Eruptive stars spectroscopy
Cataclysmics, Symbiotics, Novae, Supernovae

ARAS Eruptive Stars
Information letter n° 7 - 06-07-2014

News

Two bright CV in june, discovered by "ASASSIN" program and spectroscopically identified by ARAS observers :
ASASSN-14cl (magV = 10.3) and ASASSN-14cv (magV = 11.0)

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

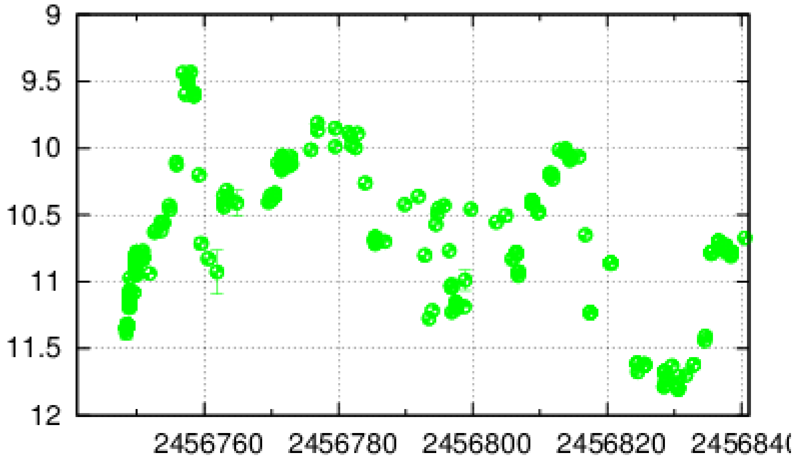
Contents

Aknowledgements : V band light curves from AAVSO photometric data base

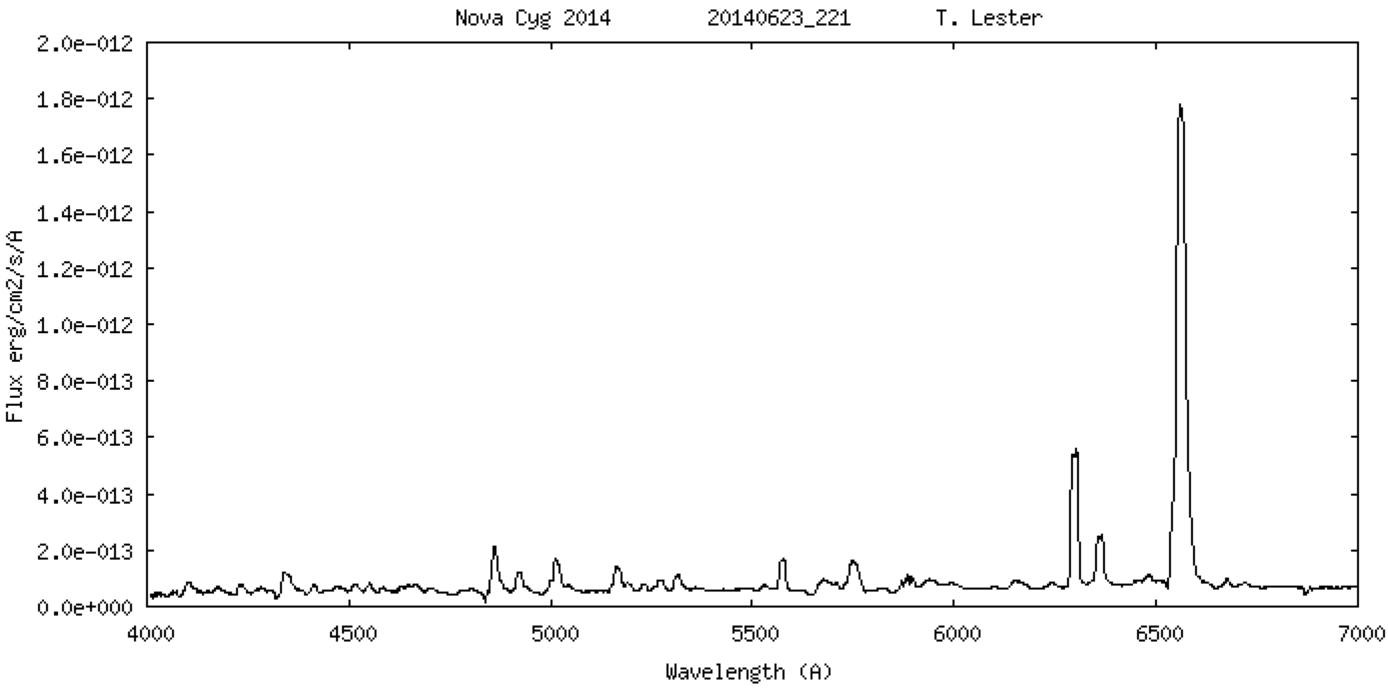
NOVAE

Nova Cyg 2014

Luminosity
Mag V = 10.8 (26-06-2014)
Unusual light curve.
The luminosity dropped from mag V = 10 (June 5) to Mag V = 11.6 (June, 15), remains almost almost constant (11.6 to 11.8) during about 10 days. The nova suddently rebrightens to mag 10.8 (June, 26)



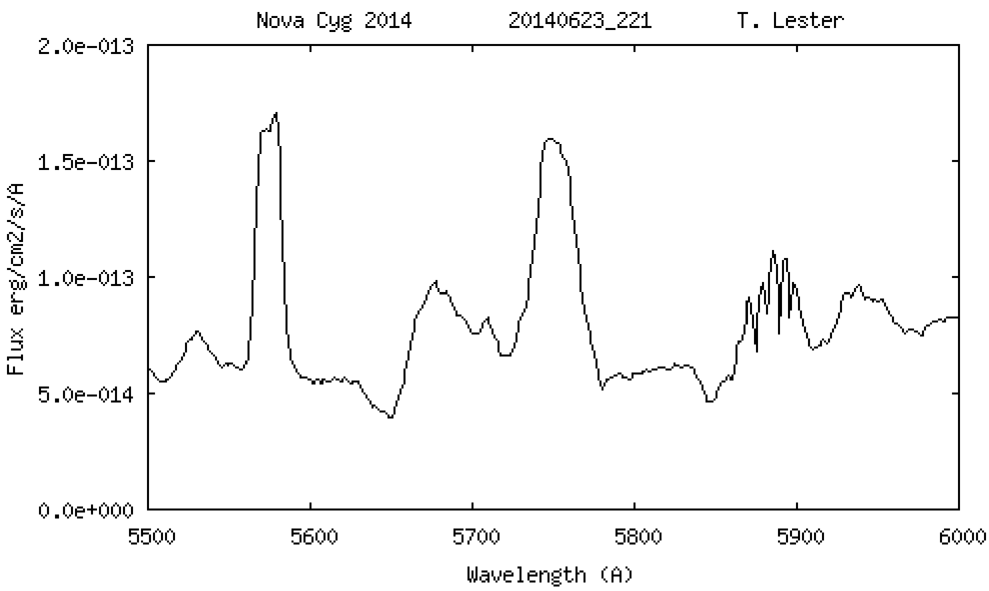
Observing : spectra required for this peculiar nova - One a day



Flux calibrated spectrum from T. Lester, using HD190603 as reference star (MILES). The calibration gives V = 11.71 on june 23.2 (AAVSO V Mag = 11.70)

The [OI] 6300, 6363 lines are particularly strong.

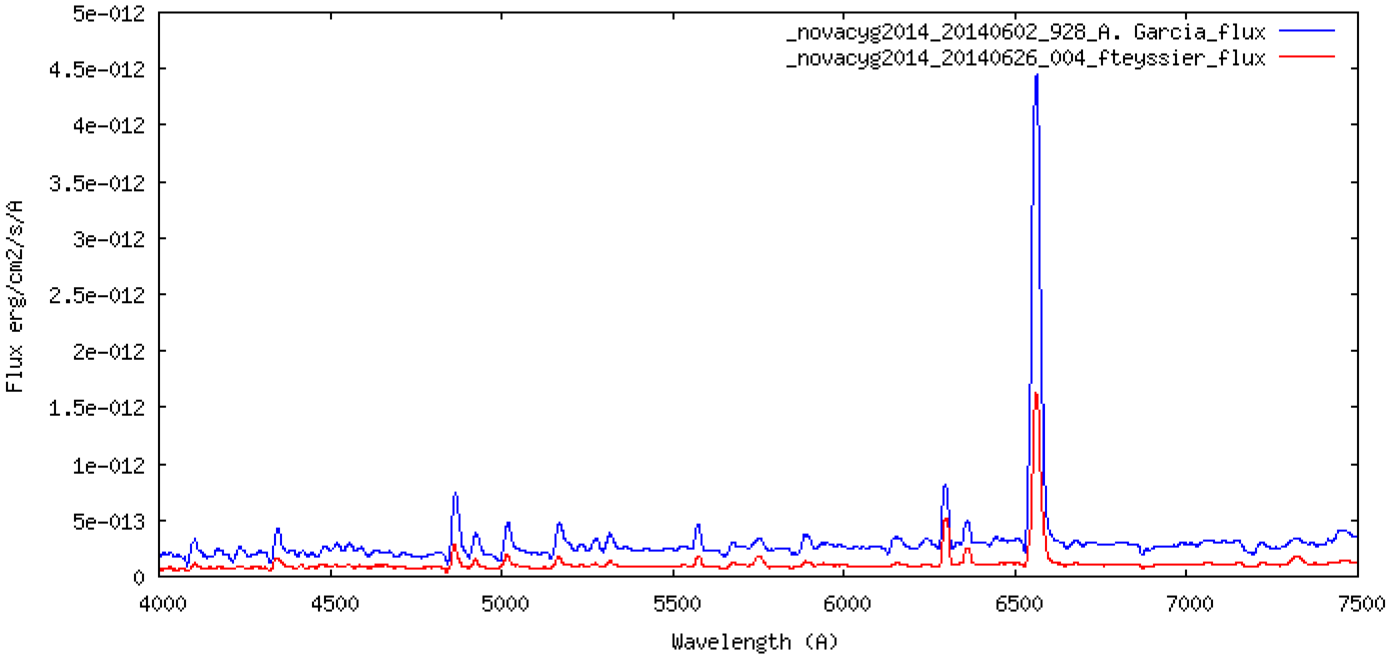
In the V band (crop), [O I] 5577, [NII] 5755 and the complex structure He I 5876 (see Steve's note)

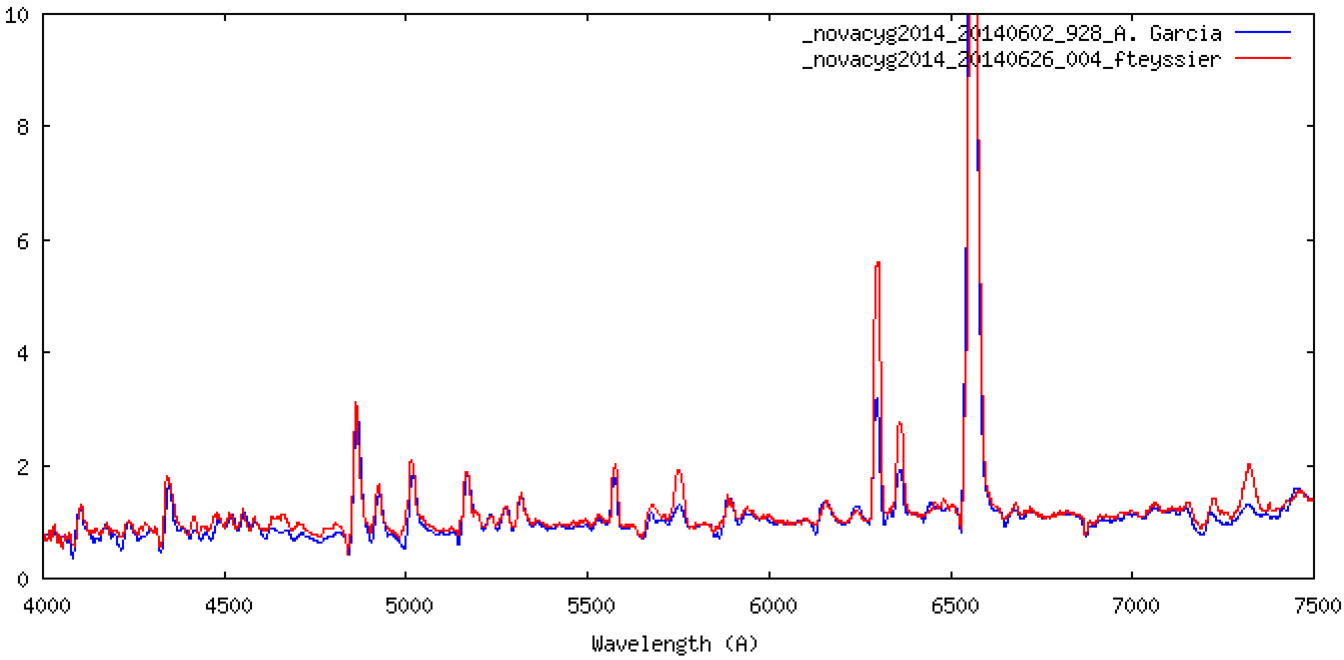


Observers : Tim Lester | Christian Buil | Paul Gerlach | Olivier Garde | François Teyssier | Jacques Montier | A. Garcia | P. Berardi | D. Boyd

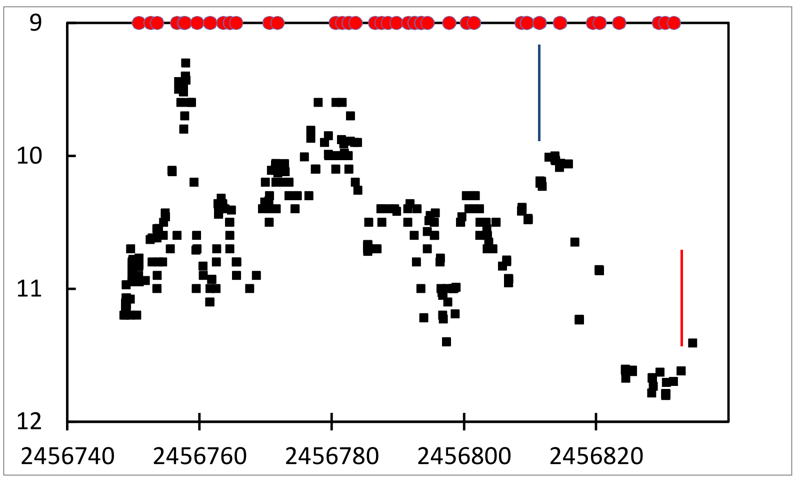
ARAS DATA BASE : 57 spectra http://www.astrosurf.com/aras/Aras_DataBase/Novae/Nova-Cyg-2014.htm
Web Page : http://www.astrosurf.com/aras/novae/NovaCyg2014.html

