

# ArasBeam : When Amateurs Contribute to Be stars research

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ArasBeam is available at <http://arasbeam.free.fr/>.

**Abstract** : Since 2003, the amateur astronomical community has decided, in collaboration with the Paris-Meudon Observatory (GEPI) to coordinate their observations to get the best spectral survey of Be stars as possible. Be stars are a good example of Professional / Amateur collaborations, in which amateur observations are very useful to professional studies. Indeed, amateur spectroscopists are numerous, dispatched over the world, and available very quickly. This is why they can provide observations that are complementary to professional observations. Several spectrographs have been developed for amateurs, with resolution up to  $R=20.000$ , a database for amateur and professional Be star spectra, BeSS, has been created, and tools have been developed. Among them, ArasBeam is a web-based tool designed to organize amateur Be spectral observations. It is available at <http://arasbeam.free.fr>. In ArasBeam a very simple color coding indicates to any observer which stars must be observed on the following night to get the best possible survey of Be stars. So far, more than 10.000 amateur spectra have been collected in BeSS. About all bright Be stars ( $V < 8$ ) listed in BeSS and visible from the Northern hemisphere have been observed at least one time. In addition, 6 outbursts have been detected by amateurs in the last 2 years.

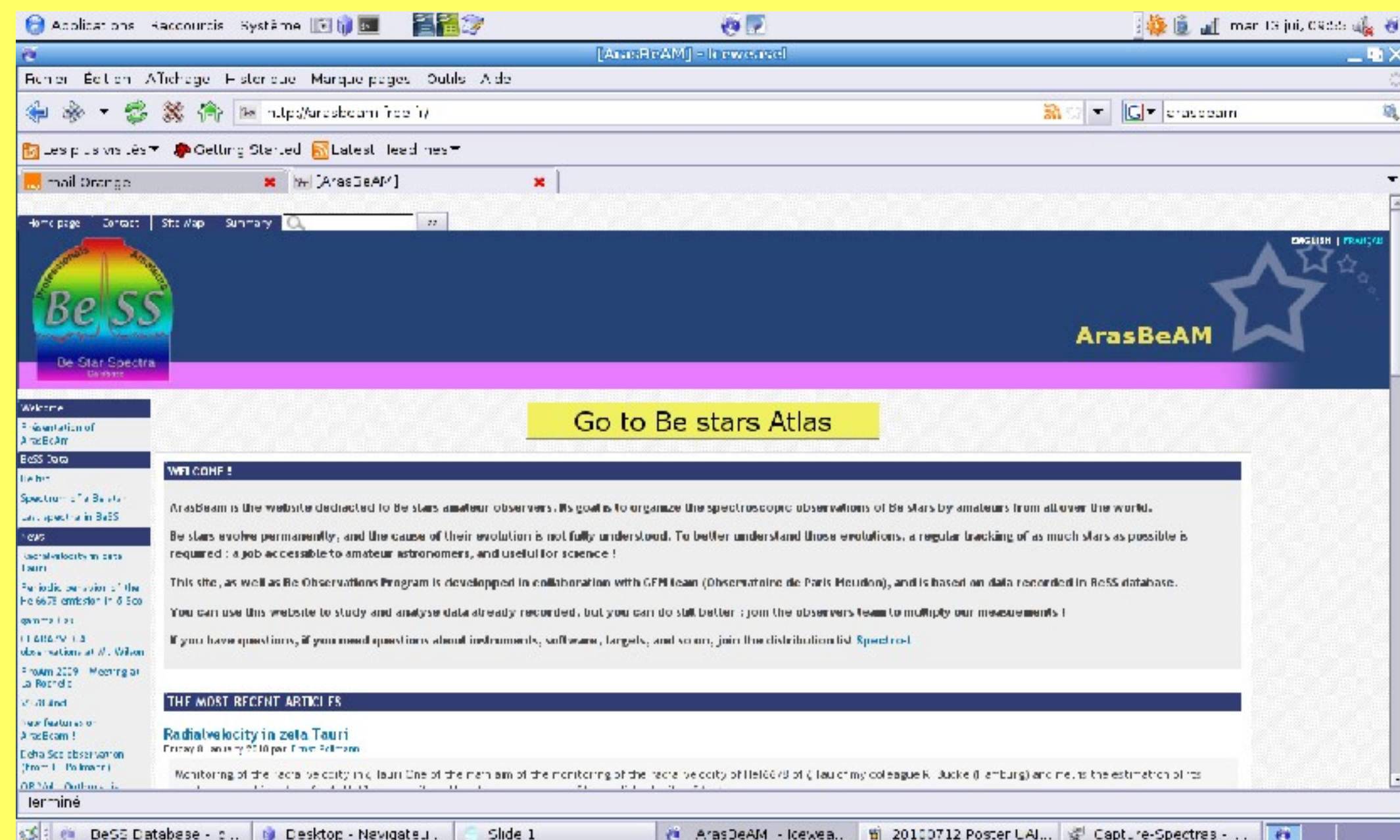


