Eruptive stars spectroscopy

Cataclysmics, Symbiotics, Nova Supernovae

ARAS Eruptive Stars
Information Letter n° 25 #2016-03 19-04-2016
Observations of March 2016

News

Symbiotic AG Dra in outburst (hot type) in April, 2016

Contents

Novae

X Per : symbiotic outburst

Symbiotics

AX Per : symbiotic outburst
V694 Mon = MWC 560 : strong outburst
CH Cyg : Ongoing campaign

T CrB : "superactive state" (*Munari & al., 2016*)

Notes

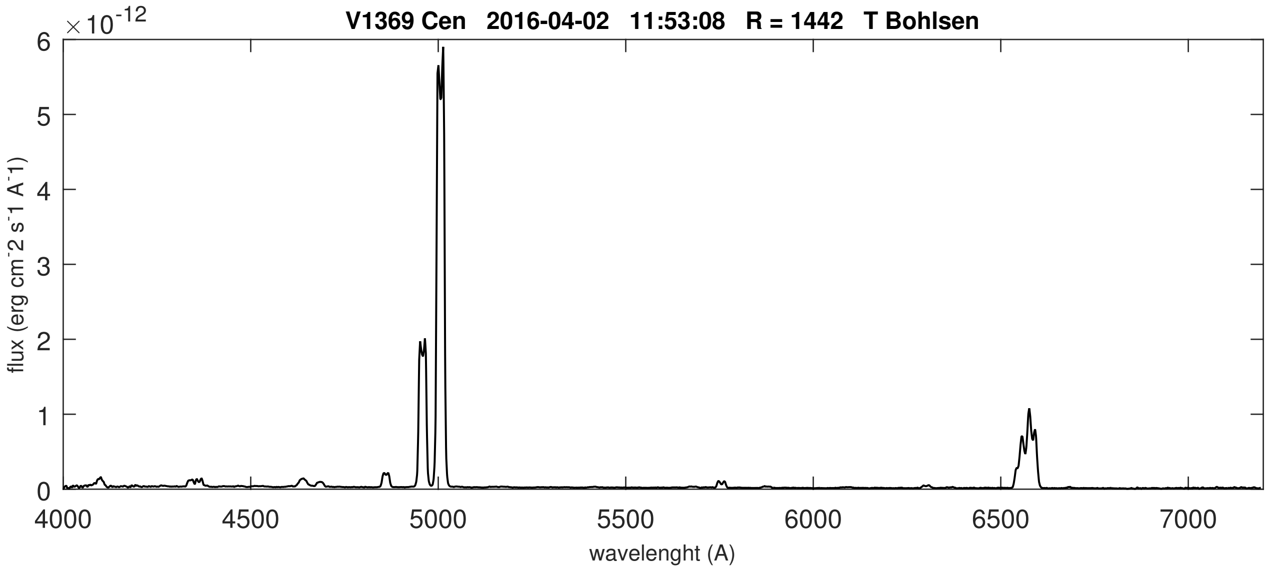
Jets and collimated outflows
News about Novae
Steve Shore

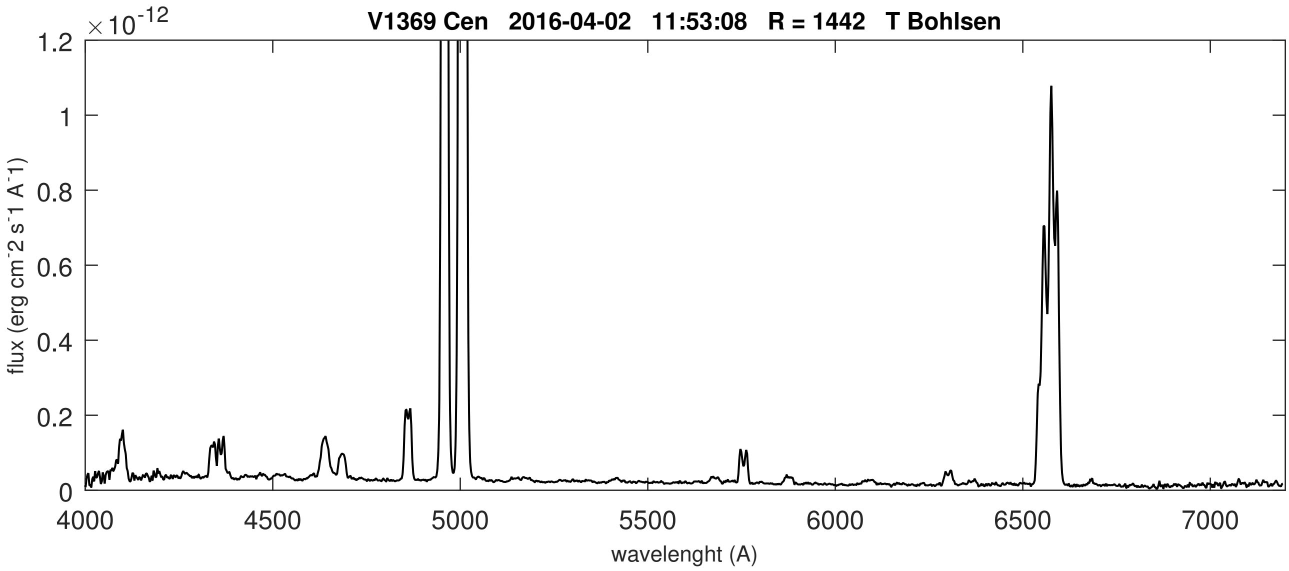
Authors : F. Teyssier, S. Shore, P. Somogyi, D. Boyd, J. Guarro Flo, P. Berardi, T. Lester, U Sollecchia, F. Campos, K. Graham, J. Edlin, J. Ferreira, T. Bohlsen, O. Garde

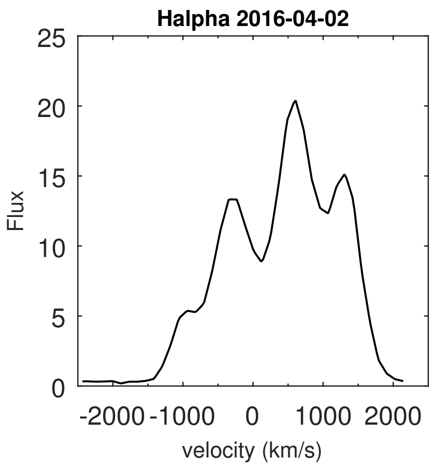
"We acknowledge with thanks the variable star observations from the AAVSO International Database contributed by observers worldwide and used in this letter."
Kafka, S., 2015, Observations from the AAVSO International Database, http://www.aavso.org

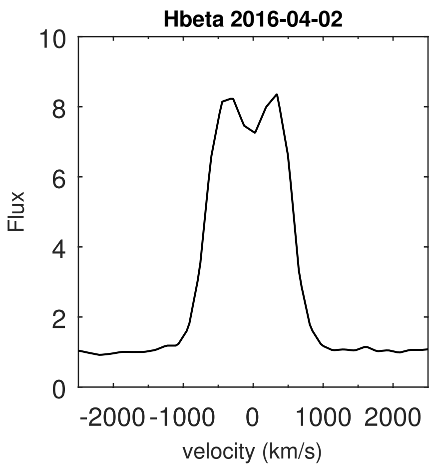
V1369 Cen = Nova Cen 2013

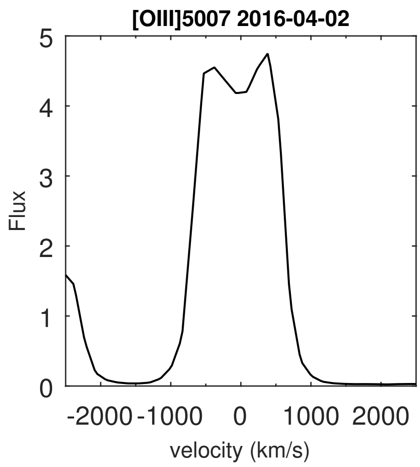
A new season for Nova Cen 2013 in nebular phase with a spectrum obtained by Terry



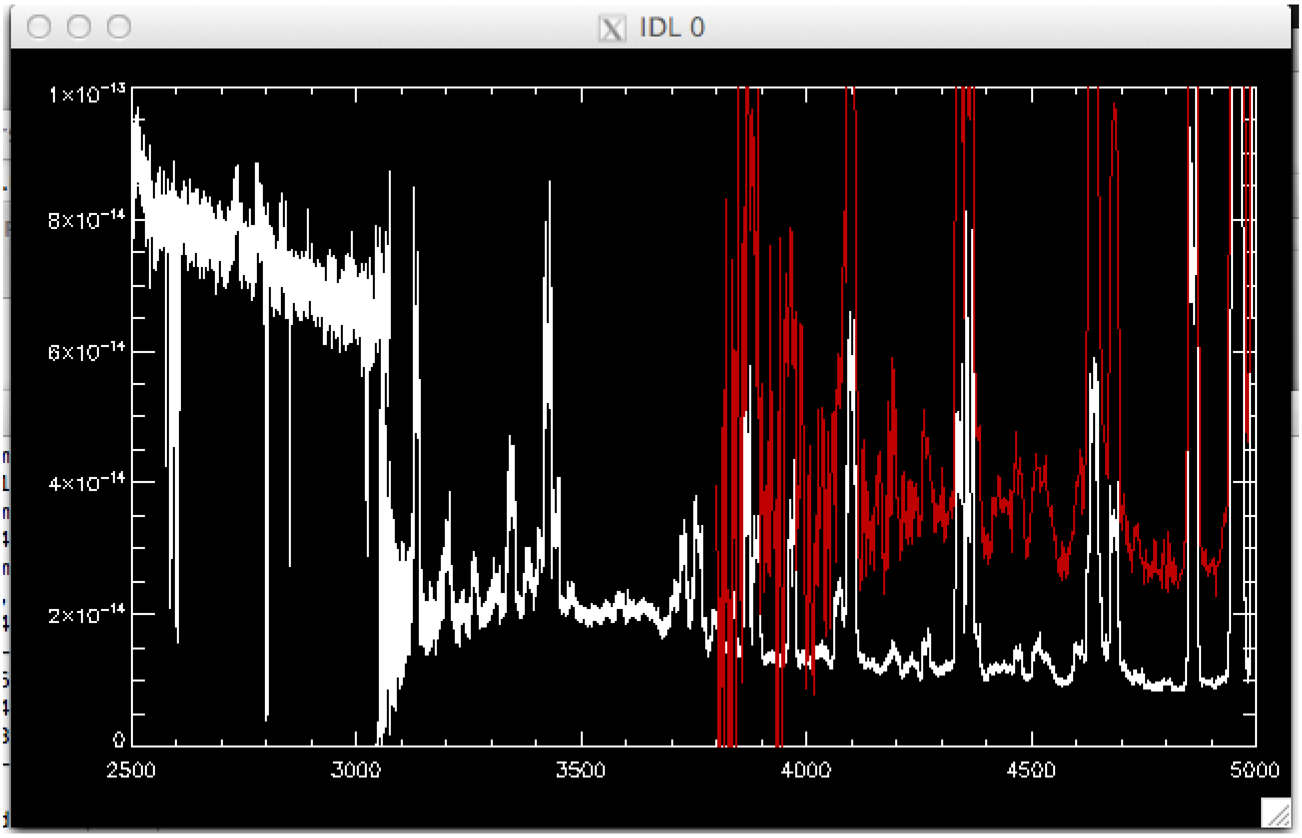








Complex shape of Ha, due to the strong contribution of [NII] 6548, 6583
The bipolar shape is clearly seen throw the profiles of Hb, [OIII], [OI], [NII] 5755
Maximum velocity is about 1200 km.s^{-1}



Comparison of Terry' spectrum (red) with STIS spectrum (white) by Steve Shore

Steve's comments :
Terry's spectrum agrees very well with the STIS data... the line profiles we have From_UVES are,of course, at a higher resolution but the flux calibration is really fine work

S Y M B I O T I C S

Symbiotics in March

CH Cygni : ongoing campaign upon the request of Augustin Skopal

V694 Mon : strong luminosity outburst. 42 spectra in March

AX Per : in outburst

T CrB : superactive phase

Observing : main targets

V694 Mon : the more spectra as possible (low and high resolution) of the extraordinary star during its strong visual outburst

AX Per in outburst

Ungoing campaign : **CH Cygni** for A Skopal (low resolution and H alpha profile at R > 10000)
Now, in the morning sky. Almost one spectrum a month.
CI Cygni, also in the morning sky

T CrB : high cadency coverage should be welcome until the next nova outburst (could take afew years)

AG Dra : in outburst in April
Advice from Steve : "please concentrate on the Raman pair (both lines, it's really important), especially the ratio of 7083/6825. Also for the He I 6678 vs. He II 4686."

And also : **V443 Her, CI Cyg, BF Cyg, V1016 Cyg ...**

S Y M B I O T I C S

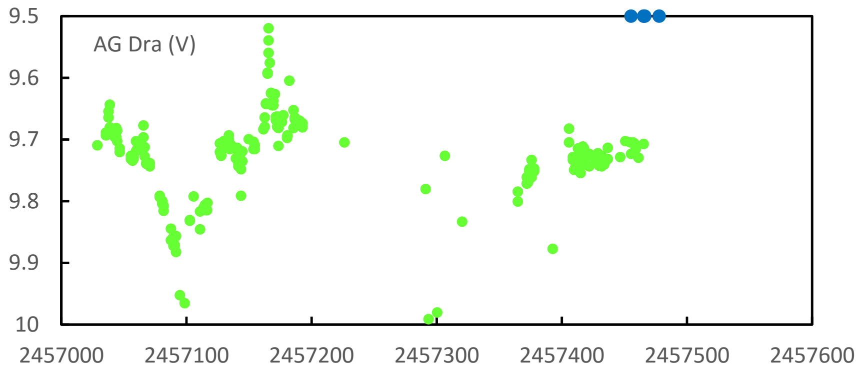
Symbiotics in ARAS Data Base Update : 05-04-2016

#	Name	AD (2000)	DE (2000)	Nb.	First spectrum	Last spectrum	Days Since Last
1	EG And	0 44 37.1	40 40 45.7	44	12/08/2010	24/02/2016	45
2	AX Per	1 36 22.7	54 15 2.5	98	04/10/2011	31/03/2016	9
3	V471 Per	1 58 49.7	52 53 48.4	3	06/08/2013	04/02/2016	65
4	o Ceti	2 19 20.7	-2 58 39.5	6	28/11/2015	20/02/2016	49
5	BD Cam	3 42 9.3	63 13 0.5	15	08/11/2011	06/03/2016	34
6	UV Aur	5 21 48.8	32 30 43.1	38	24/02/2011	07/03/2016	33
7	V1261 Ori	5 22 18.6	-8 39 58	5	16/01/2016	20/02/2016	49
8	StHA 55	5 46 42	6 43 48	2	17/01/2016	25/01/2016	75
9	ZZ CMi	7 24 13.9	8 53 51.7	31	29/09/2011	05/04/2016	4
10	BX Mon	7 25 24-	3 36 0	36	04/04/2011	12/03/2016	28
11	V694 Mon	7 25 51.2	-7 44 8	150	03/03/2011	03/04/2016	6
12	NQ Gem	7 31 54.5	24 30 12.5	39	01/04/2013	05/04/2016	4
13	GH Gem	7 4 4.9	12 2 12	3	10/03/2016	29/03/2016	11
14	CQ Dra	12 30 06	69 12 04	3	11/06/2015	08/03/2016	32
15	TX CVn	12 44 42	36 45 50.6	26	10/04/2011	12/03/2016	28
16	IV Vir	14 16 34.3	-21 45 50	2	28/02/2015	09/05/2015	336
17	T CrB	15 59 30.1	25 55 12.6	81	01/04/2012	02/04/2016	7
18	AG Dra 1	6 1 40.5	66 48 9.5	71	03/04/2013	30/03/2016	10
19	V503 Her	17 36 46	23 18 18	1	05/06/2013	05/06/2013	1039
20	RS Oph	17 50 13.2	-6 42 28.4	16	23/03/2011	16/09/2015	206
21	V934 Her	17 6 34.5	23 58 18.5	9	09/08/2013	20/06/2015	294
22	AS 270	18 05 33.7	-20 20 38	2	01/08/2013	02/08/2013	981
23	AS 289	18 12 22	-11 40 13				
24	YY Her	18 14 34.3	20 59 20	17	25/05/2011	07/09/2015	215
25	FG Ser	18 15 6.2	0 18 57.6	3	26/06/2012	24/07/2014	625
26	StHa 149	18 18 55.9	27 26 12	3	05/08/2013	14/10/2015	178
27	V443 Her	18 22 8.4	23 27 20	21	18/05/2011	07/02/2016	62
28	FN Sgr	18 53 52.9	-18 59 42	4	10/08/2013	02/07/2014	647
29	V335 Vul	19 23 14.2	24 27 40.2				
30	BF Cyg	19 23 53.4	29 40 25.1	71	01/05/2011	07/11/2015	154
31	CH Cyg	19 24 33	50 14 29.1	328	21/04/2011	01/04/2016	8
32	V919 Sgr	19 3 46-	16 59 53.9	2	10/08/2013	10/08/2013	973
33	V1413 Aql	19 3 51.6	16 28 31.7	5	10/08/2013	26/09/2015	196
34	HM Sge	19 41 57.1	16 44 39.9	7	20/07/2013	11/11/2015	150
35	QW Sge	19 45 49.6	18 36 50				
36	CI Cyg	19 50 11.8	35 41 3.2	103	25/08/2010	17/02/2016	52
37	StHA 169	19 51 28.9	46 23 6				
38	V1016 Cyg	19 57 4.9	39 49 33.9	7	15/04/2015	01/11/2015	160
39	PU Vul	20 21 12	21 34 41.9	14	20/07/2013	23/11/2015	138
40	LT Del	20 35 57.3	20 11 34				
41	ER Del	20 42 46.4	8 40 56.4	3	02/09/2011	05/11/2014	521
42	V1329 Cyg	20 51 1.1	35 34 51.2	4	08/08/2015	26/09/2015	196
43	V407 Cyg	21 2 13	45 46 30				
44	StHA 190	21 41 44.8	2 43 54.4	14	31/08/2011	08/11/2015	153
45	AG Peg	21 51 1.9	12 37 29.4	160	06/12/2009	13/01/2016	87
46	V627 Cas	22 57 41.2	58 49 14.9	12	06/08/2013	18/02/2016	51
47	Z And	23 33 39.5	48 49 5.4	58	30/10/2010	05/02/2016	64
48	R Aqr	23 43 49.4	-15 17 4.2	27	25/09/2010	25/01/2016	75

ARAS Data Base Symbiotics : http://www.astrosurf.com/aras/Aras_DataBase/Symbiotics.htm

AG Dra

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

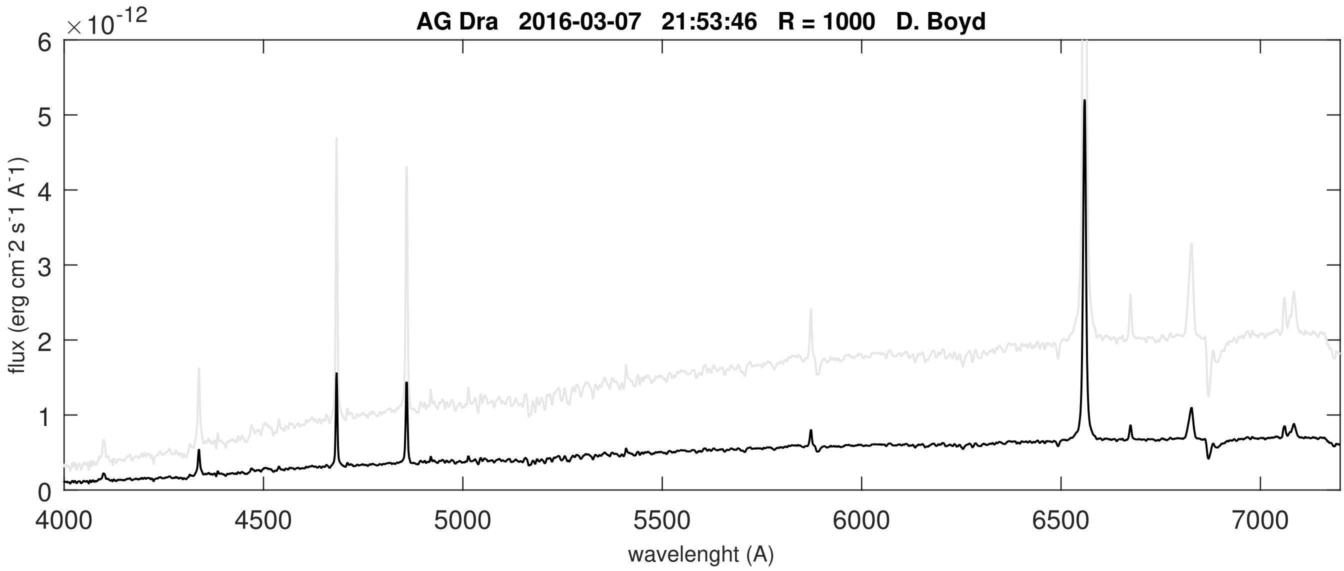


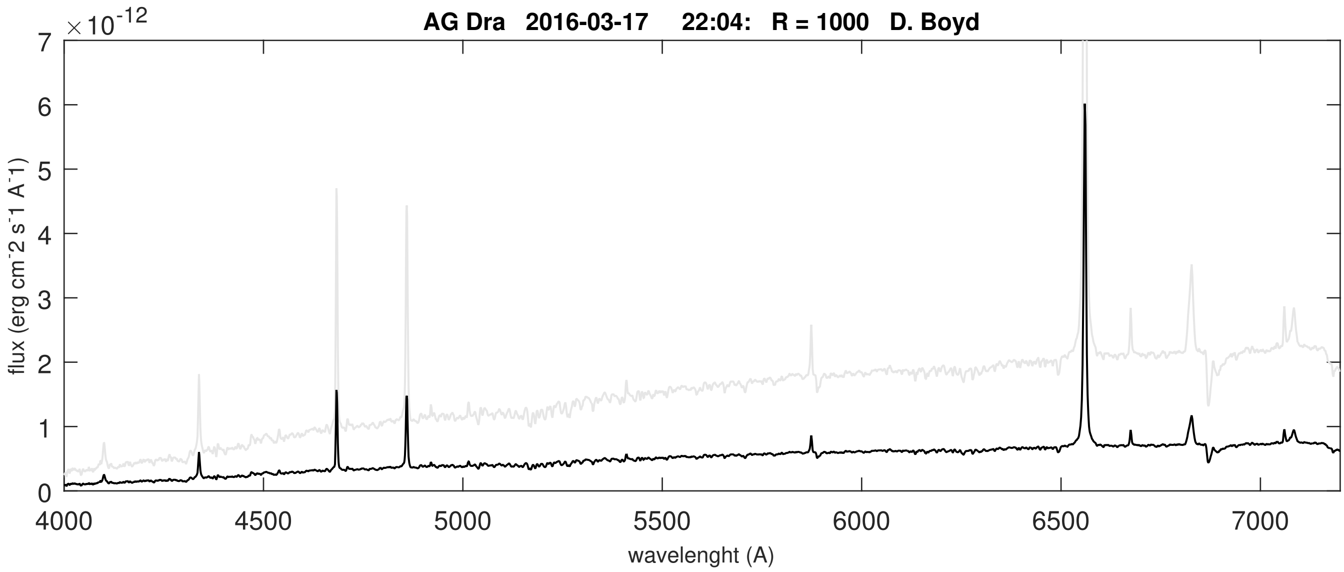
AG Dra just before its outburst in April

David Boyd : LISA R = 1000

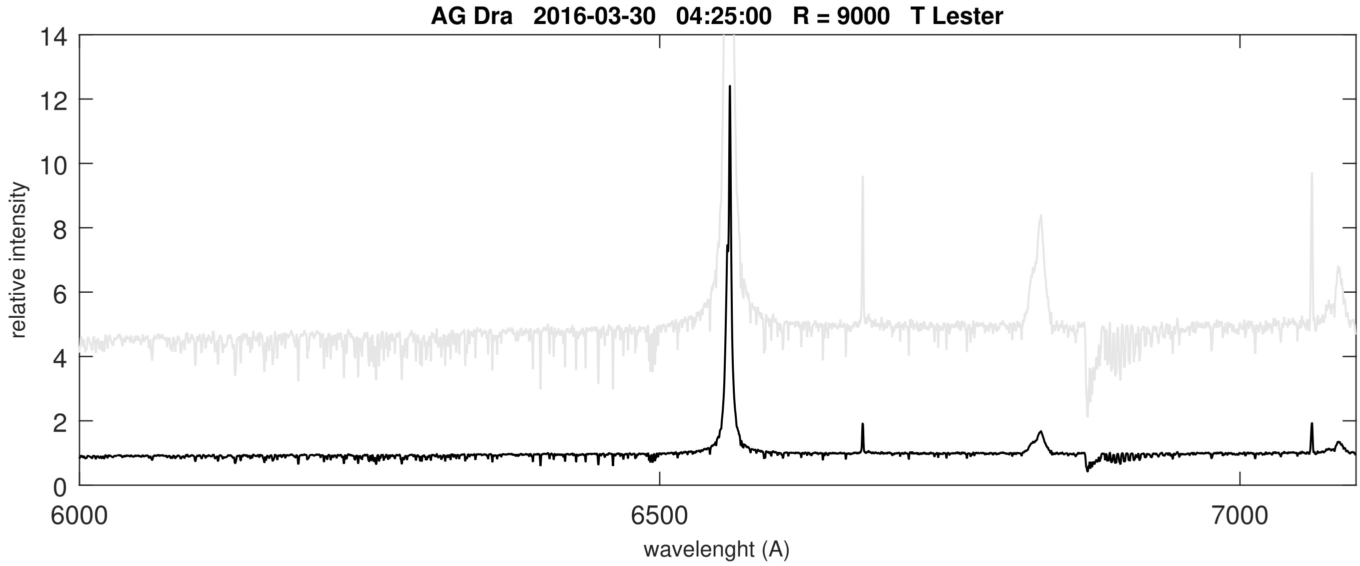
Tim Lester : home built spectrograph R 9000

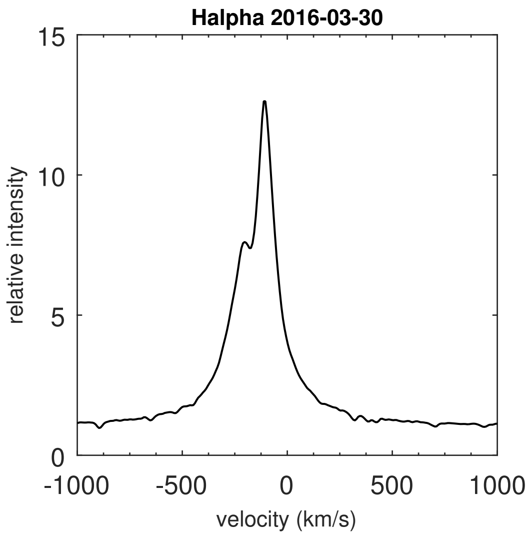
Peter Somogyi : Lhires III 600 l/mm R = 2500

