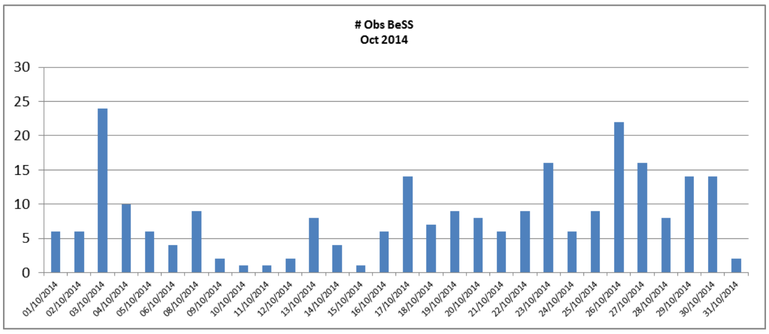
BeSS report – October 2014

Data compiled by Valérie Desnoux
Do not miss the new section on the Be projects by Ernst Pollmann [here]

Observateur	Nb spec
Pujol	100
Buil	42
Guarro Fló	22
Graham	17
Sawicki	16
MontigianiMannucci	12
Fosanelli	8
HOUPERT	7
Bohlsen	5
Berardi	4
Pollmann	4
GARREL	4
Heidemann	2
LAILLY	2
Powles	2
Sollecchia	2
Leonardi	1
Total général	**250**

