

# Eta Orionis

How to find one or more periods of this star ?

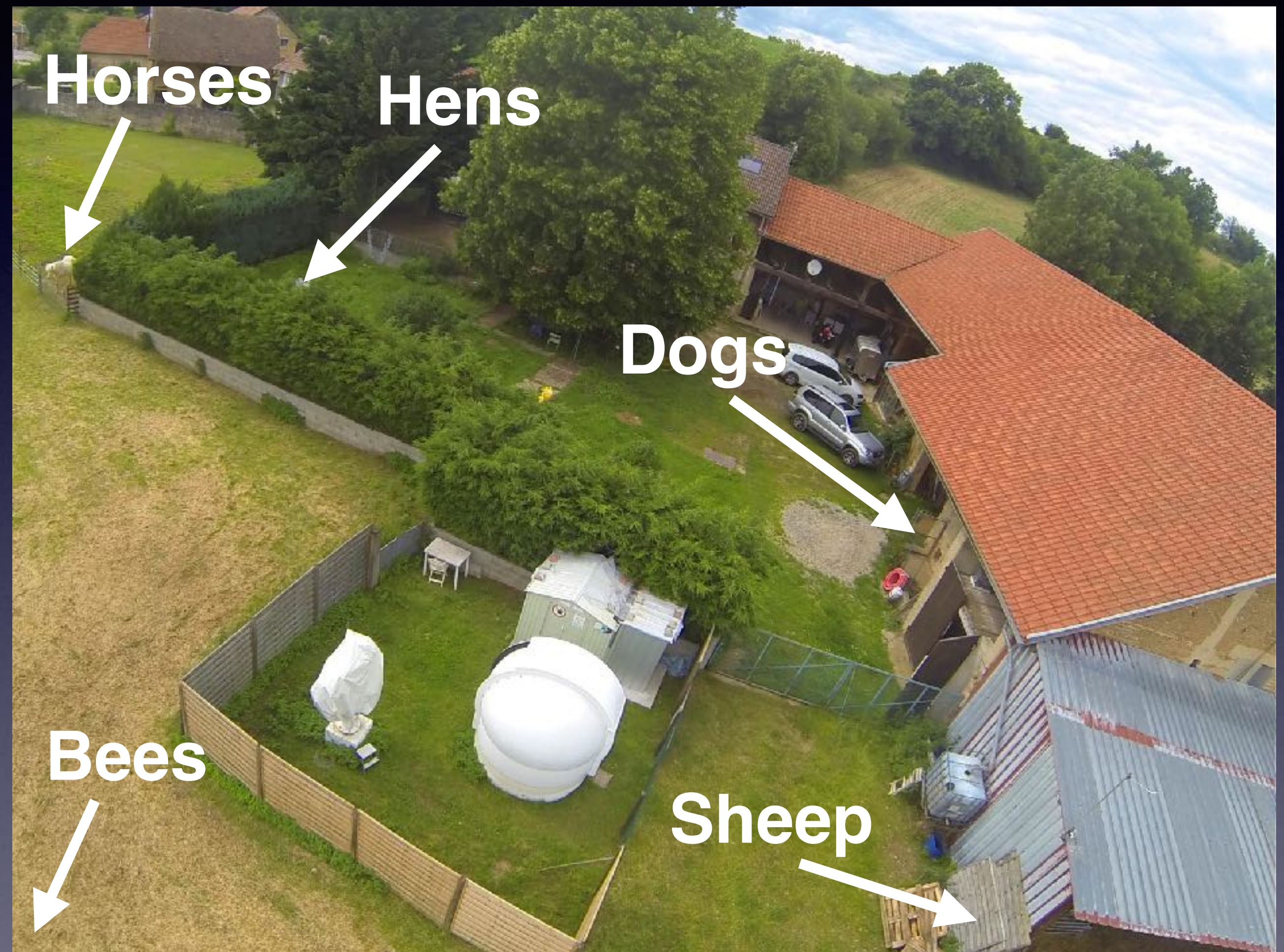
By Olivier GARDE



# My observatory

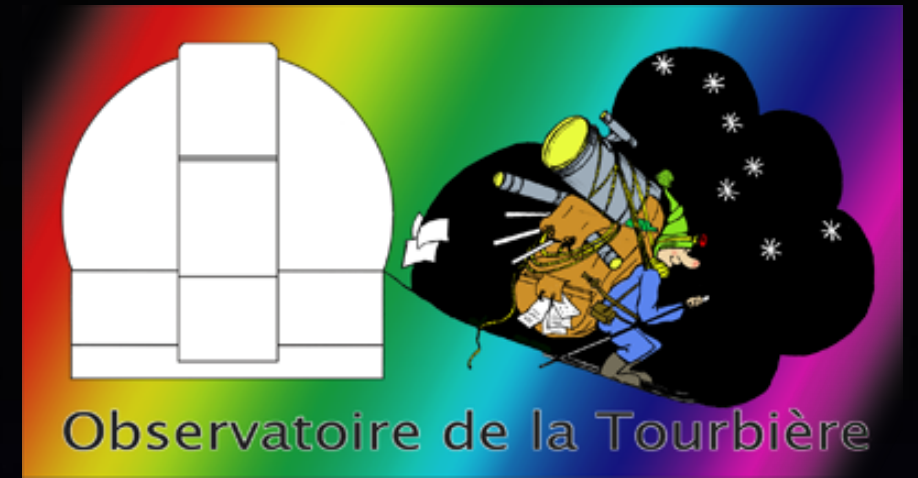


Located in south east of France



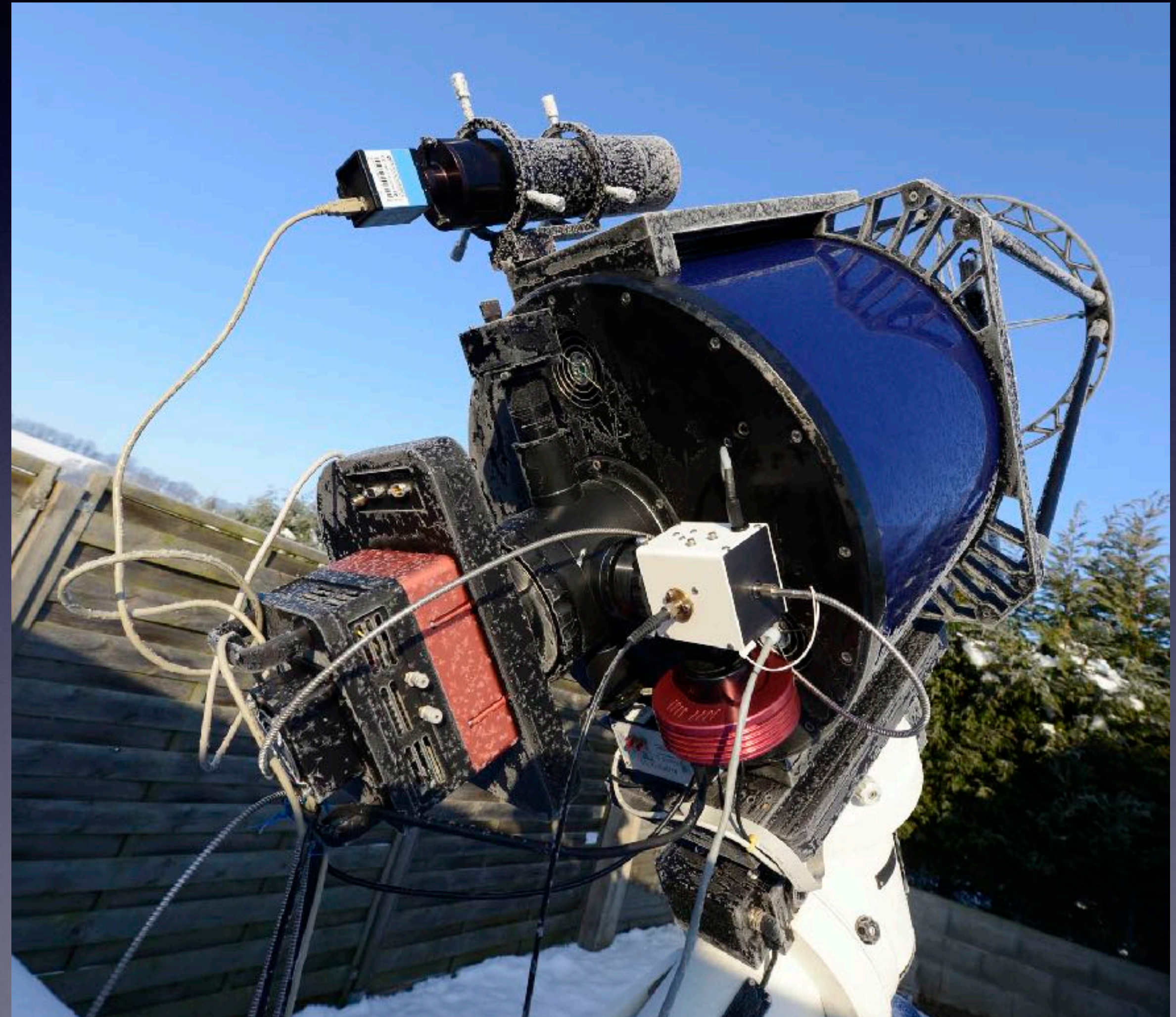
In a farm & close to a protected natural area

# My observatory



- RC 400 Astrosib #25
- AP 1600 equatorial mount
- **3** Spectrographs
- CCD STX 16803
