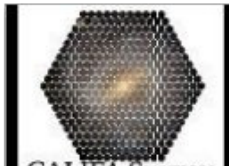
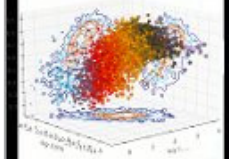


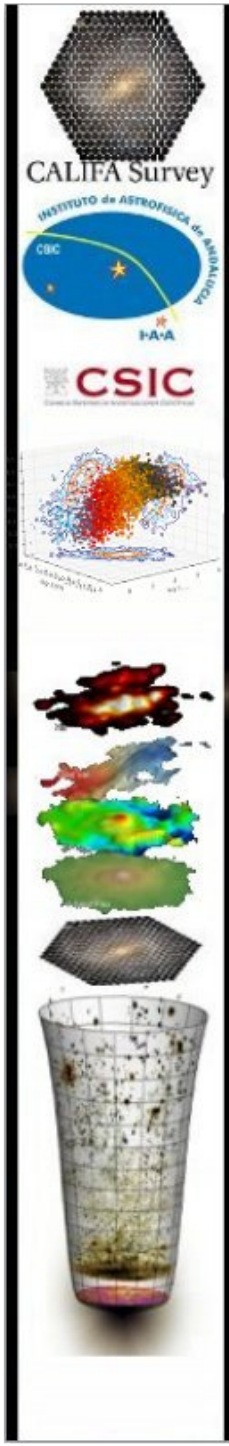


The CALIFA Survey: Properties of the HII regions

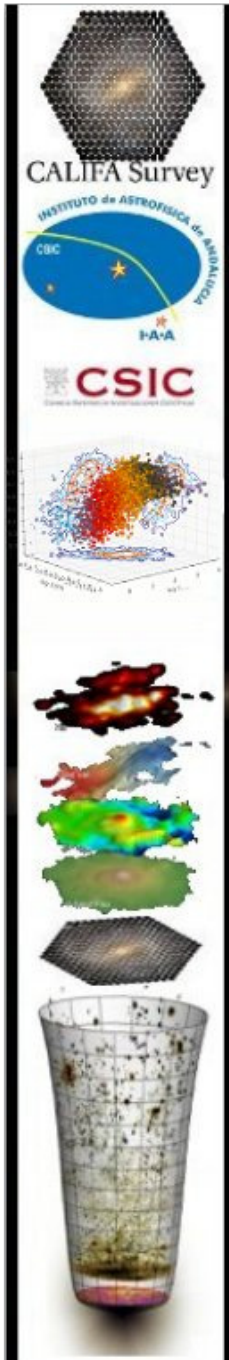
Sebastián F. Sánchez
IAA (CSIC), CAHA

- Guillermo Haro 2013-

- INAOE, Puebla, July 2013-

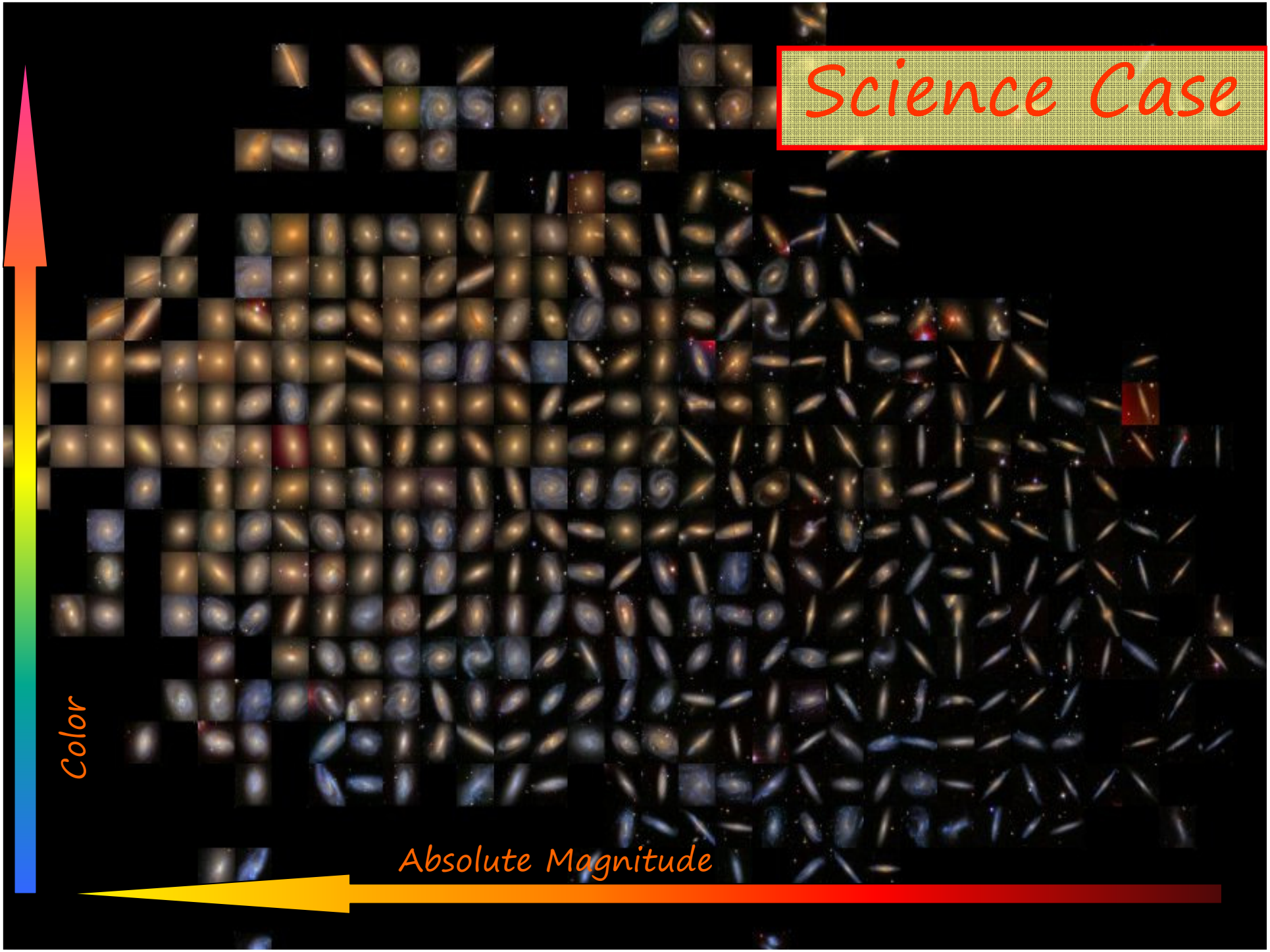


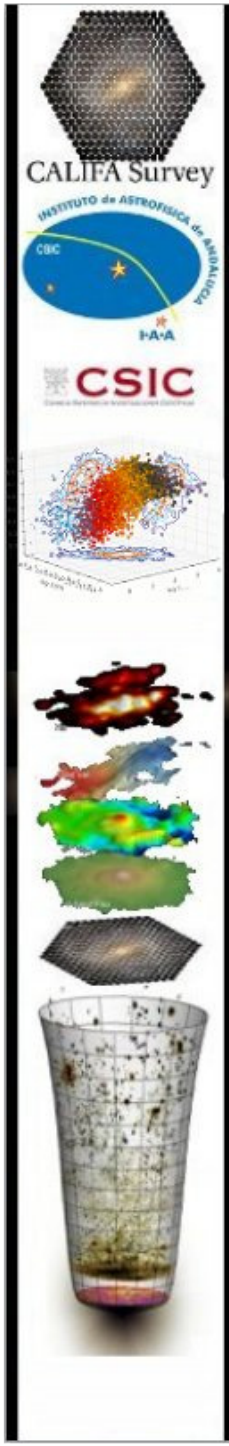
-CALIFA-
Description of the Survey



CALIFA: Summary

- Legacy Survey of Galaxies in the Local Universe, using Integral Field Spectroscopy (CAHA 3.5m telescope).
- 82 members of 13 countries (25 institutes)
- 250 dark nights in 3 years.
- Started on July 1st 2010.
- Main Goals:
  - Characterize the Spatially resolved spectroscopic properties of Galaxies in the Local Universe.
  - Uncover the fossil records of the evolution of galaxies.
- Predecesors: PINGS (PPak IFS Nearby Galaxy Survey, F.F. Rosales-Ortega)


