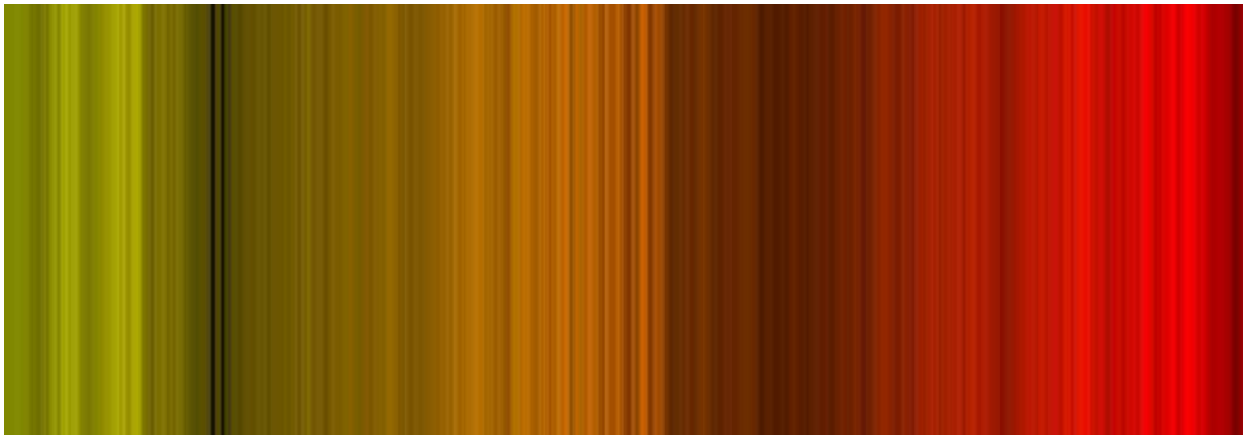
Betelgeuse spectroscopy

Betelgeuse Occultation campaign

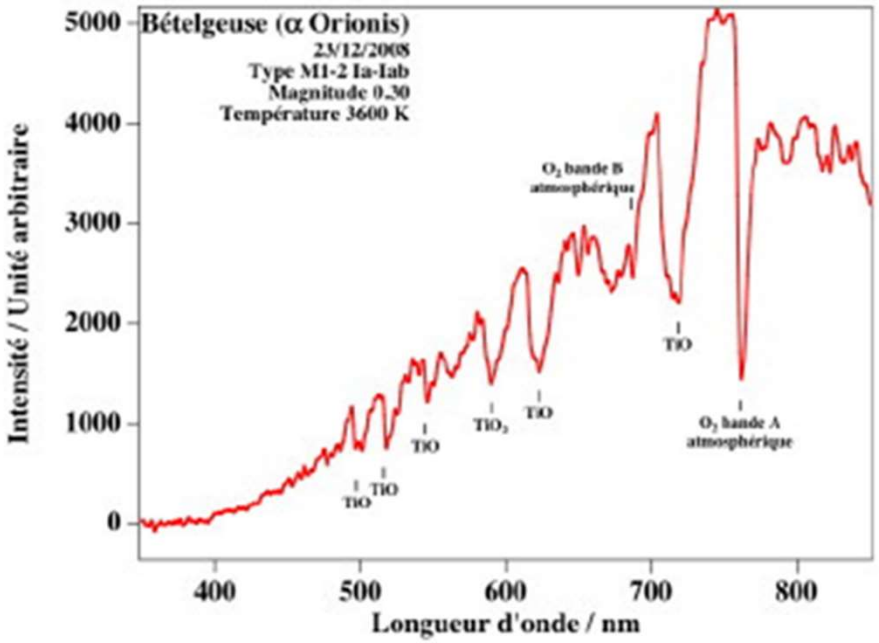
Christian Buil, Miguel Montarges, Pascal Goumard,
Thierry Midavaine, Stéphane Neveu

