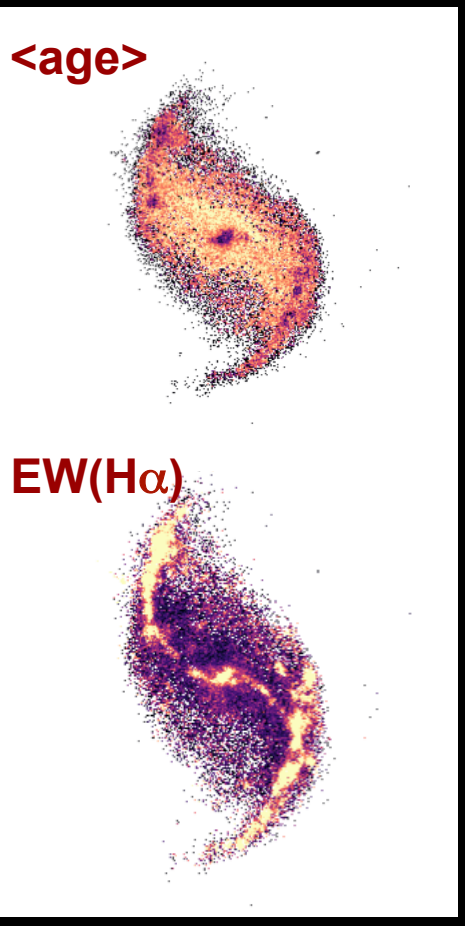
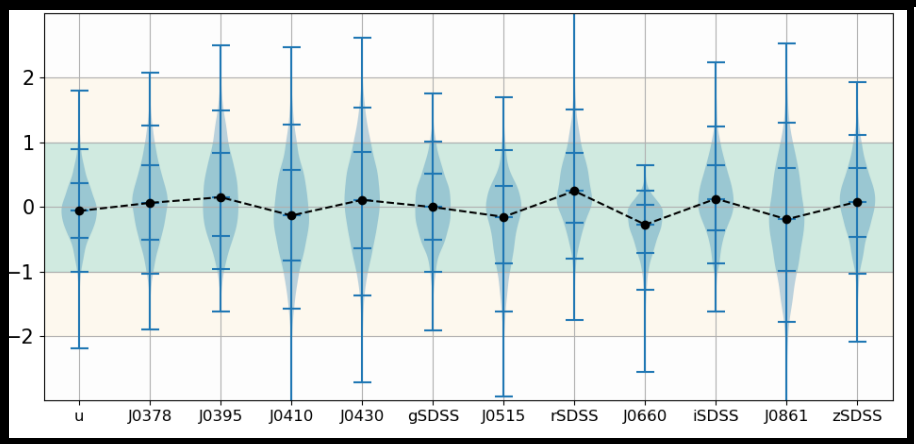
1st AlStar experiments with Scubes





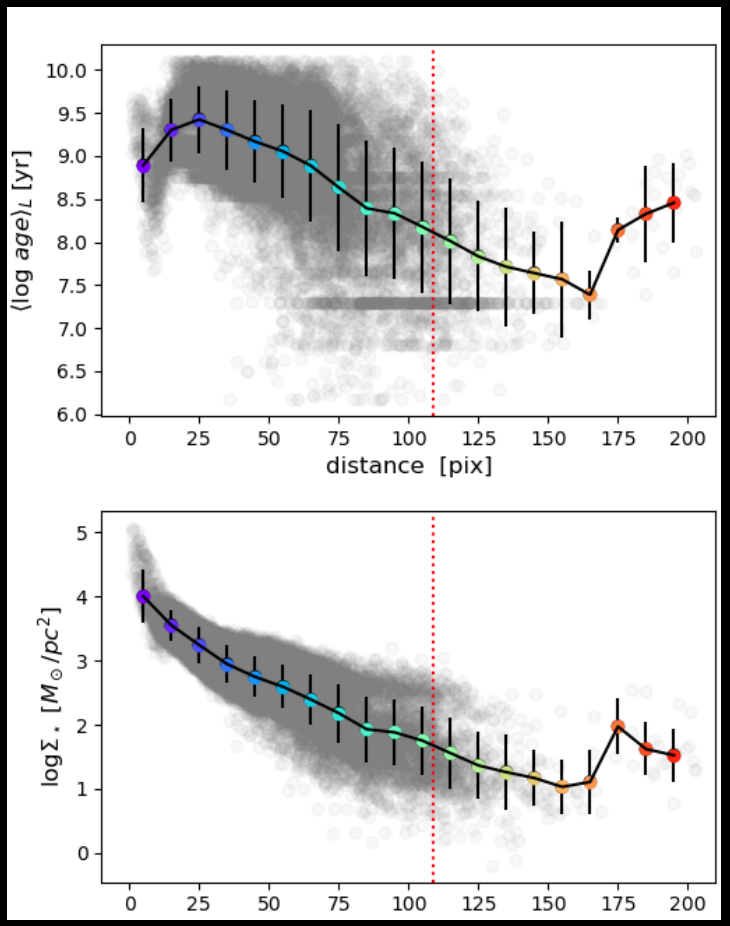
Roberto Cid Fernandes

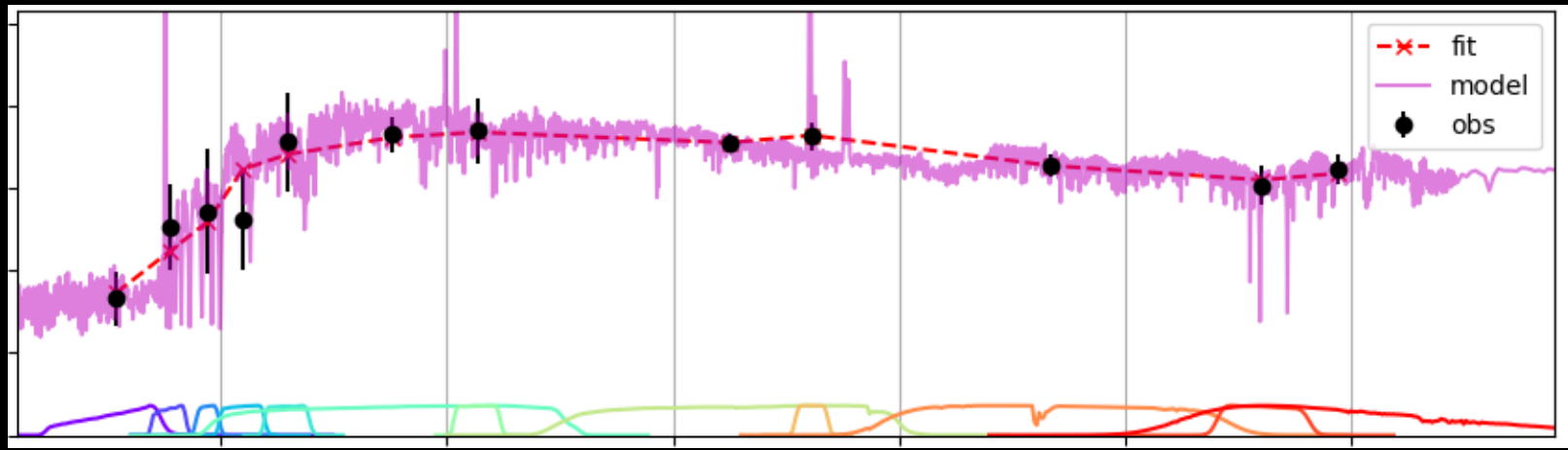
➔ Júlia Thainá Batista ➔

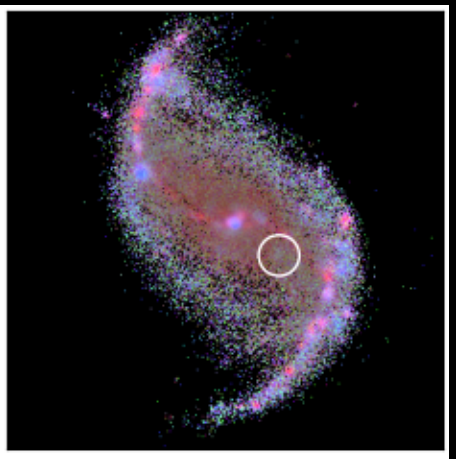
Fábio Herpich

Luna Espinosa

André Luiz de Amorim







OUTLINE

① AlStar – SED fitting (you've seen this before..)

② Scubes – masks & pre-processing…

③ AlStar + Scubes: (preliminary) results

④ Next steps and whatodowiththis

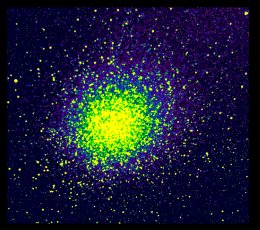
OUTLOOK

Things are going ~ well, BUT:

- Need work on pre-processing / segmentation
- Check if AlStar SFHs make sense! Add UV & IR?
- Dilemas ...

Spectral synthesis / SED fitting: The problem

14th SPLUS meeting
Dec/2020

$= x_1$  $+ x_2$  $+ x_3$  $+ \ldots$

$$M(\lambda) = \sum_{t,Z} \mathbf{x}(t,Z) \times \text{Base}(\lambda;t,Z) \times e^{-\tau(t,Z)} \times q(\lambda)$$

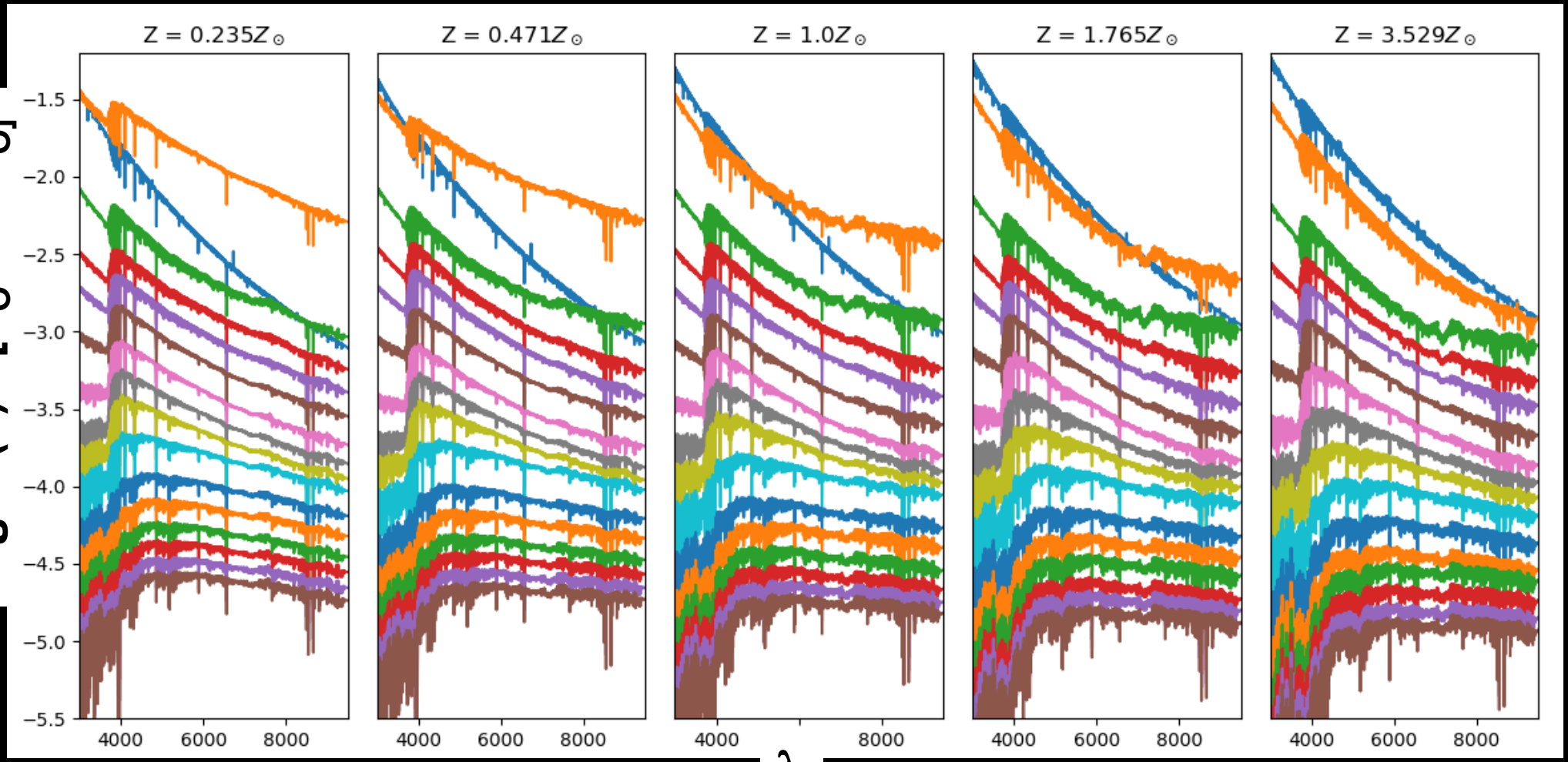
Model Spectrum	**light or mass fractions** **x = pop vector**	**Spectral Base** CB17 models + Emission Lines	**Dust** τ_V

➔ Linear system solvable via NLLS (except for dust attenuation)
➔ Monte Carlo to estimate uncertainties

