



# The deep spectrophotometric mosaic of the Orion Nebula

~~(Preliminary Results)~~

(Current status)

Manuel Núñez-Díaz<sup>1</sup>, César Esteban<sup>1</sup>,  
Adal Mesa-Delgado<sup>2</sup>, Christophe Morisset<sup>3</sup>,  
William Henney<sup>4</sup>, Jorge García Rojas<sup>1</sup>,  
Valentina Luridiana<sup>1</sup>

<sup>1</sup>Instituto de Astrofísica de Canarias, La Laguna, Tenerife, Spain

<sup>2</sup>Departamento de Astronomía y Astrofísica, Facultad de Física, Pontificia Universidad Católica de Chile, Santiago, Chile

<sup>3</sup>Instituto de Astronomía, Universidad Nacional Autónoma de México, México D.F., Mexico

<sup>4</sup>Centro de Radioastronomía y Astrofísica de la UNAM, Morelia, México



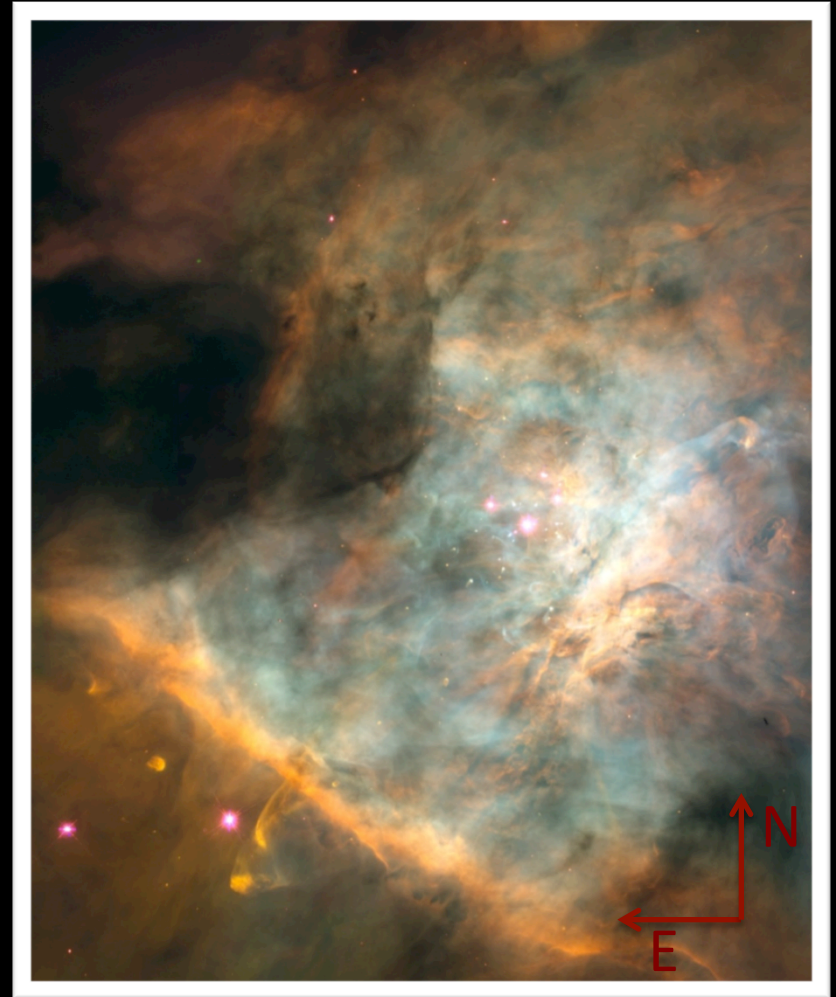
Instituto de  
Astronomía

# Introduction

“ A deep spectrophotometric mosaic of the central 5 arcmin of the Orion nebula with PPak IFU covering the optical range”

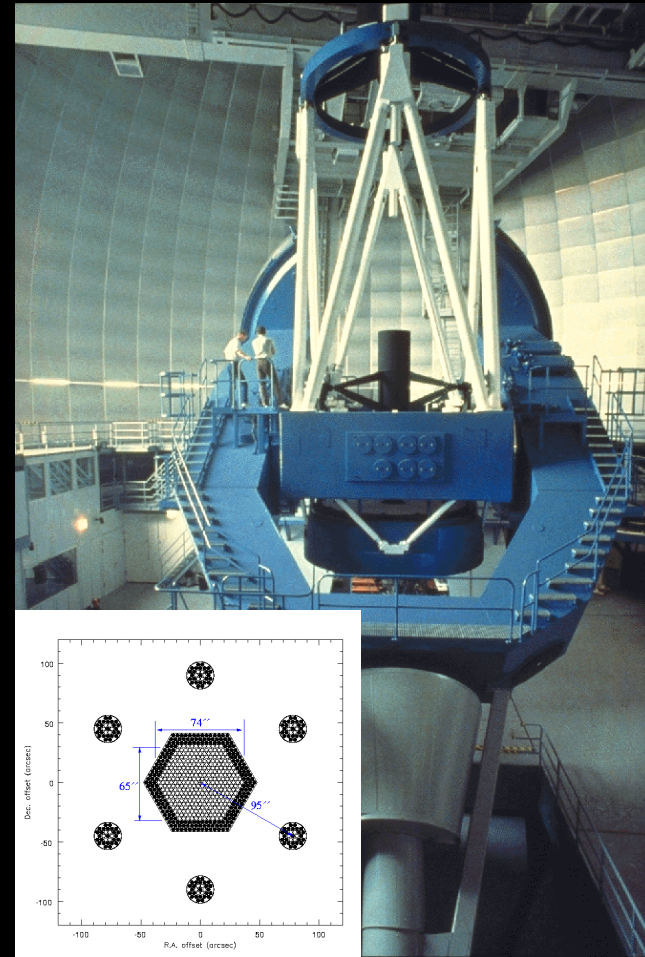
- Physical conditions
- Chemical abundances
- Map faint recombination lines
- Abundance discrepancy (AD)
- Temperature fluctuations ( $t^2$ ) ??

Is there a relation between AD and  $t^2$ ?

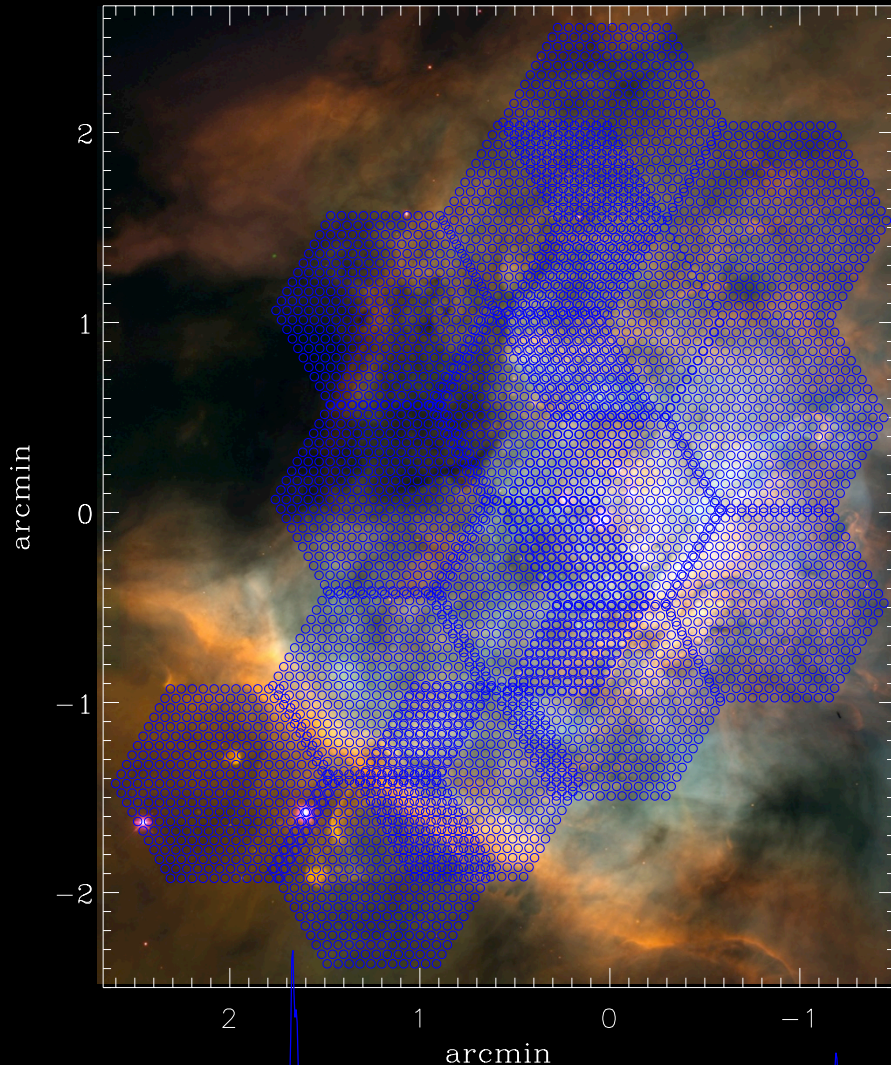


# Introduction

- 3.5m telescope @ CAHA
- PMAS - PPAk IFU (*Roth et al. 2005*)
  - ✓ Hexagonal pattern (331 fibers + 36)
  - ✓ FoV 74'' x 65''
  - ✓ Fiber diameter 2.68''
- Grating 1200 l mm<sup>-1</sup>:
  - ✓ Spectral resolution 2 Å
  - ✓ 3 position angles
- Data reduction:
  - ✓ P3D software (*Sandin et al. 2010*)
  - ✓ IRAF
- *PyNeb* tool (*Luridiana et al. , in press*)

