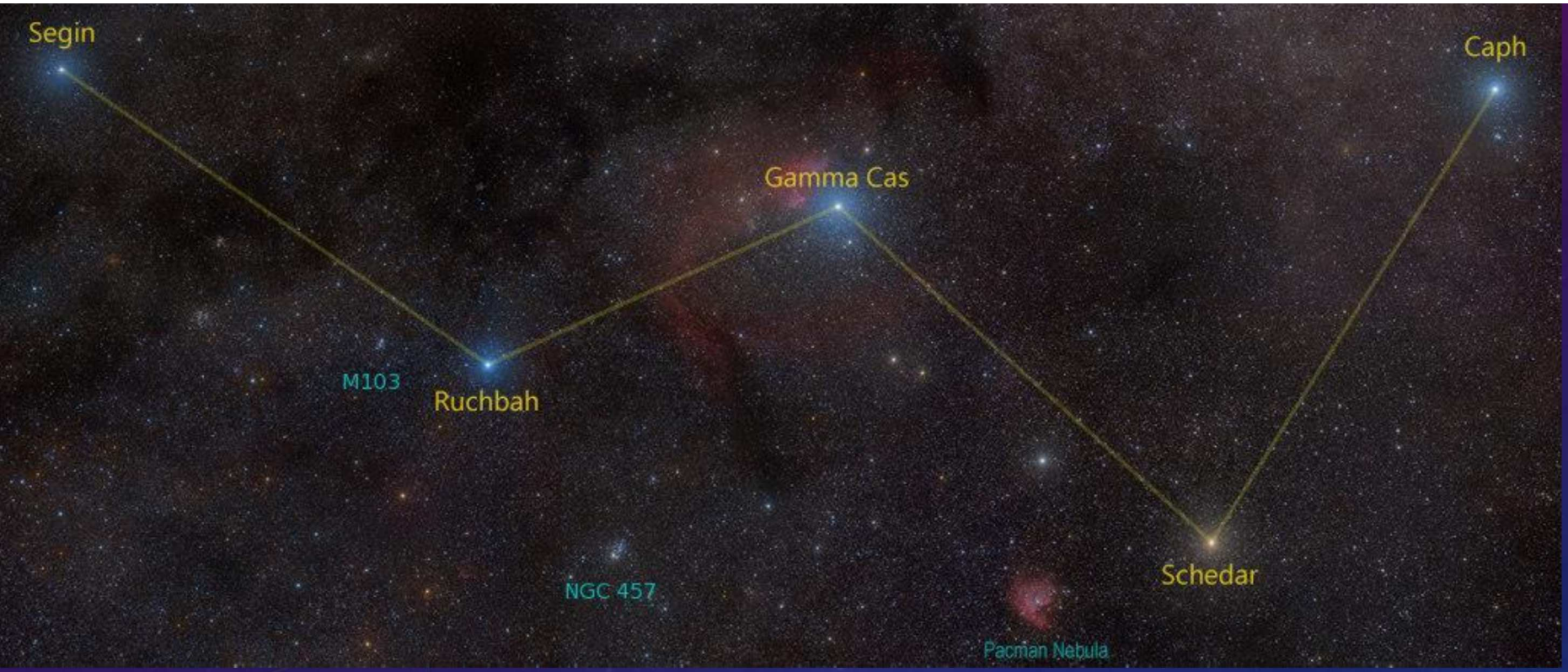
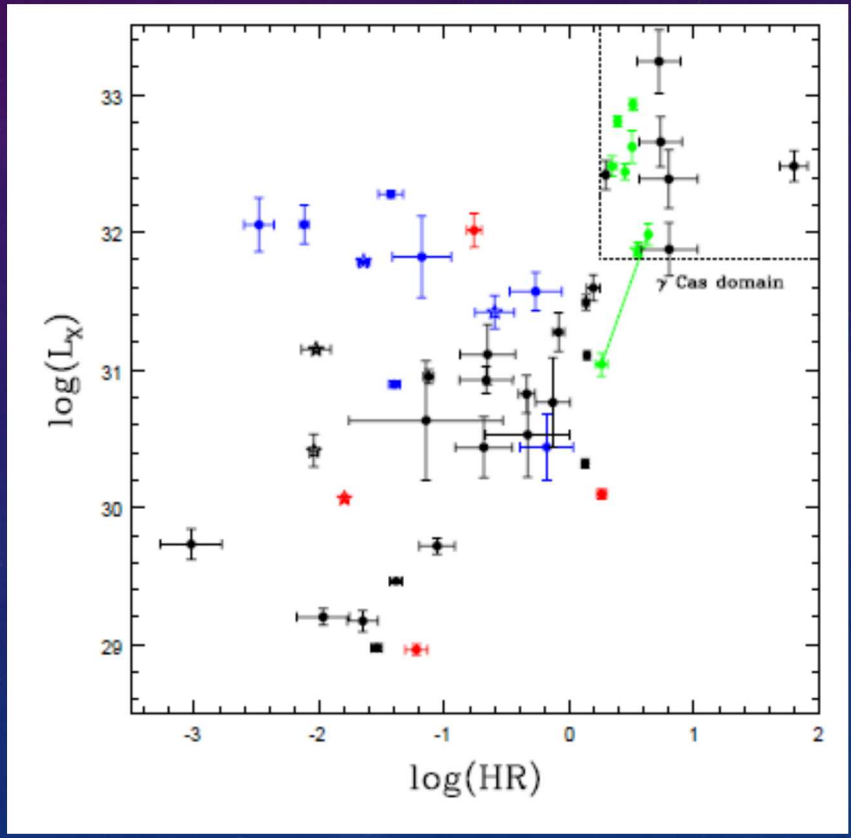