Science Case
Color
Absolute Magnitude

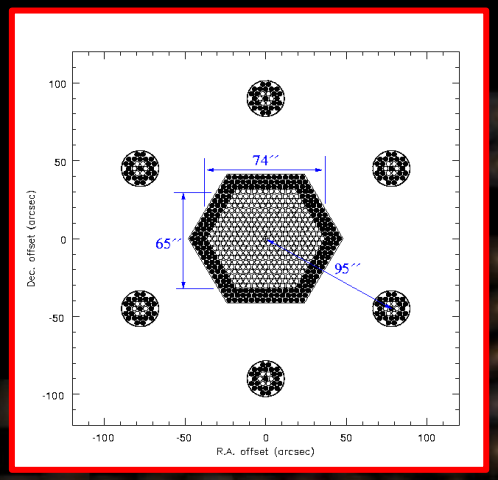


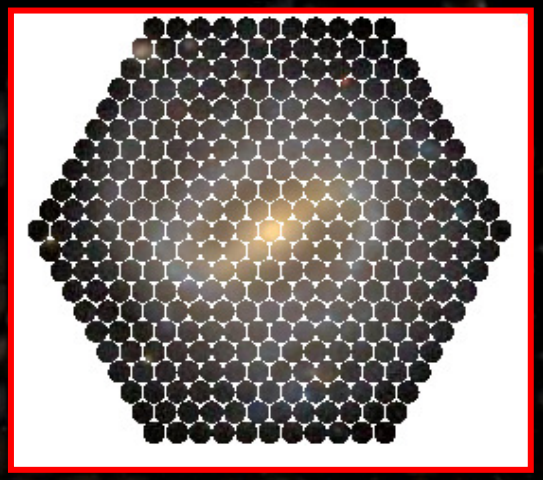
CALIFA: Metodology

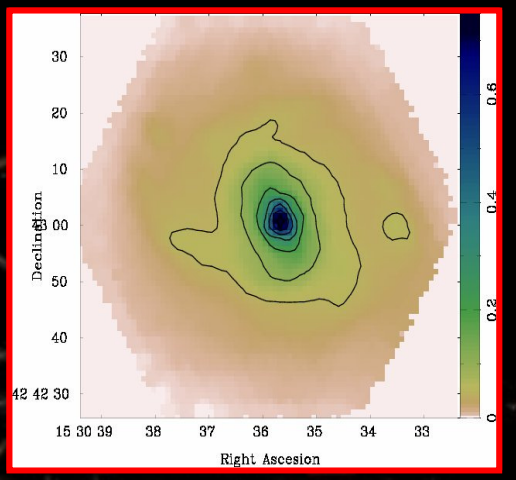
PMAS/PPAK @ 3.5m CAHA

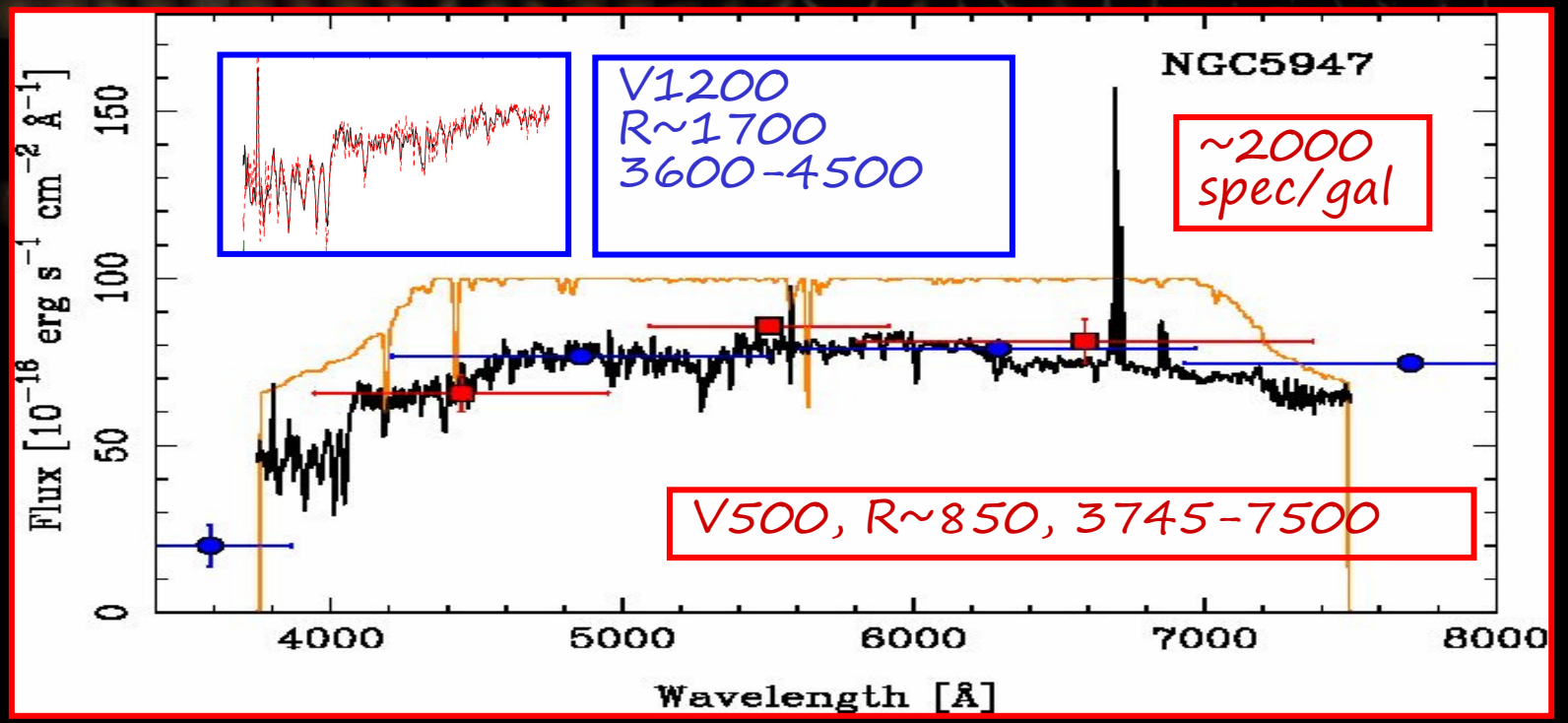
Sánchez et al., A&A, 2012a.

