Eta Carinae around the 2009 periastron - A new view with X-shooter

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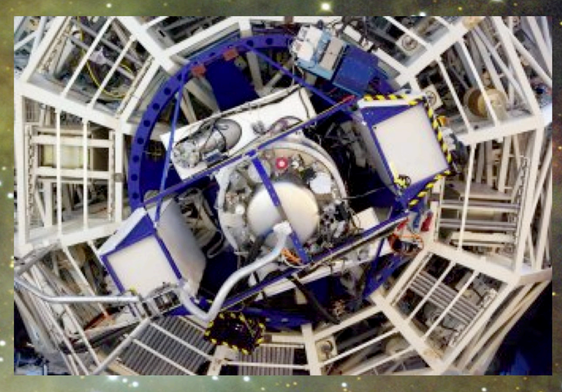
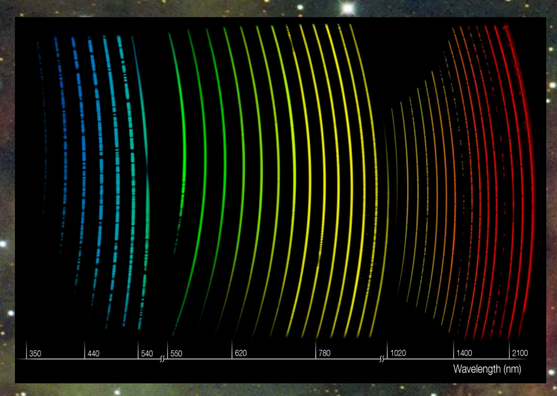
Introduction

The close Eta Carinae binary system with a smaller, but hotter companion star orbiting around the central star with a period of 5.5yr had another periastron passage of the smaller companion around Jan. 11 2009. During periastron, the harder UV radiation from the companion is shut off while it passes through the dense wind of the main star and the wind-wind shockfront collapses. Subsequently, the X-ray emission from the shock decreased, but recovered surprisingly early after the 2009 periastron[1]. In the same way, earlier spectroscopic surveys around periastron showed that emission lines from highly ionized species disappear when the far-UV radiation from the companion is shut off during the passage and start to reappear a few months later, therefore, the periastron is also named „spectroscopic low state"[2]. Here we present data from the new X-shooter spectrograph currently being commisssioned for the VLT shortly after the periastron and several months after the passage.

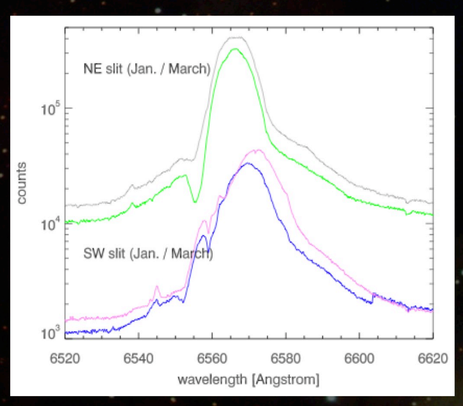
Xshooter
A new generation instrument for the VLT [3]:

3 Arms: UVB, VIS, near-IR
Wavelength coverage: 3000-25 000 Å
Medium resolution: R=4000-9000
High sensitivity: S/N=10 in 1h at R~21.5
Longslits (12") and a small IFU (3x0.6"x4")





Balmer lines

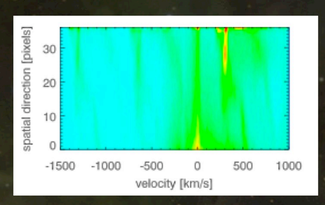


Hα profiles close to the star for both radial longslit positions.

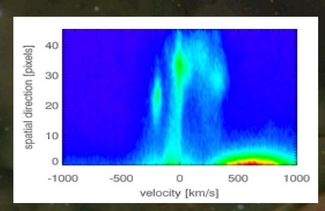
The NE slit shows less P-Cygni absorption in January but strong absorption in March.

For the SW slit, it is absent at both epochs while there is a velocity shift in March

⇨ SW slit is the ingress side of the system.



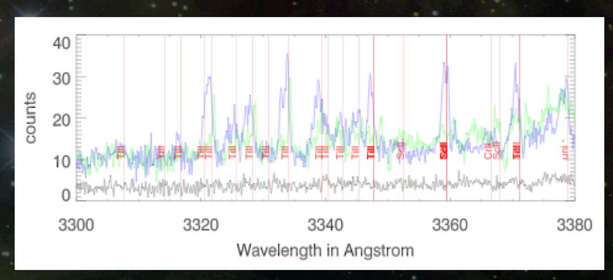
NII+Hα along Pos1: Complex structure from several ejection episodes?