FOLLOW-UP ON γ CAS STARS

YAËL NAZÉ, GREGOR RAUW (ULIÈGE)

γ CAS ANALOGS

- γ Cas served as prototype of Be stars
  but peculiar X-rays discovered in 1976
- Currently 22 γ Cas analogs (Nazé & Motch 2018)
- Characteristics :
  - -6 < log(Lx/Lbol) < -4
    or Lx(2-10keV)> 10^{31}erg/s or Lx(0.5-10keV) in $10^{32\text{-}33}$erg/s
  - kT>5keV
  - Presence of Fe complex with fluorescence line
  - Variations
  - Limited to late O/early B
- *Origin?*
  - Accretion onto WD or NS (propeller)
  - Star-disk interactions (small-scale B)



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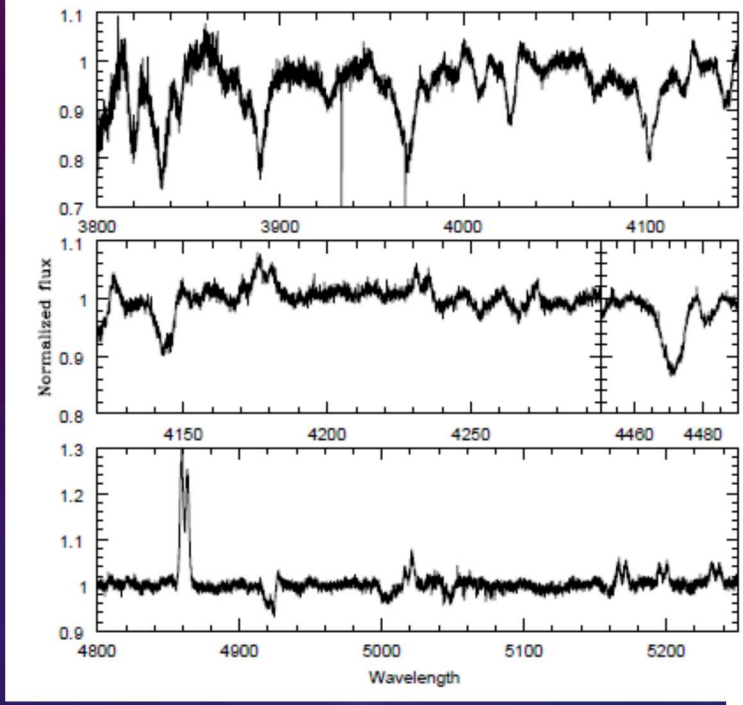

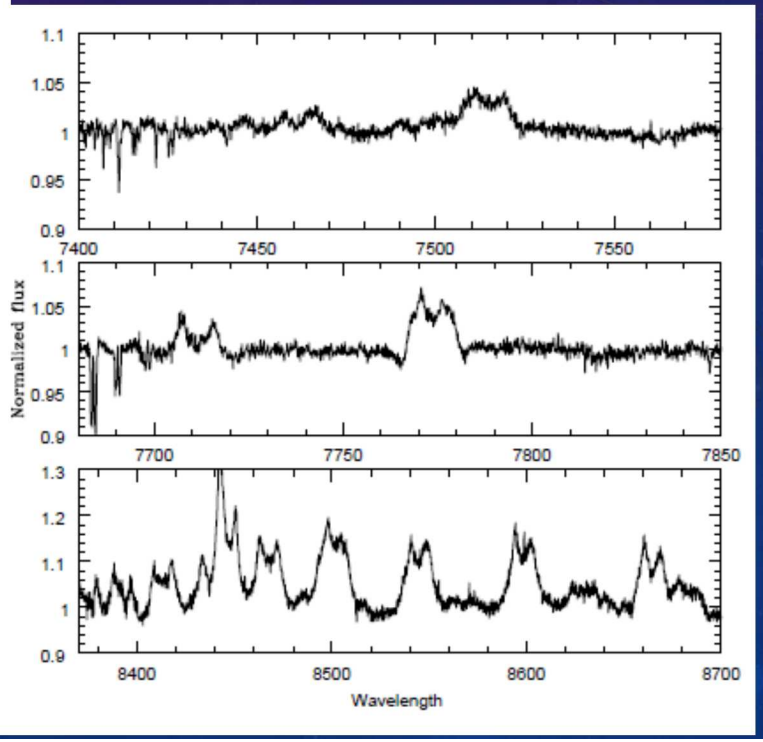

- Known binary with P=84d
- Known as γ Cas since Nazé+ 2017
- New monitoring (*Nazé+ 2019b*)
  - 3 cycles covered
  - **TIGRE** for optical, Swift (WT mode) for X-rays