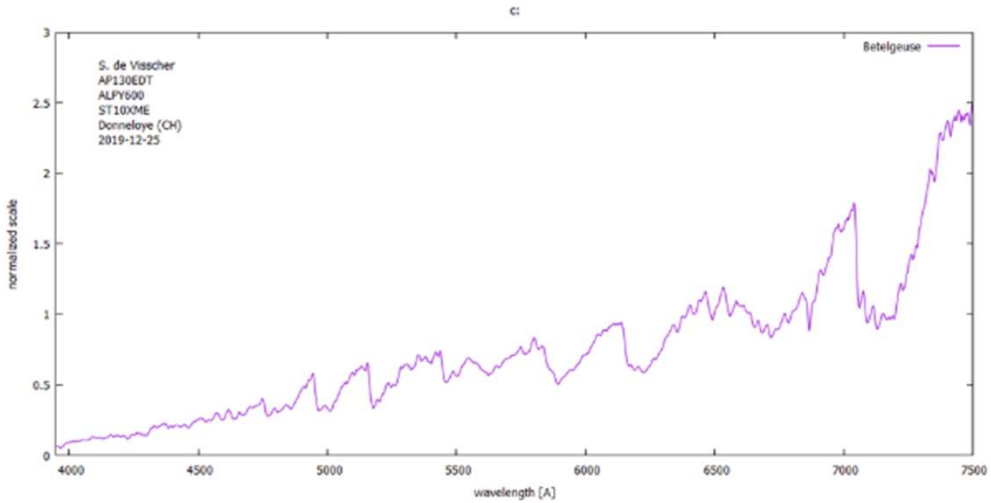
Objectives

- Get the evolution of the width / position of spectral lines in the visible/IR during occultation
- Get as many spectra as possible during this very short event < 7 seconds.
- The most interesting events are the entry end exit of Leona in front of Betelgeuse. Not the maximum of the occultation