CALIFA: Metodology

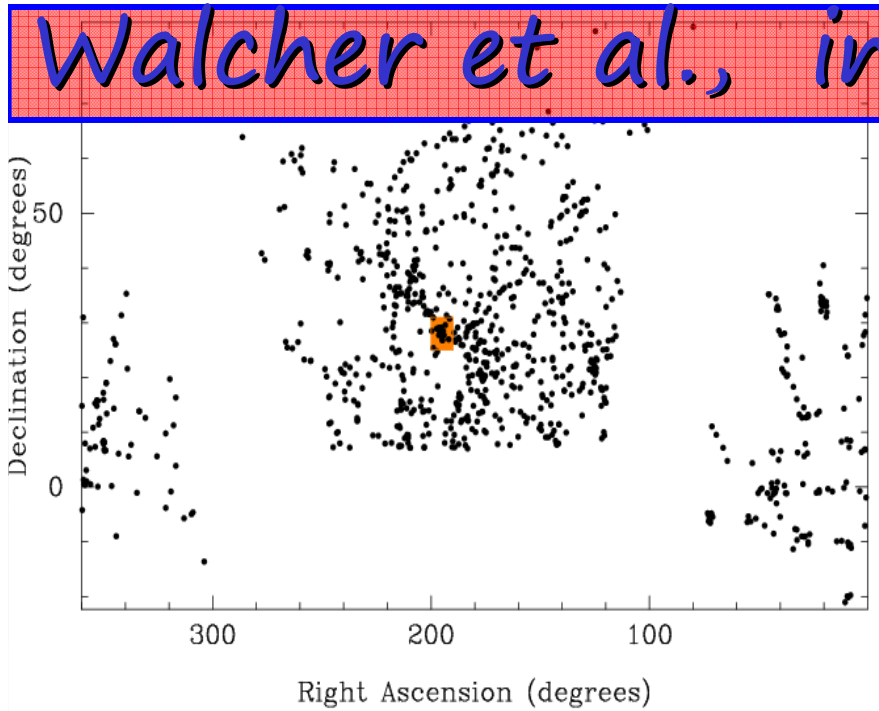


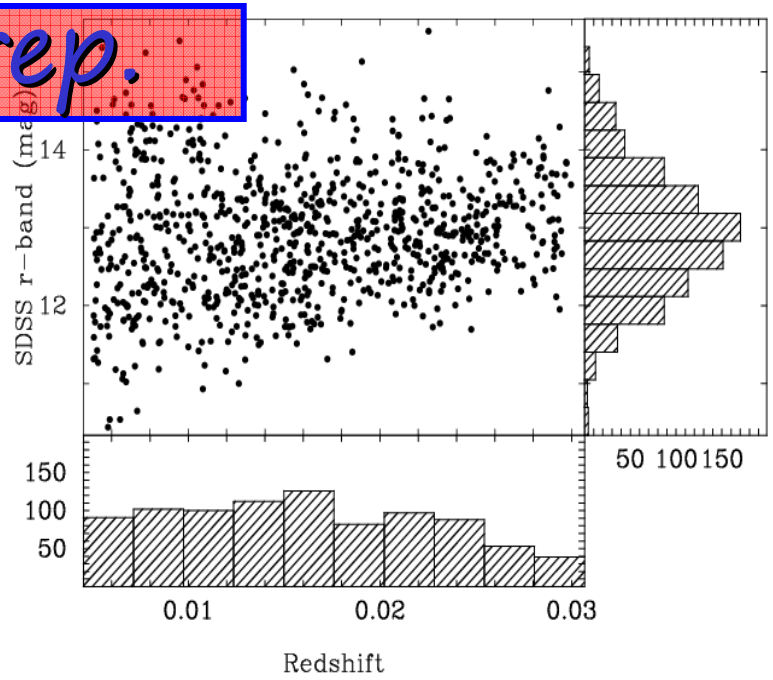


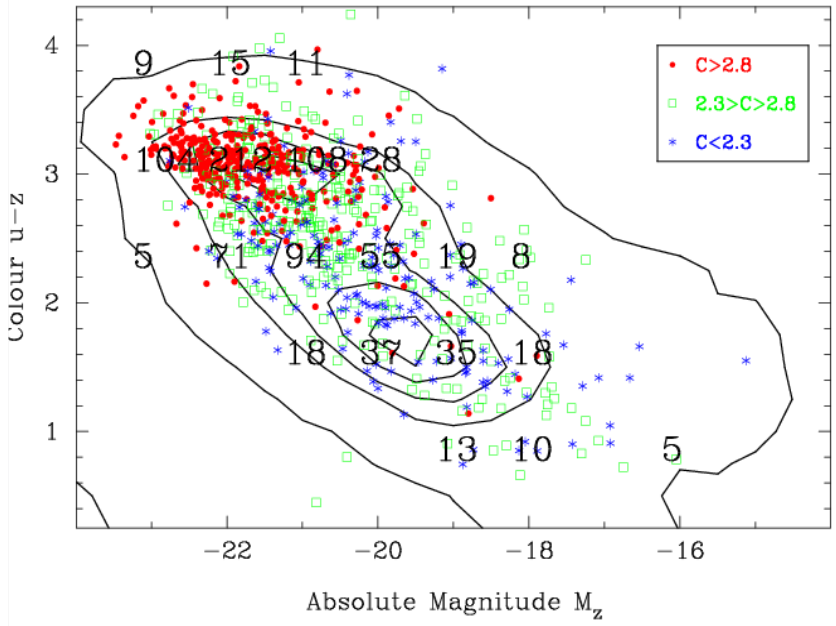


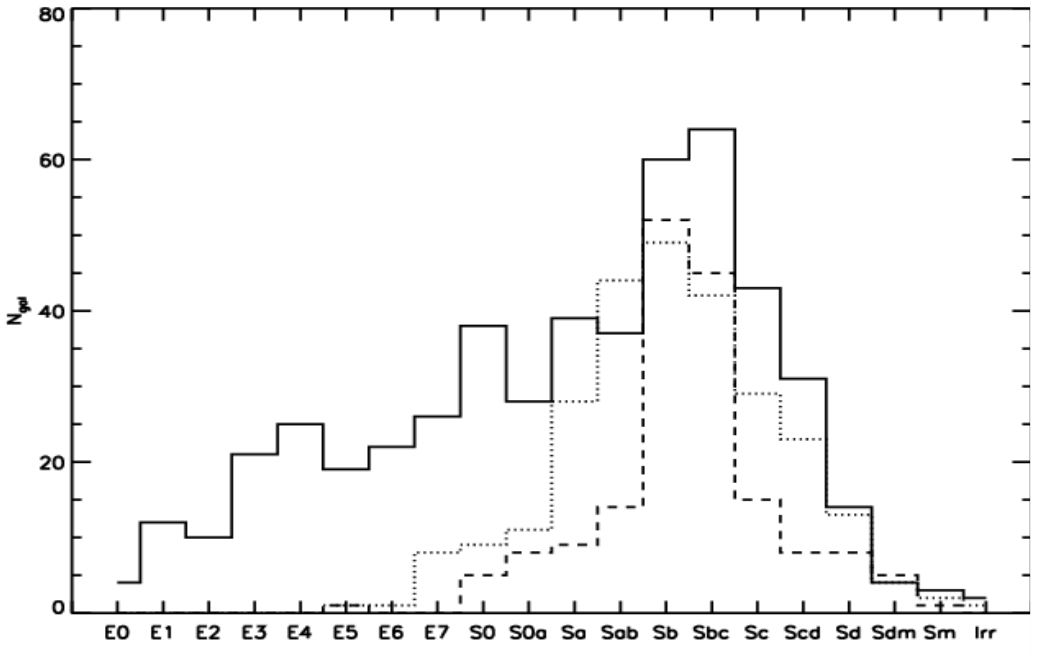


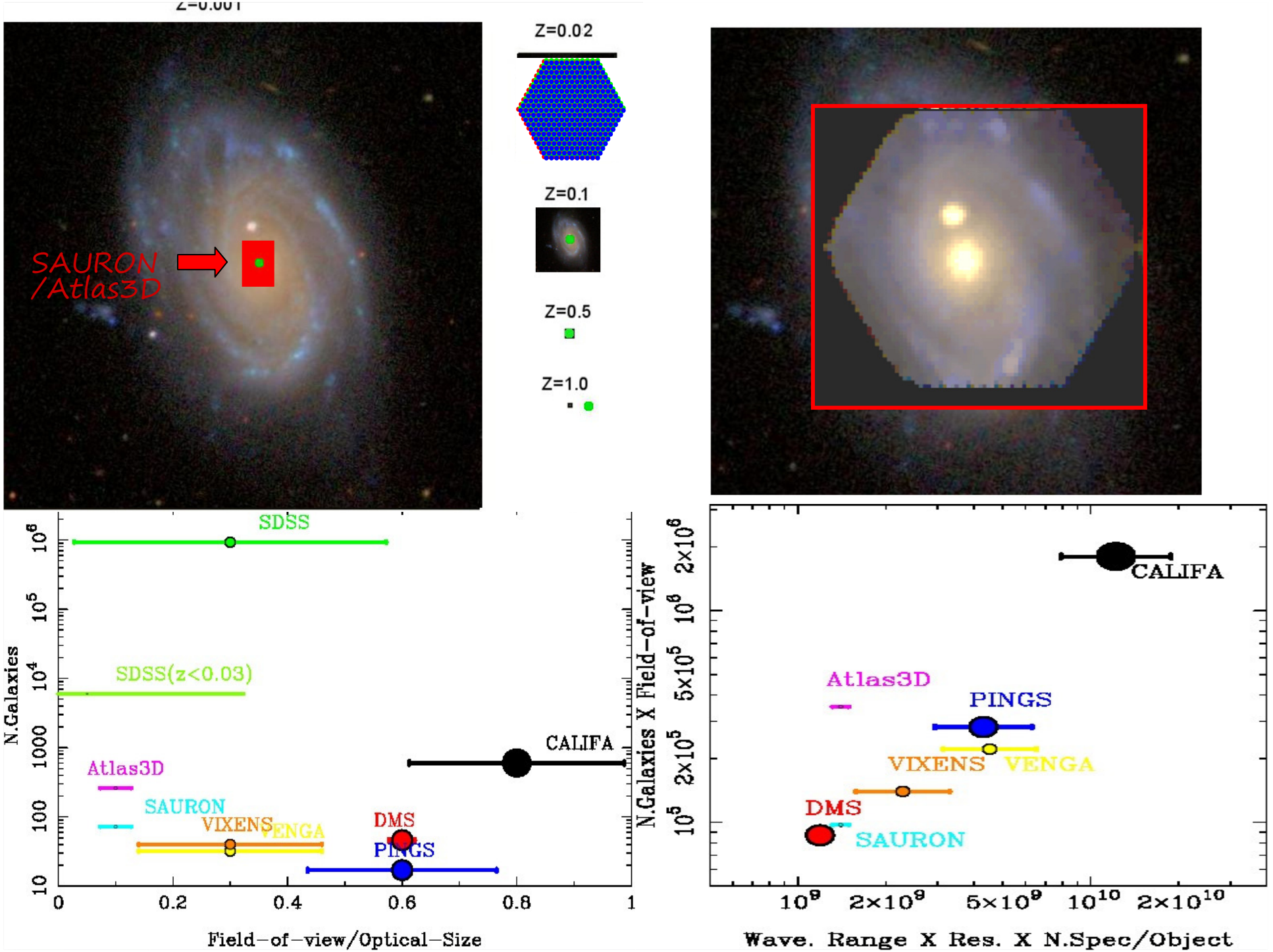
Walcher et al., in prep.