Nova Cyg 2014 Evolution in june

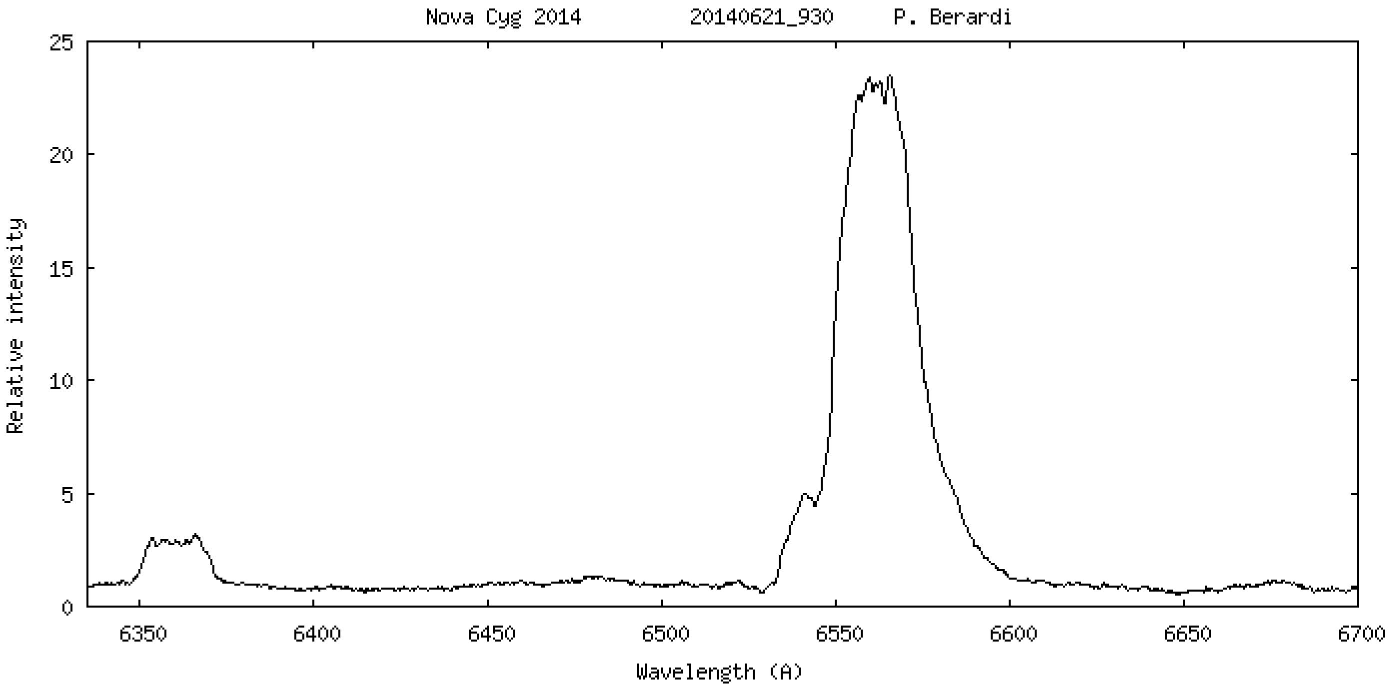




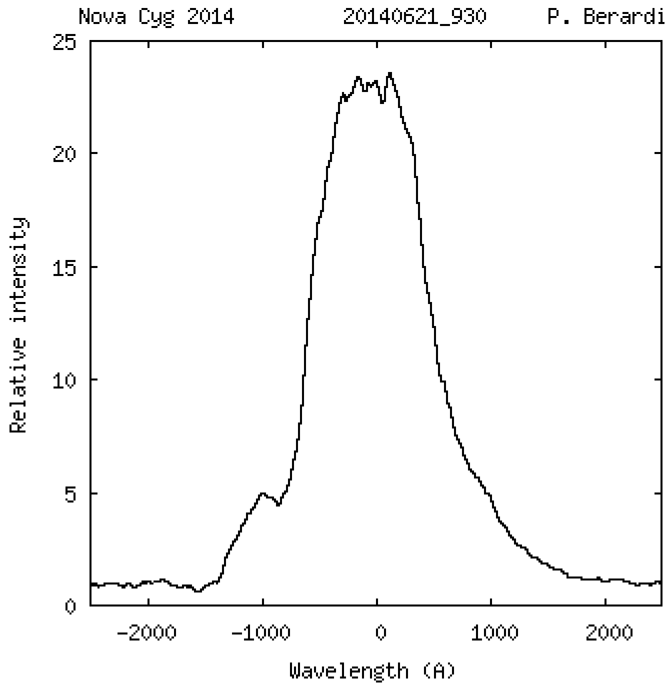
The evolution of the spectrum in june, throw spectra of A.Garcia and F. Teyssier
Top : flux calibrated spectra from measured V magnitude
Down : comparison in relative flux, with noticely strong changes of O lines : [OI] 6300 and 6363 ÅÅ, [O II] 7319, 7325 ÅÅ and [NII] 5755 Å

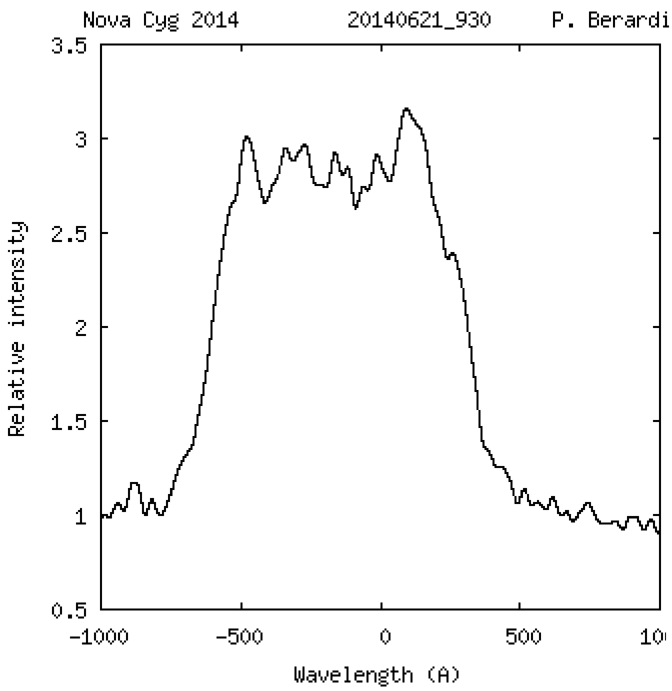


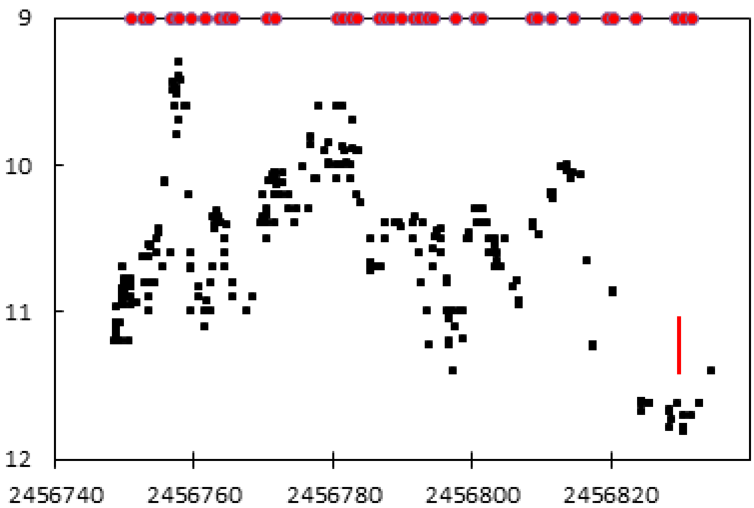
Nova Cyg 2014



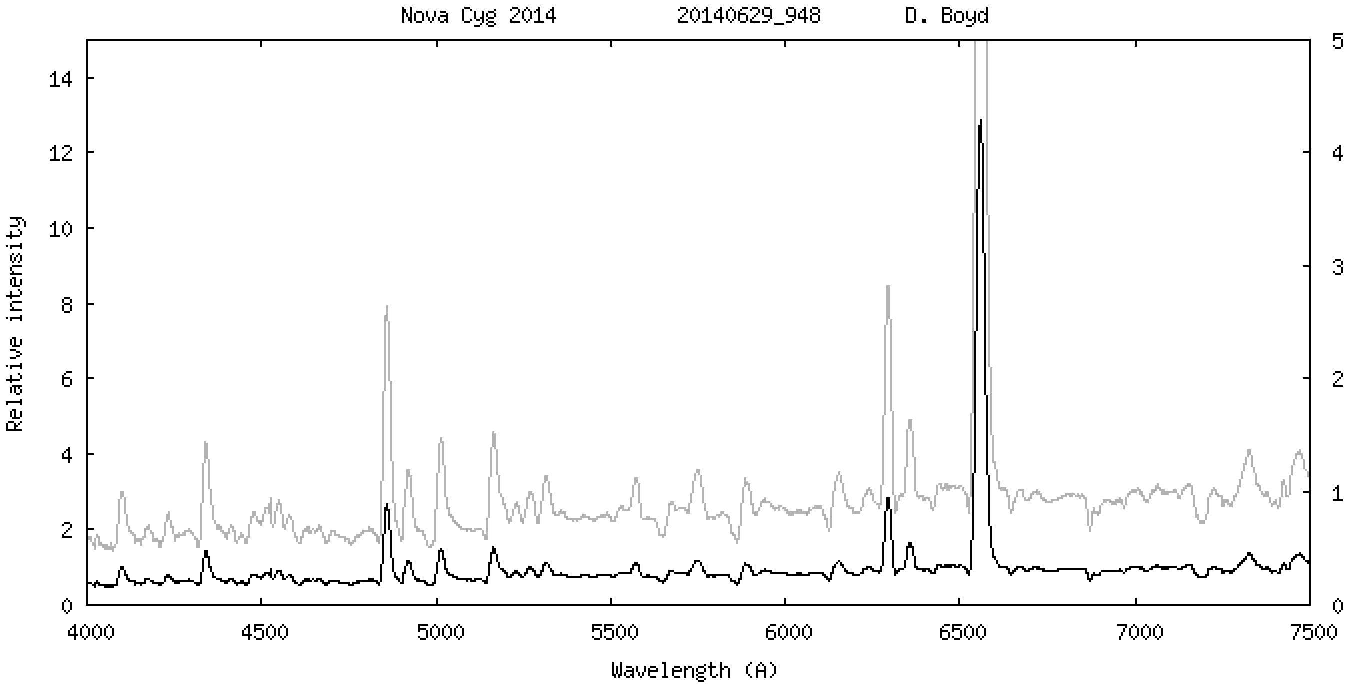
The H alpha region by P. Berardi
with a Lhires III 1200 l/mm (R = 6000)
Note the two absorptions feature in the blue edge of H alpha line at -860 and -1560 km/s.
Maximum velocity ~ 1800 km/s.
The [OI] 6363 is flat top with FWZI = 615 km/s



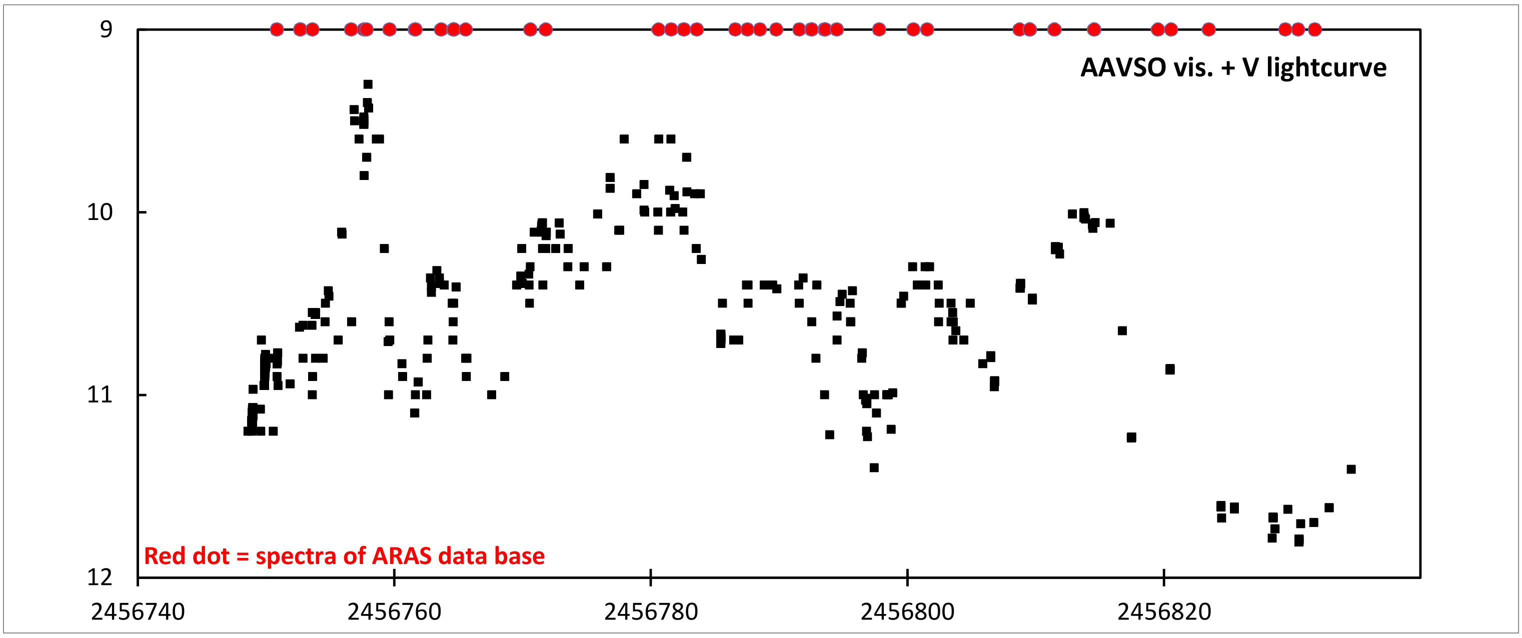




Nova Cyg 2014



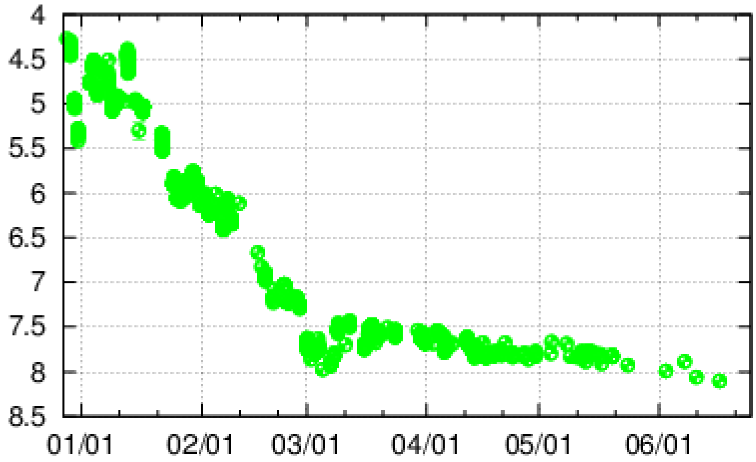
Nova Cyg 2014 light curve and dates of ARAS spectra