Hβ along Pos2

Sr-filament [4]:

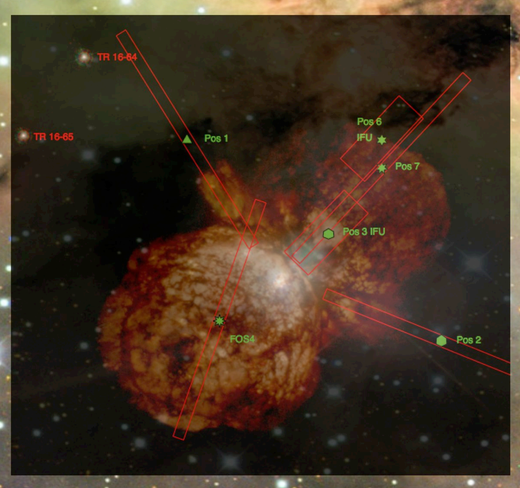
Extensive study with 3 IFU positions covering the entire filament. No temporal evolution, only one dataset.



Small cut out 1D spectrum of the outer part of the filament

The dataset:

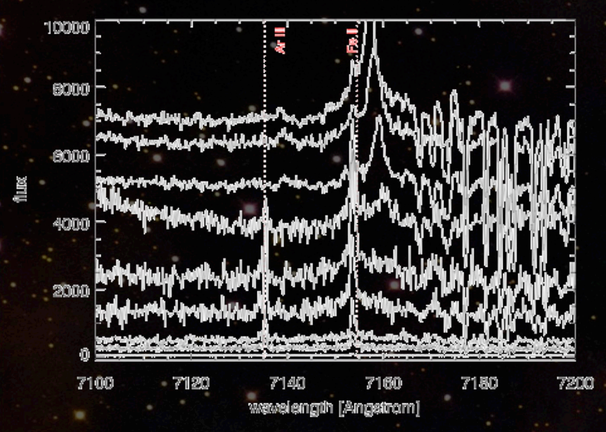
January (5-10 days after periastron):
2 nights, UVB+VIS
POS1&2, 3 IFU positions
March (2 months after periastron):
1 night, UVB+VIS+IR
POS1&2, FOS4
[June:
1 night, UVB+VIS+IR
POS1&2, FOS4]



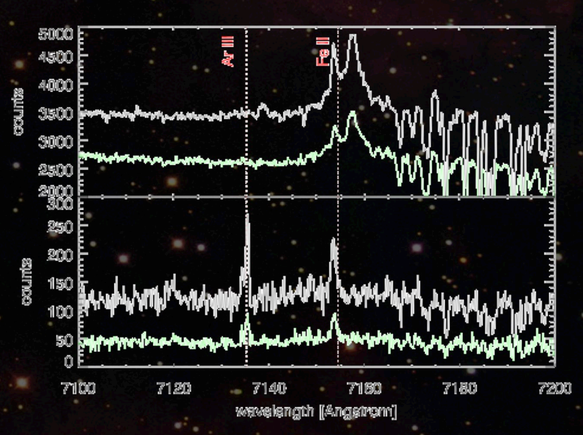
HST image of the Homunculus with positions

- Pos 1&2: longslits in radial direction from the star
  record in time of the lines disappearing during periastron
  (due to the light-travel time)
- FOS4: reflection of the central star as seen from the polar axis
- 3 IFU positions placed over the Sr-Filament
- Pos 6&7 were not observed due to time constraints

High and low ionization lines along the slit



Ar III and Fe II along slitposition1 in January, top is close to Eta Carinae



Comparison between January (white) and March (green), top panel: close to the star, bottom panel: far side of the slit

Ar III is still present on the far end of the slit while it has disappeared close to the central star. While in March, there is still Ar III present at the far end, it has not recovered close to the star.

References:

[1] various talks in this JD
[2] Damineli et al. MNRAS, 364, 1689
[3] d'Odorico et al. 2006, SPIE Conf. Proc. 6269
[4] Hartman et al. 2004, A&A 419, 215

Background picture:
Eta Carinae nebula
Mosaic of 8 exposures in BVR
Danish 1.54m, La Silla, Chile