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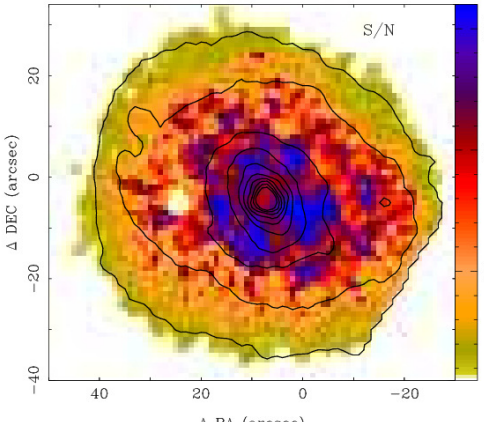
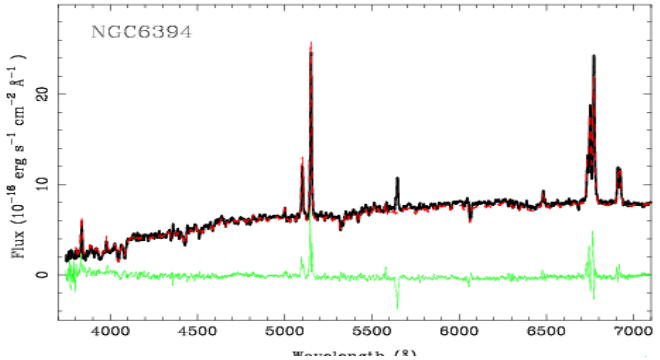
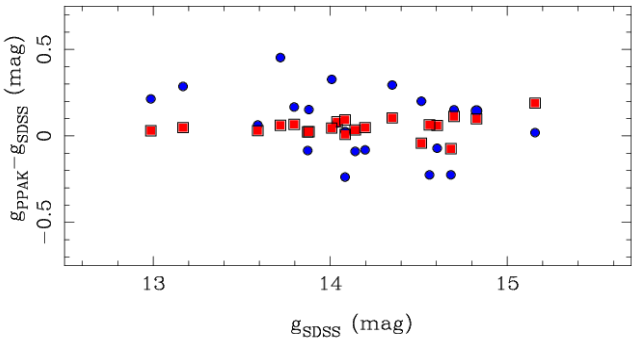
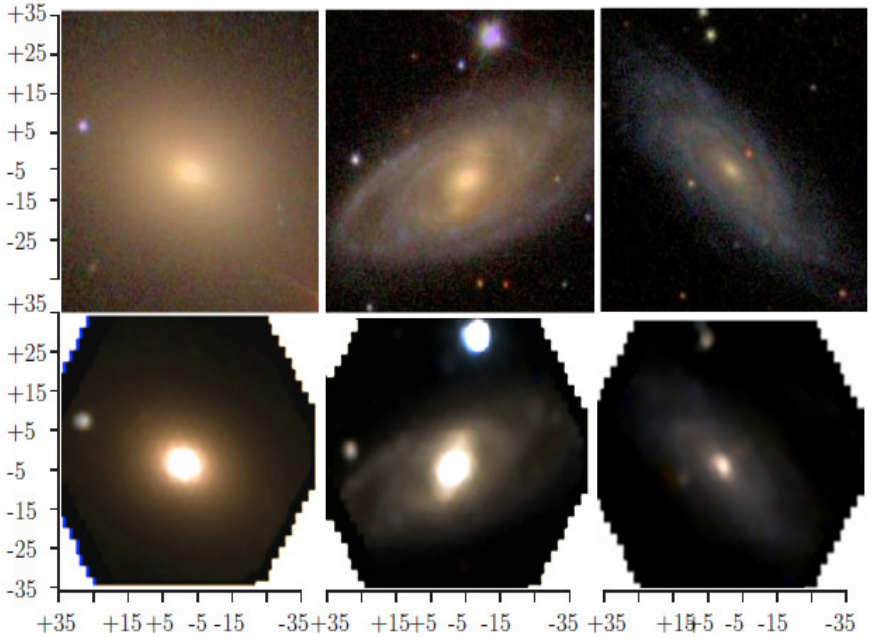
SAURON
/Atlas3D
Z=0.02
Z=0.1
Z=0.5
Z=1.0
SDSS
SDSS(z<0.03)
CALIFA
Atlas3D
SAURON
VIXENS
VENGA
DMS
PINGS
N.Galaxies
Field−of−view/Optical−Size
N.Galaxies X Field−of−view
Wave. Range X Res. X N.Spec/Object

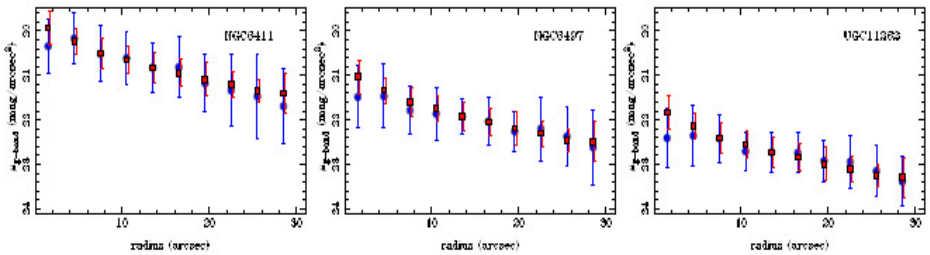
CALIFA: Working Pipeline (1.3c)