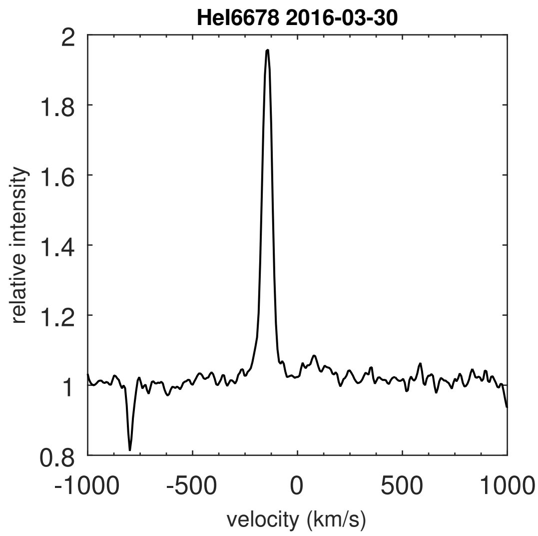


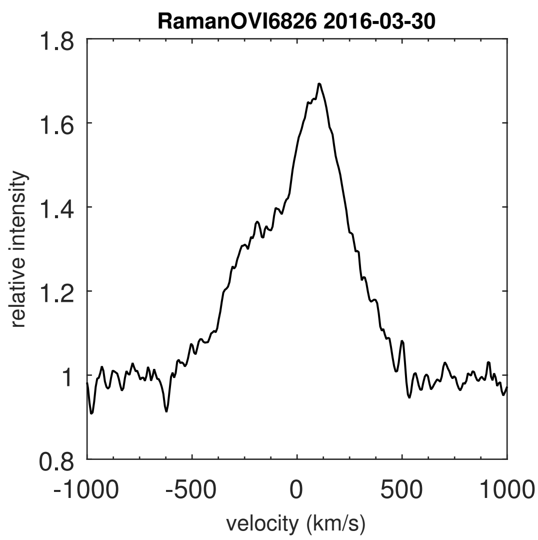


AG Dra

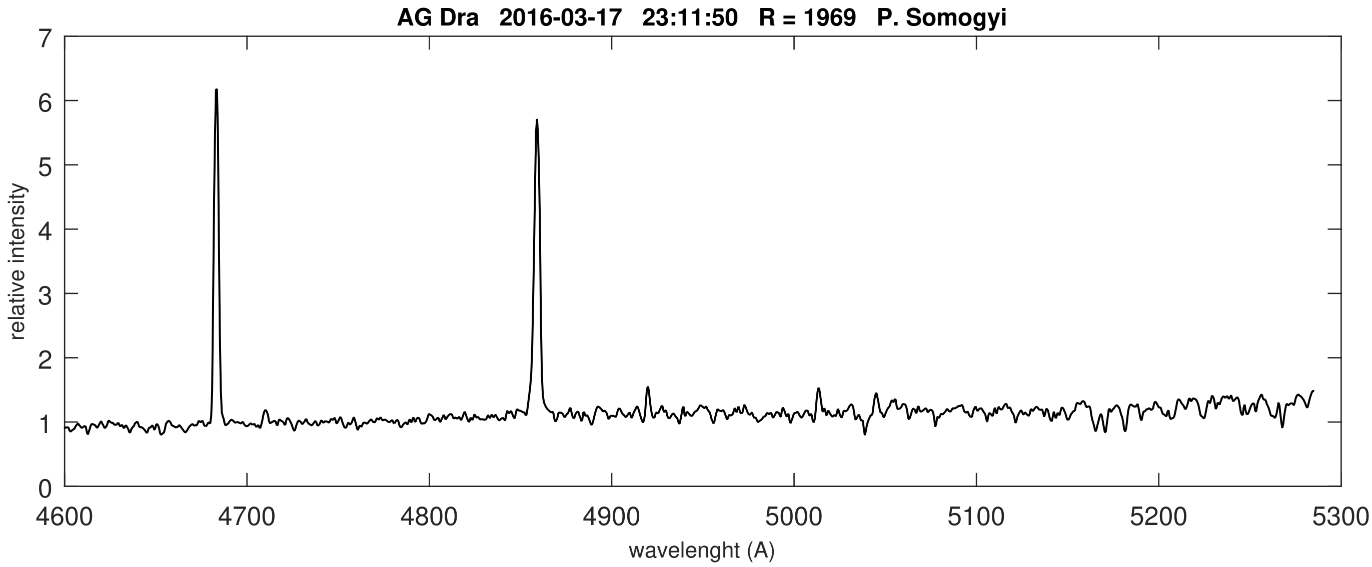

AG Dra 2016-03-30 04:25:00 R = 9000 T Lester
relative intensity
wavelenght (A)
0
2
4
6
8
10
12
14
6000
6500
7000

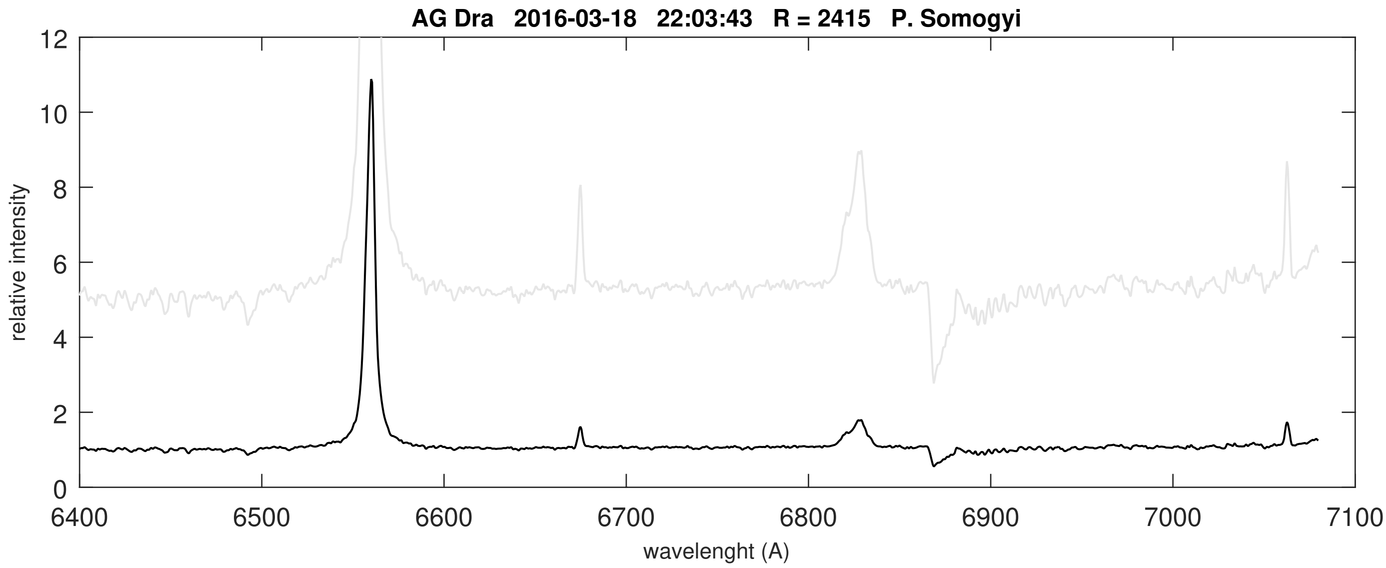

Halpha 2016-03-30
relative intensity
velocity (km/s)
0
5
10
15
-1000
-500
0
500
1000


HeI6678 2016-03-30
relative intensity
velocity (km/s)
0.8
1
1.2
1.4
1.6
1.8
2
-1000
-500
0
500
1000


RamanOVI6826 2016-03-30
relative intensity
velocity (km/s)
0.8
1
1.2
1.4
1.6
1.8
-1000
-500
0
500
1000

AG Dra

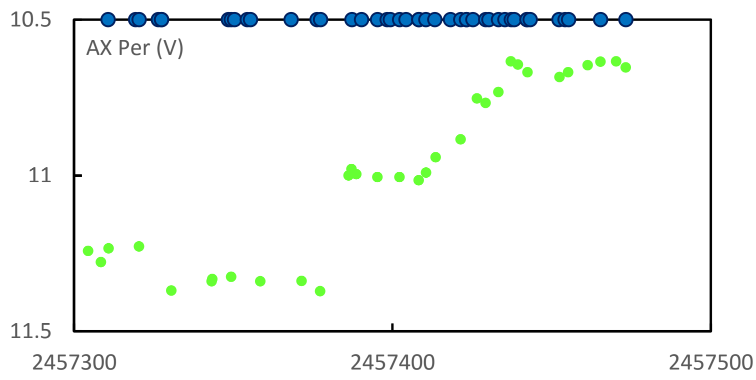

AG Dra 2016-03-17 23:11:50 R = 1969 P. Somogyi
relative intensity
wavelenght (A)
0
1
2
3
4
5
6
7
4600
4700
4800
4900
5000
5100
5200
5300


AG Dra 2016-03-18 22:03:43 R = 2415 P. Somogyi
relative intensity
wavelenght (A)
0
2
4
6
8
10
12
6400
6500
6600
6700
6800
6900
7000
7100

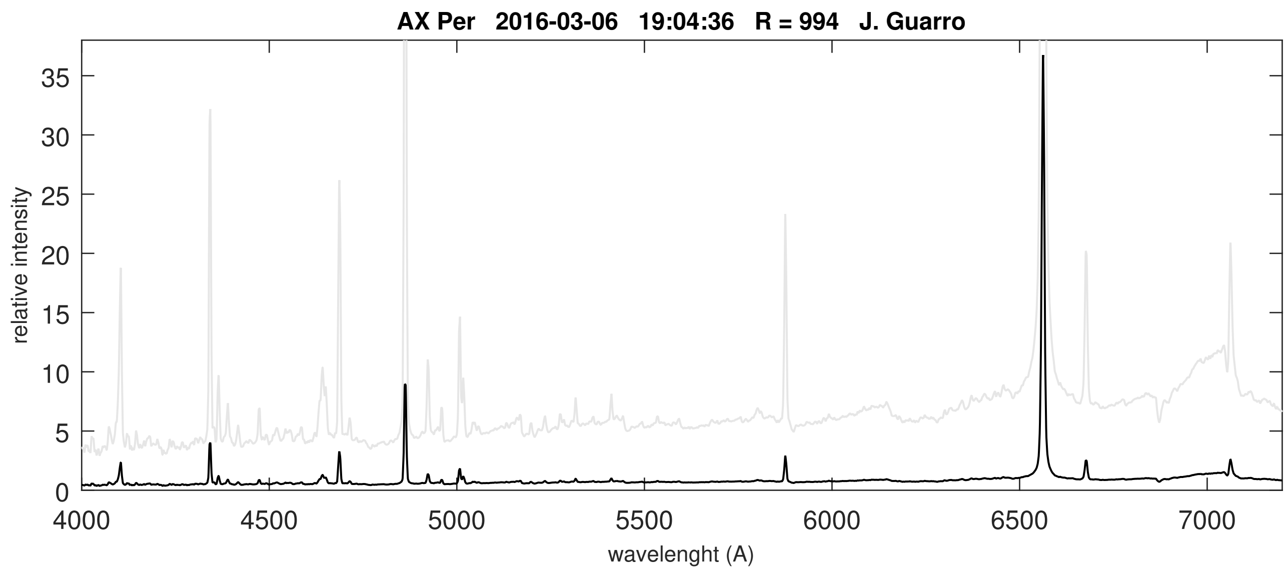
S Y M B I O T I C S

AX Per

Coordinates (2000.0)	
R.A.	1 36 22.7
Dec	54 15 2.5
Mag	11.3 (V)

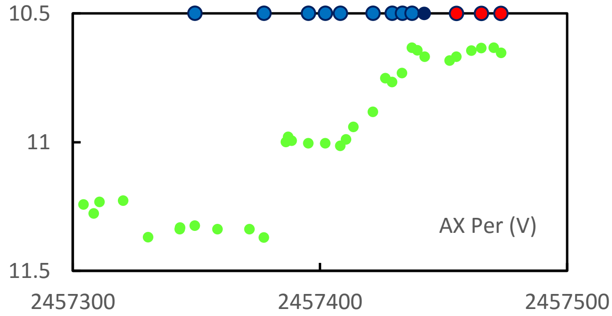


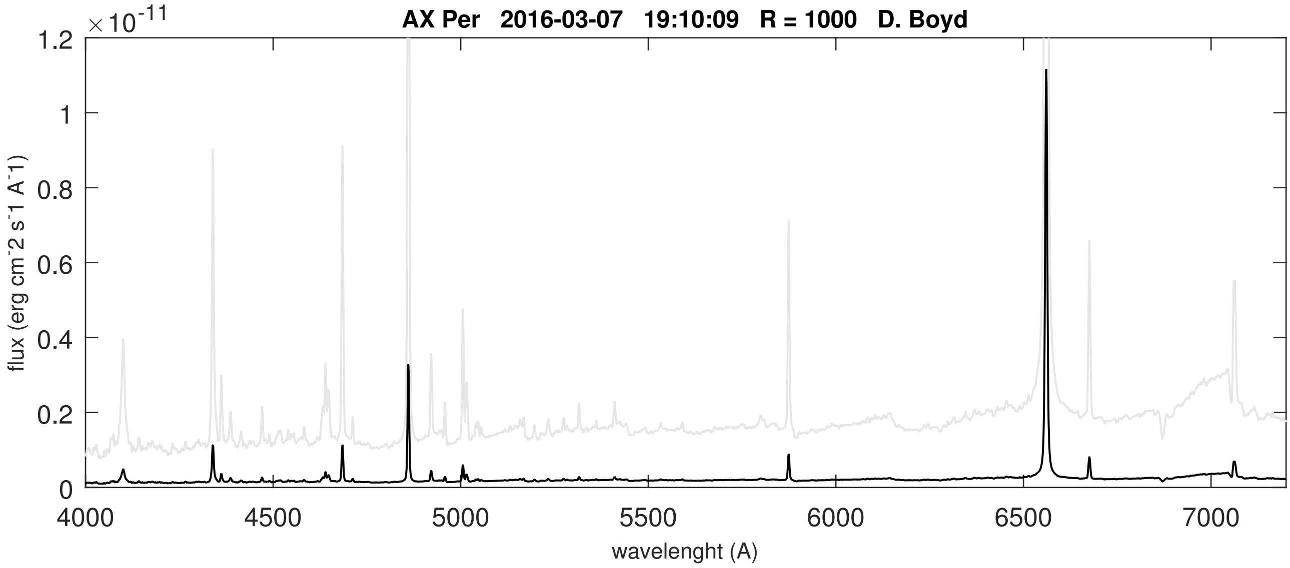
Increasing luminosity (V)
AX Per reaches mag V = 10.7 on February, 18
ARAS observers obtained a good coverage of the classical symbiotic outburst of AX Per

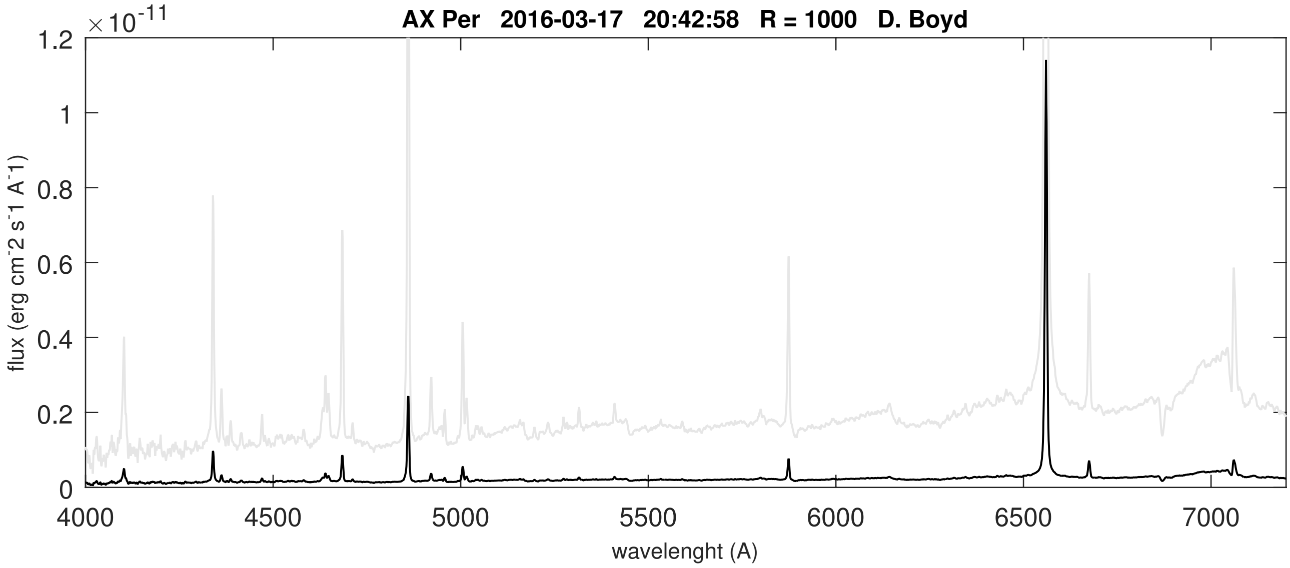


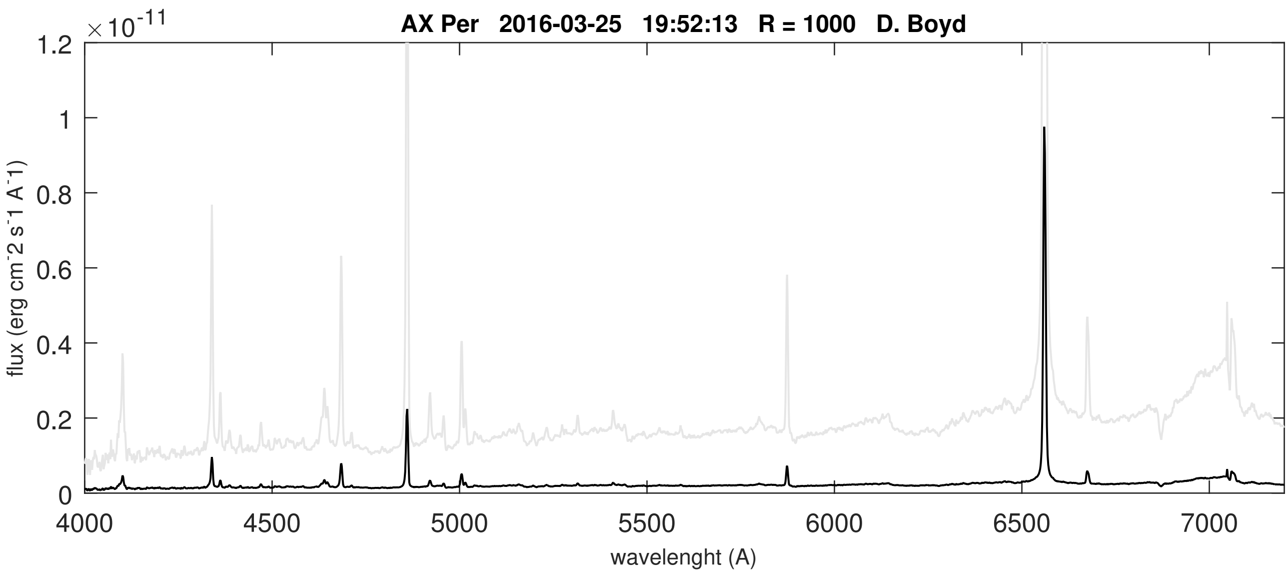
AX Per

AX Per in March: flux calibrated spectra obtained by D. Boyd

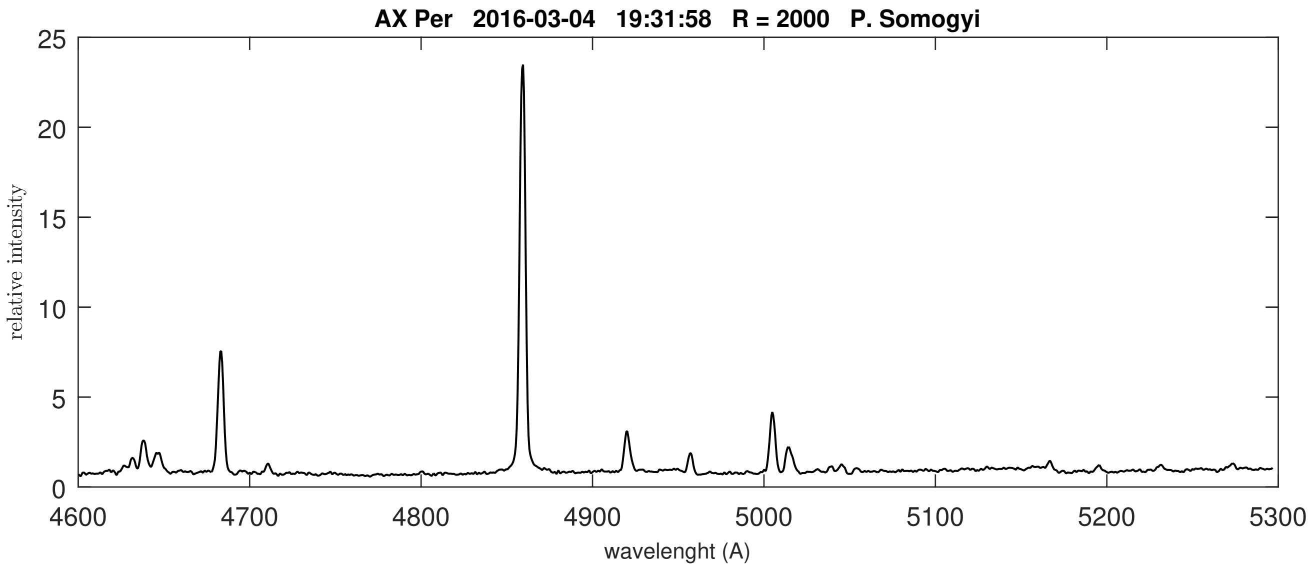


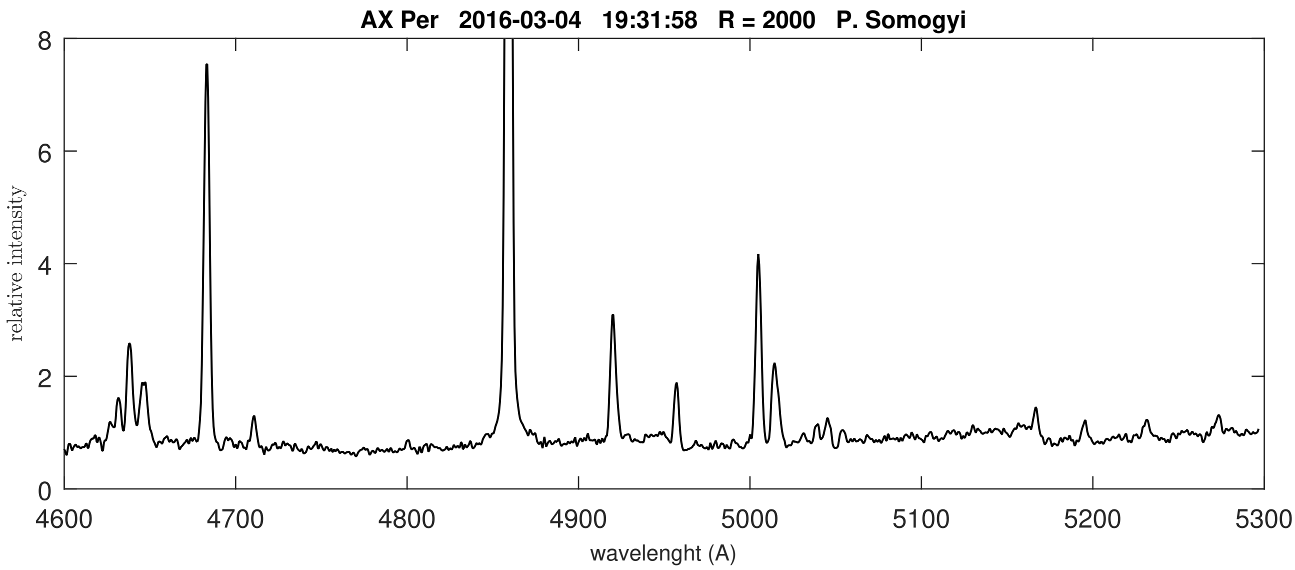






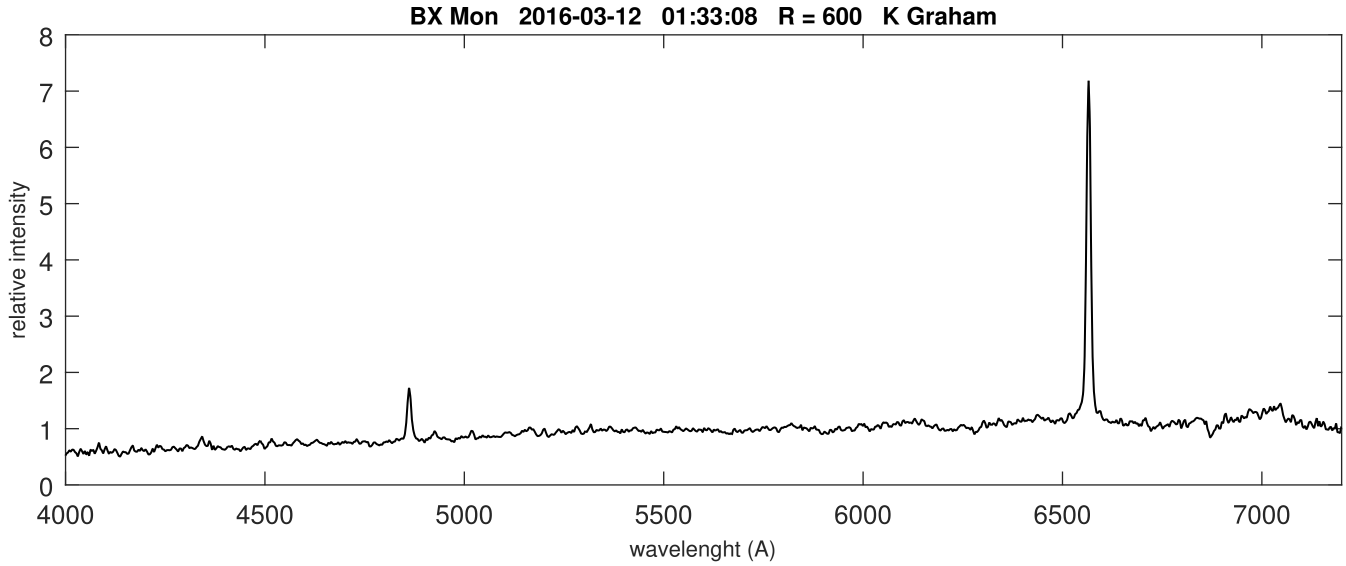
AX Per


AX Per 2016-03-04 19:31:58 R = 2000 P. Somogyi
relative intensity
wavelenght (A)
0
5
10
15
20
25
4600
4700
4800
4900
5000
5100
5200
5300


AX Per 2016-03-04 19:31:58 R = 2000 P. Somogyi
relative intensity
wavelenght (A)
0
2
4
6
8
4600
4700
4800
4900
5000
5100
5200
5300

BX Mon

Coordinates (2000.0)	
R.A.	07 25 22.8
Dec	-03 35 50.8
Mag	10.2 (01-2016)