- 250 H-alpha spectra acquired
- 140 objects observed
- 17 observers contributed

The most observed objects were gam Cas, pi Aqr and V2136 Cyg, lam Cyg, V442 And



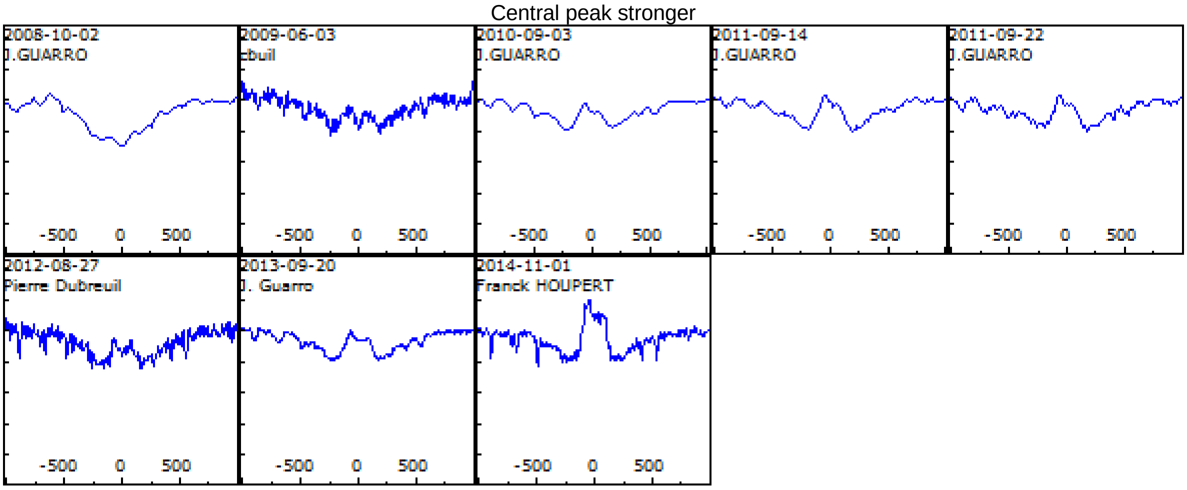
Objects observed

Classique								**?**	**Herbig**
pi Aqr	HD 6343	HD 205060	kap Aql	KX And	28 Cyg	V2163 Cyg	10 Cas	V594 Cas	V1578 Cyg
gam Cas	18 And	NN CMa	AX Mon	V868 Ara	HD 21641	LQ And	HD 196712		AB Aur
phi Per	omi And	HD 44996	11 Cam	HD 205551	16 Peg	43 Ori	HD 61224		
V442 And	eps Cas	V1150 Tau	HD 37352	HD 223387	HD 50820	bet Psc	HD 50658		
lam Cyg	zet Tau	20 Vul	HD 13867	V378 And	tet Ari	HD 232590	HD 20017		
V2136 Cyg	HD 17505	HD 21650	V549 Per	lam Eri	EW Lac	iot Lyr	ALCYONE		
PLEIONE	V1369 Ori	HD 23800	psi Per	HD 206773	120 Tau	HD 21620	HD 71072		
omi Cas	QR Vul	HD 62367	HD 225095	LZ Del	V1165 Tau	omi Her	eps Cap		
60 Cyg	Menkhib	EM* CDS 1215	8 Lac B	HD 20340	HD 232552	V2162 Cyg	HD 163007		
HD 207232	ups Cyg	HD 23552	V397 Lac	V413 Aur	V357 Lac	HD 39018	MEROPE		
omi Aqr	HD 21455	V439 Cep	HD 224544	ALFIRK	HD 22780	12 Aur	V817 Cas		
MZ Aur	nu Cyg	bet Mon A	V532 Lyr	V923 Aql	CW Cep	V801 Cas	V423 Lac		
phi And	2 Cet	BD+40 4353	228 Eri	KY And	V420 Pup	CT Cam	HD 195554		
FF Cam	25 Peg	V434 Aur	HD 4931	HD 18552	HD 21362	HD 194057	HD 13669		
59 Cyg	8 Lac A	HD 216057	66 Oph	14 Lac	V764 Cas	FR CMa	EM Cep		
eta Ori	SHELIAK	BK Cam	V978 Cas	BD+44 3594	2 Ori	HD 179253	NT Peg		
HD 208682	HD 169999	V696 Mon	V420 Aur	HD 199218	HD 29866	HD 20134	6 Cep		
V742 Cas									