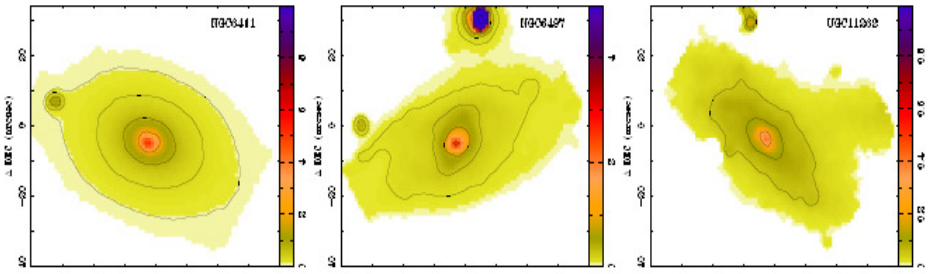




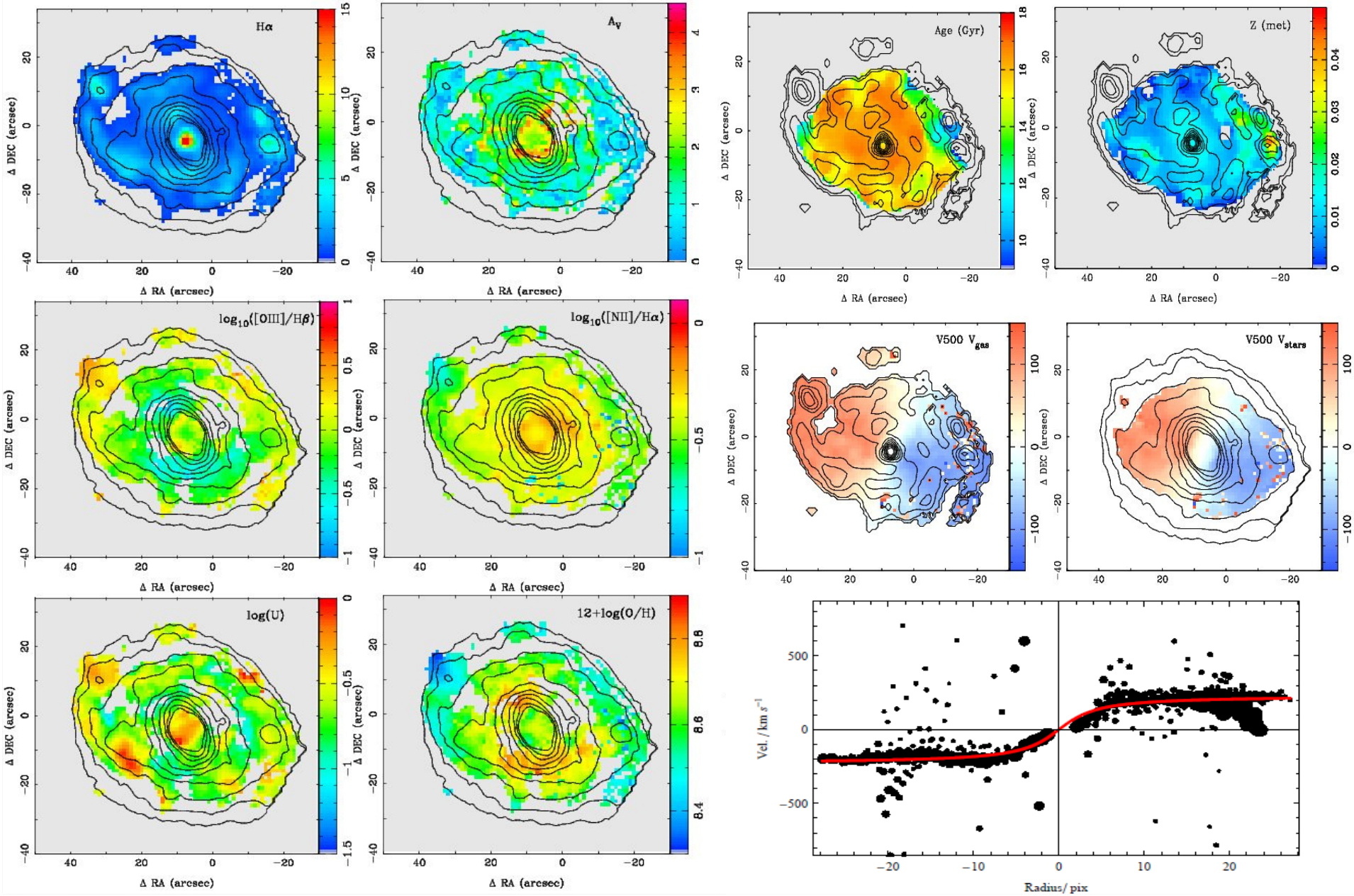




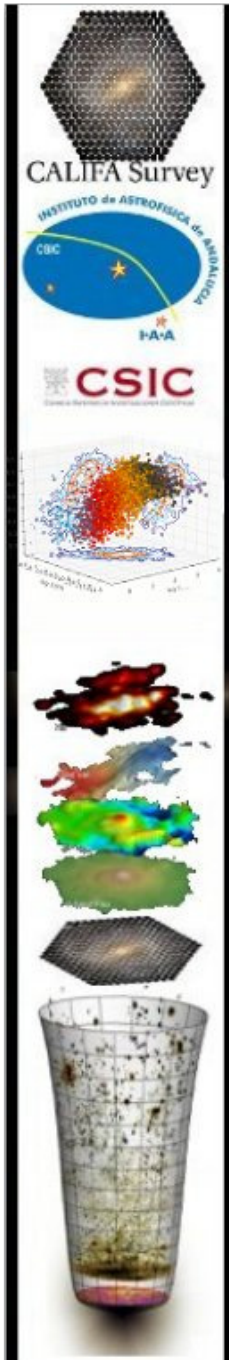


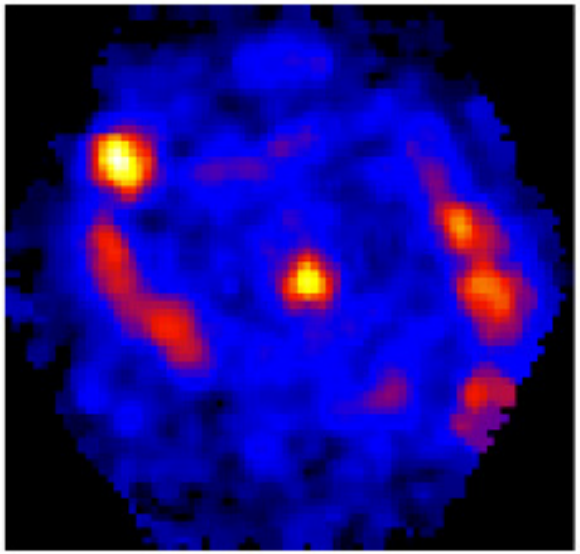


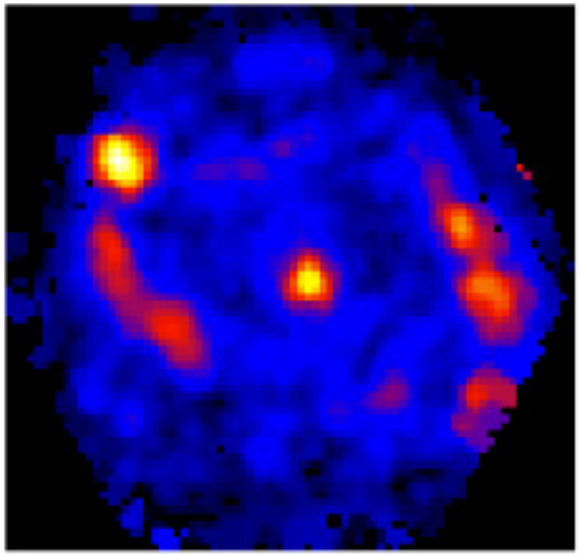
CALIFA: Analysis Pipelines

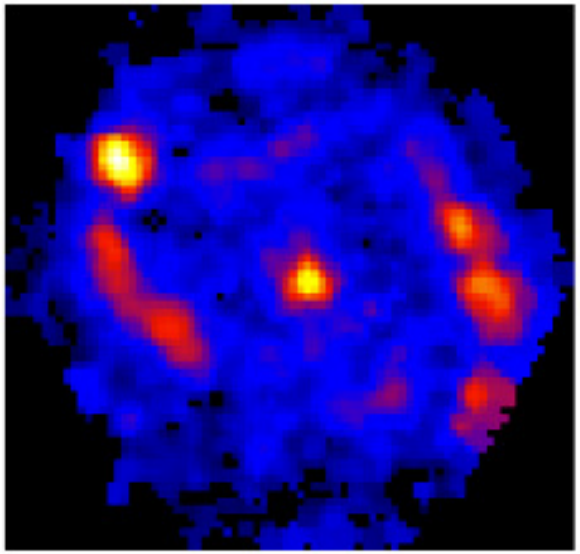


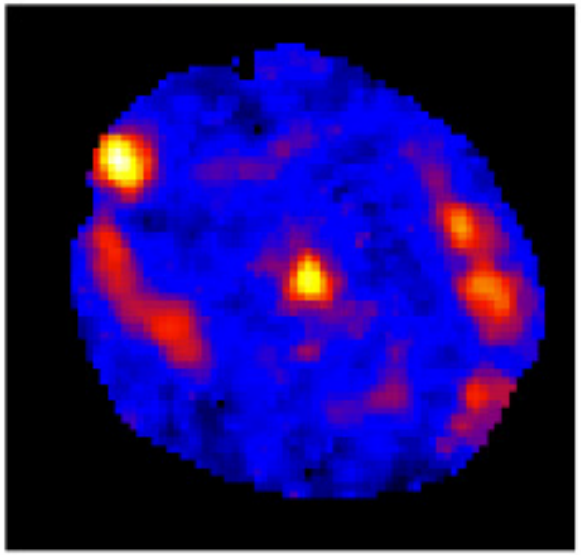
CALIFA: Analysis Pipelines









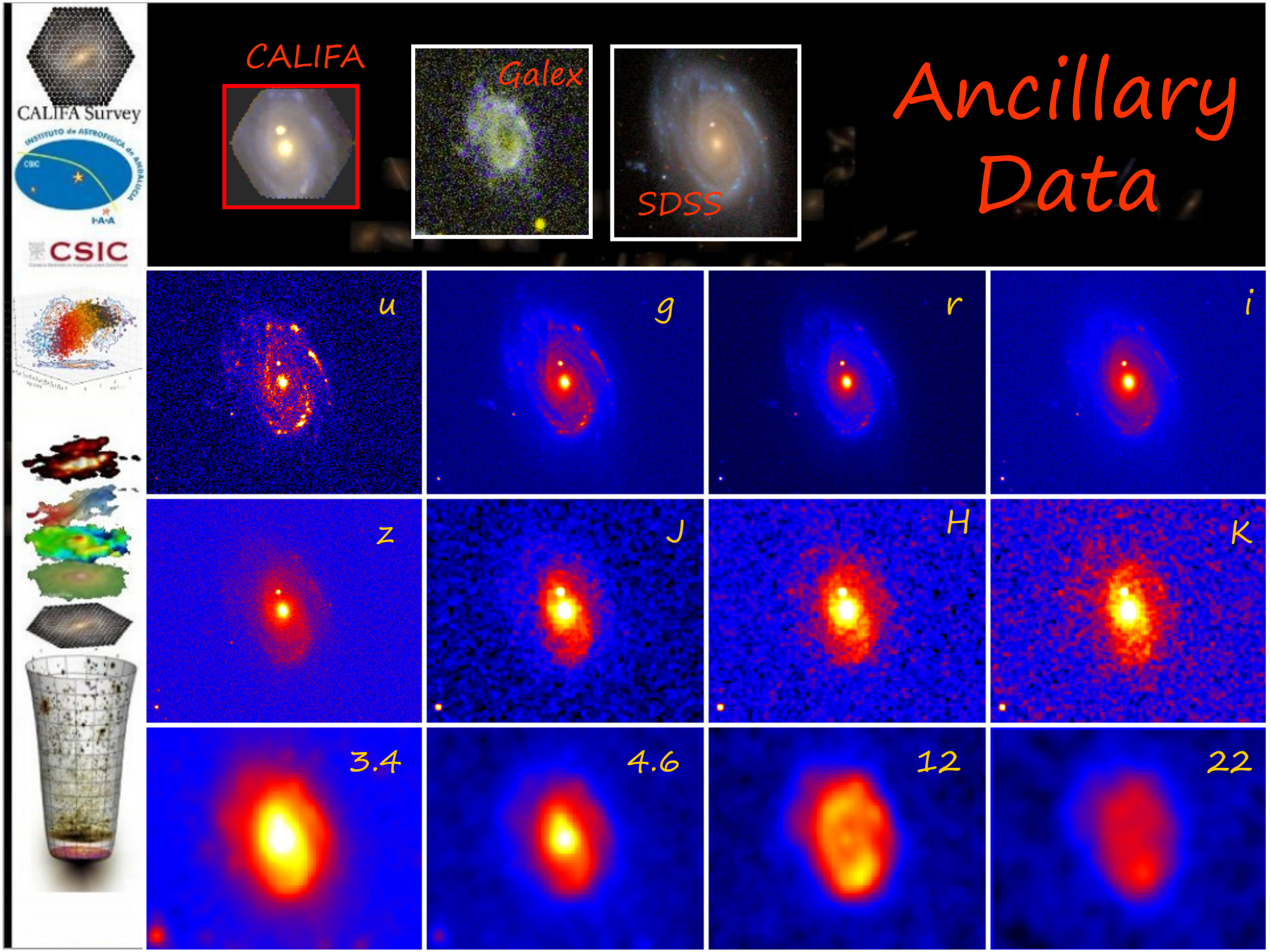


FIT3D

pPFX + Py3D

Starlight + MPfit

Starlight + LM


CALIFA Survey
CSIC
CALIFA
Galex
SDSS
Ancillary Data
u
g
r
i
z
J
H
K
3.4
4.6
12
22

Web Interface: QC, Archive, DR

CALIFA Survey

- CALIFA Red Book