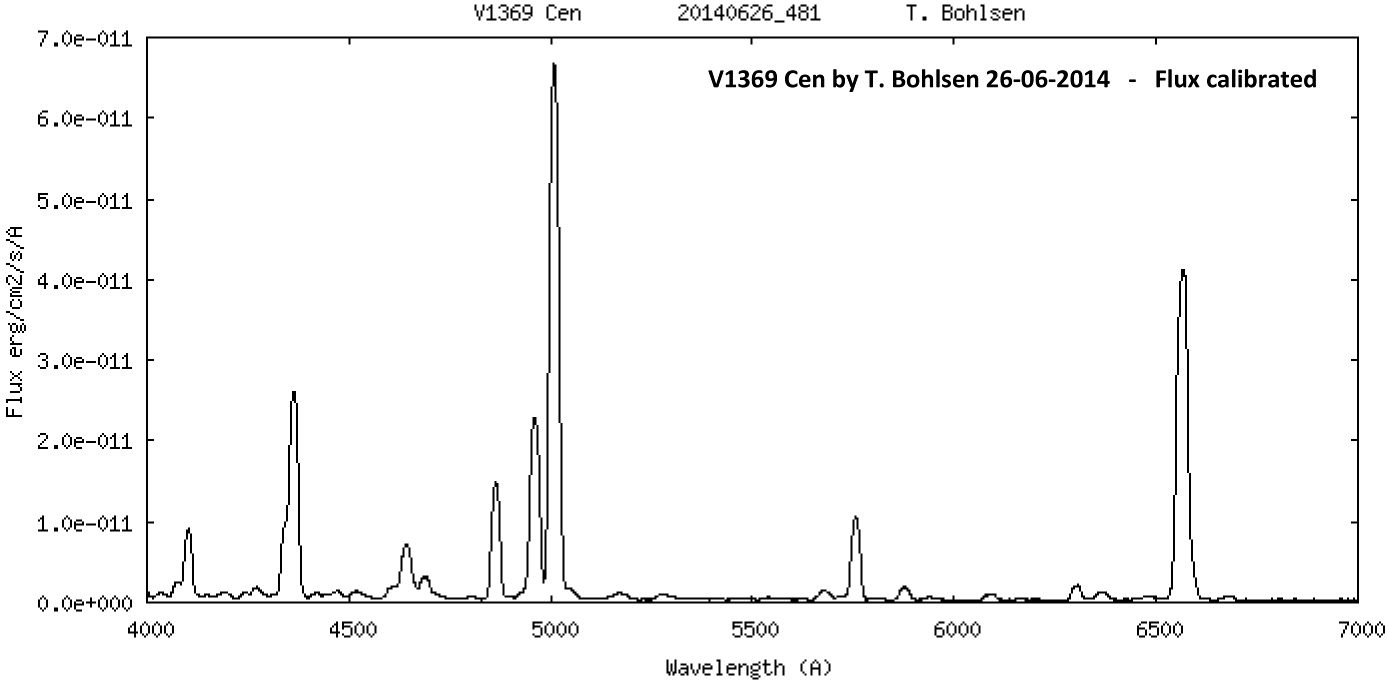
N O V A E

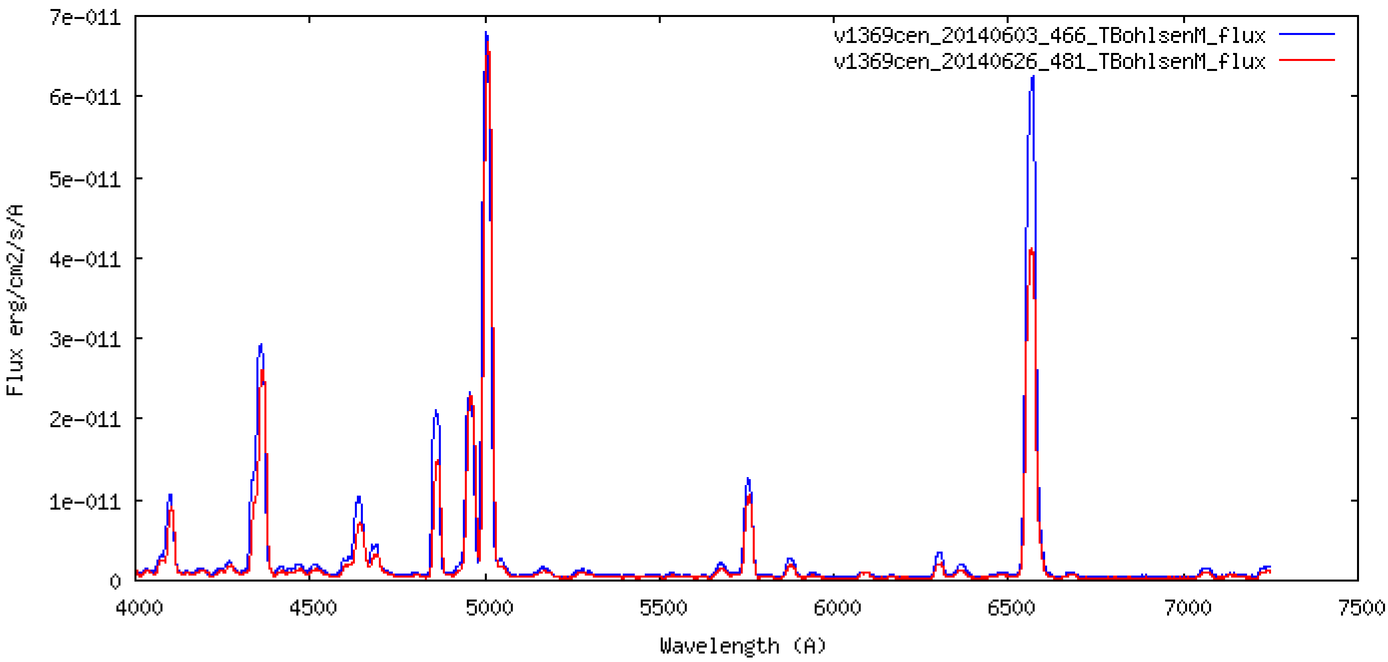
Nova Cen 2013 = V1369 Cen

Luminosity
Mag V = 8.1 (25-06-2014)
Plateau phase, slowly declining, about 4.5 mag under maximum luminosity



Observing
New spectra from Terry Bohlsen
Pretty constant spectrum during this plateau phase
[OIII] flux remains alsmost constant while the intensity of other lines decrease, noticelly Balmer lines





V1369 Cen evolution from 06-03 to 26-06-2014

Observers : Terry Bohlsen - Malcom Locke - Jonathan Powles - Ken Harrison - Julian West - Tasso Napoleao - Rogerio Marcon

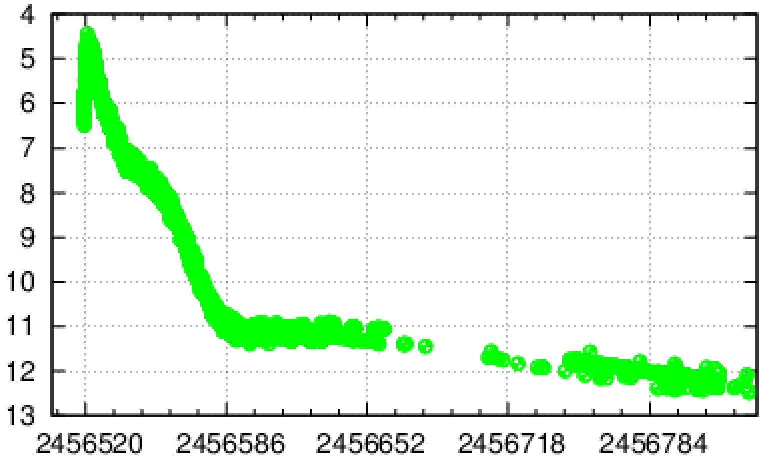
ARAS DATA BASE : 152 spectra **http://www.astrosurf.com/aras/Aras_DataBase/Novae/Nova-Cen-2013.htm**

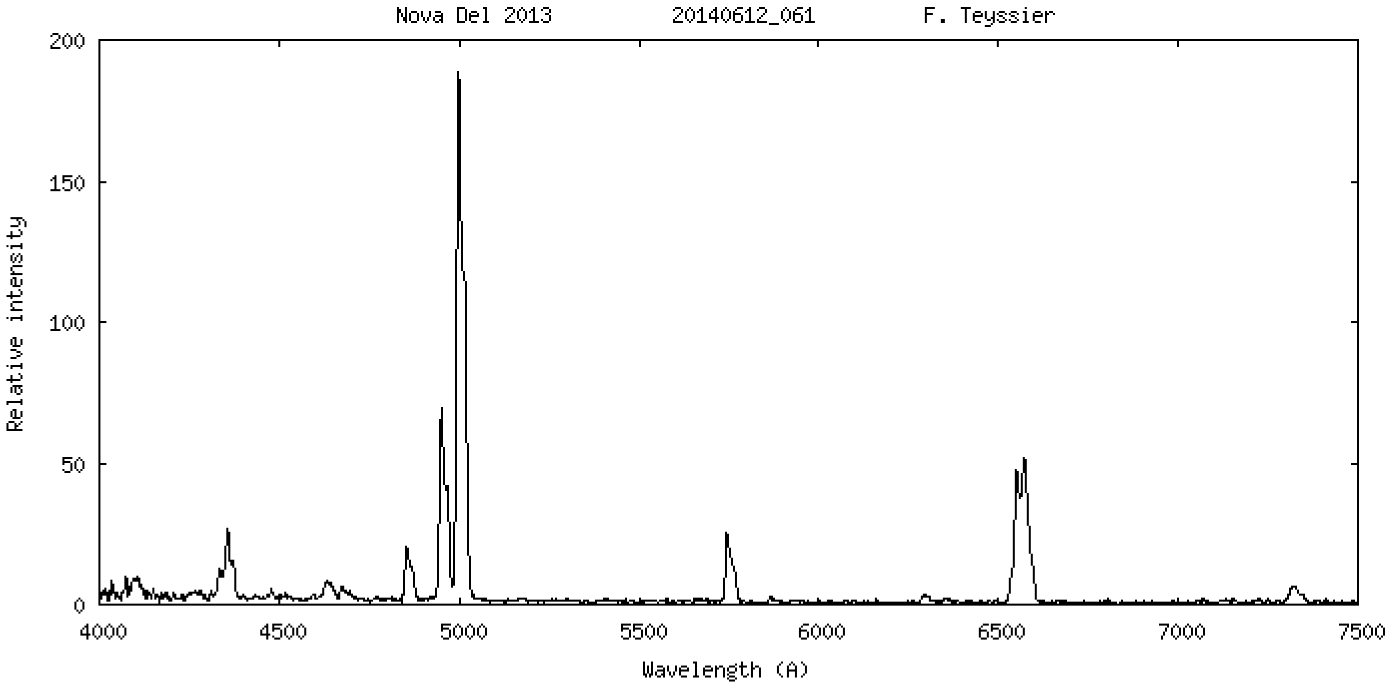
NOVAE

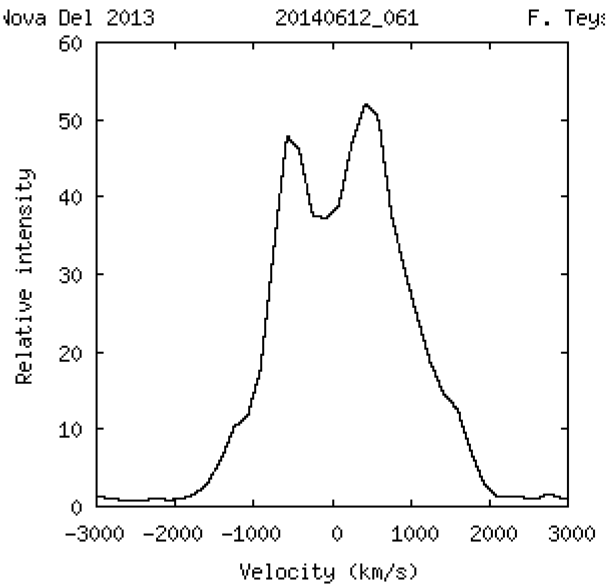
Nova Del 2013 = V339 Del

Luminosity
Mag V ~ 12.3 (28-05-2014)
Always in the very long plateau phase, slowly declining

Observing
Spectra required (one a week)







Pretty constant spectrum during the long plateau phase

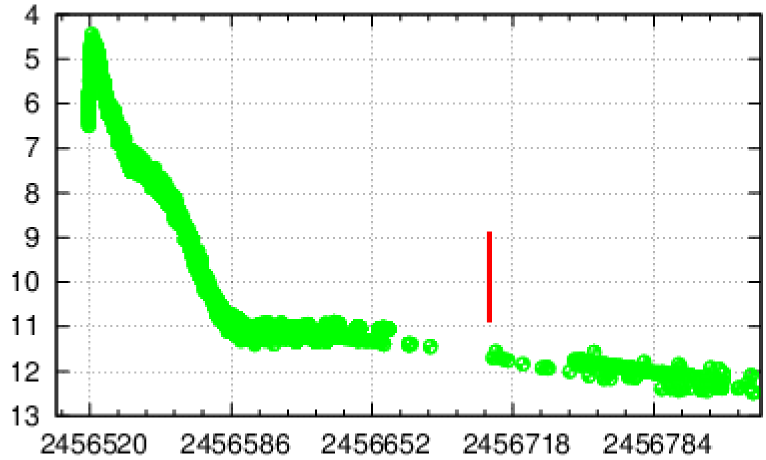
Observers (2014) : Christian Buil - Tim Lester - Francois Teyssier- David Boyd

ARAS DATA BASE 2014 | 13 spectra| http://www.astrosurf.com/aras/Aras_DataBase/Novae/Nova-Del-2013_2.htm
ARAS Web Page for Nova Del 2013 : http://www.astrosurf.com/aras/novae/Nova2013Del.html