Emission increase since last observations

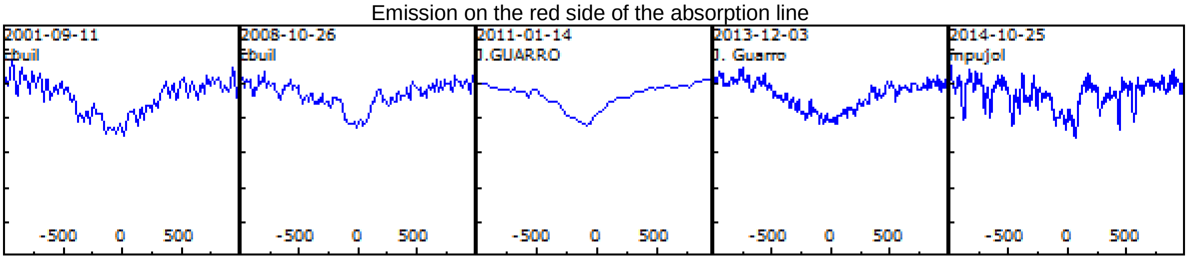
HD 189689

Central peak stronger



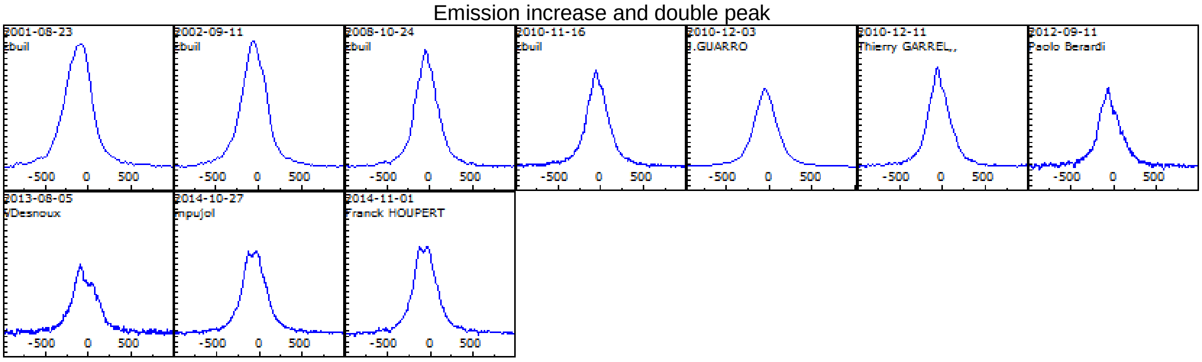
HD 20340

Emission on the red side of the absorption line



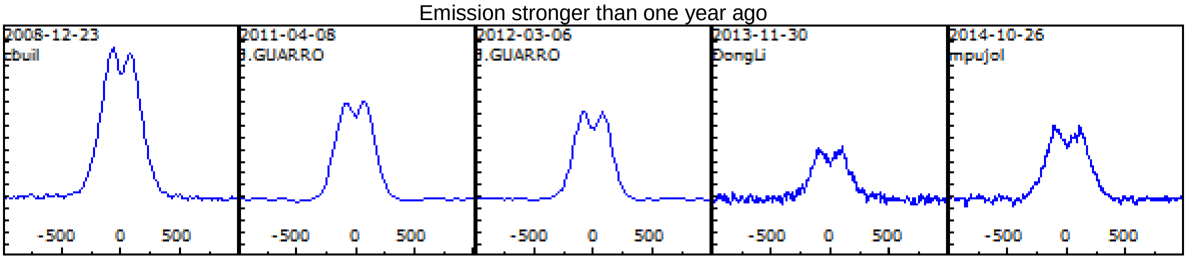
HD 232552

Emission increase and double peak



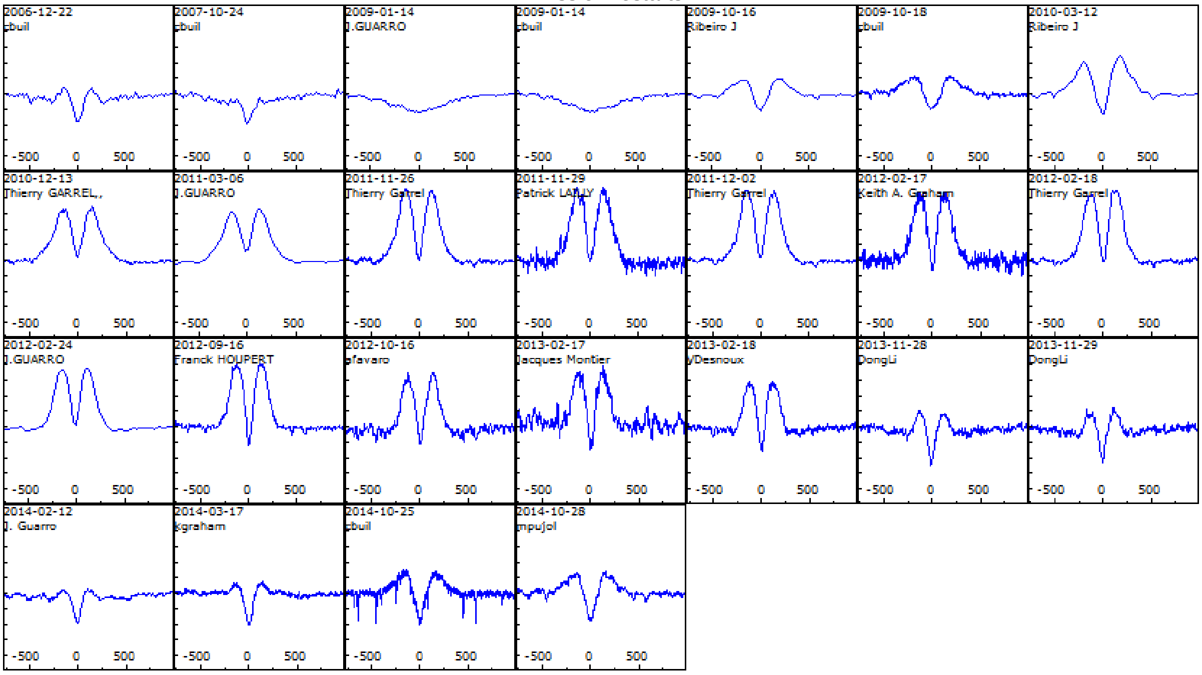
V 434 Aur

Emission stronger than one year ago



V1369 ori

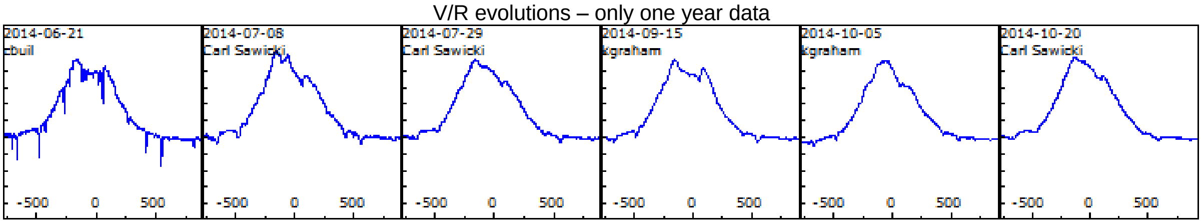
Emission restarts



Moderate evolutions of H-alpha line

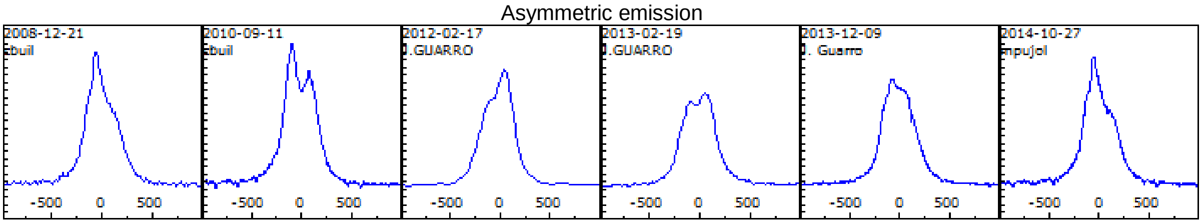
59 Cyg

V/R evolutions – only one year data



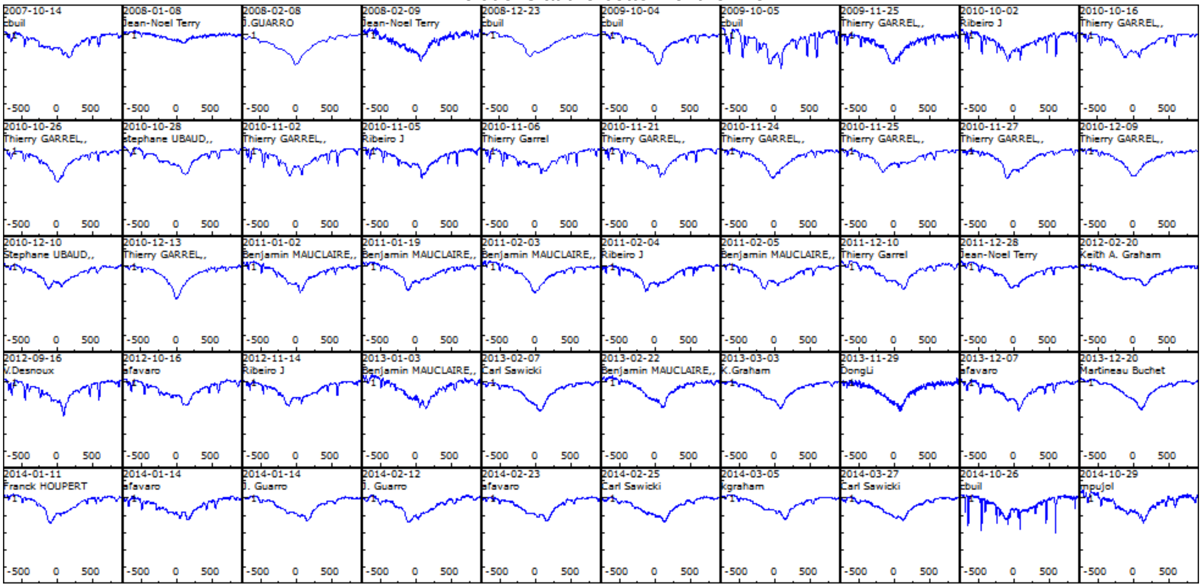
V1150 tau

Asymmetric emission



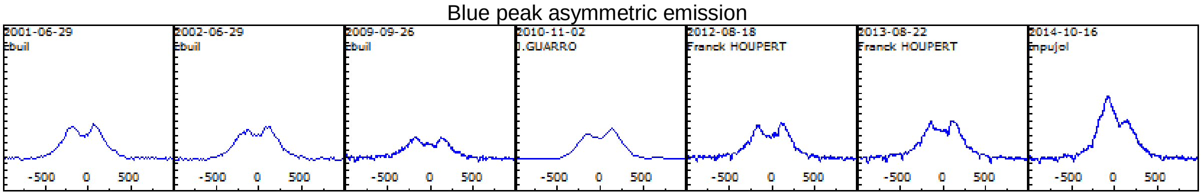
Eta Ori

