Preliminary HII regions catalog from the observations of CALIFA survey

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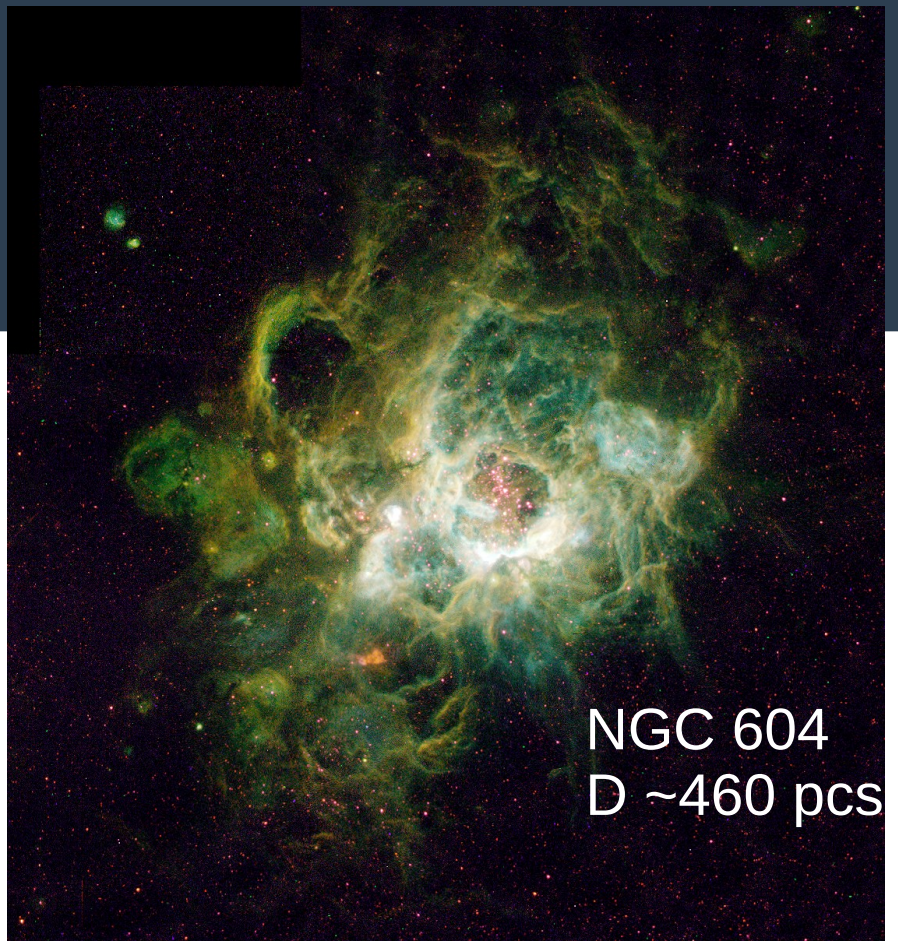
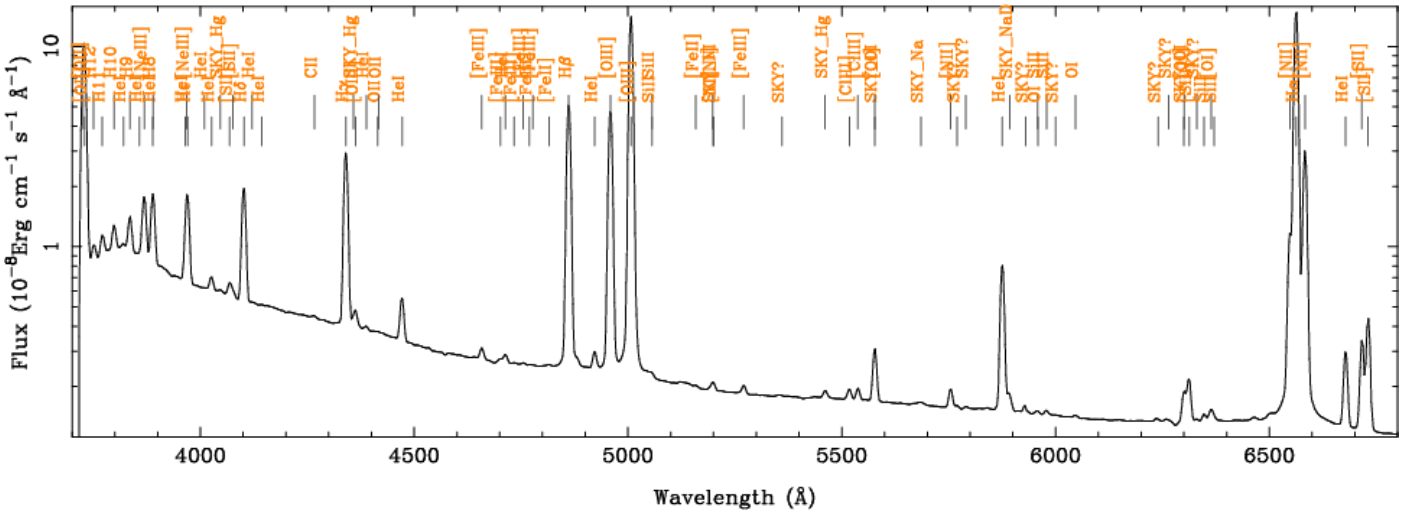
Guillermo Haro 2018

Giant HII Regions

- **Regions of interstellar atomic hydrogen that is ionized by massive, hot and young stars.**
- **The stars that ionize the gas cloud are O-type and B-type**





HII regions

- **Physical properties**

  Mass: Giant HII regions $\sim 10^6 M_\odot$ (Typical HII regions 10^2-10^4 $M_\odot$)

  Size: Giant HII regions ~ 1kpc (Typical HII regions from 1 pc to 10^2 pcs)

  Density: 1 -10^4 cm^{-3}

  T_e: 5000 -15000 K

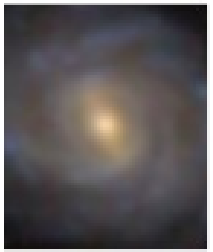
  T_*: 35000-50000K

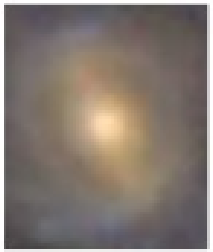
  Age of Ionizing Star ~ 10^6 yr

- **Importance of studying HII regions**
  - We can know the chemical composition of the current IM
  - HII regions are tracer of SF
  - Abundances of HII regions are tracers of abundances at galactic level
  - With those abundances we can constrain the evolution models of galaxies

MUSE

Atlas3D

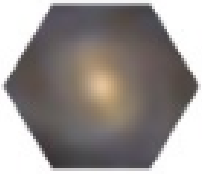


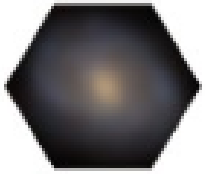


z~z califa

z~z Atlas3D

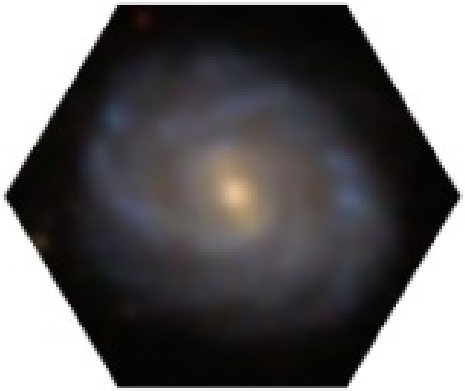
MaNGA largest FoV





FoV~1.5Re ~2.5Re

CALIFA (V500/V1200)

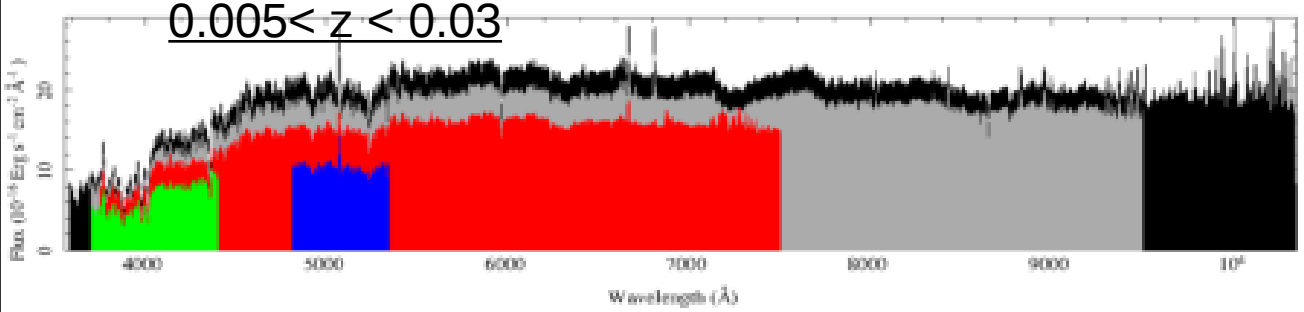


SAMI

z~z califa

z~z SAMI

0.005< z < 0.03

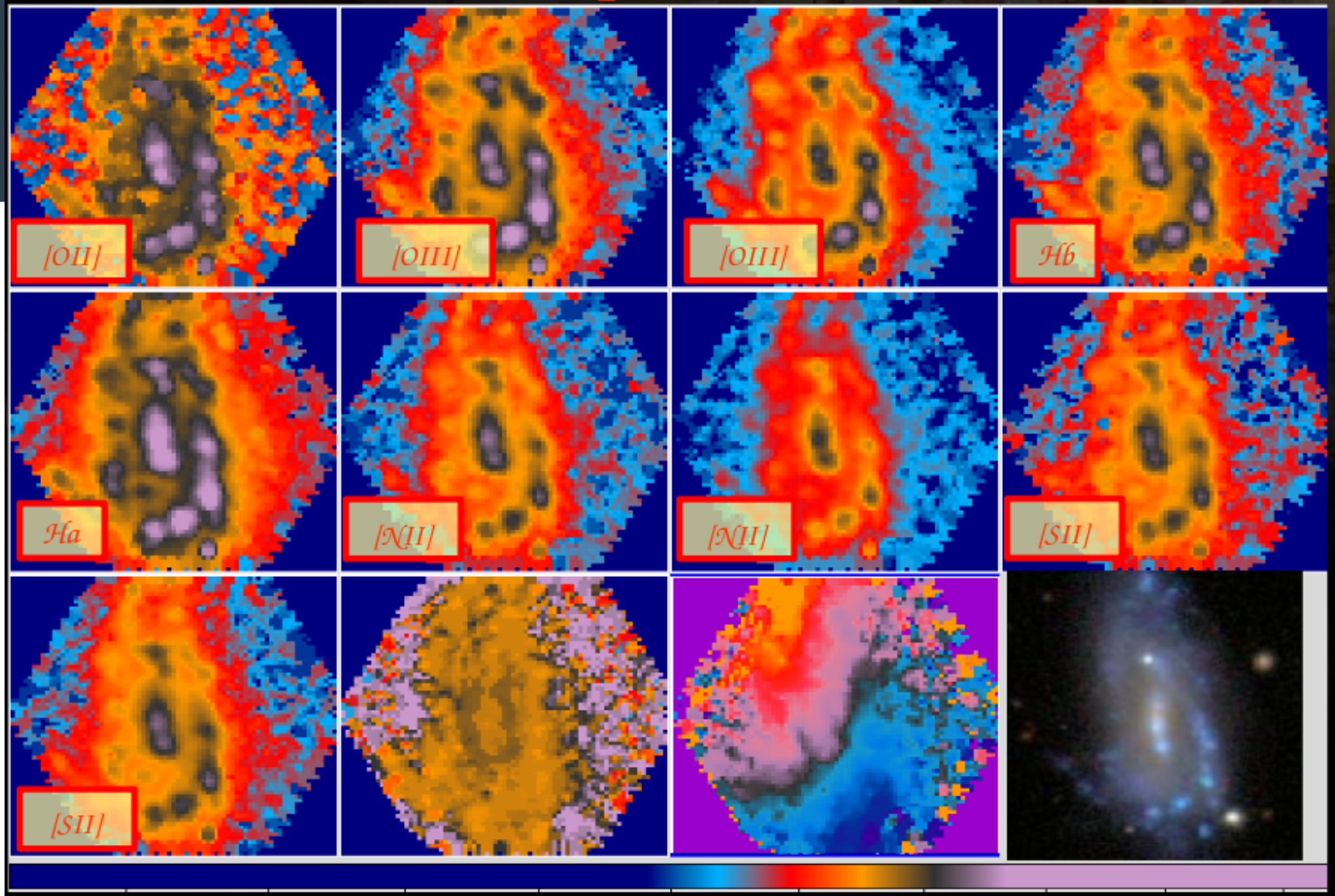


CALIFA
2x3x331 spaxels; 2.7”/spaxel
881 galaxies of any type
~1.200.000 spec.; 3700-7500 Å