AlStar: Stellar base

14th SPLUS meeting
Dec/2020

- 80 stellar populations = 16 ages x 5 metallicites

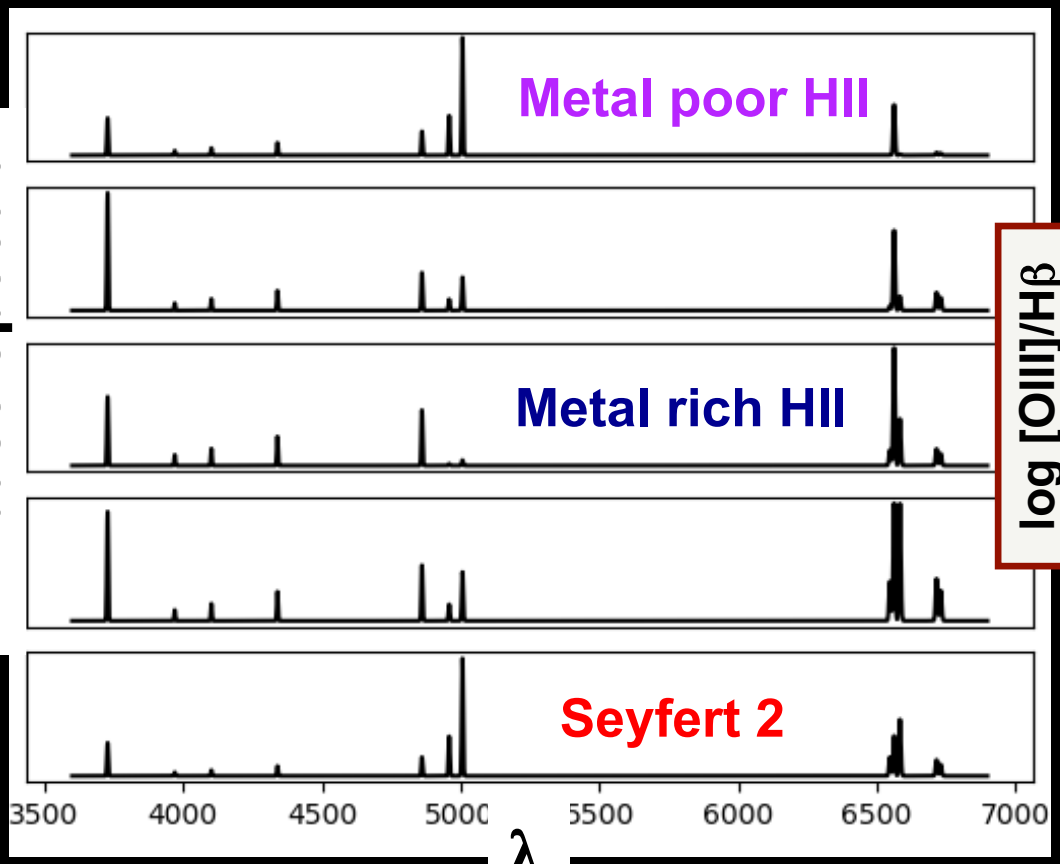


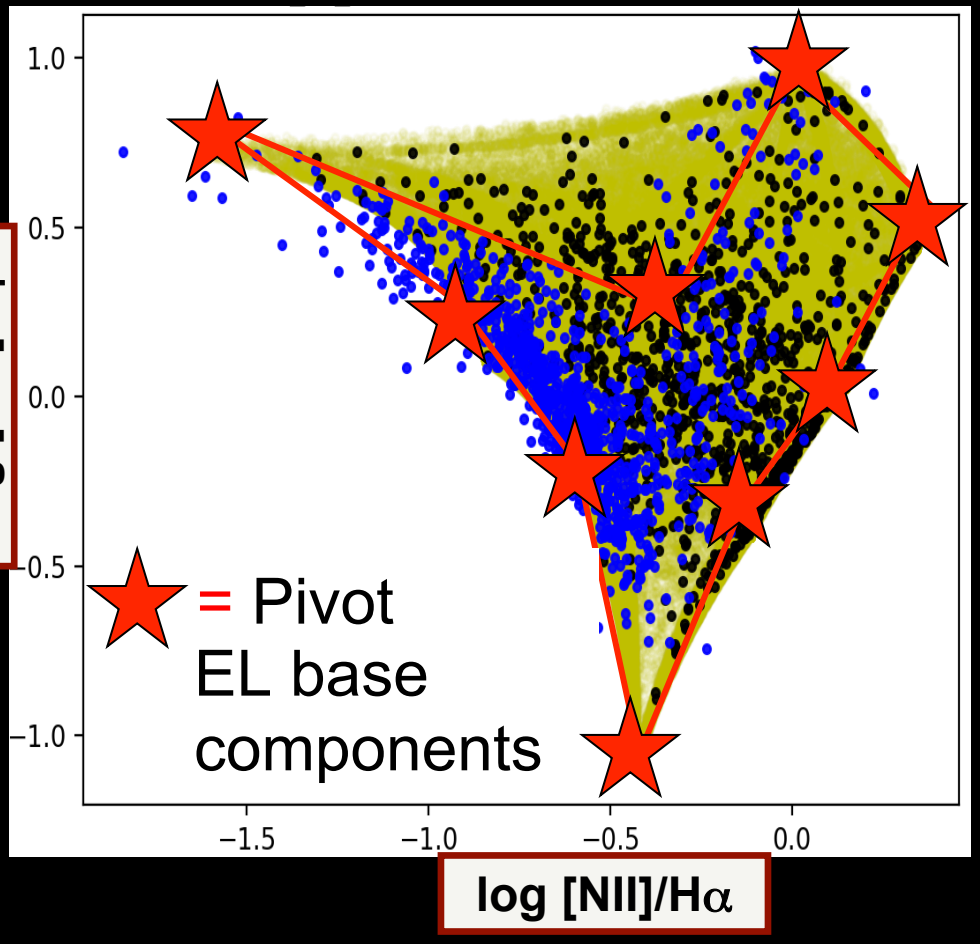
t = 0 → 3M → 10M → 30M → 60M → 100M → 250M → 450M → 700M → 1G → 2G → 3G → 4.5G → 6.25G → 8.5G → 11G → 14G

AlStar: Emission Line base

14th SPLUS meeting
Dec/2020

- ~~individual lines~~ – too much freedom ☹
- BPT-based line components – smarter / realistic ☺

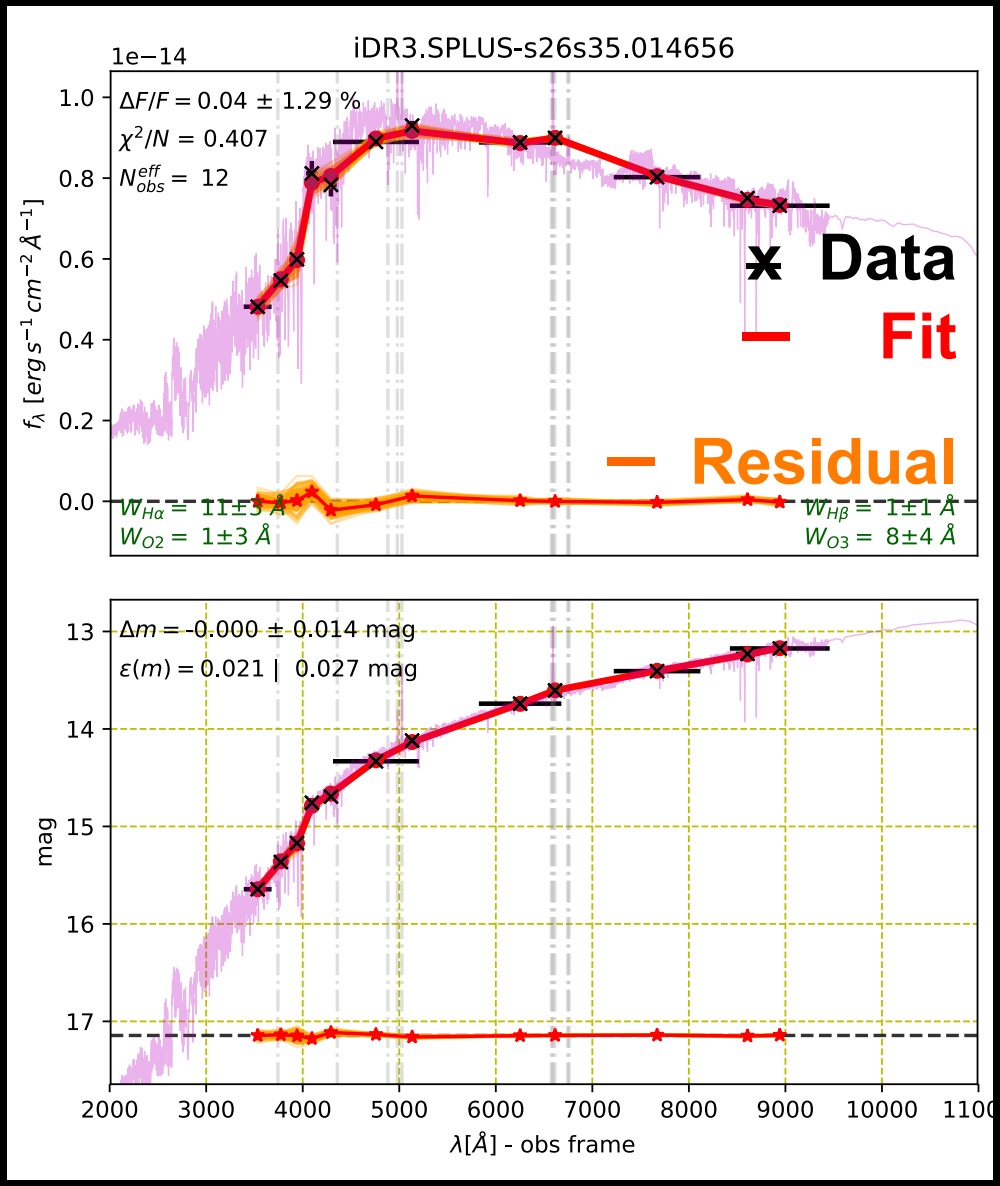


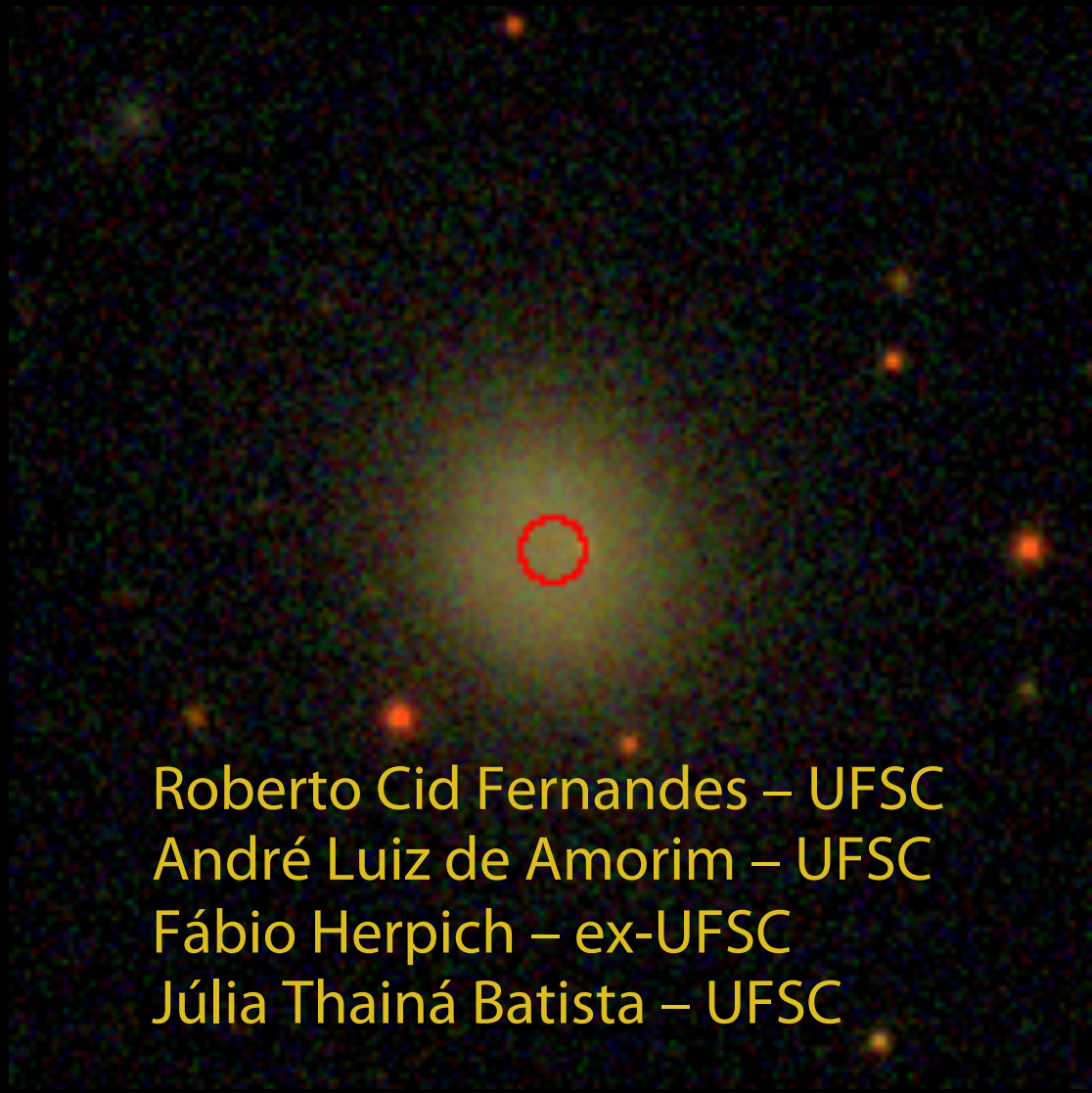


5 line-groups : [OII]3727 , [OIII]4959+5007 , [NII]6548+6584 , [SII]6716+6731 , Hα+Hβ+Hγ+Hδ+...