Evolutions at the bottom of the line



V2162 Cyg

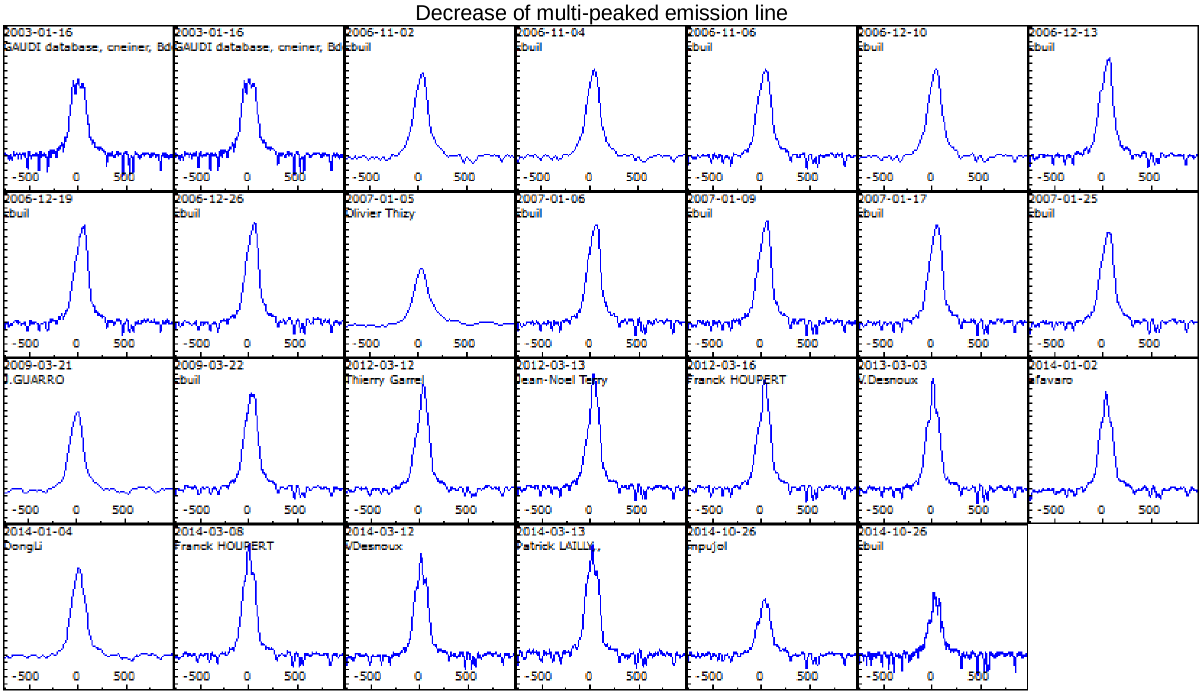
Blue peak asymmetric emission



Emission decrease of H-alpha line

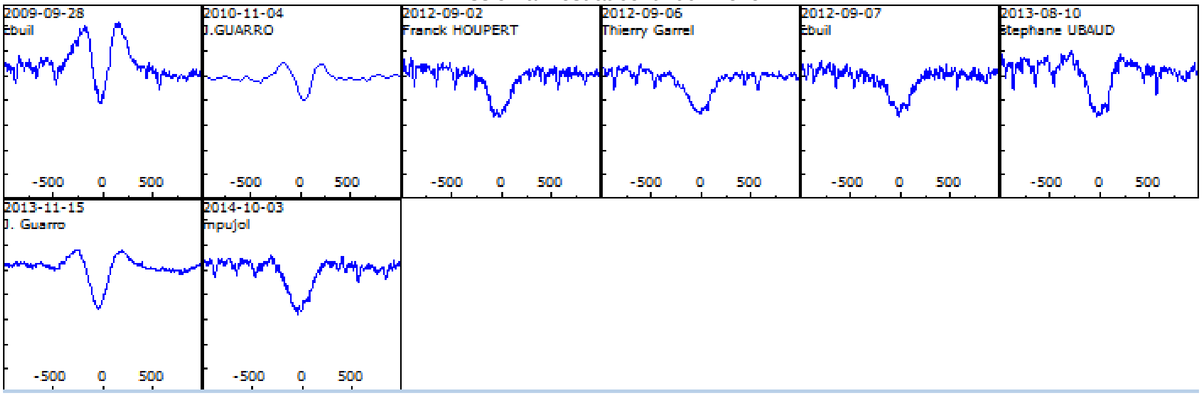
HD 50820

Decrease of multi-peaked emission line



V439 Cep

Emssion almost at continuum level



Be monitoring projects

By Ernst Pollmann

Long-term monitoring of Hα emission strength and photometric V magnitude of γ Cas

(by E. Pollmann[1], W. Vollmann[2] & G. W. Henry[3]) published in IBVS No. 6109

[1] Emil-Nolde-Strasse 12, 51375 Leverkusen, Germany
[2] Dammäckergasse 28/D1/20, A-1210 Wien, Austria
[3] Center of Excellence in Information Systems, Tennessee State University, Nashville, USA

After the discovery of Be stars (Secchi,1867) these stars were systematically monitored in long-term observing programs. Today we know that their spectra vary on timescales of a few days up to several decades. The Hα and Hβ emission lines in particular can sometimes vary unpredictably and dramatically in strength and appearance. An international group consisting mainly of members of the ARAS spectroscopy group (www.astrosurf.com/aras/) has been observing the Hα emission line strength of the disk of the Be star γ Cas from the year 1994 up to now (2014) (Smith et al. 2012). They continue the professional observations carried out from August 1971 to October 1989 (Horaguchi et al. 1994 and Miroshnichenko et al. 2002) and together cover more than 40 years of data (Fig.1).