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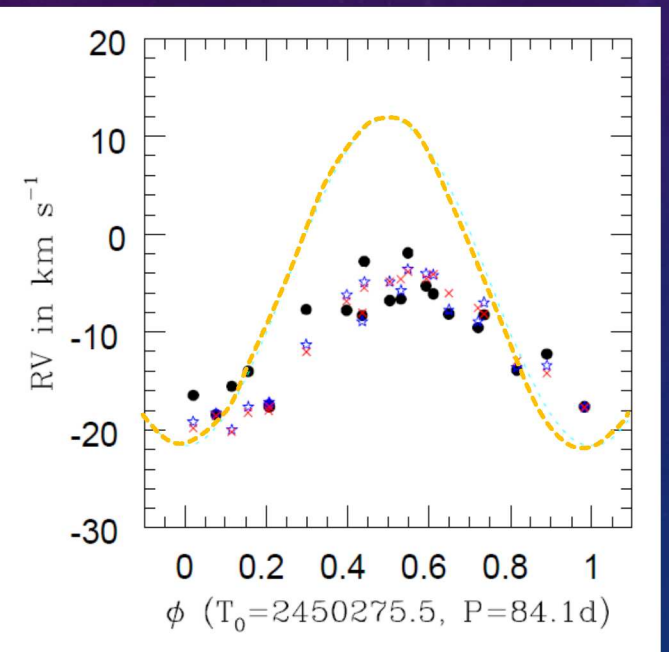
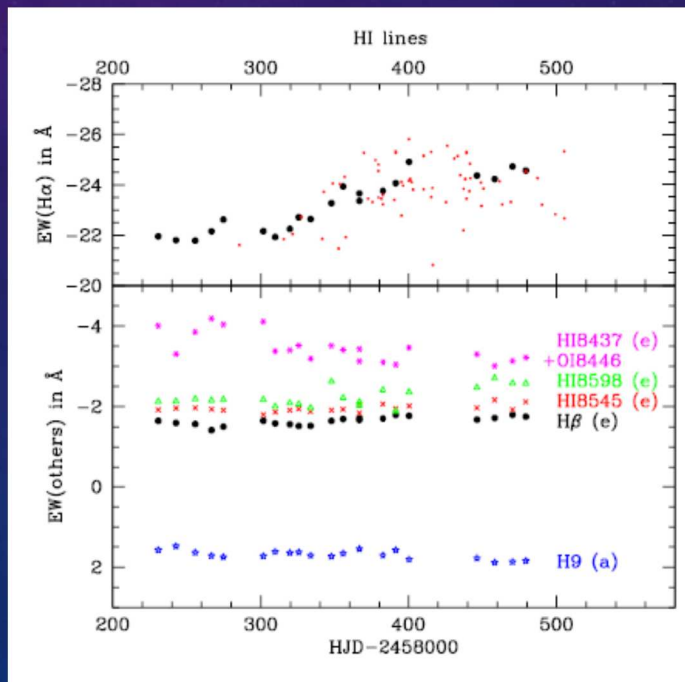
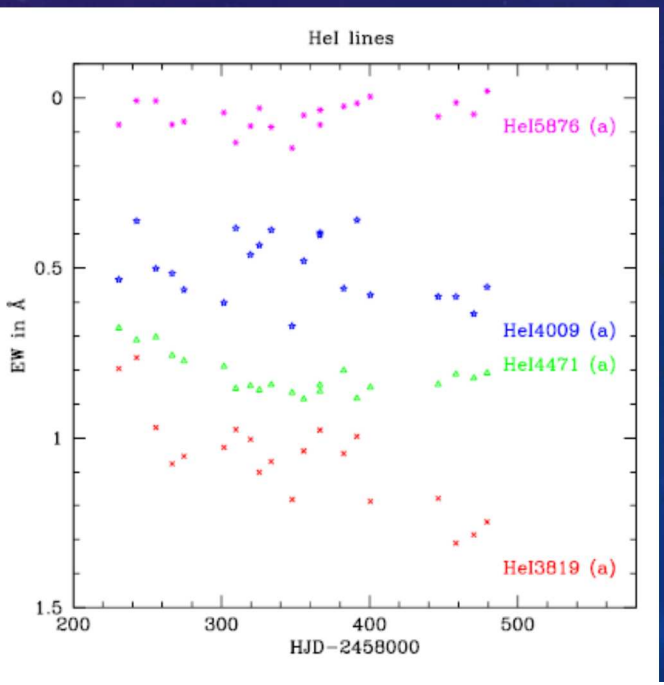
Variations are detected!