- Remote control (Team Viewer)

Sometimes during winter : **-15°C**



# My observatory



1

- Echelle spectrograph from Shelyak  
(**eShel R=11000**)
- Integrated in a wine cellar
- Temperature regulation



# My observatory

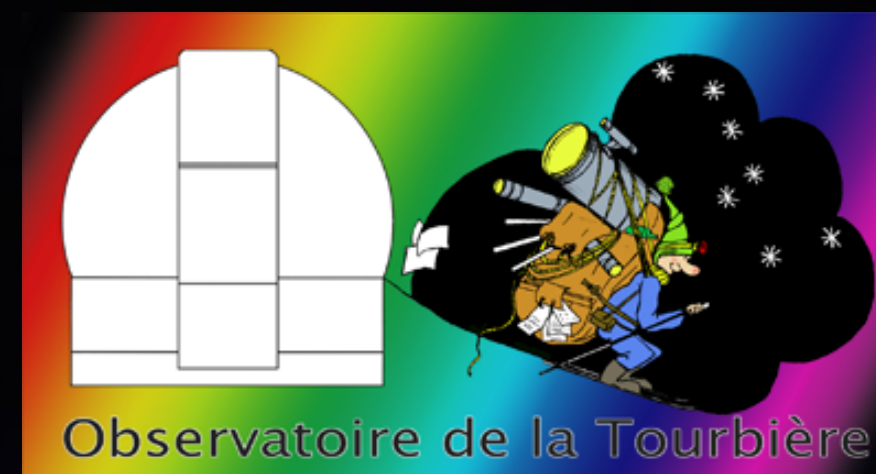


**PID regulation**  
(Eurotherm)



Accurate temperature control  
**+/- 0,2° C**

# My observatory



2

- Echelle spectrograph from Shelyak  
(**ESP R=30000**)



