifted out of the core along the line of sight so of the optically thick surface is very small compared to an extended envelope, the absorption will be limited to a small fraction of the total line. The larger the inner region is relative to the overall wind emitting region, the stronger the absorption will be (relatively speaking). Beals, in the 19650s, called these various species of P Cyg lines but they're largely a geometric effect. Well, as you see, not quite because the velocity gradient also desaturates the line and weakens the absorption. The most important point is the absorption (or scattering, which is the same thing in terms of column densities) is there because something is optically thick. In symbiotics, the wind of the red giant dominates the optical, for the UV the hot companion (the white dwarf) dominates. Th absorption is much stronger on those UV lines precisely because they're formed absorbing against the photosphere of a hot star whose outflow is very compact.

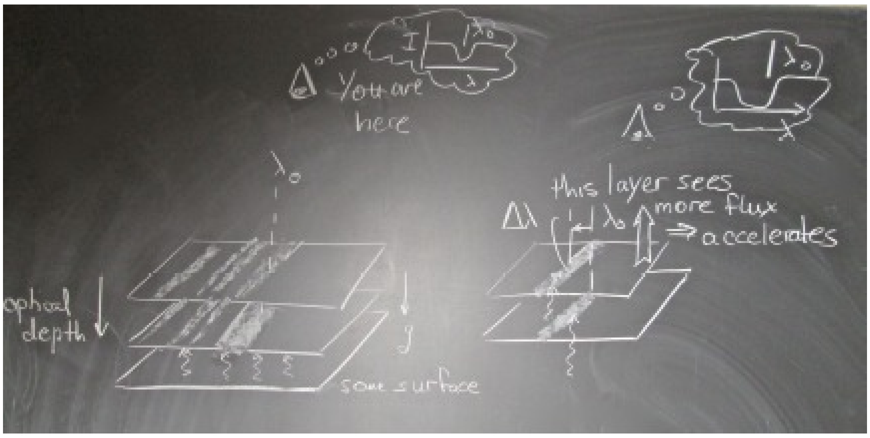


Figure 1. The driving of the outflow. As the velocity increases, the line cores of overlying layers shift out of those in the underlying portions of the atmosphere and experience an increase in the local flux. This accelerates the layers so the absorption lines continue to drive the flow until -- at the terminal velocity -- they turn opaque because the layers have the same velocity.

Now back to the discussions of winds and lines

Steve Shore

Some of this extends what I was discussing in the last newsletter. But what we didn't cover is that the outflow can vary depending on the luminosity of the star and the opacity of the ejecta. Take an O star, a massive star with a surface temperature of about 30 kK. If it's compact, for example on the main sequence, the escape velocity will be high and the luminosity doesn't suffice to cause much of an outflow. Let the star start expanding during its evolution and, even though its surface temperature drops, the radiative driving increases. The opacity increases enormously as the radius expands and it may reach the stability limit in its atmosphere. Note, I wrote atmosphere, not interior. If the luminosity is large enough a wind is inevitable but the lower the surface gravity the lower the critical luminosity must be. This also applies to accretion disks. They are luminous because of viscous dissipation -- a jargon for the process that removes orbital kinetic energy and permits inflow -- but unlike stars their luminosity is strictly related on the mass accretion rate in the disk and on the star's ratio of mass to radius. First, this is why you see novae (and cataclysmic variables) in quiescence. It isn't the surface of the white dwarf that is responsible, it's the luminosity of the accretion disk. Second, there's the limit to the luminosity for the disk that a star doesn't know about. The mass can't accrete faster than what would produce the critical luminosity to drive an outflow. This is called the Eddington luminosity in the cataclysmics community. The luminosity is, essentially, the rate at which gravitational energy is lost by the matter spiraling into the central object. And there's also another limit, the third point in this difference with stellar winds: the amount of mass can't accumulate too rapidly on the central star. That ``too rapidly'' is the thermal timescale. If energy is released on the last accretion step, and the layer is heated, it can become unstable (look at how many ways this can happen!) because it can't cool quickly enough, and the layer expands. So a wind could result, temporarily, if the accretion rate is too large.

This all happens in cataclysmic binaries and likely also in symbiotic systems. In an excess accretion event, for instance, a symbiotic might blow off jets (e.g. Z And, CH Cyg?) whose velocity can exceed the escape speed from the white dwarf. Novae, on the other hand, don't seem to show winds in their quiescent phases and explosively blow off the accreted material.