- CALIFA Collaboration
  - Members
  - Structure
  - Publications
- News
  - News
  - Next Events
- CALIFA Sample
  - Observed Objects Up-to-Date
  - SDSS Poststamps: Obs. Sample
  - SDSS poststamps: Full sample
- CALIFA Meetings
  - 3rd Busy Week
  - 2nd Busy Week
  - 1st Busy Week
  - Kick-Off Meeting
- Internal WIKI

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- Support tickets
- Create content
- Log out

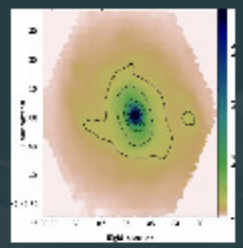
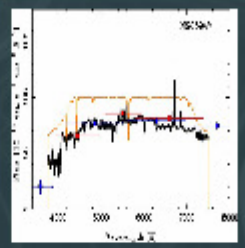
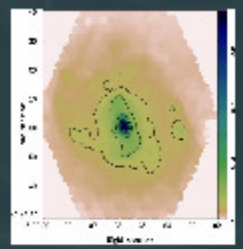
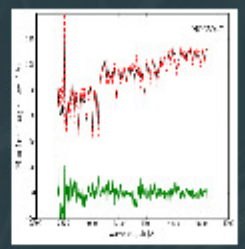
CALIFA EXPLORER V0.1