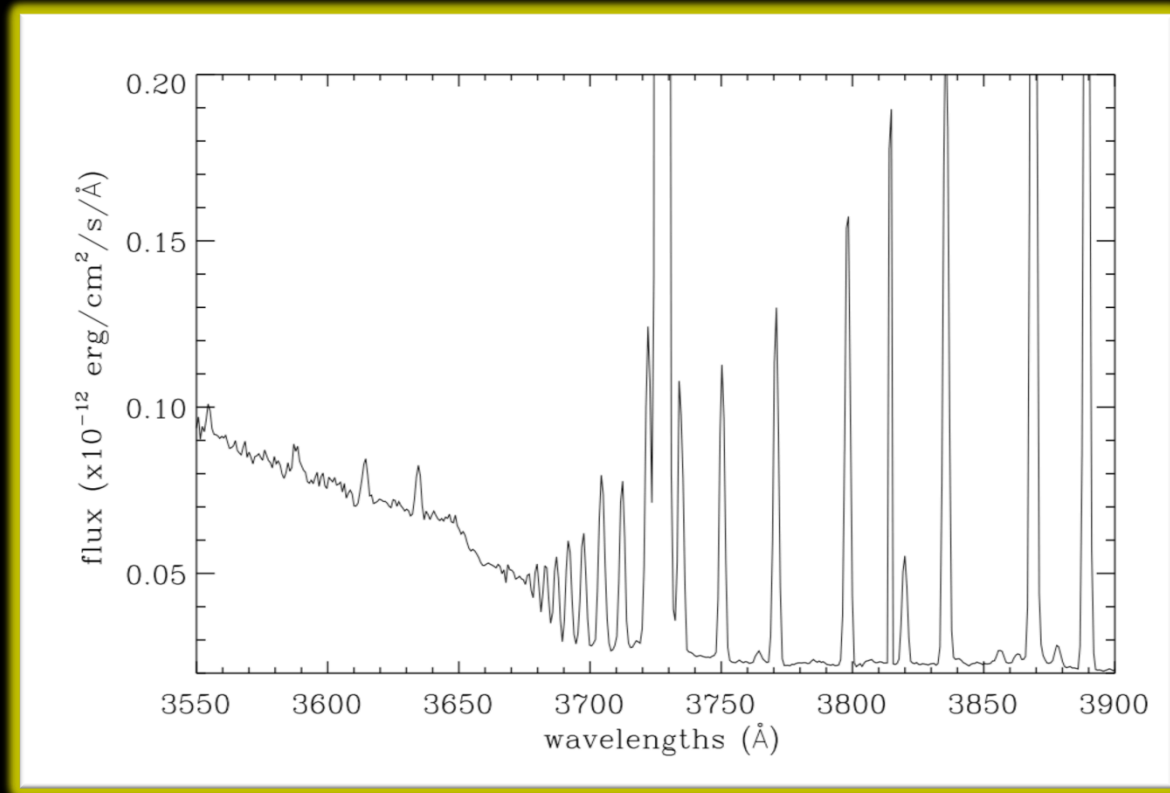


# Blue spectral range



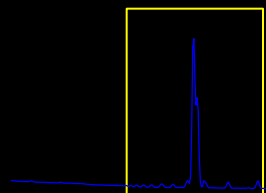
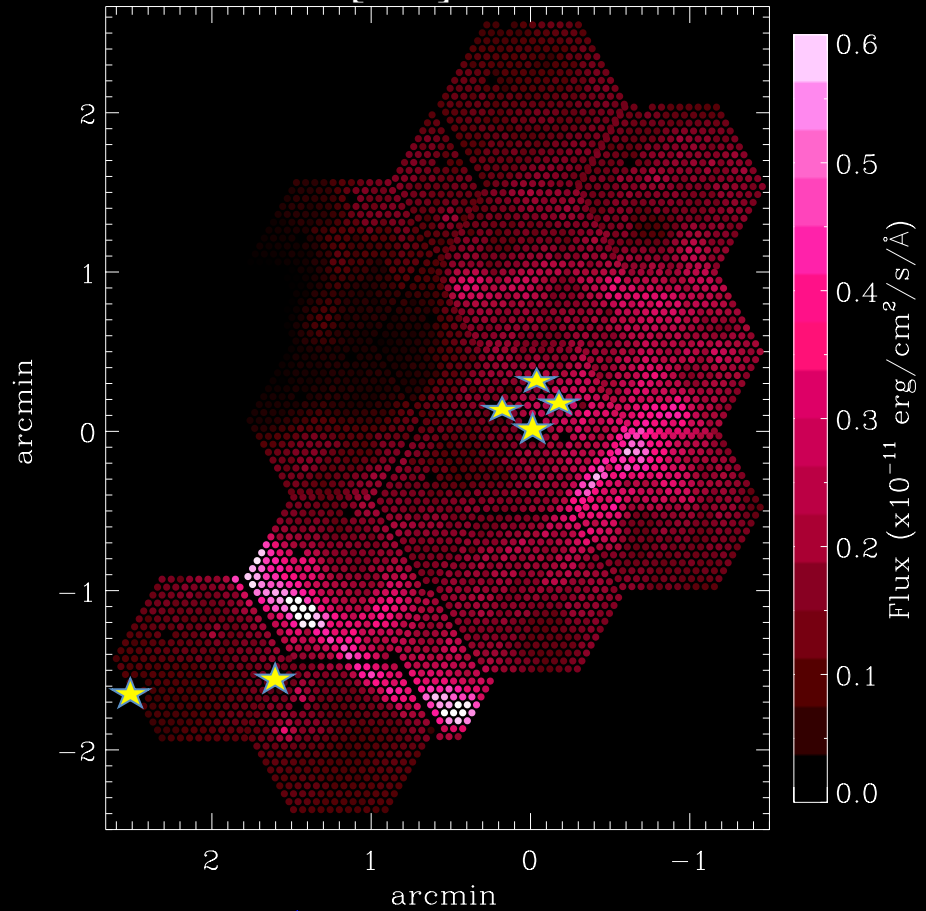
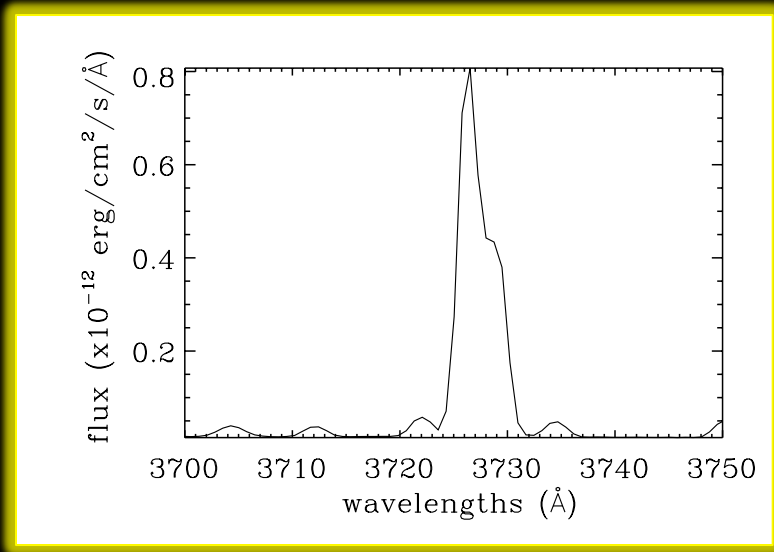
- Spectral range: 3550 – 4800 Å
- Long exposures: 3 x 600 s
- Short exposures
- **5872 spectra** (5296 + 576)