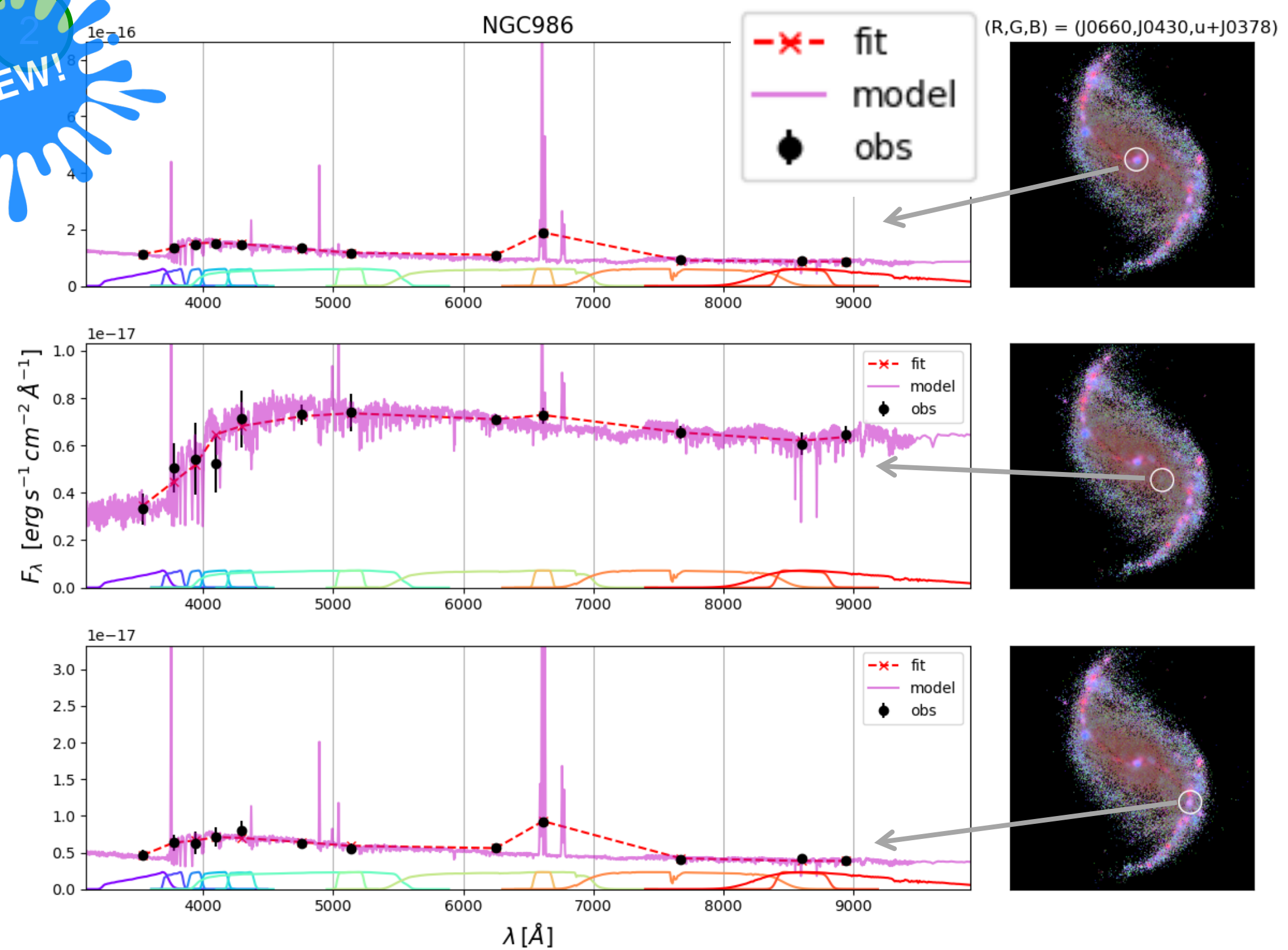
14th SPLUS meeting
Dec/2020

1st AlStar results for Fornax galaxies





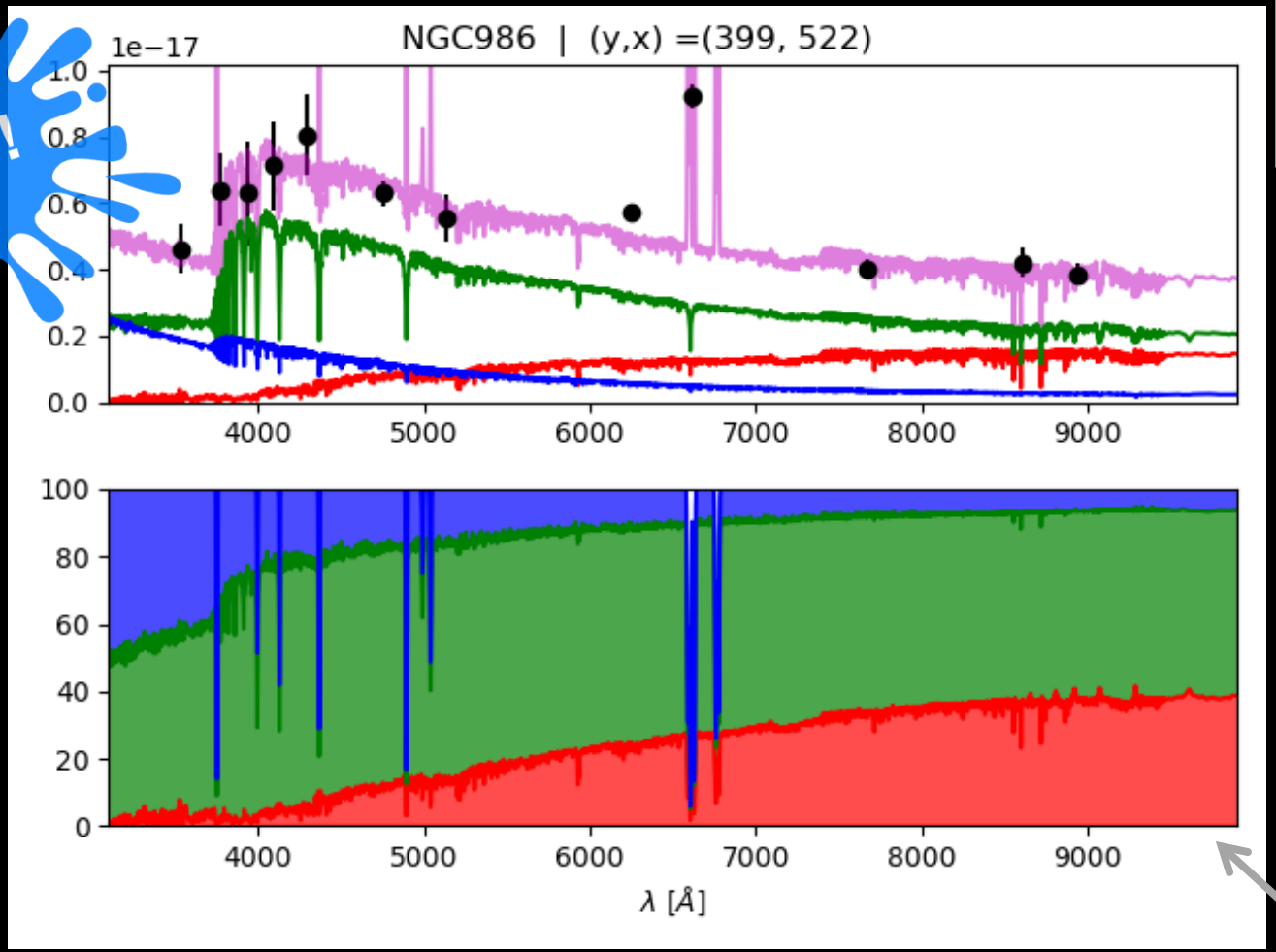
Roberto Cid Fernandes – UFSC
André Luiz de Amorim – UFSC
Fábio Herpich – ex-UFSC
Júlia Thainá Batista – UFSC


NEW!
NGC986
(R,G,B) = (J0660,J0430,u+J0378)
fit
model
obs
1e−16
1e−17
1e−17
F_λ [$erg\,s^{-1}\,cm^{-2}\,Å^{-1}$]
λ [$Å$]

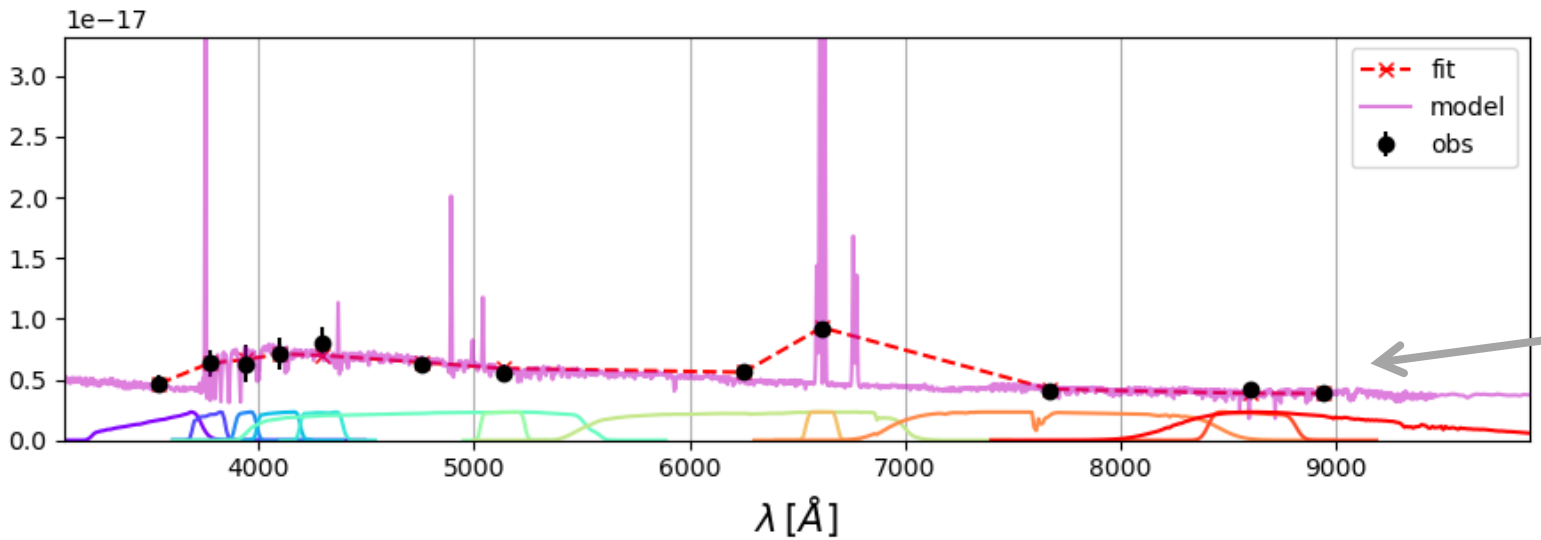
2

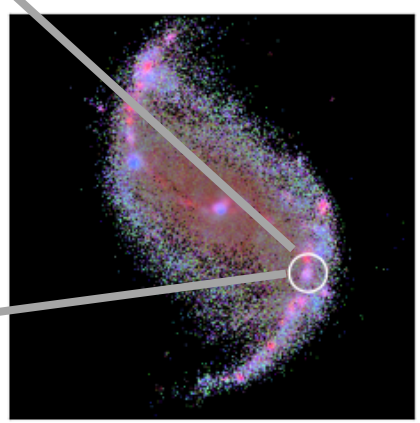
NEW!

15th SPLUS meeting Today



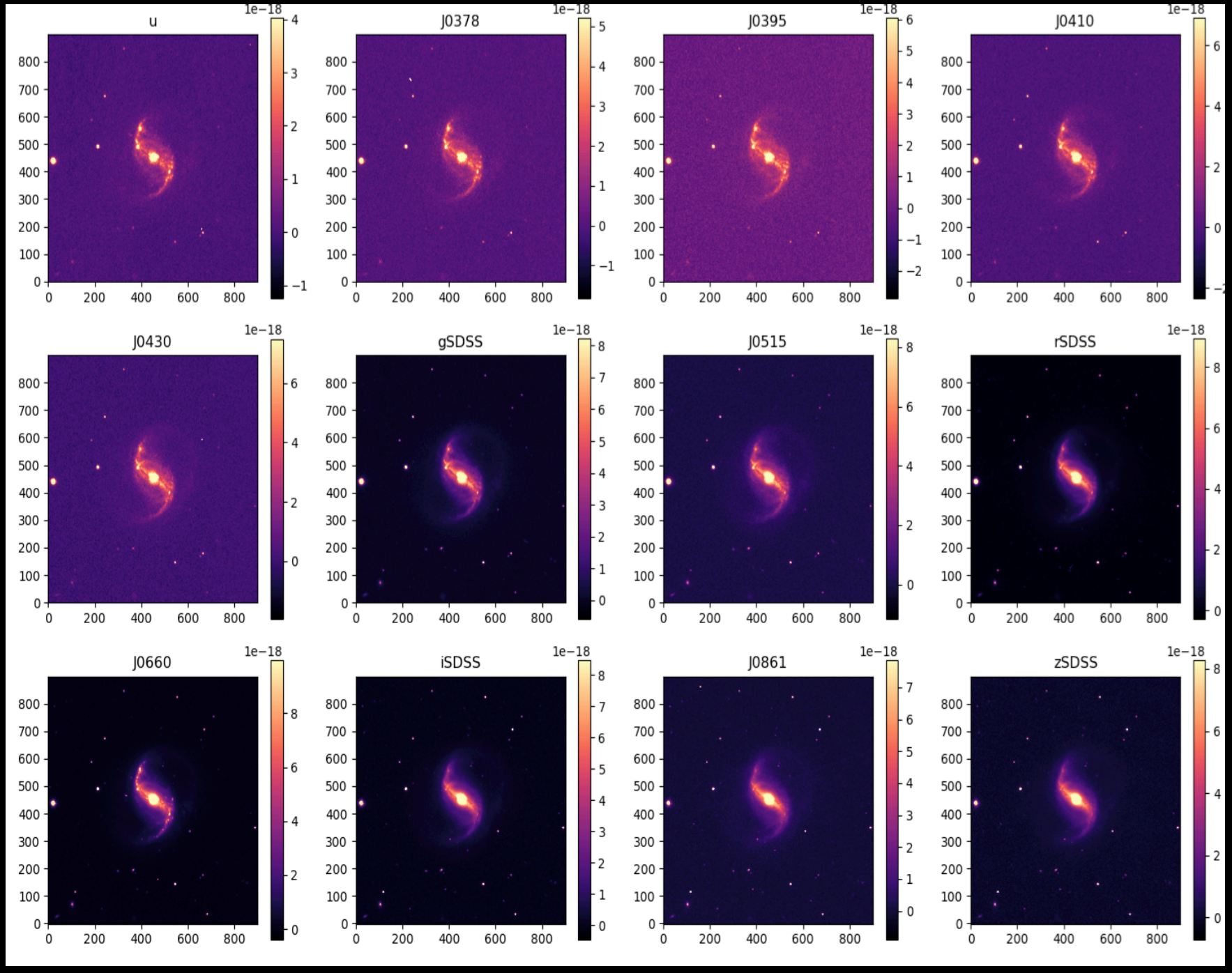
Old
Intermediate
Young
populations



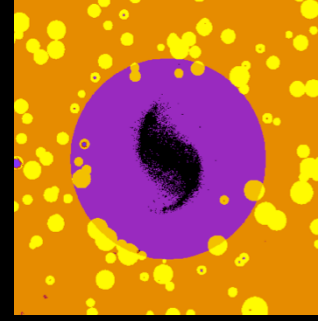


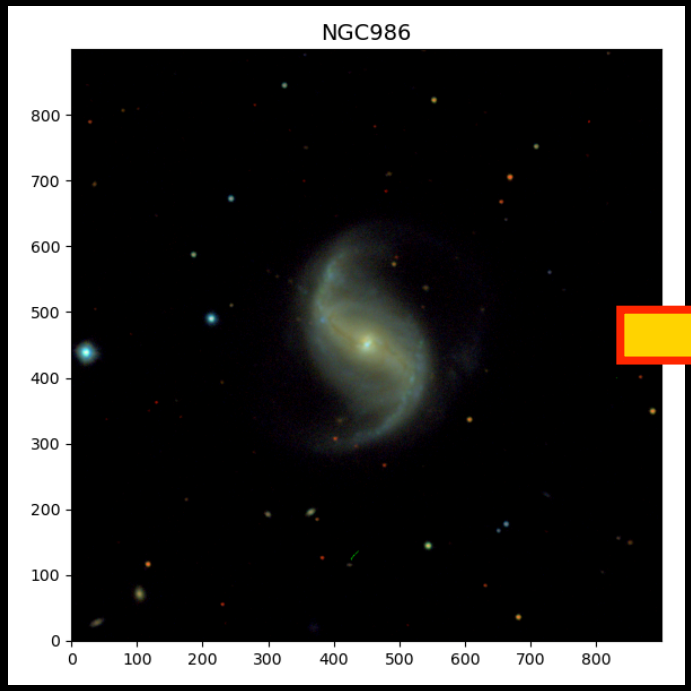
Scubes: λ, $F_{\lambda yx}$, $\varepsilon_{\lambda yx}$, $flag_{\lambda yx}$

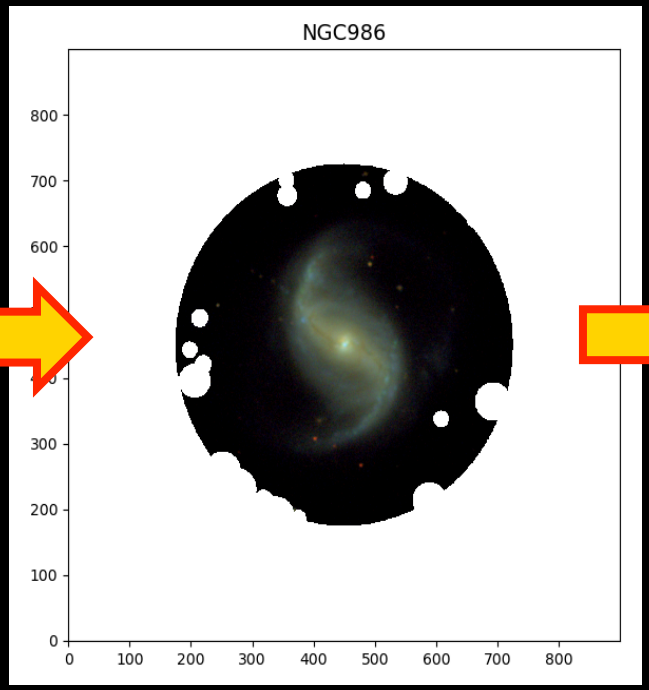
NGC 986

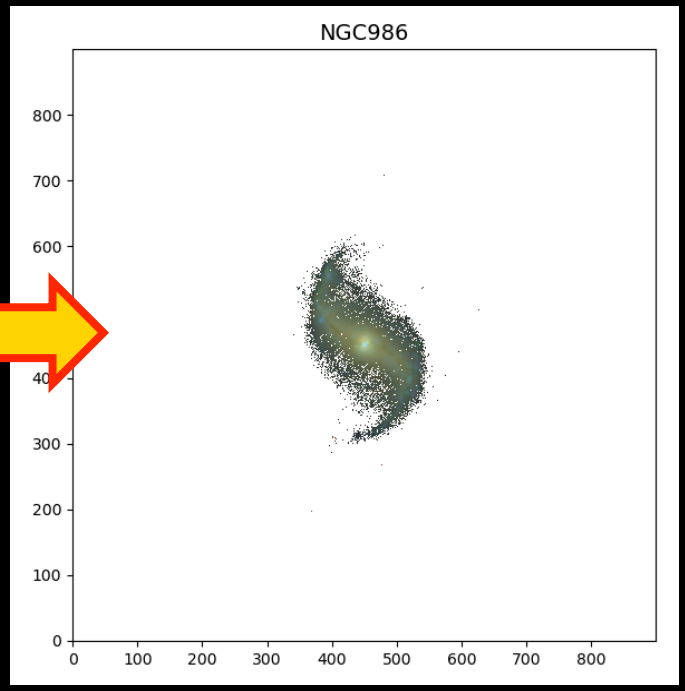


Scubes: λ, $F_{\lambda yx}$, $\varepsilon_{\lambda yx}$, $flag_{\lambda yx}$ + $mask_{yx}$