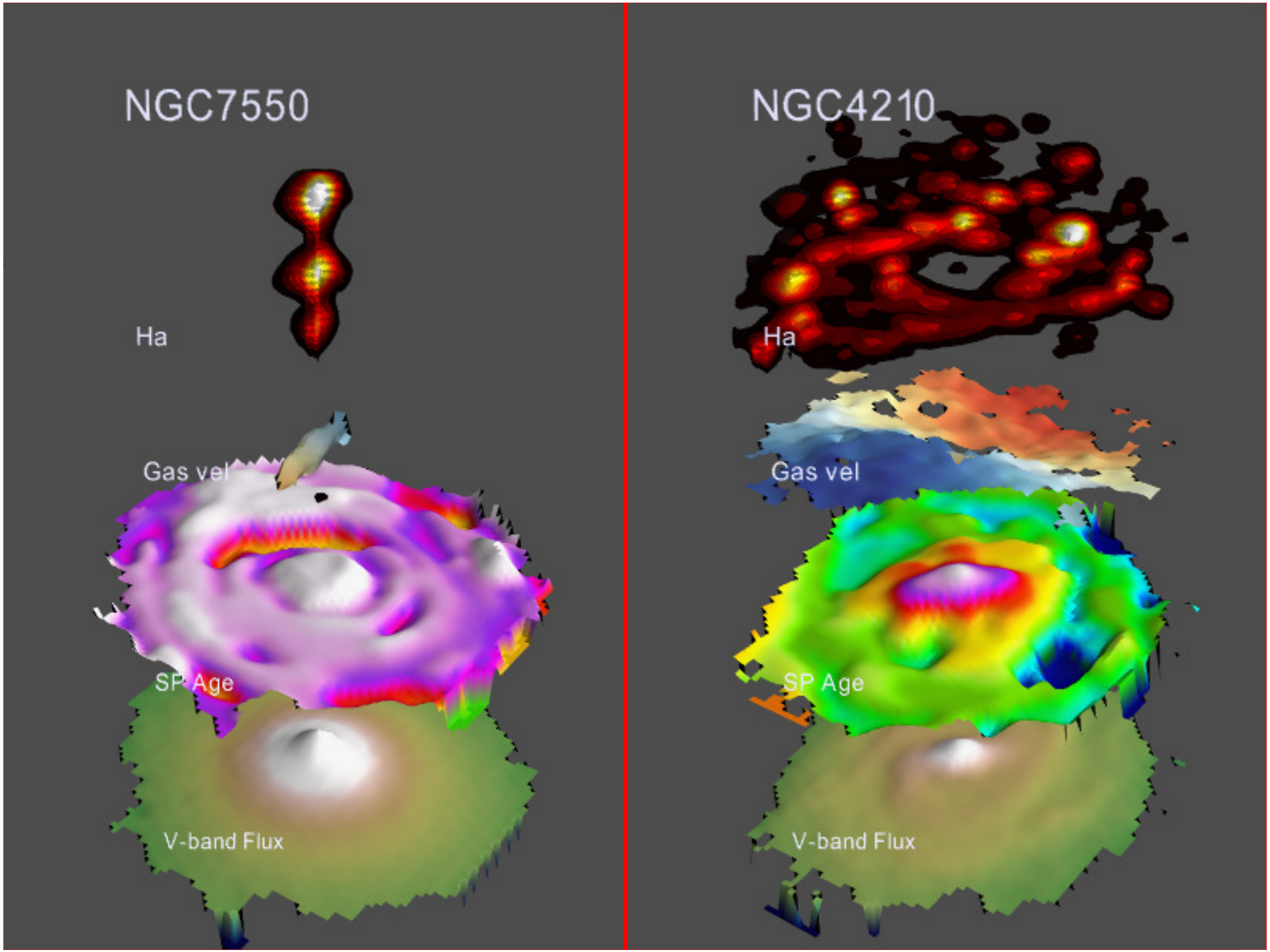
Tue, 11/22/2011 - 15:31

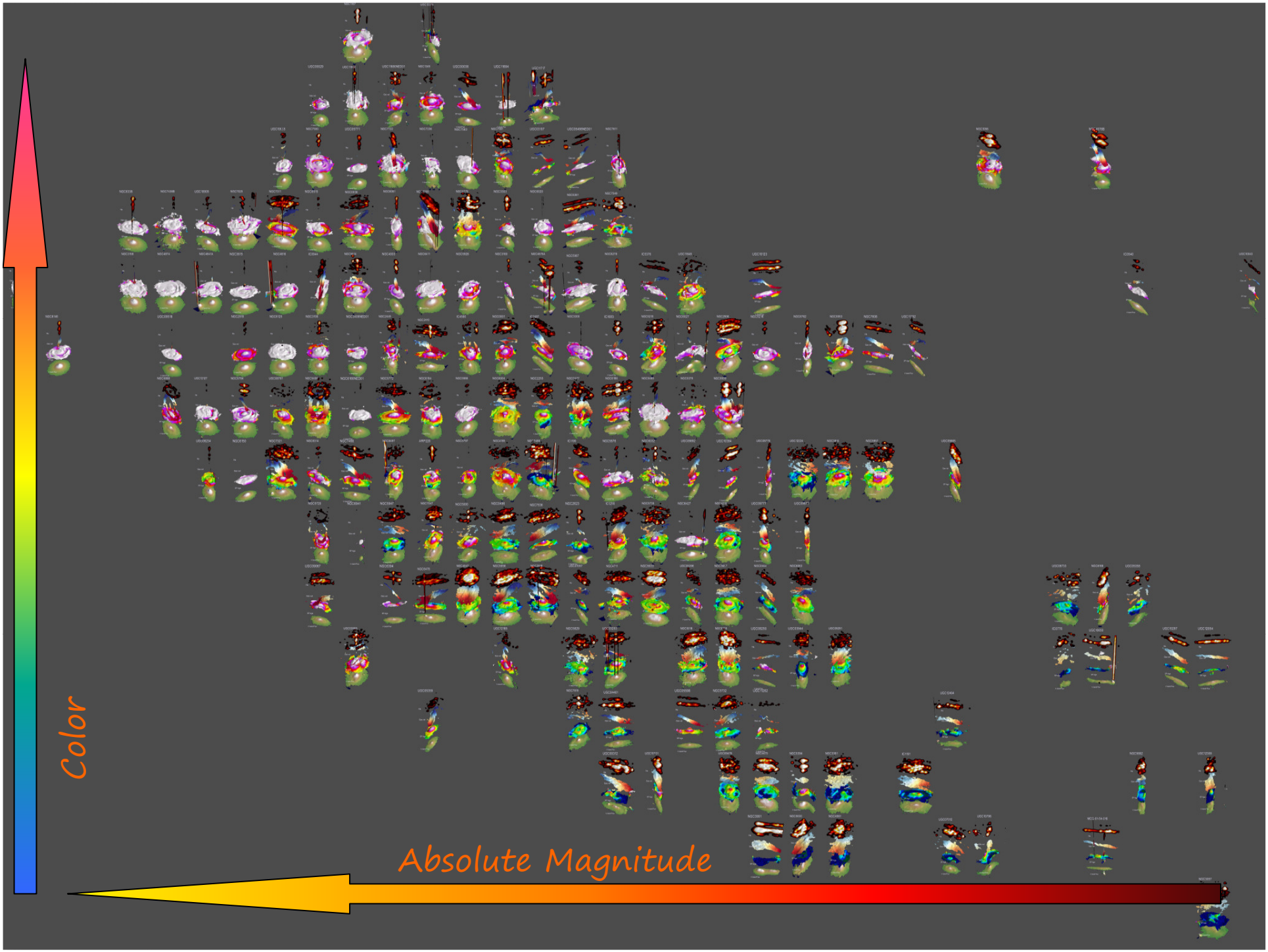
NAME (938)	RA	DEC	CALIFAID
NGC5947	15:30:36	+42:43:01	938

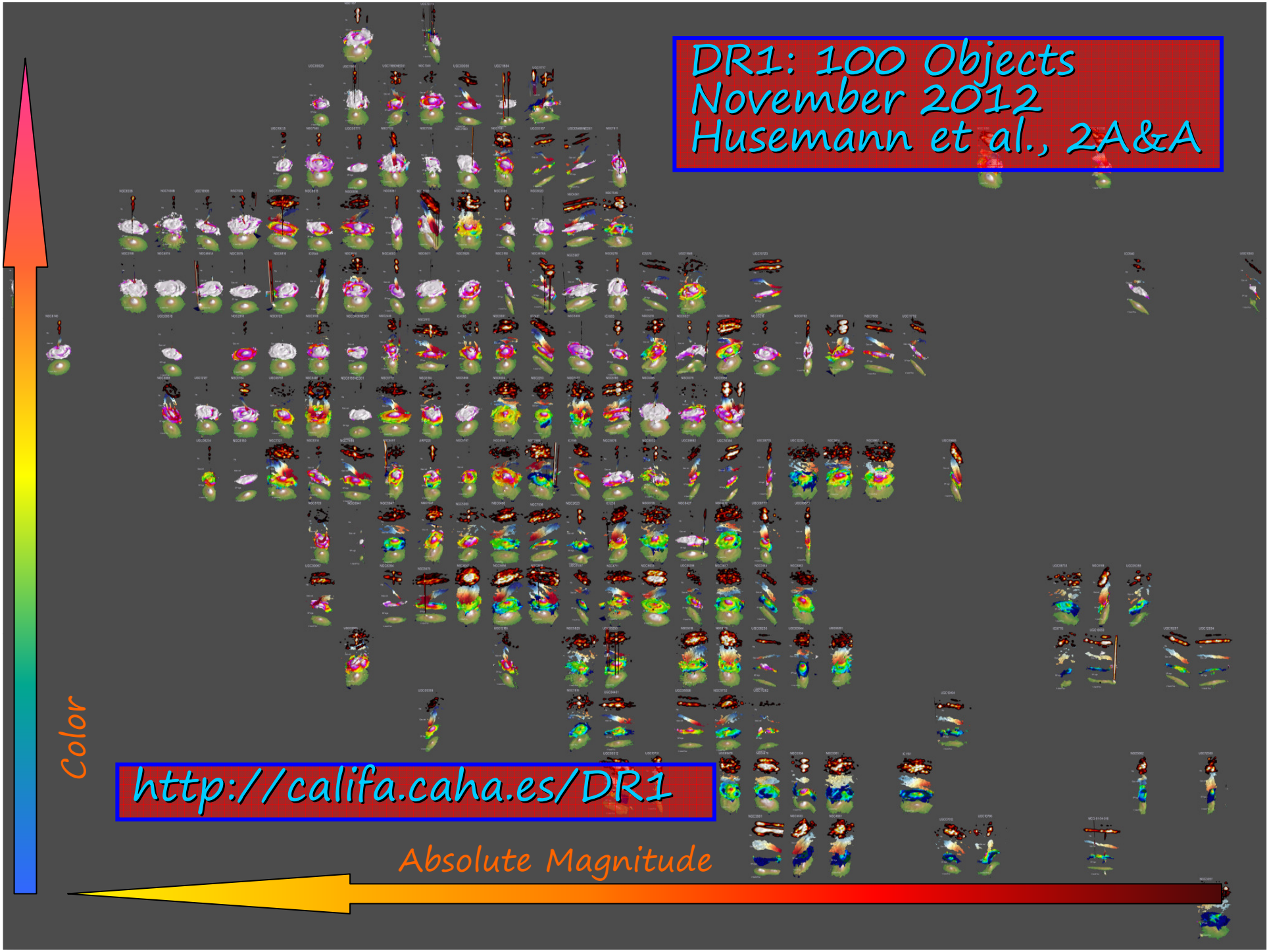
BASIC PARAMETERS	VALUE	REF.
Name	NGC5947	NED
Redshift	0.01965	NED
Petrosian Mags (u,g,r,i,z)	(15.763 ,15.763 ,14.197 ,13.491 ,17 ,12.863)	NED
Galaxy Type	0	NED