# Blue spectral range: Balmer jump



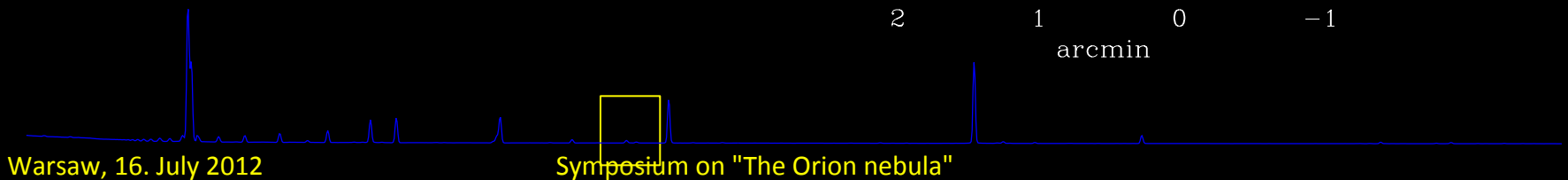
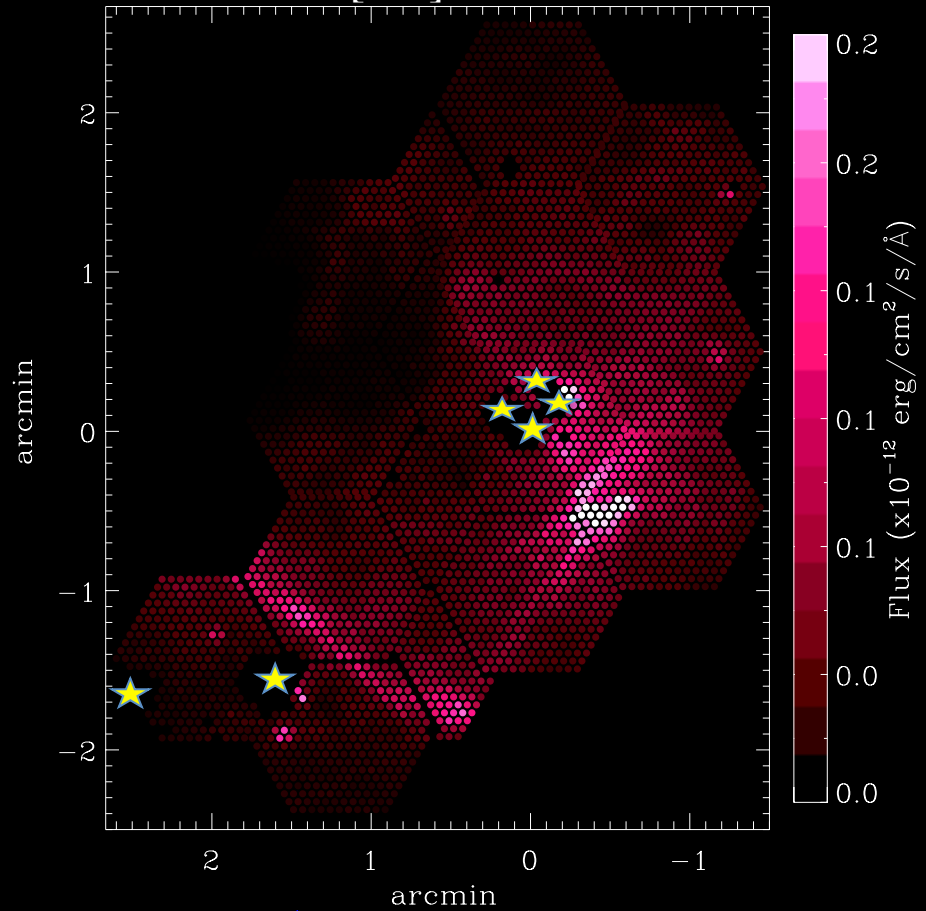
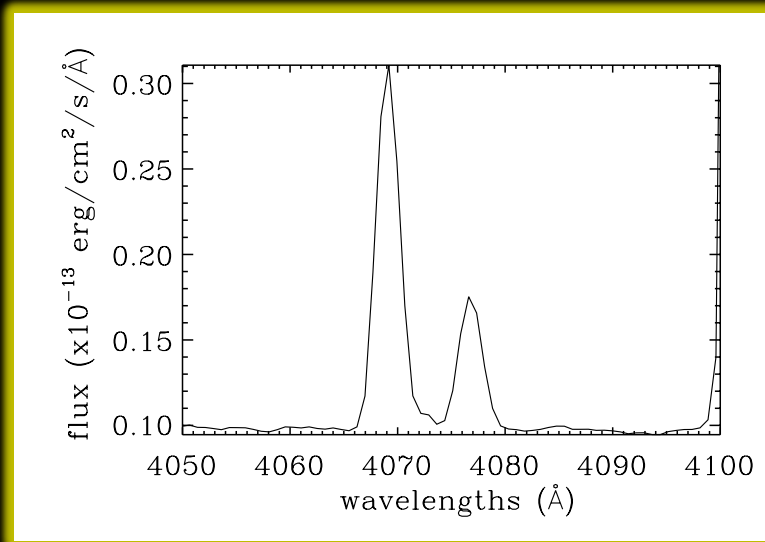
# Blue spectral range: [O II]

[O II] 3726 Å



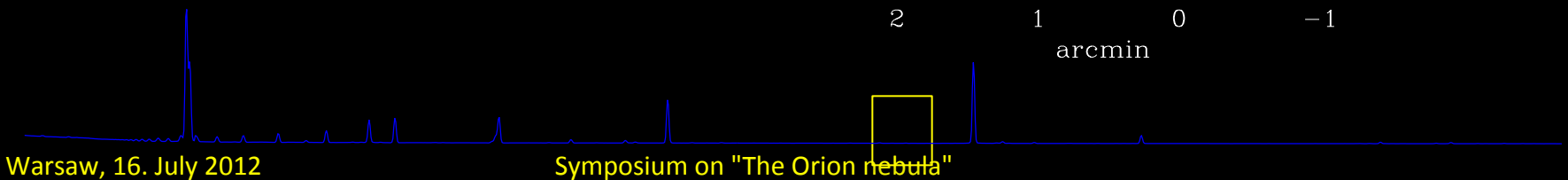
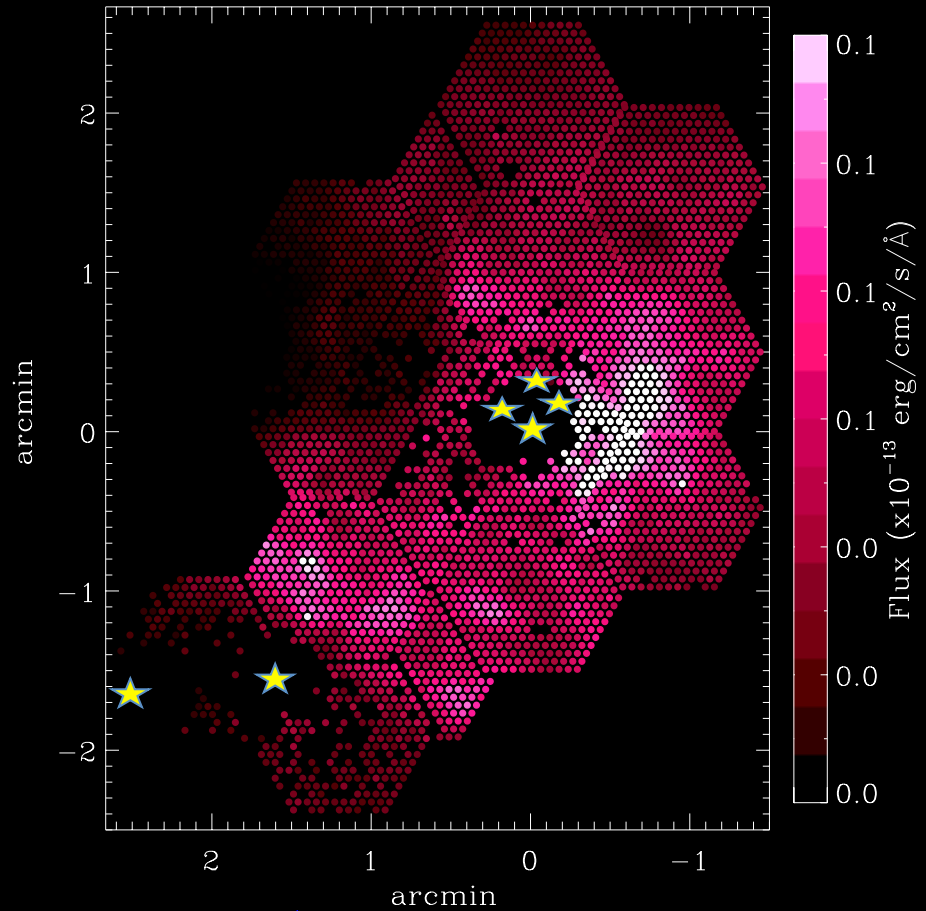
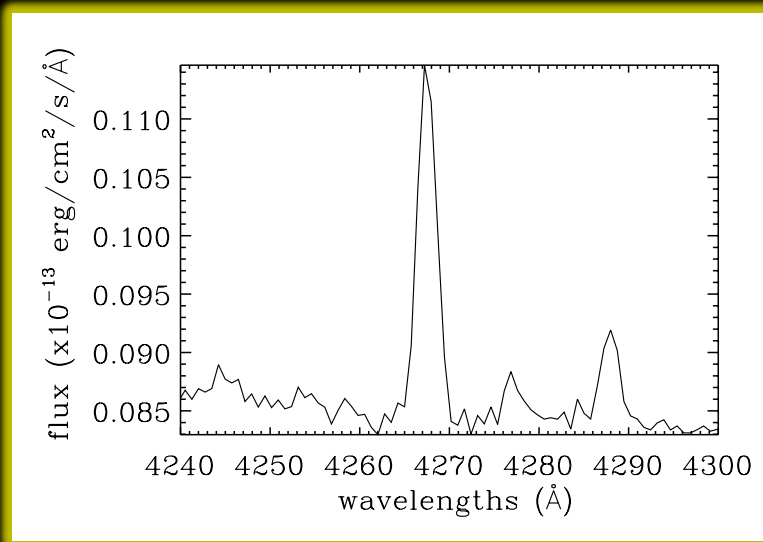
# Blue spectral range: [S II]