# My observatory

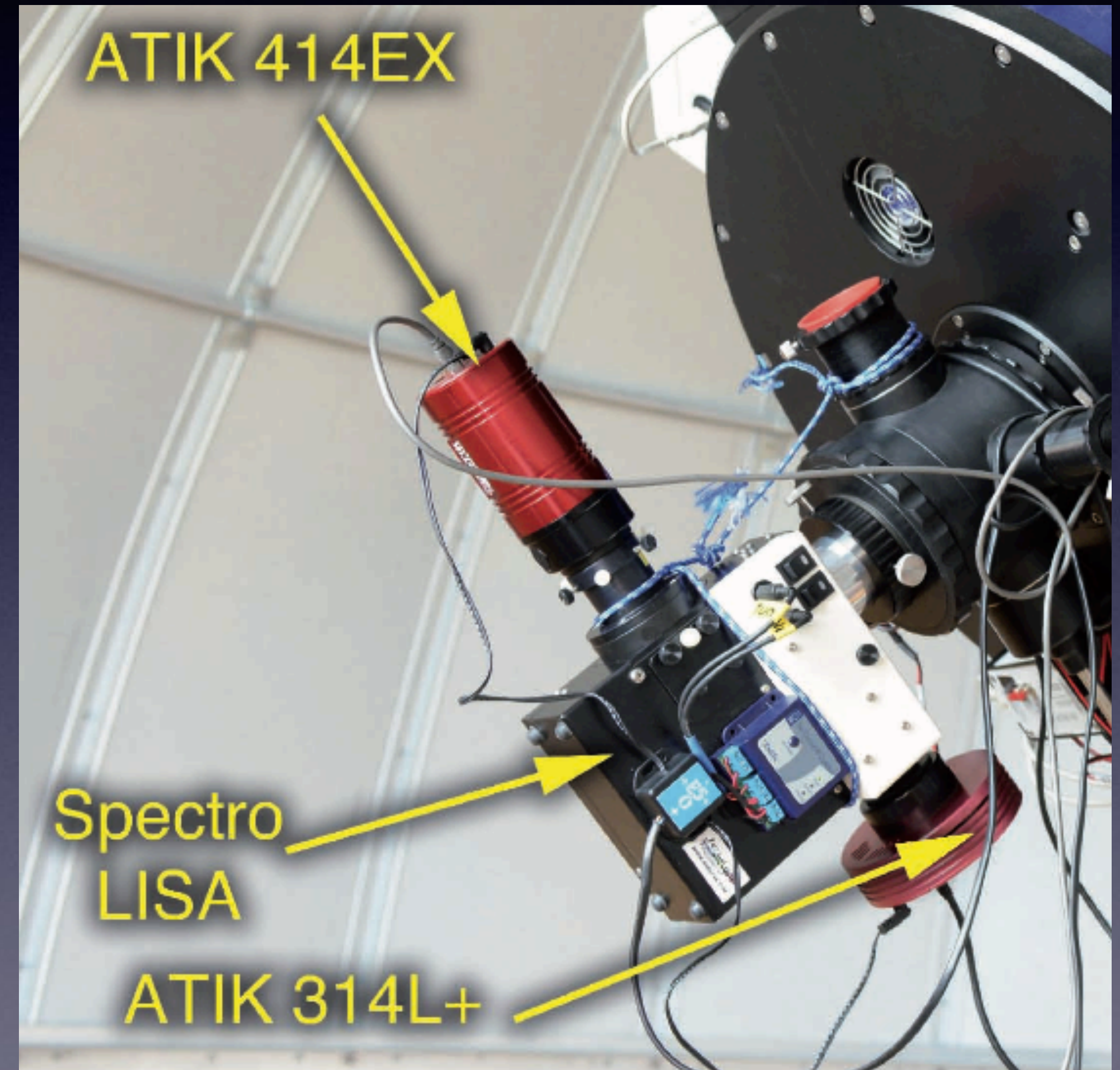


# My observatory



3

- LISA spectrograph from Shelyak (**R=1000**)





# My observatory



The control room at home



Club d'Astronomie  
et Centre d'Animation  
de Lyon Ampère

# My observatory



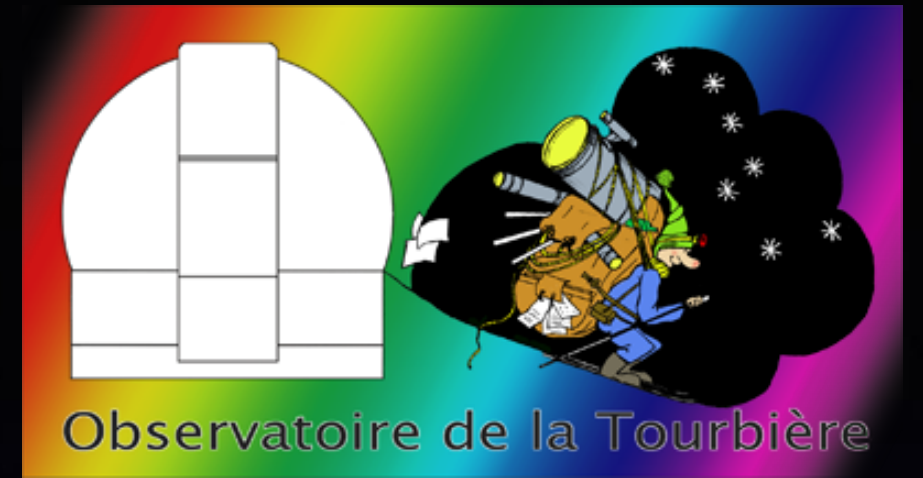
The image displays four computer screens used for astronomical observation and control:

- Top Left:** A software interface for telescope control, showing a star chart with various astronomical data fields (RA, DEC, AZ, TIME, TZ) and a central view of the sky.
- Top Right:** A software interface for spectral analysis, displaying a spectrum plot with a peak and a list of identified spectral lines.
- Bottom Left:** A software interface for sky mapping, showing a star chart with a detailed view of a star and its associated data.
- Bottom Right:** A web-based monitoring interface for the observatory, displaying real-time temperature data:
 

GROUP	Value
T° Spectro	10.38 °C
T° Air cool	12.40 °C
T° Local	15.0 °C

4 screens in one to control all the process

# Eta Orionis



**28 Ori**  
**HD 35411**

AD : 05h 24' 28,616''

DEC : -02° 23' 49,731''