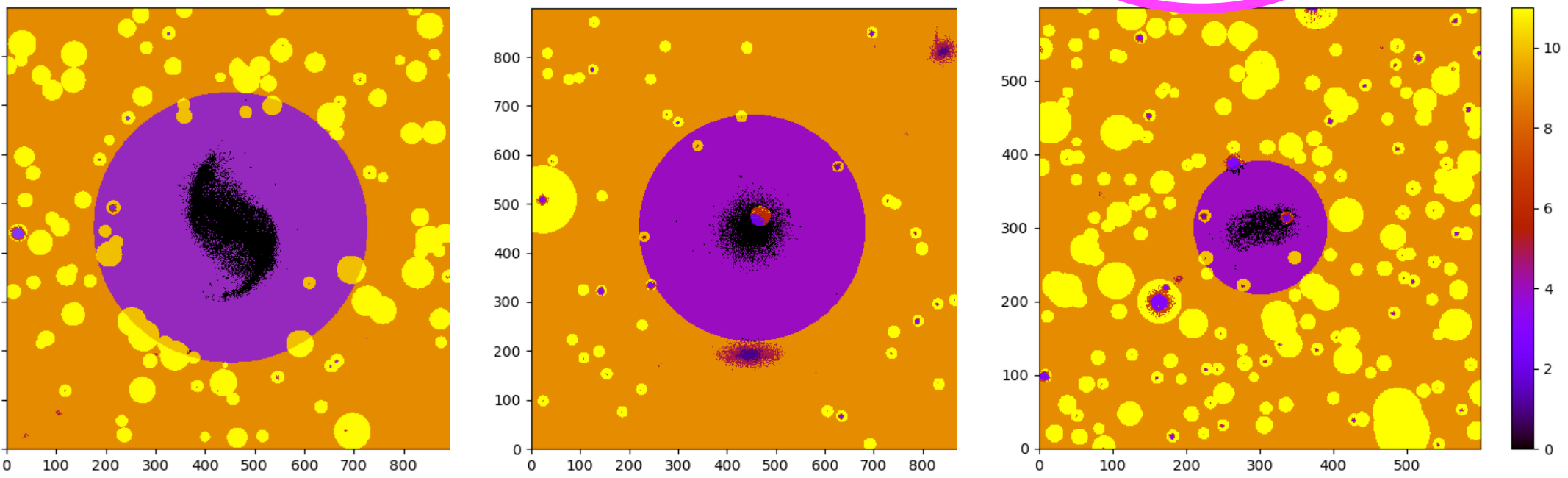


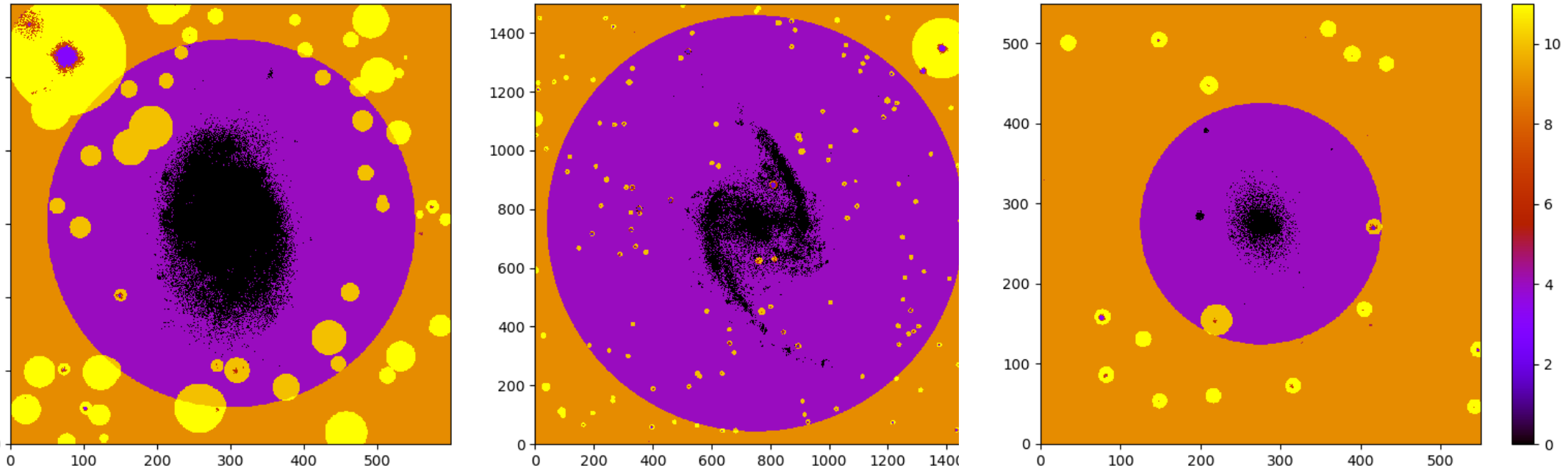
- Delimit area of interest
- Mask foreground stars & other crap
- Select good data: <S/N> > 2

→ $mask_{yx}$
= list of pixels to fit

Need smarter segmentation scheme!
Rebinning / Smoothing / Voronoi / …

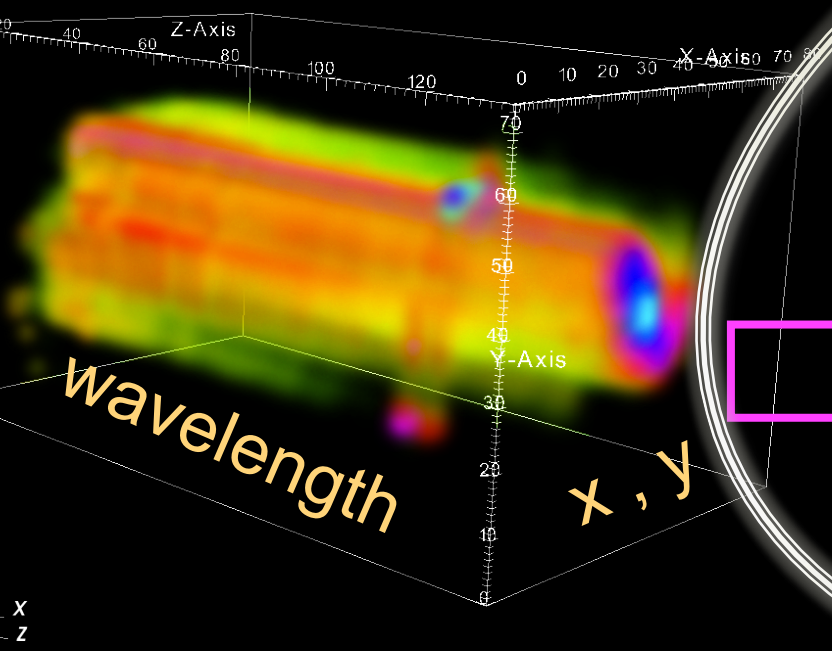
Scubes: λ, $F_{\lambda yx}$, $\varepsilon_{\lambda yx}$, $flag_{\lambda yx}$ + $mask_{yx}$



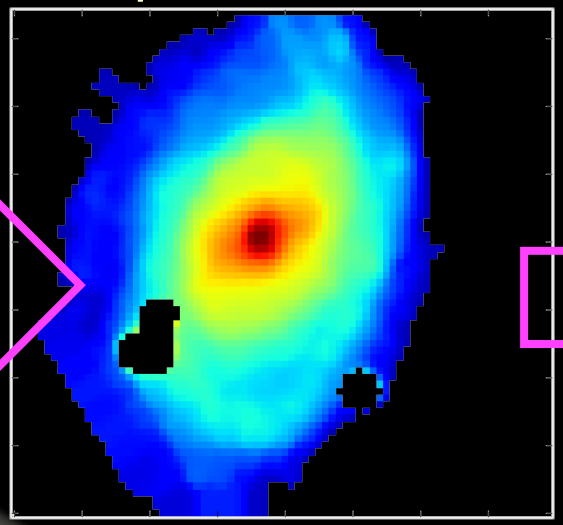


The **PyCASSO** pipeline

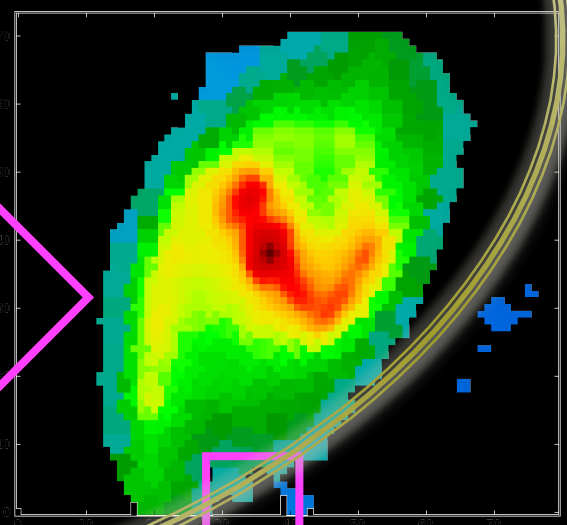
Python **CA**lifa **S**tarlight **S**ynthesis **O**rganizer



Cleaning: spatial & spectral masks



Voronoi binning: S/N > 20



N ~ 1000 individual spectra:

- $F_z(\lambda)$ and its error
- Spectral masks - $m_z(\lambda)$
- Bad pixel flags - $b_z(\lambda)$
- Correlated errors
- Galactic extinction
- Rest-framing & resampling

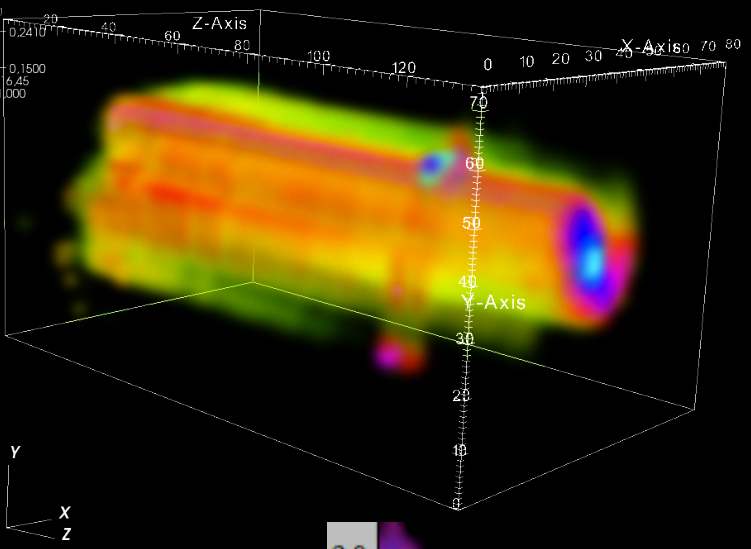
STARLIGHT

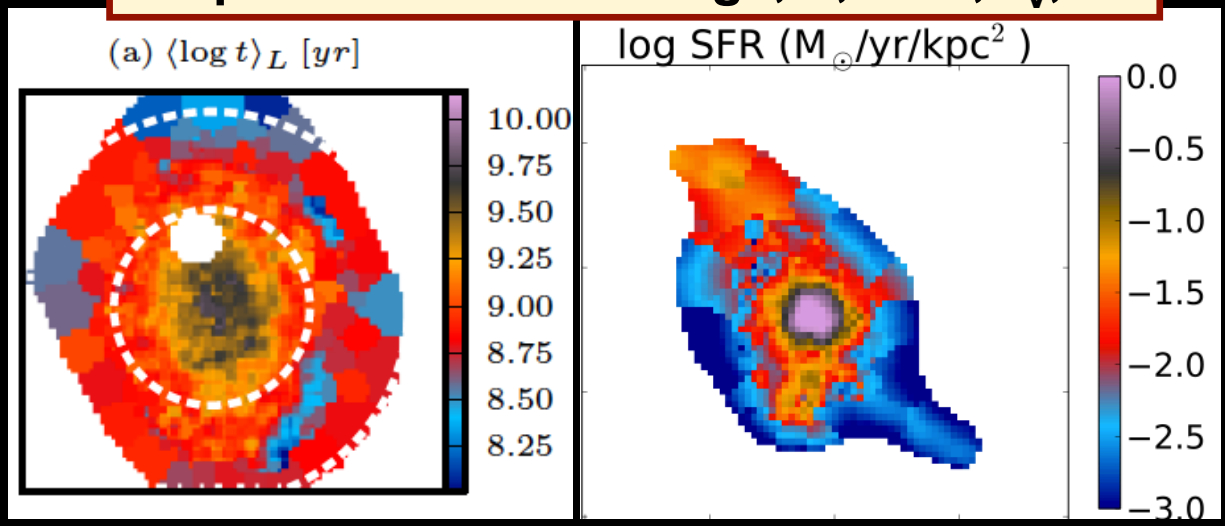
M_* , v_* ,σ_*, τ_V, <age$_*$>, <Z$_*$>, SFH, ...

as a function of (x,y) !!