[S II] 4067 Å



# Blue spectral range: C II

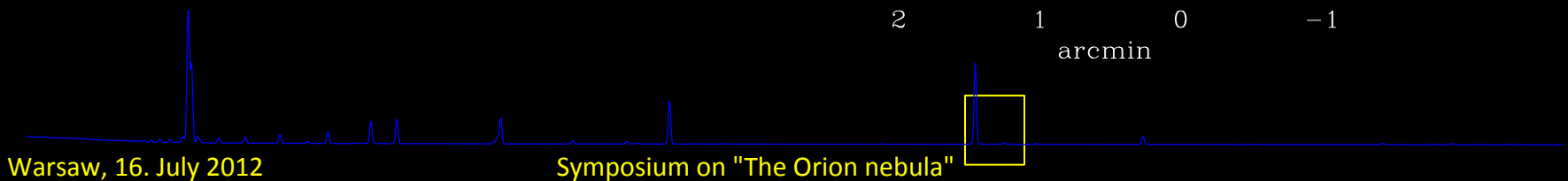
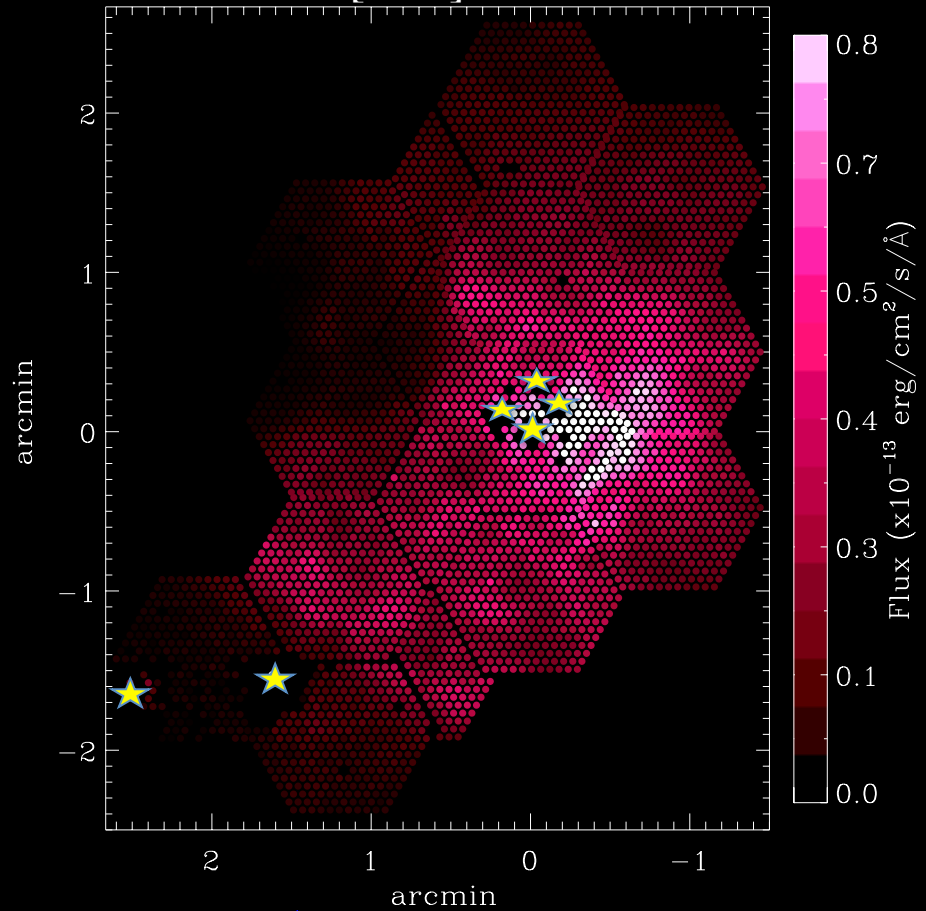
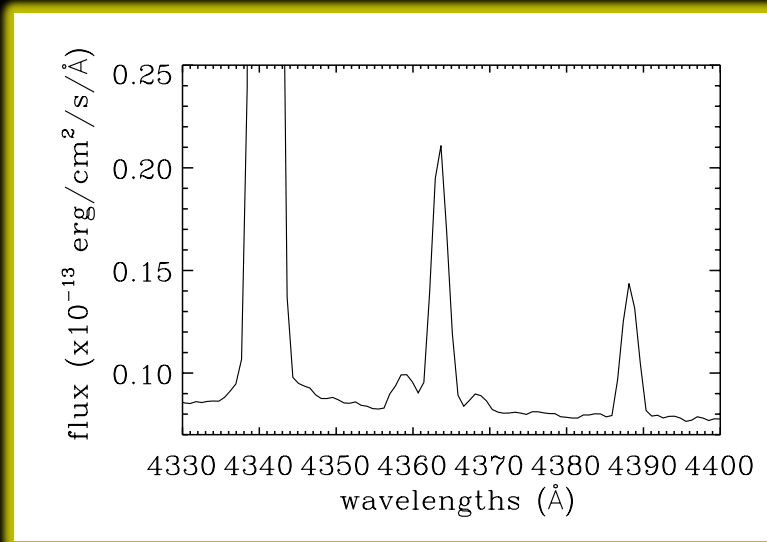
C II 4267 Å





# Blue spectral range: [O III] 4363 Å

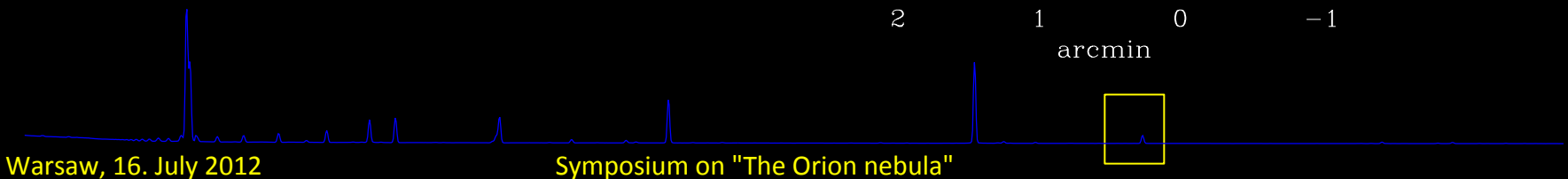
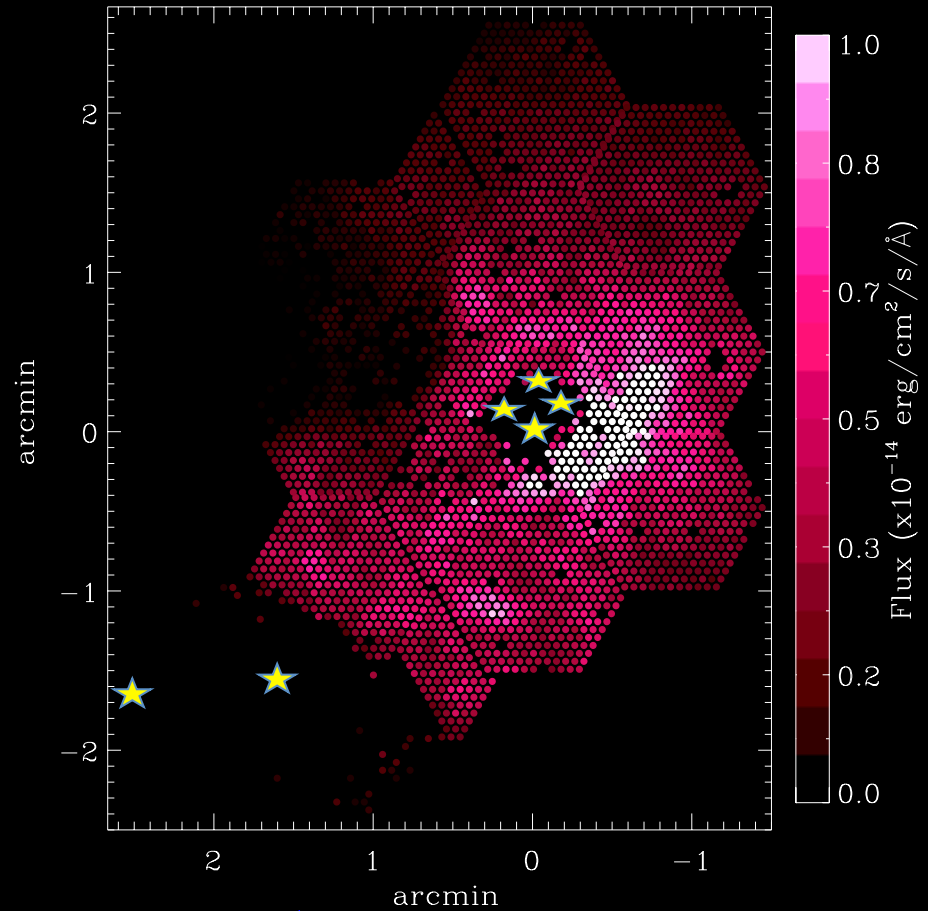
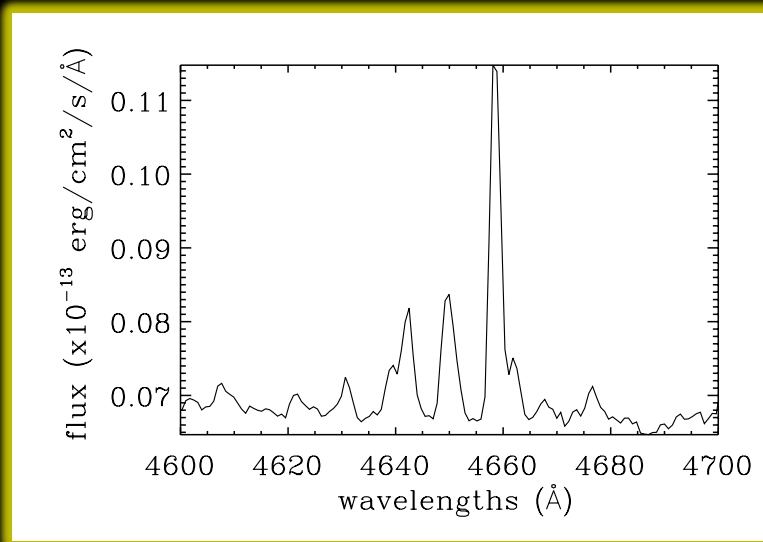
[O III] 4363 Å