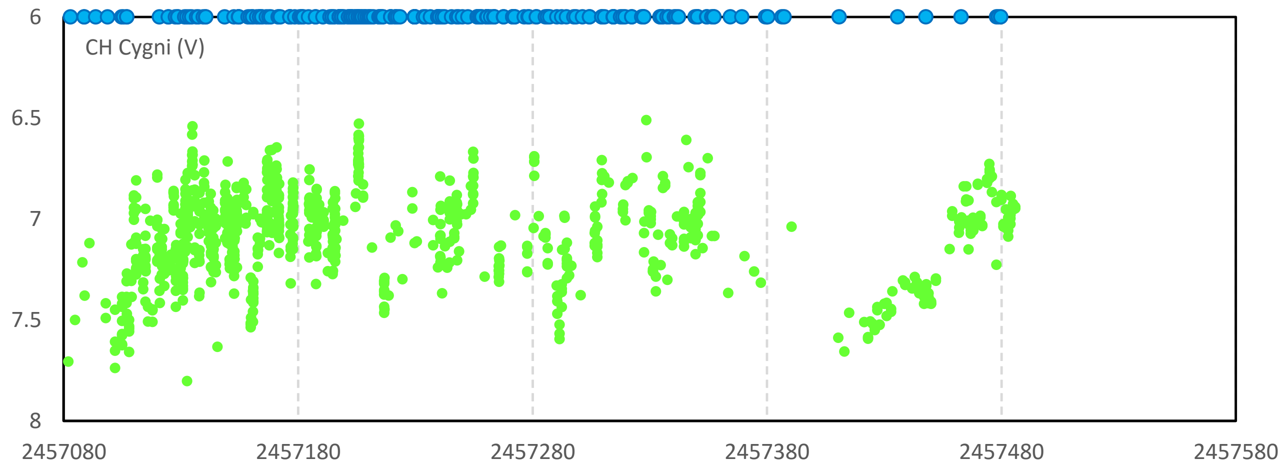


SYMBIOTICS

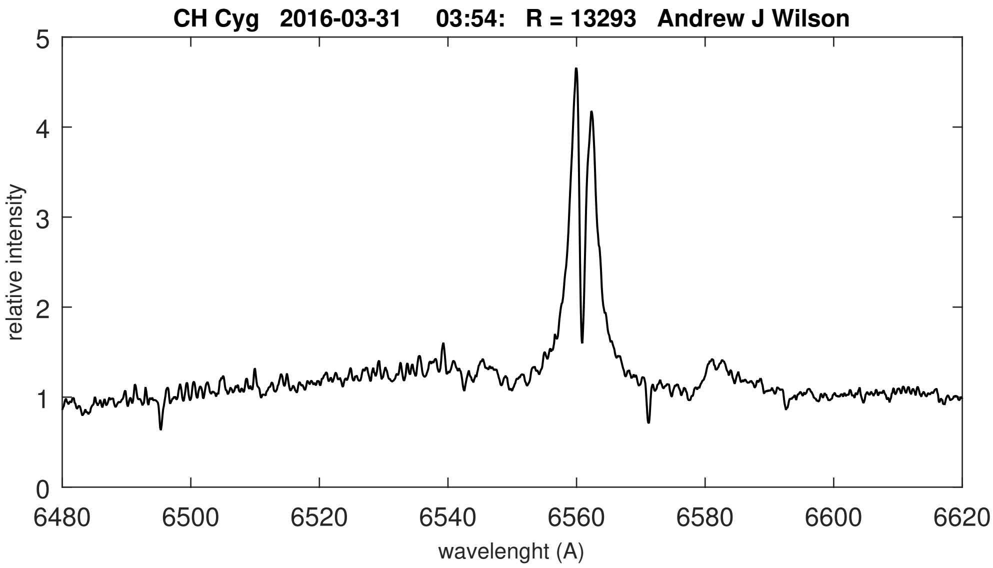
CH Cyg

Coordinates (2000.0)	
R.A.	19 24 33.1
Dec	+50 14 29.1
Mag	

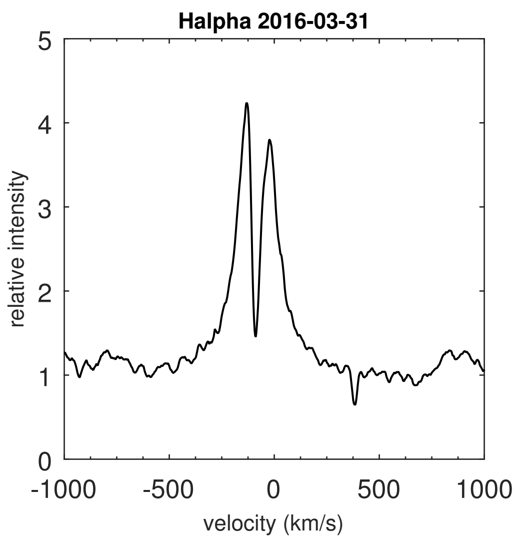
Ongoing cmapaign upon the request of Augustin Skopal
At least one spectrum (high resolution and low resolution, with a good atmospheric response



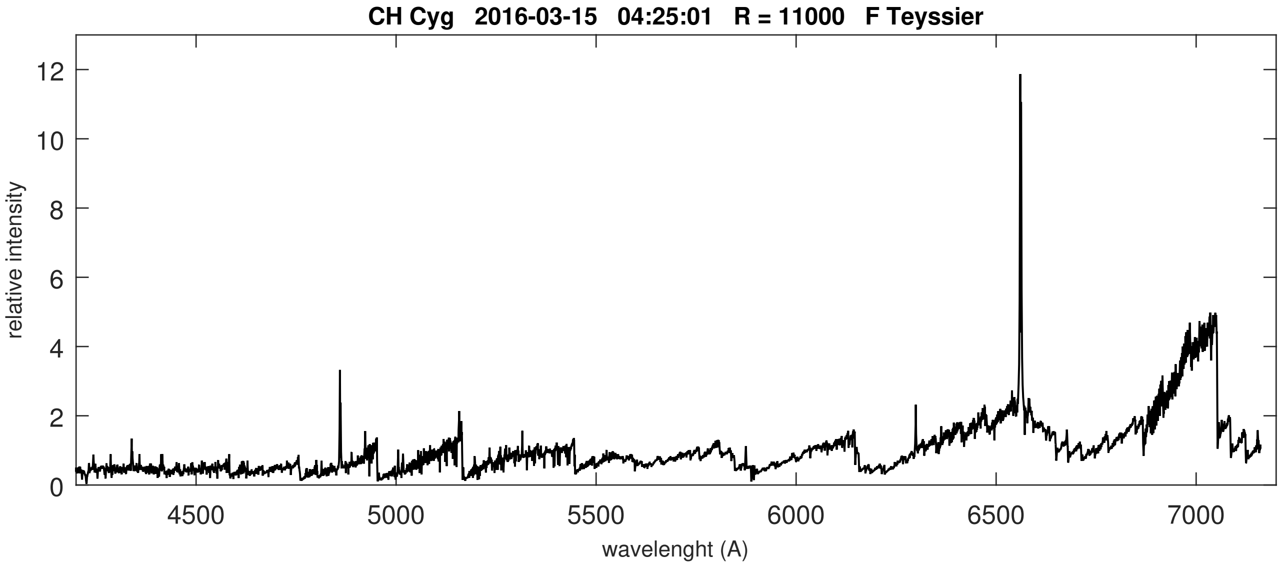
AAVSO light curve V in 2015-2016
ARAS Spectra blue dots

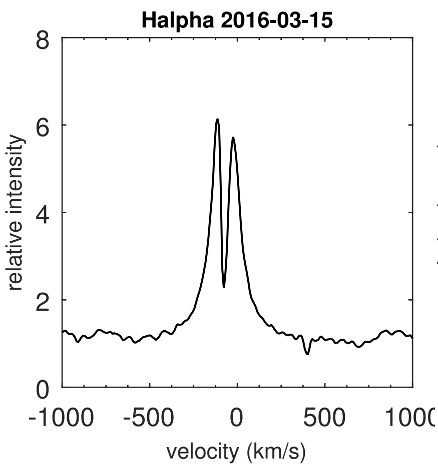


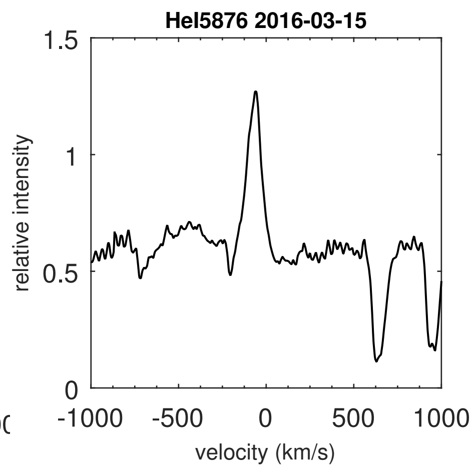
H alpha line by Andrew J. Wilson with a Lhires III 2400 l/mm

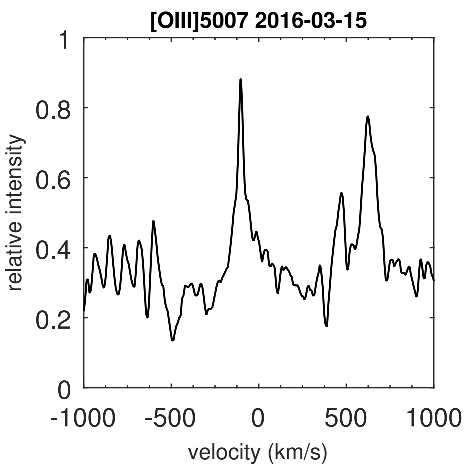


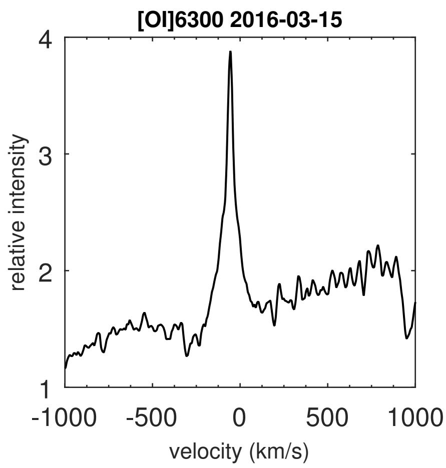
CH Cyg

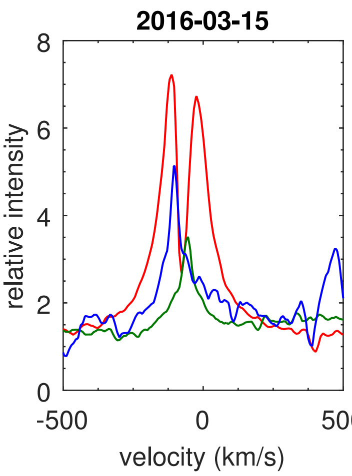

CH Cyg 2016-03-15 04:25:01 R = 11000 F Teyssier
relative intensity
wavelenght (A)

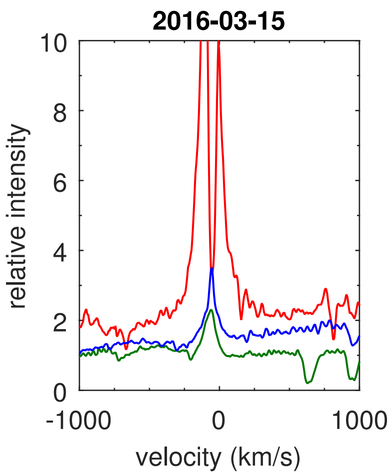

Halpha 2016-03-15
relative intensity
velocity (km/s)


HeI5876 2016-03-15
relative intensity
velocity (km/s)

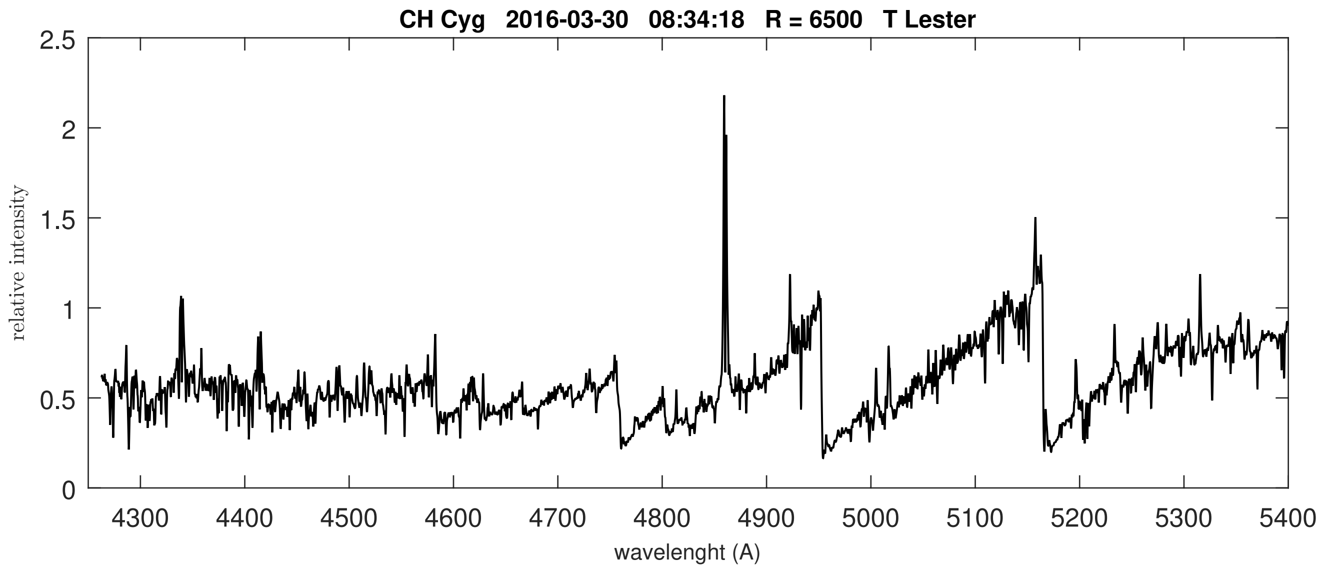

[OIII]5007 2016-03-15
relative intensity
velocity (km/s)


[OI]6300 2016-03-15
relative intensity
velocity (km/s)

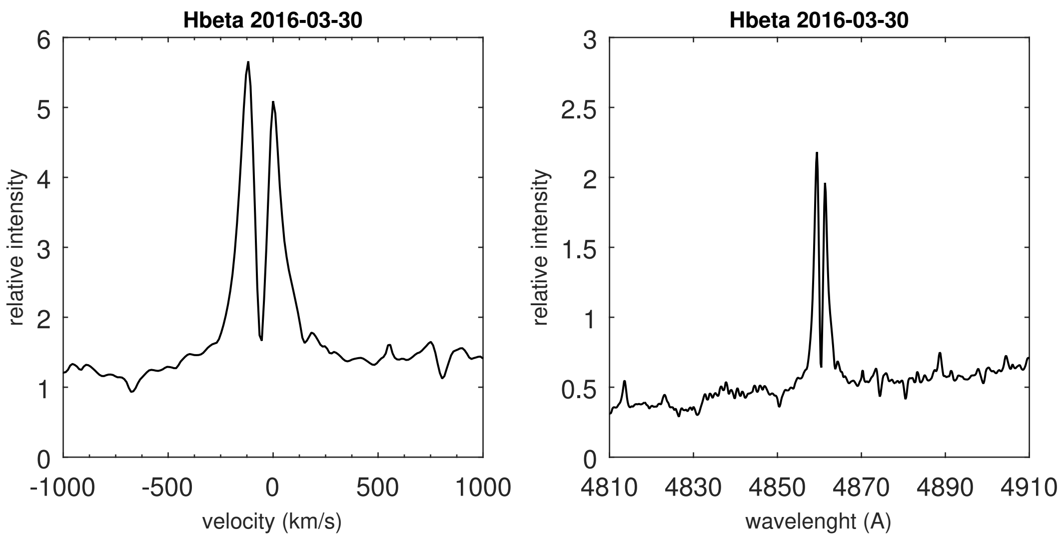

2016-03-15
relative intensity
velocity (km/s)


2016-03-15
relative intensity
velocity (km/s)

CH Cyg



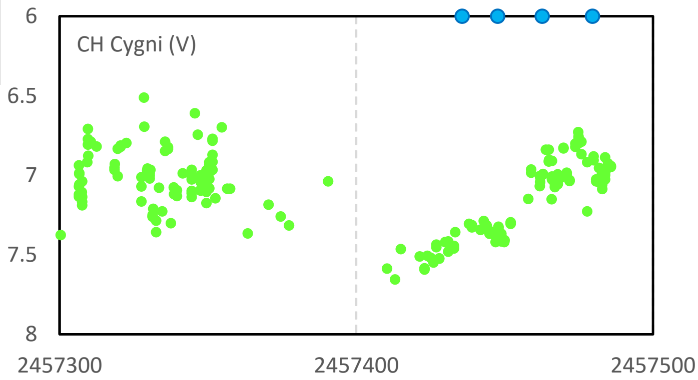
H beta region
Tim Lester
R = 6500

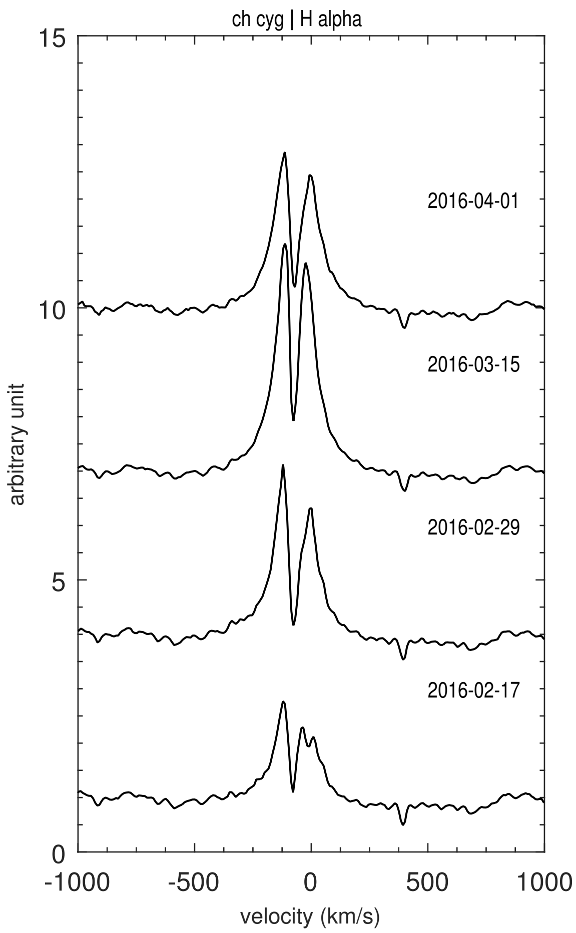


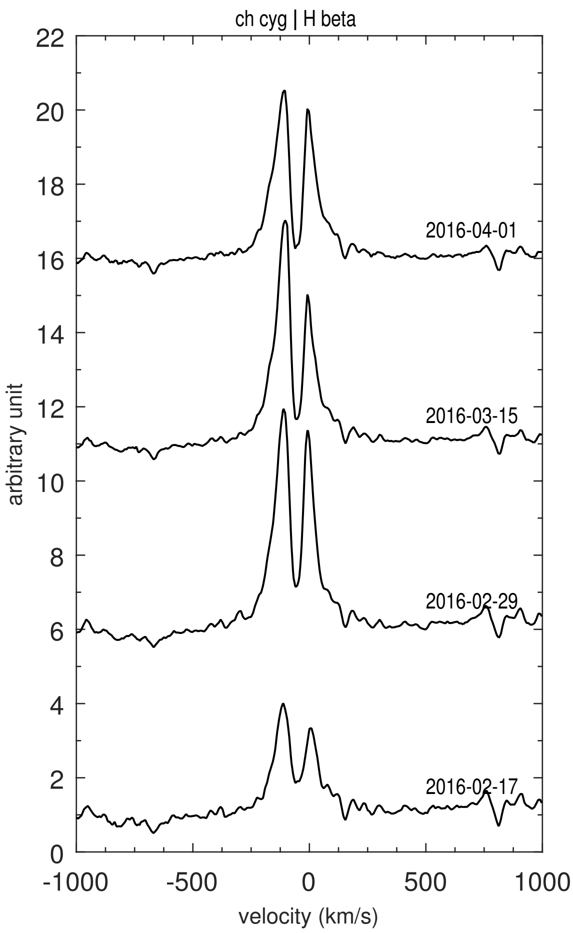
SYMBIOTICS

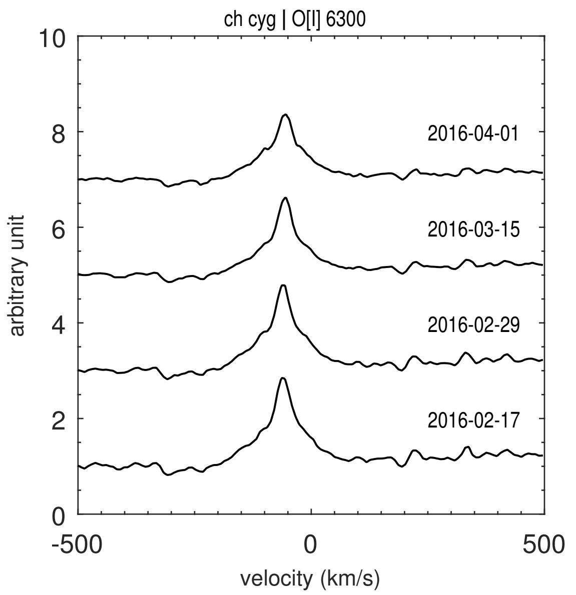
CH Cyg

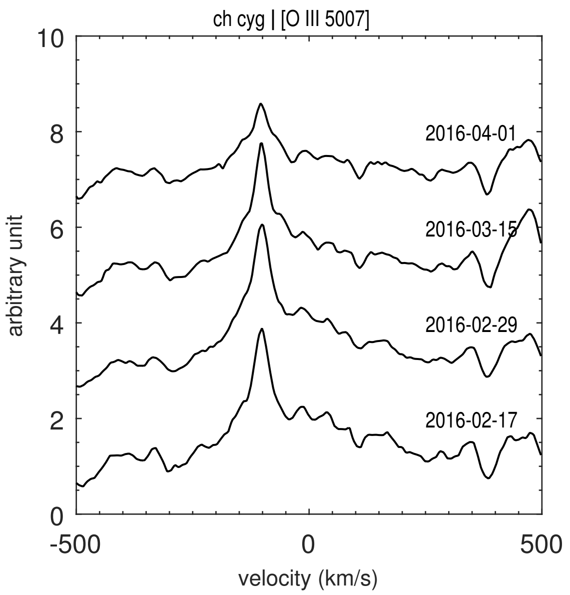
A few lines from eshel spectra (F. Teyssier) in 2016