Atlas3D
1577 spaxels; 0.94”/spaxel
260 ETGs
~400.000 spectra; 4810-5350 Å

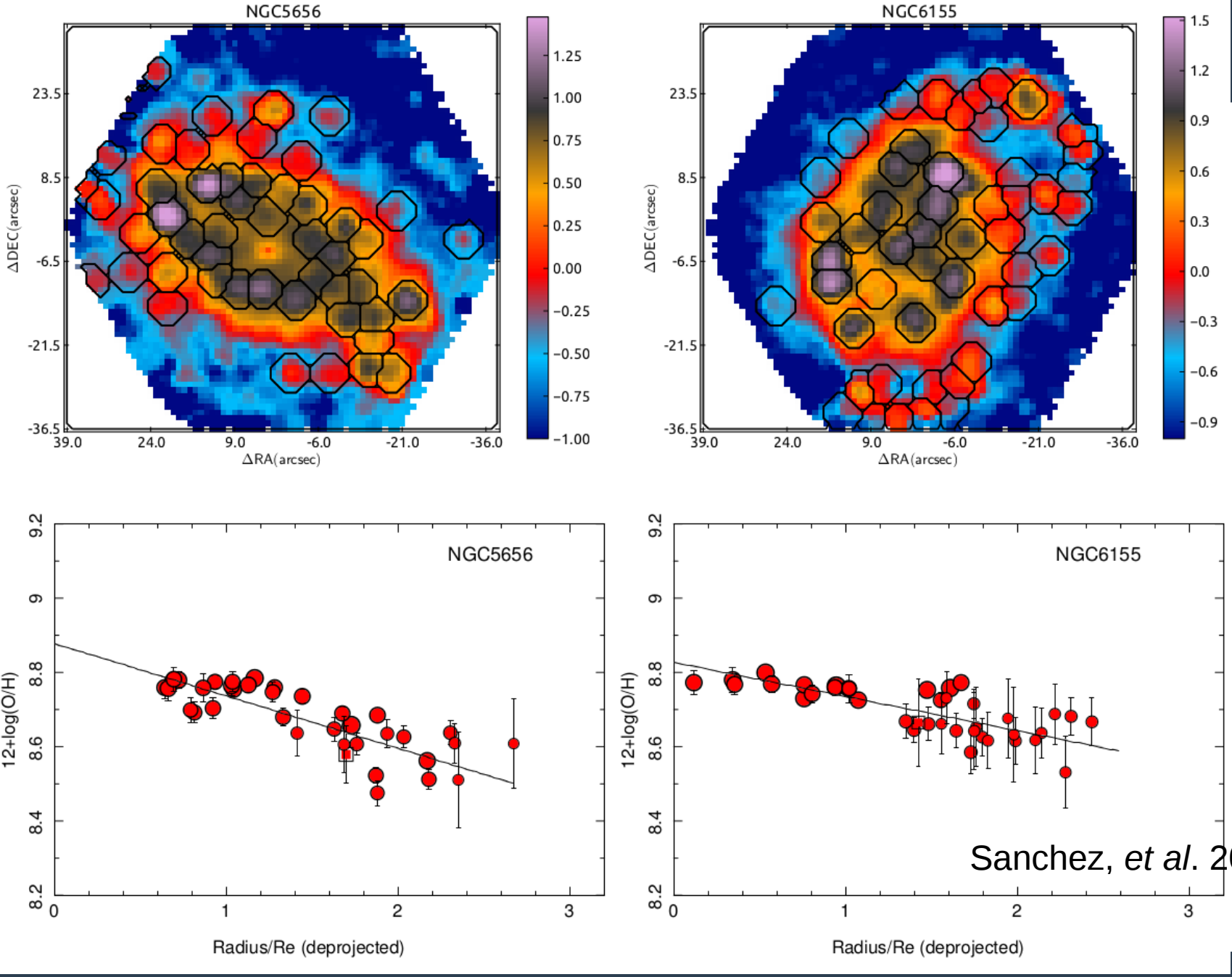
MaNGA
3x(19-127) spaxels; 2”/spaxel
7000 gal. of any type (~1.5Re)
2000 gal. of any type (~2.5Re)
1000 gal. of any type (any Re)
~800.000 spec.; 3550-10000 Å

SAMI
9x61 spaxels; 1.6”/spaxel
3400 galaxies of any type
~1.900.000 spec.; 3700-9500 Å



Ionized Gas: Multiple emission lines intensity maps, velocity and velocity dispersion.

306 Galaxies ~ 7000 ionized regions



HII regions catalog update

2014 HII catalog

(Sanchez, *et al,2014*)

306 galaxies observed with CALIFA survey

~7000 ionized regions

Catalog update

~850 galaxies

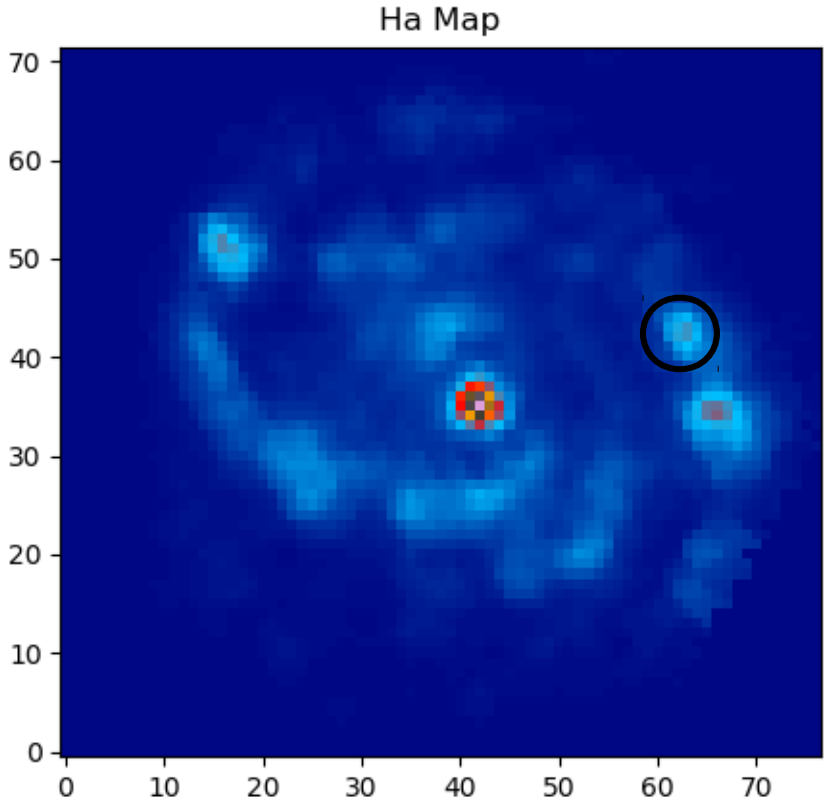
~20000 HII regions

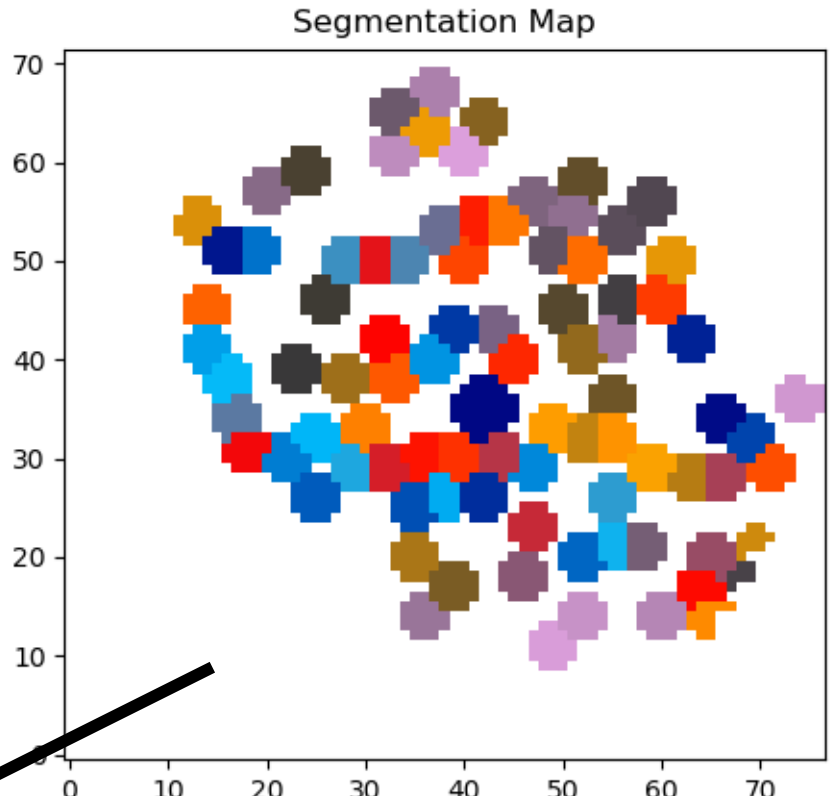
52 emission lines: from [OII]λ3727 to [SII]λ6731