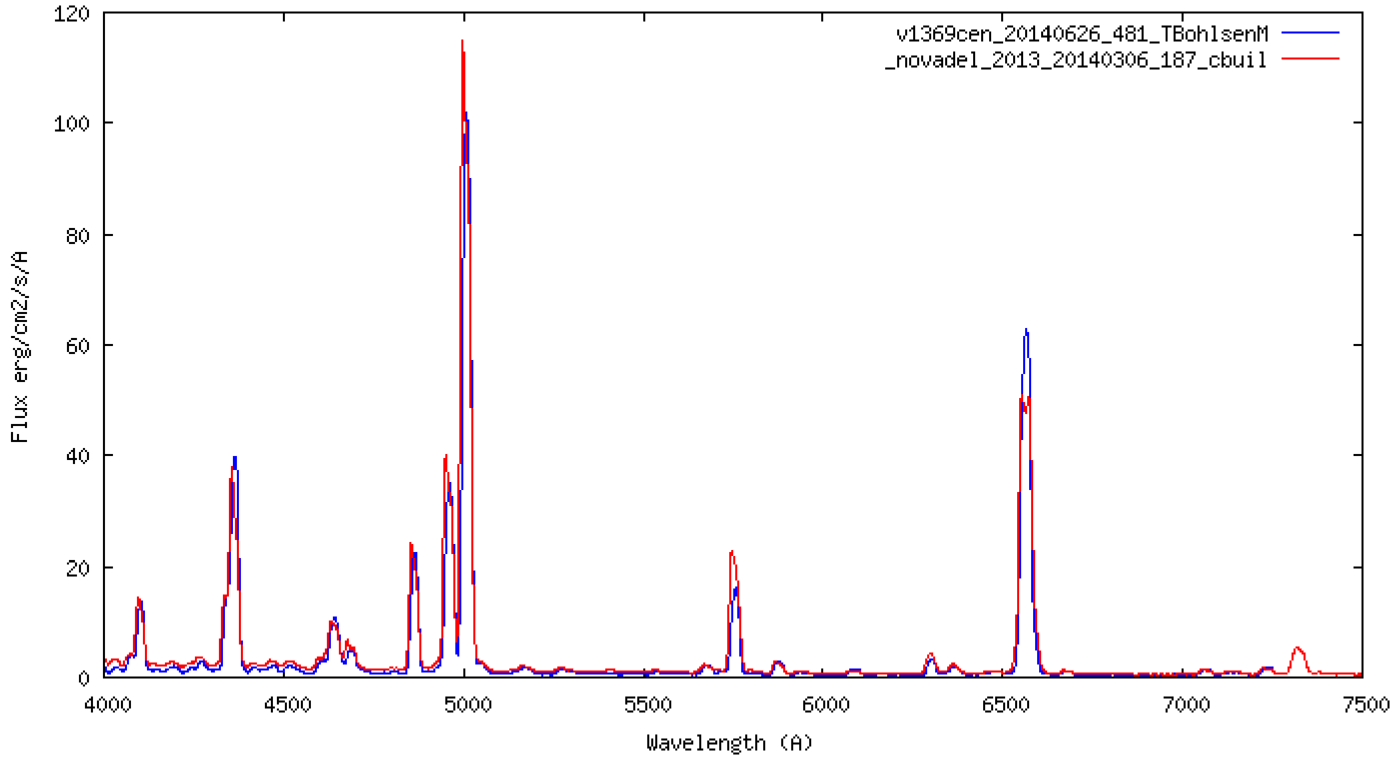
Nova Del 2013 Nova Cen 2013 Comparison

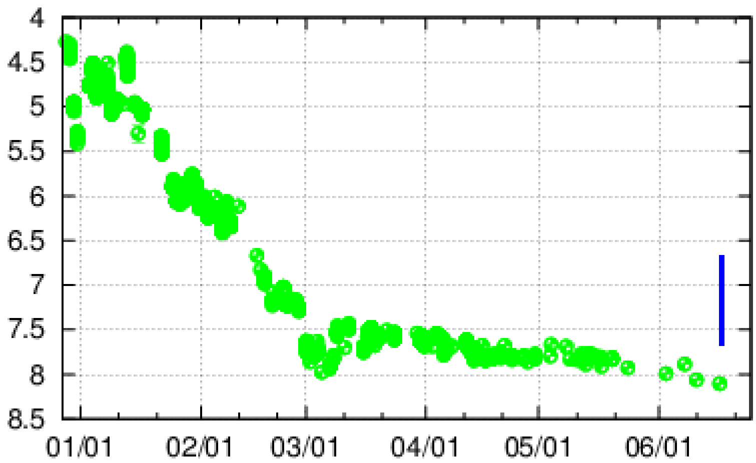
The twin novae

Comparison of the two novae throw spectra of C. Buil and T. Bohlsen
The two spectra have been obtained about four months after the begining of the plateau phase.
They are remarkably similar.



Nova Del 2013 light curve and date of C. Buil's spectrum





Nova Cen 2013 light curve and date of T. Bohlsen s spectrum

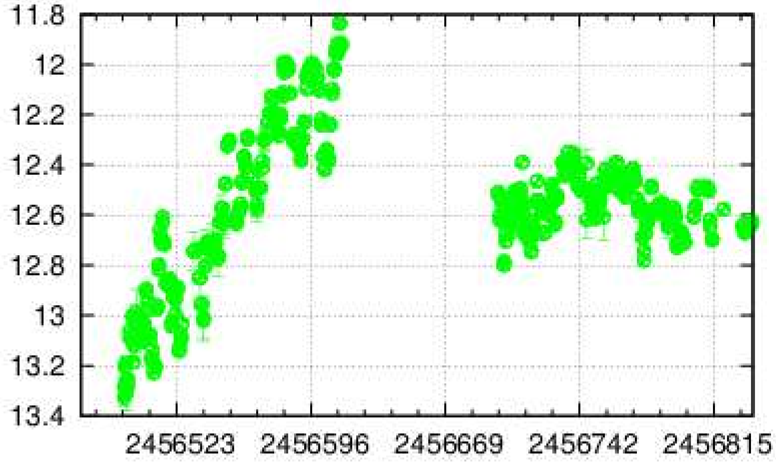
NOVAE

Symbiotic nova VVV-NOV-003

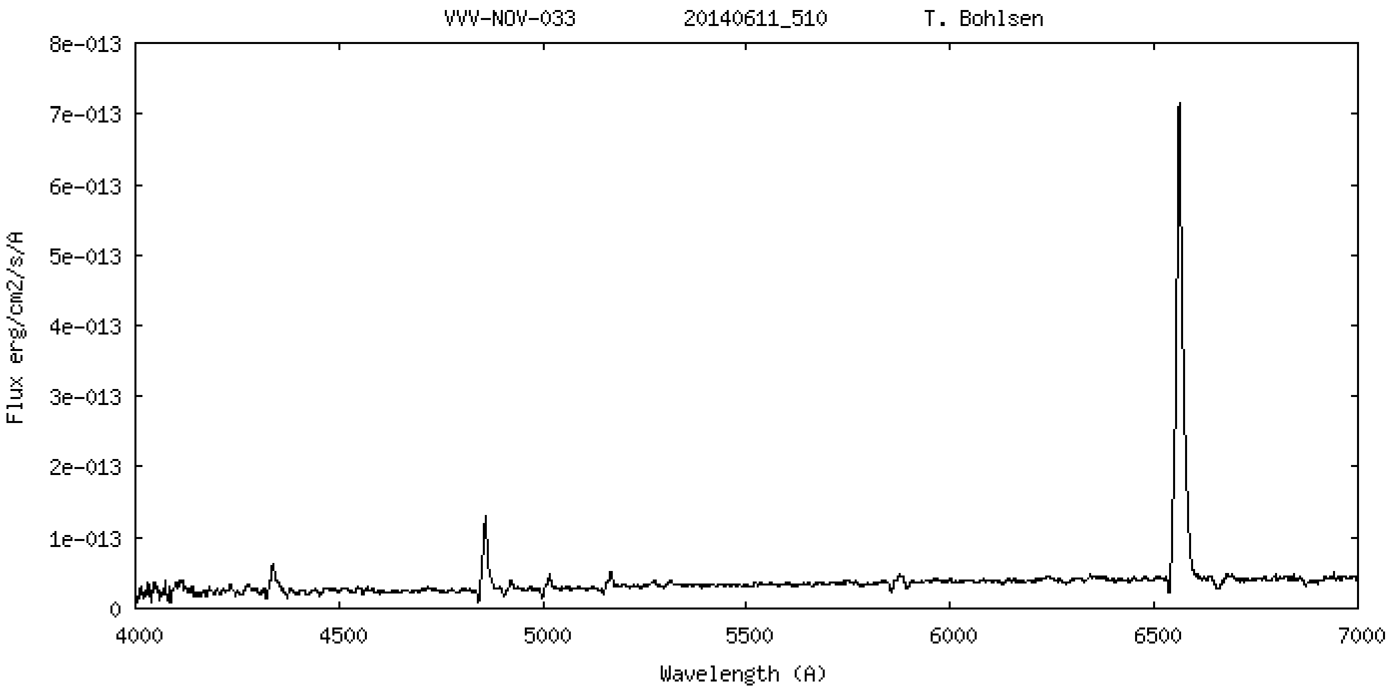
Symbiotic nova discovered by VVV Survey data (vvvsurvey.org)

Coordinates (2000.0)	
R.A.	17:50:19.27
Dec.	-33:39:07.3

Luminosity
Mag V = 12.6 (29-06-2014)



Observing :
Ungoing observations by T. Bohlsen
Despite its low declination, VVV-NOV-003 can be observed in southern europa. Good target for OHP 2014 meeting



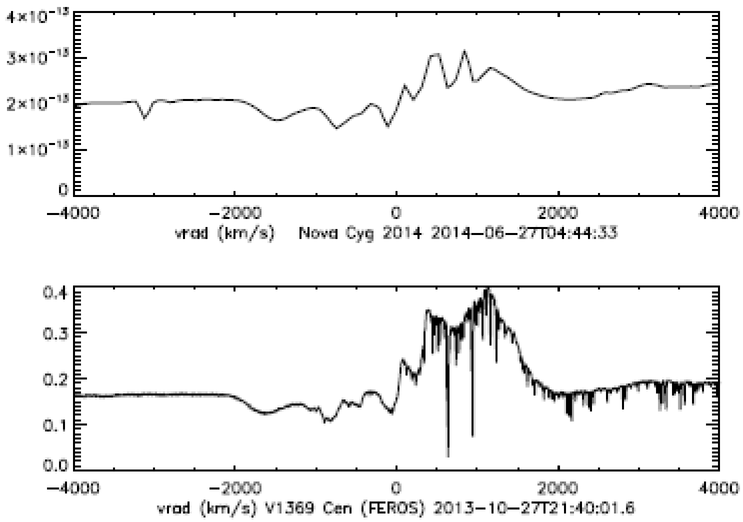
Balmer and Fe II lines with absorption component

Observers : C. Buil| O. Garde | T. Bohlsen
ARAS DATA BASE | 25 spectra| http://www.astrosurf.com/aras/Aras_DataBase/Novae/VVV-NOV-003.htm
ARAS Web page : http://www.astrosurf.com/aras/novae/VVV-NOV-003.html

Comments on Nova Cyg 2014: almost generic

Steve Shore

The last spectra of this nova show something unexpected and quite remarkable, even at low resolution. In the accompanying figure, the top spectrum is N Cyg 2014. The bottom is V1369 Cen about two weeks into the outburst. Both show similar light curves, and both are likely CO novae (although the definitive observation, in the UV, is still to come in the next month or so with STIS). Note that the He I line shows a high velocity feature at about -1500 km.s^{-1}, the same is seen in V1369 Cen.



V1369 Cen, Nova Cyg 2014 : He I 5876 Å and Na I D1,D2.
V 1369 : FEROS | Nova Cyg 2014 : Tim Lester's spectrum

I'll add that the same phenomenon, with about the same velocity, occurred after the peak in V339 Del and also in the early stages of T Pyx. In all cases, the velocity increased over time, indicating that the excitation was progressively moving outward though the ejecta. The maximum velocity on the Balmer absorption troughs is similar and shows a similar behavior. It's not rare! The same evolution is followed by a substantial number of novae, although this is just now obvious. The demonstration that this is truly He I comes from the same detached profile appearing on 6678 Å and 7065 Å (although compromised by water vapor absorption in many spectra, especially low resolution). Helium is a particularly difficult case since the lower level is populated by FUV transitions, much like the Balmer lines, but at even higher energies. This means that the external portions of the ejecta, even at the time when the recombination has produced lower velocity features on Na I (and Ca II H and K, I'll add), there is sufficient density and far ultraviolet flux to excite the periphery of the ejecta. The maximum velocity of this feature is the same as the Balmer lines, and clearly shows that the ejecta have much higher velocities than inferred from the emission (or full width half maximum) of the profiles (a too easily measured quantity, one that should be diligently avoided).

This has significance for measurements in other wavelength regions. The discrete features seem to have a typical optical depth (that is, they are either optically thin or not completely covering the central source).

Let me explain this since it relates to line formation. The Na I lines, for example, are resonance transitions, meaning they come from the ground state of Na^{o}. Since the population depends only on the ionization state (they are at a relative zero-energy level), the only thing that should differ between the D1 and D2 lines is their intrinsic atomic cross section, the *oscillator strength* weighted by the statistical weight of the state (in this case, it's the same). This is, for a single ion like Na^{o}, independent of temperature. So since the optical depth is linearly proportional to this intrinsic strength and the column density in the ground state (hence ion), the optically thin lines should have a ratio of about 1.7 (with the 5889 Å component being stronger). In the multiple line systems, this is often -- but *not always* -- the case. In some of the novae you've observed, even correcting for resolution effects (that change the ratio of the equivalent widths of the lines, the area of the profile indicating how much energy has been removed in a wavelength interval) , the ratio is closer to unity. The line is optically thin if there is residual flux at the profile minimum, but that is misleading in such complex structures as you've seen in these systems. It assumes complete covering. Think of a cloud seen against a bright sky. It appears dark (see the image, one I photographed during the drive this week to Trieste near Asiago).

Example of a dark, scattering cloud seen against a bright background and also an optically thick scattering surface (the bright clouds in the base of the picture.