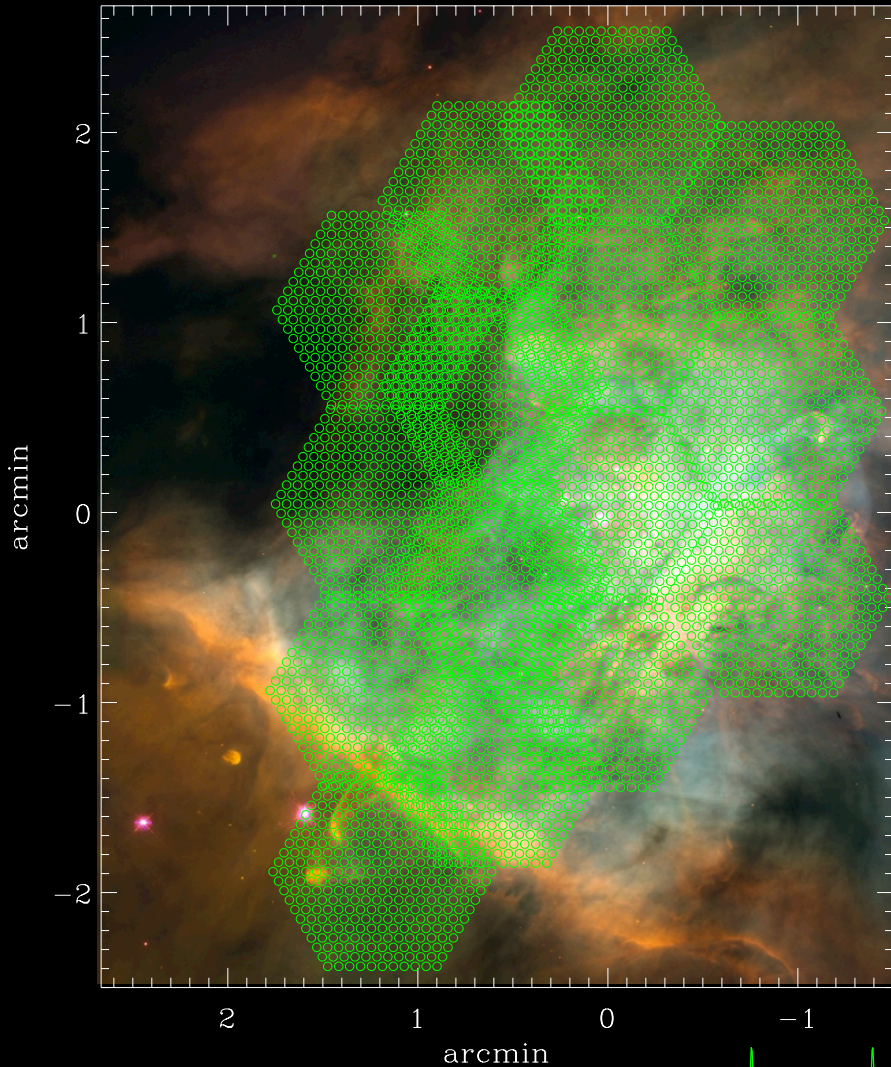
# Blue spectral range:

## O II + [Fe III]

### O II 4650Å



# Green spectral range



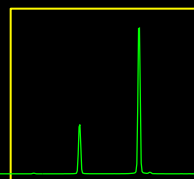
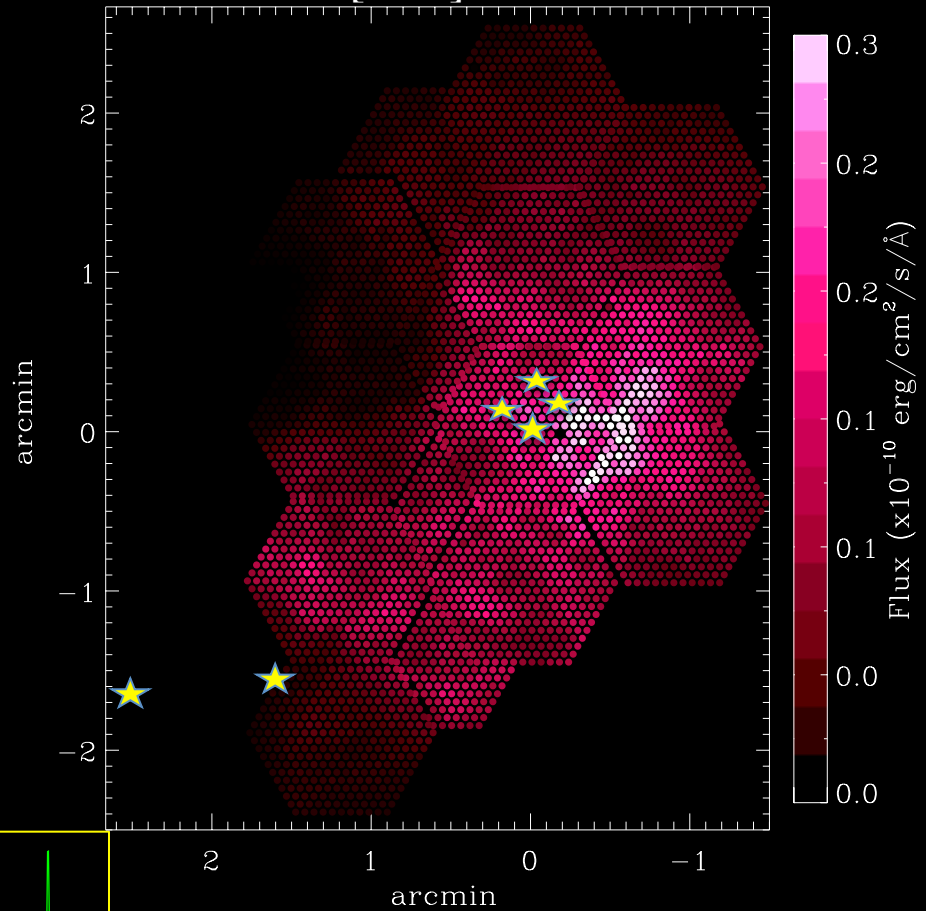
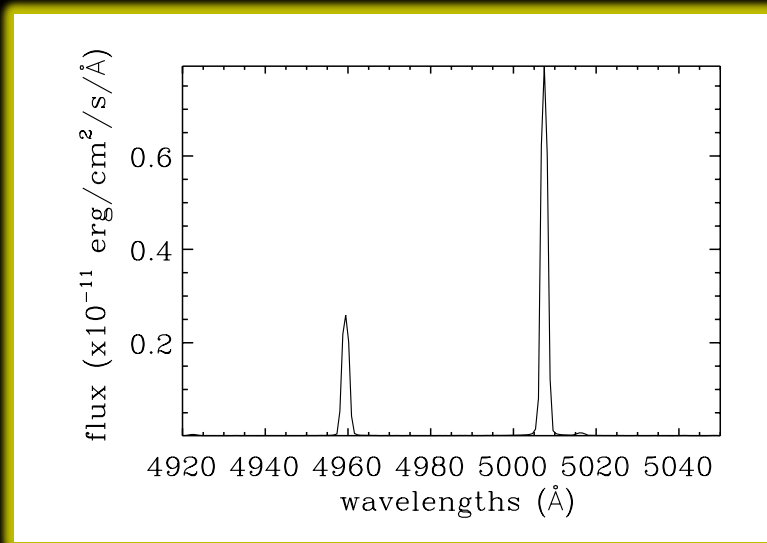
- Spectral range: 4400 – 5650 Å
- Long exposures: 3 x 120 s
- Short exposures
- **5505 spectra** (4965+ 540)

He I 4471 = He I 4471



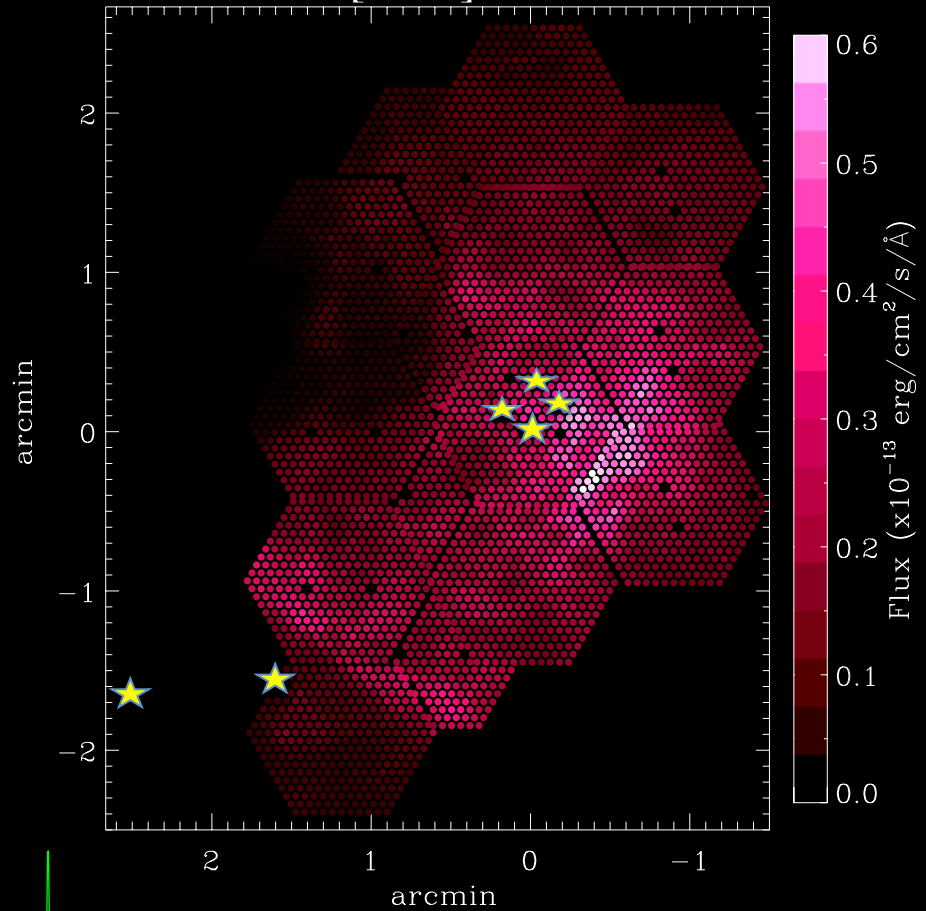
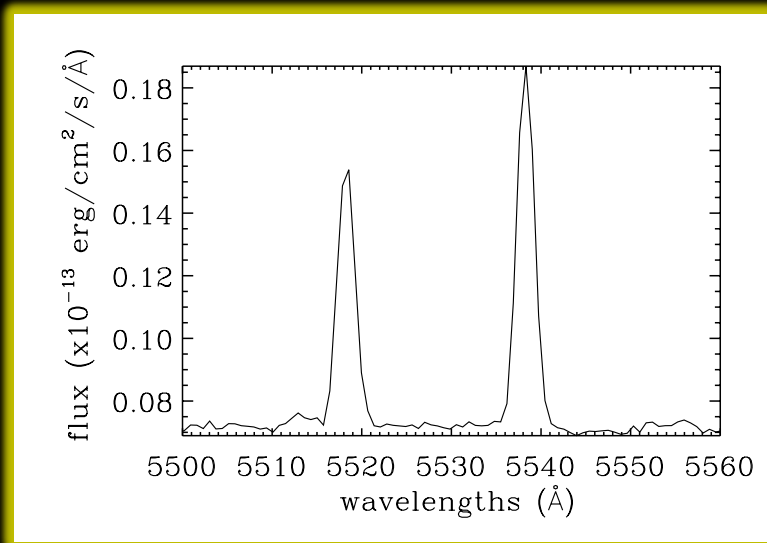
# Green spectral range: [O III] nebular