Underlying stellar population properties

HIIexplorer (perl) → pyHIIexplorer (python)

pyHIIexplorer





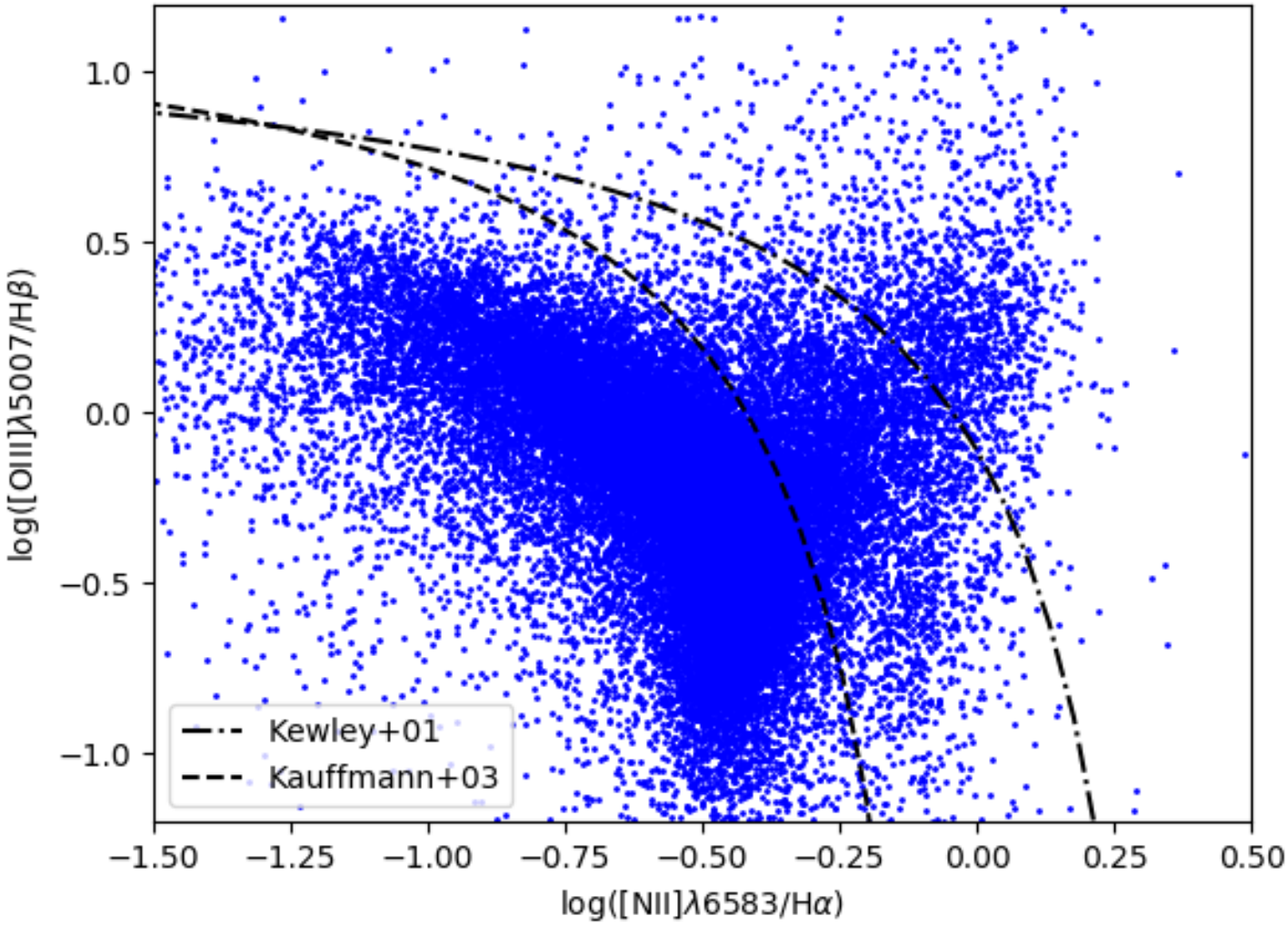
Tables

Emision lines properties for each ionized region

Underlying stellar population properties

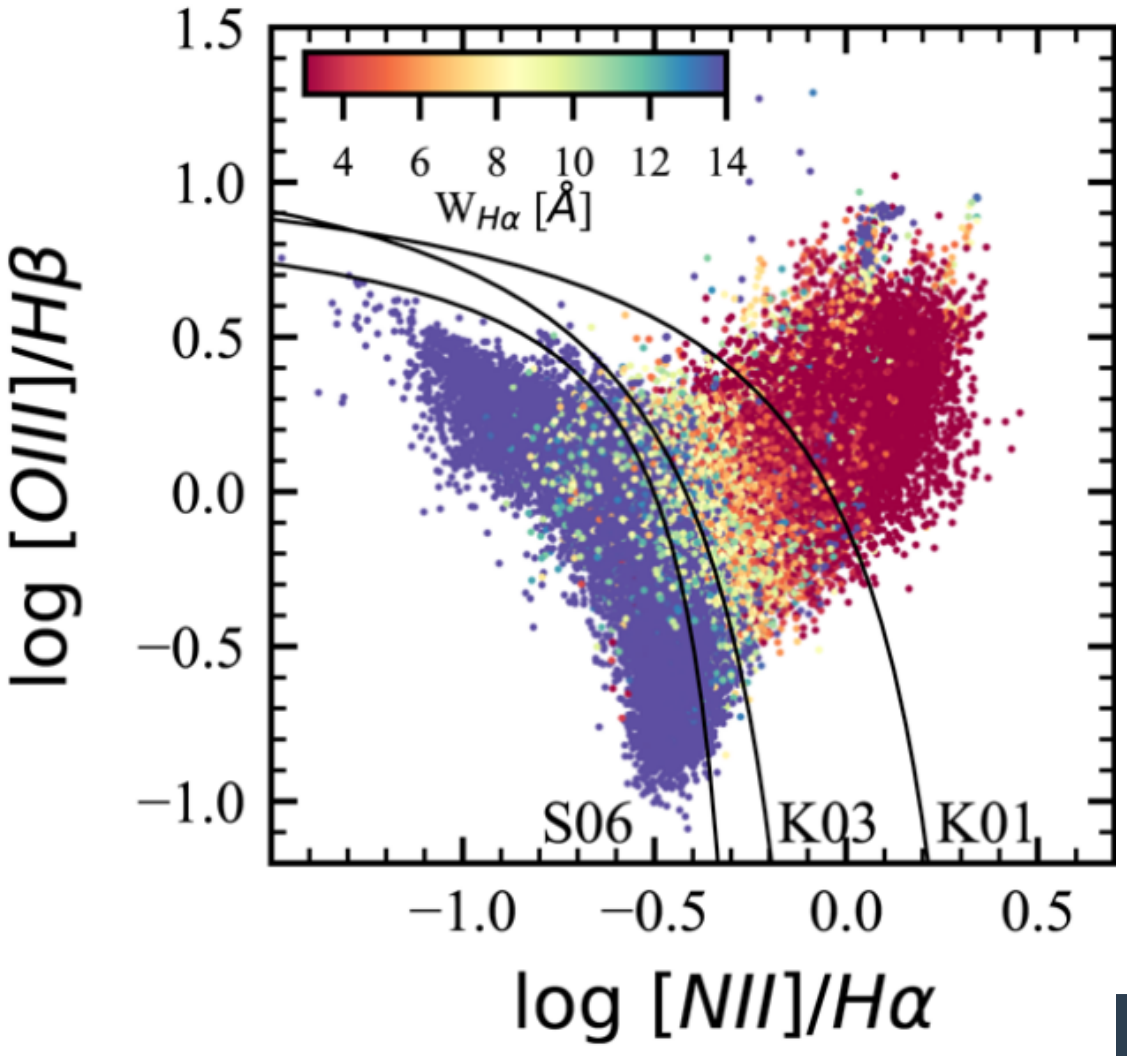
HII regions catalog

Identified clumpy regions: ~37312 regions



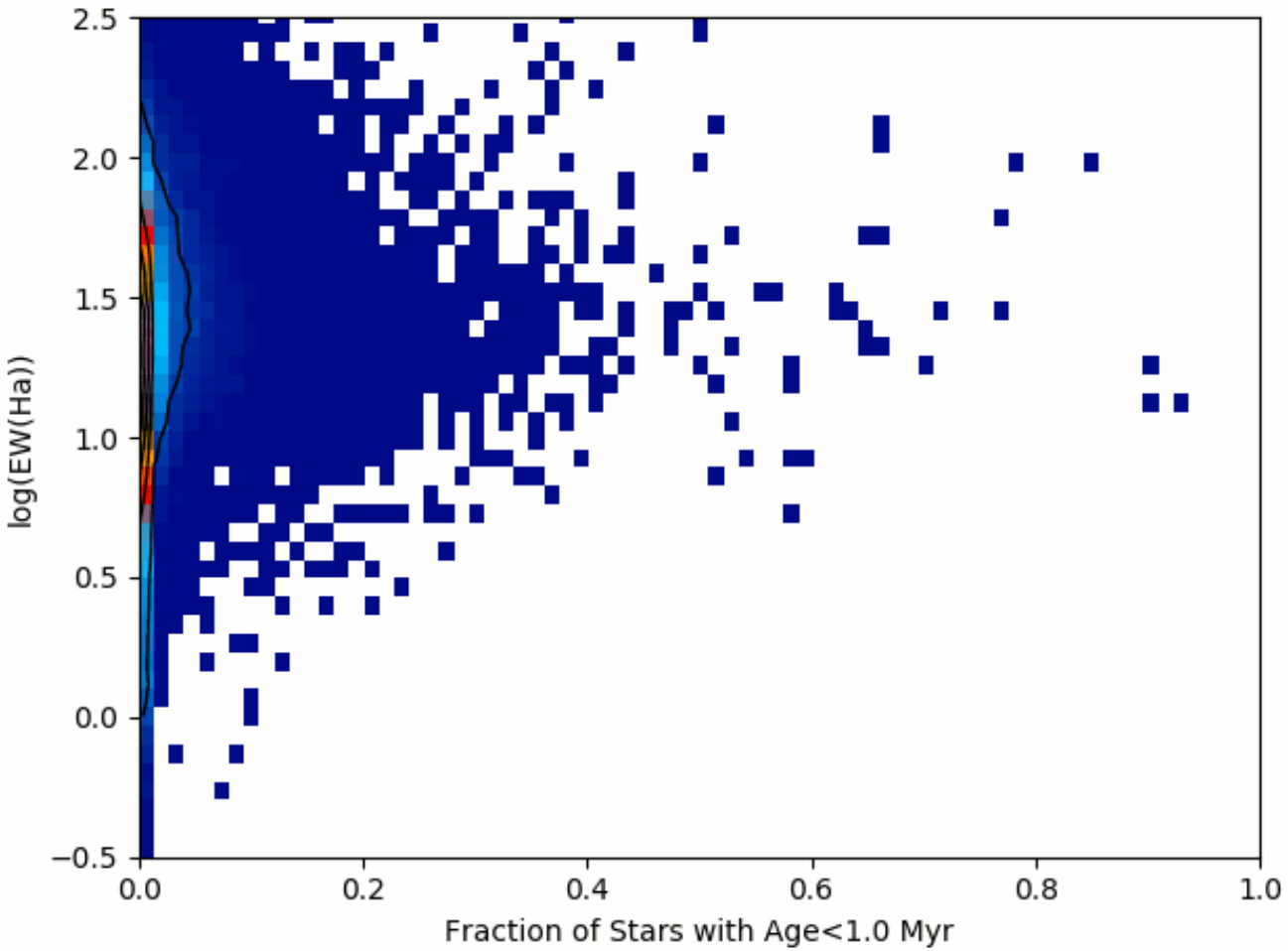
Getting HII regions

- **EWHa → Type of ionization source**



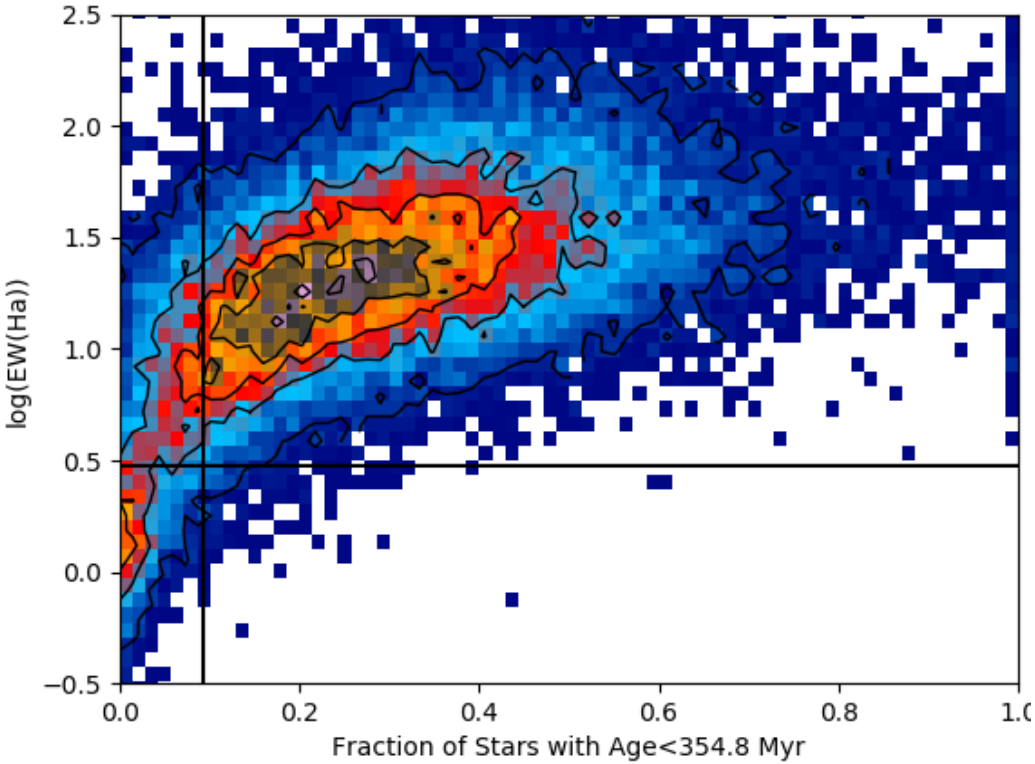
Lacerda, *et al*. 2018

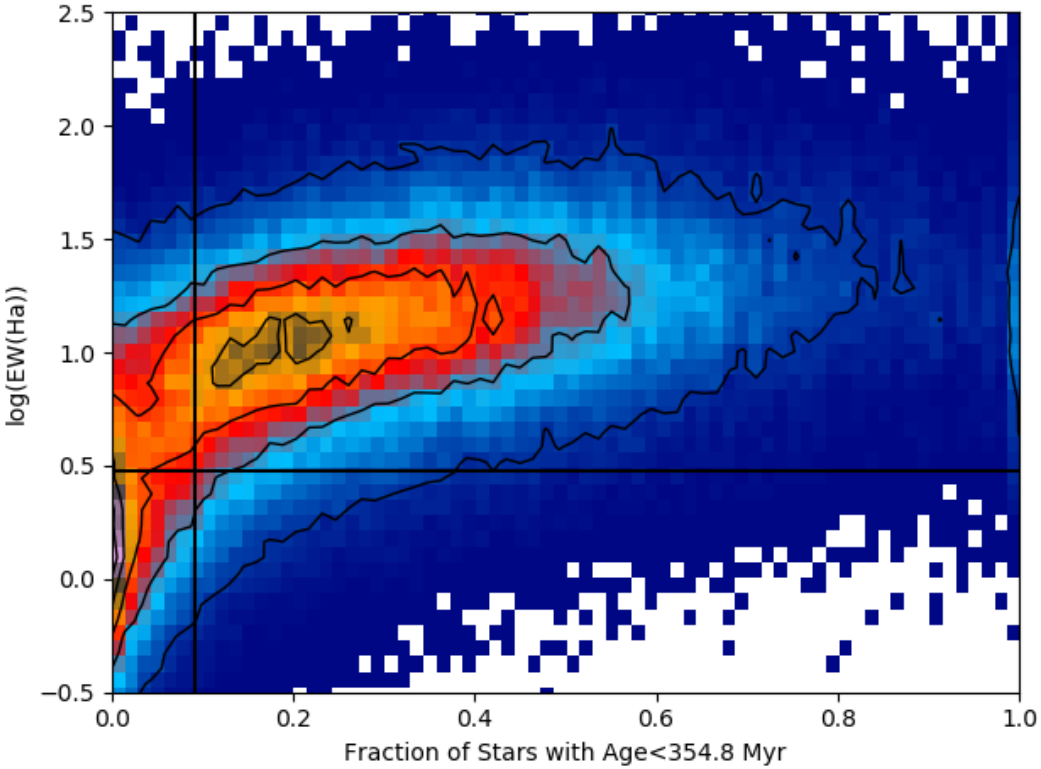
Getting HII regions



We need consider that the percentage of young stars provide a robust and physically motivated method to select genuine HII regions