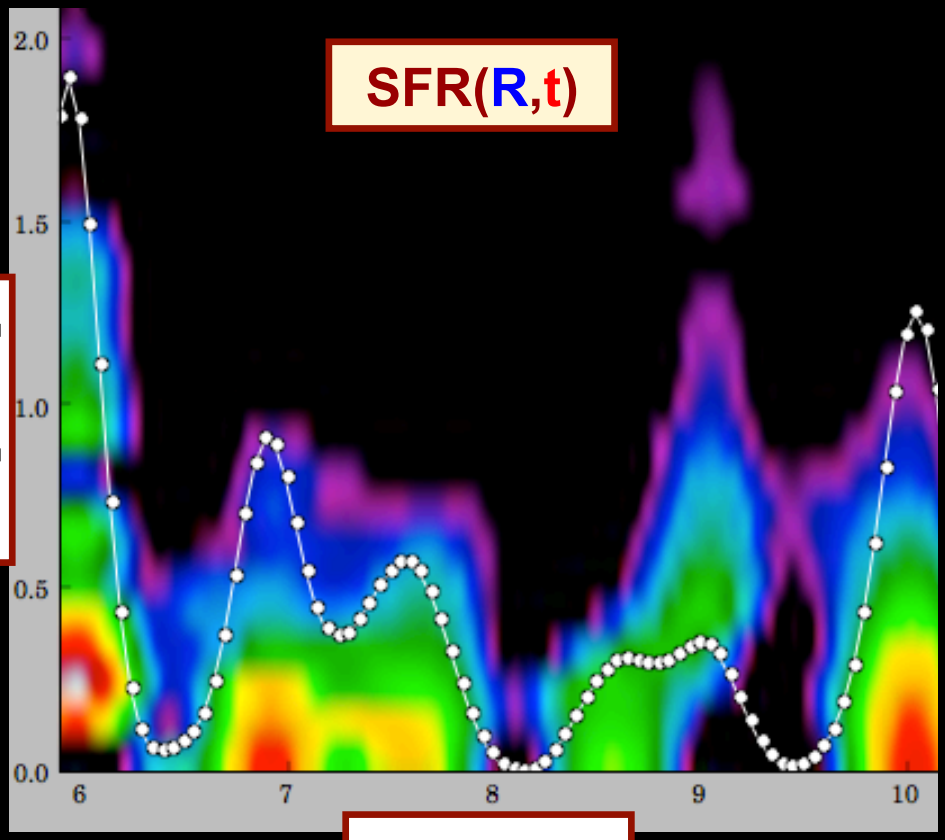
From datacubes to:

Maps of mean stellar age, Z, SFR, τ_V, …

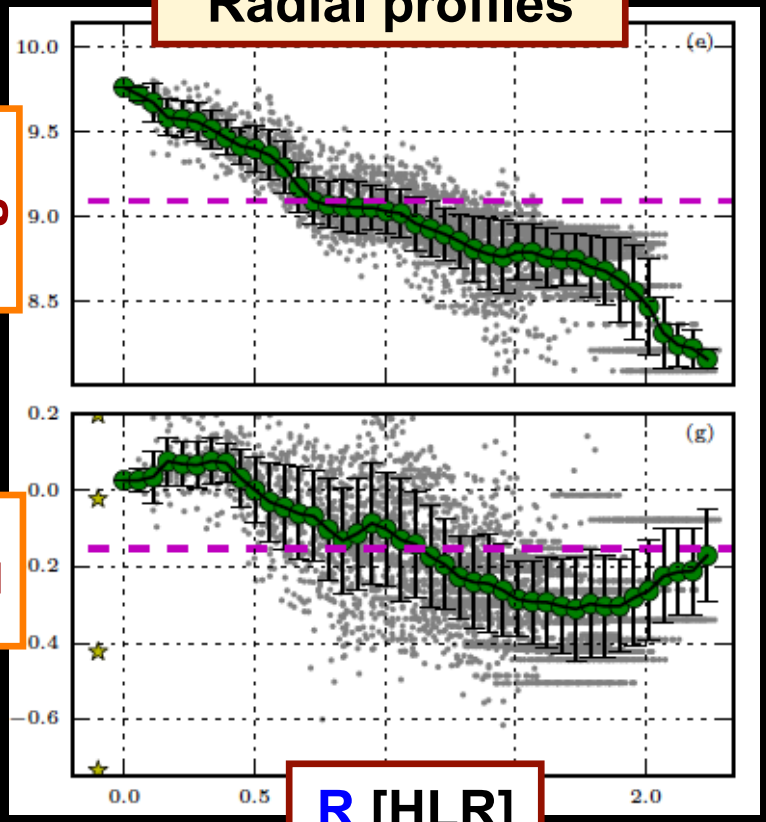




SFR(R,t)



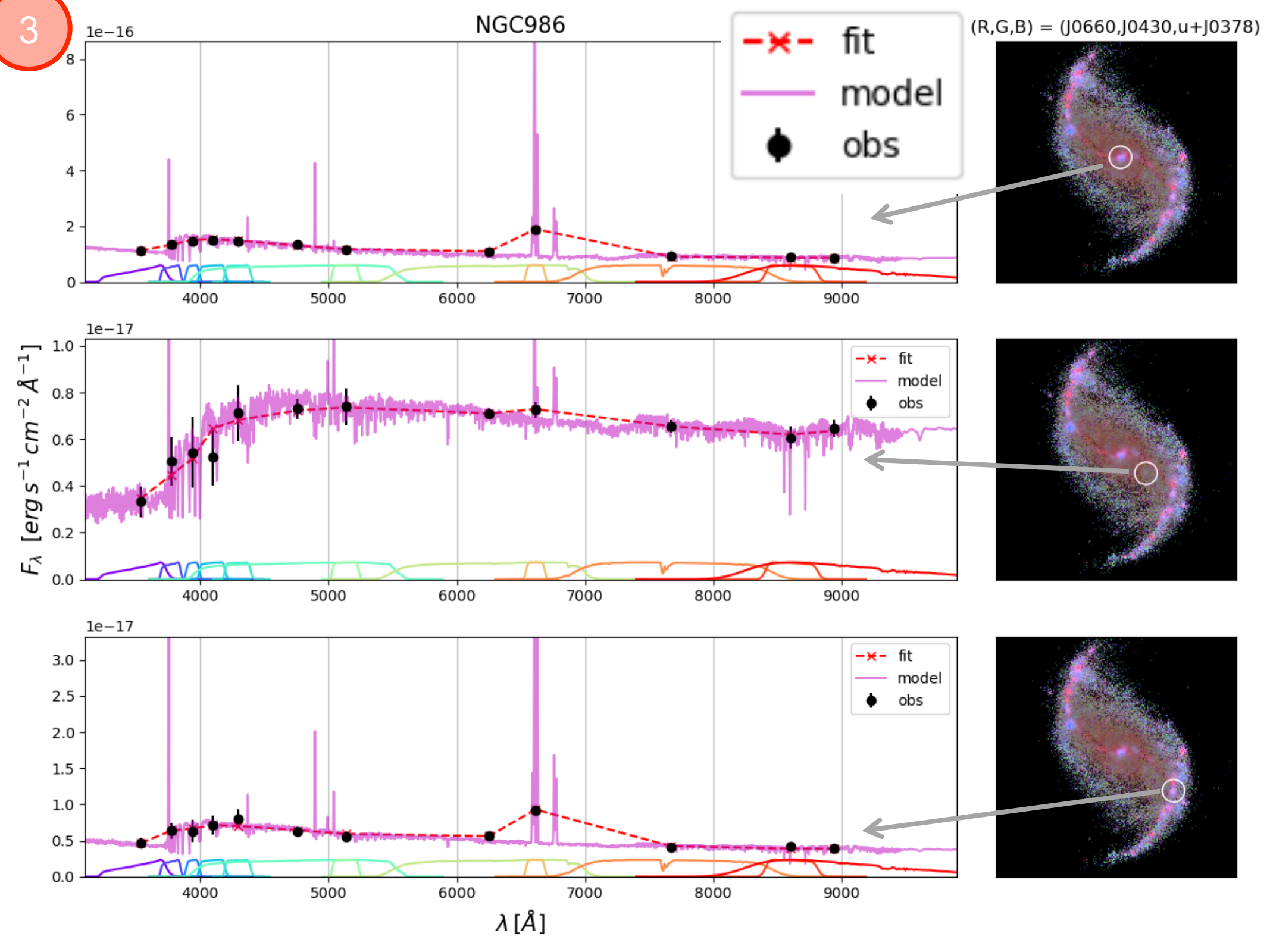
Radial profiles



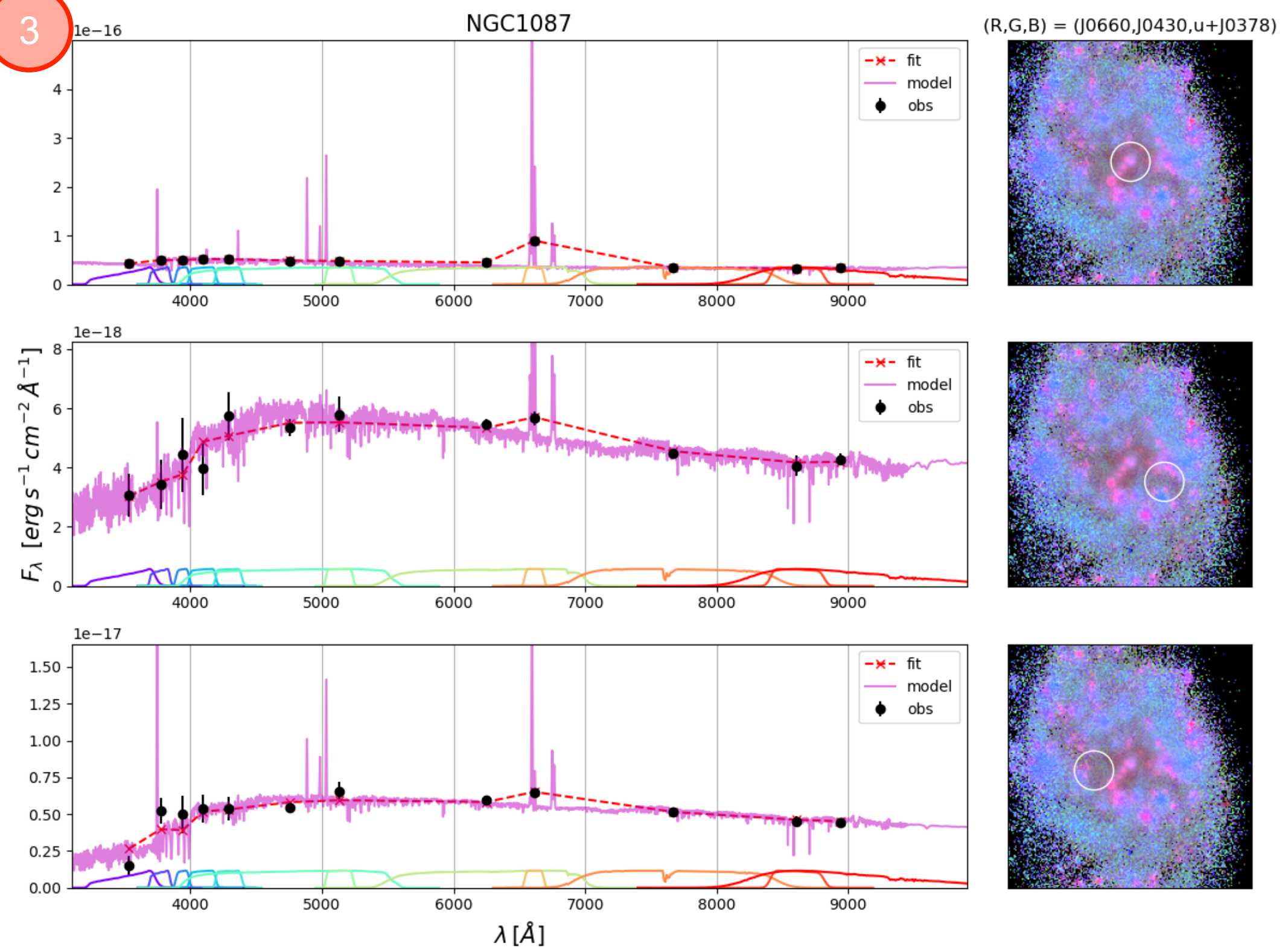
1st Results

- ✓ Examples of pixel spectral fits
- ✓ A test of the photometric errors
- ✓ Maps & “radial” profiles

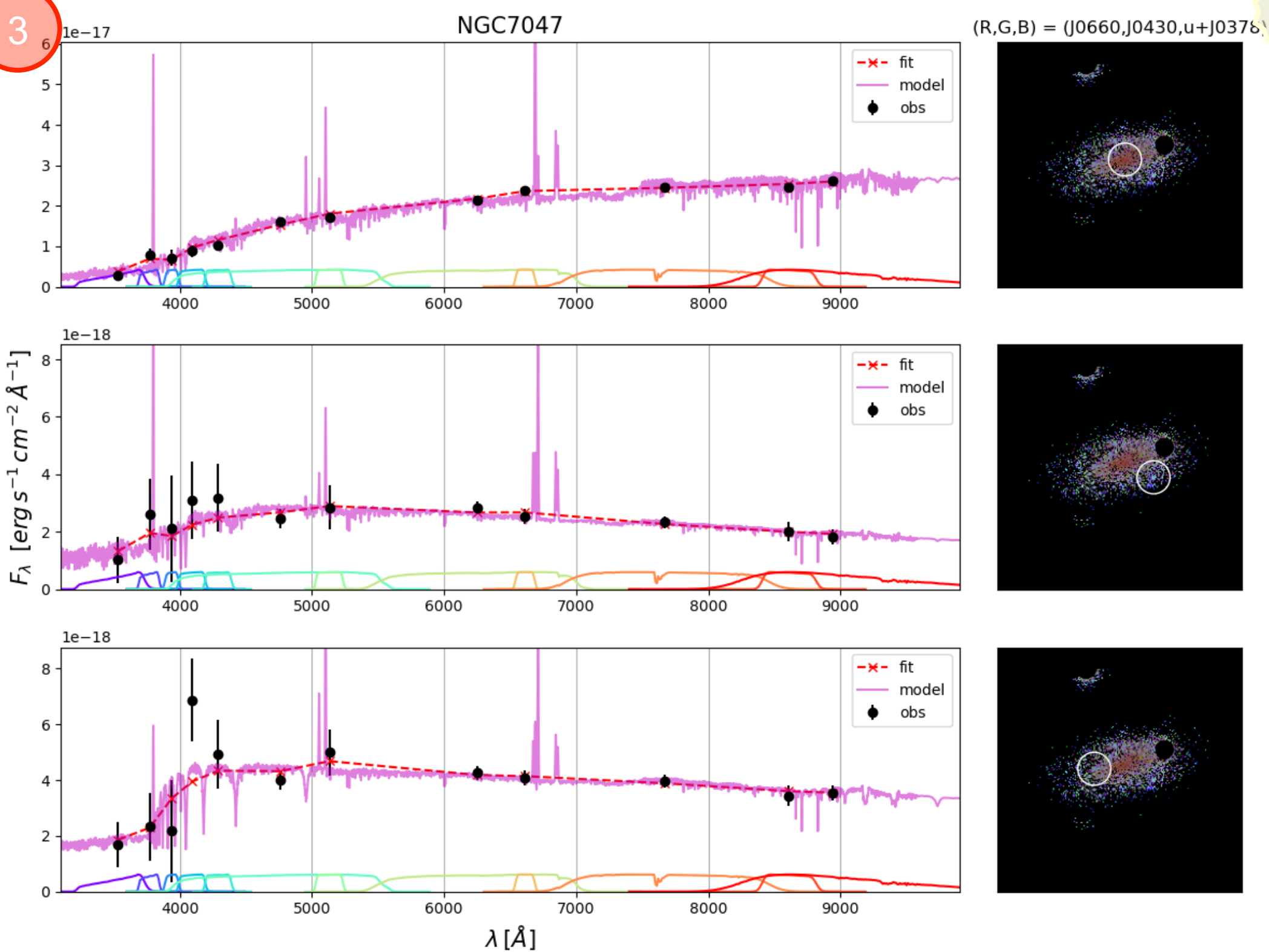
3


NGC986
(R,G,B) = (J0660,J0430,u+J0378)
fit
model
obs
1e−16
1e−17
1e−17
F_λ [$erg\,s^{-1}\,cm^{-2}\,Å^{-1}$]
λ [$Å$]