[O III] 5007 Å

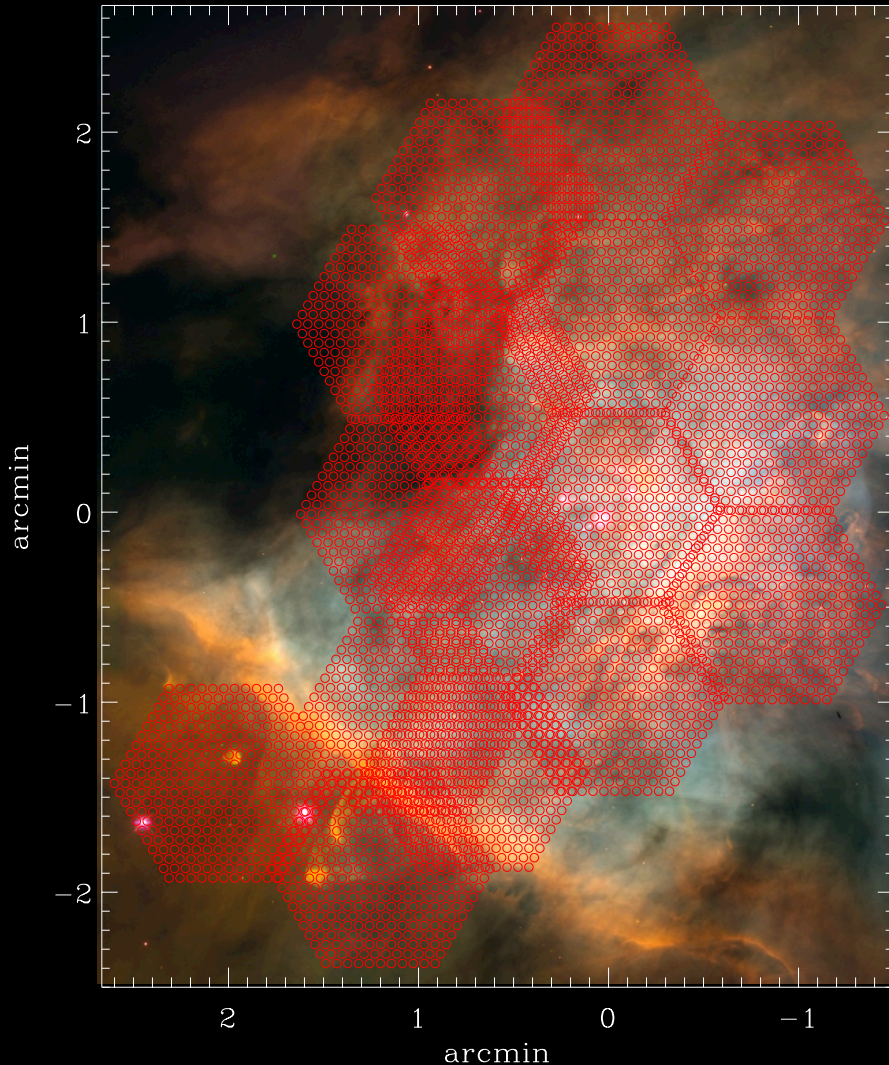


# Green spectral range: [Cl III]

[Cl III] 5735 Å

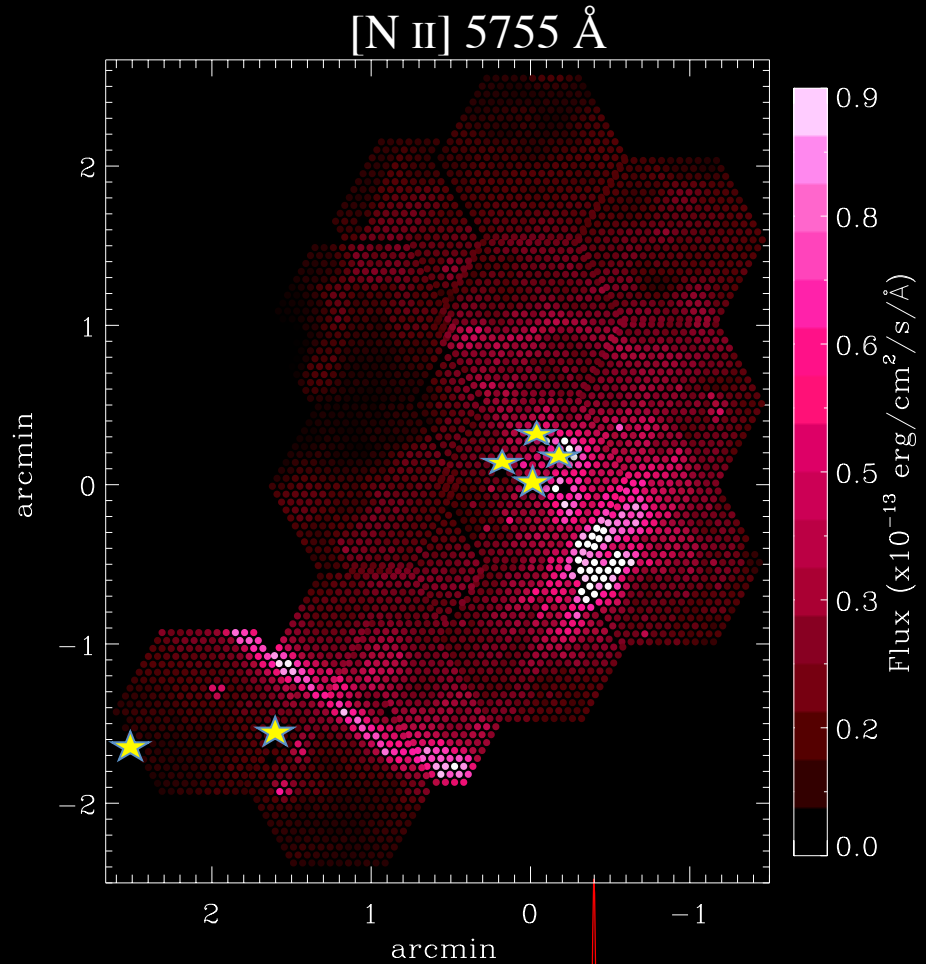
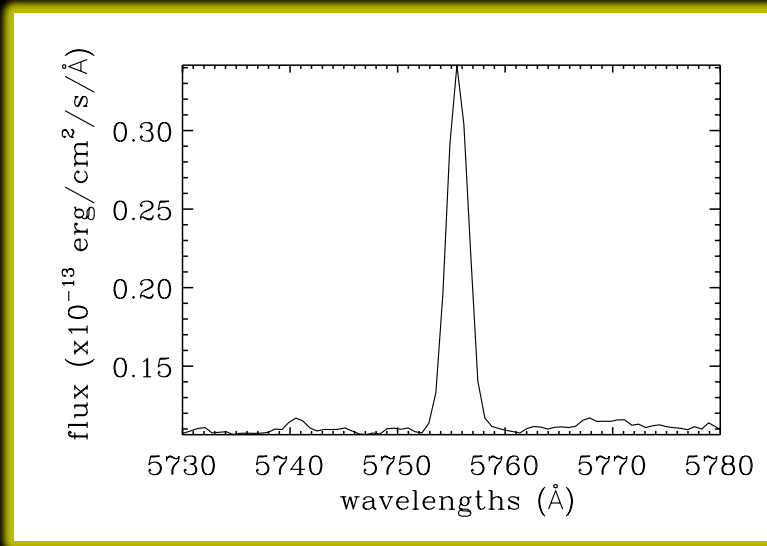