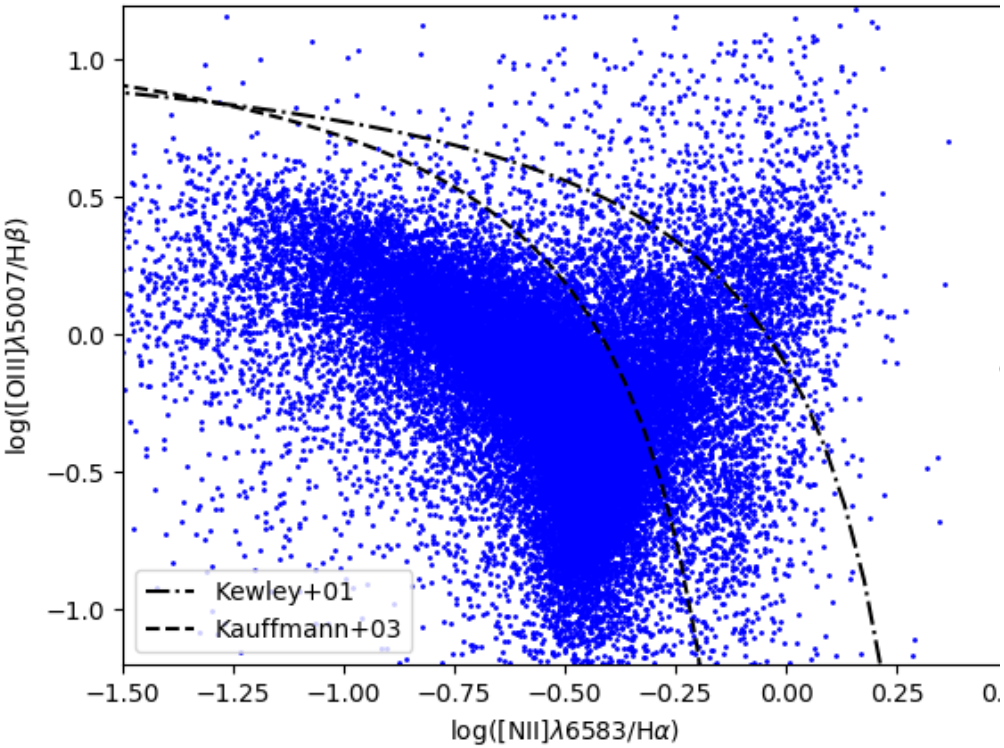
Getting HII regions

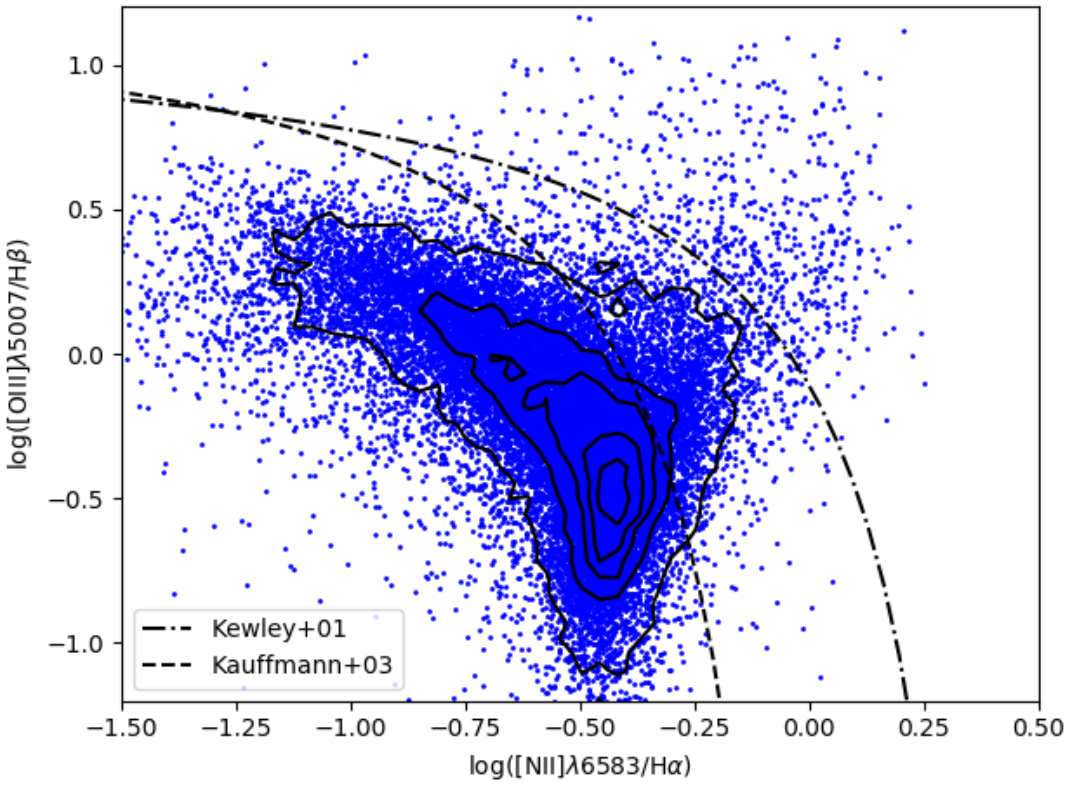




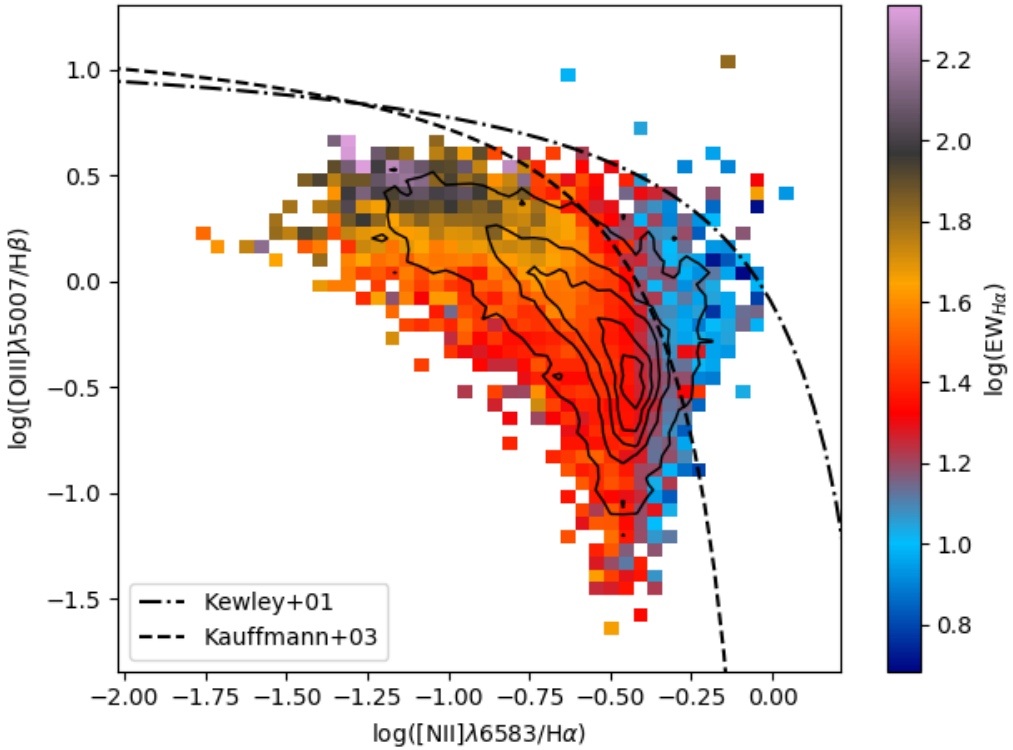
EWHa = 3
Fraction of stars ~9%

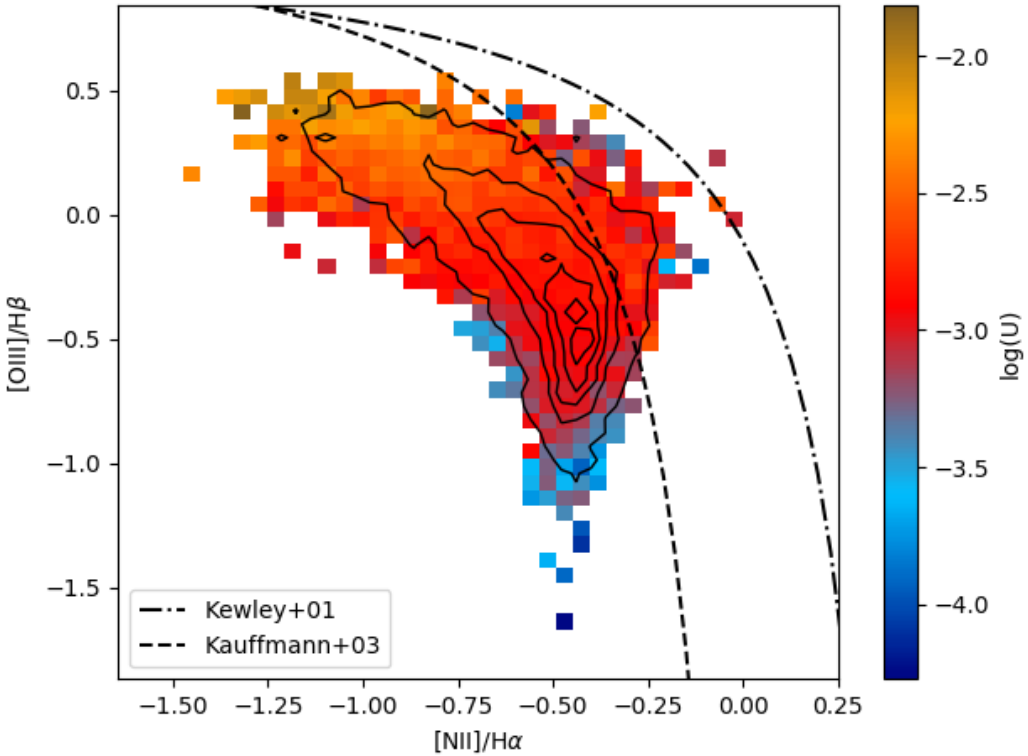
HII regions catalog