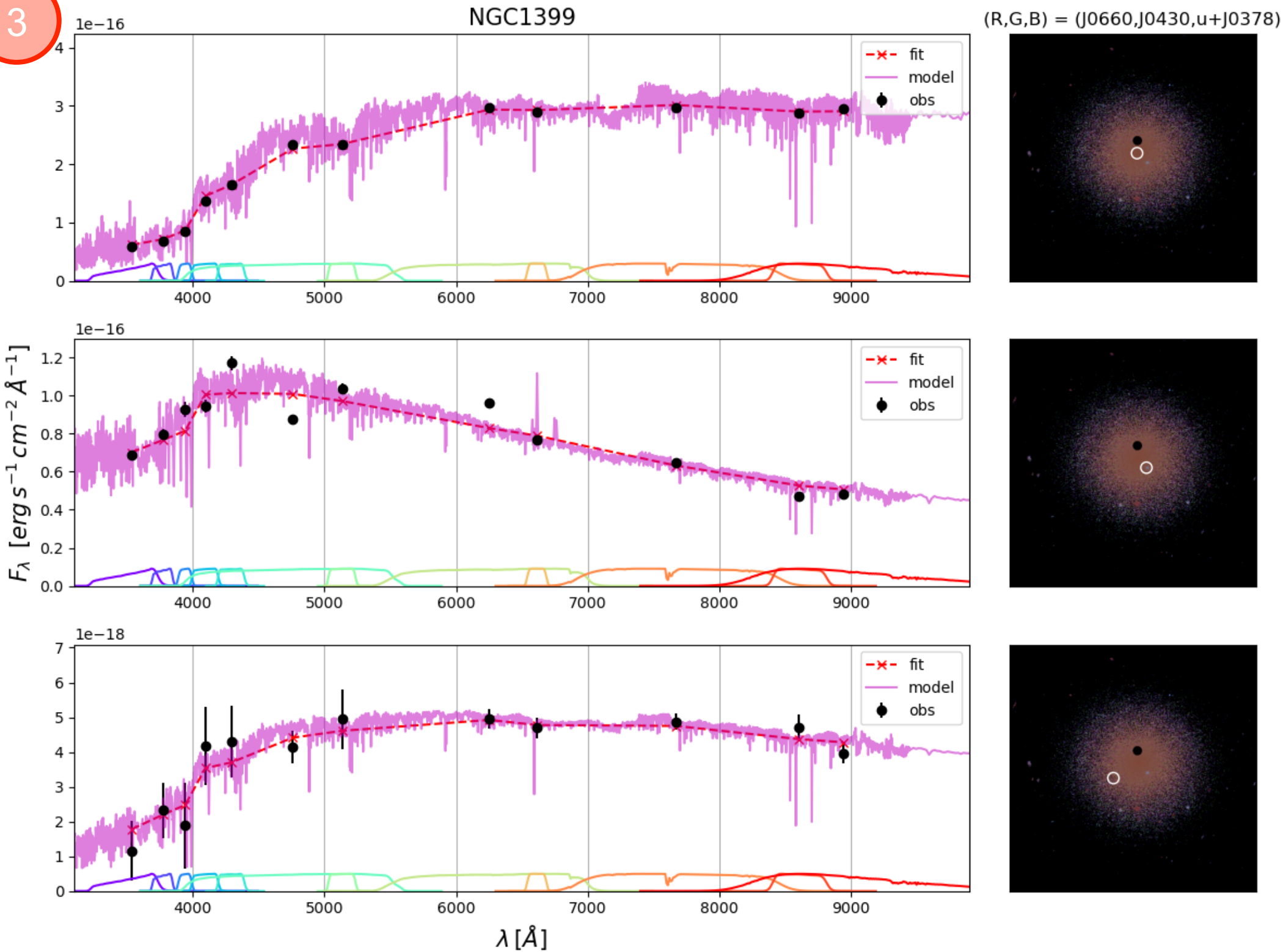
3


NGC1087
(R,G,B) = (J0660,J0430,u+J0378)
1e−16
1e−18
1e−17
fit
model
obs
F_λ [$erg\,s^{-1}\,cm^{-2}\,Å^{-1}$]
λ [$Å$]

3


NGC7047
(R,G,B) = (J0660,J0430,u+J0378)
1e−17
1e−18
1e−18
fit
model
obs
F_λ [$erg\,s^{-1}\,cm^{-2}\,Å^{-1}$]
λ [$Å$]

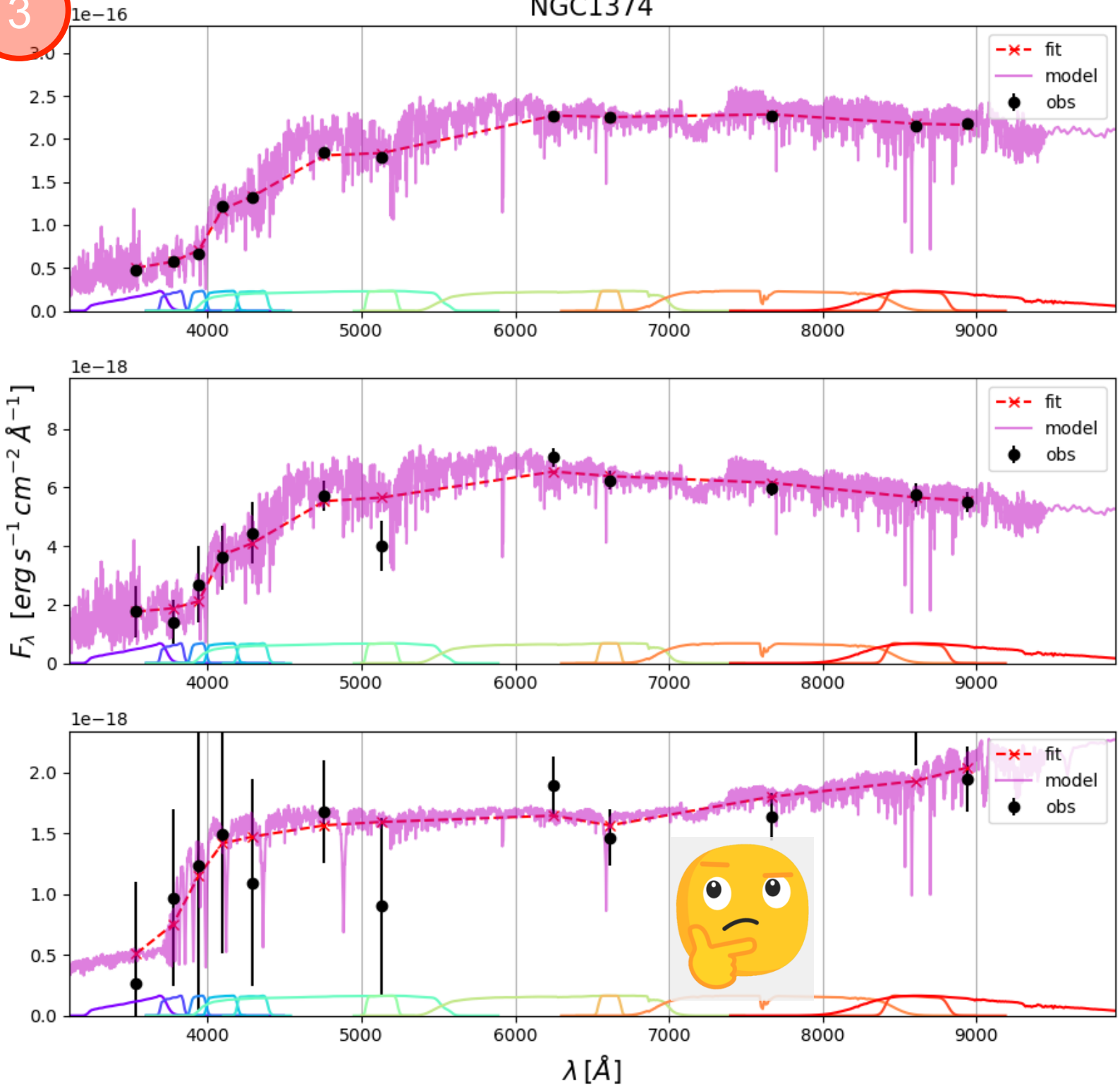
3

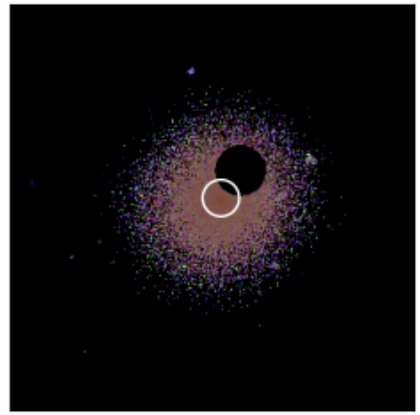

NGC1399
(R,G,B) = (J0660,J0430,u+J0378)
1e−16
1e−16
1e−18
fit
model
obs
F_λ [$erg\,s^{-1}\,cm^{-2}\,Å^{-1}$]
λ [$Å$]

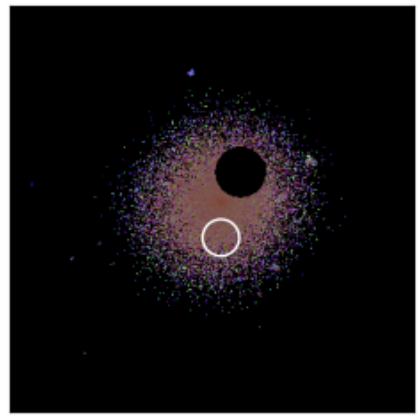
3

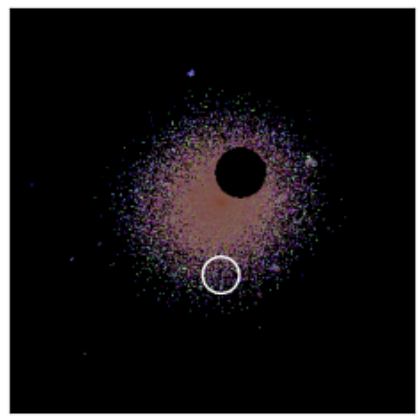
NGC1374

(R,G,B) = (J0660,J0430,u+J0378)



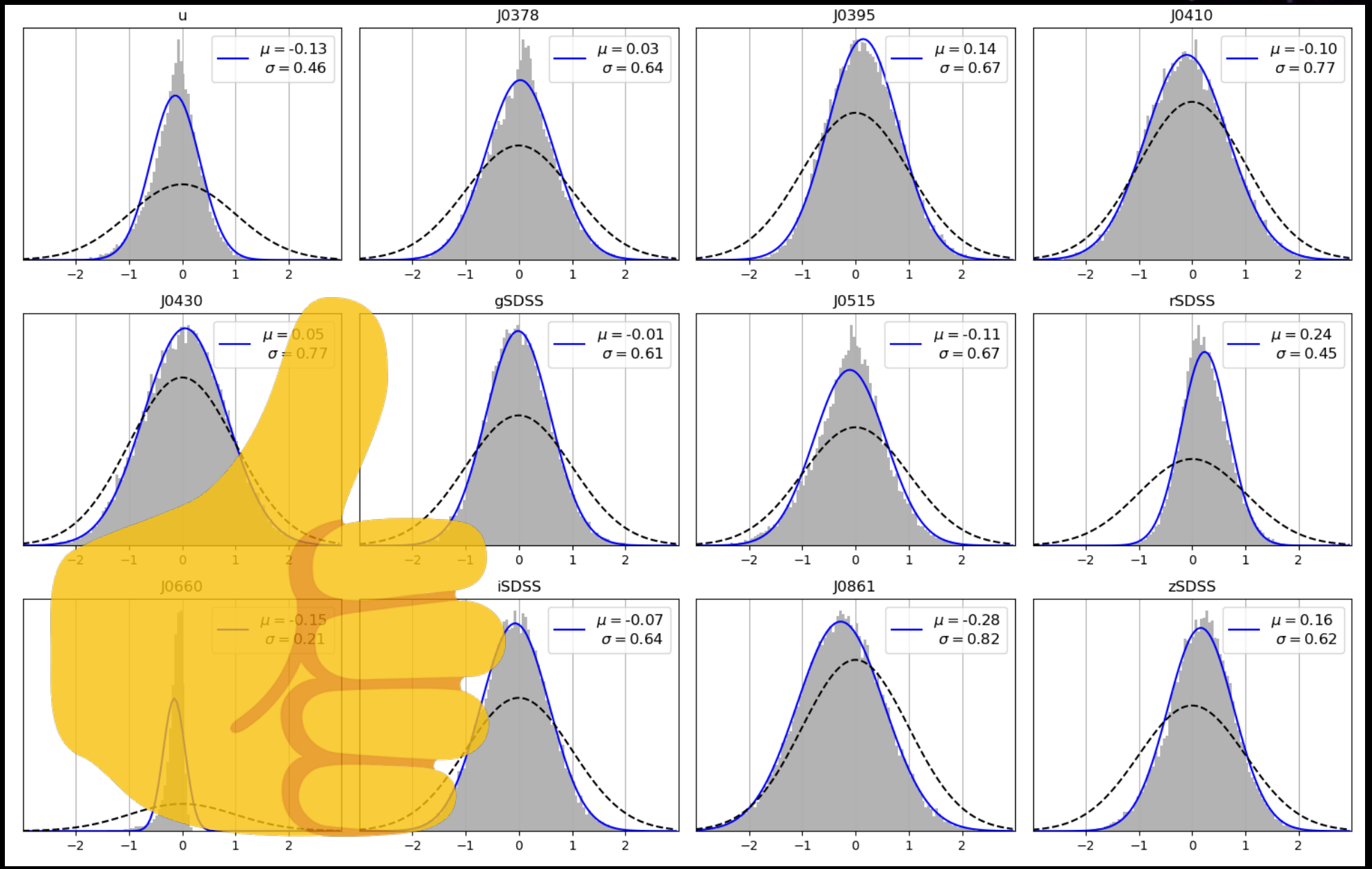






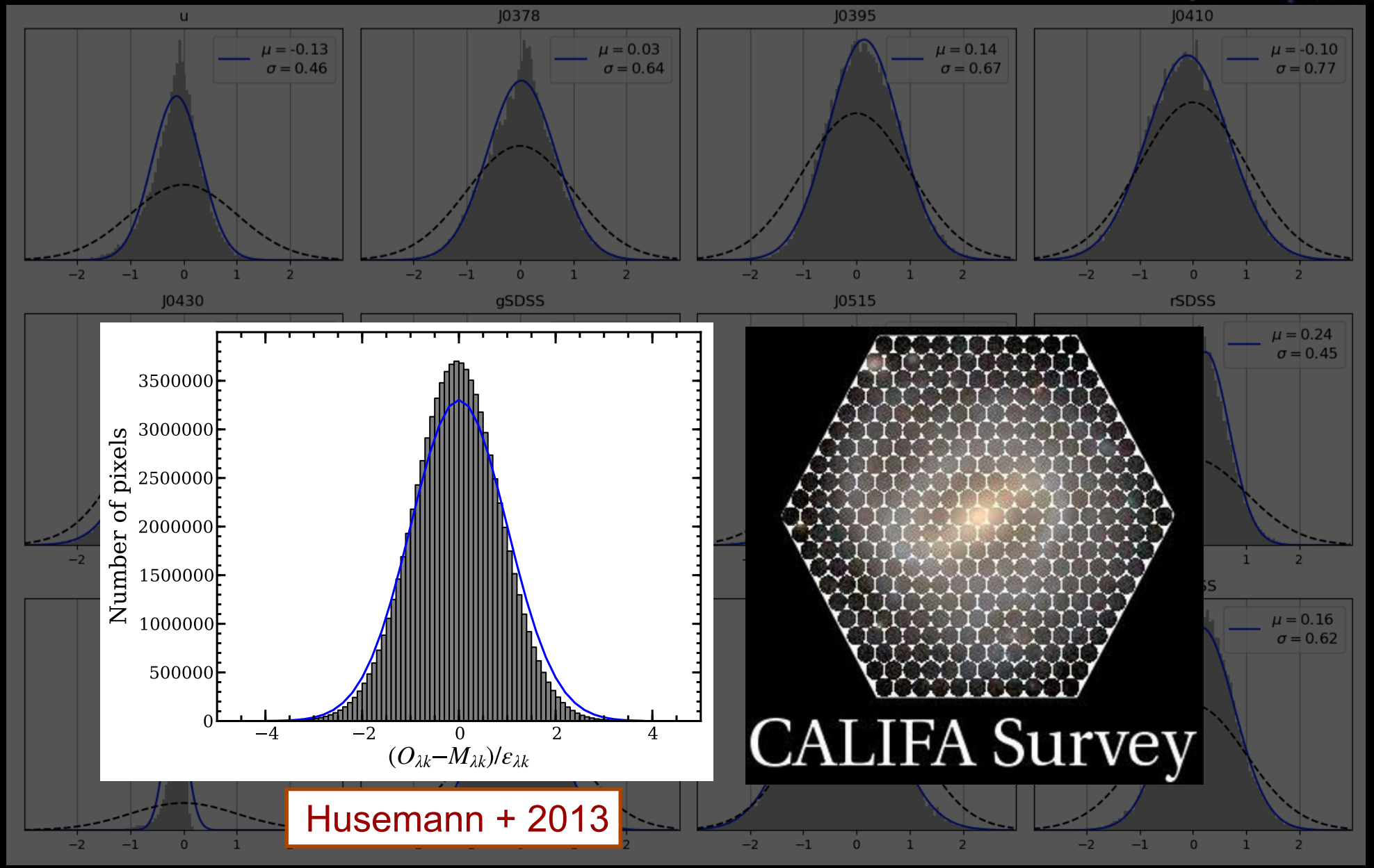
Results: empirical test of the errors $\varepsilon_{\lambda yx}$