Fig. 1 – ArasBeam homepage

List of Be stars with Magn lower than 9  
Limit Destination : -25  
Only H $\alpha$  spectra are taken into account

4/6 objects

Star	HD #	RA	DEC	Magn.	Tot nb	1 year	2 months	Last	Obs Period
del Sui	143275	+16 00 20.0	-22 37 18.2	2.29	47	68	24	20-0-06-30 21:10:08	7
gam Cas	5194	+00 56 42.5	+60 43 03.1	2.39	793	79	8	20-0-07-07 22:50:15	180
PHECDA	103287	+1° 53 49.8	+53 4° 41.7	2.43	24	14	10	20-0-06-29 22:55:19	365
zet Oph	149757	+16 37 09.5	-10 34 01.5	2.58	25	5	2	20-0-06-06 03:14:27	365
ALCYONE	23630	+03 47 29.1	+24 06 18.5	2.87	27	8	0	20-0-02-05 17:05:33	365
eta CM1	58715	+07 27 09.0	+08 17 21.5	2.89	30	8	0	20-0-04-27 23:25:07	60
zet Lau	37252	+05 37 38.7	+21 08 33.2	3.03	73	53	0	20-0-04-28 23:23:23	60
ALFIRK	205021	+2° 28 39.6	+70 33 38.4	3.22	217	130	1	20-0-06-30 01:19:09	365
33s Cas	11415	+0° 54 23.7	+63 40 12.4	3.34	14	8	0	20-0-03-14 18:49:19	365
eta Ori	55411	+05 24 28.6	+02 23 49.7	3.38	9	4	0	20-0-03-09 18:24:37	365
SHF10A	174438	+18 50 04.8	+33 7° 45.6	3.57	69	37	15	20-0-07-03 22:53:48	365
em1 And	711675	+73 01 55.3	+42 1° 9 33.5	3.63	21	6	0	2003-09-11 03:44:04	365
ELECTRA	23902	+03 44 52.5	+24 04 48.0	3.71	20	5	0	20-0-02-15 18:12:53	365
em1 Her	146014	+18 07 32.6	+28 45 45.0	3.84	10	2	1	20-0-06-05 23:13:14	365
cap Dra	109387	+12 33 28.9	+69 47 17.7	3.88	45	27	3	20-0-06-29 21:04:28	365