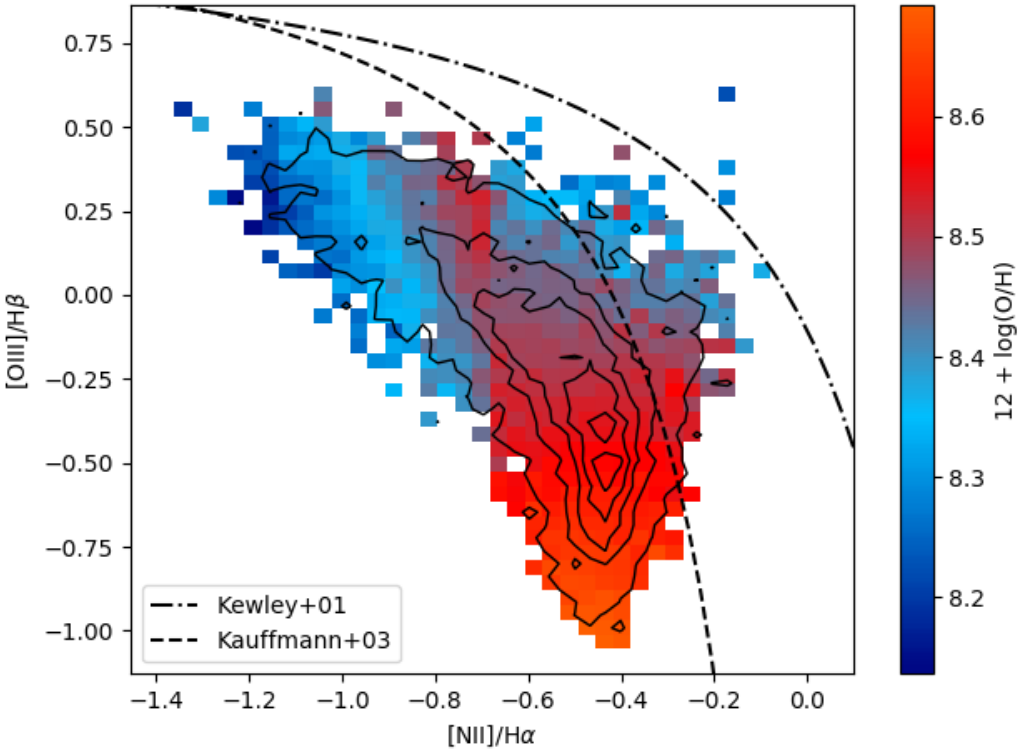


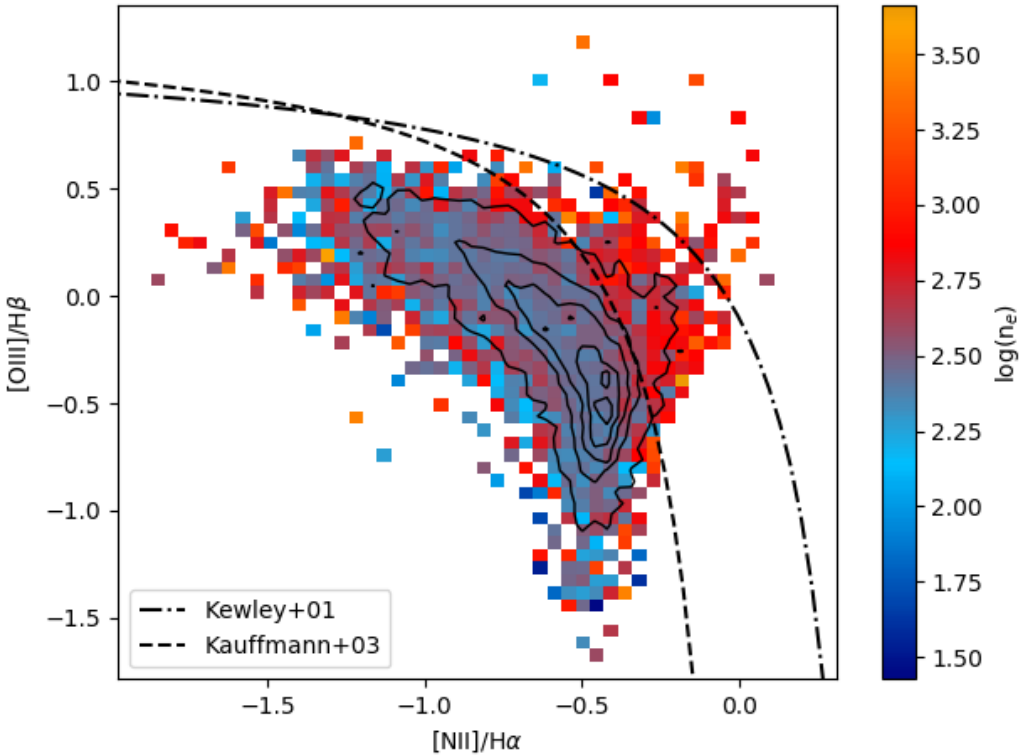
HII regions properties





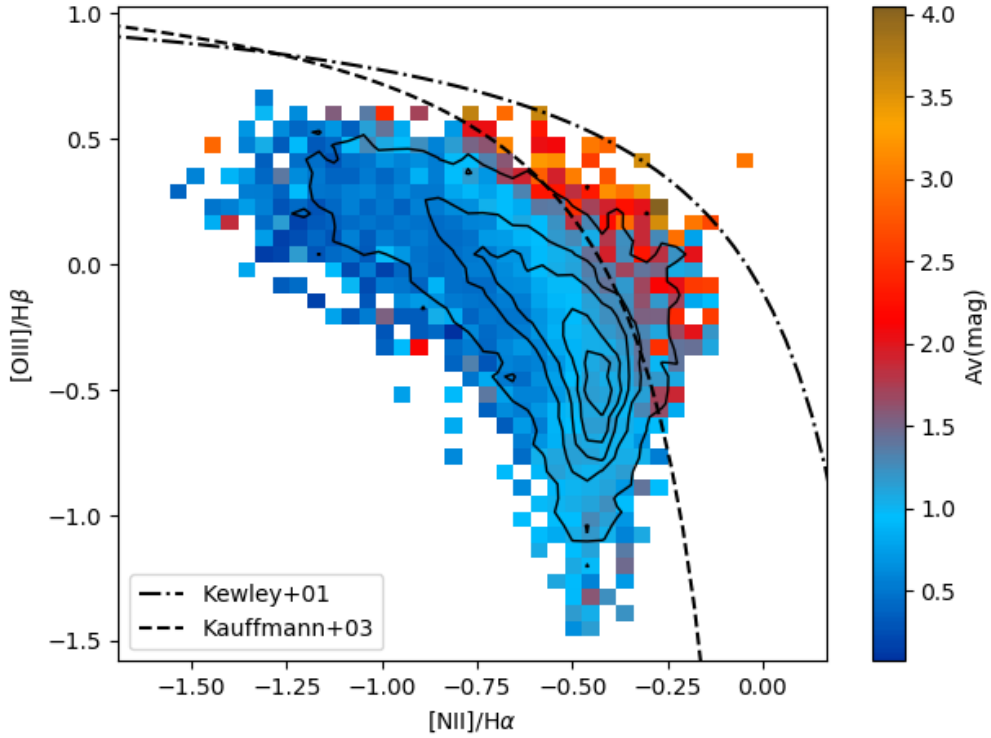
OIII/OII





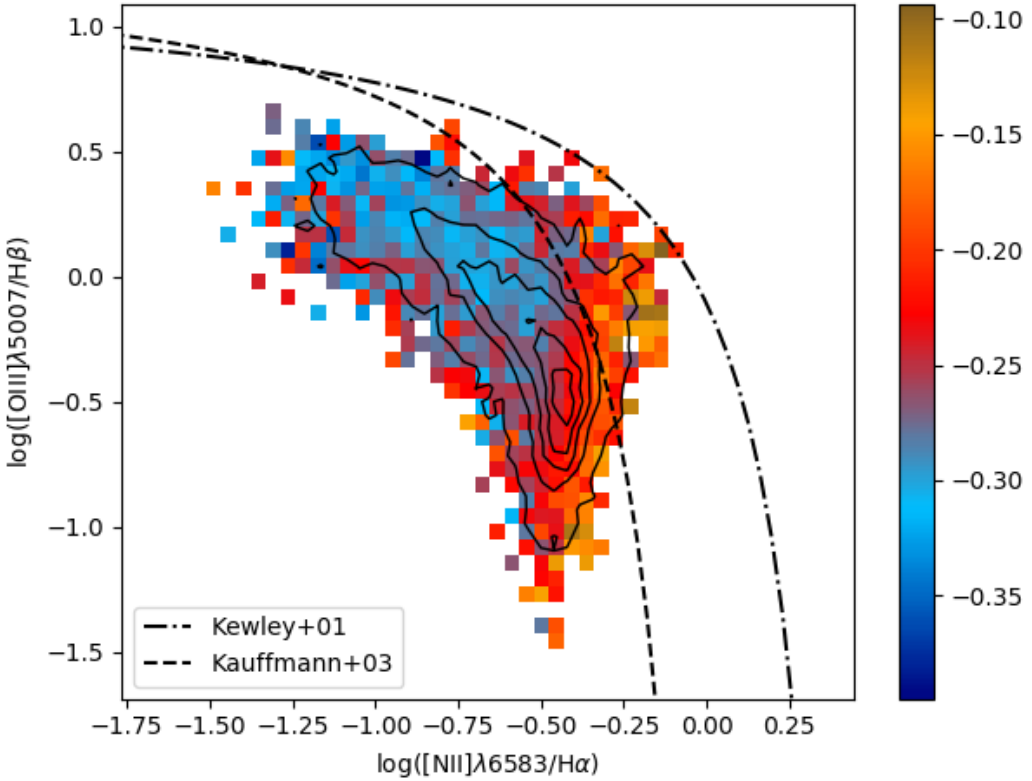
ONS

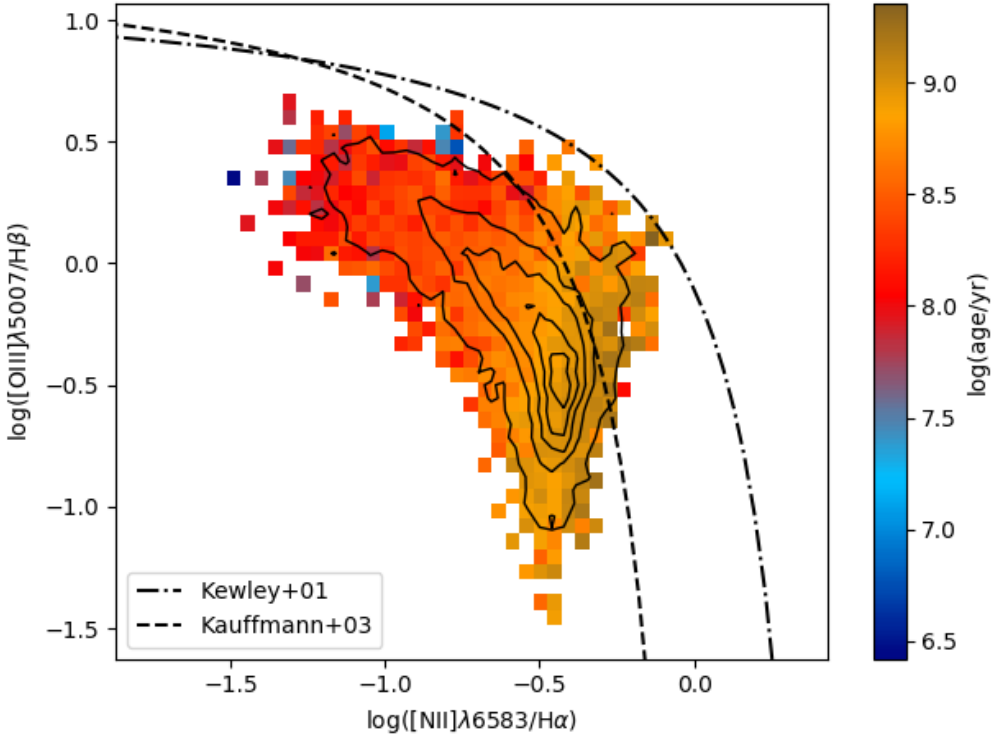
SII ratio