Mag. **V=3.35**

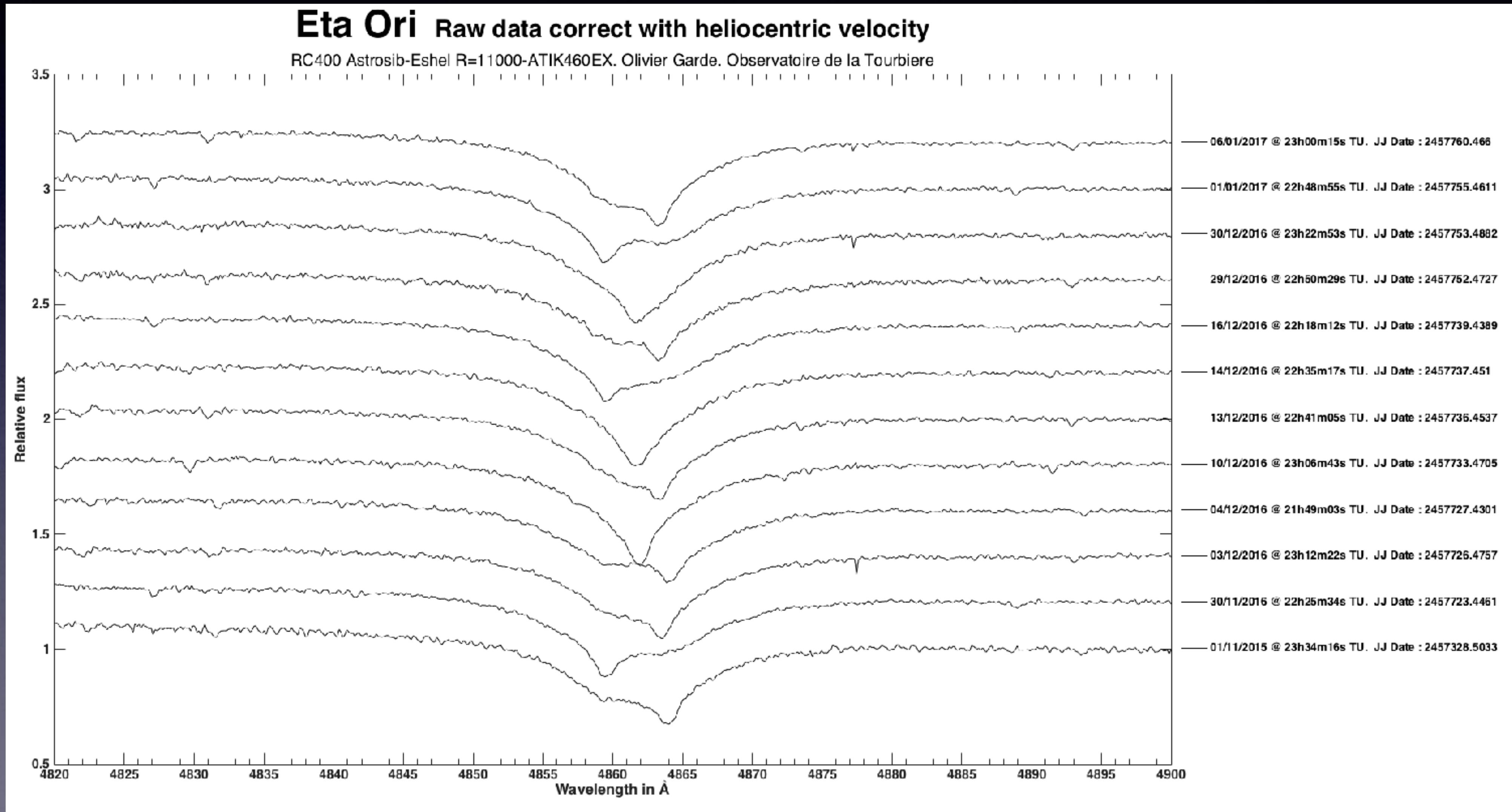
**Quadruple** or multiple  
star system  
and also a **Be Star**