- EW : Hα strengthens, other may ↑ or ↓
- RV : 3 methods used for Hα - same results but lower K than before (!not due to disk!)
- No trace of companion







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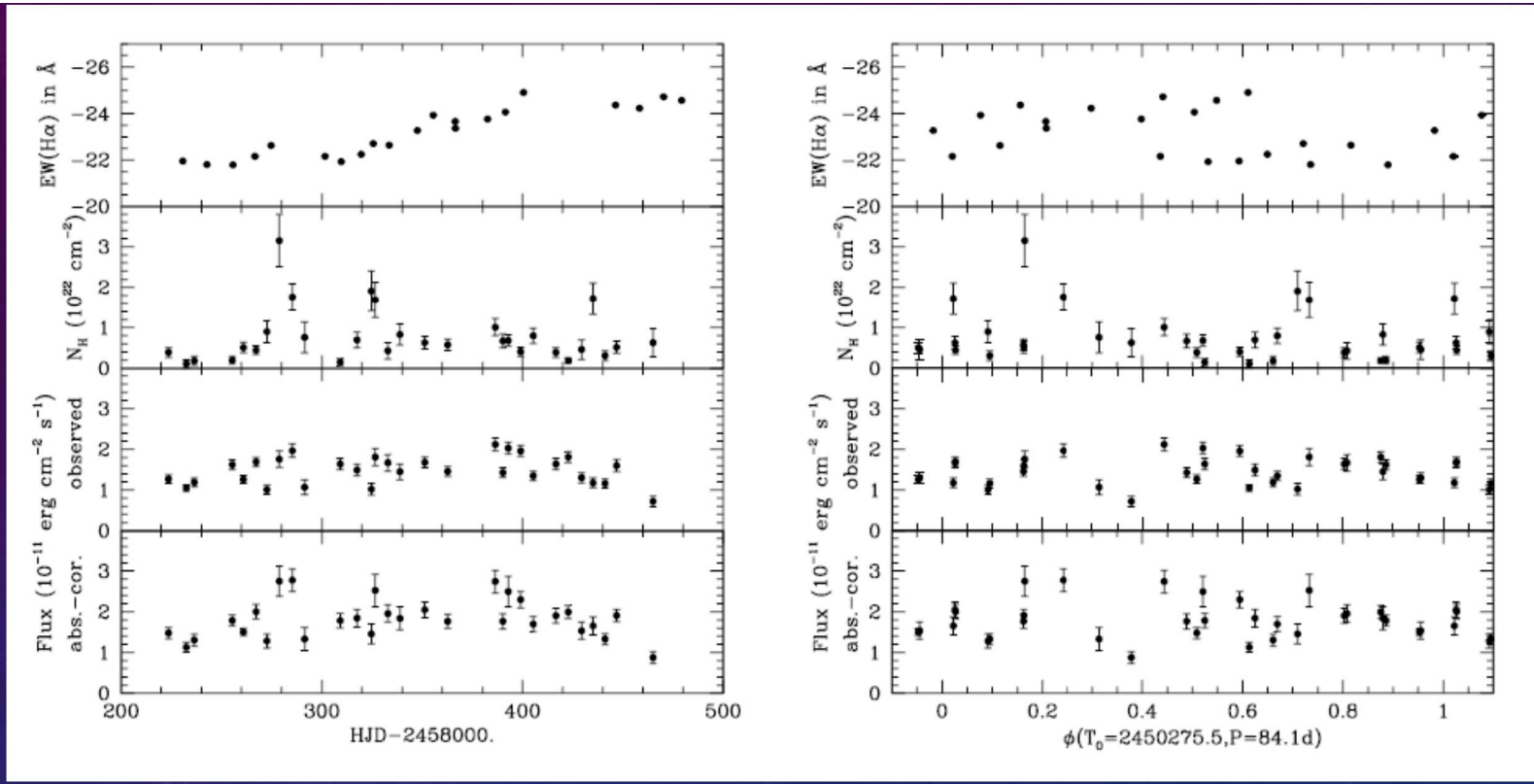

X-ray vs optical

- Both vary but no correlation between them (not linked to disk?)
- No correlation with phase either (not linked to orbit?)
- Spectral fits : Nh somewhat larger, kT & flux similar to XMM discovery observation