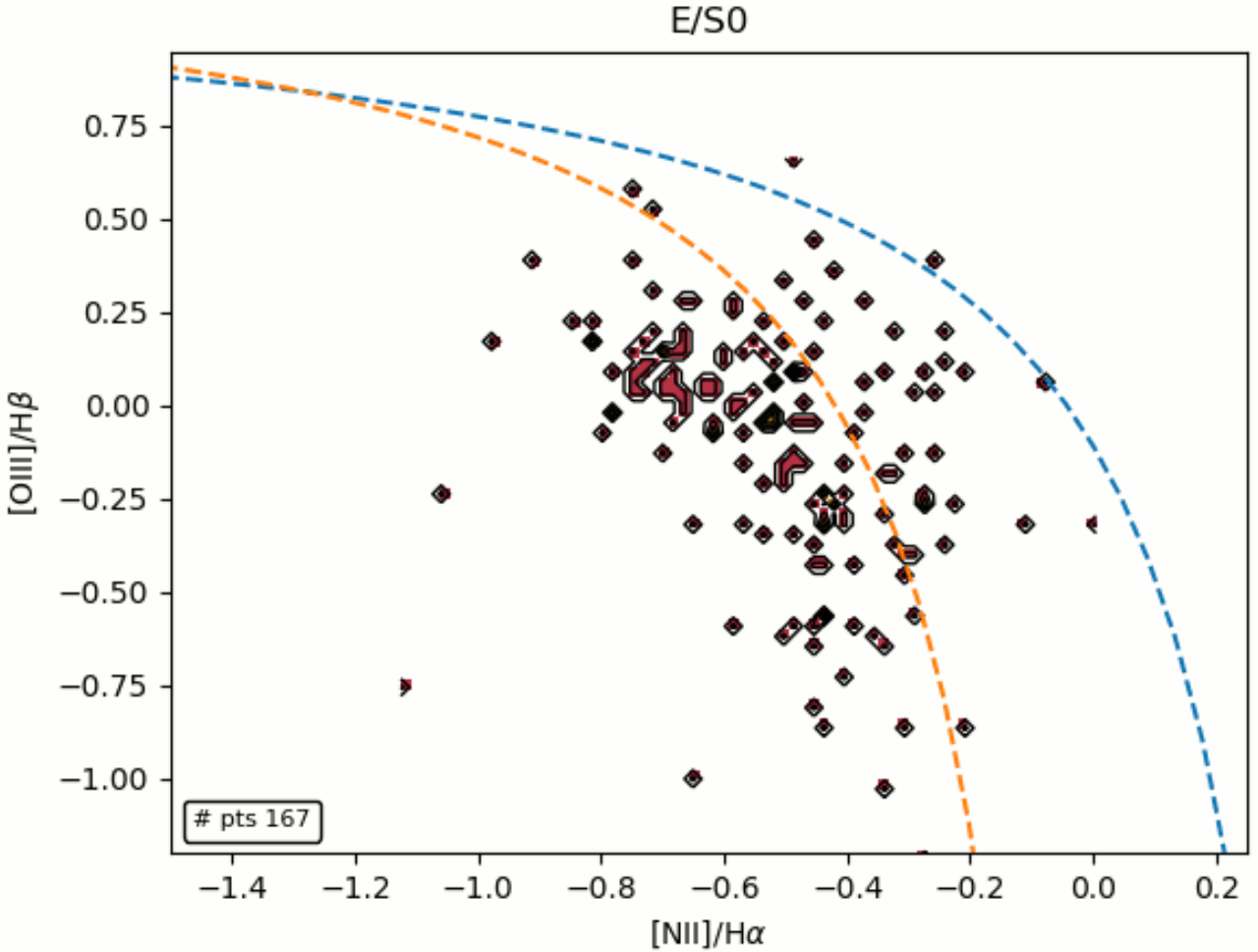
Ha/Hb ratio,Cardelli,1989

HII regions: Underlying stellar population

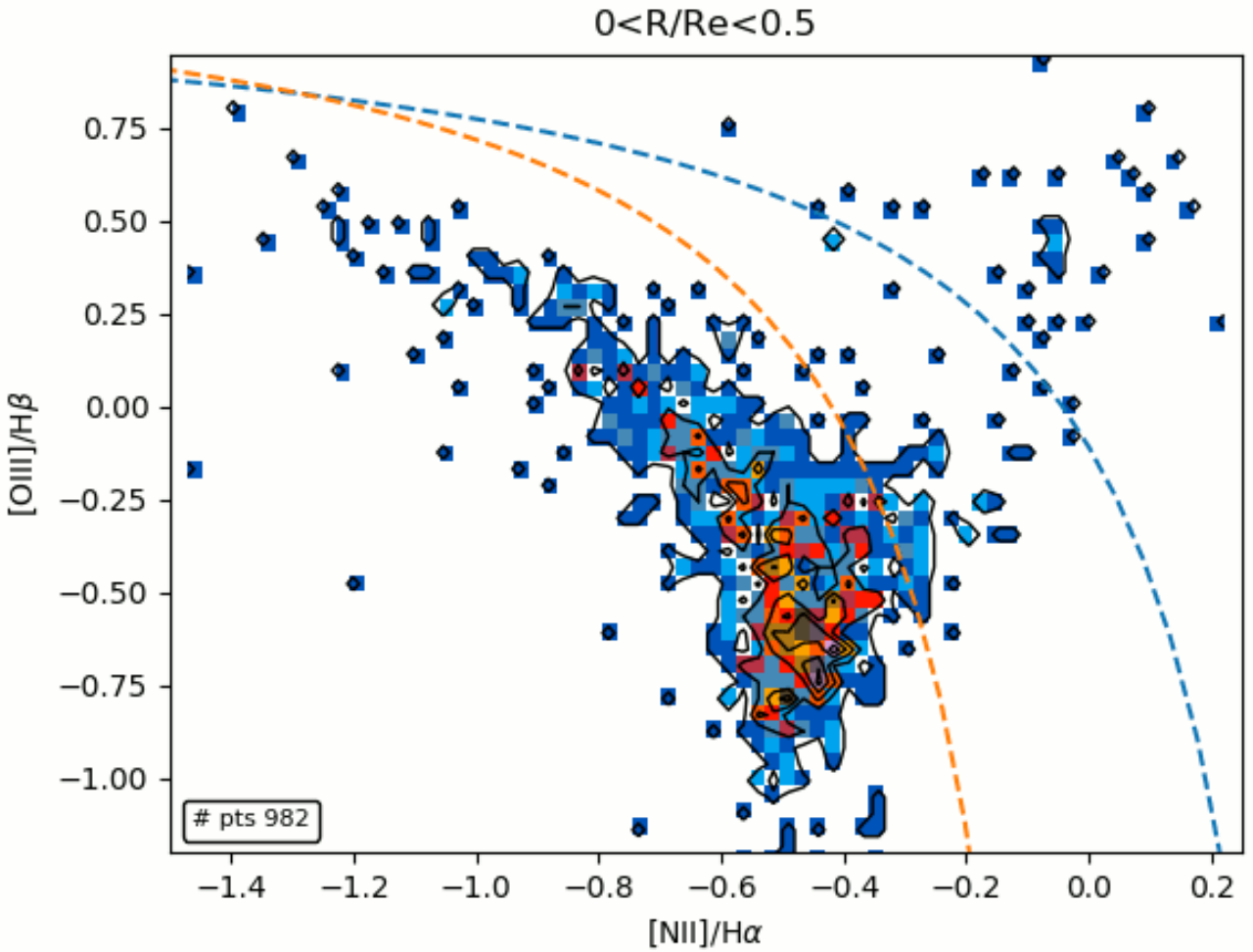




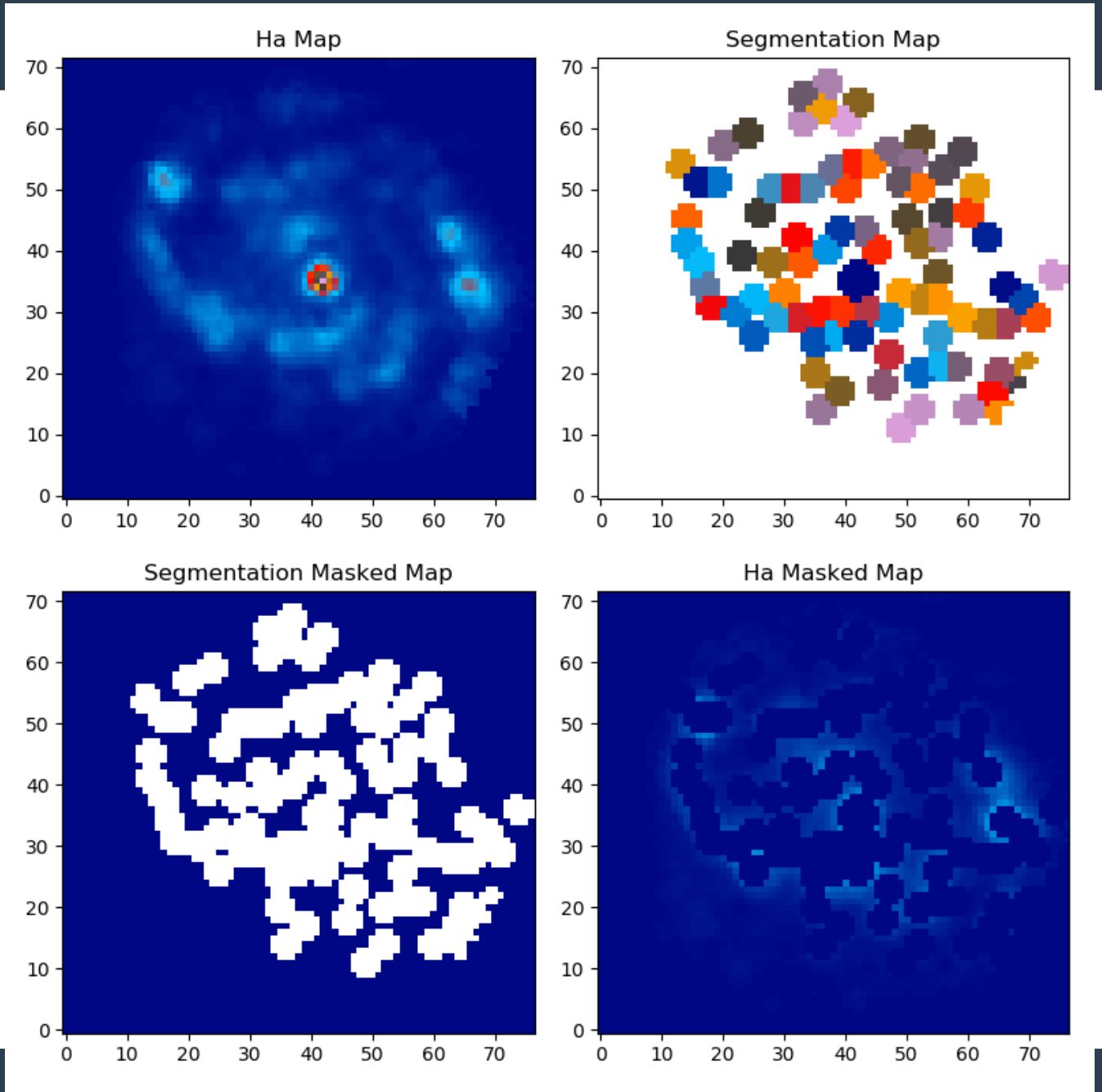
HII regions: Galaxy morphology