# The data



**12**  
 spectra

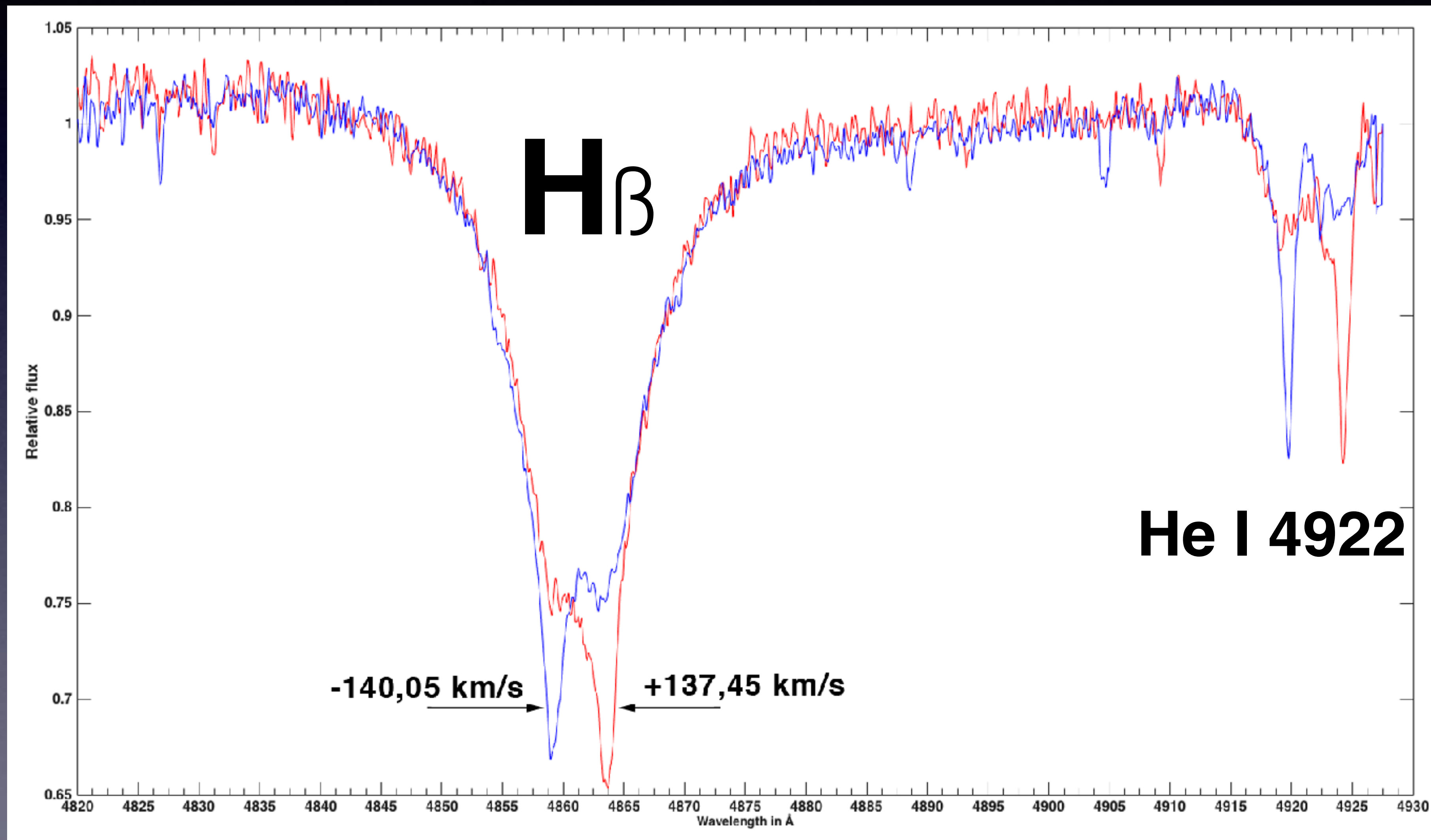


**H $\beta$**  line

# Calculation of a period



**Doppler-Fizeau**  
effect near maximum



# The data



## Data table of the 12 spectra

### Doppler-Fizeau shift

$$V_r = c * \left( \frac{\lambda_{\text{Obs}} - \lambda_0}{\lambda_0} \right)$$

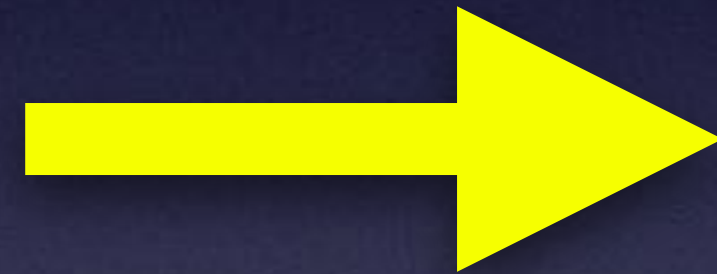
Date of observation	Julian Date (1)	Helio Velocity	H Beta value	Velocity in km/s
01,982 11 2015	7328,5033	-17,746	4863,85	157,25
30,934 11 2016	7723,4461	-5,230	4859,45	-114,09
03,967 12 2016	7726,4757	-3,723	4863,55	138,76
04,909 12 2016	7727,4301	-3,380	4863,85	157,25
10,963 12 2016	7733,4705	-0,372	4861,90	37,00
13,945 12 2016	7736,4537	1,022	4863,30	123,34
14,941 12 2016	7737,451	1,492	4861,70	24,67
16,929 12 2016	7739,4389	2,420	4859,45	-114,08
29,952 12 2016	7752,4727	8,634	4863,25	120,26
30,974 12 2016	7753,4882	9,149	4861,70	24,67
01,951 01 2017	7755,4611	10,003	4859,35	-120,25
06,959 01 2017	7760,466	12,234	4863,20	117,17

(1) Julian Date : JJ-2450000

# Calculation of a period

```

dateHBETA.dat
7328.5033 157.25
7723.4461 -114.09
7726.4757 138.755
7727.4301 157.25
7733.4705 37.00
7736.4537 123.34
7737.4510 24.667
7739.4389 -114.08
7752.4727 120.255
7753.4882 24.667
7755.4611 -120.25
7760.4660 117.17
  
```



**Périodogramme (algorithme de Lomb-Scargle)**

Nom du fichier .DAT à analyser :

Période minimale :  Période maximale :

Pas de calcul :

---

Périodogramme de k:\eta orionis time serie\dateHBETA.dat ...  
 Vitesse radiale = 45.995 km/s  
 Période = 7.9600000 jours  
 K = 142.4273 km/s (demi-amplitude)  
 J0 = 7329.3948 (date du premier maximum)  
 Fichier périodogramme -> k:\eta orionis time serie\period.dat  
 Vitesse radiale ajustée -> k:\eta orionis time serie\fit.dat  
 Courbe de phase (données d'entrée) -> k:\eta orionis time serie\phase.dat  
 Courbe de phase (modèle) -> k:\eta orionis time serie\phase2.dat  
 Erreur O-C de la courbe de phase -> k:\eta orionis time serie\delta\_phase.dat  
 Ok.