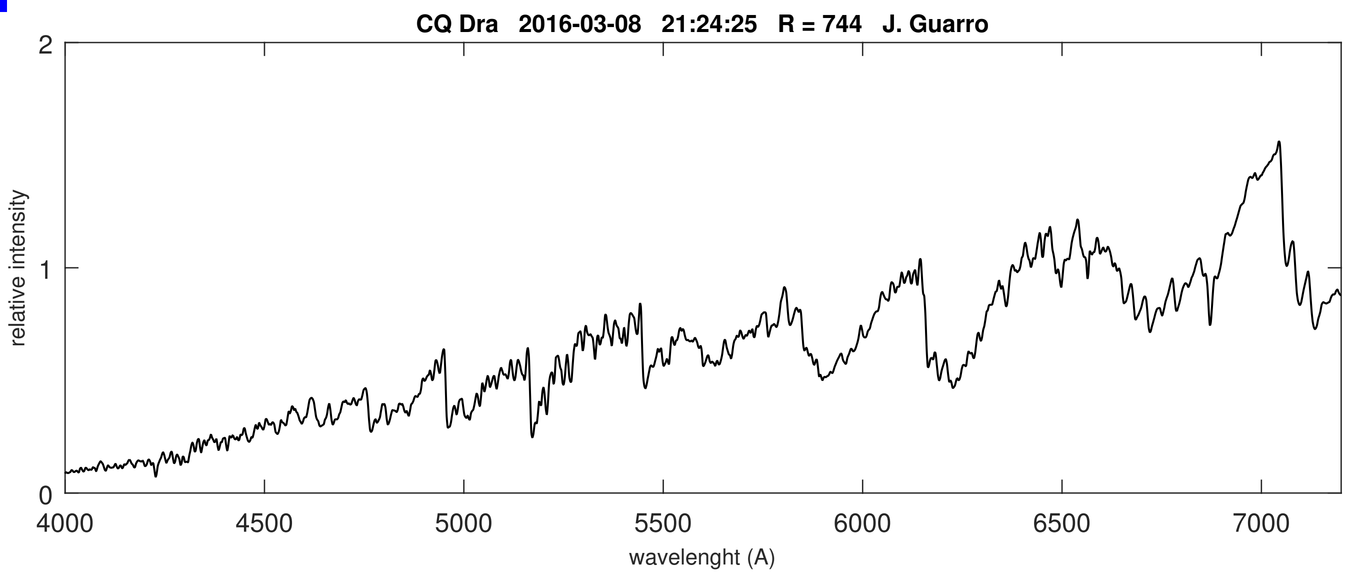


S
Y
M
B
I
O
T
I
C
S

CQ Dra

Coordinates (2000.0)	
R.A.	12 30 06.65
Dec	+69 12 04.0
Mag	5

CQ Dra = 4 Dra mag 5
A bright target

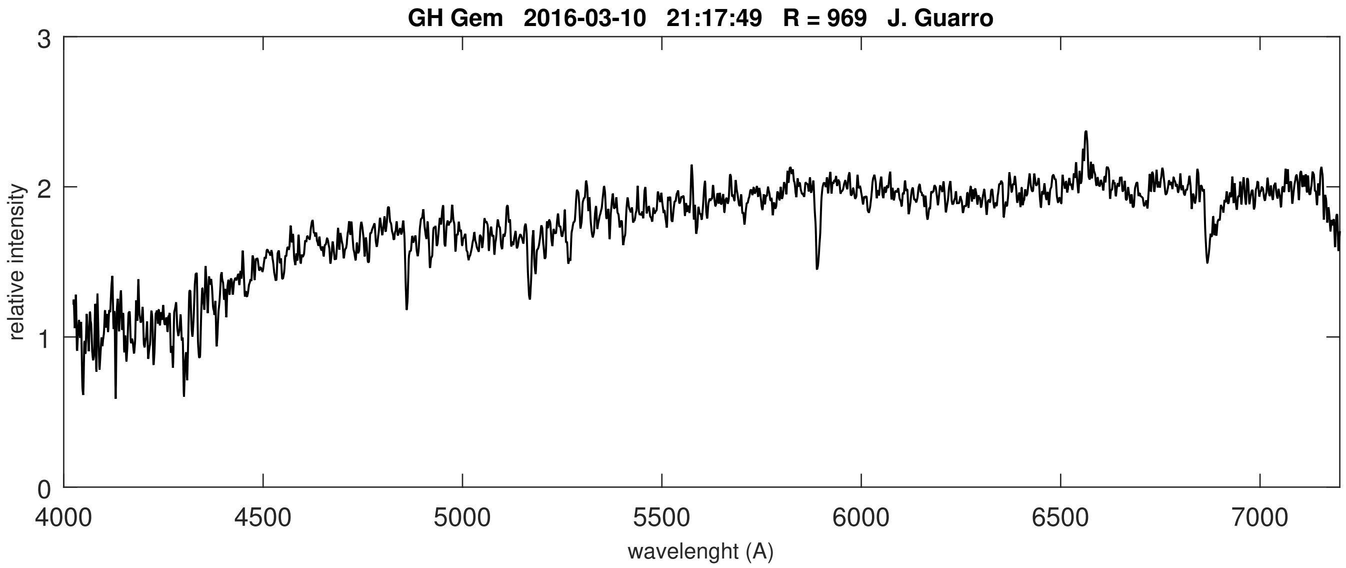


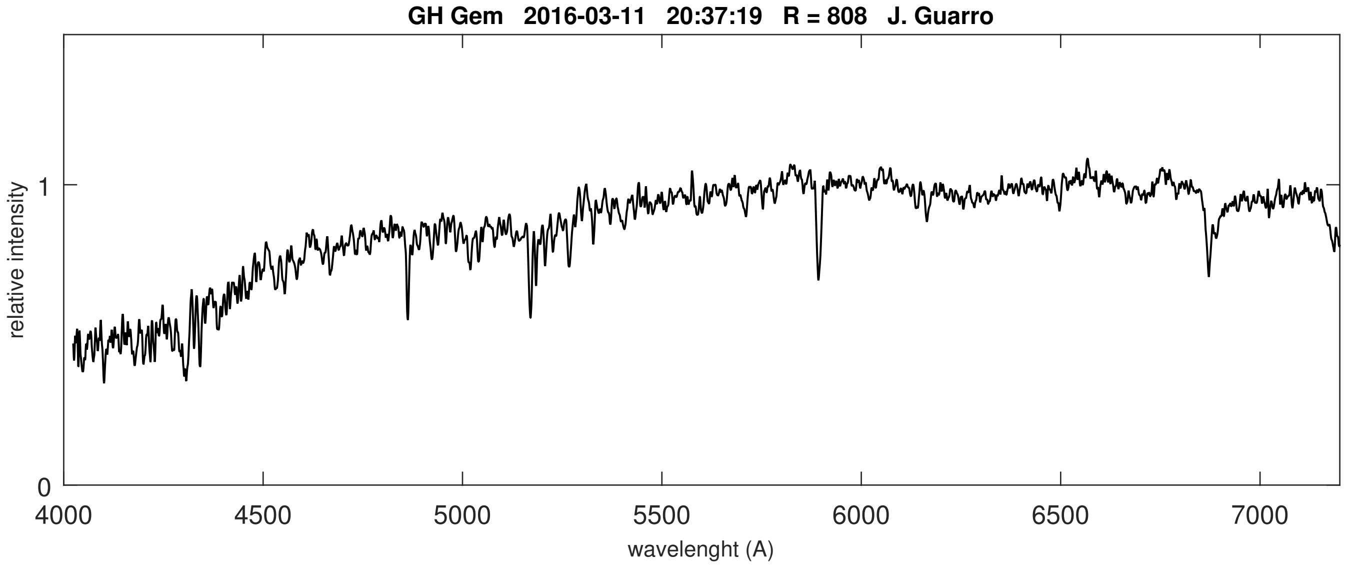
SYMBIOTICS

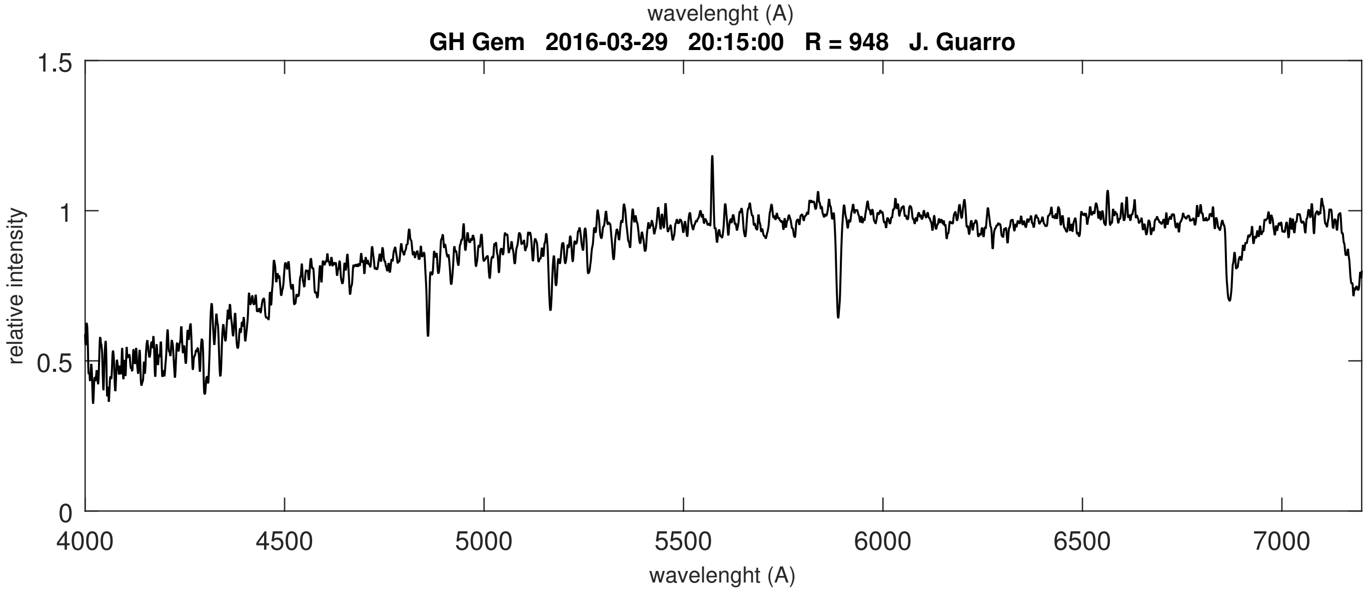
GH Gem

Coordinates (2000.0)	
R.A.	
Dec	
Mag	

Changes in H alpha in these 3 obained in March, 2016 by Joan Guarro



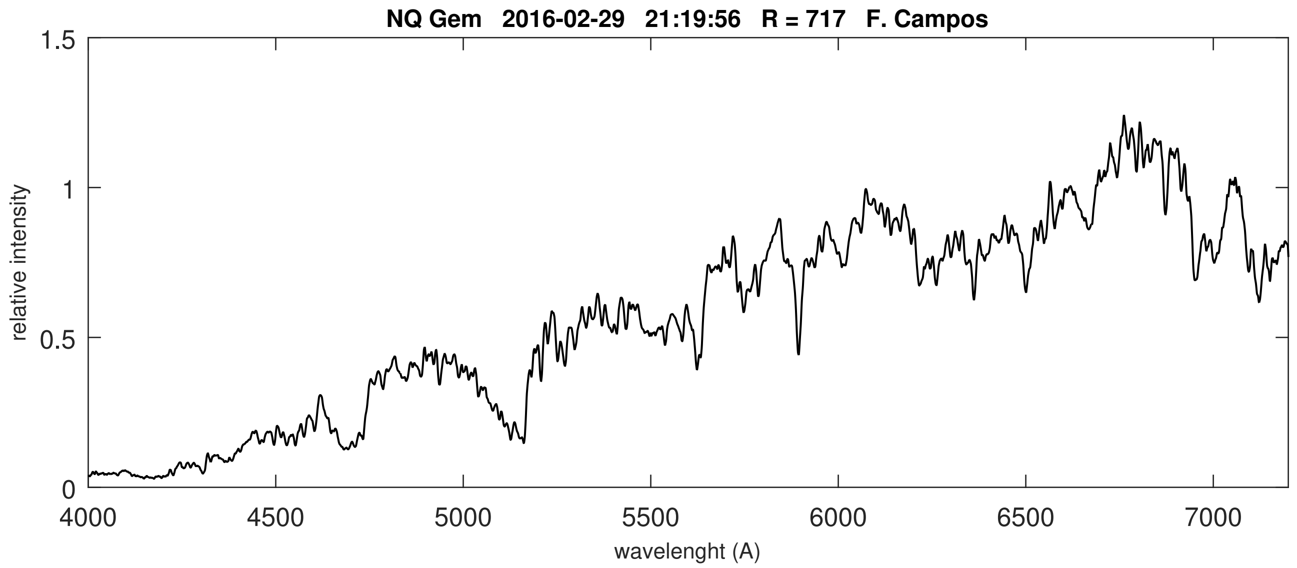


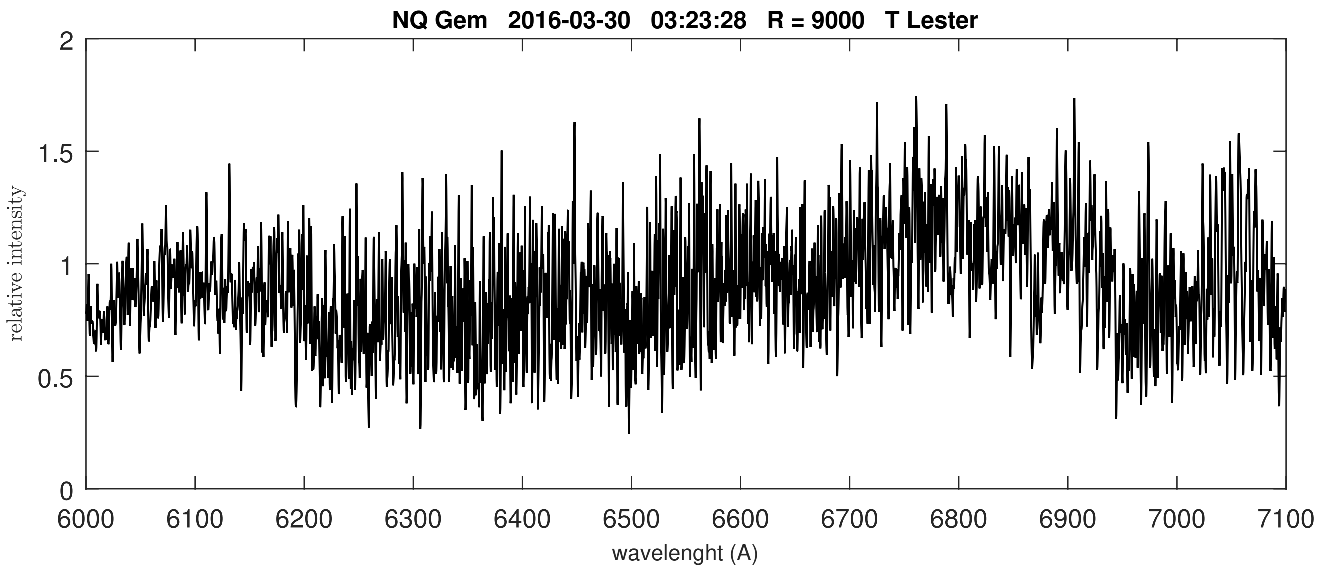


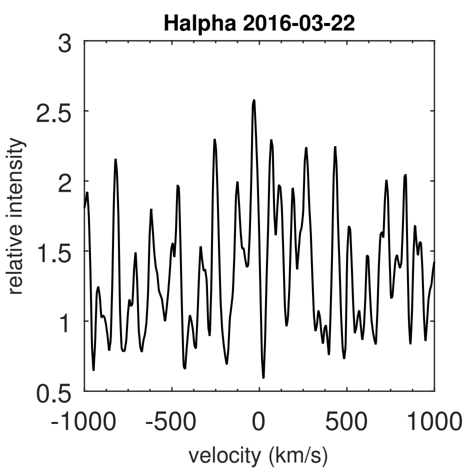
SYMBIOTICS

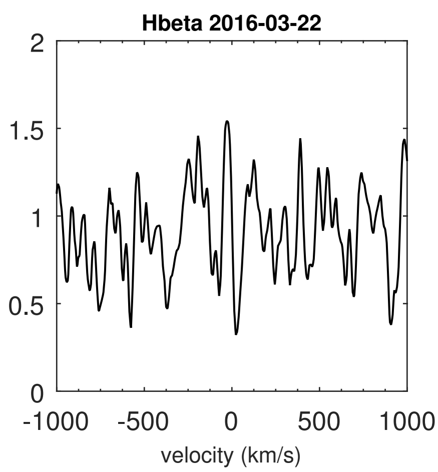
NQ Gem

Coordinates (2000.0)	
R.A.	07 31 54.5
Dec	+24 30 12.5
Mag	7.9









Hα and Hβ
eshel R = 11000
F. Teyssier

SYMBIOTICS

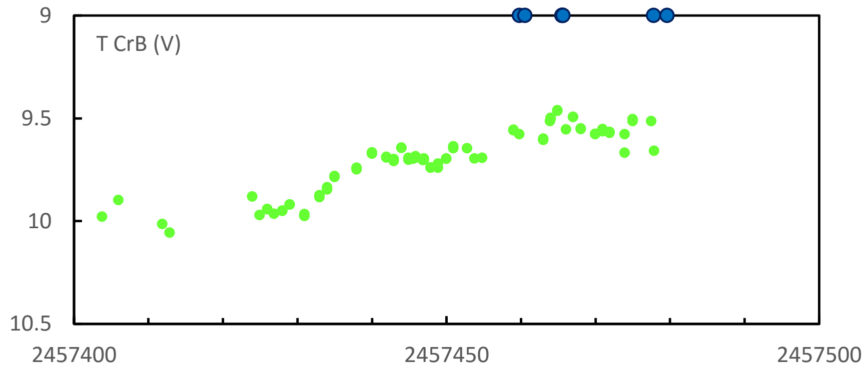
T CrB

Coordinates (2000.0)	
R.A.	15 59 30.2
Dec	+25 55 12.6
Mag	

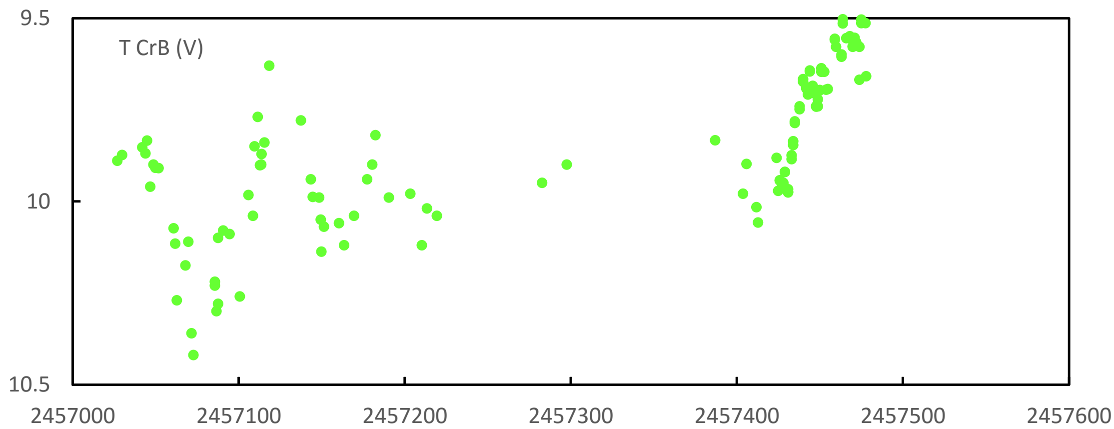
The recurrent nova T CrB has entered in 2015 a phase of unprecedented high activity.

Is therefore everything in place for a new nova outburst in 2026, again 80 years past the last eruption ?

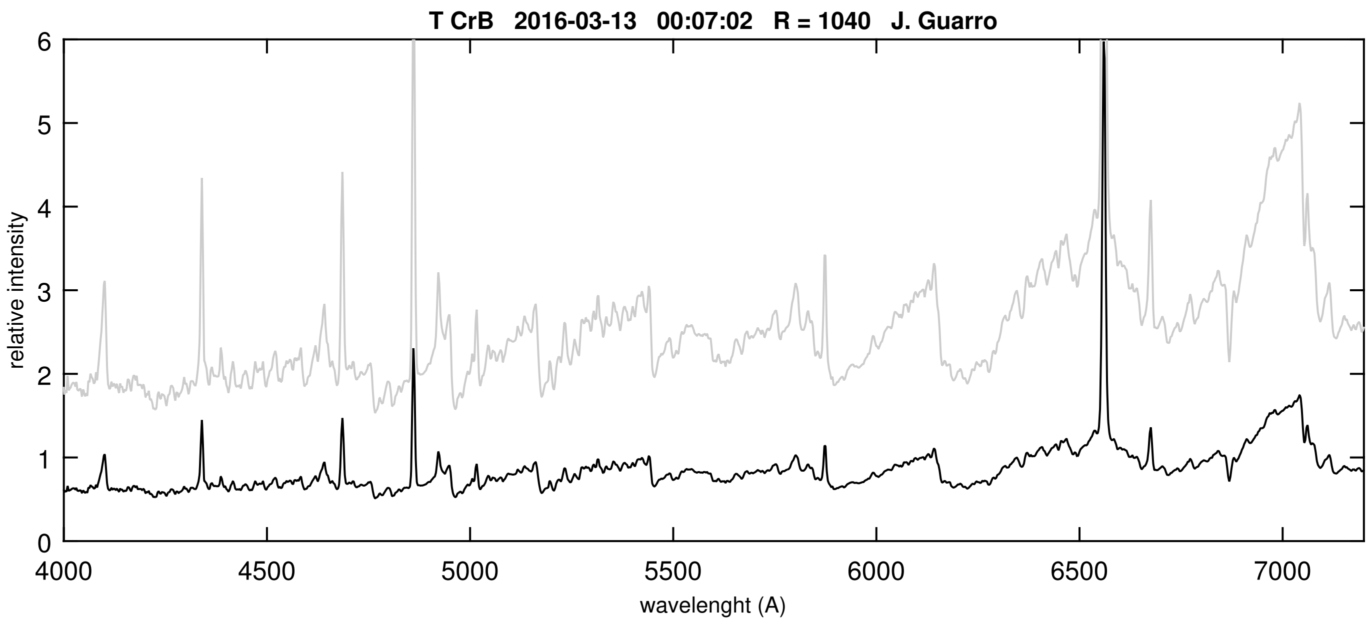
See Munari & al., 2016



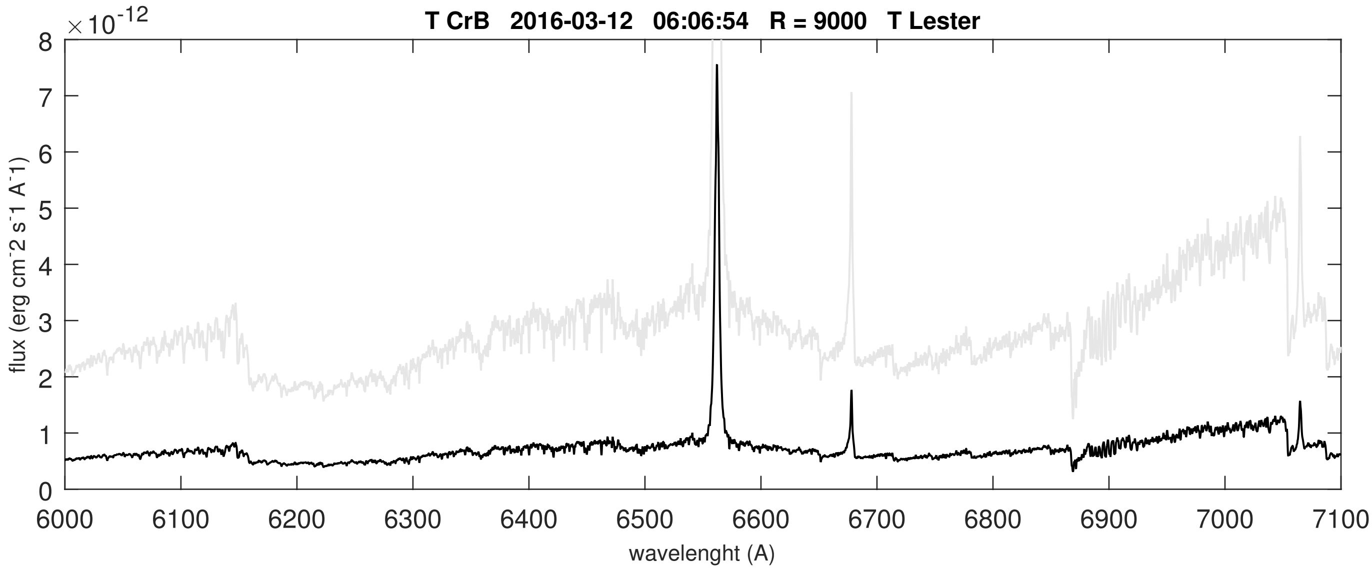
AAVSO V Band lightcurve 2016
ARAS Spectra in march : blue dots



AAVSO V Band lightcurve 2015-2016



T CrB

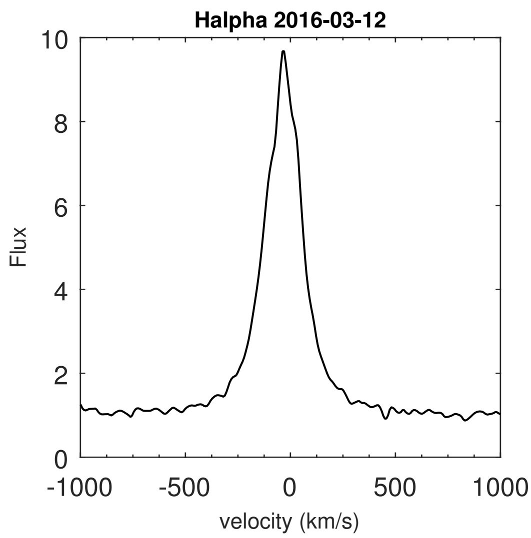


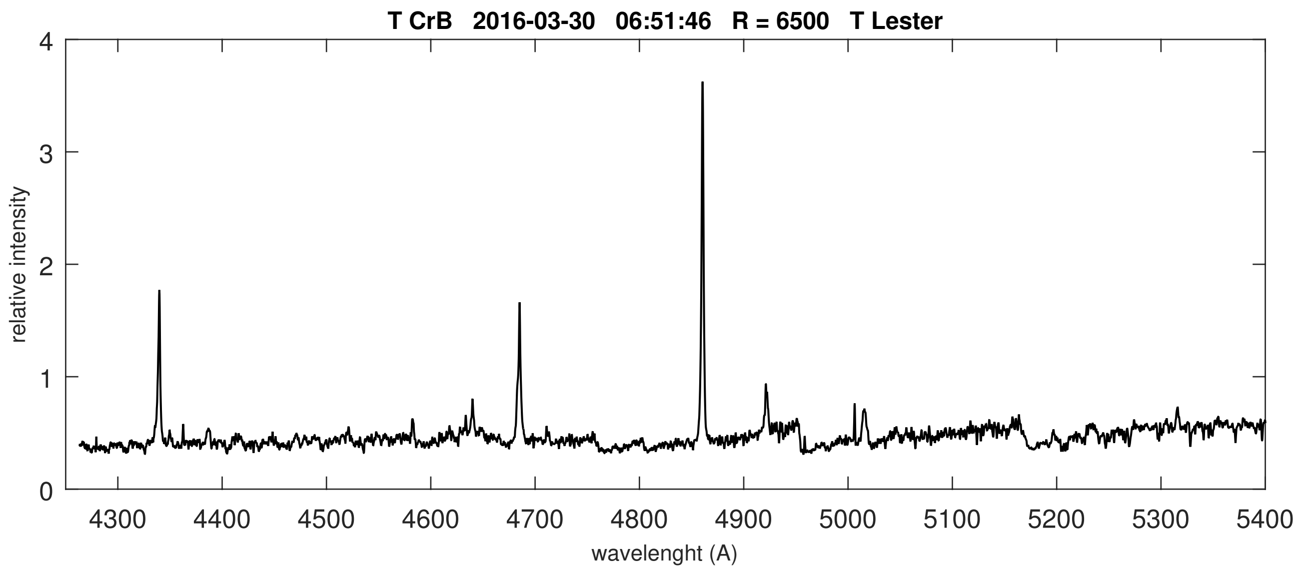
Fux calibrated spectrum obtained by Tim Lester with its home buit spectrograph at R = 9000

EXPLANATIONS :

To get the flux I did the following:
1 - convert the Miles reference spectrum for HD143807 to flux using its listed magnitude of 4.957 (I do this by using the Bessel V funtion)
2 - process my spectrum for HD143807 with normalization turned off and divide it by the exposure time in sec.
3 - divide the Miles flux spectrum by my spectrum and measure the average value of the continuum to get a flux conversion factor.
4 - process my spectrum for T CrB with normalization turned off and divide it by exposure time.
5 - multiply my spectrum for T CrB by the conversion factor from step 3.

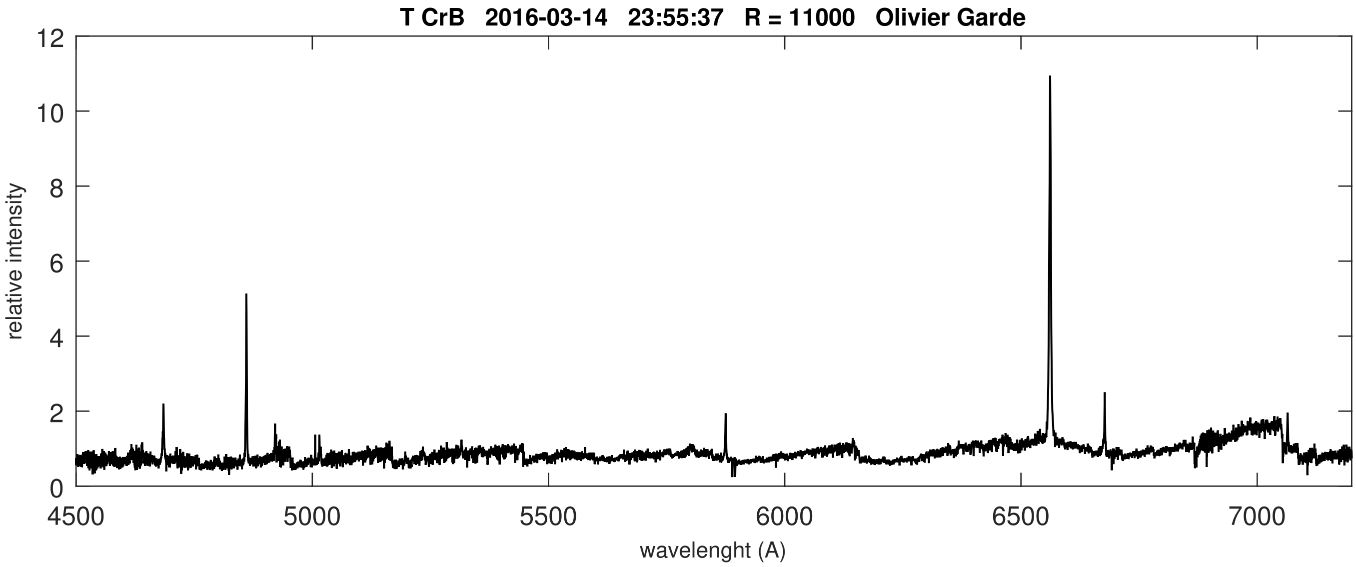
The seeing was very good at 1.6 arc sec when I was acquiring T CrB and the Miles reference.
Also the average altitude was fairly high (~ 50 deg) and guiding was very good .
My slit is 2.3 arc sec wide so the slit efficiency was about 90% and quite consistent.
Under these conditions the flux estimate should be pretty good.