Now think of the same picture blurred and combined. The individual features would merge. The same would be true for the absorption lines. There would be bright, scattering (or emission) lines from the one and absorption from the

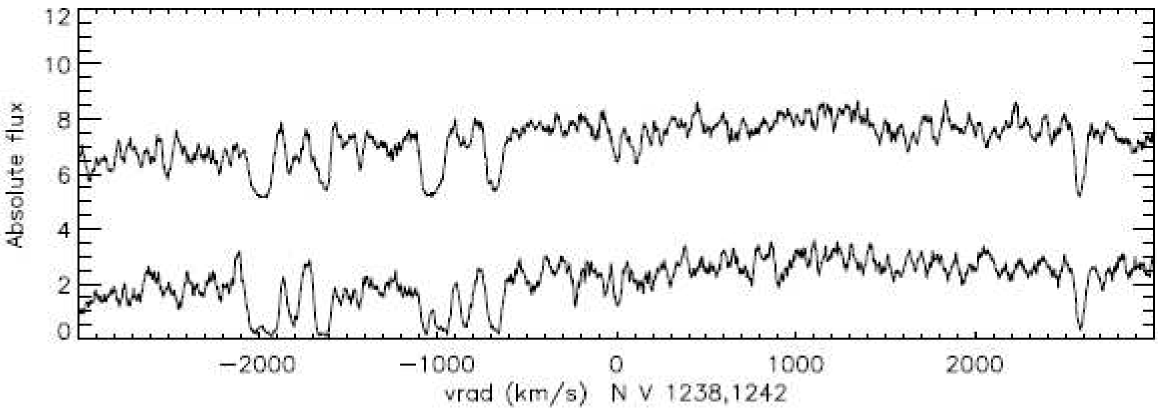
NOVAE

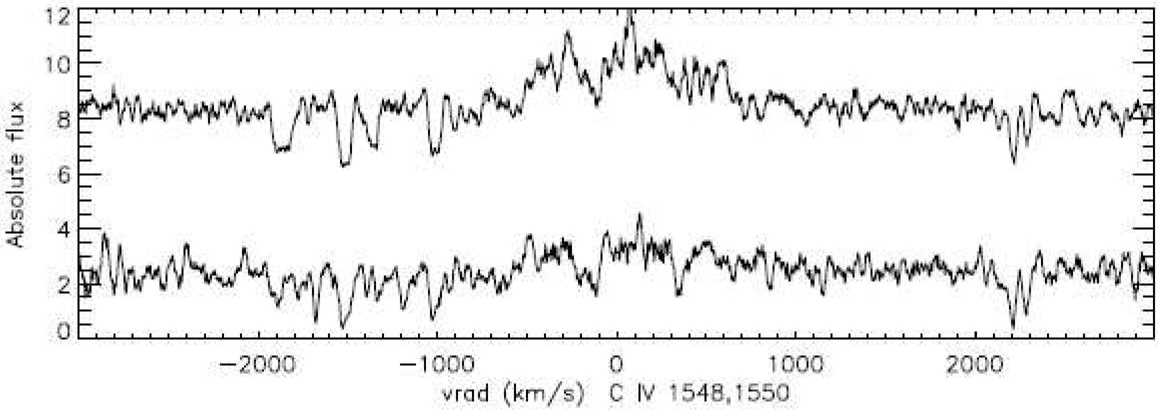
Comments on Nova Cyg 2014: almost generic

Steve Shore

other. It isn't covering the field of view completely, in fact if you reduce the resolution enough it disappears. So you'd see residual flux even though it is a completely opaque filament or knot. That's what happens, it appears, in the spectra you've seen. The narrow features may be optically thick, meaning they are confined to a small interval in velocity, hence they must be truly denser than their surroundings, but they have a small solid angle seen against the brighter opaque surface of the ejecta or the central star. This is the same effect you see in stellar winds, and only the line ratios provide the information about whether they are large or small. In a stellar wind, the residual intensity is very near zero, in novae it can be as large as 50%. That's because winds are more nearly spherical and therefore cover the central star completely (in fact, over-fill the solid angle).

The N V 1238,1242 Å and C IV 1548,1550 Å discrete features in T Pyx on days 617 and 834 after outburst obtained with HST/STIS.





Now what this has to do with the Nova Cyg 2014 observations is that the same light curve behavior has been observed in the three novae V339 Del, V1369 Cen, and Cyg 2014 that was seen during the maximum of T Pyx. Yes, I know the last is a recurrent nova, but that's not important if the same mechanism acts.

And without these sequences, the early spectra you've been providing with high cadence, we can't disentangle these effects as either radiative or dynamical (or, perhaps, both).

Steve Shore, 06-07-2014

Selected list of bright symbiotics stars of interest

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

Mag V * : 01-04-2014

Observations from 01-06 to 30-06

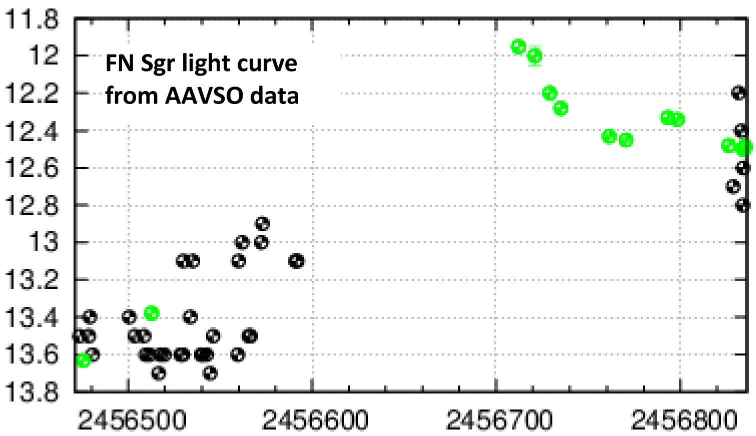
New spectra	
T CrB	4
V934 Her	1
YY Her	1
RS Oph	1
BF Cyg	3
CI Cyg	2

FN Sgr

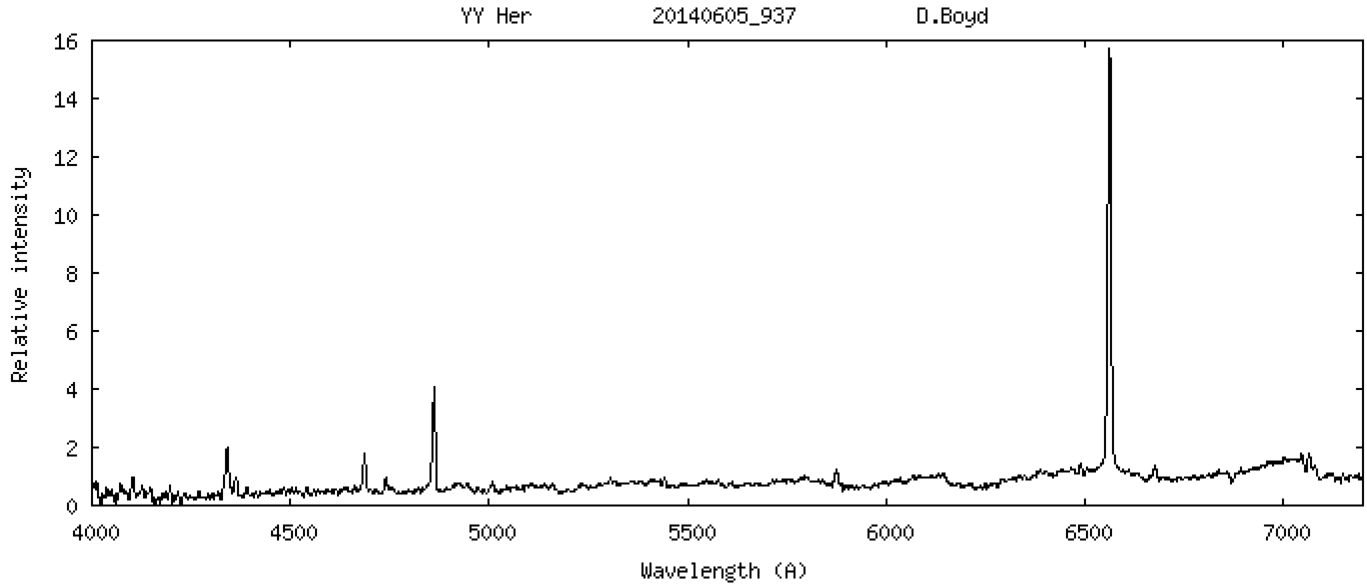
FN Sgr experienced a symbiotic outburst at the begining of the year, raising an observed maximum luminosity of V = 11.9 in february 2014

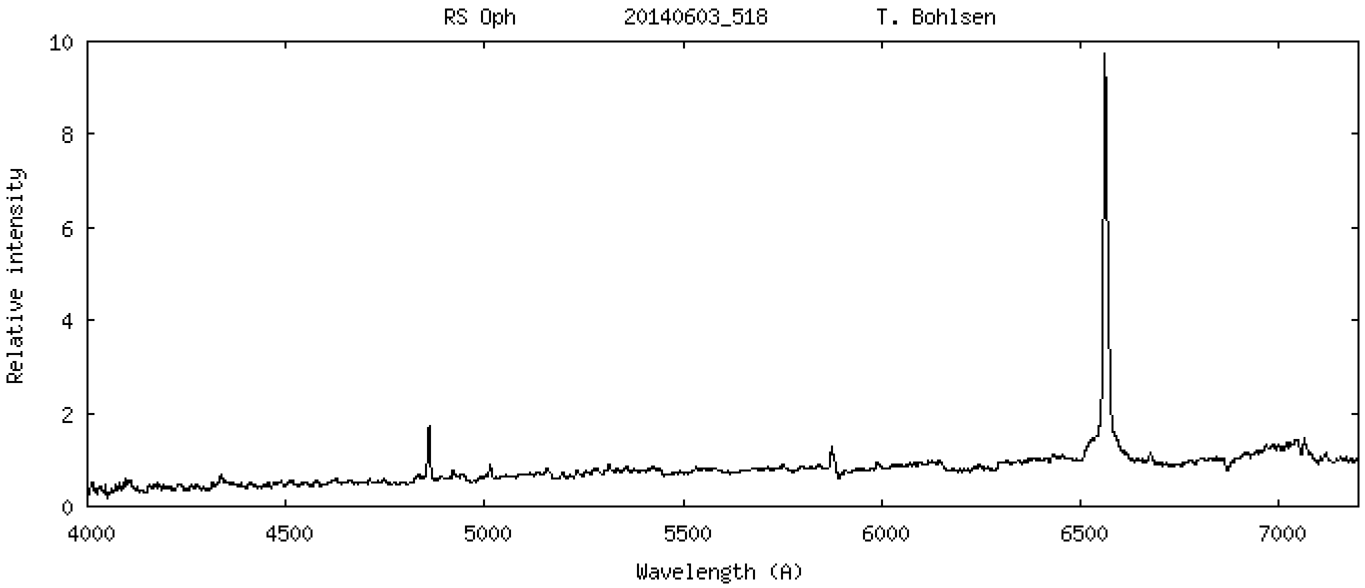
Coordinates (2000.0)	
R.A.	18 53 54.77
Dec.	-18 59 40.5