.dat file

Periodogram in ISIS software

# Calculation of a period



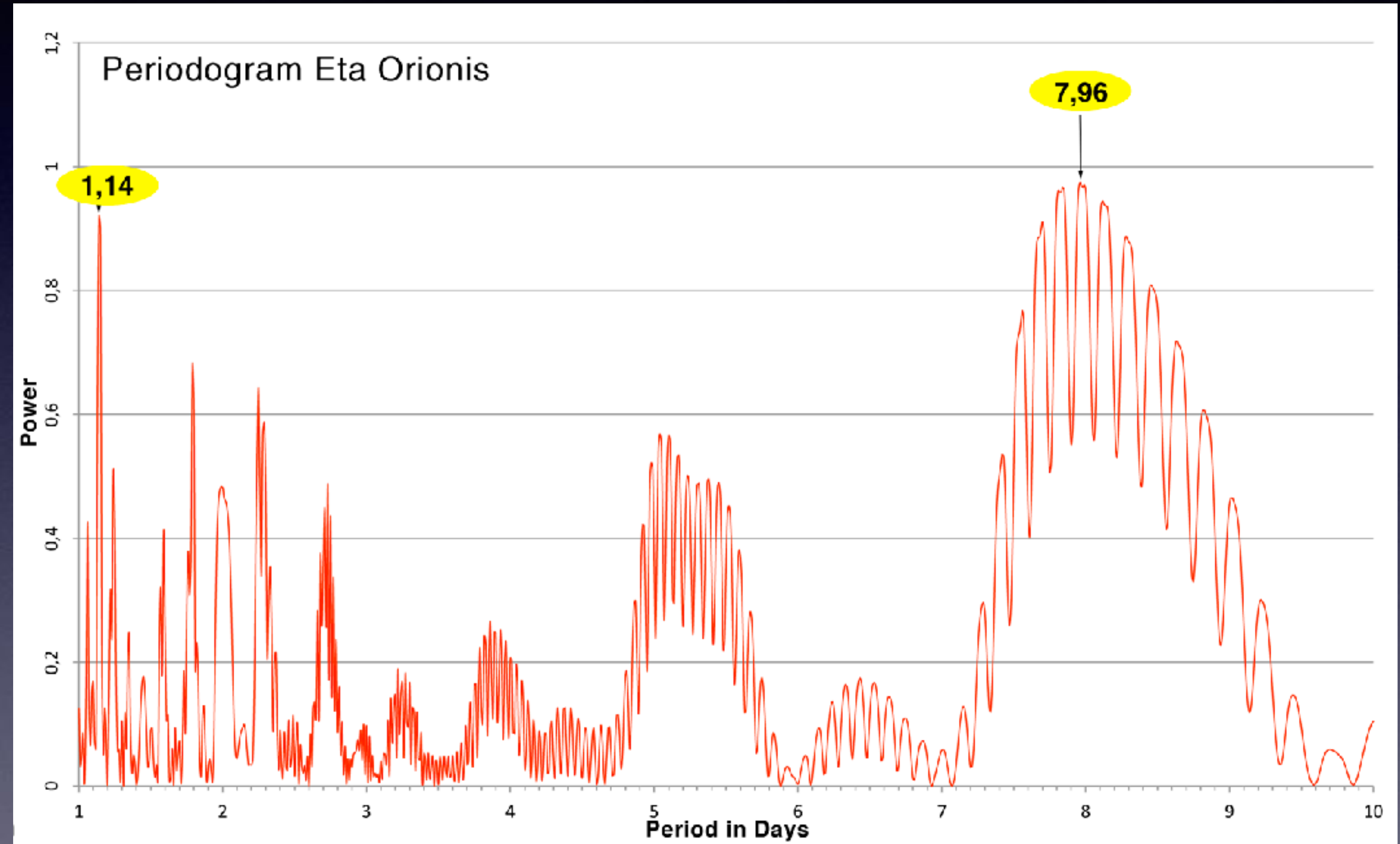
## Algorithm Lomb-Scargle

### 2 mains periods

- 1.14 days
- 7.96 days

### Alias period

$$P_{Alias} = \frac{1}{\left(\frac{1}{P_{Obs}}\right) - \left(\frac{1}{P_{Orb}}\right)} = \frac{1}{\left(1 - \frac{1}{7.97}\right)} = 1,143 \text{ Jours}$$

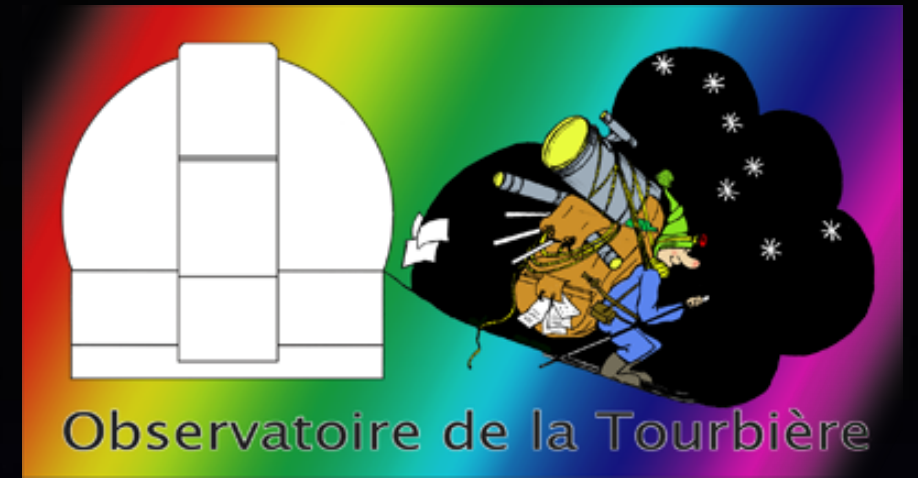


The real period is **7.96 days**

(7.9892255 days by C. Walkers & P. Lampens in A&A 1988)