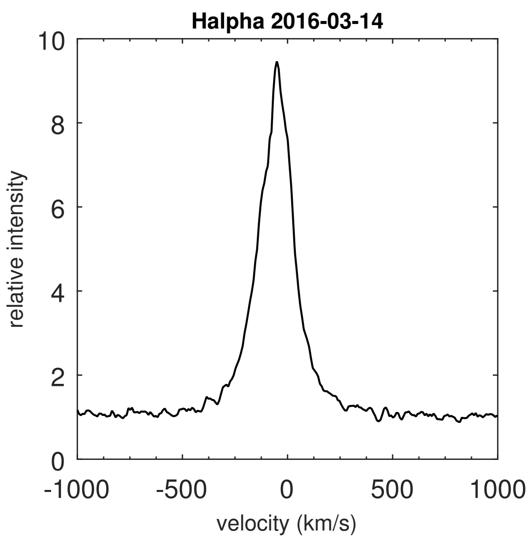


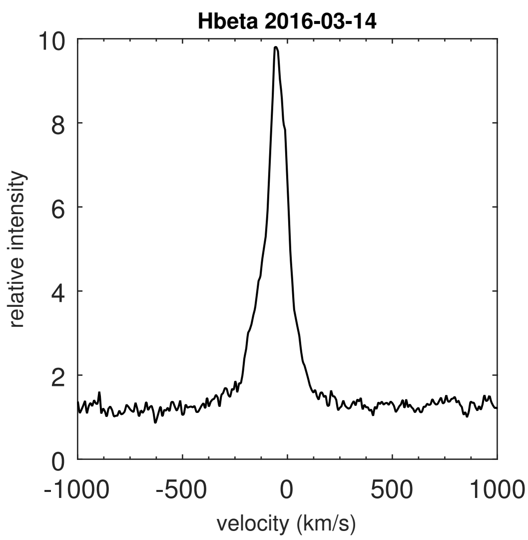


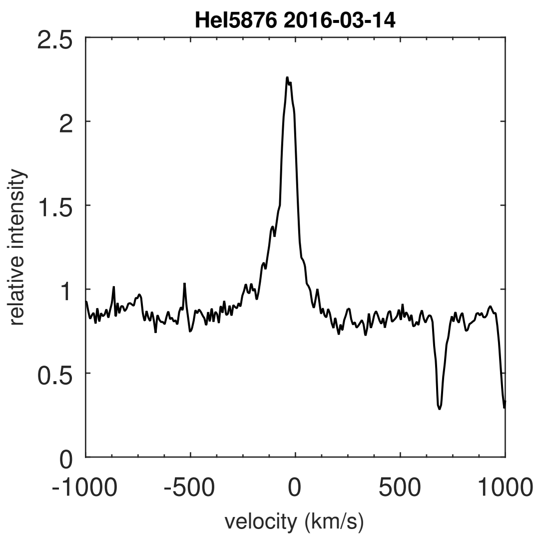
T CrB

Olivier Garde eShel R = 11000
Continuum adjusted using a low resolution spectrum





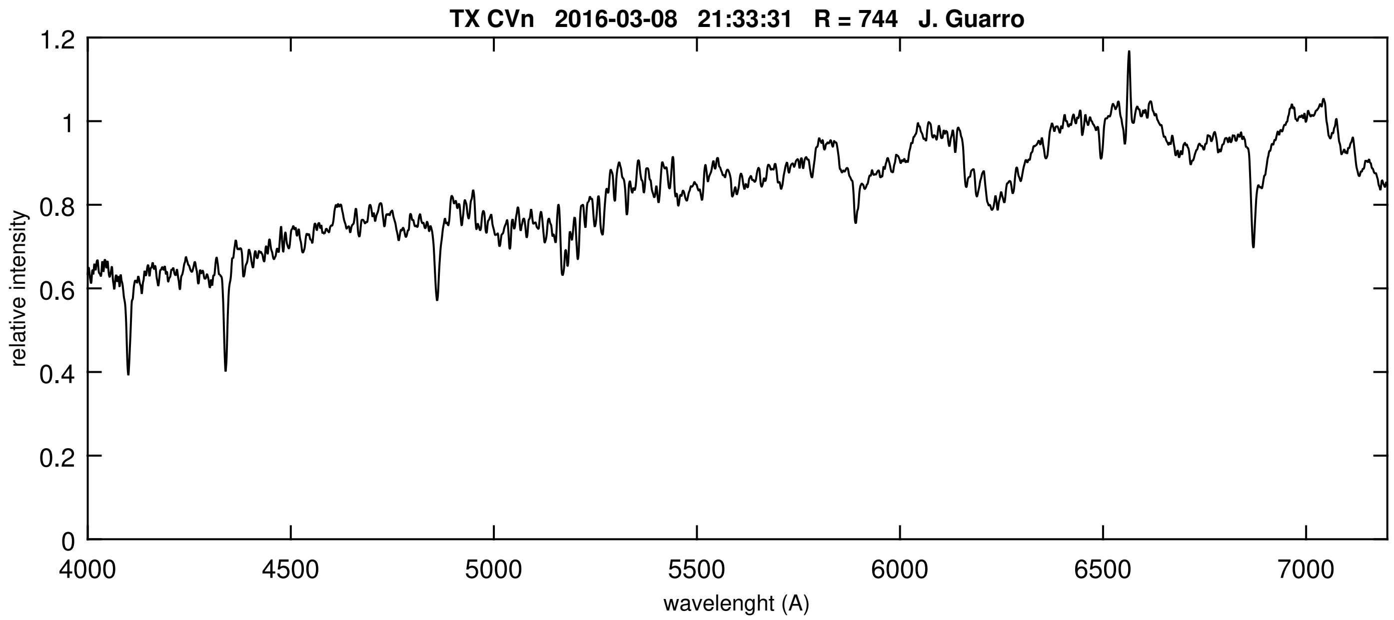


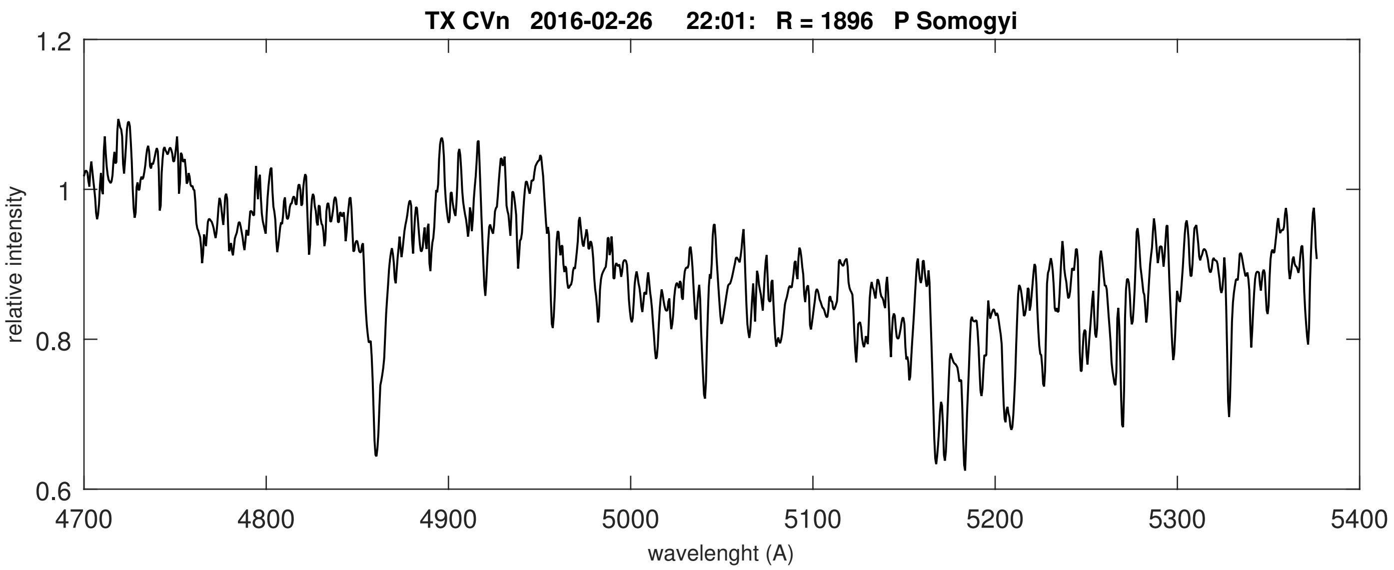


SYMBIOTICS

TX CVn

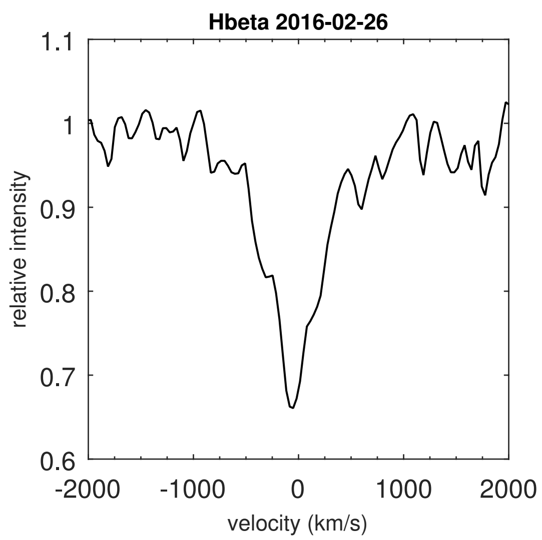
Coordinates (2000.0)	
R.A.	12 44 42.0
Dec	+36 45 50.7
Mag	



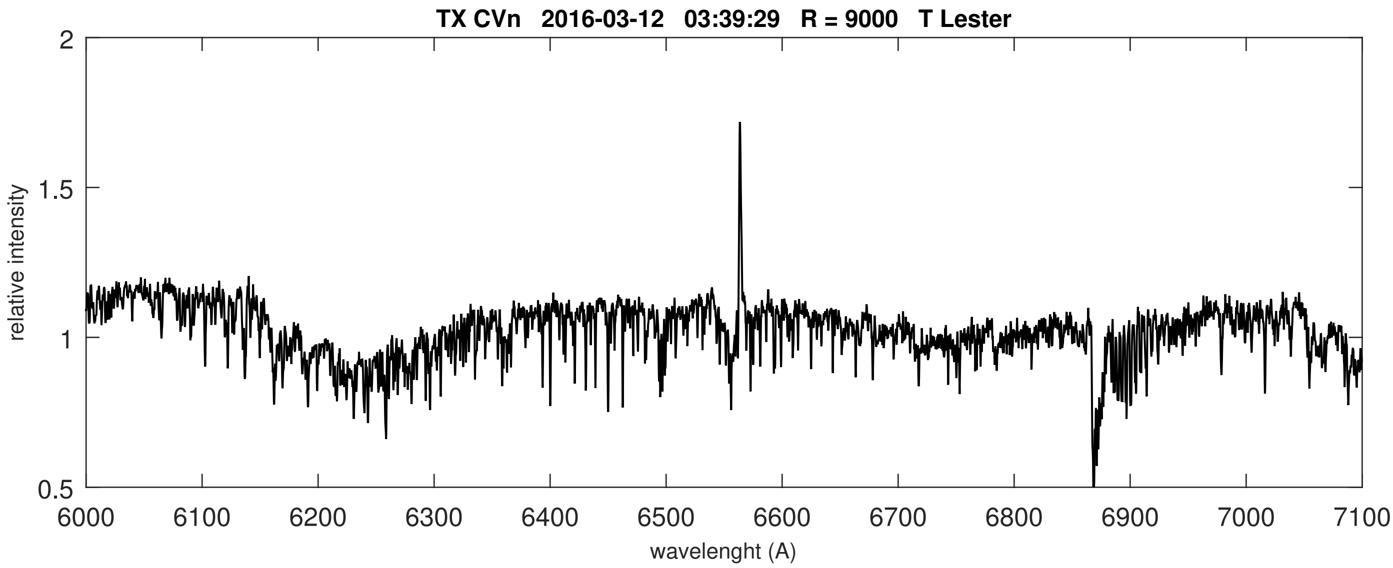


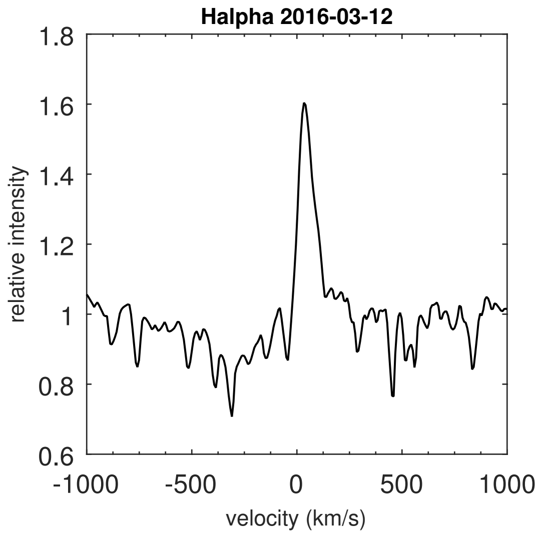
H Beta region
Peter Somogyi
Lhires III 600 l/mm

Right : H beta line



TX CVn

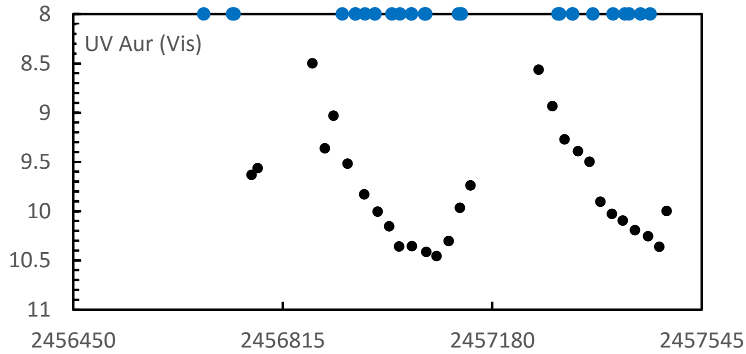

TX CVn 2016-03-12 03:39:29 R = 9000 T Lester
relative intensity
wavelenght (A)
2
1.5
1
0.5
6000
6100
6200
6300
6400
6500
6600
6700
6800
6900
7000
7100


Halpha 2016-03-12
relative intensity
velocity (km/s)
1.8
1.6
1.4
1.2
1
0.8
0.6
-1000
-500
0
500
1000

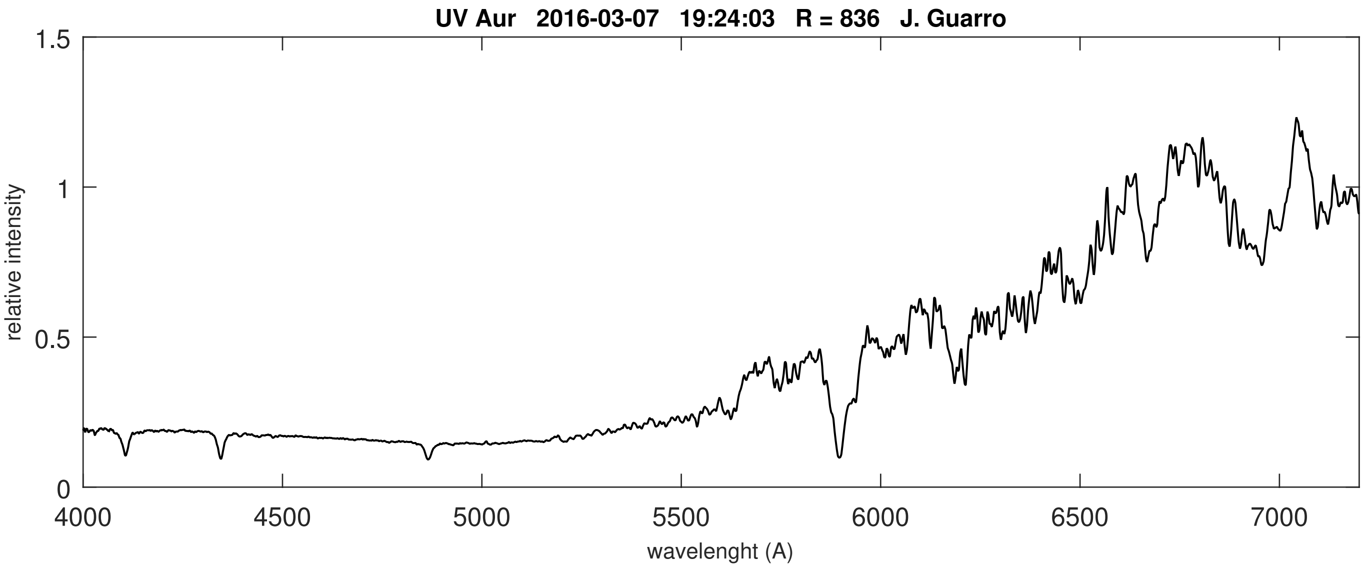
SYMBIOTICS

UV Aur

Coordinates (2000.0)	
R.A.	5 46 42.1
Dec	+06 43 47.1
Mag	10.2 (01-2016)



AAVSO light curve (visual, mean values)
from 2014 to 2016
ARAS spectra : blue dots

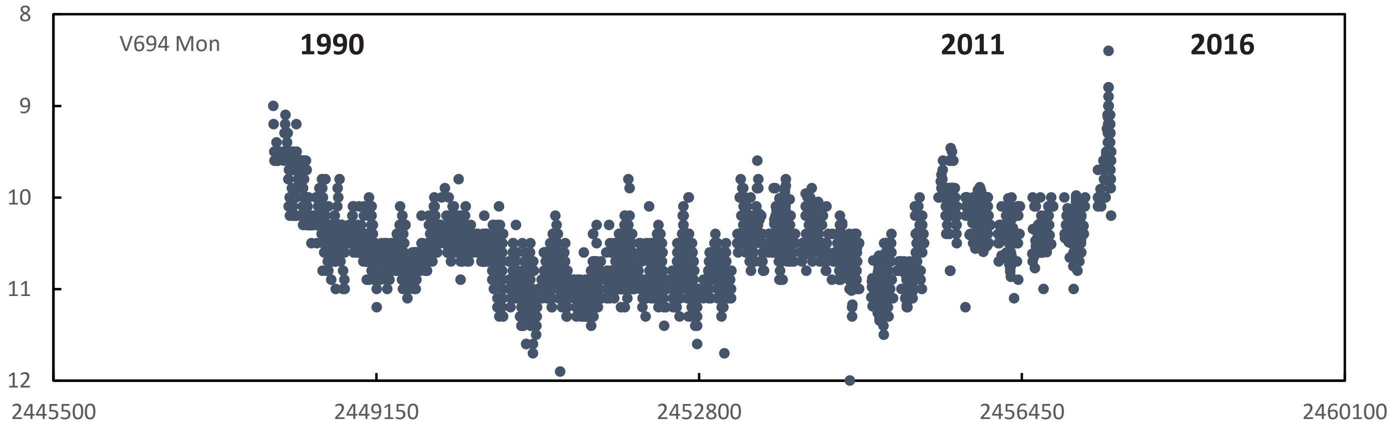


S Y M B I O T I C S

V694 Mon

Coordinates (2000.0)	
R.A.	07 25 51.3
Dec	-07 44 08.1
Mag	9.8 (12-2015)

V694 Mon Field
18th Feb., 2016
David Boyd

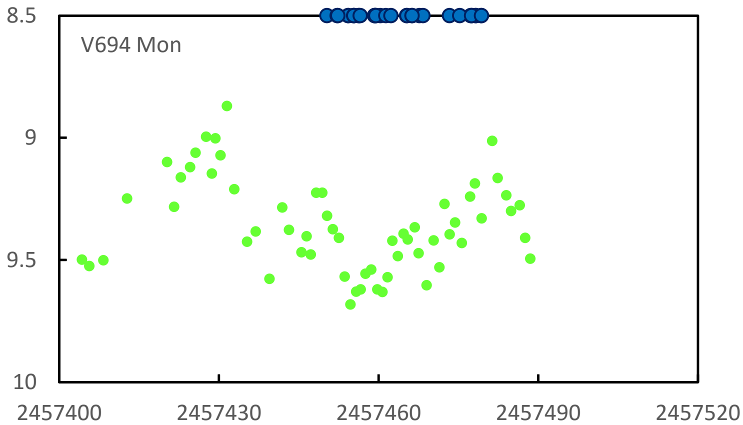


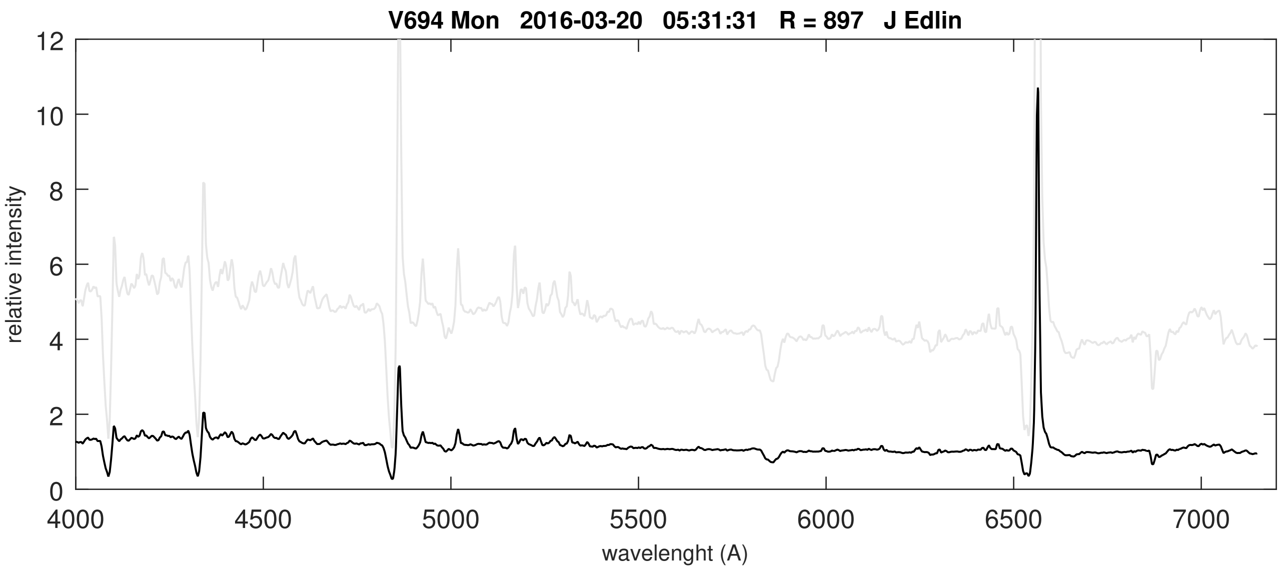
Long term AAVSO light curve in V and Visual. 2016 outburst brighter than 1990

AAVSO V band database 2016, 01-16 to 04-10
ARAS Spectra in March (35): blue dots

At date, the maximum velocity of absorptions still remains at about 2300 km/s. No plateau detected between absorption and emission.

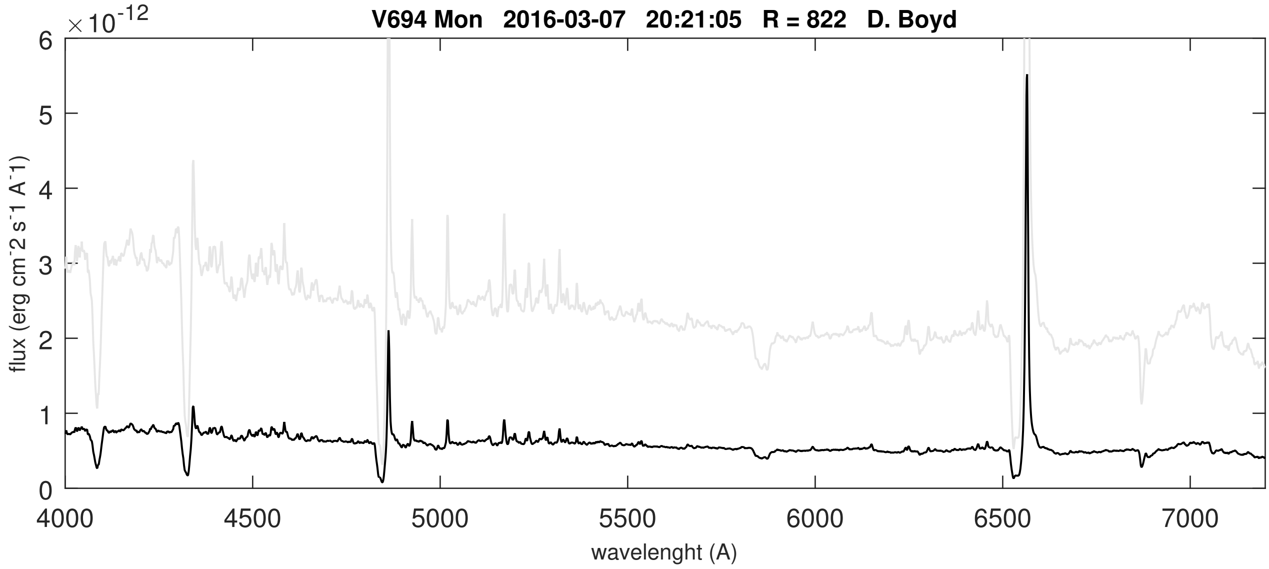
Observing : continue observing until MWC 560 ceases to be a nighttime object

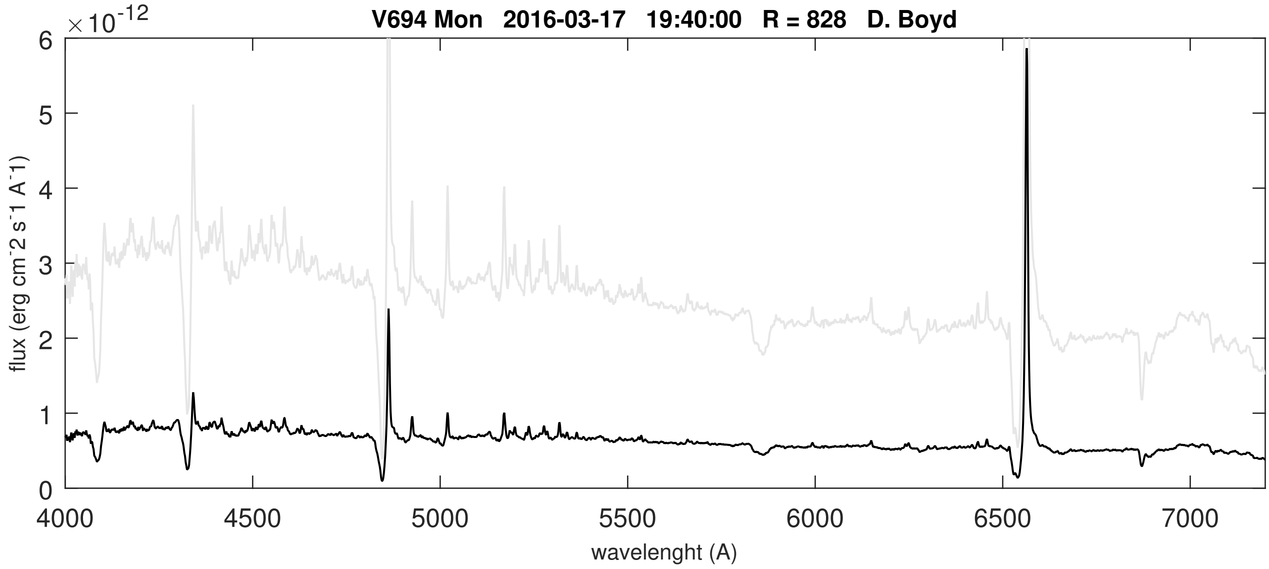


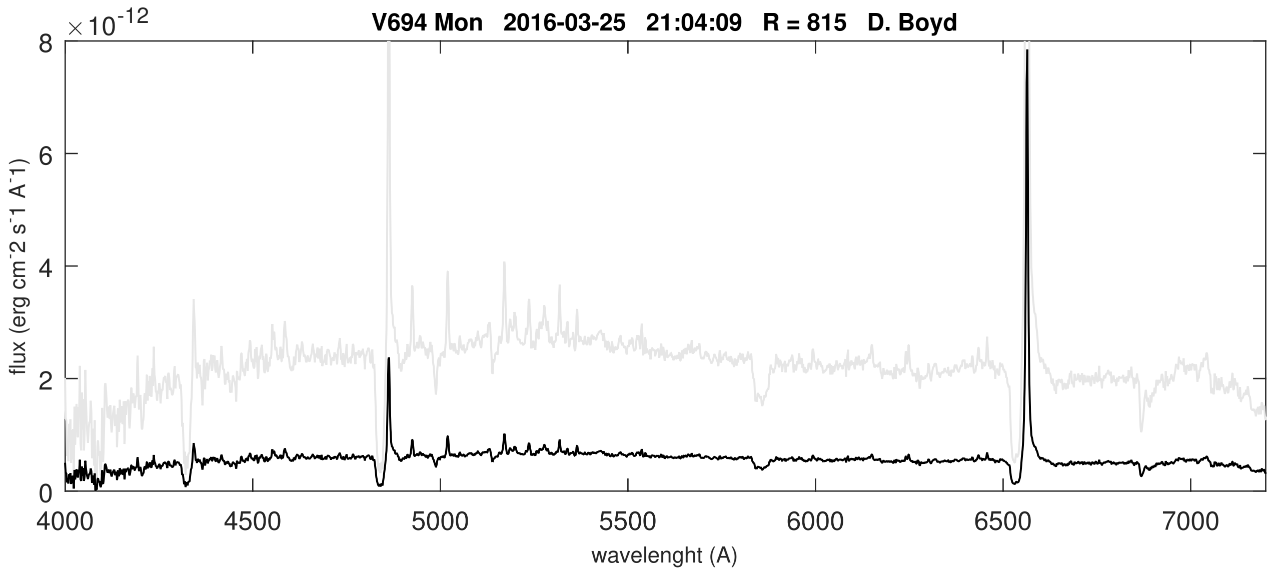


V694 Mon

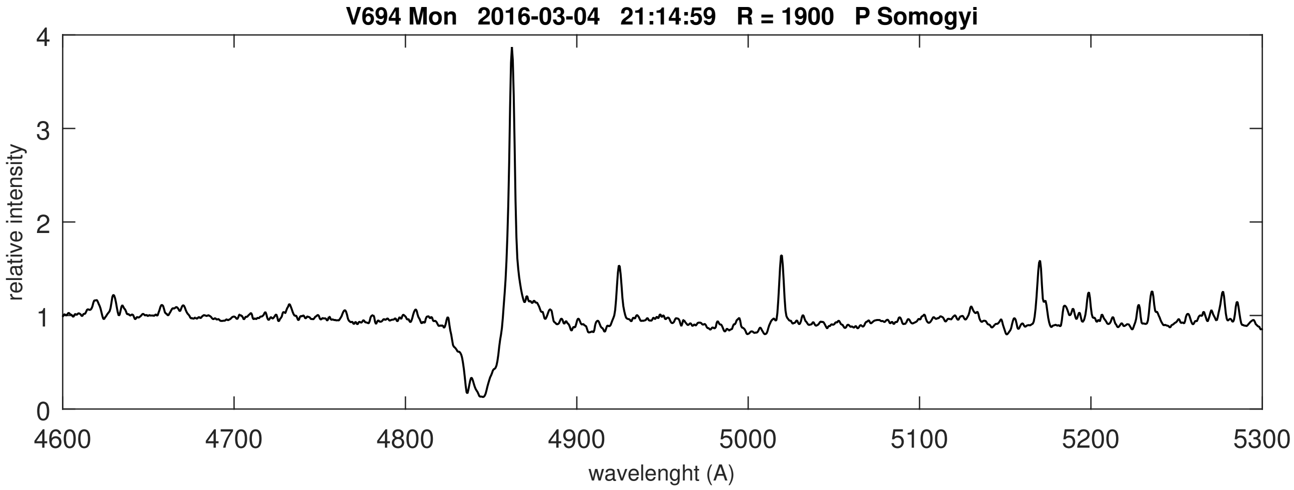
Flux calibrated spectra obtained by David Boyd witha a LISA (R = 1000)