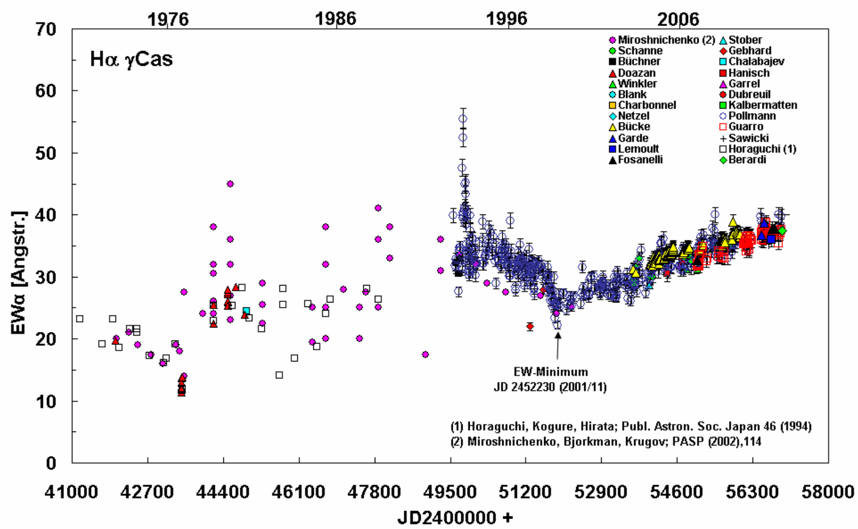


Fig.1: Hα EW long-term monitoring by professional and amateur observers from August 1971 up to today (2014). EWα is the Hα equivalent width – for its definition refer to Pollmann and Rivinius (2010).

The idea to investigate a possible correlation between the visual magnitude and the spectroscopic Hα equivalent width (EW) emerged from the study of the relationship between γ Cassiopeia's X-ray emission and its circumstellar environment of Smith et al. (2012). The results of the investigation of the X-ray production of the star and its relationship to the intensity of the Hα emission of the disk (Smith et al. 1998) were an additional incentive for our study. Essential to our study was the availability of high precision V magnitudes for a comparable time frame with the spectroscopic Hα EW measures. Fortunately we were able to use the photometric Vmag measures of G. Henry for the time period JD 2451085 to JD 2456702. They are complemented by DSLR measures of W. Vollmann (JD 2455154 to JD 2456671) and CCD & Jonson-V-filter of J. Guarro. The Vmag measures by G. Henry were already used in the study "Rotational and cyclical variability in γ Cas" (Smith, Henry, Vishniac, 2006; Henry, Smith 2012). The observations were carried out for 15 years with the 40cm "Automated Photometric Telescope" APT in Arizona. The accuracy of the DSLR & CCD measures is ± 0.02 mag, while the photoelectric APT measures are accurate to ± 0.005 mag.

The spectroscopic observations are done by members of the international amateur spectroscopic community. They have been carried out since 1994 with CCD's and telescopes of 20 to 40 cm aperture, first with prism spectrographs then with slit spectrographs with a resolution R between 5000 and 17000. The measurement of the Hα EW was done generally in the wavelength range 6530 to 6610 Å with an accuracy of ± 3% for the measures of a night (reproducibility of evaluation of two to three sum spectra per night). Today it is well known that most Be stars are photometric long-term variables, and that at least two characteristic behaviours can be recognized in cases in which simultaneous photometry and optical spectroscopy are available: positive and inverse (negative) correlation between the Balmer emission strengths and the star brightness (Harmanec, 1983). Indeed, a positive correlation has been observed in several Be stars (e.g. 28 Tau: Pollmann et al. 2012; κ Dra: Juza et al. 1994; 4 Her: Koubsky et al. 1997) as their Hα emission gets stronger when their photometric V magnitude increases.These stars are not only seen pole-on but also from different viewing angles. Our study builds on the work by Pollmann et al. (2012) which used visual magnitude estimates which are superseded now by the significantly more accurate photoelectric measures with the APT. Fig. 2 shows the light curve of γ Cas based on the APT measures by G. Henry, complemented by the DSLR measures of W. Vollmann & J. Guarro in 17 observing seasons.