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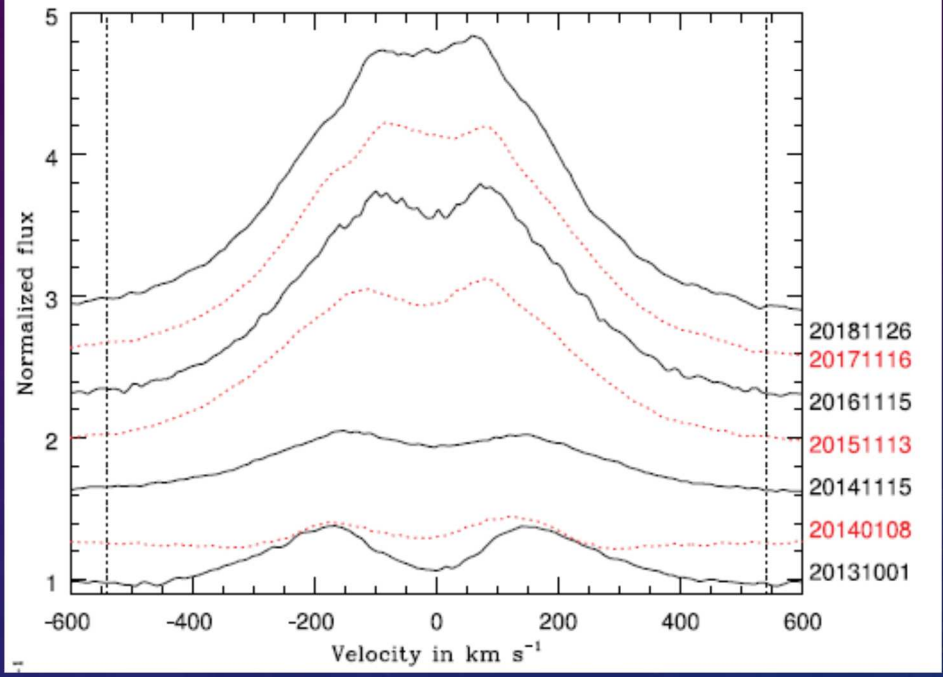
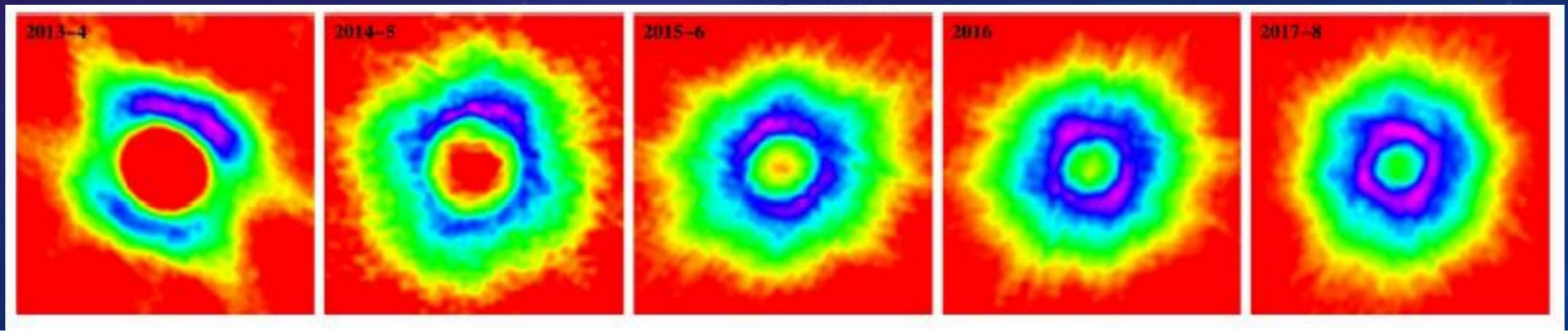
Long term changes (*Nazé+ 2019a*)

- amateur data on Hα line :
  - End of 2013 (disappearance)
    -> 2018 (strong emission)
  - V/R modulation disappears : disk more symmetric
  - Peak separation : R(disk) changes from 2 to 13R*





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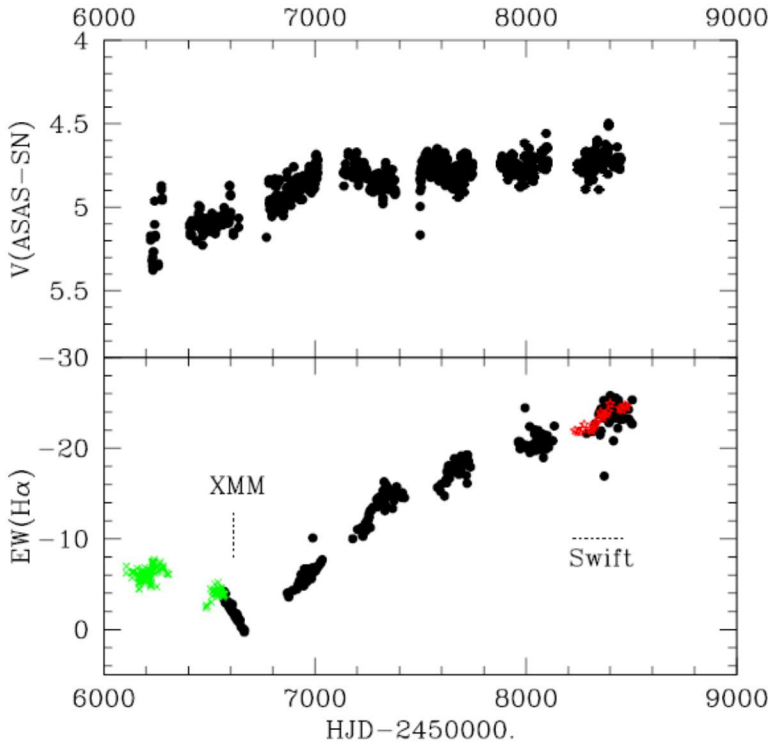
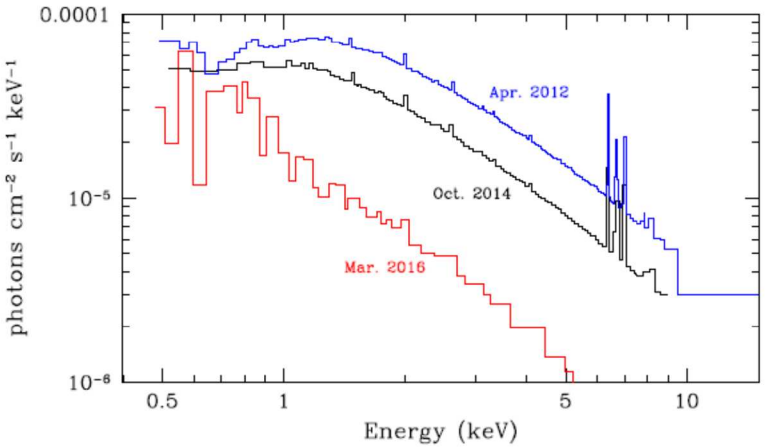
Long term changes (*Nazé+ 2019b*)

- X-ray observations taken at very different disk states but similar properties !