# Proper motion

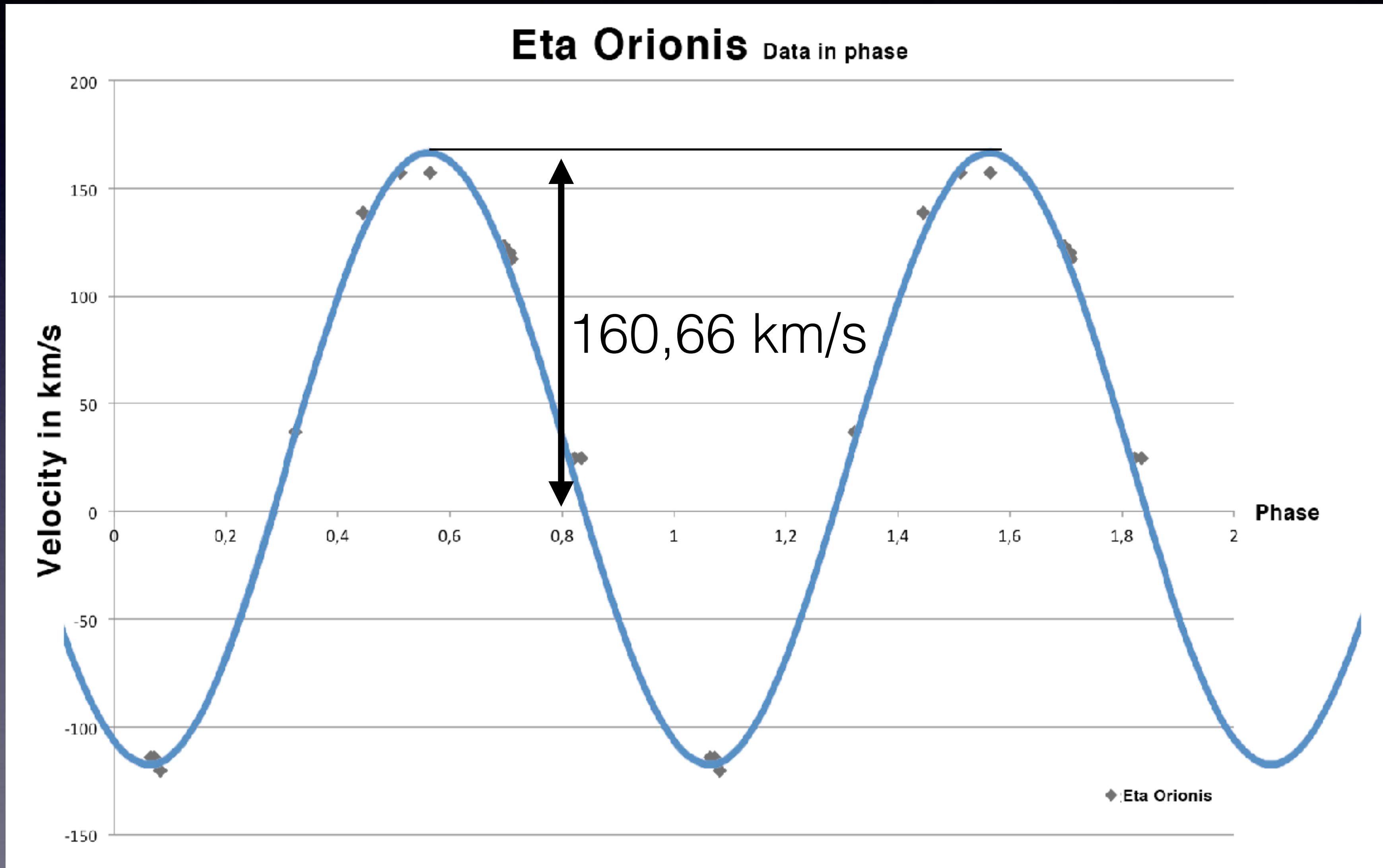


Coef.  $K = 142.427 \text{ km/s}$   
 (1/2 amplitude)

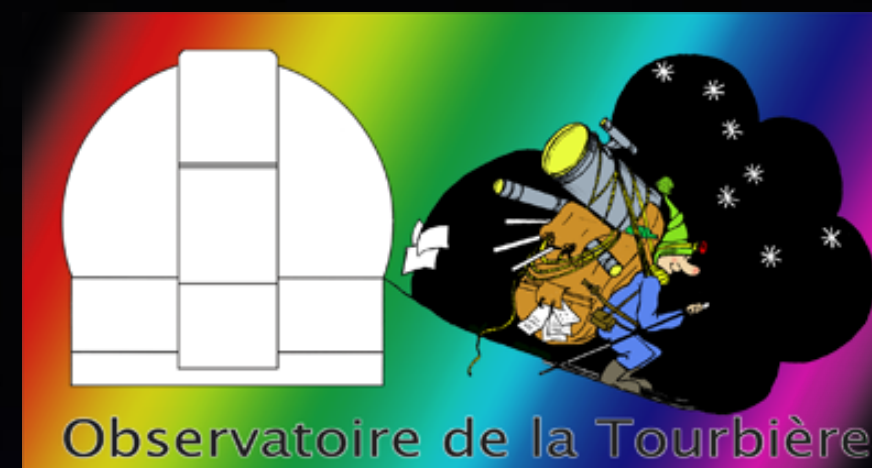
Proper motion of  
 Eta Orionis

Max  $V - K = 18.23 \text{ km/s}$

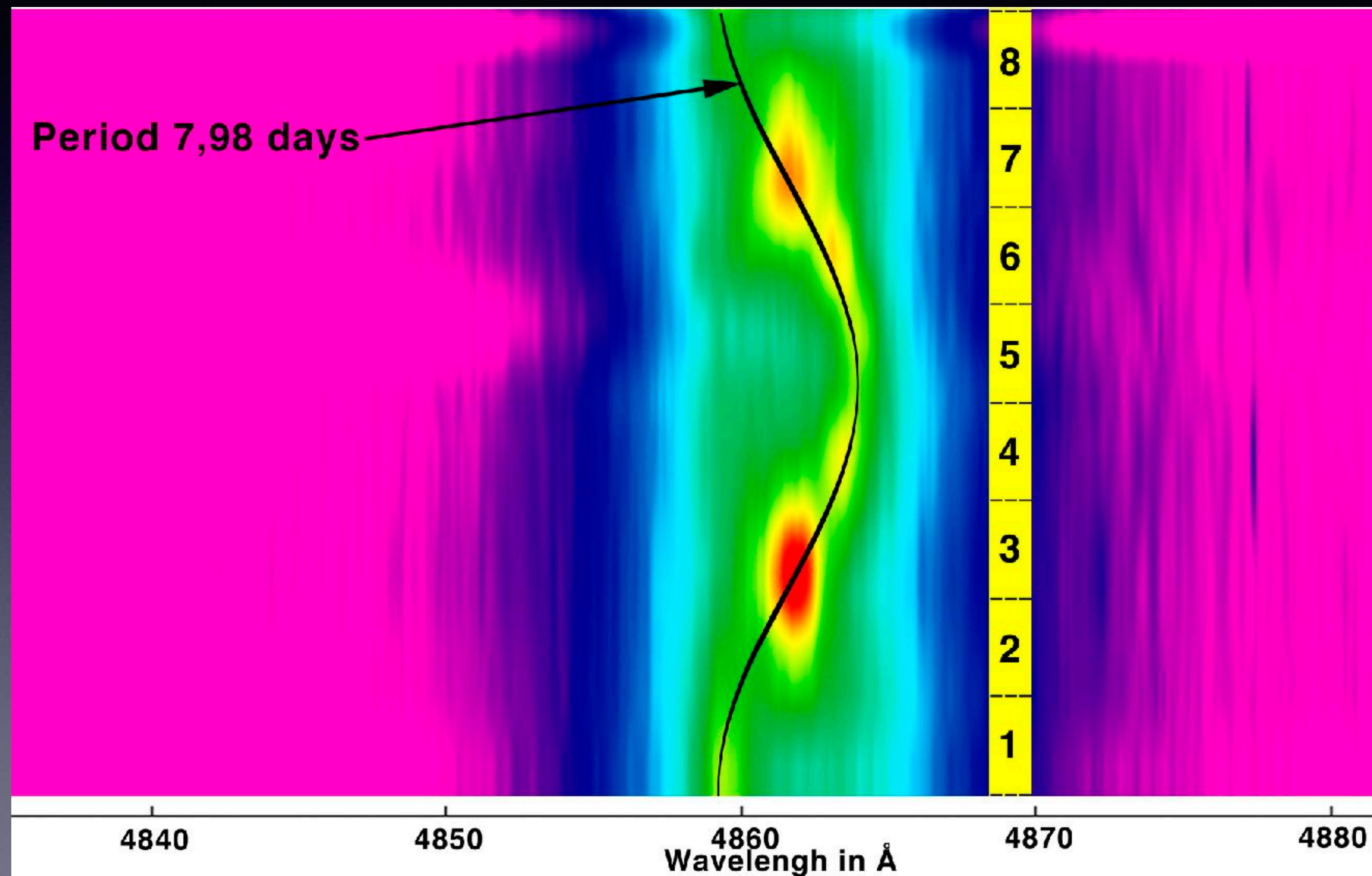
19.8 km/s (SIMBAD)