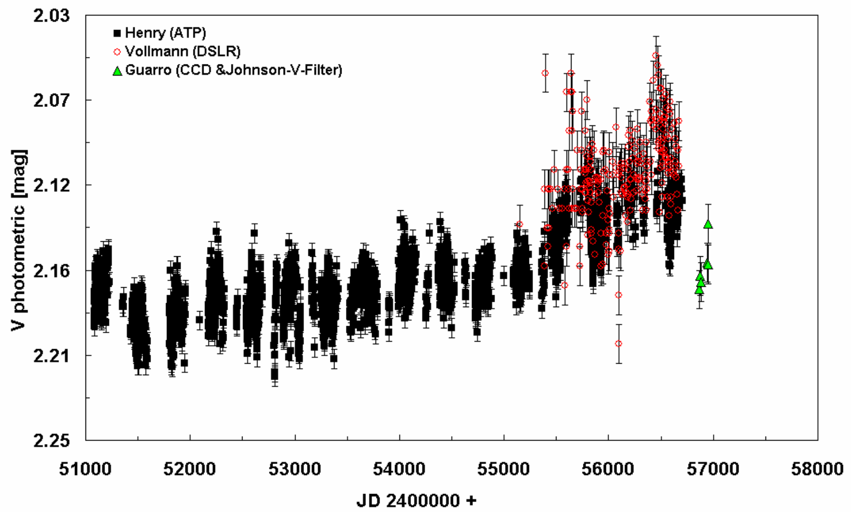


Fig.2: Johnson V mag of γ Cas, measured with the APT telescope, DSLR & CCD

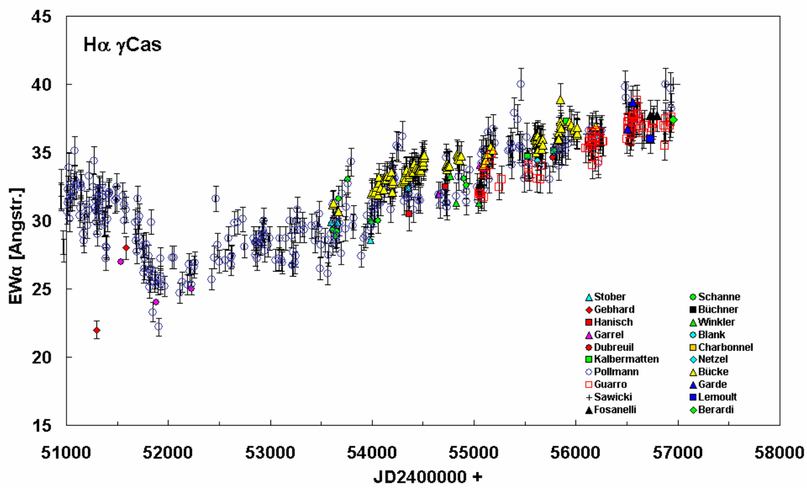


Fig.3: EW for the same time period as the photometric measures in Fig.2 (section of Fig. 1).

Fig. 3 shows the variable intensity of the Hα EW for the same time span as Fig. 2. To makes the visual hints for a correlation between the spectroscopic and photometric time series in these figures and already noted in the studies by Pollmann et al. (2012), Juza et al. (1994); and Koubsky et al. (1997)

more concrete, we averaged the data for every observing season (see table in Fig. 4) and plotted them in a correlation diagram (Fig. 4). Hence, a correlation coefficient of 0.86 could be derived for the correlation between the Hα EW and V magnitude.

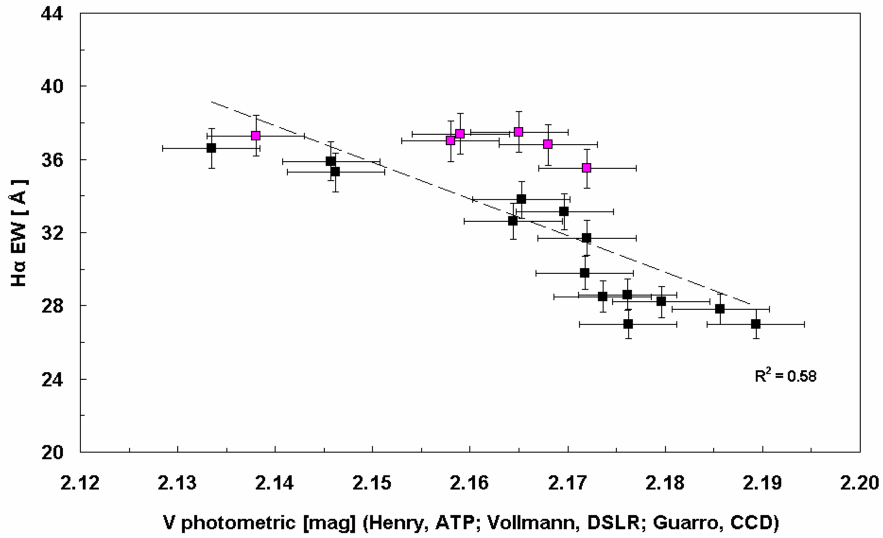


Fig.4: Correlation diagram of Hα equivalent width EW versus V magnitude (explanation in the text).