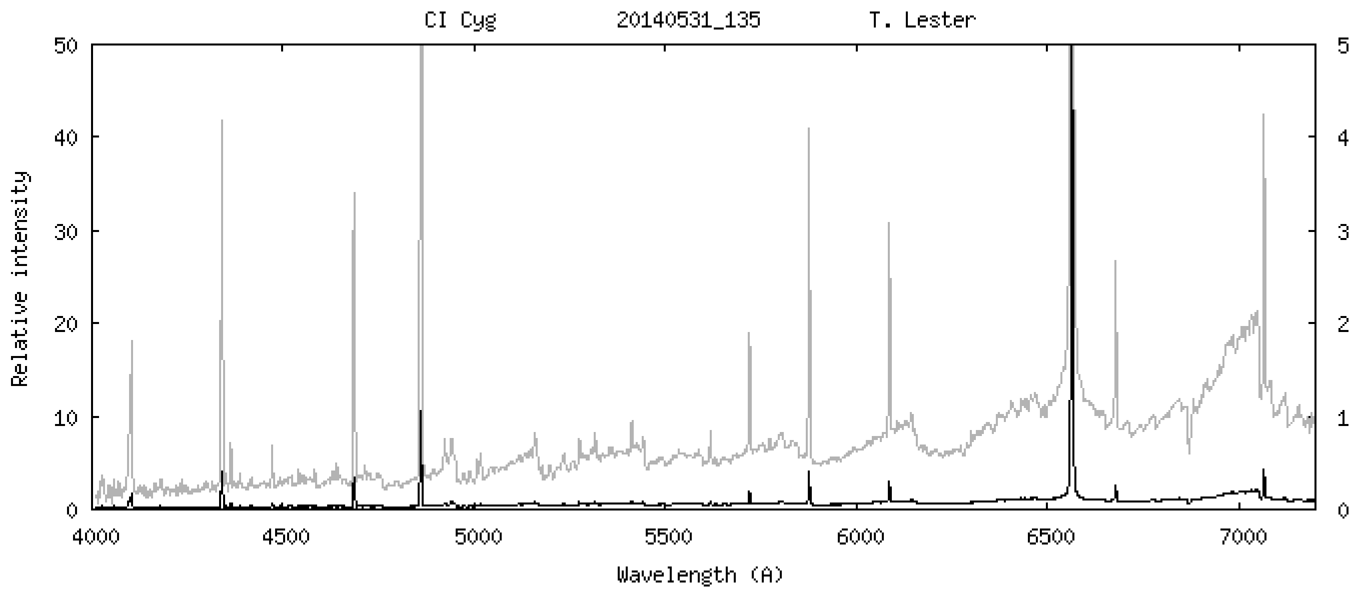
A target or summer nights



YY Her | RS Oph | CI Cyg

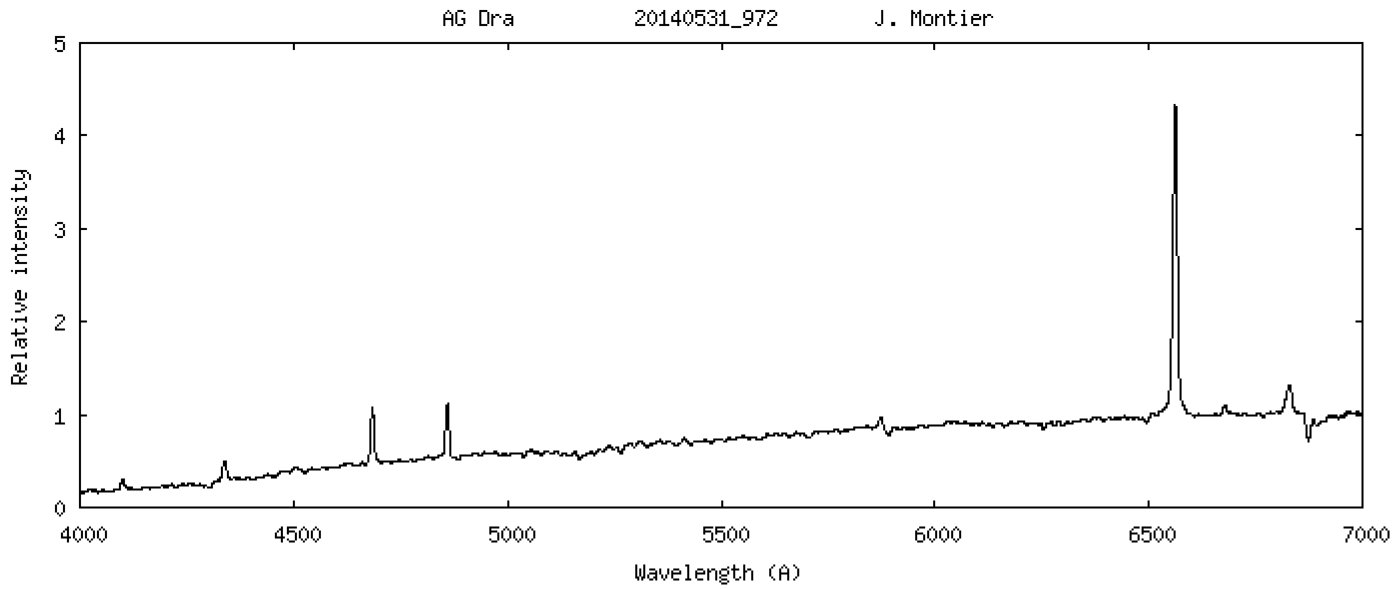


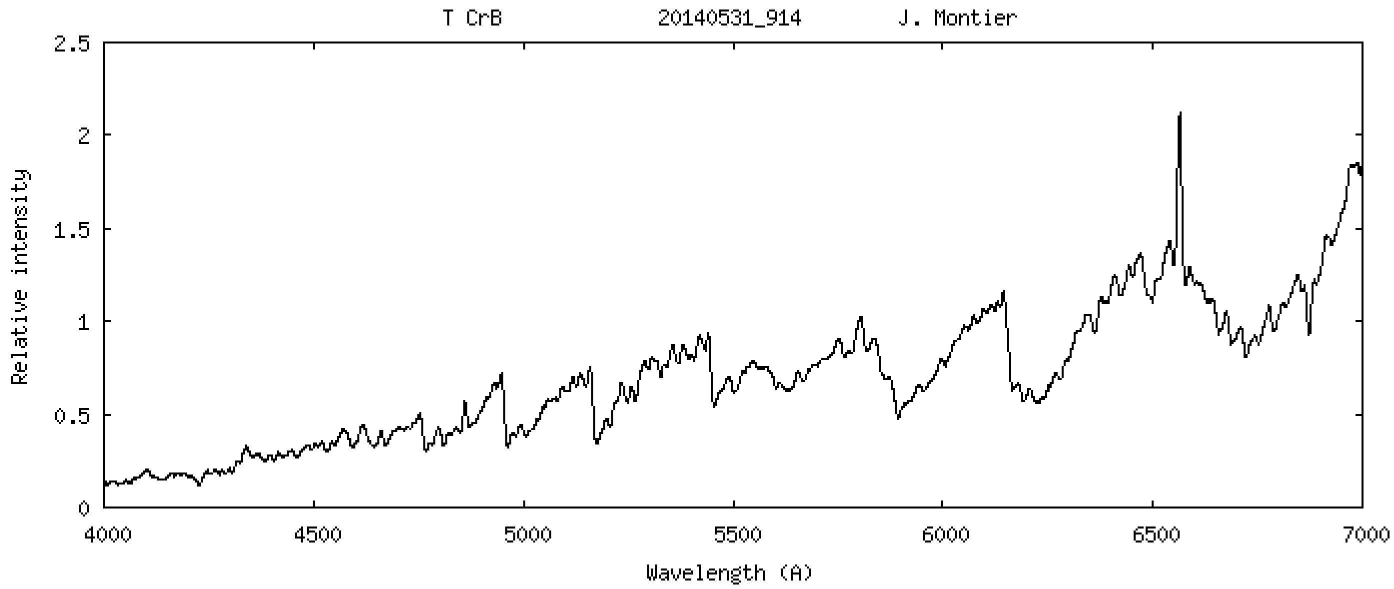


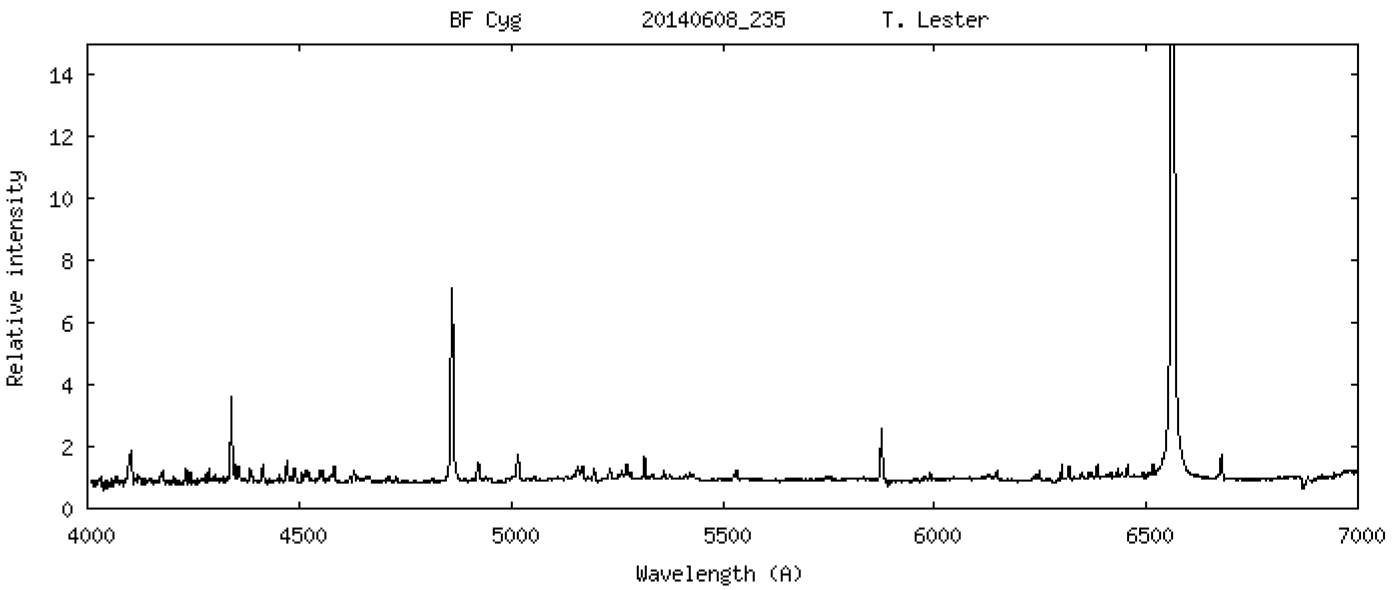


ARAS DATA BASE | http://www.astrosurf.com/aras/Aras_DataBase/Symbiotics.htm

AG Dra | T CrB | BF Cyg



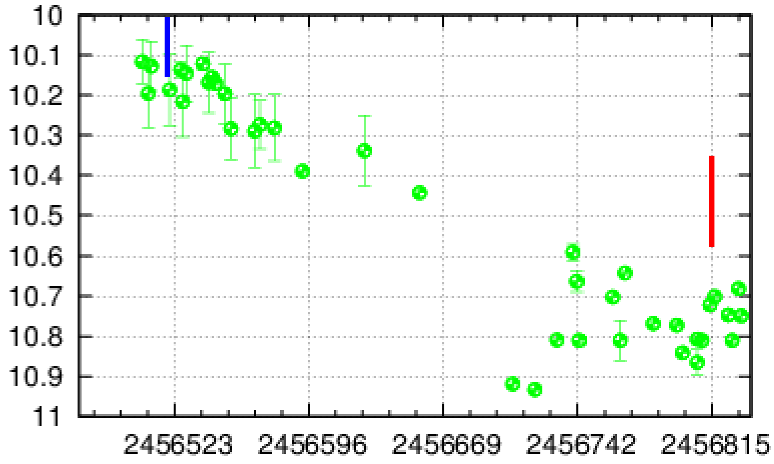


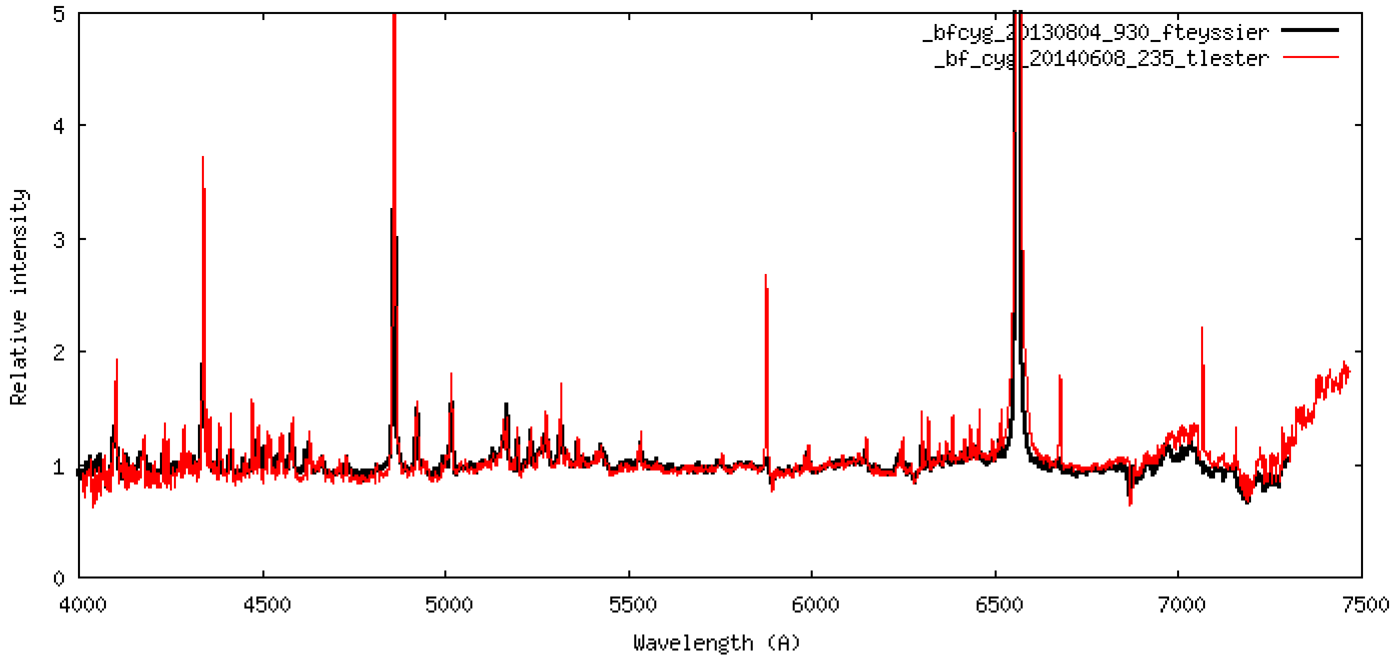


ARAS DATA BASE | http://www.astrosurf.com/aras/Aras_DataBase/Symbiotics.htm

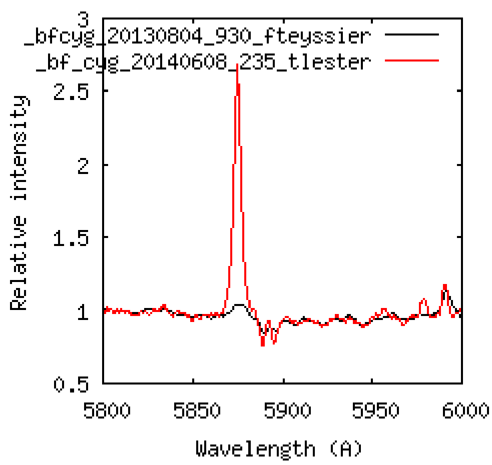
Zoom on BF Cygni

BF Cygni is an eclipsing symbiotic binary comprising a M5III giant and a white dwarf with an orbital period of 757 days
A collimated ejection (rare amoung the symbiotics) has been detected by A. Skopal & al. (2013)

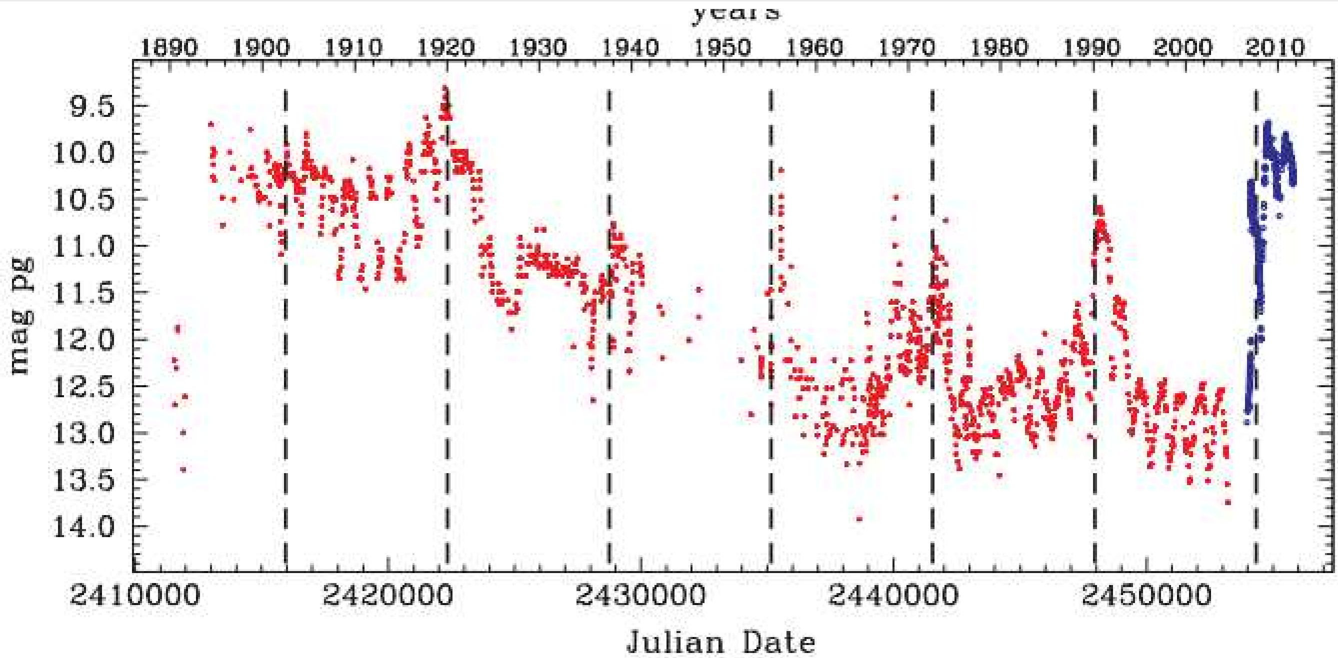




Comparison of two spectra (2013 aug. and 2014, june showing the impressive evolution, noticelly He I lines
More spectra are welcome.



Zoom on BF Cygni

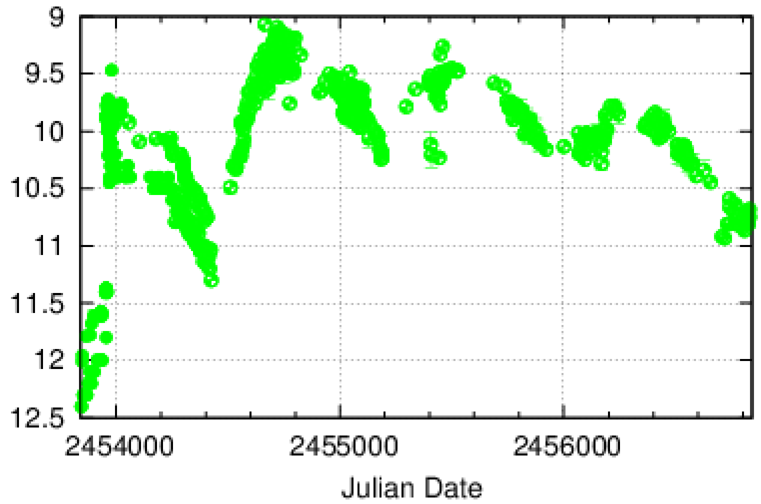


Historical light curve of BF Cyg from Siviero & al. (2012)

"The system underwent a major outburst in 1890 (Leibowitz & Formiggini 2006), that required almost a century to decline to quiescence, and a second one occurred in 2006, with BF Cyg still at maximum brightness after 5 years. On top of this remarkable light-curve, different types of variability and recurrence scales have been observed."