# Calculation of a period

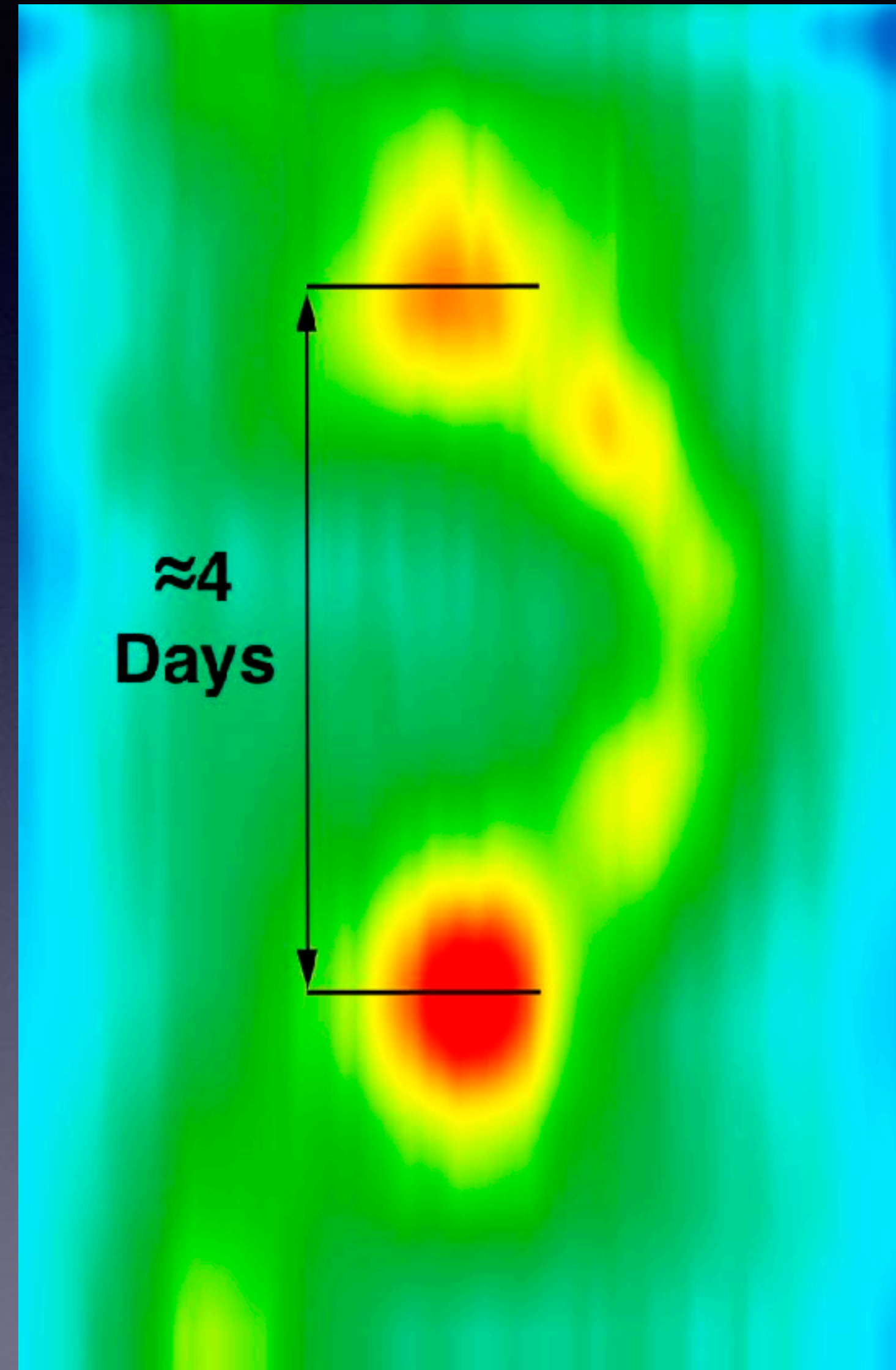


All **12** spectra  
in phase

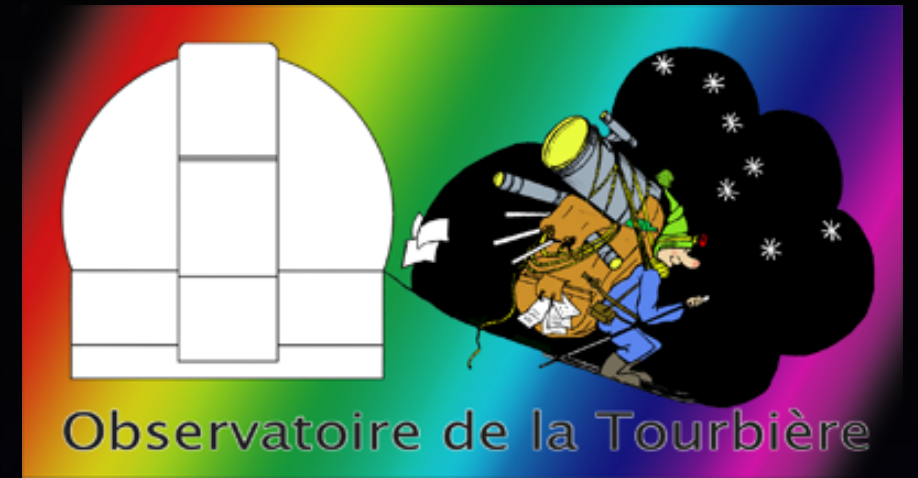


# Calculation of a period

Probably a shorter period  
within the mains period of 7.98 days



# Questions ?



- **A star classification in Bess specific to multiple stars ?**
- **Are there any interesting to study the periods of this kind of stars ?**

Thank you  
for your attention