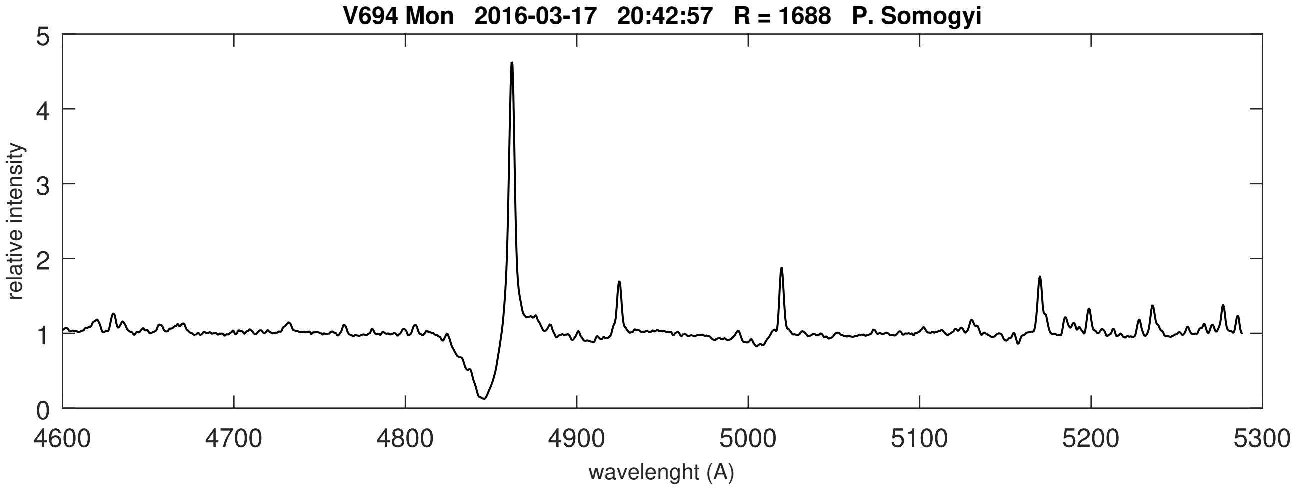


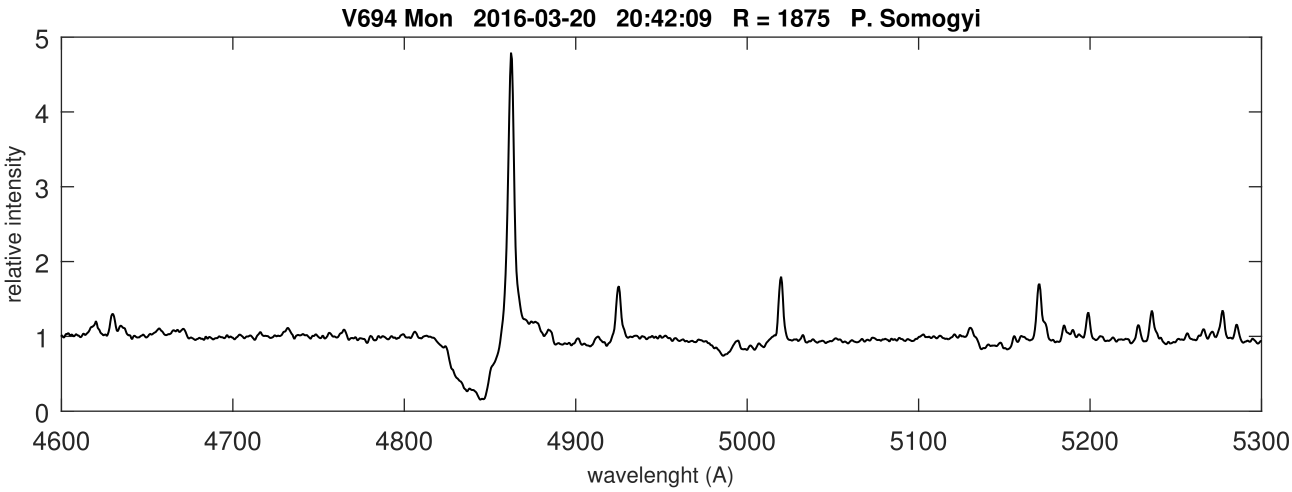


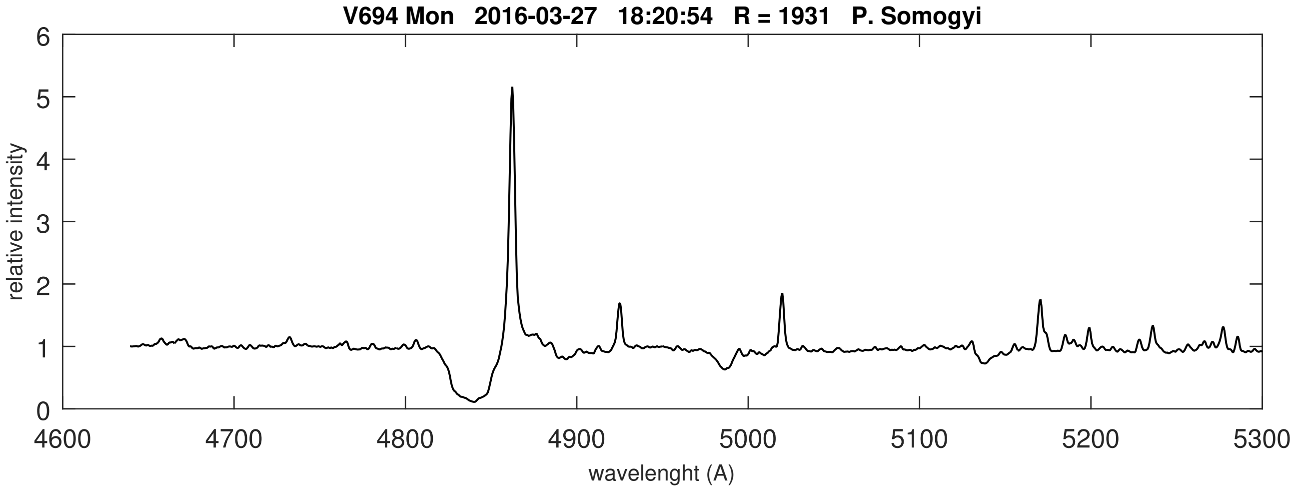


V694 Mon


V694 Mon 2016-03-04 21:14:59 R = 1900 P Somogyi
relative intensity
wavelenght (A)

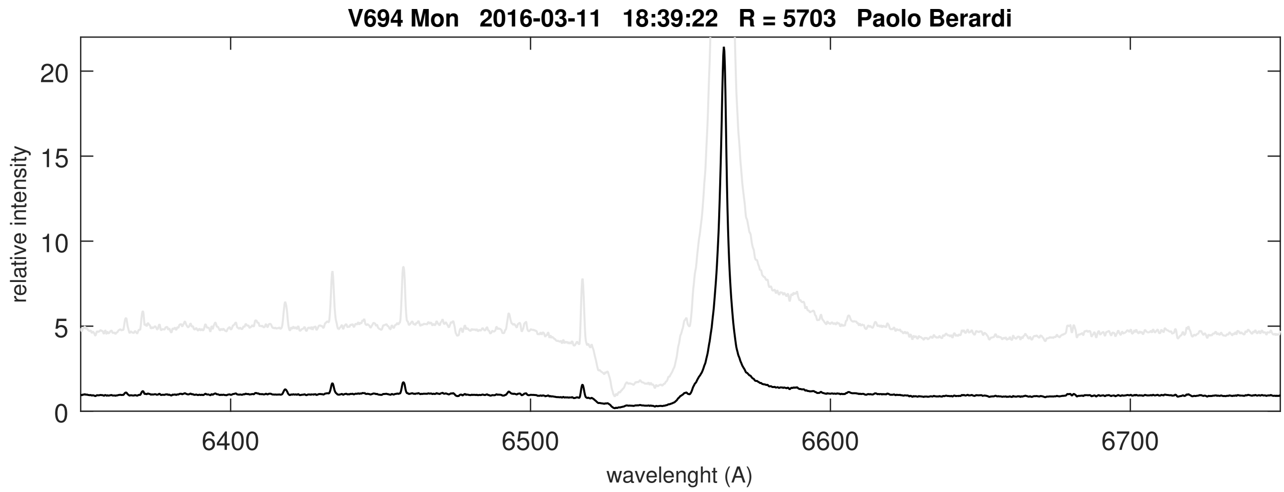

V694 Mon 2016-03-17 20:42:57 R = 1688 P. Somogyi
relative intensity
wavelenght (A)

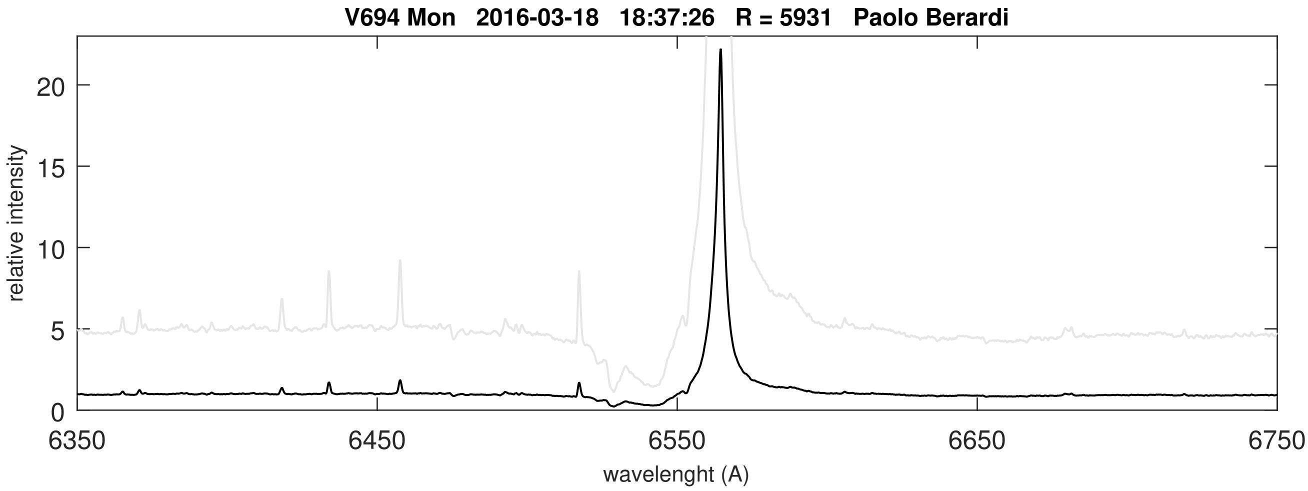

V694 Mon 2016-03-20 20:42:09 R = 1875 P. Somogyi
relative intensity
wavelenght (A)

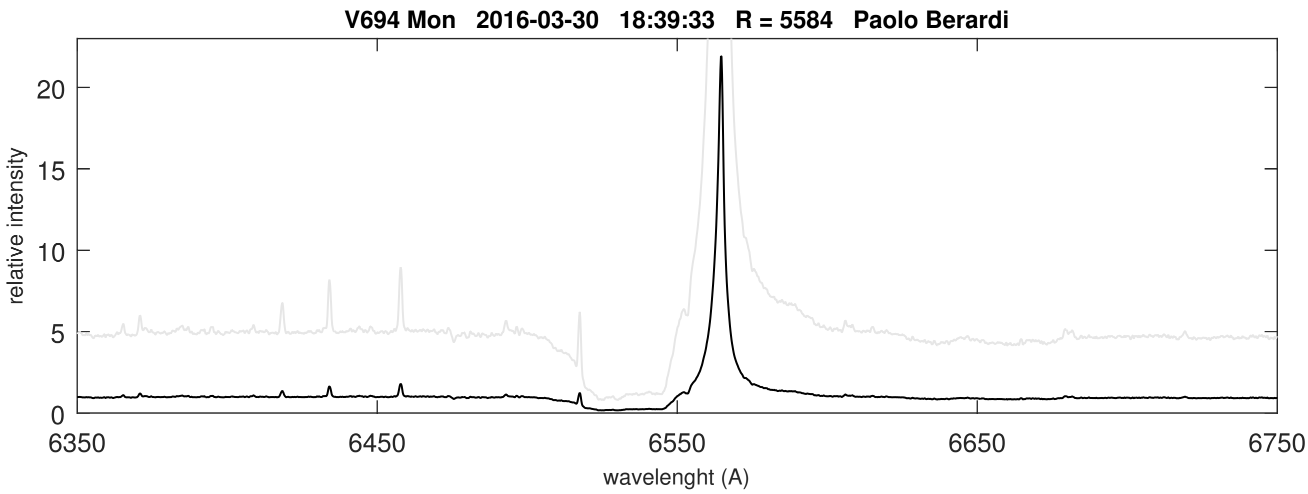

V694 Mon 2016-03-27 18:20:54 R = 1931 P. Somogyi
relative intensity
wavelenght (A)

V694 Mon

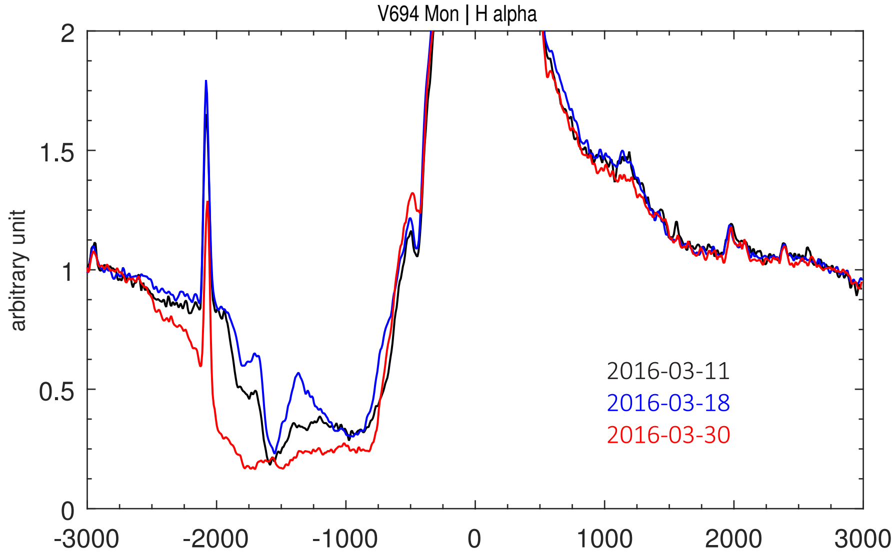
H alpha region by Paolo Berardi with a Lhires III 1200 l/mm (R = 6000)





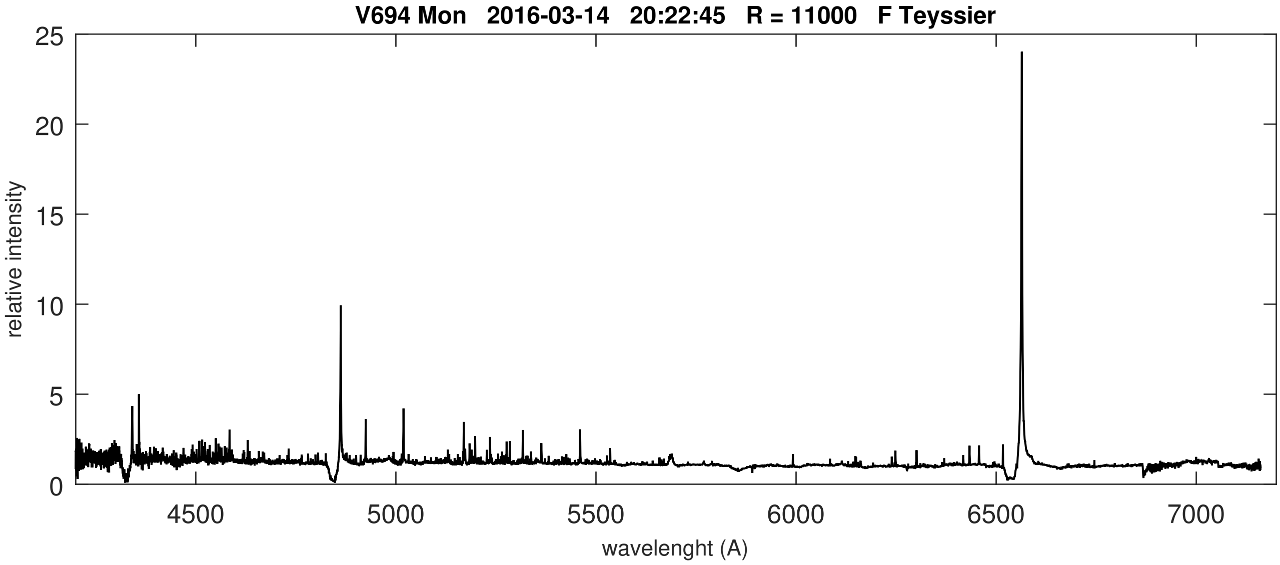


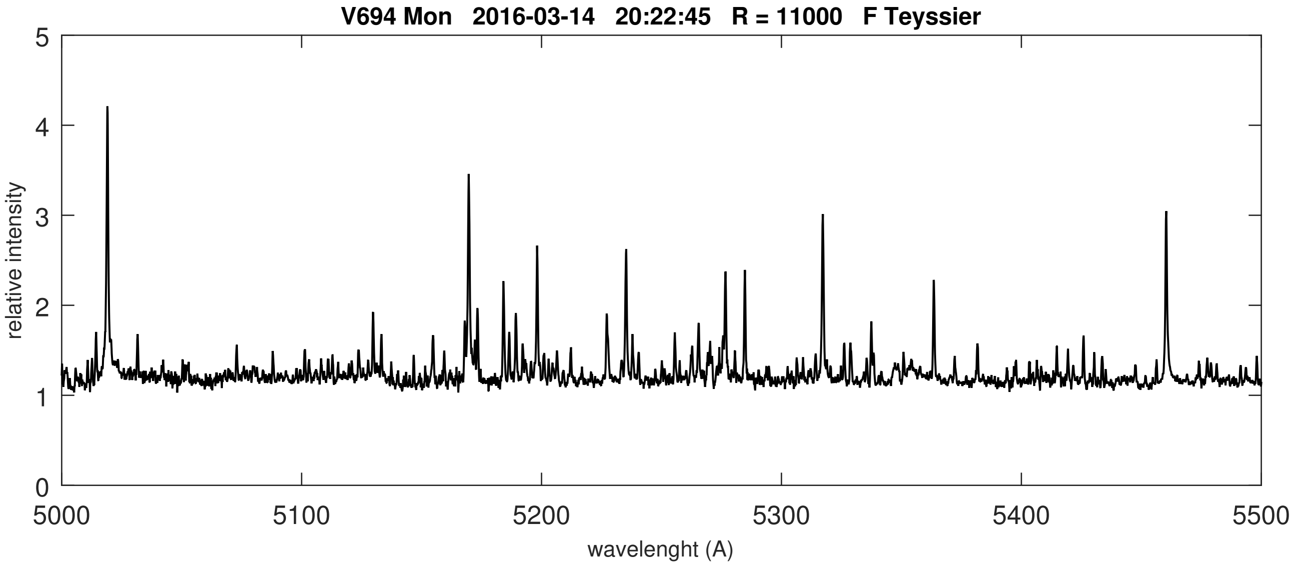
Comparison of the absorptions profiles of H alpha line

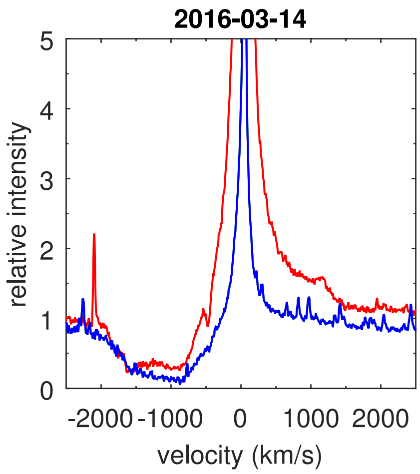


V694 Mon

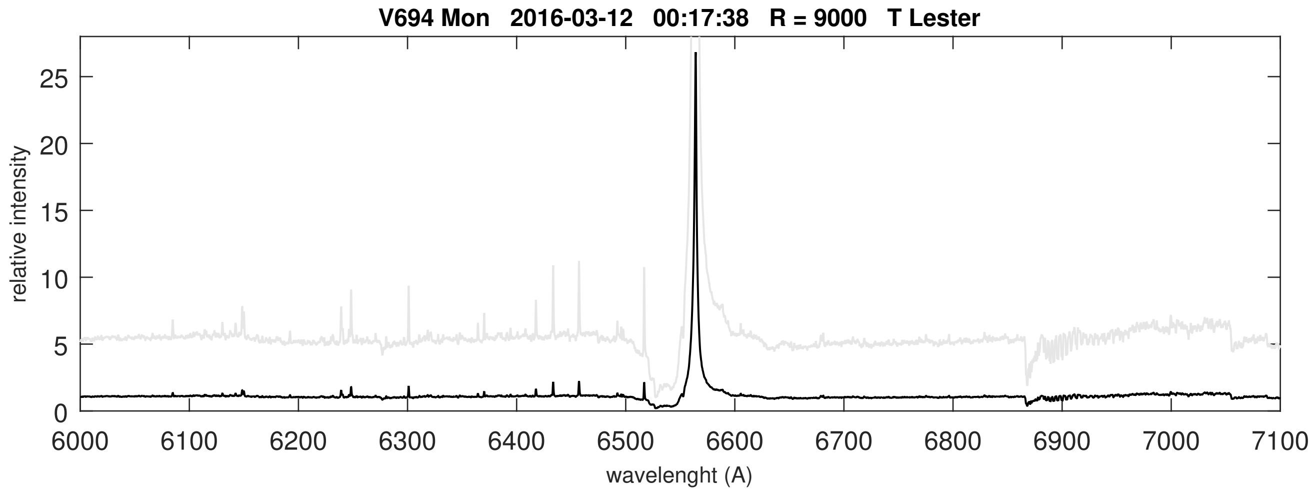
eshel spectrum R = 11000 - F. Teyssier

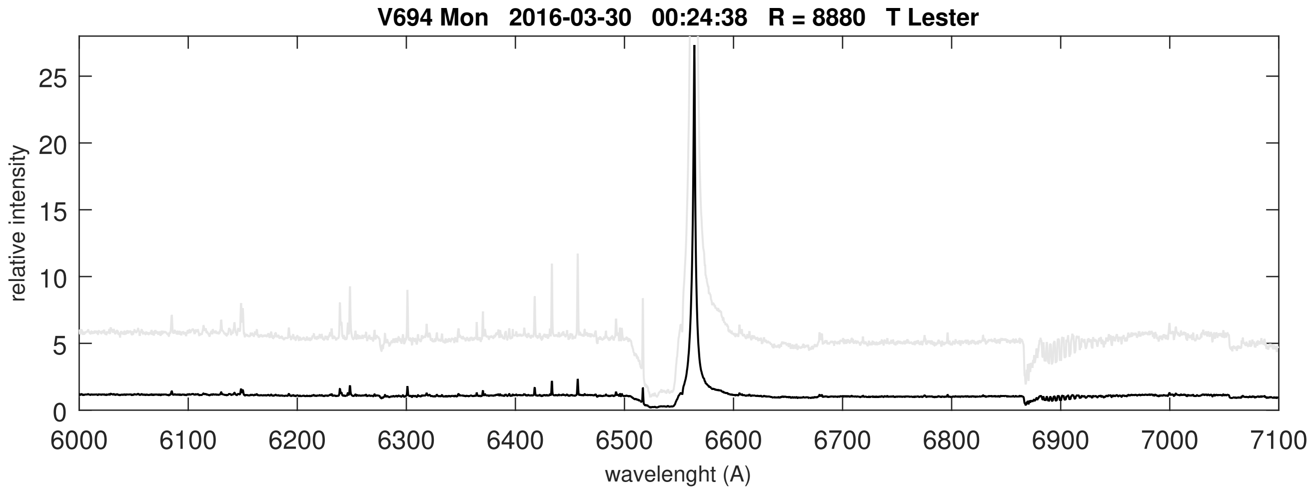


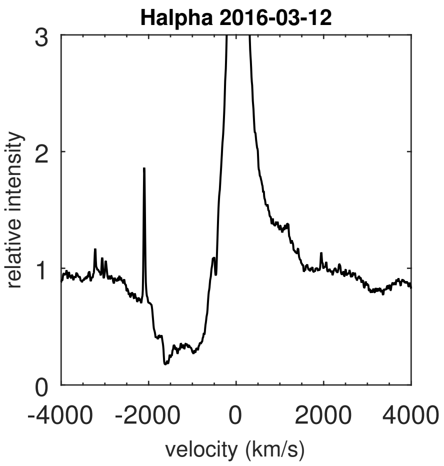


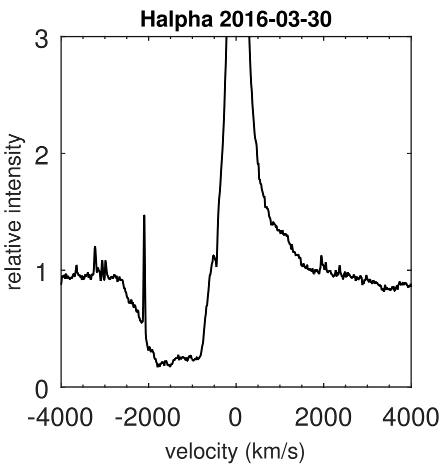


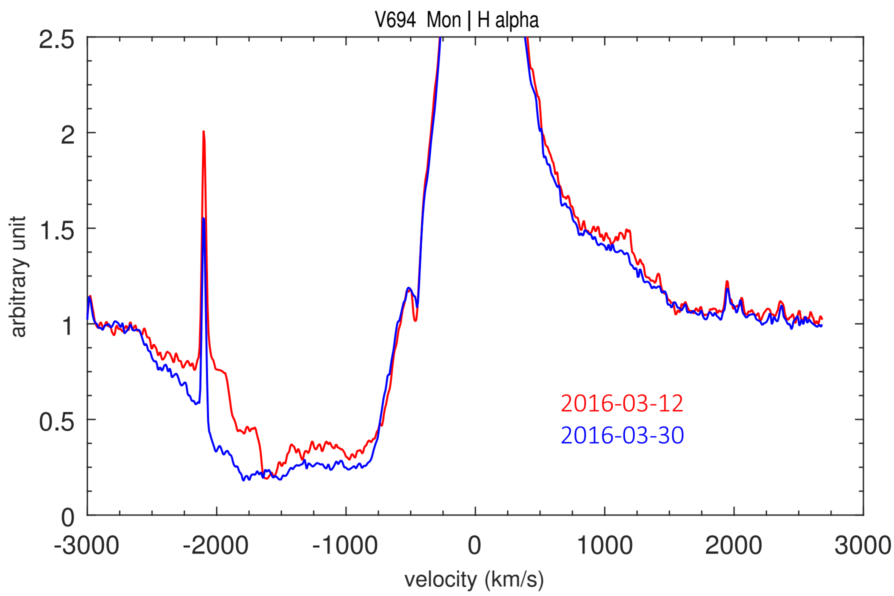
V694 Mon


V694 Mon 2016-03-12 00:17:38 R = 9000 T Lester
relative intensity
wavelenght (A)
0
5
10
15
20
25
6000
6100
6200
6300
6400
6500
6600
6700
6800
6900
7000
7100