Statistics of reduced residuals: $u_\lambda = (O_\lambda - M_\lambda) / \varepsilon_\lambda$



Results: empirical test of the errors $\varepsilon_{\lambda yx}$

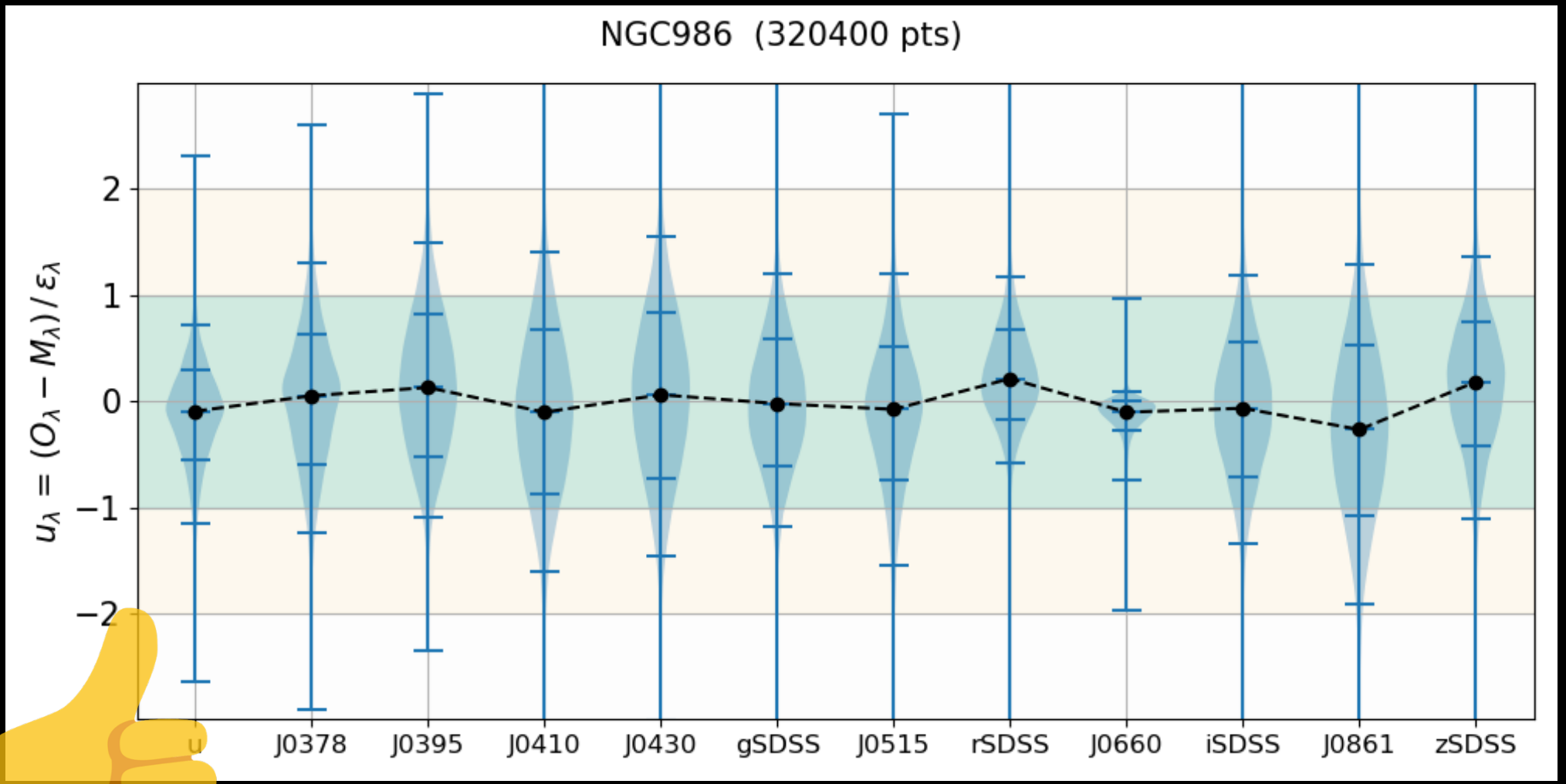
Statistics of reduced residuals: $u_\lambda = (O_\lambda - M_\lambda) / \varepsilon_\lambda$



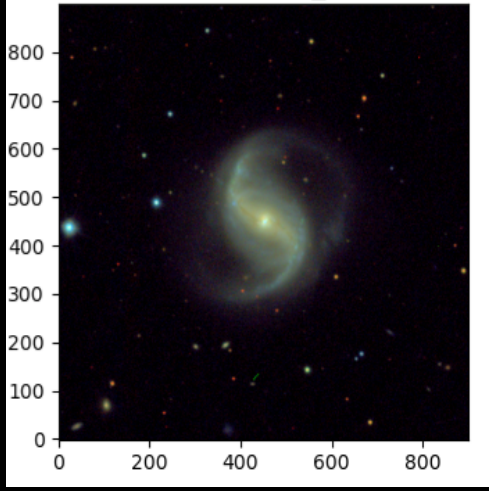
Husemann + 2013

Results: empirical test of the errors $\varepsilon_{\lambda yx}$

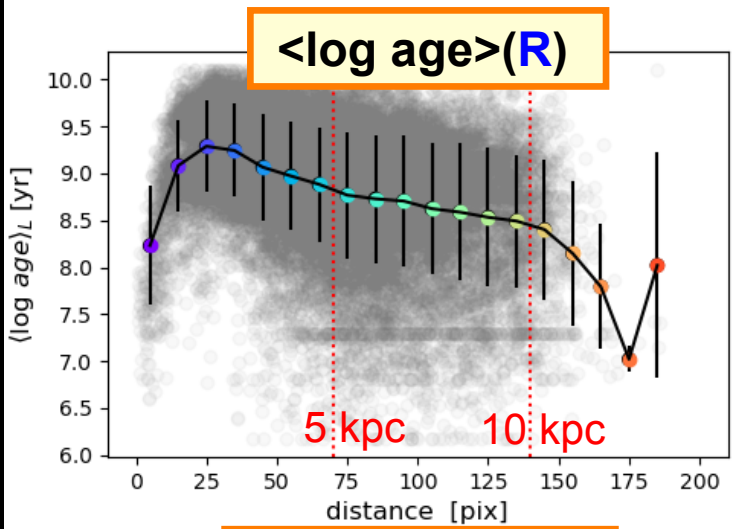
Statistics of reduced residuals: $u_\lambda = (O_\lambda - M_\lambda) / \varepsilon_\lambda$