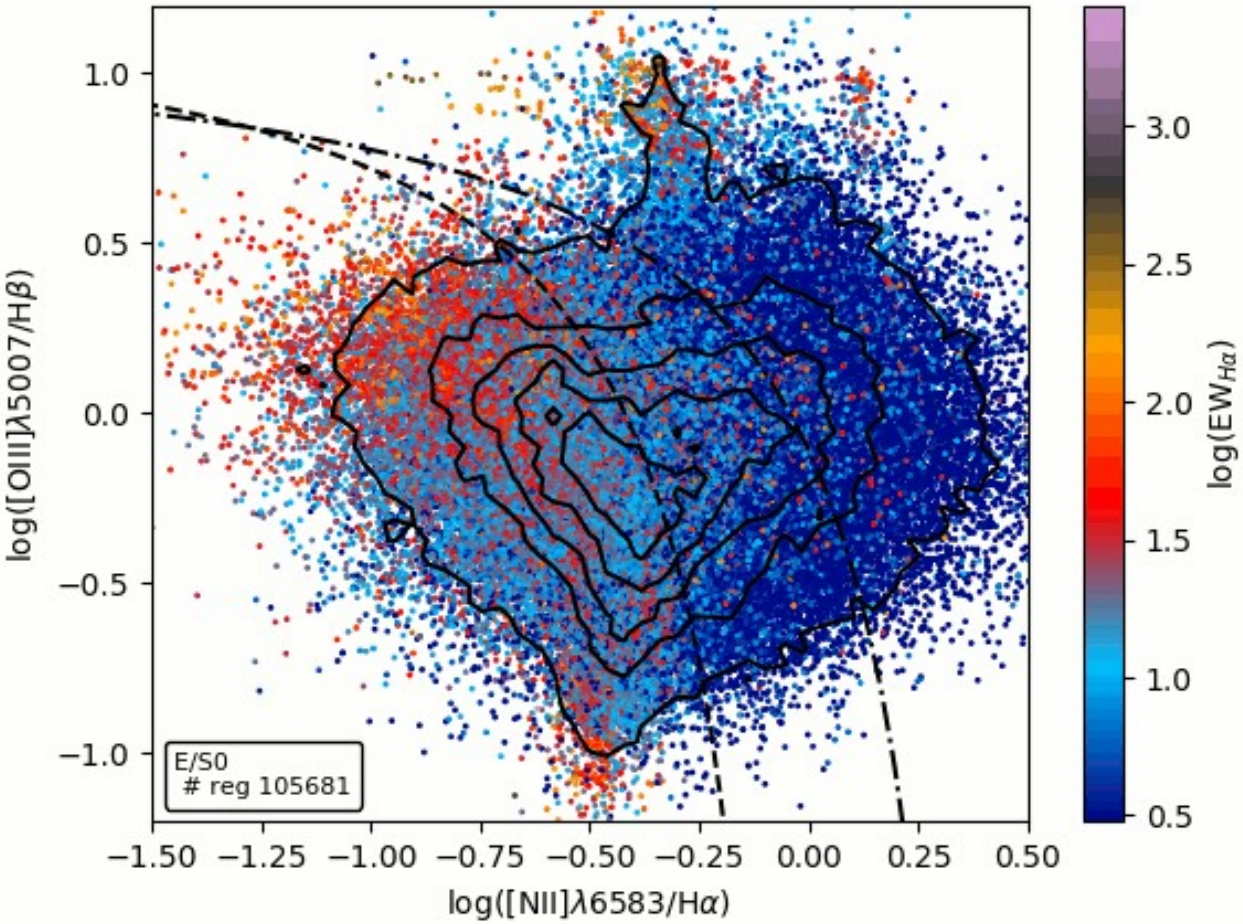
HII regions: Galaxy morphology



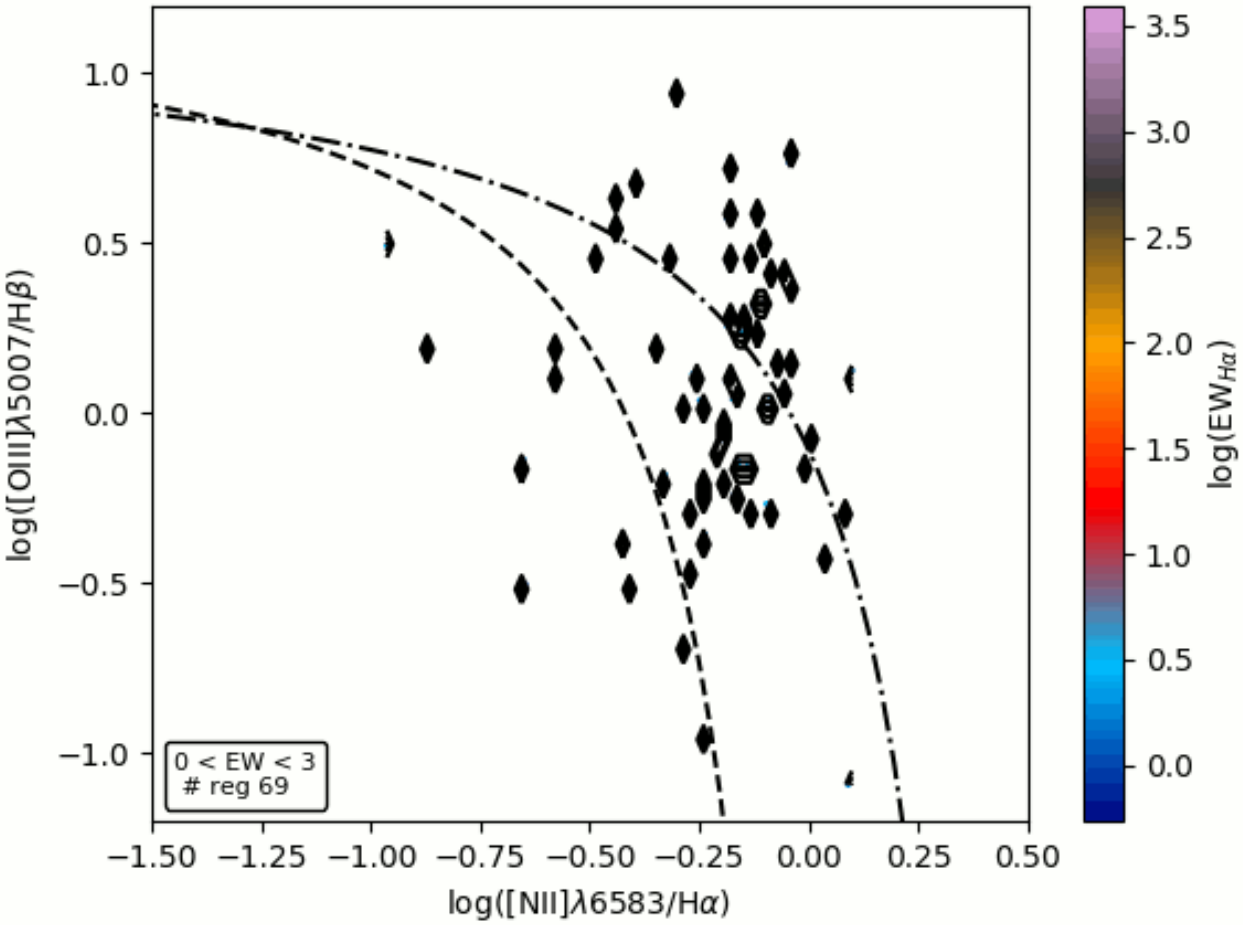
Diffuse gas


Ha Map
Segmentation Map
Segmentation Masked Map
Ha Masked Map
0
10
20
30
40
50
60
70

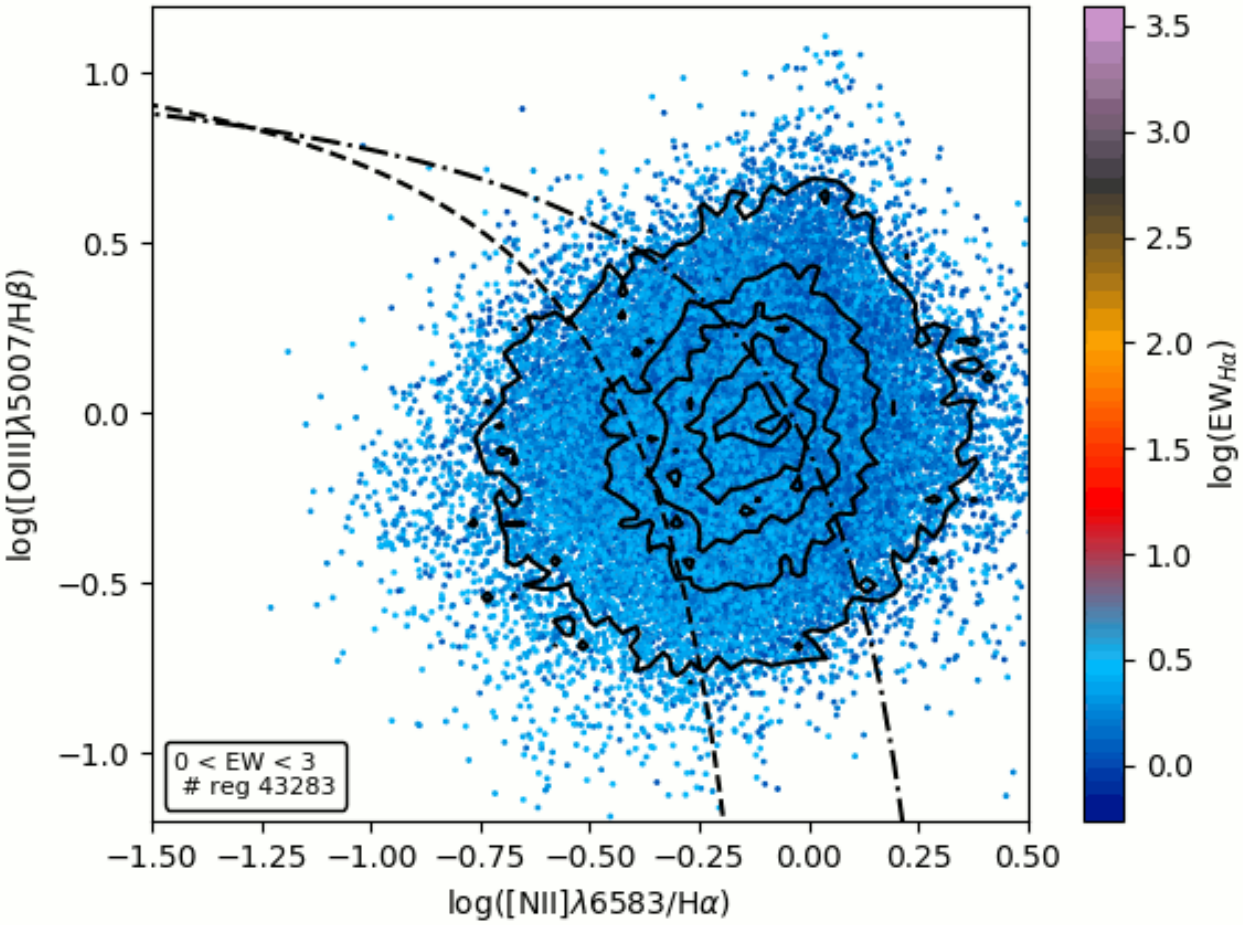
Diffuse gas...