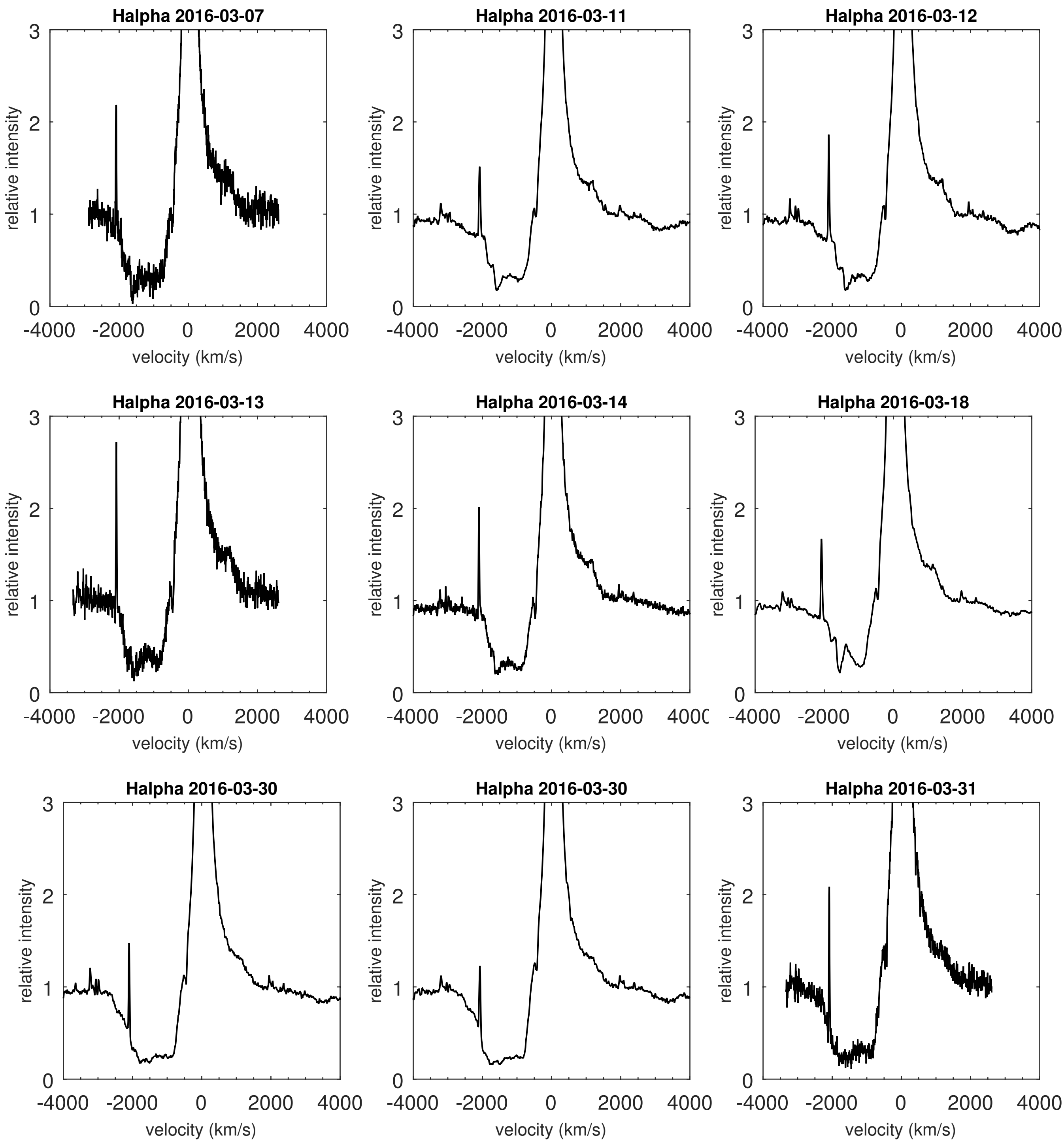

V694 Mon 2016-03-30 00:24:38 R = 8880 T Lester
relative intensity
wavelenght (A)
0
5
10
15
20
25
6000
6100
6200
6300
6400
6500
6600
6700
6800
6900
7000
7100


Halpha 2016-03-12
relative intensity
velocity (km/s)
0
1
2
3
-4000
-2000
0
2000
4000


Halpha 2016-03-30
relative intensity
velocity (km/s)
0
1
2
3
-4000
-2000
0
2000
4000


V694 Mon | H alpha
arbitrary unit
velocity (km/s)
2016-03-12
2016-03-30
0
0.5
1
1.5
2
2.5
-3000
-2000
-1000
0
1000
2000
3000

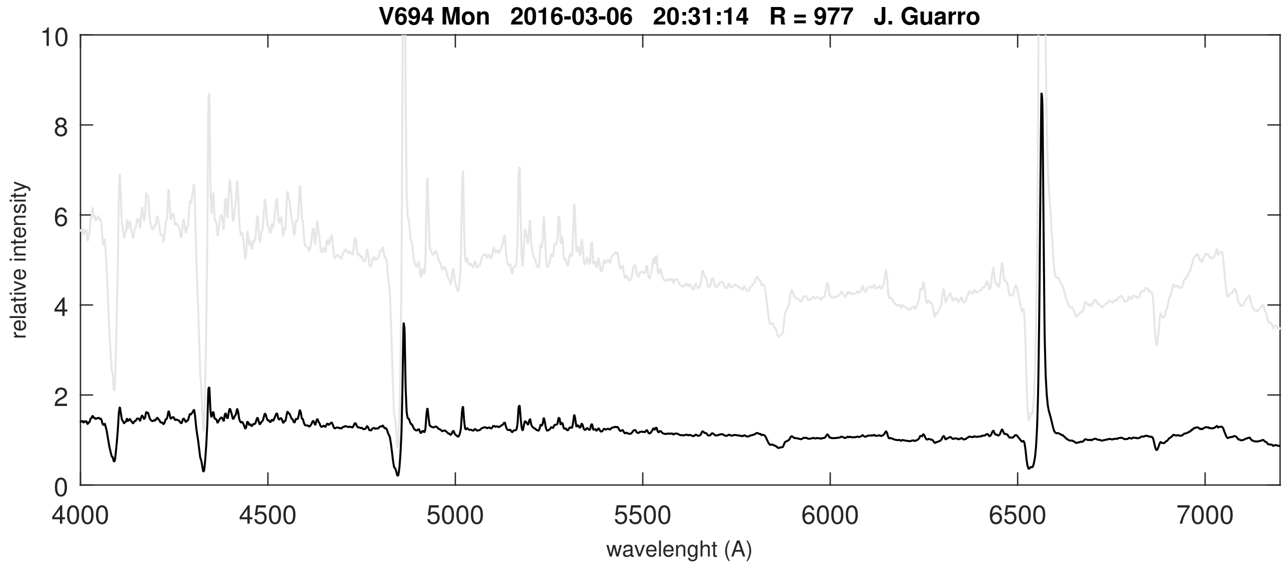
V694 Mon

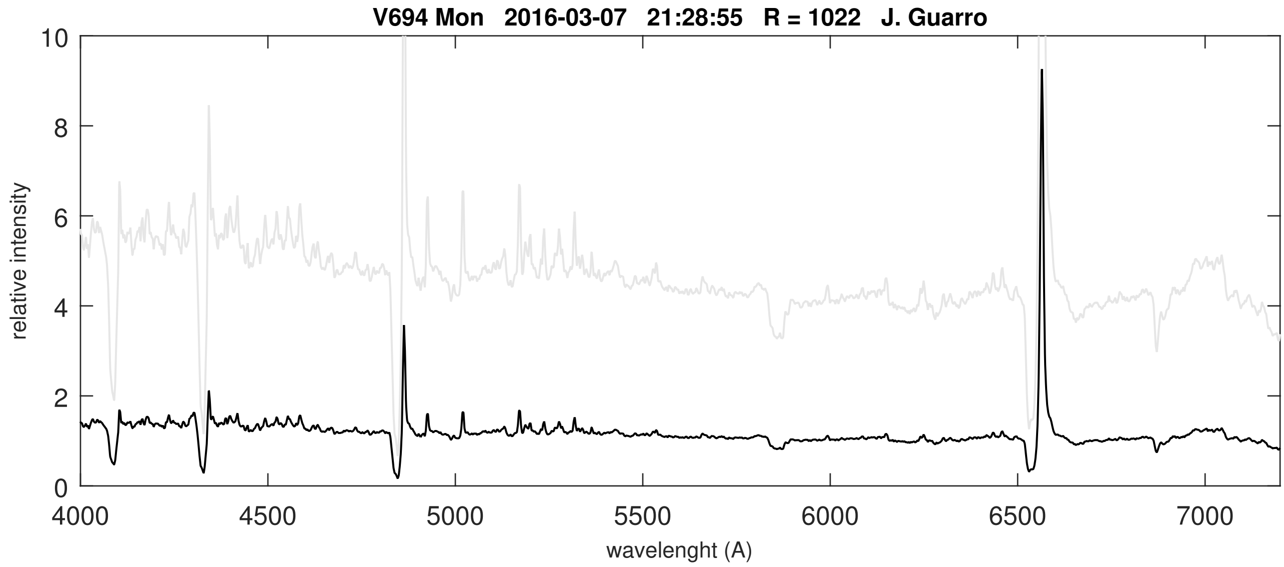


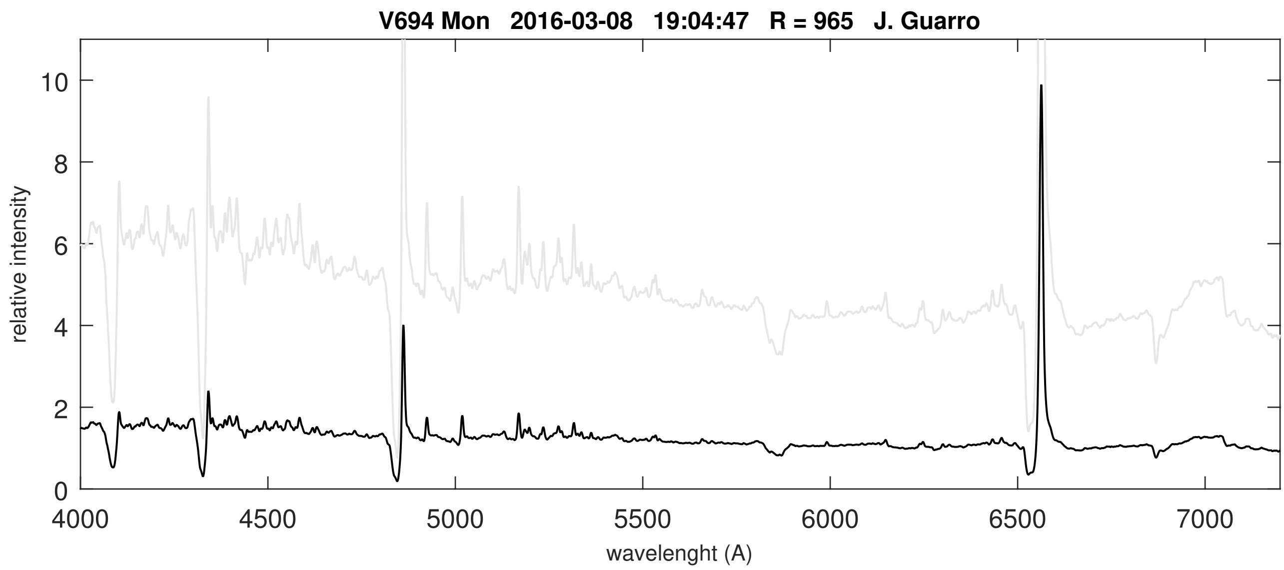
**Absorption profile of H alpha line at resolution R = 5000 to 13000
from various observers : Tim Lester, Paolo Berardi, Andrew J. Wilson, François Teyssier**

V694 Mon

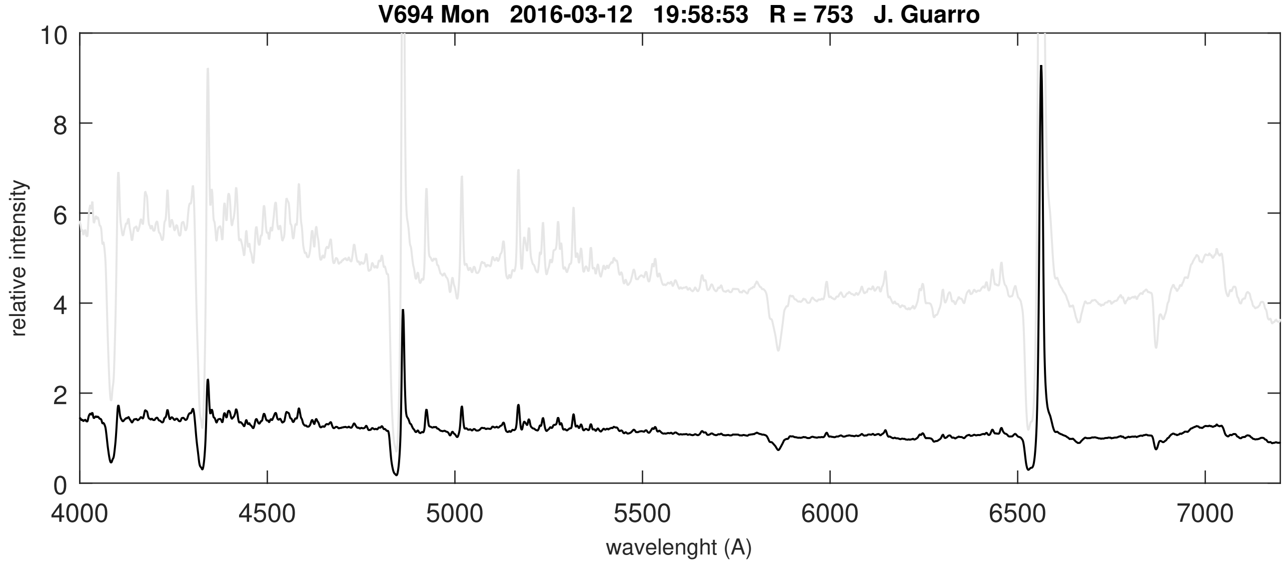
The coverage of V694 Mon in March by Joan Guarro with a home made spectrograph (R = 1000)

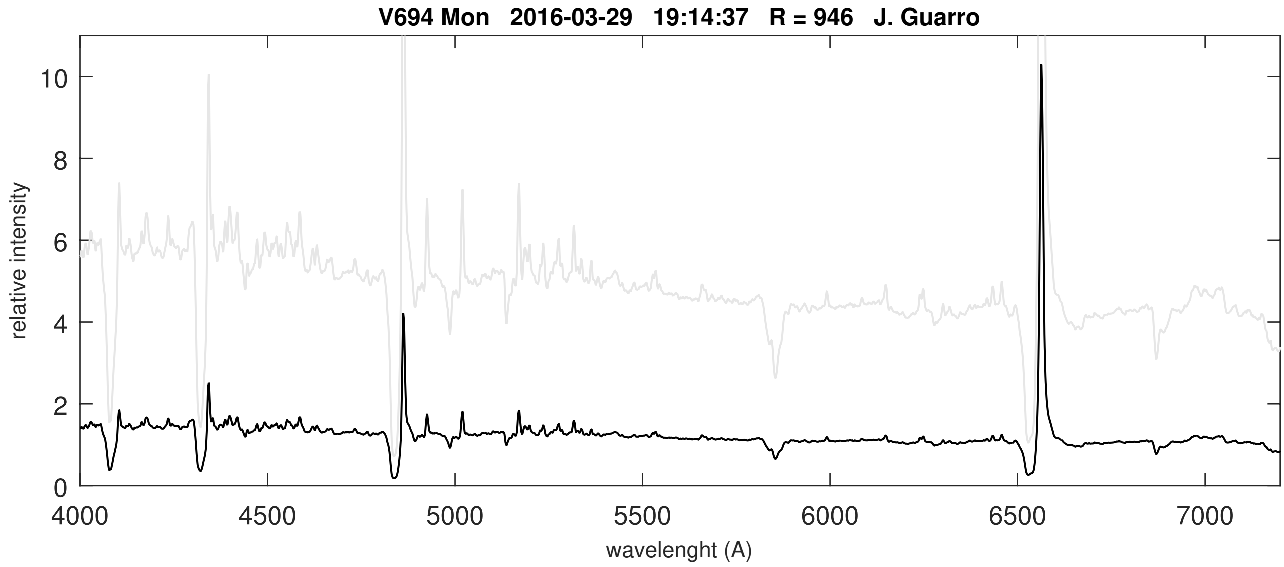


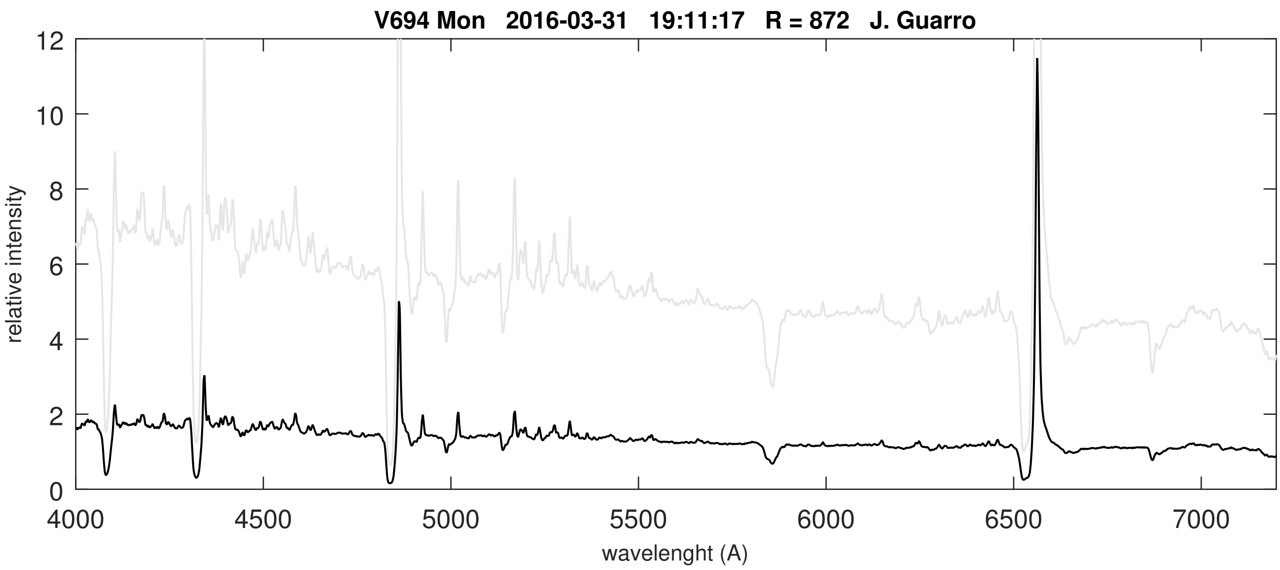




V694 Mon


V694 Mon 2016-03-12 19:58:53 R = 753 J. Guarro
relative intensity
wavelenght (A)
0
2
4
6
8
10
4000
4500
5000
5500
6000
6500
7000

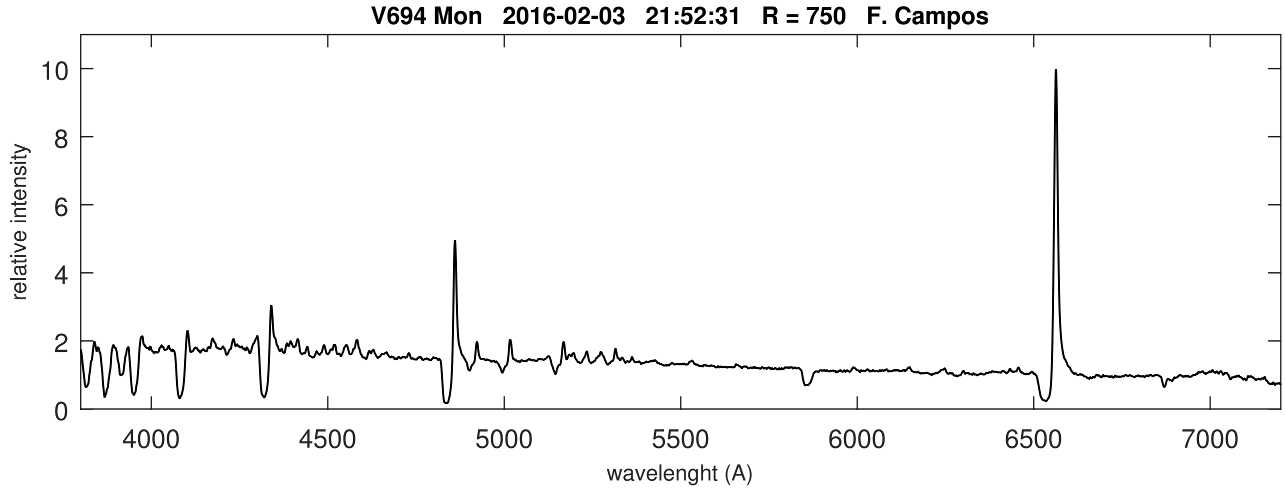

V694 Mon 2016-03-29 19:14:37 R = 946 J. Guarro
relative intensity
wavelenght (A)
0
2
4
6
8
10
4000
4500
5000
5500
6000
6500
7000

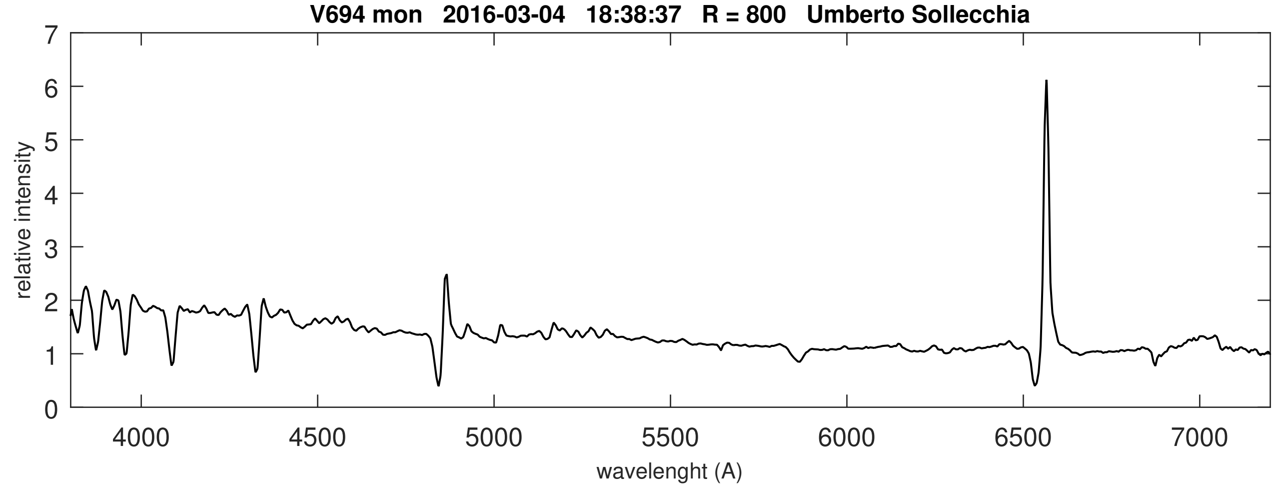

V694 Mon 2016-03-31 19:11:17 R = 872 J. Guarro
relative intensity
wavelenght (A)
0
2
4
6
8
10
12
4000
4500
5000
5500
6000
6500
7000