The correlation coefficient of 0.58 in the diagram of Fig. 4 is based primarily on the precision photometric APT measures. The further monitoring will show how this coefficient will improve in the future. The physical cause for the correlation results from the fact that Hα EW is an indicator for the variability of the size, volume and density of the disk around the star, which also gives rise to brightness variations (cf. Pollmann et al. (2012), Juza et al. (1994), Koubsky et al. (1997).

Before our study, it was questionable if magnitude variations of γ Cas would be detectable since we see its disk from a viewing angle of about 45 degrees. However, our data show that the increase of the Hα EW by ca. 10 Å observed during the last 15 years was accompanied by a slight magnitude increase of 0.06 mag. Our observations give evidence for a non-linear relationship between the Hα EW and the V magnitude but it is unknown how long their increase will continue in the future.

The very first investigation of this kind was conducted by Doazan et al. (1983).Their investigations shows, that during and after the spectacular episode of the Be phase from 1932 to 1942, the Balmer lines and the brightness followed the same trend of variations (see Hα in Fig. 5). New correlation model calculations of Hα EW and UBV photometry for Be stars with increasing disk sizes and/or an increasing disk density of Sigut & Patel (2013) are able to explain the positive and negative correlations between long-term variations in Hα EW and V brightness as observed for well known Be stars (Harmanec1983). However, the need for real observations to examine and refine the model calculations was expressed explicitely. We provide it here.

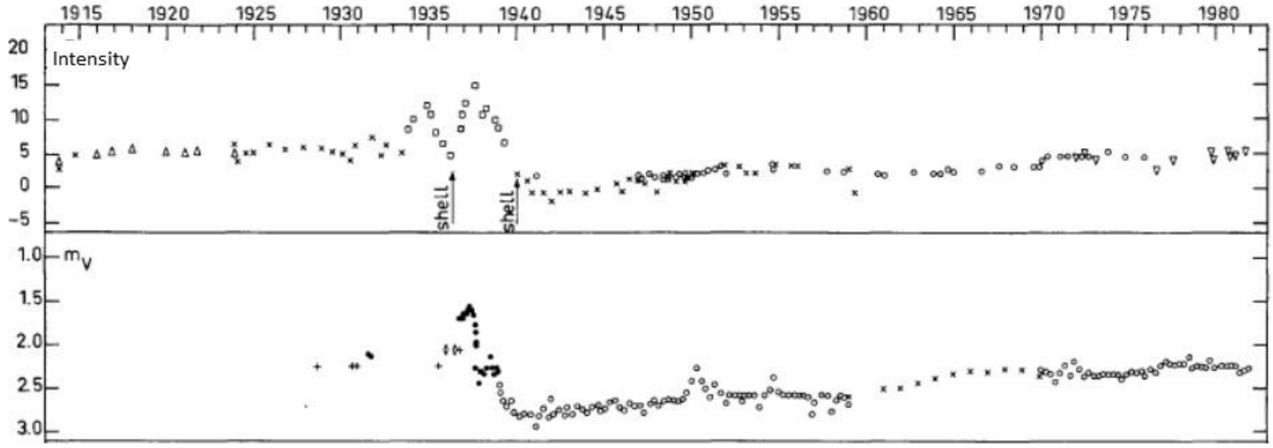


Fig. 5: Long-term variations of γ Cas in the visual region: (top panel) intensity variations of the Balmer emission lines (squares: Hα); (bottom panel) long term variations of the visual brightness; (from: Doazan et al., Second IUE European Conference, ESA-SP 157, p. 145).

Acknowledgements
We are grateful to Dr. Dietrich Baade (ESO, Munich) who´s critical comments did lead to a clear improvement of this work and to Dr. Myron Smith for the fruitful discussions.

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Remark:
The published original report has been modified because of new additional Vmag measurements of Joan Guarro.

Authors

Valérie Desnoux
Valerie.desnoux@free.fr
Aras Site at http://www.astrosurf.com/aras/
BeSS database at http://basebe.obspm.fr/basebe/
ArasBeAM portal at http://arasbeam.free.fr/

Ernst Pollmann
ernst-pollmann@t-online.de
International Working Group ASPA
Active Spectroscopy in Astronomy
http://www.astrospectroscopy.de
http://www.astronomie.de/astronomische-fachgebiete