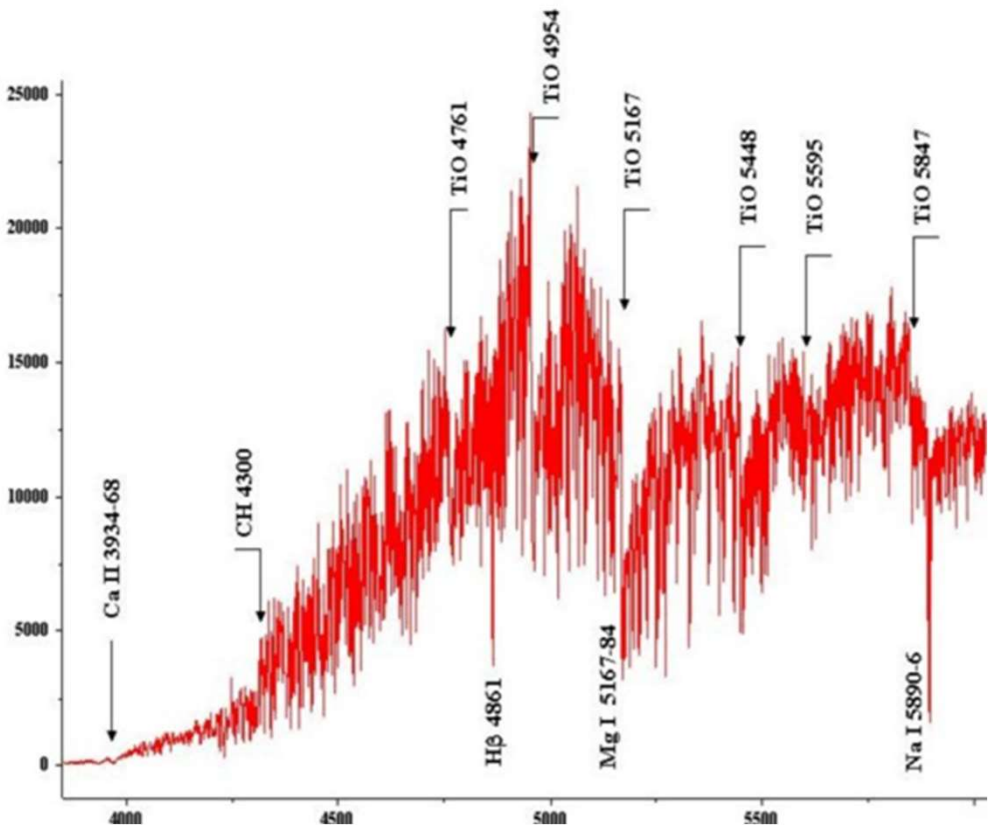
Betelgeuse spectra

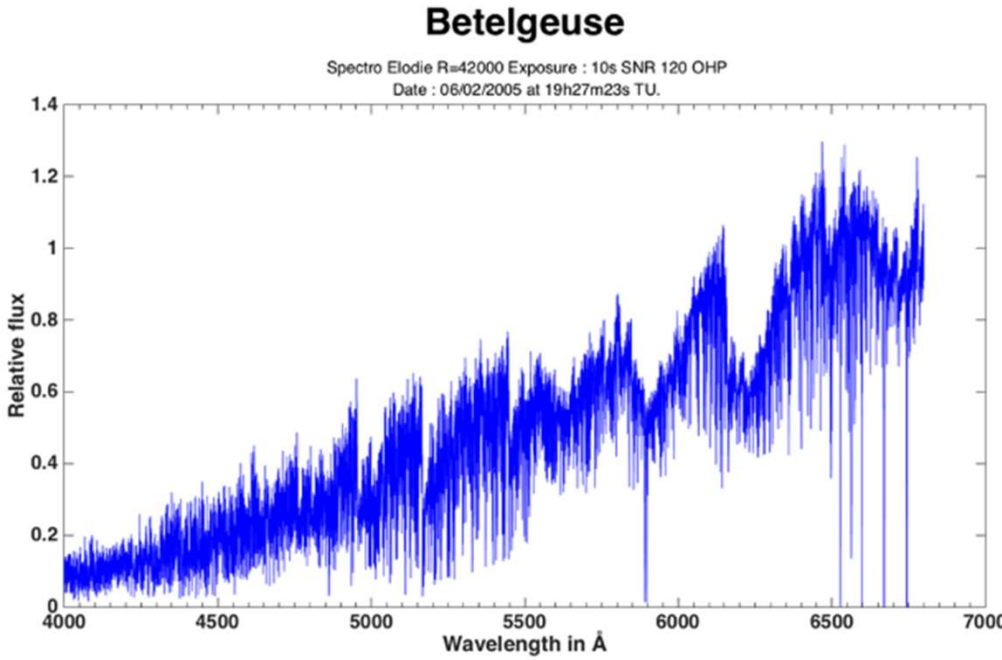




Betelgeuse low resoution spectra (from internet)

High resolution Betelgeuse Spectra





Constraints

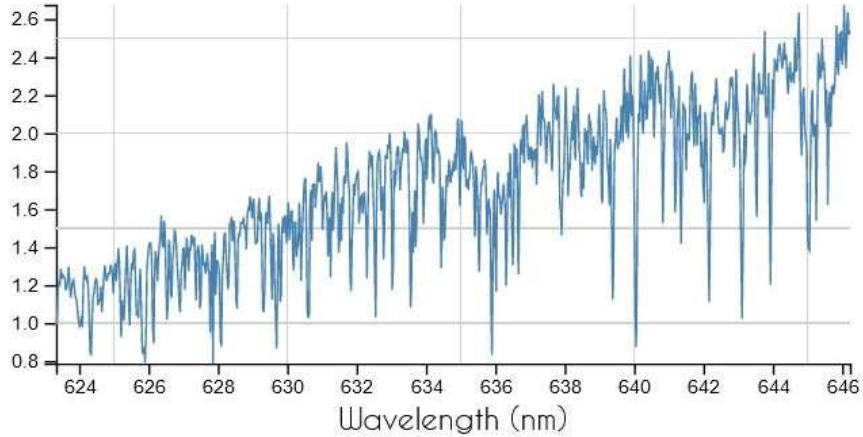
- Detect doppler effect 10-20 km/s in spectral lines
- Spectral resolution required R > 20 000 ideally R = 40 000
- Precise recording of timing for each spectra required as for the photometry (< 100 ms accuracy). Use NTP Meinberg or time box.
- Magnitude of Betelgeuse will drop during the occultation from 0 to 8 .. 10.. We don’t know exactly
- Get spectra of Betelgeuse before and after the event
- Get spectra of reference star
- Individual spectra.. No image stacking possible

  Miguel Montarges, Arthuro Lopez, Philippe Mathias selection :
  Lines around 635nm +- 25nm : V, Cr, Ti, Halpha lines and photosphere
  Lines around 860nm +- 25nm Ca ion lines, attempt to detect the chromosphere

- <u>We do not need low resolution spectra</u> made with Alpy, star analyser and so on.