# Red spectral range



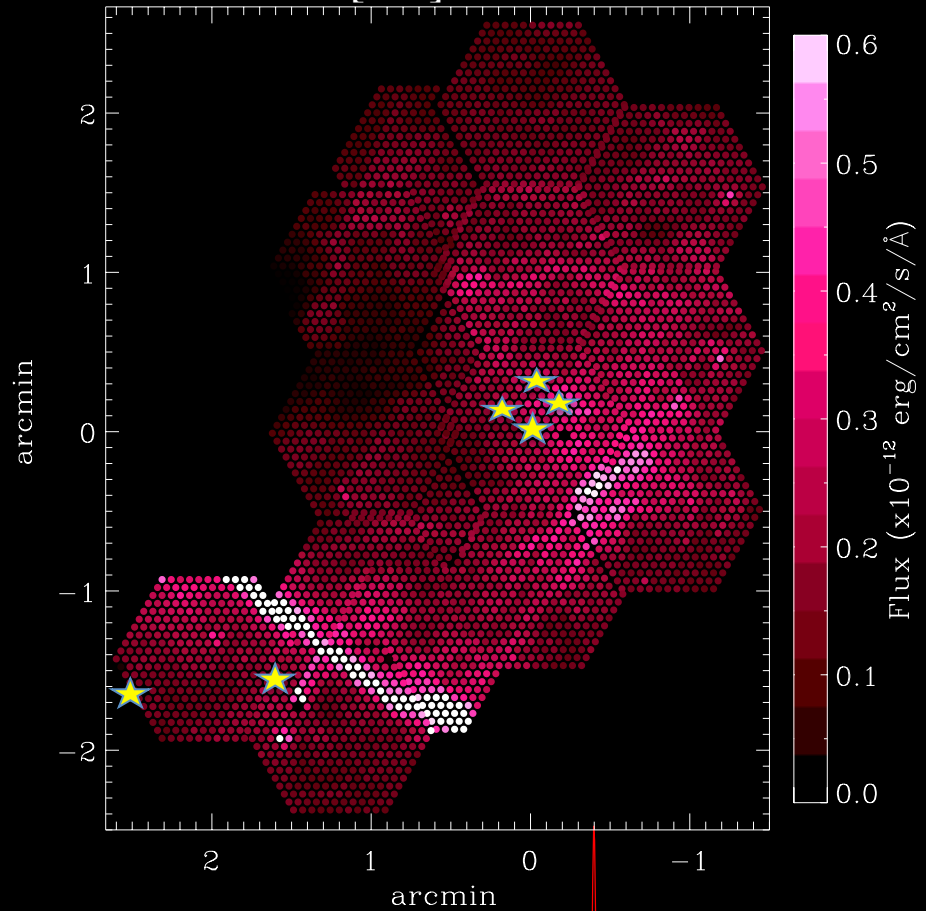
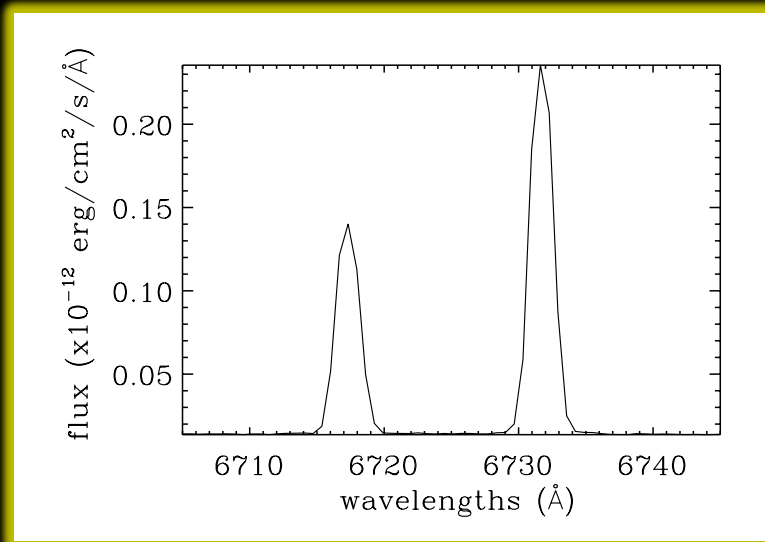
- Spectral range: 5650 – 6800 Å
- Long exposures: 3 x 90 s
- Short exposures
- **5872 spectra** (5296 + 576)

# Red spectral range: [N II]



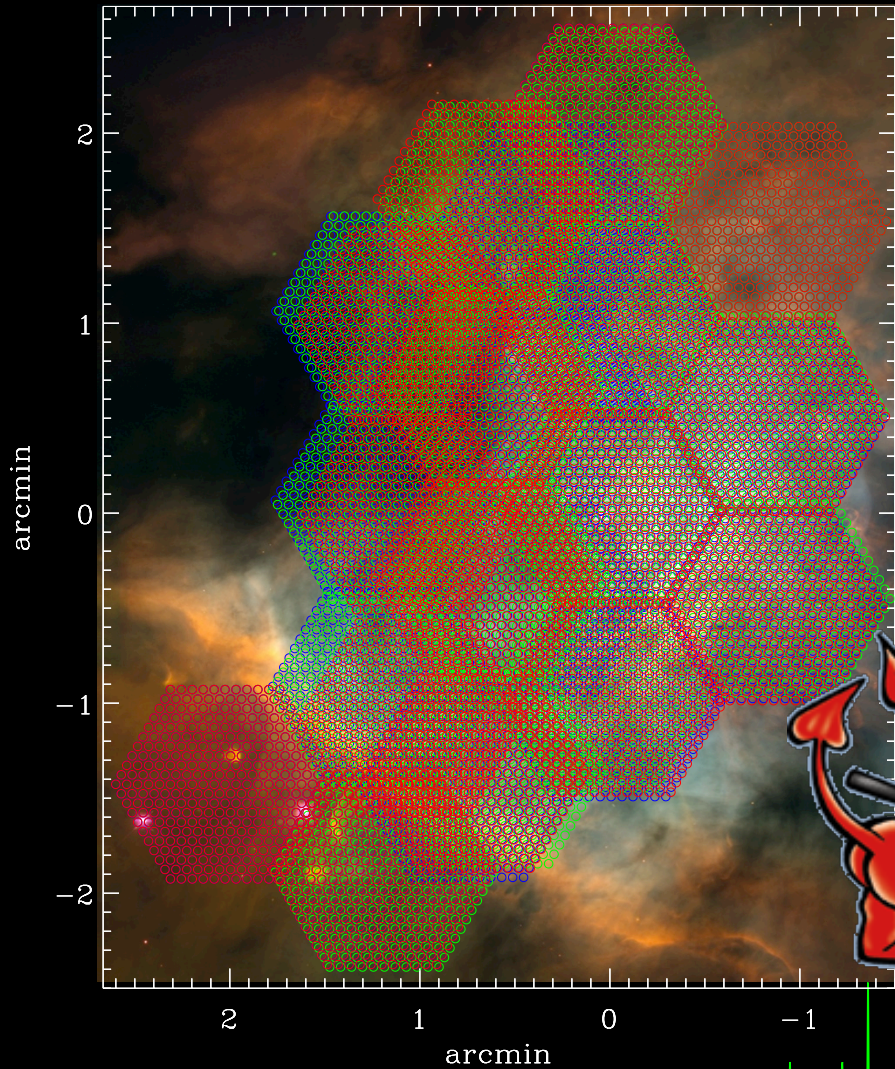
# Red spectral range: [S II]