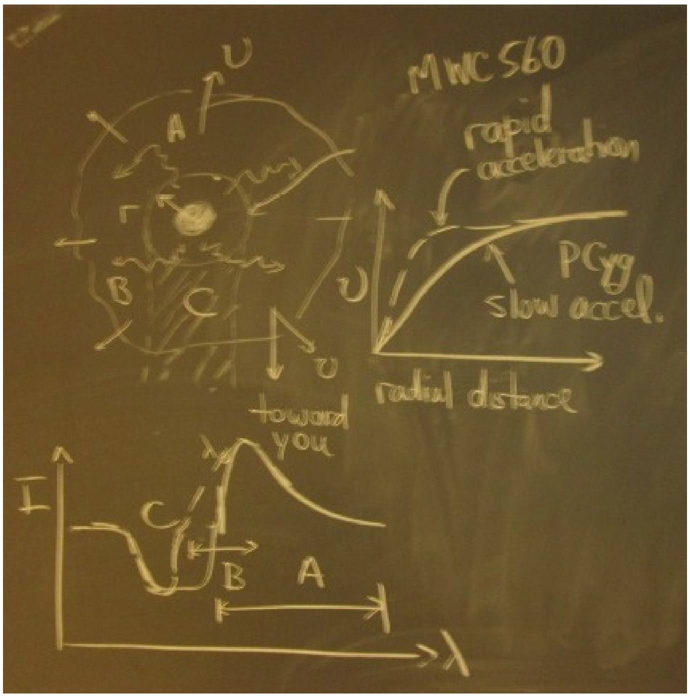


Figure 2. The dissection of the line profile. For a recombination wave or a very large velocity gradient in the inner parts, the absorption detaches from the emission (as, for instance, in MWC 560). For a slower rate of acceleration, the line absorption trough extends even to the photospheric (zero) velocity.

Now to get back to the line profiles, what you see. A wind is a wind, all winds look basically alike except for their velocity gradients. The inner parts are where the absorption is strongest but this extends throughout the outflow because of the saturation effect at the periphery. But excited state lines (e.g. the whole Balmer sequence) are never as optically thick as resonance lines so you may not see the actual terminal velocity. Worse, the weaker the line the more the absorption concentrates toward the inner part.

Now back to the discussions of winds and lines

Steve Shore

Figure 3. Accretion disks with outflows are even more complicated. Here the absorption is along th line to the central object, and the disk forms an emission line whose width depends on the mean orbital velocity relative to the observer. This twin peak profile is characteristic of ddisks but, as we've discissed for the optically thin case of novae with aspherical ejecta, not unique.

But this is also a benefit in the diagnosis, and you've also seen this in novae: the higher the Balmer line, the lower the measured maximum velocity, the so called ``Balmer decrement''. This is th principal diagnostic for a wind but in a nova, or an outflow, it's especially important because the absorption disappears in sequence according to the intrinsic strength of the line, like a stripping away of the opaque layers as they expand. But there's an important caution: the terminal (maximum) velocity of the flow is virtually never (!) seen in the optical lines (except, perhaps, for the Ca II H and K lines and, for neutral winds, the Na I D doublet). When you see, for example, absorption on Hα extending to 1000 km.s^{-1} you can be sure the gas is actually expanding at a much higher (perhaps twice) speed. This is true for all outflows. But if there is emitting gas at the high velocities, you will see the red wing extend to nearly th real outflow speed. Unless, that is, the flow is not spherical. In a jet, the ratio of the absorption to emission is very strongly dependent on the angle the jet makes with the line of sight. Scattering is worse than recombination because it depends on the viewing angle of the axis of the jet. Seen looking down the axis, as in T Pyx, the absorption dominates over the emission and you see very little (other than the redshifted emission) in the way of a P Cyg profile. The same for jets seen on their sides,little emission and the outflow speeds will not be the real maxima.

I'm returning o this theme of nonspherical flows and ejecta for an important reason. To again cite Francois' comment, the viewer's line of sight is crucial for the appearance of a nonspherical medium. That's certainly one reason all novae look different in details. This is one of the most important reasons for large samples at high time coverage, if the line of sight dominates the diagnostics in the optically thick stages then only a large enough sample of novae (or winds) observed during that stage will sort out the randomness of this perspective. We discvussed long ago why there are no real ``Fe II'' or ``He/N'' novae, this holds true for any orientation sensitive line formation.

Steve Shore,
10-05-2015

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

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

Contribution to ARAS data base

From 01-04 to 30-04-2015

F. Boubault
D. Boyd
C. Buil
J. Edlin
O. Garde
K. Graham
J. Guarro
J. Montier
T. Lester
J. Powles
U. Sollecchia
P. Somogyi

Submit your spectra

Please :
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Resolution should be at least R = 500
For new transcients, supernovae and poorly observed objects,
SA spectra at R = 100 are welcomed

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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
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