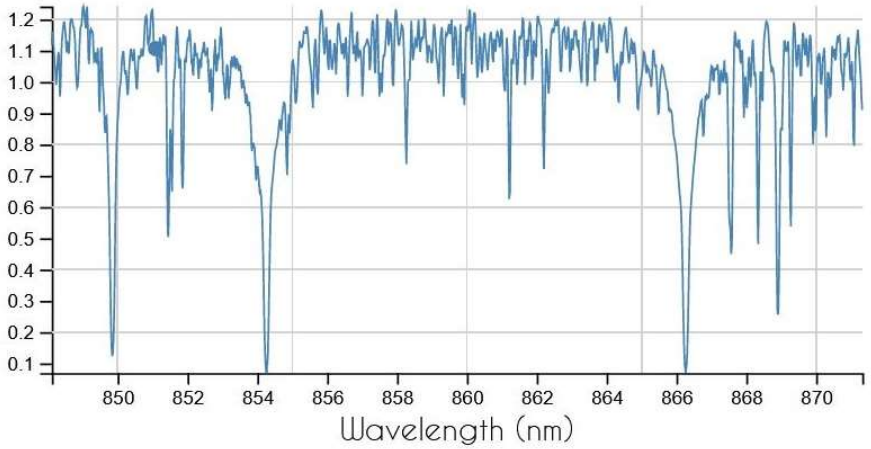
Spectral lines of interest

- Focus in red part or near infrared if possible (depending on your optic and sensor response)
- 635 nm lines +- 25 nm
- V, Cr, Ti, Halpha and photosphere



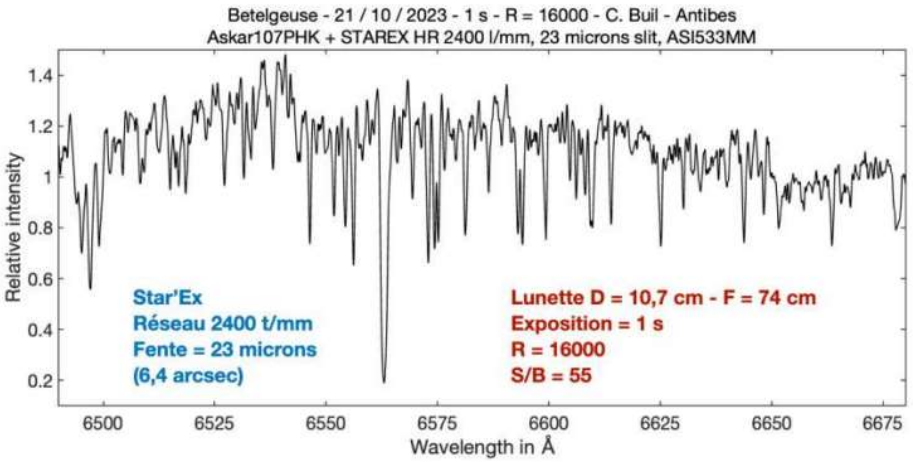
Spectras from IRAP / Polarbase

- 860 nm lines +- 25 nm
- Ionised Ca and chromosphere



Setup proposal based on C. Buil Tests

- Spectro Star ’Ex HR, grating 2400l/mm 25mm
- Slit 23 microns
- Exposure time 1s (or less if possible regarding S/N)
- Refractor 100mm aperture F7
- Signal/Noise 55 to 90
- R 16 / 20 000
- Strongly depends on seeing



Star'Ex VHR mounted on a telescope feeding the slit of the spectrograph

- Team with a spanish amateur observatory
- Telescope f number 8 -10
- Standard T2 interface
- Successive 1s exposures or
- Sideral drift along the slit on a 60sec exposure