Fig. 2 – Color coding for observation priority

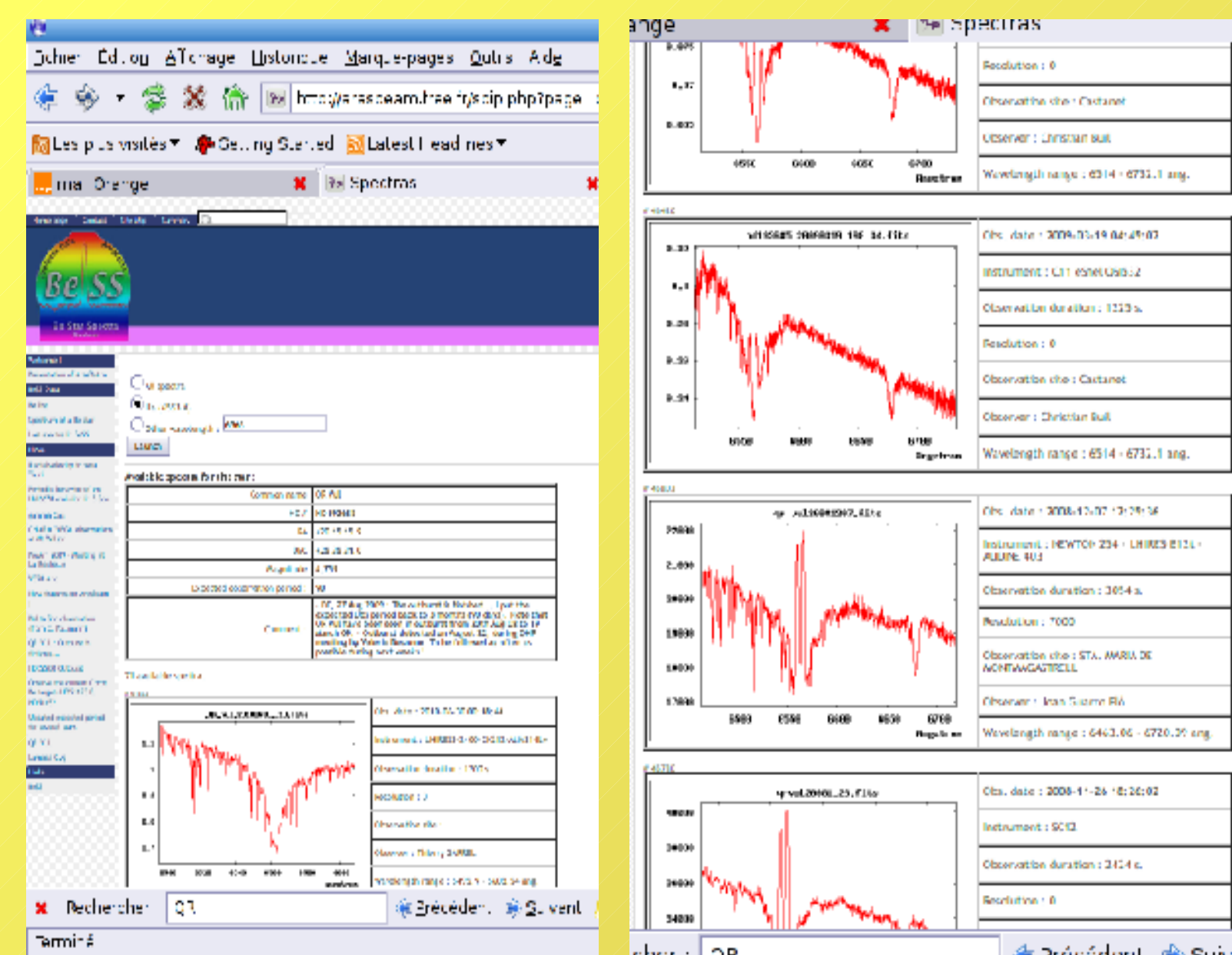


Fig. 3 – displaying spectra (QR Vul outburst)

## Amateurs, spectroscopy and Be stars

Be stars are easy targets for small instruments (300 stars up to magn 8, northern hemisphere), their spectra evolve at different timescales (from days to years), periodically or with random outbursts. These stars require a continuous observation, to better understand the Be phenomenon.

The amateur community has developed several tools to contribute to Be spectroscopic observations :

- spectrographs, like Lhires III or eShel (see Poster Poster S3-05),
- software for spectra processing (Iris, RLhires, VisualSpec, Audela...),
- and ArasBeam, a web based tool to coordinate Be observations.

Our spectra are uploaded in BeSS database (see Poster Poster S3-06).

We have a mailing list : Spectro-1 (<http://groups.yahoo.com/group/spectro-1>)

## Amateur Be Observation Program is simple :

- Focus on H $\alpha$
- Observe all Be stars up to mag 8 at least once a year.
- Detect Be outbursts, and track them intensively.
- Of course, amateurs are ready to observe specific targets upon request.

ArasBeam is to coordinate amateur observations : this is when amateur works together, that they become really complementary to professionnals.

## The tool

ArasBeam is a website developed and administrated by amateurs.

Main features are :

- Show the list of Be stars from BeSS catalog, with dynamic sorting keys.
- Display all existing BeSS spectra for a given Be star.
- Define an expected observation period for each Be star, depending on its activity. By default, this period is one year.
- Give a priority for observations, based on expected period and latest observation. This is made with a visual color coding (see fig. 2).
- Give some news on Be observations (this is a multi-authors platform).