log([OIII]λ5007/Hβ)
log([NII]λ6583/Hα)
log(EW$_{Hα}$)
E/S0
reg 105681
1.0
0.5
0.0
−0.5
−1.0
−1.50
−1.25
−1.00
−0.75
−0.50
−0.25
0.00
0.25
0.50
3.0
2.5
2.0
1.5
1.0
0.5

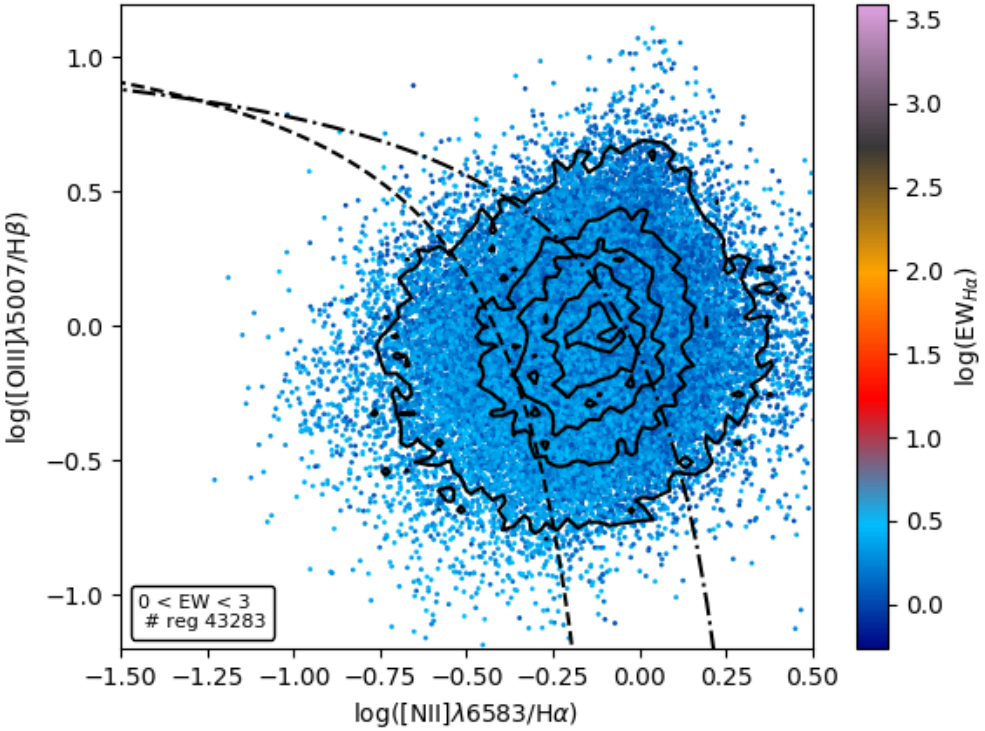
Diffuse gas...

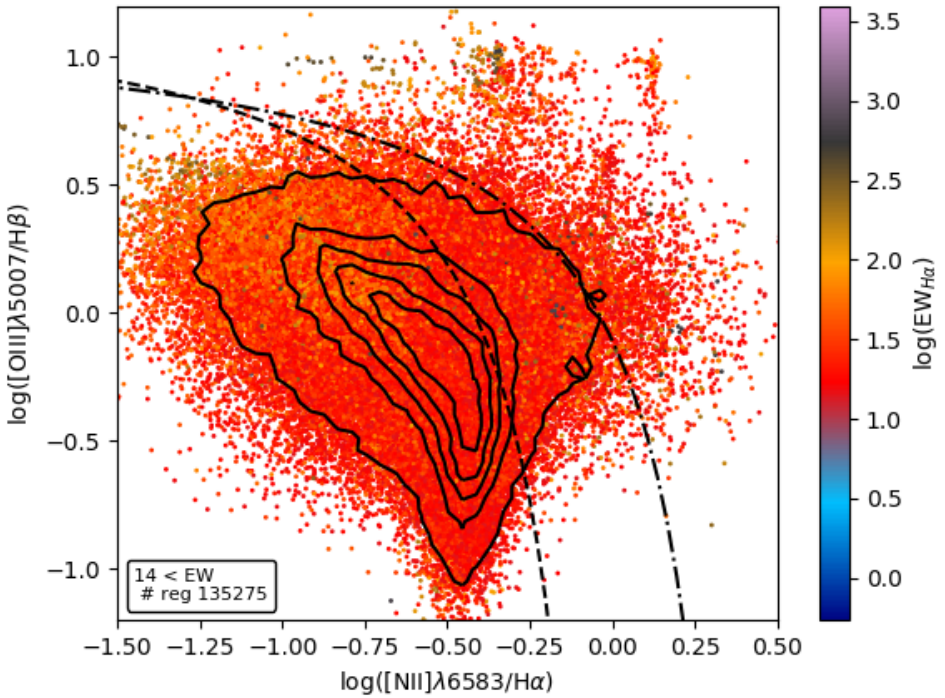

1.0
0.5
0.0
−0.5
−1.0
log([OIII]λ5007/Hβ)
0 < EW < 3
reg 69
−1.50 −1.25 −1.00 −0.75 −0.50 −0.25 0.00 0.25 0.50
log([NII]λ6583/Hα)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
log(EW$_{Hα}$)

Diffuse gas


log([OIII]λ5007/Hβ)
log([NII]λ6583/Hα)
log(EW$_{Hα}$)
0 < EW < 3
reg 43283
1.0
0.5
0.0
−0.5
−1.0
−1.50
−1.25
−1.00
−0.75
−0.50
−0.25
0.00
0.25
0.50
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

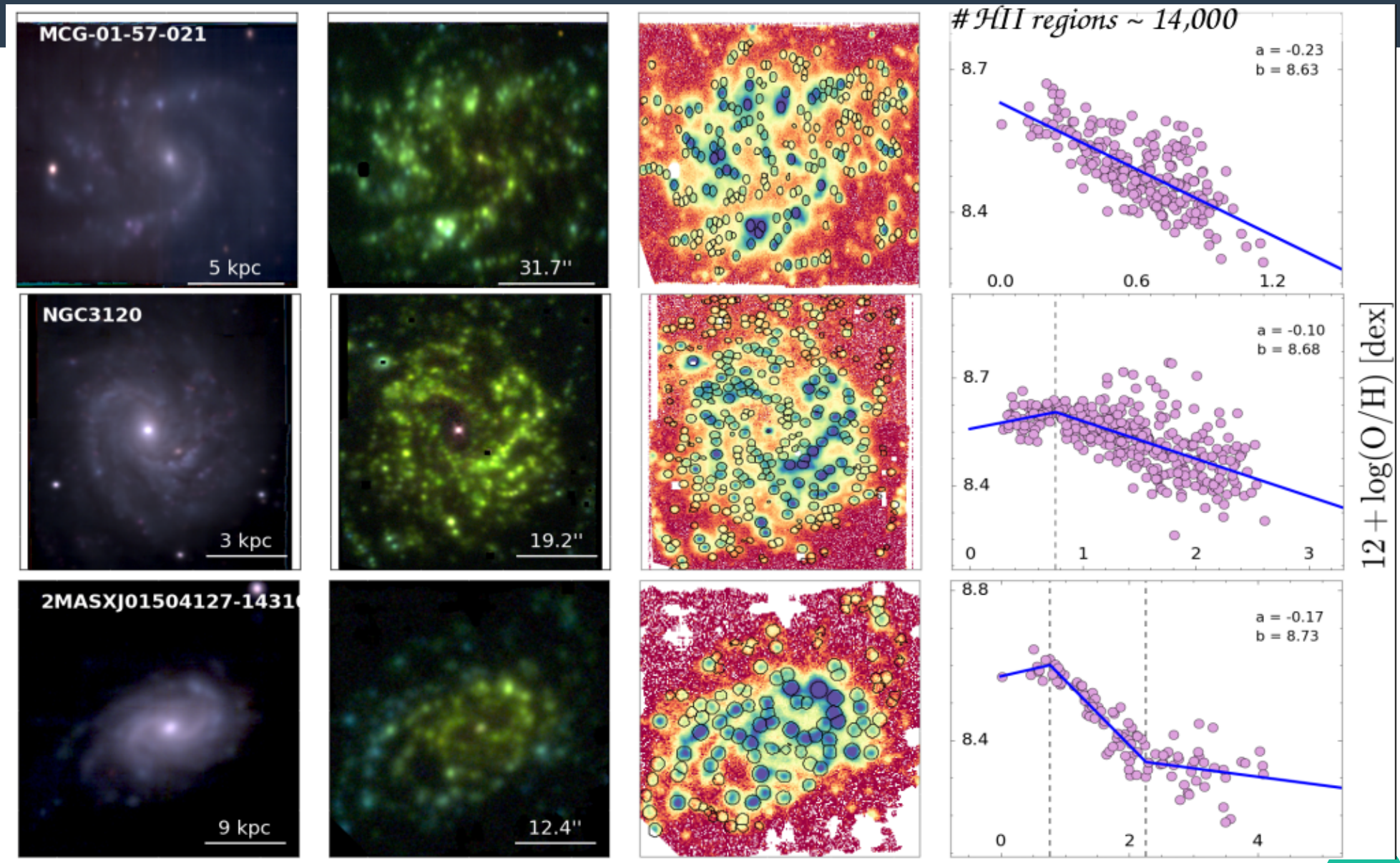
Diffuse Gas


0 < EW < 3
# reg 43283
log([OIII]λ5007/Hβ)
log([NII]λ6583/Hα)
log(EW$_{Hα}$)


14 < EW
# reg 135275
log([OIII]λ5007/Hβ)
log([NII]λ6583/Hα)
log(EW$_{Hα}$)

~100 galaxies

Sanchez-Menguiano, *et al*,2016



In the future...

- **Working with MUSE/AMUZING**
  - A catalog of HII regions from the AMUZING project will be gotten. Also, photoionization models will be made with the data of this catalog

Conclusions

- **The new catalog will have about 20000 HII regions**
- **52 emission lines: from [OII]λ3727 to [SII]λ6731**
- **Underlying stellar population properties**
- **HIIexplorer python version**
- **Diffuse gas correction?**