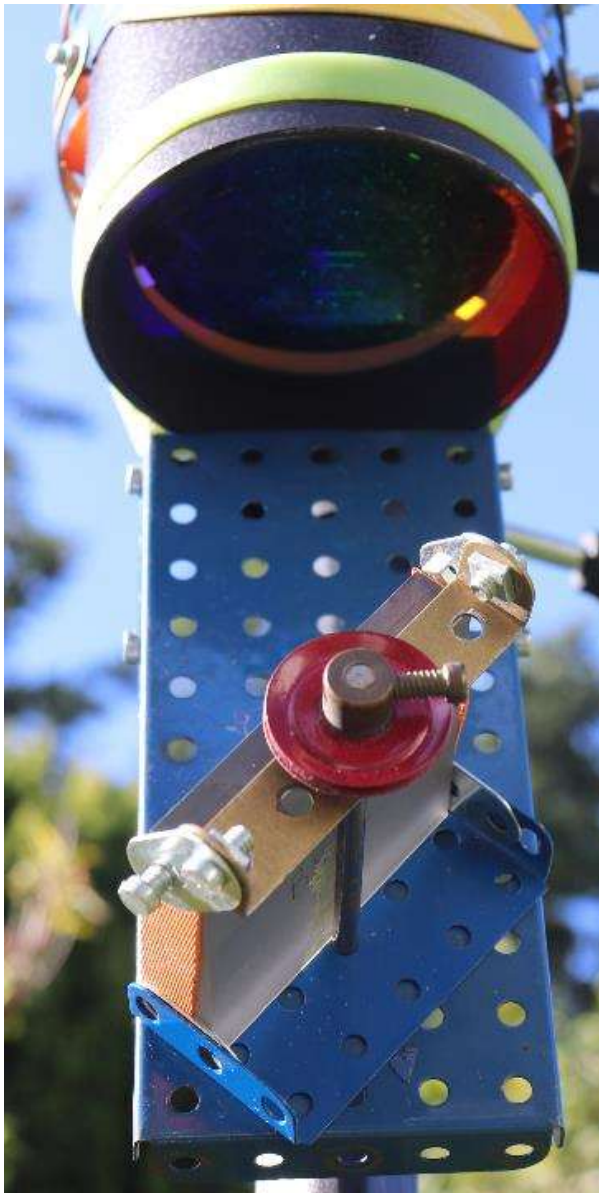
- You may use any kind of high resolution spectrograph as long as you meet the objectives. (E-shell, Lhires III, personal spectrograph..)

Alternate solution :
Slitless with a large grating on the pupil

- Large grating 58mm 1200g/mm : R max = 58 x 1200
- The seeing gives the slit width
- The focal length, the pixel pitch behind the grating dispersion give the effective resolution

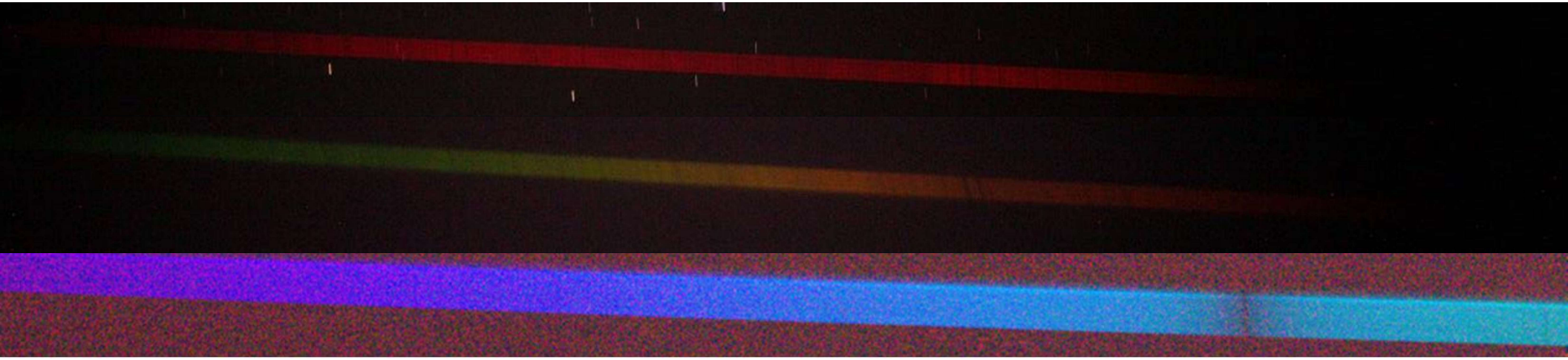
Pupil grating spectrograph demonstrateur using blazed grating 1200 grooves/mm 58mm (Jobin & Yvon Horiba) 400mm zoom lens

Pascal Goumard, Thierry Midavaine



Pupil grating spectrograph with a beam splitter grating 1500g/mm 58mm (Jobin & Yvon-Horiba) in front of 70mm refractor, 400mm focal length

Thierry Midavaine



First test on Altair and Vega 30 sec exposure using the sideral drift, around H beta Balmer line with a Canon 500D Sigma zoom 400mm sept 2023,

Pascal Goumard, Thierry Midavaine