## Current results :

- 31 amateur observers recorded in BeSS (mainly in Northern hemisphere).
- About **11.000 amateur spectra** have been uploaded in BeSS so far.
- **2850** of them are focused on **H $\alpha$** .
- 295 Be stars **up to mag. 8** have at least one spectra. This is 97% of the BeSS catalog up to magn. 8 for Northern hemisphere.
- **6 outburst** have been detected in 3 years of observations : QR Vul, HD 22780 (Fig. 4), Lam Cyg, Lam Eri, HD 37149 and HD 34959.
- 5 other Be stars, known as highly active have a high observation rate : Theta Crb, 66 Oph, V1040 Sco, HD 57682.
- 17 stars have more than 10 spectra in the last year.

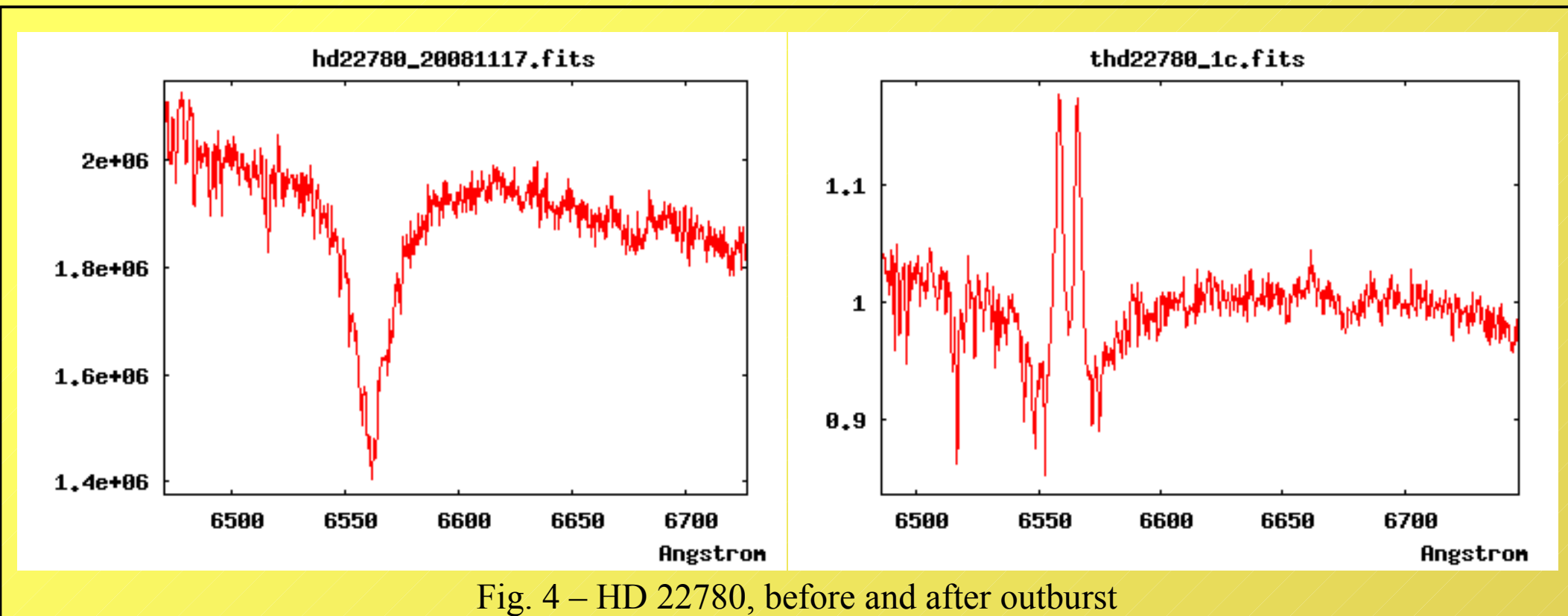


Fig. 4 – HD 22780, before and after outburst