During the decline, on can see the Z And Type ouburst of a about 2 mags and the periodic oscillation

Crop on the light curve since 2006 outburst to now



Selected publications about BF Cyg

Discovery of collimated ejection from the symbiotic binary BF Cygni
Skopal, A.; Tomov, N. A.; Tomova, M. T.
http://adsabs.harvard.edu/abs/2013A%26A...551L..10S

BF Cyg during its Current Outburst
Siviero, A.; Tamajo, E.; Lutz, J.; Wallerstein, G.; ANS Collaboration
http://adsabs.harvard.edu/abs/2012BaltA..21..188S

A photometric and spectroscopic study of the symbiotic binary BF CYG
Skopal, A.; Vittone, A.; Errico, L.; Bode, M. F.; Lloyd, H. M.; Tamura, S.
http://adsabs.harvard.edu/abs/1997MNRAS.292..703S

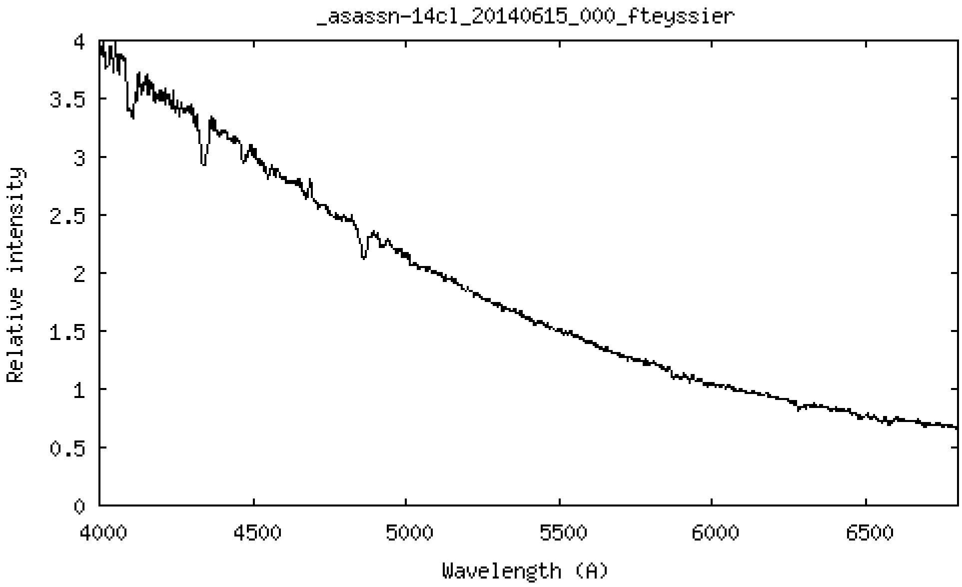
On the nature of the symbiotic star BF Cygni
Mikolajewska, J.; Mikolajewski, M.; Kenyon, S. J.
http://adsabs.harvard.edu/abs/1989AJ.....98.1427M

ASASSN-14cl

ASASSN-14cl
Detected 2014-06-14.52 at mag 10.7
Spectroscopically identified as a cataclysmic outburst by F. Teyssier (ATel #6235)

Coordinates (2000.0)	
R.A.	**21h 54m 57.6s**
Dec.	**26° 41' 16"**

See also : http://www.aavso.org/aavso-special-notice-386



Spectrum obtained by F. Teyssier
SC 10" LISA R = 1000 2014-06-15.0
At mag = 10.3

Spectroscopic classification of ASASN-14cl as a cataclysmic variable in outburst

ATel #6235; *Francois Teyssier (ARAS)*
on ***15 Jun 2014; 10:06 UT***
Credential Certification: Krzysztof Stanek (stanek.32@osu.edu)

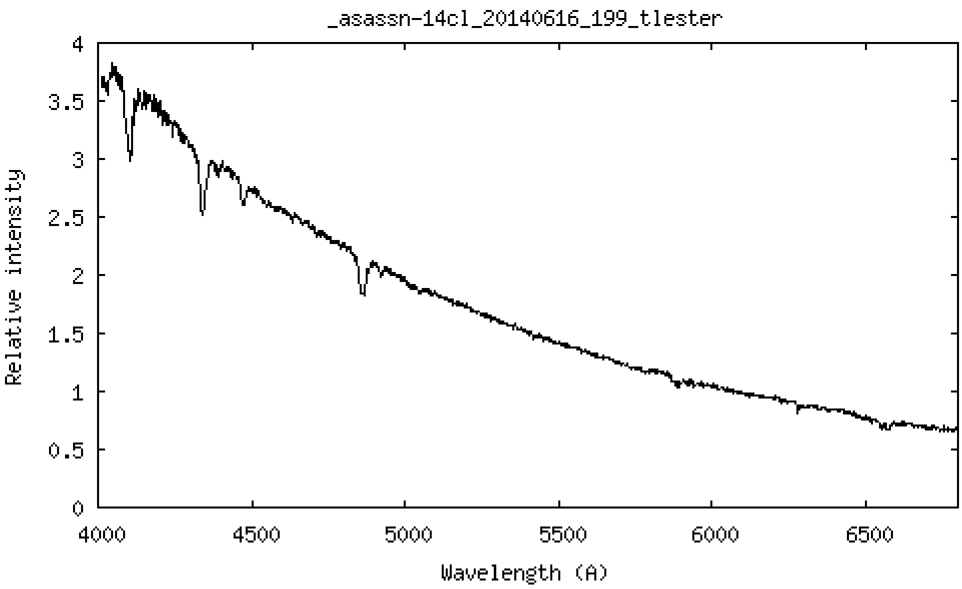
We report than an optical spectrogram of ASASSN-14cl (ATel #6233) shows that it is a dwarf nova outburst, as suggested by Stanek et al. (2014). The spectrum obtained on June 15.0 UT (range 400-680 nm, resolution 0.6 nm) with a 25 cm SC10" telescope and slit spectrograph LISA (R = 1000, 9 x 300 sec exposures) shows a strong blue continuum, narrow component in a broad absorption for H alpha, other Balmer lines in absorption and He II 4686 in emission.

ASASSN

is All-Sky Automated Survey for Supernovae project , which will (eventually) automatically survey the entire visible sky every night down to about 17th magnitude

http://www.astronomy.ohio-state.edu/~assassin/index.shtml

The transcient page is located :
http://www.astronomy.ohio-state.edu/~assassin/transients.html

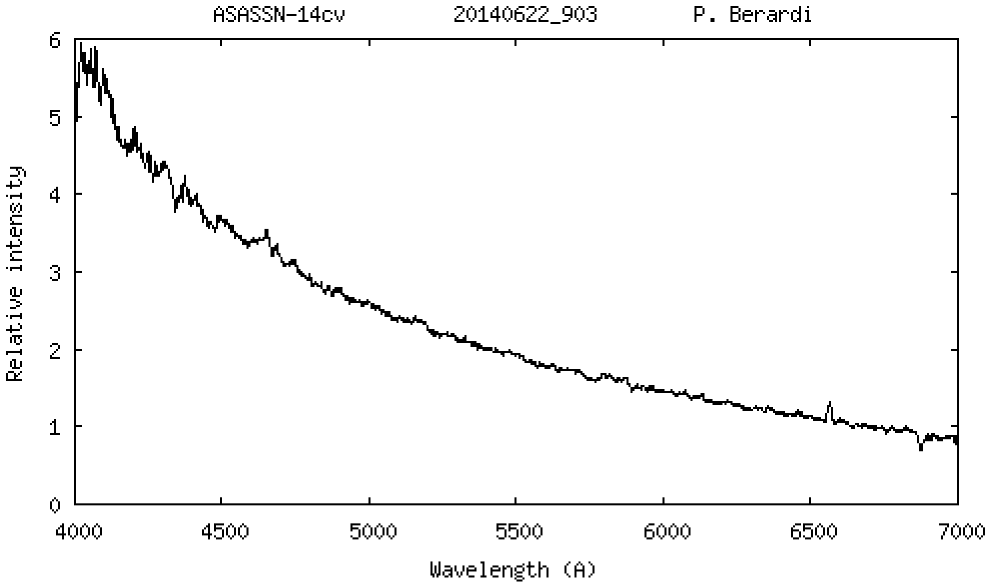


Spectrum obtained by T. Lester DK 31cm" Slit Spectroscop R = 1600
2014-06-16.2

ASASSN-14cv

ASASSN-14cv
Detected 2014-06-21.42 at mag 11
Spectroscopically identified as a cataclysmic outburst by P. Berardi and T. Lester

Coordinates (2000.0)	
R.A.	**17:43:48.58**
Dec.	**52:3:46.8**

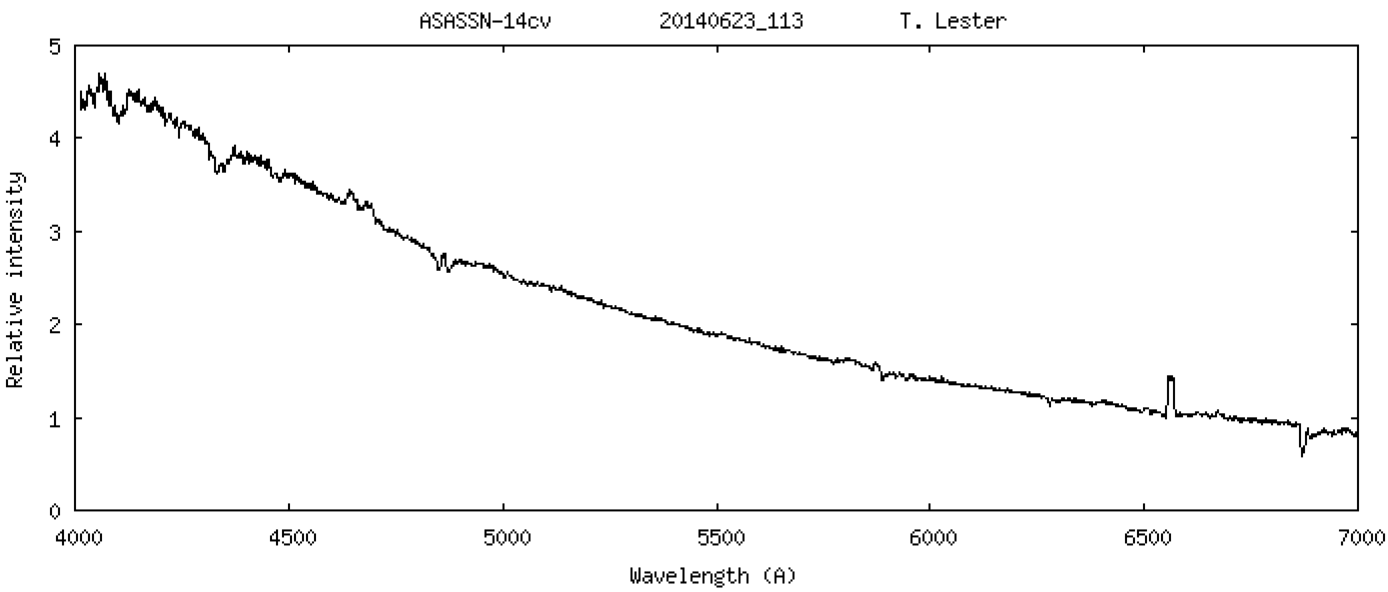


Spectrum obtained by P. Berardi
SC 9" Lhires 150 l/mm R = 700
2014-06-22.9 At mag = 10.3

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

ATel #6258; *Paolo Berardi, Tim Lester, Francois Teyssier (ARAS)*
on 23 Jun 2014; 18:48 UT
Credential Certification: Krzysztof Stanek (stanek.32@osu.edu)

We obtained two low-resolution optical spectra of ASASSN-14cv (vsnet-alert 17395, vsnet-alert 17402, vsnet-alert 17404) on June 22.9 UT using a 0.23-m Schmidt-Cassegrain telescope, Lhires III spectrograph configured for low-resolution (400-730 nm, res. 1 nm) and on June 23.1 using a 0.31-m DK telescope, slit spectroscope 600 l/mm (400-750 nm, res. 0.5 nm). The strong blue continuum, a relatively faint emission of H-alpha, a narrow component in a broad absorption for H-beta line, CIII/NIII 4640 blend and HeII 4686 in emission confirm that the object is a dwarf nova outburst.



Spectrum obtained by T. Lester DK 31cm Slit Spectroscop R = 1600 2014-06-16.2

Symbiotic stars and accretion phenomena in binary systems - Part 4.

Steve Shore **1/3**

More on mass transfer in binary systems: something about dwarf novae

So far, the accretion disk has been a sort of magazine, a storage place for matter that slowly drifts inward and accumulates on the central star. Were this the only thing that happens, they would be rather simple beasts. The only problem would be the origin of the viscosity that transfers energy and angular momentum. But were the disks merely passive, the observed accretion rate would suffice to answer the physical question of origin (or at least bound the values for any possible mechanism). This seems to be alright for Be stars, for which the mater is almost optically thin. But that is a mater of structure. So for this installment, let's look a bit more at what goes on in cataclysmic systems. By these I mean *any* system that has a white dwarf accreting matter. For the moment, I'll exclude neutron stars and black holes, although you can observe those even at medium resolution with your equipment (both aperture and spectrographs; I'll discuss an example later, OK?). These don't necessarily merit such an apocalyptic name but that's the field.