- Comparison with γ Cas (Motch+ 2015) :
  - Correlation X/optical for small variations...
- Comparison with HD45314 (Rauw+ 2018) :
  - Near disappearance of disk
    = near disappearance of γ Cas characteristics !
- Result unexpected for *both* scenarios !





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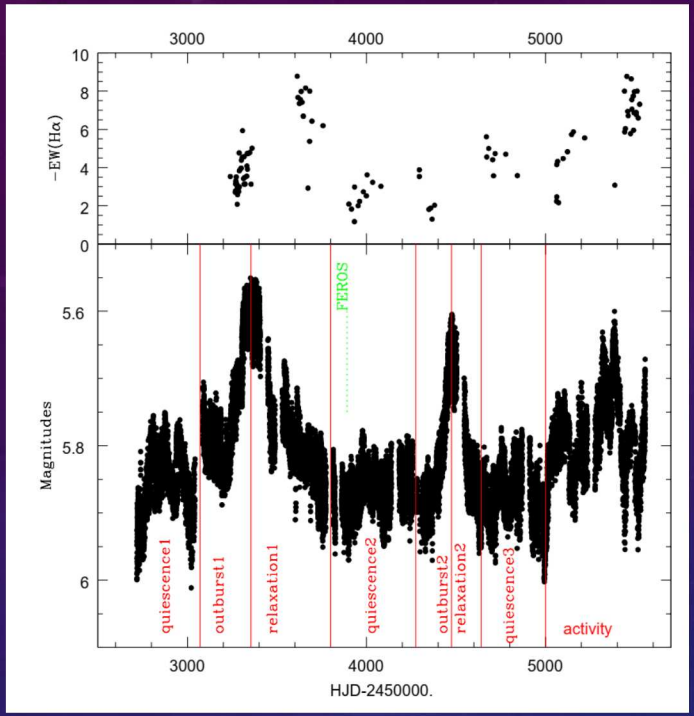
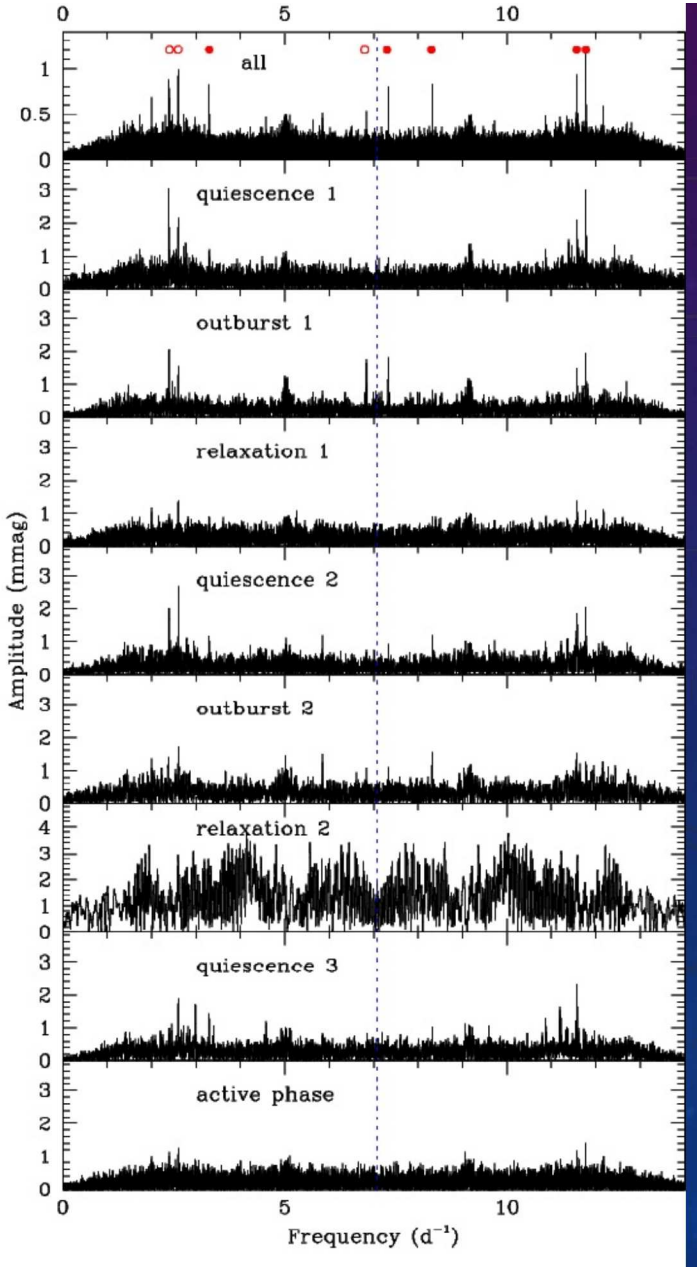


Short-term optical variations (*Nazé+ in prep*)

- Photometry : SMEI

Are γ Cas different from other Be stars ?