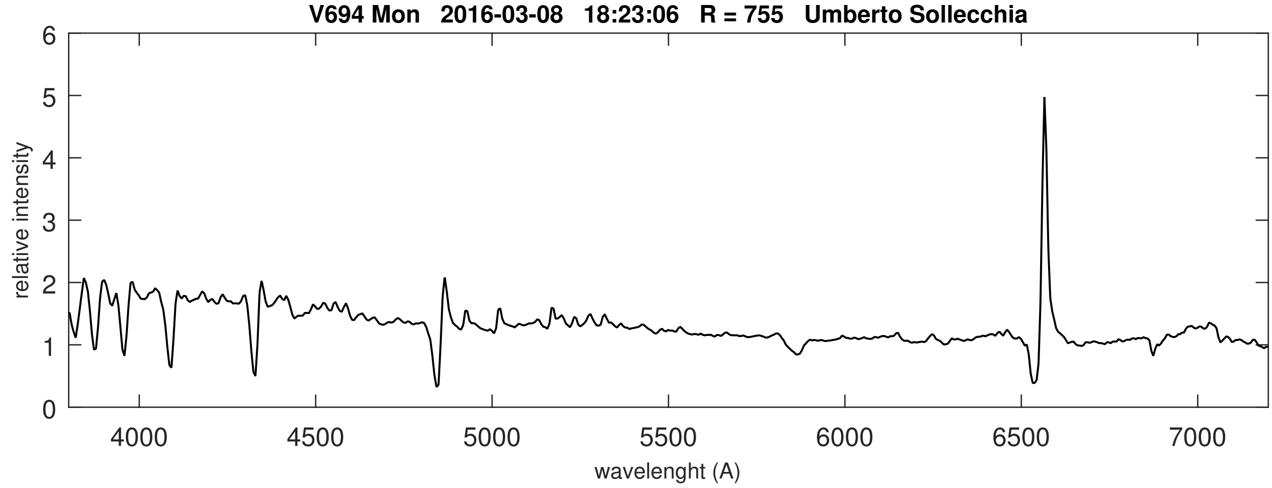
SYMBIOTICS

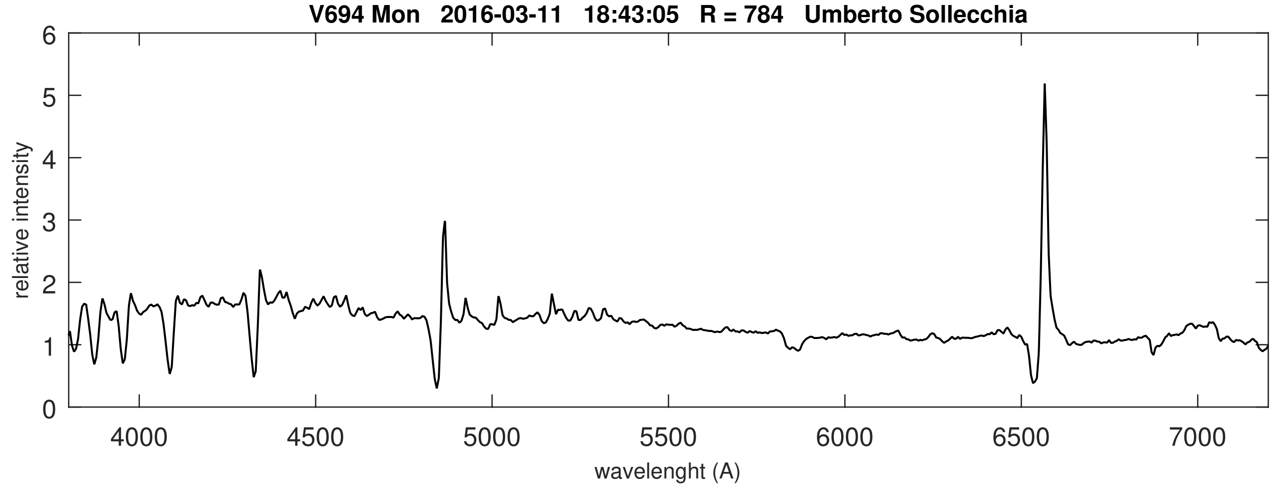
V694 Mon

Survey with Alpy 600 : no detection of plateau between absorption and emission

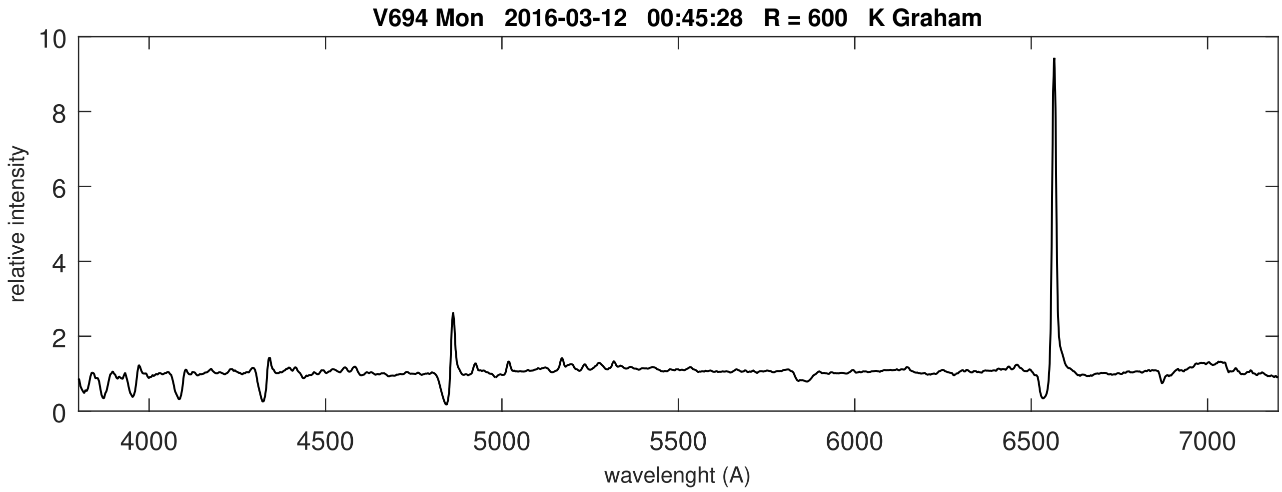


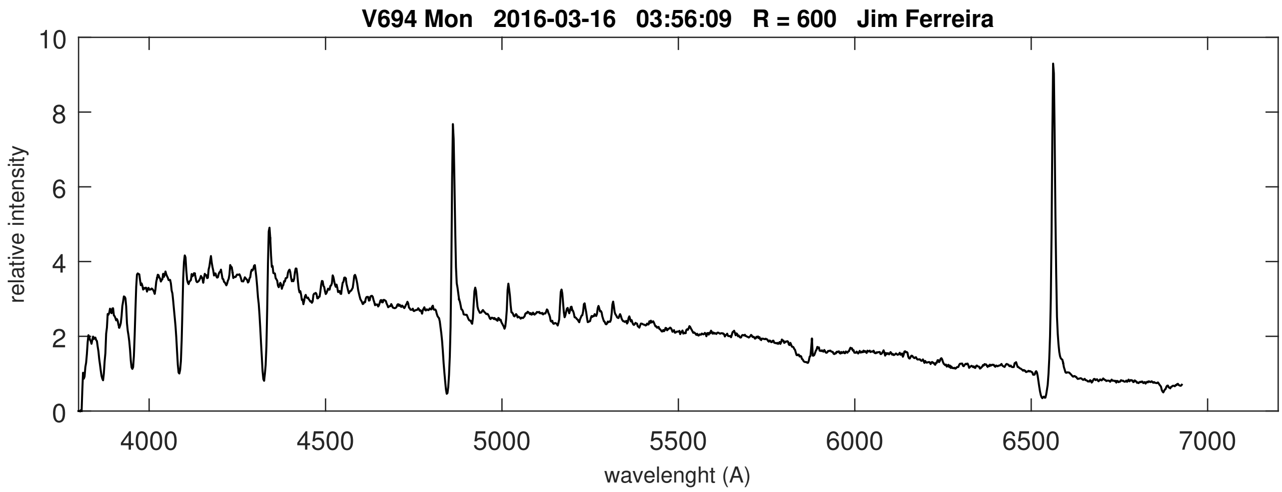




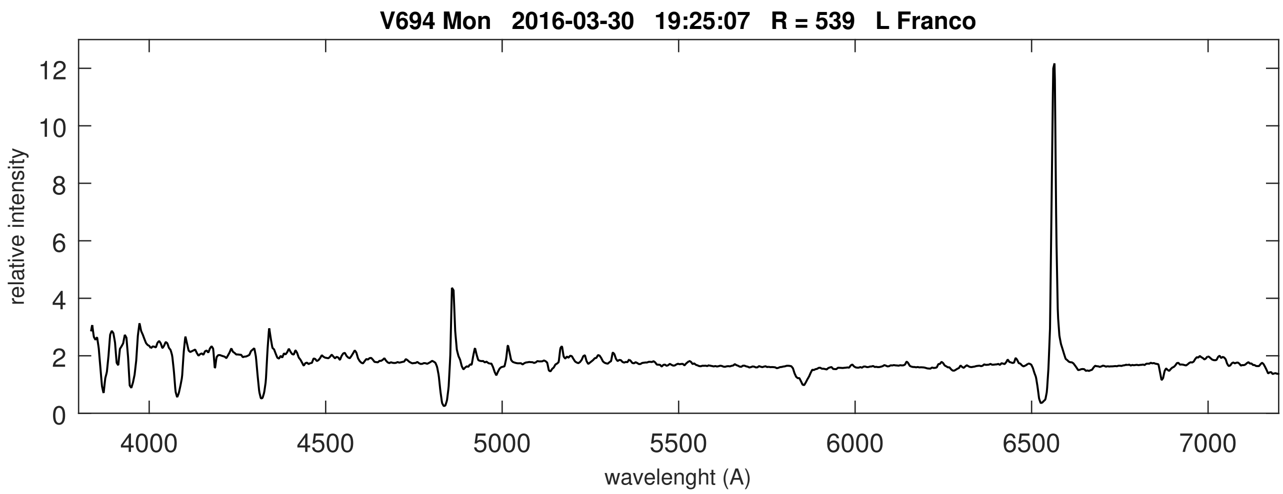


V694 Mon



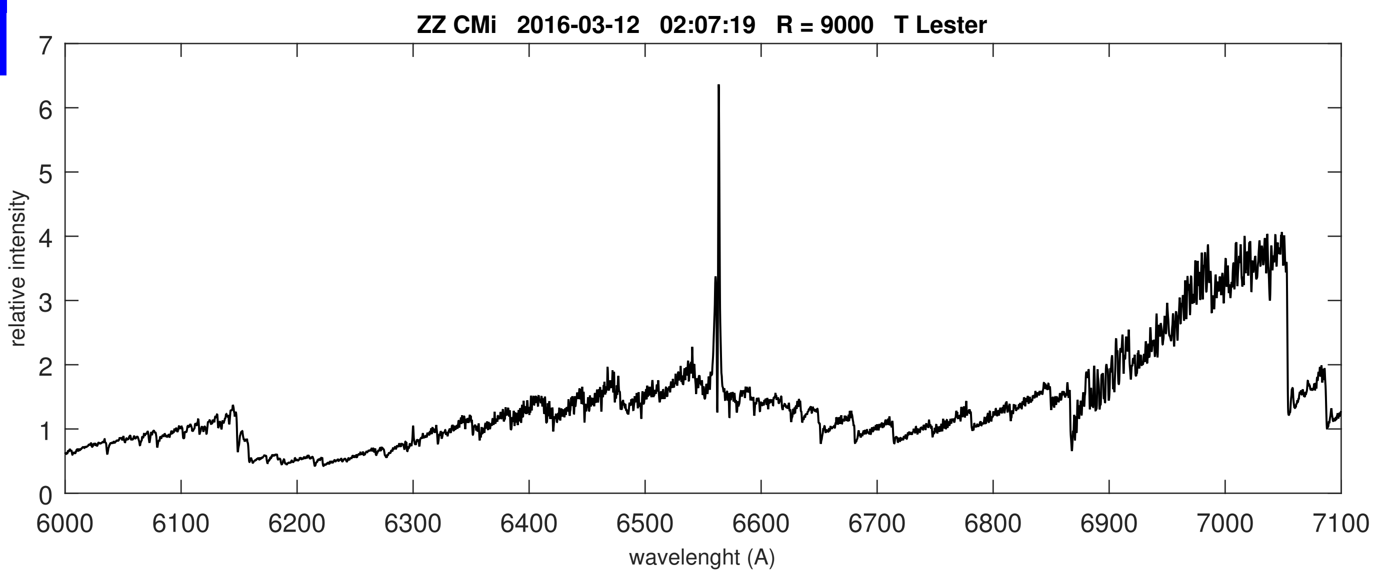


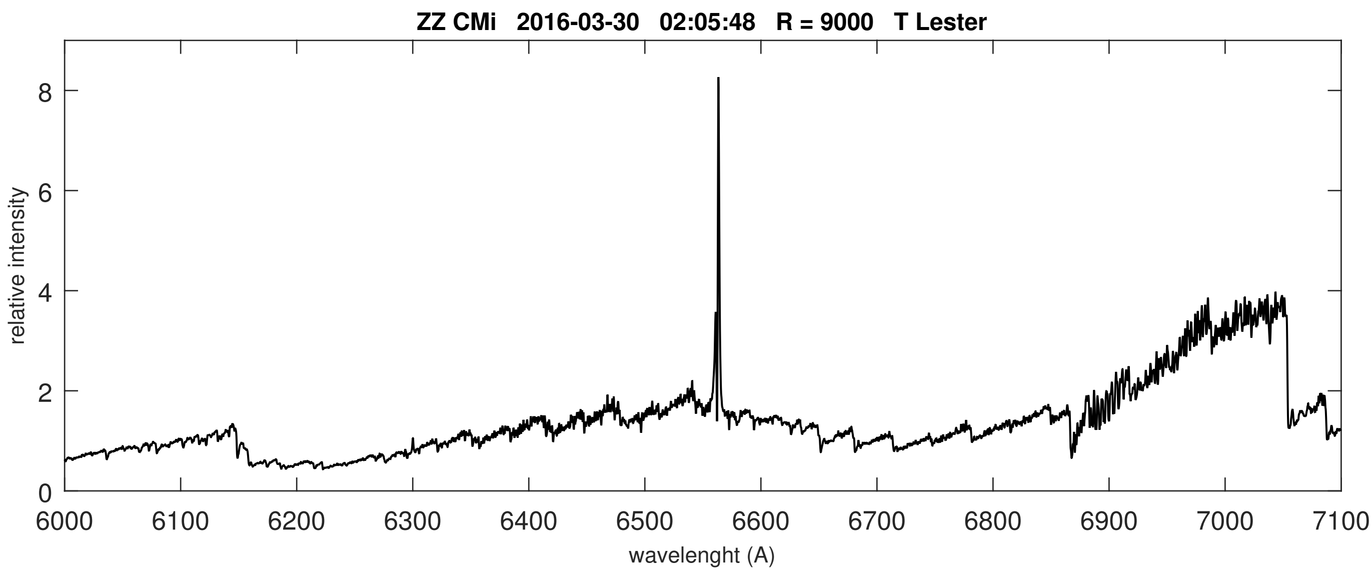
Continuum should be corrected

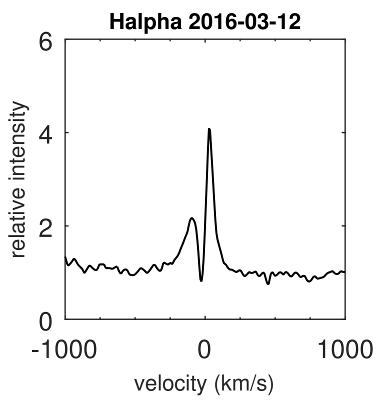


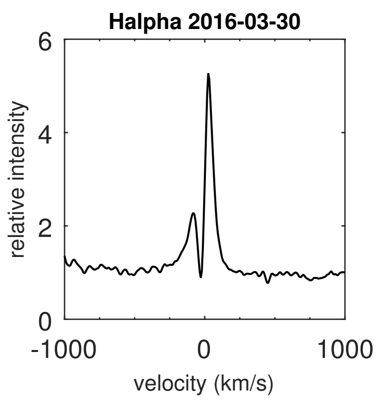
ZZ CMi

Coordinates (2000.0)	
R.A.	07 24 14.0
Dec	+08 53 51.8
Mag	10.2









Jets and collimated outflows

Steve Shore

We've discussed winds and ejecta, and in the context of SS 433 a bit about collimated flows. But in light of the new outburst of the symbiotic system V694 Mon = MWC 560 it's time to go into more detail. This isn't a system with extended structure, unlike SS 433. It doesn't show the vast range of velocity of the precessing jets emerging from that system. And by the standard of SS 433, this system is a snail, the maximum velocities are never more than a few percent of the speed of light. In fact, they are more in the range measured for winds and that is a hint regarding the origin of this flow.

First, some line formation issues. On a stellar wind, the flow is usually assumed to be spherical (allowing the usual one dimensional -- radial -- treatment of al relevant properties). Even with geometric blocking of the receding side of the outflow by the originating star, the sphere is pretty completely covered in the observer's frame of reference. With velocities a few times the escape value, a quantity that varies with mass and radius of the central star, the wind decelerates with distance and reaches a constant velocity at large distance. In spherical flows, this usually occurs far enough from the photosphere that the local volumetric density is very small and the only reason for seeing absorption at all is the much reduced outward gradient of the velocity. As we've discussed some time back, this produces a distinct edge to the absorption profile whose depth depends on the optical depth, which is large because of the long path over which this stalled (constant speed) gas lies. All of the standard P Cyg profiles are, in one way or another, explained in this simple way. OK, the details are missing and we've gone into some previously, but the gist is that any driven flow must reach a terminal velocity. Explosions, on the other hand, freely span any velocity interval imposed on them. Consequently, the emission extends to the same velocity (except for possible blocking of the line of sight) as the maximum blueshift. The absorption doesn't only form against the stellar surface, it is seen against any continuum (or pseudo-photosphere), or even a broad emission line in the receding side of the flow itself (so-called ``self-absorption''). For the Be stars, the one robust, model independent feature of the absorption is that it is against the lines and the photosphere of the central star.

Now imagine the flow is, instead, collimated. Naively,we can think of this like a transparent pipe or even a hose. Most of the spherical volume is empty, except for any that just surrounds the pipe. Now take this pipe and, in the mind's eye, rotate it. When you're looking along its axis, there's a long absorption pathlength, while viewing at an angle, there's far less. For the transverse direction, the absorption virtually disappears. This depends on the opening angle of the collimation (if it does have a variable width) but it is enough to say the emission will be narrower, occur at phases when the absorption is absent. Now as we discussed for nova ejecta, the absorption along the radial direction toward the star is much greater than the transverse optical depth so th absorption should, be biased toward the phase when you're looking at the minimum 2D viewing angle to the axis.

The next question is the velocity distribution within the outflow. In SS 433, the one example we have of a microquasar that has both nearly relativistic jets and optical atomic emission lines, the flow in the line forming region seems to be at nearly constant velocity. The individual knots don't seem to accelerate, they've al;ready reached some terminal speed and coast outward. This holds for the velocities needed to explain the cork-screw pattern observed in centimeter radio interferometry with the VLA. Whatever the launching mechanism, it seems to be very efficient in accelerating the matter outward within a very short distance of the source. In V694 Mon, this isn't as clean, nor is it in other presumed jet outflows from symbiotics and cataclysmics. The individual knots are seen to accelerate over a week or so to the terminal velocity. You see this in the absorption, it marches toward the maximum velocity in the line almost linearly in time. It seems amazing but there are almost no dynamical studies of how the line profile indicates the velocity field. Some of the studies to date are

http://adsabs.harvard.edu/abs/2001A\%26A...377..206S
http://aas.aanda.org/articles/aas/pdf/1997/04/ds1147.pdf
http://adsabs.harvard.edu/abs/1994AJ....108..671S
http://www.aanda.org/articles/aa/pdf/2002/32/aa2389.pdf
http://www.konkoly.hu/cgi-bin/IBVSpdf?6032

For Z And, where lower velocity emission line features have been observed and identified as jets (http://adsabs.harvard.edu/abs/2009ApJ...690.1222S) (another, possibly related star, XX Oph, shows the same bizarre behavior of the ultraviolet that appears in V694 Mon but without the jet features-- yet). The high velocity transient emission features in V694 Mon appear only at high velocity and near the terminal speed.

In launching a wind, the radial outflow is produced by the opposition of radiation pressure and surface gravity, or by pulsation-driven events. In the first, as we discussed for stellar winds in general, there's a terminal velocity up to three times the escape velocity, indicating that the flow is continually accelerated by a weakening source (since the flux falls off as the inverse square of the distance). The motion is strictly radial, even if there are filaments or shocks that might be localized within the flow from waves and instabilities (think of one small part of the wind slowing down, only to be slammed into by that behind). In contrast, a jet requires some form of restriction of the opening angle. If this were a discharge from a pipe, say in your kitchen, it would be simple: confine the boundary with rigid walls and the flow then accelerates. But here there are no walls, at least not stationary ones. If the flow initiates from a disk, as several models have indicated for this and its cousins, there has to be orbital motion of the wall itself and the radiation is not spherically distributed in the acceleration zone. There must, in other words, be a sort of swirling (internal rotation) within the jet. Another picture uses magnetic fields to accelerate the flow, a sort of twisted propagating electromagnetic wave that literally pushes the matter outward (this is, technically, called a ``Poynting flux jet'' after the flux carried by an electromagnetic wave). The magnetic field lines get twisted within the disk, again by the differential orbital motion of the matter, and the momentum is transferred to the overlying matter. In all cases, there should be some indication in the line variations, especially absorption where the line of sight is fixed and known, that there's some sort of helical motion within the jet. To date, there isn't.

A final indication that the flows are not spherical and that their velocity isn't necessarily slowing down is the blue edge of the profiles. You'll notice in the ARAS spectra, and especially those in Schmid et al. (2001), that the blue edge seems to fade into the continuum. If there is a large velocity gradient even at high velocity, that the blobs are not just drifting, then the optical depth in individual features should decrease in time since the column density decreases with distance in a specific velocity range. That would suggest that, even if the individual components are launched ballistically and collide, they are still somehow distributed over a large range at the point of disappearance. You see this in nova spectra, we've discussed ballistic motion at some length (likely too much), and maybe that's the clue here and the reason to keep observing this creature at high cadence. If the outflow is a sort of hiccup, with periods of activity somehow initiated by orbital; properties (perhaps a periasteron passage of the companion) then the collisions of individual knots will produce the X-rays (if they're hard, they will resemble those in novae ejecta) and there's a broad range of ejection velocities with the fastest moving knots getting the farthest before fading into nothing. But then the individual emission features would be those at th boundary of the jet where the line is thin. These should be accompanied by emission features on the red wing, although the timing will be important to study here. To date there have been very few studies that match the individual events on the two sides, the same holds for other symbiotics, nd it would make for an interesting study to see what happens. There are small changes in other, non-resonance lines, and the forbidden l lines have only been studied in any detail in the Schmid and Iijima papers.

One last point to note, a remark that may seem familiar. The Balmer lines, and most other optical lines, arise from excited states. Only Ca II and Na I are resonance lines of sufficient opacity to detect the absorption features (and the Na I doesn't go into emission). The structures seen in these lines should be the features of reference and you might consider shifting your observations to cover these wavelengths along with the Balmer lines (remember, you get He I 5875 and Na I D and the Fe II 5169 line sin the same setting, and even the [O I] 6300 if you us e the 600 line grating on the LHIRES, for those not fortunate enough to have an echelle). For the echelle, high cadence is very very helpful, better than daily would be ideal. The season's now over but when this starts again it will be very important to keep watch on this beast.

For others, XX Oph is not on the rise, as is CH Cyg (the campaign you are already following) so I hope these remarks about the flows are useful.

Steve Shore
18-04-2016

The observational campaigns on CI Cyg, CH Cyg, and AG Dra have been producing remarkable results and it's only lack of time that I haven't commented on them individually. The unique aspect of your work is now the wealth of high resolution material coming out of the studies. I recommend concentrating on a few things: (1) the variations of the two Raman features, when observable, is particularly important (the link is to the two components of O VI at 1038, 1042 Å that are scattered from Lyβ). These, along with the He I vs. He II lines, is a good indication in any of these systems of how the UV is behaving, hence the connection with the hot source. Variations in the [O III] lines are likely changes in the ionization structure, [N II] 5755 and [O I] 5577, are very important lines to monitor. For most of you, the [N II] 6548, 6583 doublet (flanking Hα is available and the monitoring of these lines will be a second link to ionization changes. (2) In the next installment, in the hope it will help inspire ways of analyzing your data for yourselves, I'd like to discuss some aspects of profile and time series analysis.

Please send comments, complaints, even yawns. I'm hoping that, after all this time, these columns are still useful and interesting. Any suggestions will always be greatly appreciated.

News about Novae

Steve Shore

On Mar. 17 and 19, we obtained STIS and ESO observations of V1369 Cen. I wanted to show some of the results since they're perhaps the best examples we now have of the UV and this is the official end of the campaign in which so many of you participated over the 2013-2016 period. The HST observations were timed to coincide with the late stage. The striking appearance of absorption features on C IV 1548, 1550; Si IV 1392,1403; and N V 1238,1242 Å was suspected in V339Del and seen in T Pyx (and not understood then!) but now appears to be a common feature. Unlike the V694 Mon features, there are rock stationary. They appear even in the Balmer andFe II lines during the early curtain stage, and precisely the same components can be traced from about the first week. They are, in other words, frozen structures in the ejecta. The sequence of narrow lines seen in the Fe-curtain stage are those sampled by the recombination as the UV thickens, but they are, it seems, biased by the individual knots or filaments (we don;'t know which)already imposed on the matter at the time of the explosion.

The changes in the line strengths has to be a variation in the ionization. That V1369 Cen also shows aborption at Si IV makes it unique. Such a low ionization species has not been seen before at this stage and is clear indication that some of the knots are very sense.

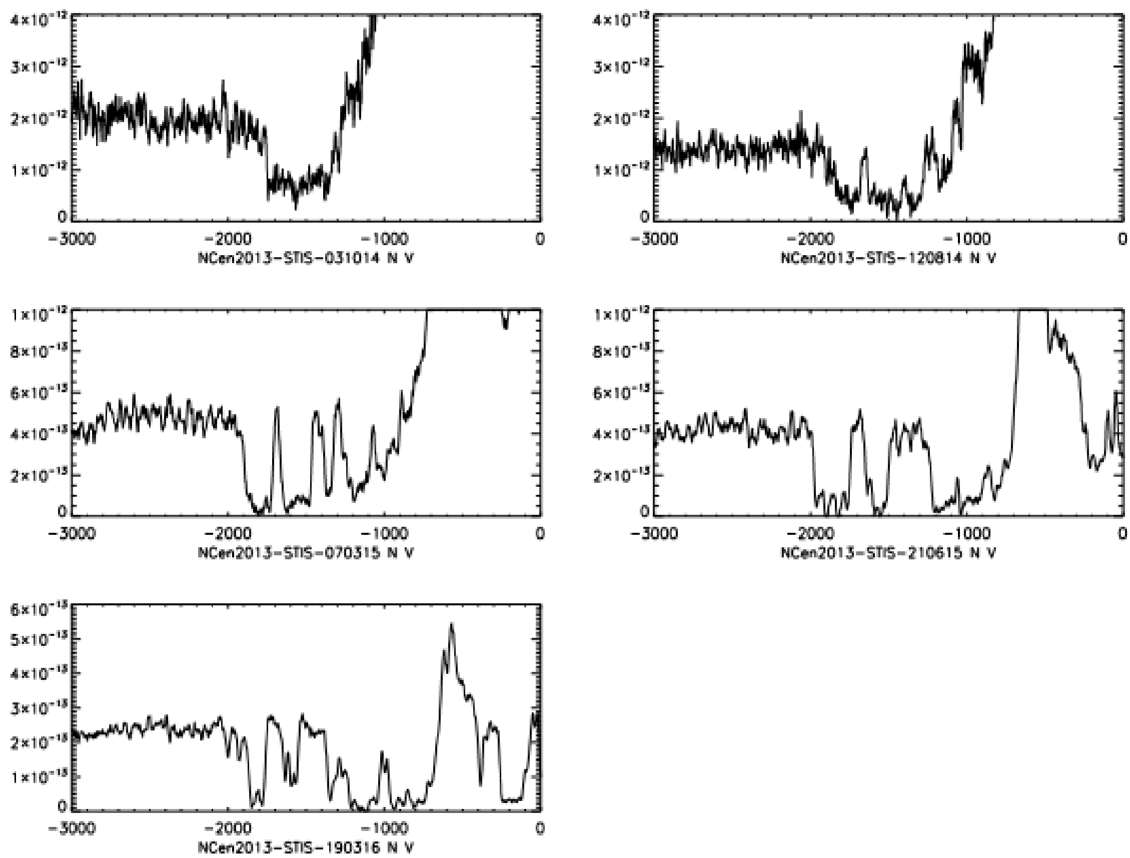


Figure 1. The N V UV doublet absorption lines, starting with the broad optically thick sborption in the Fe-curtain phase and extending to the individual knots resolved in progressively later spectra.

News about Novae

Steve Shore

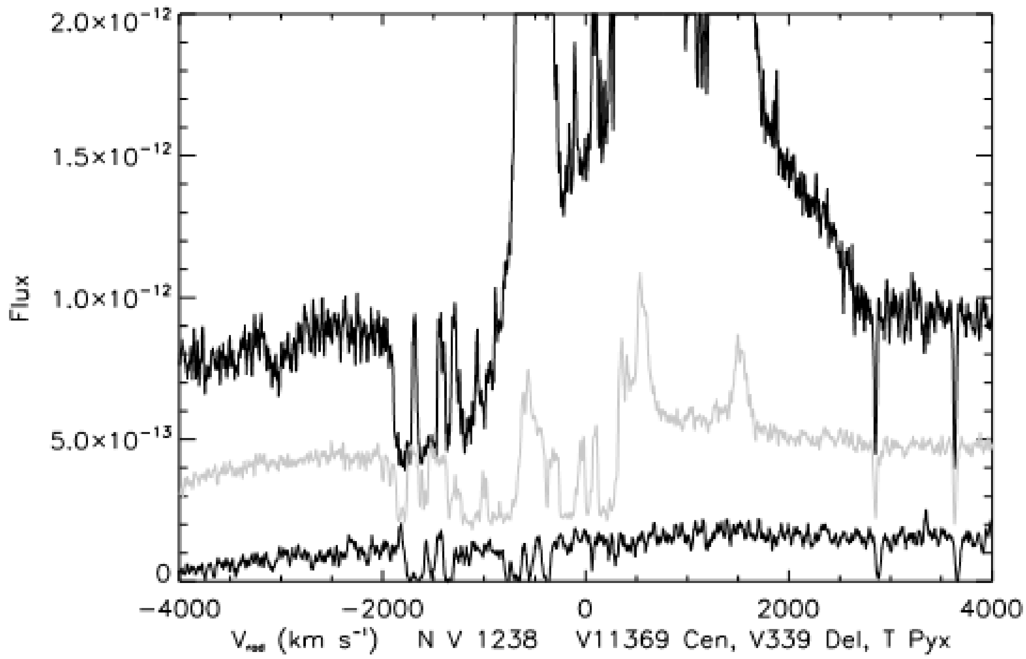


Figure 2. The comparison of T Pyx, V339 Del, and V1369 Cen at the N V 1238, 1242 Å doublet. These are the absorption lines I mentioned in the text, showing that there seems to be a universality of some sort in the late time structure of the ejecta..

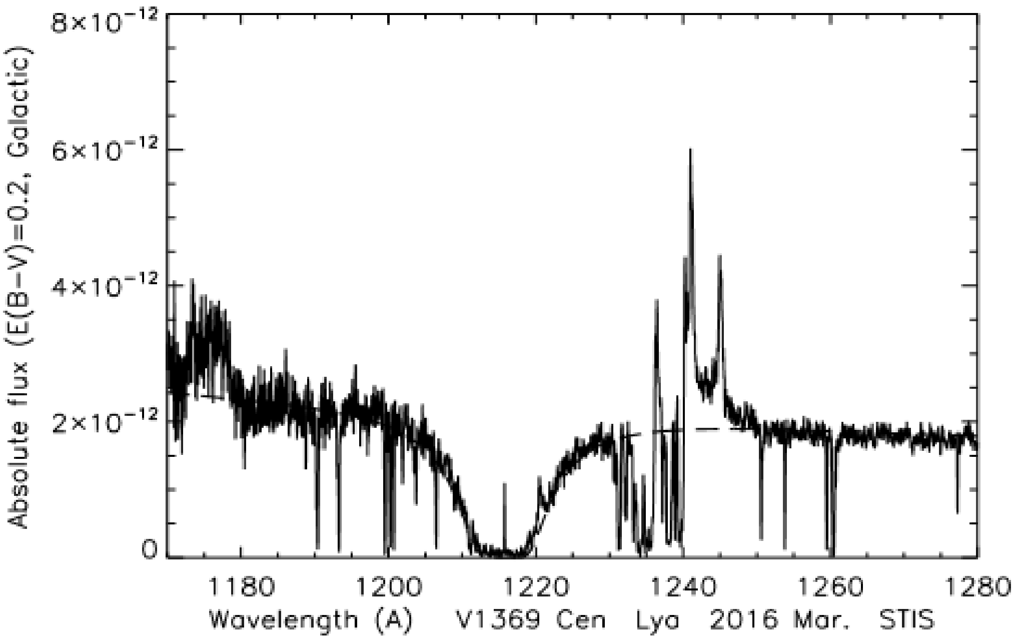


Figure 3. The Lyα line for V1369 Cen, indicating an E(B-V)=0.2 with a column density of about 0.7 x 10^{21}cm^{-2} the same value obtained from the last Swift X-ray observations of the supersoft source. The significance of this observation is the similarity of the extinction for this nova and V339 Del, so the distances are different (with V1369 Cen being closer, hence likely resolvable soon.

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 Monthly report

Previous issues :
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VV Cep campaign

http://www.spectro-aras.com/forum/viewforum.php?f=19

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 welcome

1/ reduce your data into BeSS file format
2/ name your file with:
_ObjectName_yyyymmdd_hhh_Observer

Exemple: _chcyg_20130802_886_toto.fit

3/ send you spectra to

Novae, Symbiotics : François Teyssier
Supernovae : Christian Buil
VV Cep Stars : Olivier Thizy