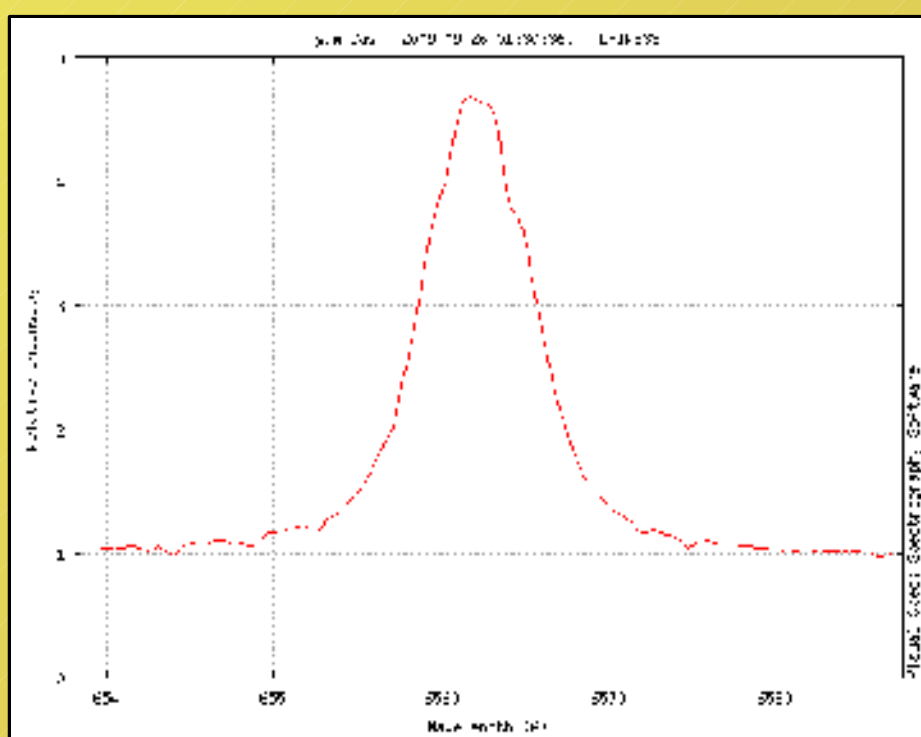


Fig. 5 – Gam Cas

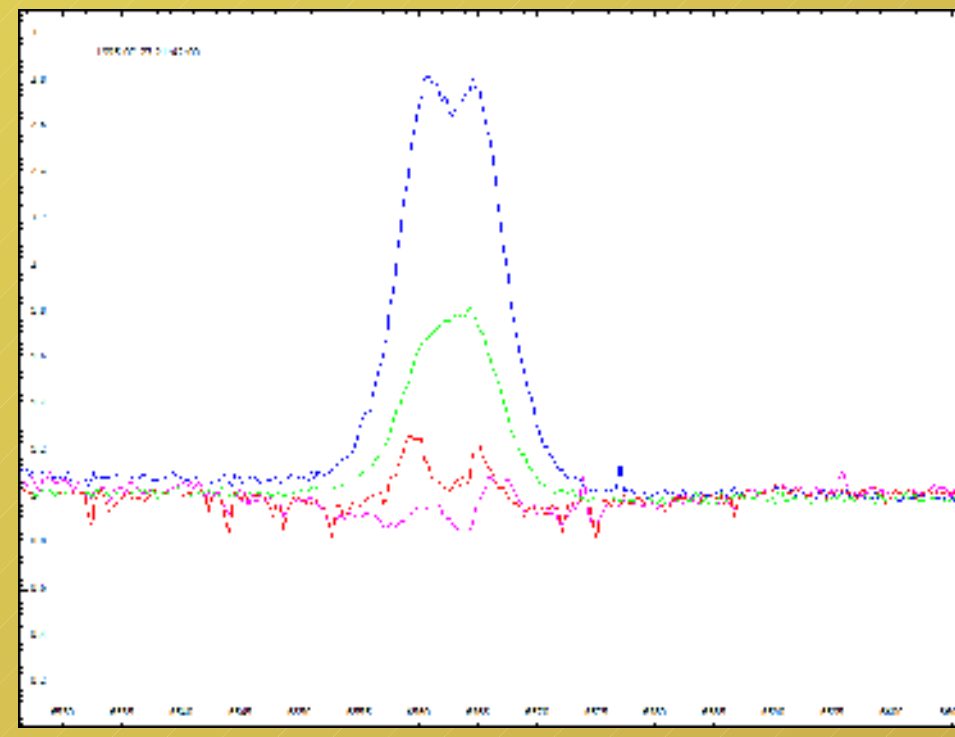


Fig. 6 – 25 Cyg evolution

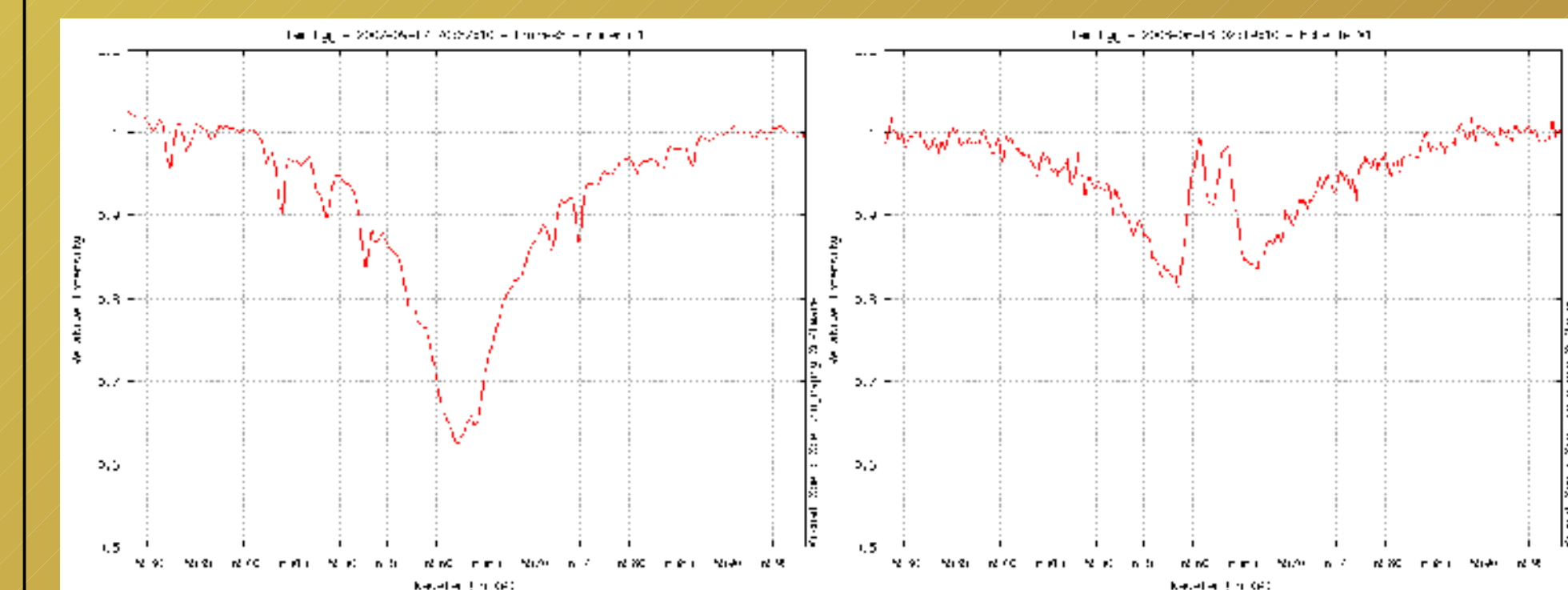


Fig. 7 – Lam Cyg, before and after outburst

## Next steps :

- Make almost every day Be stars spectra - at least one on each Be mag <8 every six months
- Increase Be stars spectra time coverage, using the spectro-1 list to engage observers around the globe and updating the alert web page
- Organizing training class (such as OHP spectro star parties in august - <http://astrosurf.com/thizy/ohp2010/>)
- Continuously communicate on this program in amateur meetings and symposiums
- Analyze the current data to optimize the expected observation period for each Be star, depending on its activity and some key data.

## Conclusions :

Spectrography is quite new to amateur astronomers. But this activity is growing fast, and is now mature. The data we've collected during last years are very complementary to professional data : we're limited in magnitude and SNR, but we have a much better time coverage, for a high number of stars.

Knowing that about 80% of professional observations are made in spectroscopy, we can easily understand that when amateurs start working in this area, this opens a lot of opportunity for new Pro / Am collaborations. Be star observation program is a perfect example of such a successful collaboration.

This program have been made possible thanks to an active work on both sides, amateur and professional.