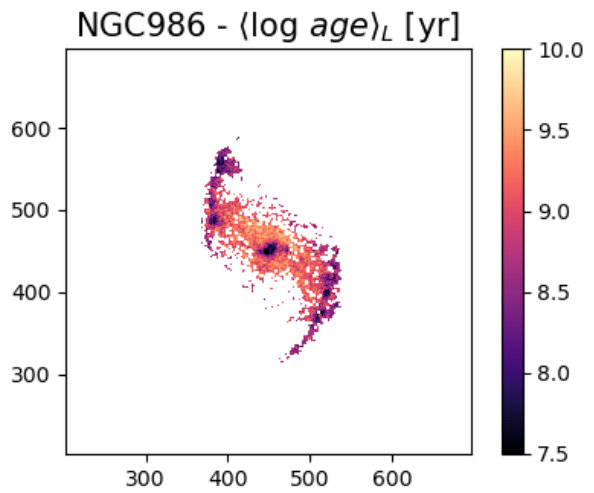


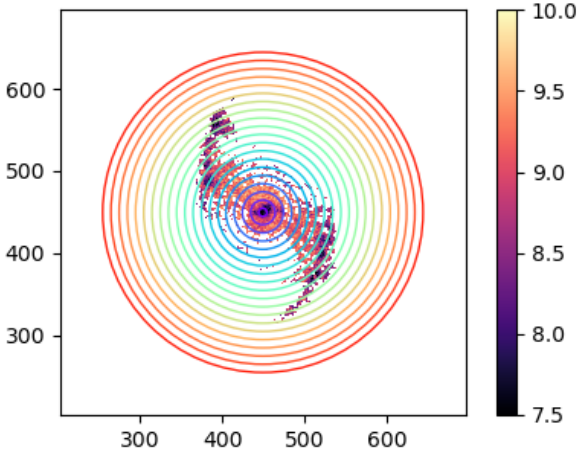
Results: Maps & circular profiles

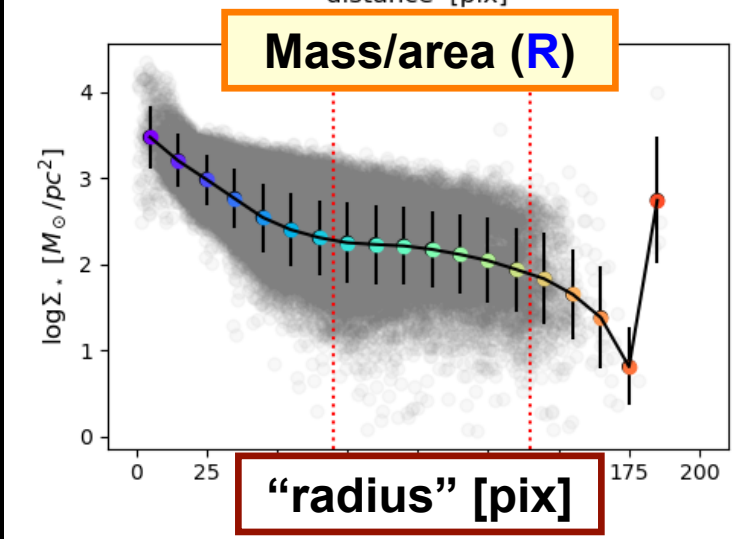


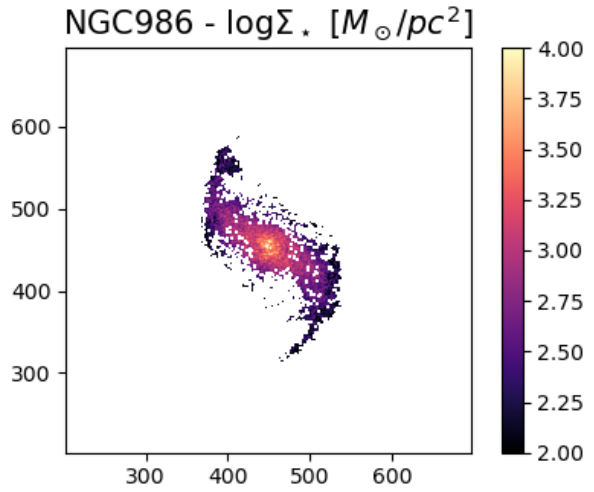
!Should do elliptical rings …

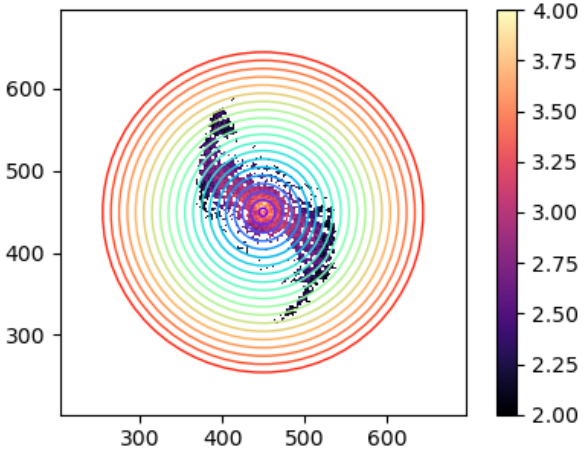




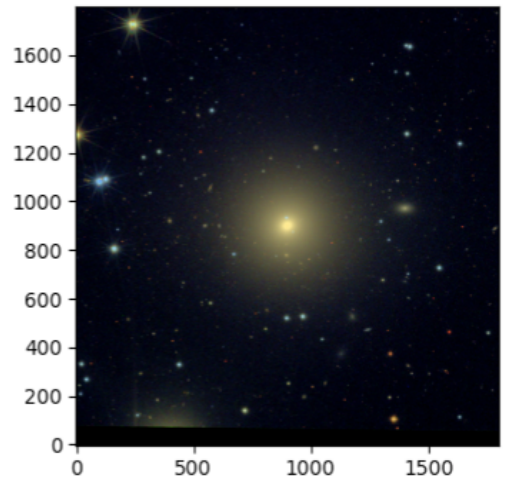


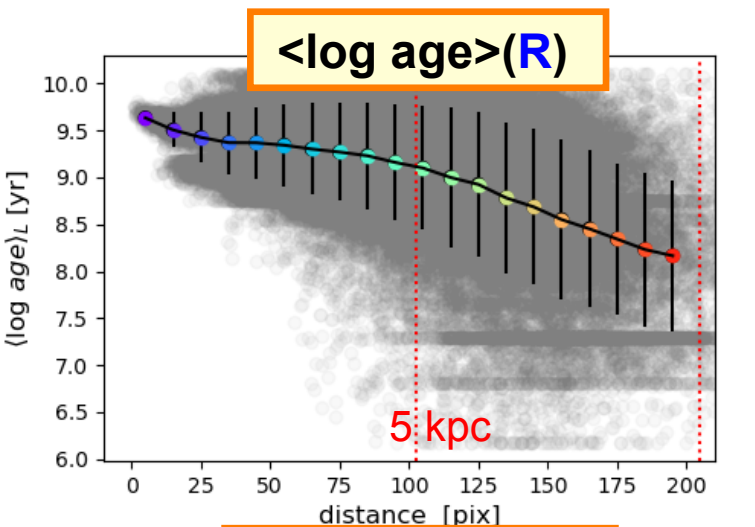


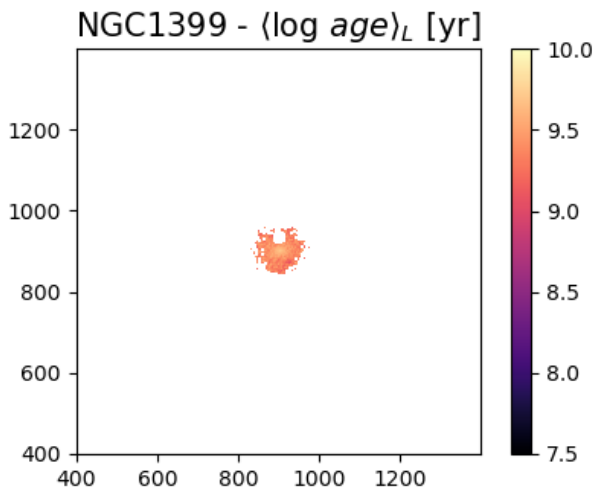


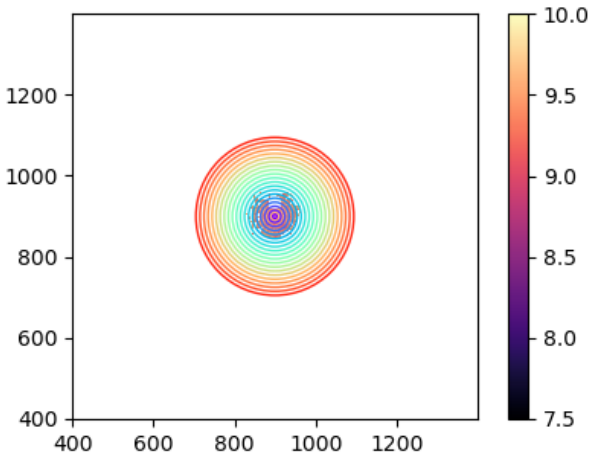


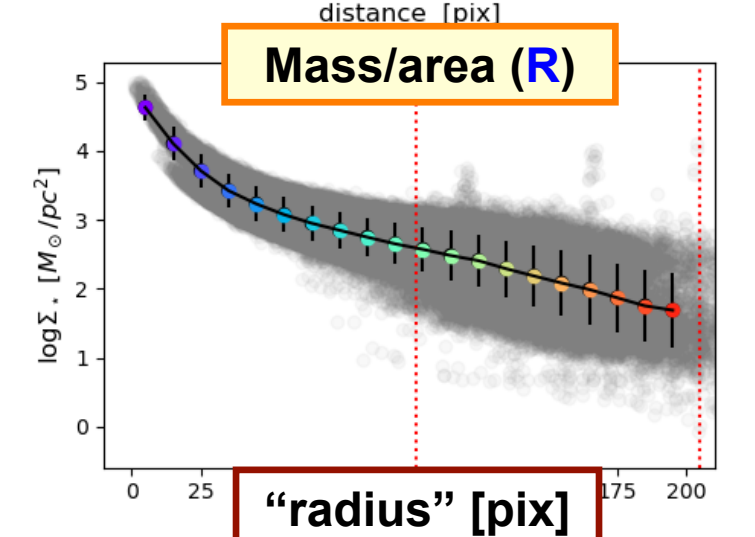
Results: Maps & circular profiles

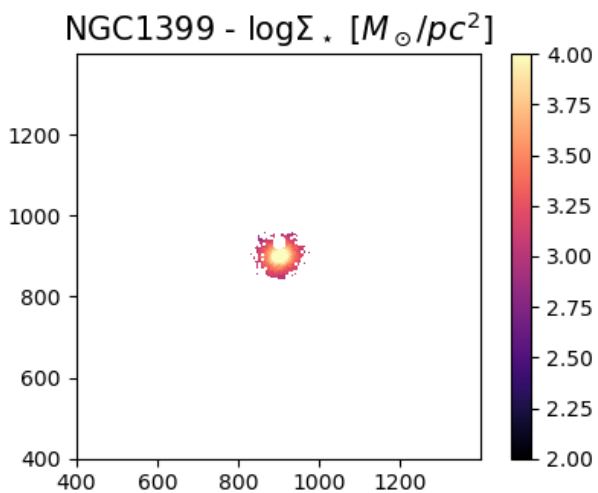


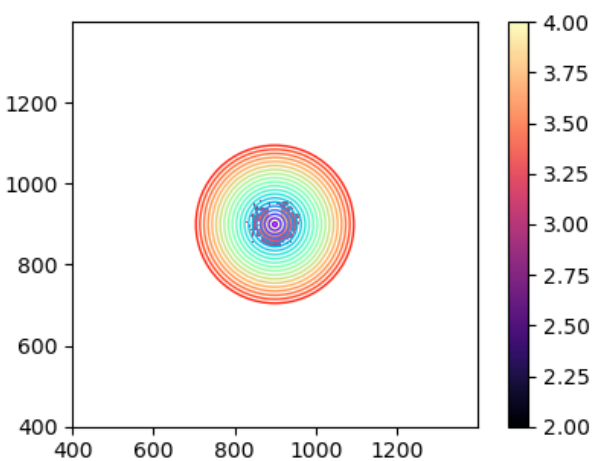




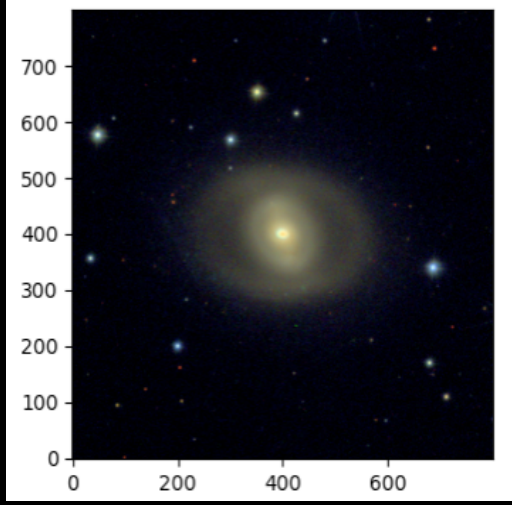


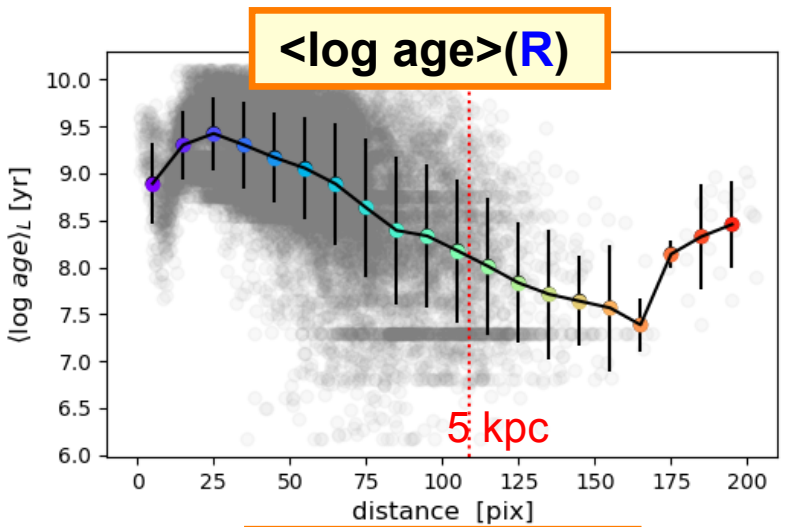


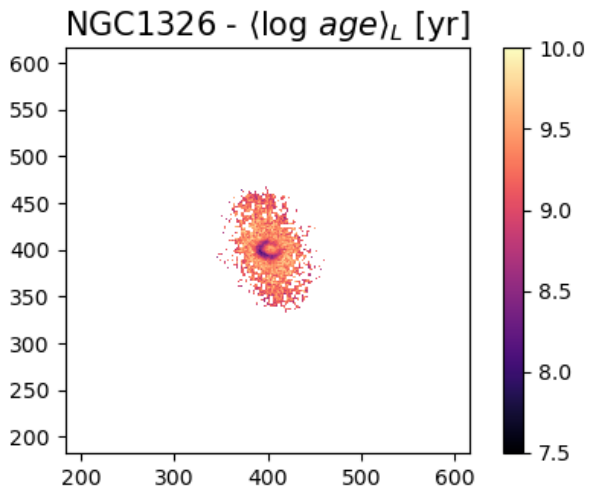


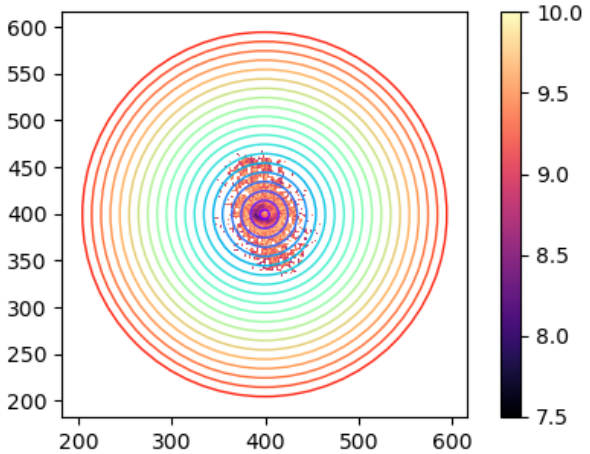


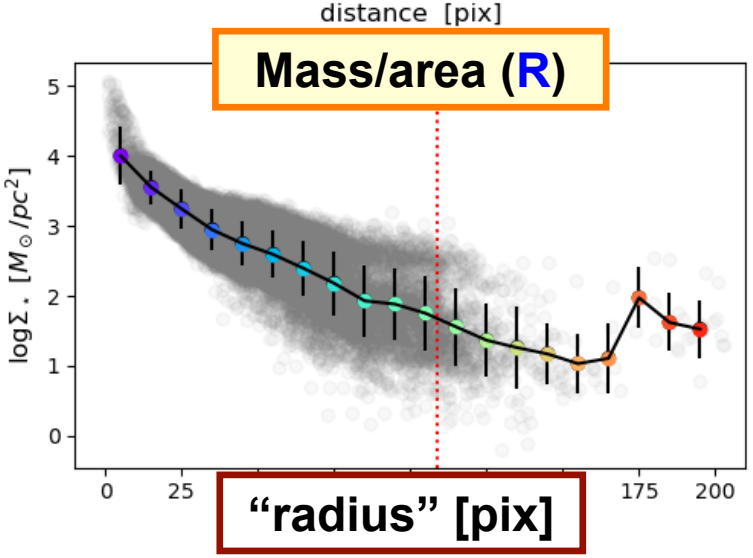
Results: Maps & circular profiles

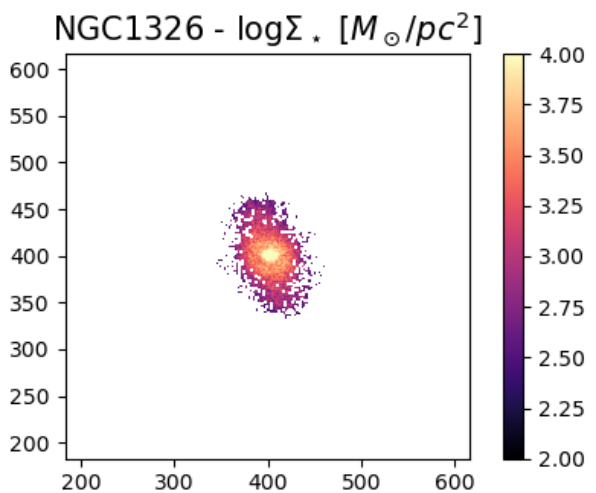


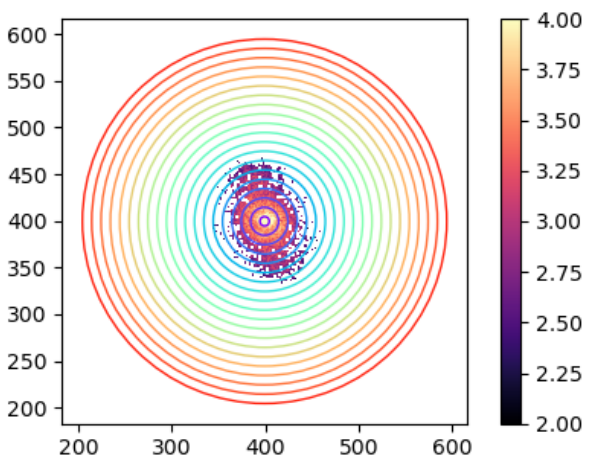












Conclusions & outlook

Things are going ~ well, BUT:

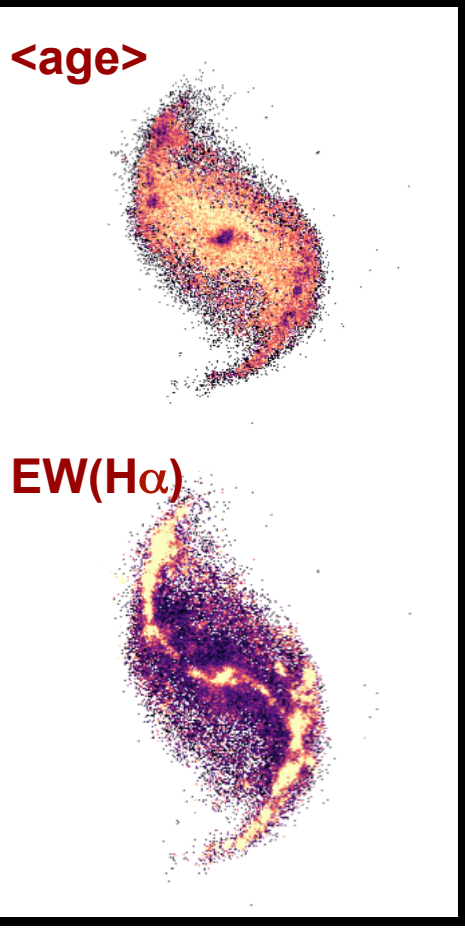
- Need work on masks / pre-processing / segmentation / ...
- Check if AlStar SFHs makes sense!
- Add UV & IR? Who's gonna do it?

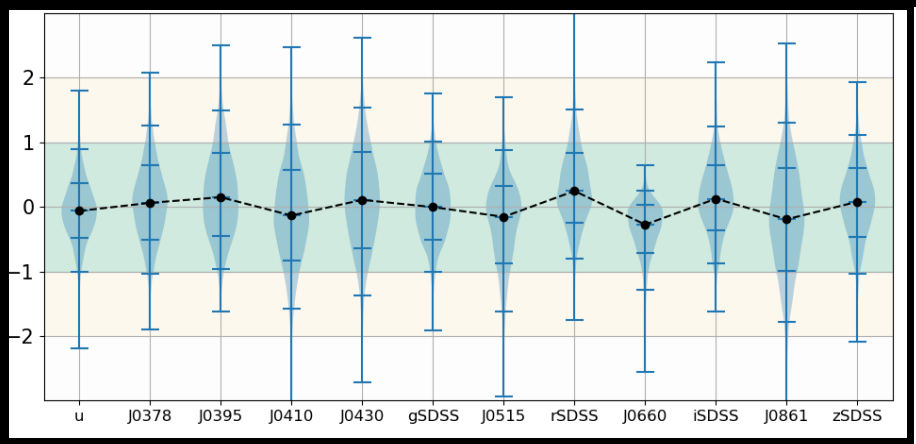
- The dilemas of poor-man-IFU work ...

  ¿ It is all worth it given CALIFA/SAMI/MaNGA/MUSE/… ?

  ¿ What are we gonna do with it, really ?

1st AlStar experiments with Scubes





Roberto Cid Fernandes

➔ Júlia Thainá Batista ➔

Fábio Herpich

Luna Espinosa

André Luiz de Amorim