To return to the structure issue, assume for now that the central star dominates over any local gravity from the matter of the disk itself. This isn't a problem for those formed in cataclysmics. If you're transferring only a relatively small amount of mater at any time, and you know how much has to accrete, then it's easy to estimate how much can remain in the disk. A way of seeing this is to ask how much mss has to accumulate to produce a recurrent nova, since that triggers when a specific pressure is reached within the accumulated layer. If that's about 10^{-5} $M_{\odot}$, and these explode on timescales of a century (otherwise how would we know they're recurrent?) then the rate of mass transfer has to be about 10^{-5} $M_{\odot}$. yr^{-1} and that also means this has to transfer through the disk in that timescale. How much mass is actually accumulated on the star is estimated from the WD luminosity, if it comes strictly from loss of orbital kinetic energy and is released in a thin shock at the star's surface. This luminosity is proportional to the surface gravity times the mass accretion rate (well, to be honest, it's the rate of release of gravitational potential energy buy the infalling mass), so L ~ M' where M' is the rate of *mass accretion*. Actually, no matter where the energy is released, no more is available than the depth of the gravitational potential well into which the mass lost from the companion is falling. But there's a catch. The matter doesn't fall in radially so some accumulates within the disk. The maximum rate at which an object can accumulate mass also depends on whether the shock is optically thin (so it loses energy immediately and just arrives cold after the shock) or stays hot and radiates. The latter is the *thermal timescale* that depends on the amount of matter accumulated and its internal energy. Thermodynamically, this is the same as driving a steam engine too hard, heating it faster than it can get rid of the energy. The system becomes unstable and matter would be blown off. The same is then true if the *disk* is optically thick. If the rate at which matter releases energy generated by viscous drag -- internal frictional heating in a differentially orbiting disk -- then the disk itself becomes thermally unstable. This causes it to expand and contract, and depends on the opacity of the disk that, in turn, depends on the local temperature and column density. If the rate of accretion, the rate of supply from the companion, is too high, the disk goes unstable. But not throughout at once. The different regions are thermally connected and the heating waves propagate at the local sound speed (the thermal velocity of the gas particles). The disk locally inflates, its brightness increases, but the *spectral* interval in which this is seen depends on the disk temperature. That is higher for the inner than outer parts. This local disk inflation then shows up first in that portion of the spectrum at which that annulus radiates the bulk of its energy. The inner part does this in XRs, the outer in visible and IR ranges. The outbursts depend on how quickly the disk readjusts its structure and this is what you see in a {\it dwarf nova} outburst.

Actually, the process is amazingly simple and resembles the driving of a pulsating variable star, like an RR Lyr or δ Cep. There the instability is deep within the envelope and the entire star expands and contracts with an amplitude depending on radius. The seat of the instability is the convection zone, where the opacity is due to ionization of the principal elements (e.g. H, He) and becomes resonant when the convection zone is overlain by the right amount of mass to produce counteracting compression when it cools and falls back. In accretion disks this never globally organizes, the disk is orbiting at different rates and the heating isn't uniform. The thickness also depends on radius (the peripheral regions are thicker because the surface gravity is lower) so you have different parts of the disk triggering and then propagating the trigger while expanding and cooling.

The spectrum of the disk is a clue to this process. Accretion boundary layers are hot, that's where the last energy release occurs at the highest gravity locally, and also geometrically thin. So you expect XR emission and also very high ionization lines. The local energy release at greater radii is lower but the disks are both more extended and cover a greater area, hence the flux times the area is large and the regions above the local photosphere (in other words, the optically thick surface of the disk if it {\it is} optically thick) is like a chromosphere. Hence you see ionized species like He II 1640, 4686 ÅÅ and C IV 1550 Å. This is the origin of the common wisdom that He II signals the presence of a disk. The line profile, since the emission region is within a finite annulus that doesn't extend the full radius of the disk, looks like the profile of a ring -- two peals separated at about the orbital velocity for that annulus whose separation also decreases as the disk is seem more nearly face on. If seen through the plane, there can be absorption from the colder regions in the outer disk against the hotter inner regions, a true absorption (not scattering) process. It is quite amazing that there are long-running debates about whether this is seen in cataclysmic disks (I won't make any other comment!).

The timescale for the outburst is a thermal timescale, not just an oscillation time, and the events last as long as the imbalance between the rate of energy generation by viscosity and loss radiatively persists. The heating, by the way, is also simple to understand if you think of bending a spoon (remember, perhaps, Uri Geller??). If you do this slowly you don't do anything but slowly distort the handle. The faster you do it, the hotter it gets. This is because you're stressing the system and its response is strain. The rate of heating is the product of the rate of stressing and straining. The temperature rises because conduction can't keep up with the rate of energy generation so, eventually, the spoon breaks (and is very hot). A less drastic (and non-destructive) example is to put a rubber band between your lips and stress it. You'll feel the change in the temperature. In an accretion disk the rate of stress is directly proportional to the rate of strain, a similar situation to a spring following Hooke's law (the deformation is directly proportional to the applied force). So the heating varies like the {\it square} of the strain. And the strain is the same as the orbital frequency (in this case, Keplerian motion). I know this is getting nasty but don't worry, it's not much harder than whipping cream and imagining the entanglement of the polymers in the fluid. Since this depends on the distance (lower strain at greater distance) the outer disks are cooler since the energy generation rate is lower for the same mass accretion rte. Changing the viscosity causes the energy generation to vary, if it increases so does the local luminosity, and that's the hard part of understanding dwarf novae.

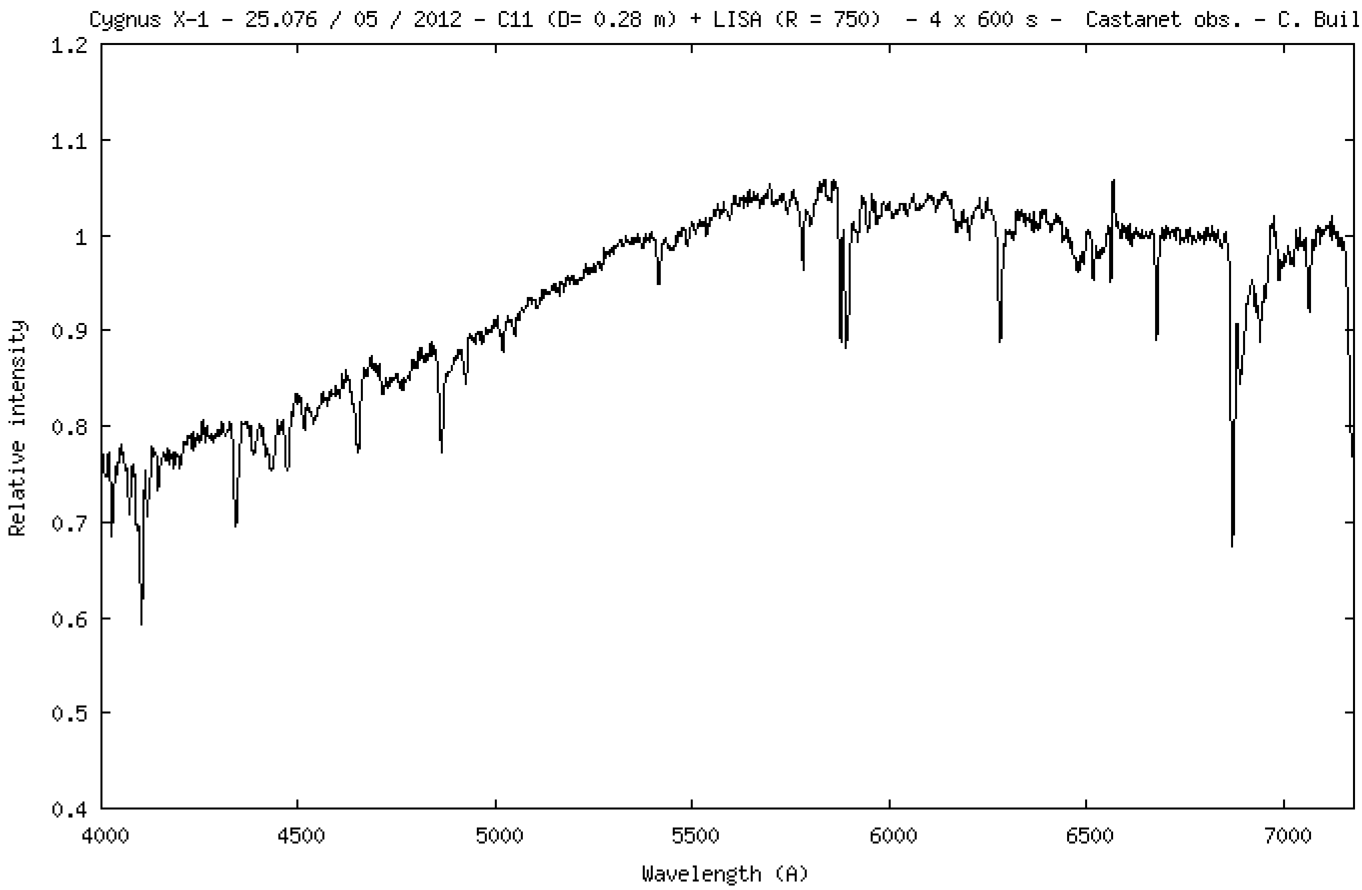
It appears that the dwarf novae have, therefore, optically thick disks that are unstable to a thermal oscillation (a sort of local pulsation). Whether this happens in novae is another mater. Such fluctuations, quasi-periodic in nature, were seen in GK Per 1091 in the decline phase and there and the compilations by the AAVSO show, from photometry, that other novae do this too. How this relates to the mass transfer rate and disk dynamics should then be clear -- nova disks may accumulate enough mass, in non-recurrent systems -- to become optically thick and unstable. But hardly all. Or, at some point during the decline, the re-initiation of accretion may drive the already engorged white dwarf envelope into an oscillation for a while. We don't know and, more important, there's little spectroscopy available of this stage to know. Even low resolution spectra are very valuable here and, since this occurs during outburst, would be possible even with small apertures (think of SS Cyg and U Gem, the two longest records we have of photometry).

The other observation that provides a limit on the mass transfer rate (neither accumulation nor heating) is the change in the period because of the slow drift of the center of mass. The angular momentum of the system changes because of mass loss and dissipation but that may be minor compared to the slow movement of the center of mass toward the mass gainer. Depending on the initial mass ratio, this leads to a change in the period. But you know that there are dissipative processes and, to return to the point at the start, there is also a sort of storage of the angular momentum transported by the stream within the disk. So it's a bit more complicates since if mass is thrown out of the system some of the angular momentum of the binary is also lost. That's where observations of the line profiles for novae and dwarf novae is also important, if there is a wind it can transport both mass and angular momentum out of the system. We don't know the magnitude of either loss or how the driving of the wind (if present) is connected to the heating. Superhumps, driven by tides and local heating, are a very important for this process but how is still being sorted out.

But for the moment, I'd better stop and let you take a breath.

a few comments on Cyg X-1

Now for a last teaser. I promised earlier to mention one black hole system for which your observations would be particularly interesting. Cyg X-1, also known (by Interpol) with the alias HD 226868, is an O supergiant - black hole system, the first discovered. TAt V=8.9, it's a bright source and not a difficult observation. The orbital period is 5.6 days making it an ideal candidate for monitoring. This was the first high mass XR binary to be discovered with a BH companion (Bolton 1972), with an inferred mass well above the upper limit for a neutron star (it's about 10 $M_{\odot}$ depending on the mass of the O supergiant). The system is highly variable over decades, going into outbursts that depend on the mass accretion rate and the optical thickness of the disk. And since it has a black hole at its center, the phenomena under what is called ``strong gravity'' dominate the inner disk structure. This includes dragging of the inner



Cygnus X- 1 by Christian Buil - 2012-05-25.076 - R = 750

Recent publications

Novae

On the Effect of Explosive Thermonuclear Burning on the Accreted Envelopes of White Dwarfs in Cataclysmic Variables
Edward M. Sion
http://arxiv.org/abs/1406.5455

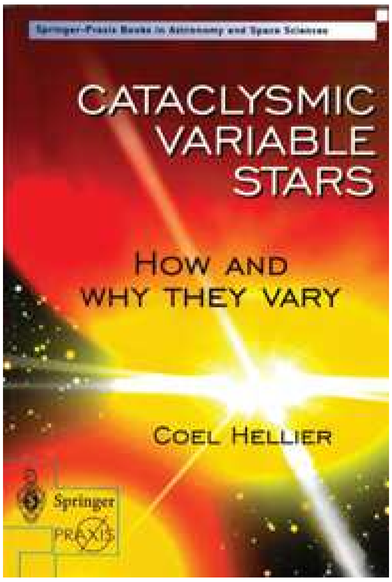
Symbiotics

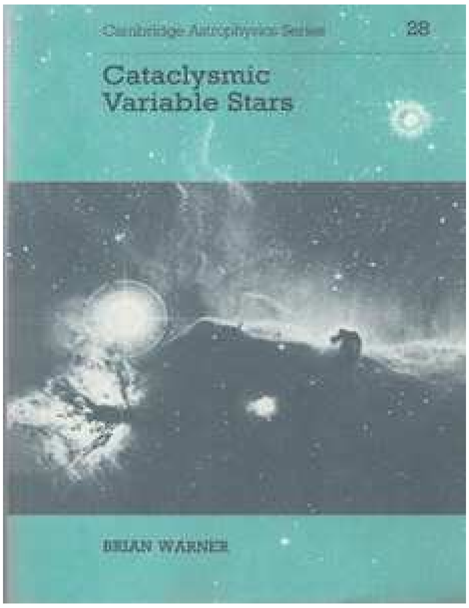
Outburst activity of symbiotic system AGDra
Ladislav Hric, Rudolf Galis, Laurits Leedjarv, Marry Burmeister, Emil Kundra
http://arxiv.org/abs/1406.5505

Supernovae

Analysis of blue-shifted emission peaks in type II supernovae
J. P. Anderson &al.
http://arxiv.org/abs/1404.0581

Constraints on the explosion mechanism and progenitors of type Ia supernovae
Luc Dessart, Stephane Blondin, D. John Hillier, Alexei Khokhlov
http://arxiv.org/abs/1310.7747





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!

Other ARAS subjects :

Be Stars

2014 May monthly report :
http://www.astrosurf.com/aras/surveys/beactu/report2014/BeSS%20report_mai2014.pdf
Ans previous issues :
http://www.astrosurf.com/aras/surveys/beactu/index.htm

RR Lyrae 2014 campaign

The campaign is described in
http://rr-lyr.irap.omp.eu/dokuwiki/doku.php?id=rrlyr2014
Recent publication in MNRAS (http://cdsads.u-strasbg.fr/abs/2014MNRAS.441.1435L)

The historical vanishing of the Blazhko effect of RR Lyr from GEOS and *Kepler* surveys

J. F. Le Borgne,[1,2,3*] E. Poretti,[1,2,3,4] A. Klotz,[1,2,3] E. Denoux,[3] H. A. Smith,[5] K. Kolenberg,[6,7] R. Szabó,[8] S. Bryson,[9] M. Audejean,[10] C. Buil ,[11] J. Caron,[12] E. Conseil,[13] L. Corp,[3,14] C. Drillaud,[13] T. de France,[14] K. Graham,[14] K. Hirosawa,[15] A.N. Klotz,[3] F. Kugel,[12] D. Loughney,[16] K. Menzies,[14] M. Rodriguez,[17] and P. M. Ruscitti[18]

Contribution to ARAS data base
From 01-06 to 30-06-2014

P. Berardi
T. Bohlsen
D. Boyd
A. Garcia, J. Guarro
K. Graham
T. Lester
J. Montier
F. Teyssier

Submit your spectra

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

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

Exemple: _chcyg_20130802_886_toto.fit

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

Further informations :
Email francoismathieu.teyssier at bbox.fr

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