[S II] 6731 Å





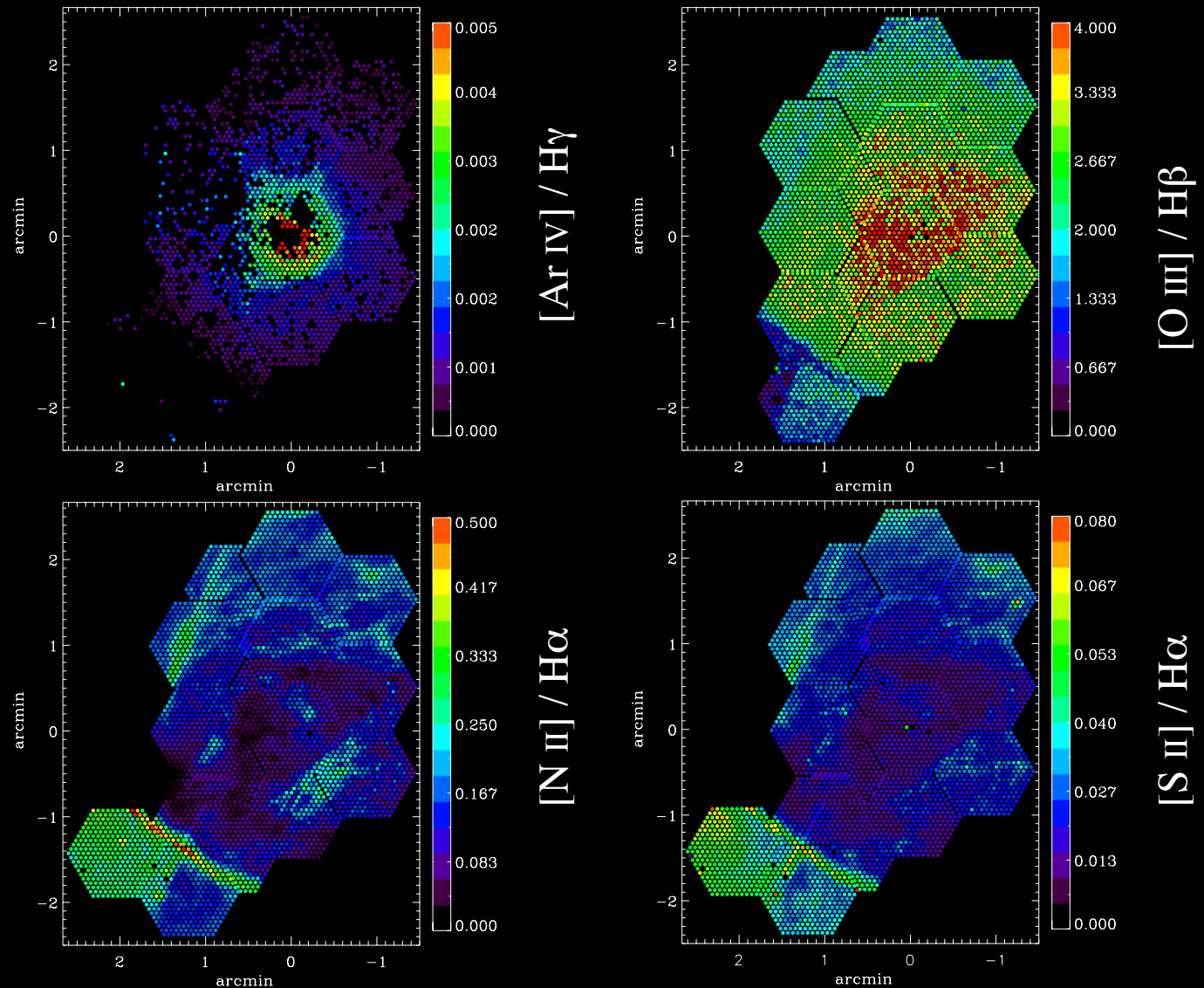
# Blue + Green + Red



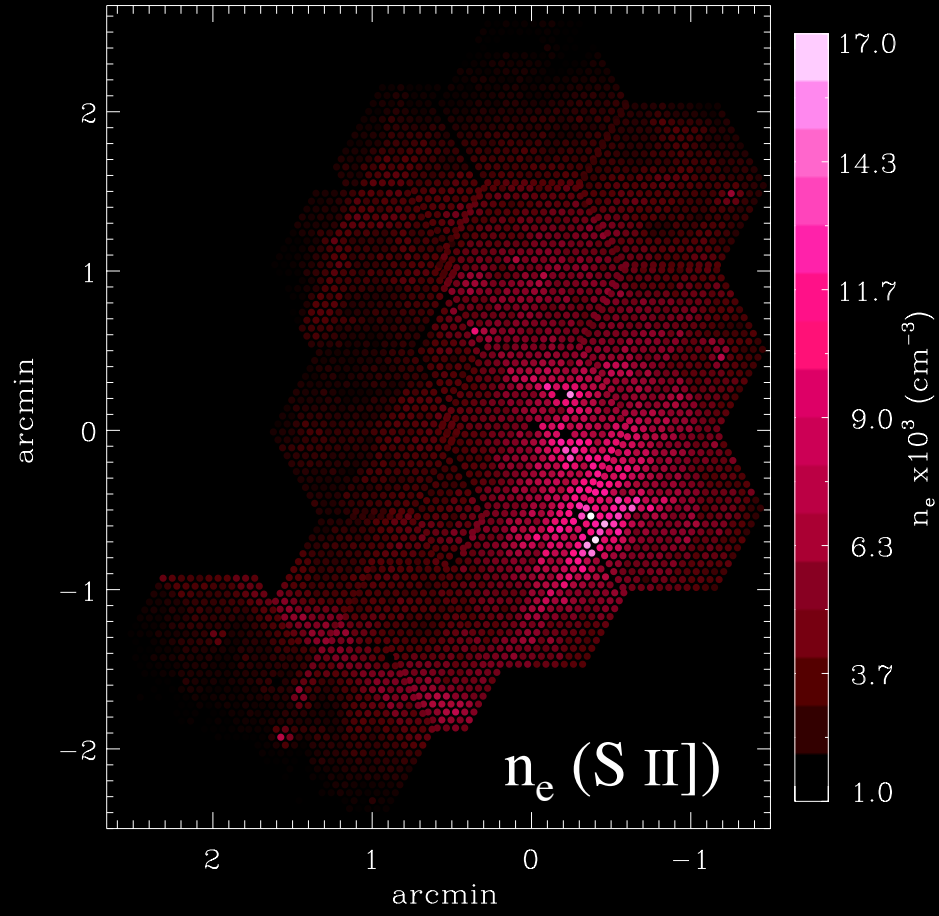
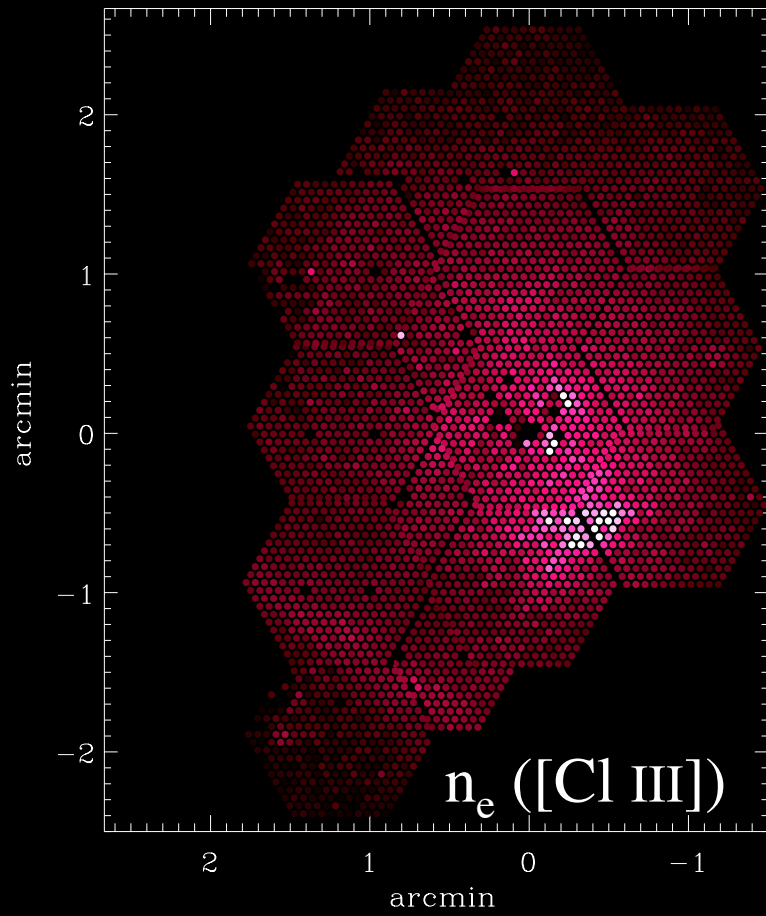
- Not co-spatial
- Scales factors?
- Scale blue-green
- $c(\text{H}\beta)$ ?  $\rightarrow$   $\text{H}\delta$ ,  $\text{H}\gamma$ ,  $\text{H}\beta$ ,  $\text{H}\alpha$
- $T_e([\text{O III}]) \rightarrow$  blue + green



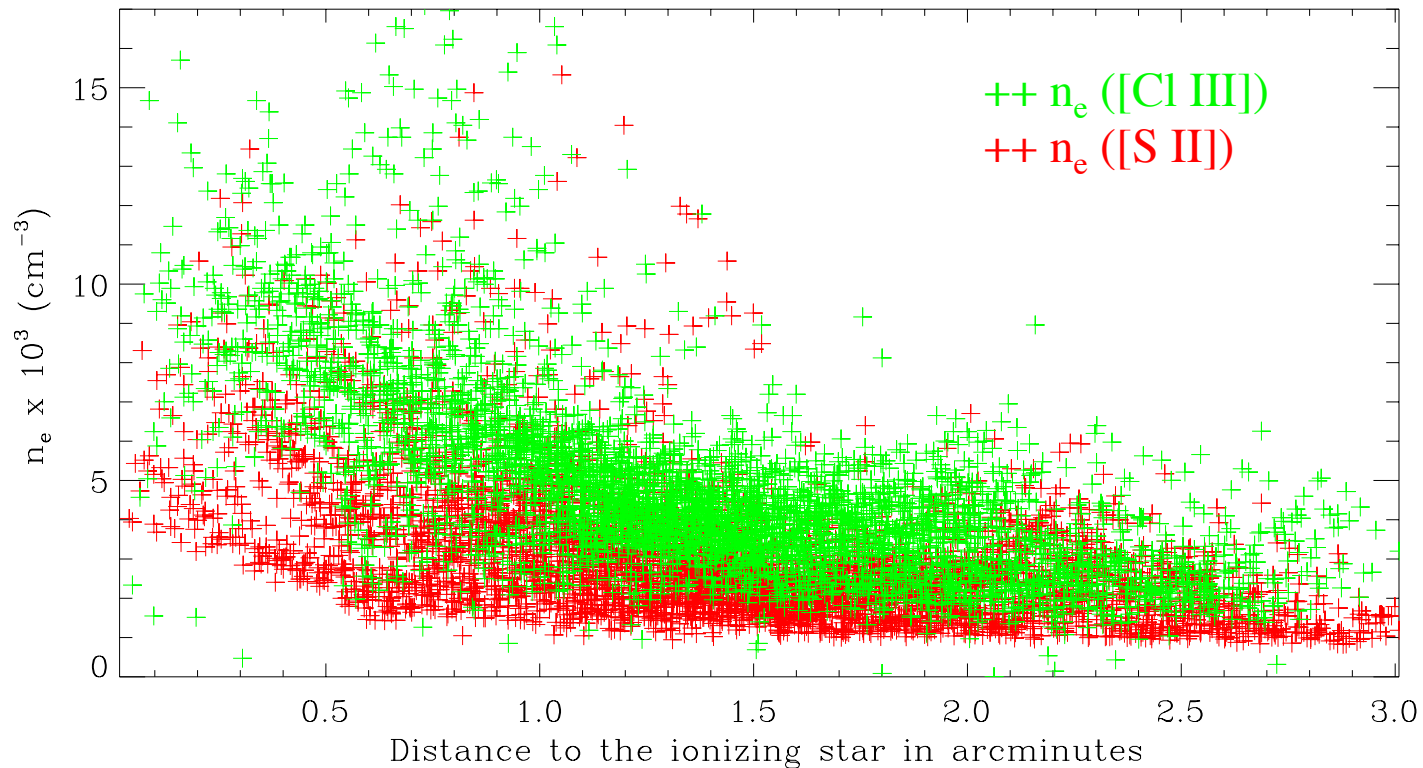
# Ionization structure



# Physical conditions: electronic density



# Physical conditions: electronic density



# Future work

- Extinction correction
- Electronic temperature maps:
  - [N II] & [O III]
  - Balmer jump
- Chemical abundances:
  - CELs
  - RLs
- Temperature fluctuation ( $t^2$ )