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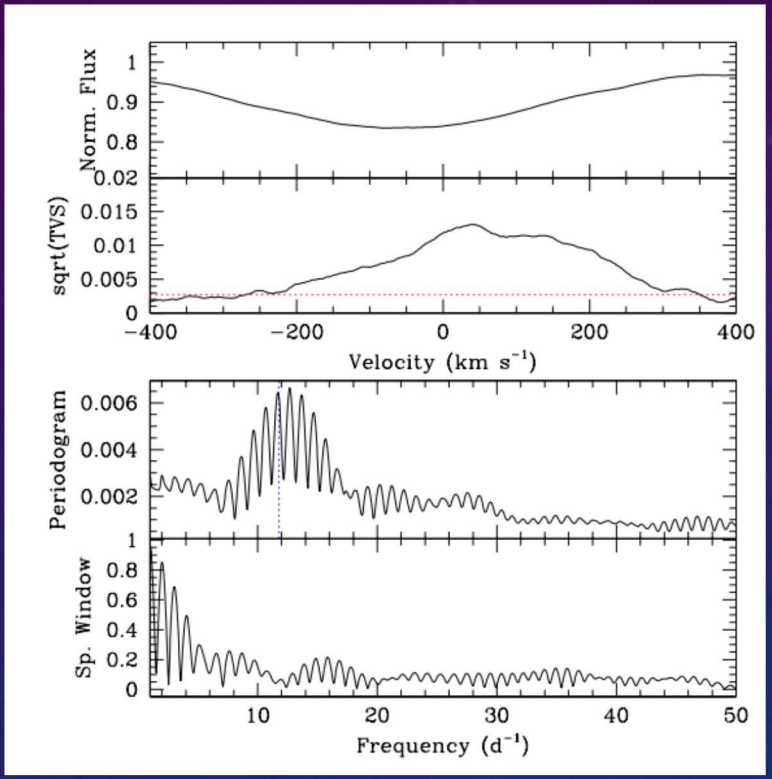
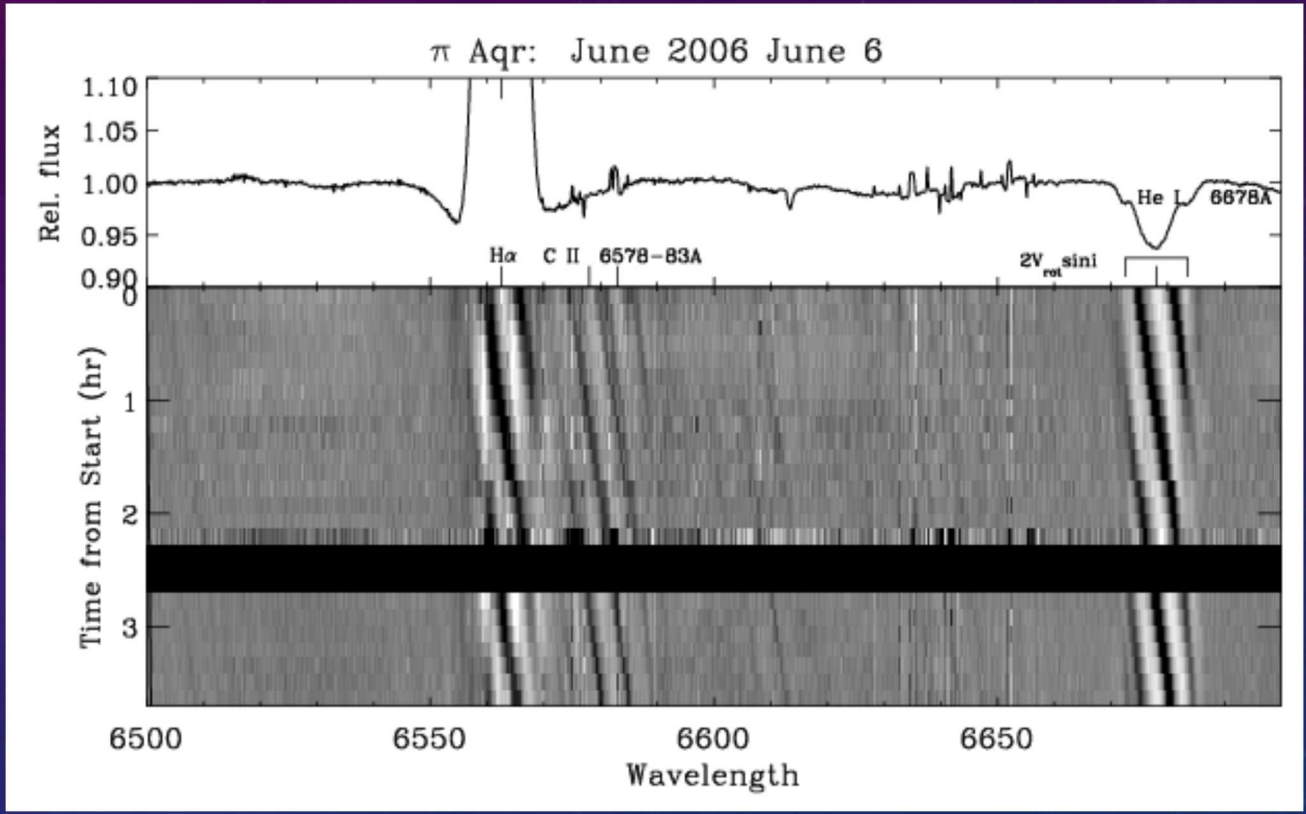




Short-term optical variations

- Spectroscopy : FEROS+Aurélie

⇒ Same f as in photometry : OK

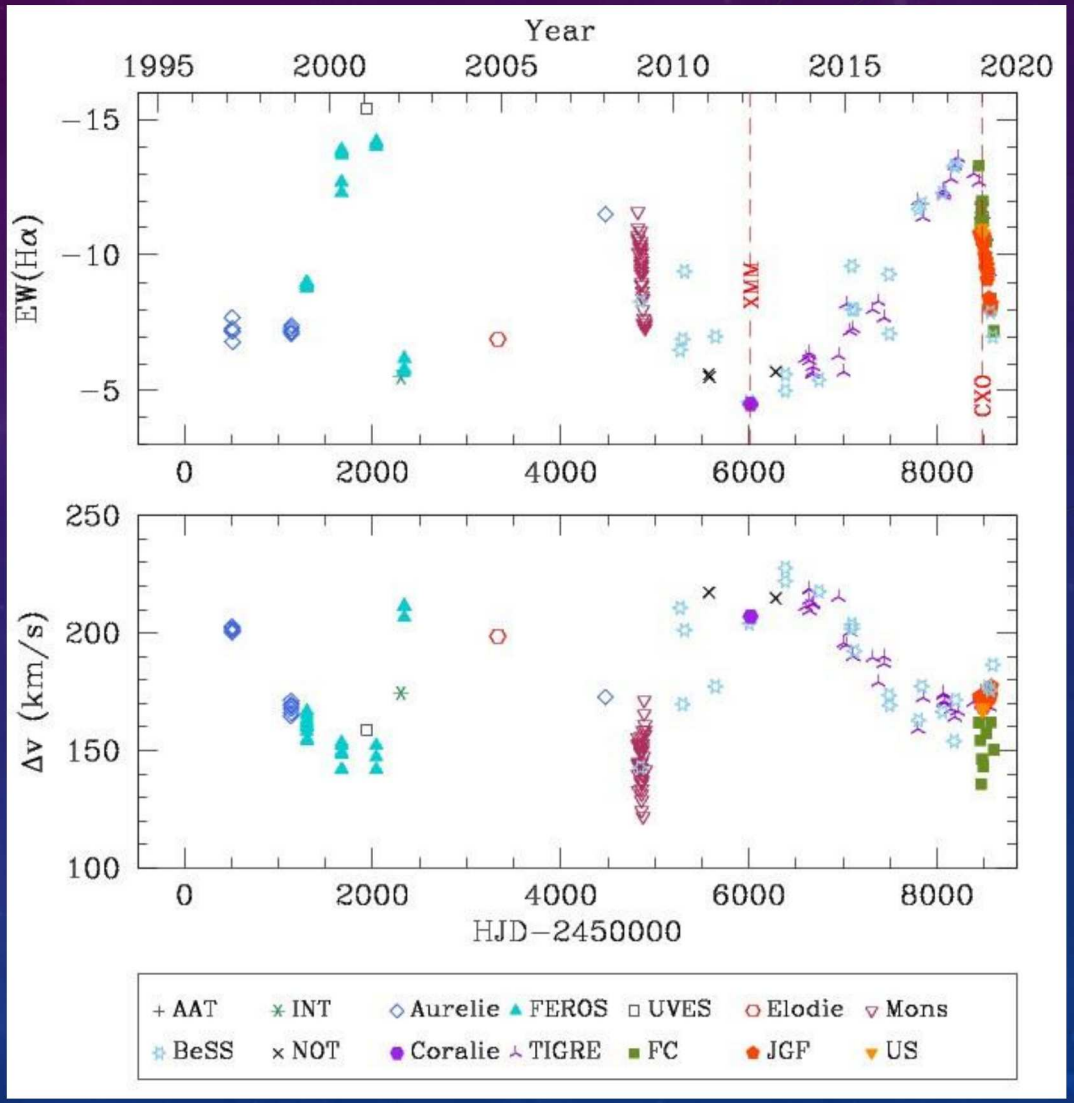
⇒ Changes in frequency amplitude : OK

⇒ High f (>5/d, NRP with l~6, m~2) : unusual, but also amongst γ Cas stars !

HD60848

- Oe star, not known to be γ Cas... yet !
- Strong variations of its Hα line :
  can a star become γ Cas ?

- First X-ray observation taken @ small EW (Rauw+ 2013, 2015) : typical of O-stars...
- Chandra TOO near maximum EW (*Rauw+ in prep*) : no change...



Our collaboration with you has improved our knowledge of these strange stars...

Muchas gracias !

But there is still a lot to do to truly understand them fully – they are so unique !