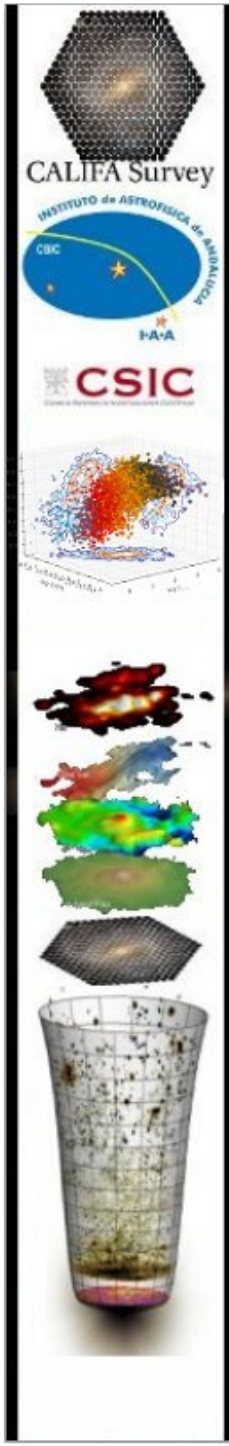
CALIFA OBSERVATIONS

V500	20100610 V500 Cube		
V1200	20100705 V1200 Cube		

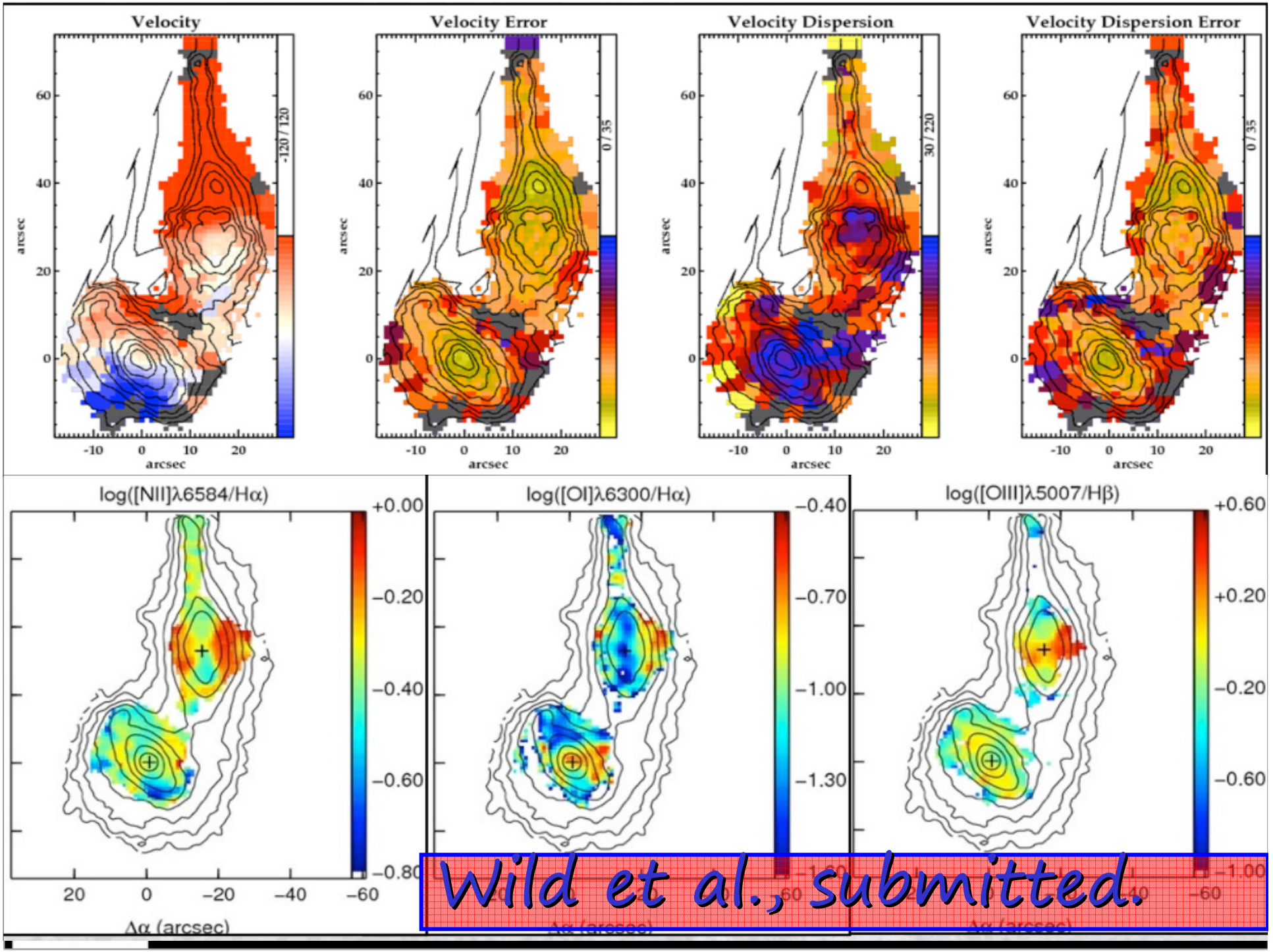

NGC7550
Ha
Gas vel
SP Age
V-band Flux
NGC4210
Ha
Gas vel
SP Age
V-band Flux


Color
Absolute Magnitude

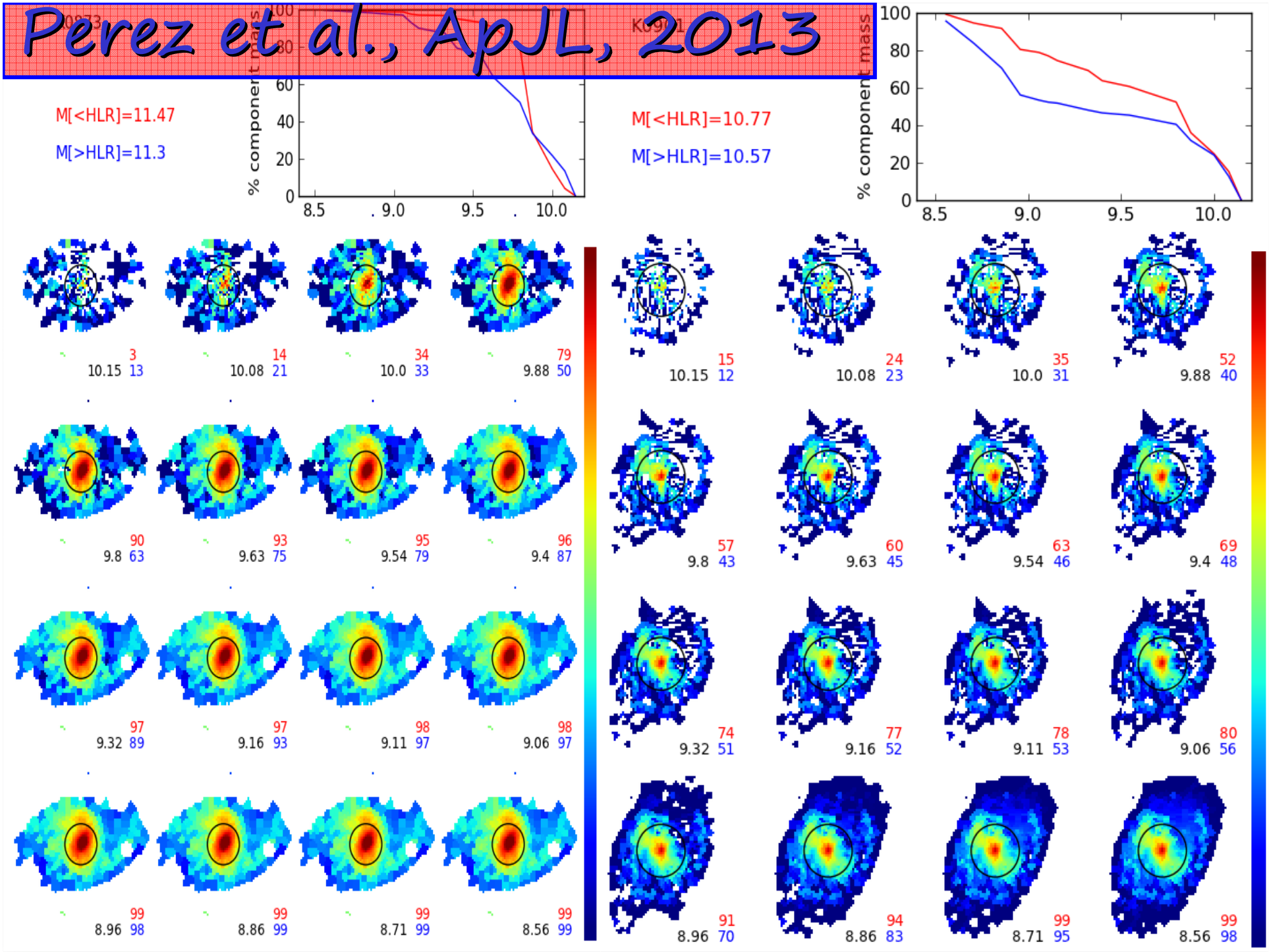

DR1: 100 Objects
November 2012
Husemann et al., 2A&A
Color
Absolute Magnitude
http://califa.caha.es/DR1

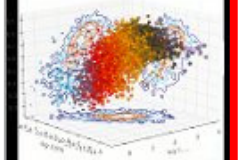


-CALIFA-
First Science Results

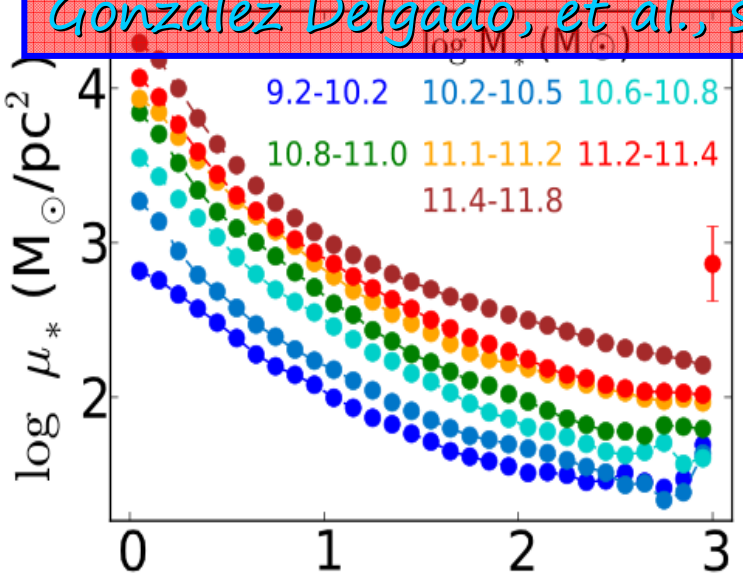

Velocity
Velocity Error
Velocity Dispersion
Velocity Dispersion Error
arcsec
-120 / 120
0 / 35
30 / 220
log([NII]λ6584/Hα)
log([OI]λ6300/Hα)
log([OIII]λ5007/Hβ)
Δα (arcsec)
Wild et al., submitted.

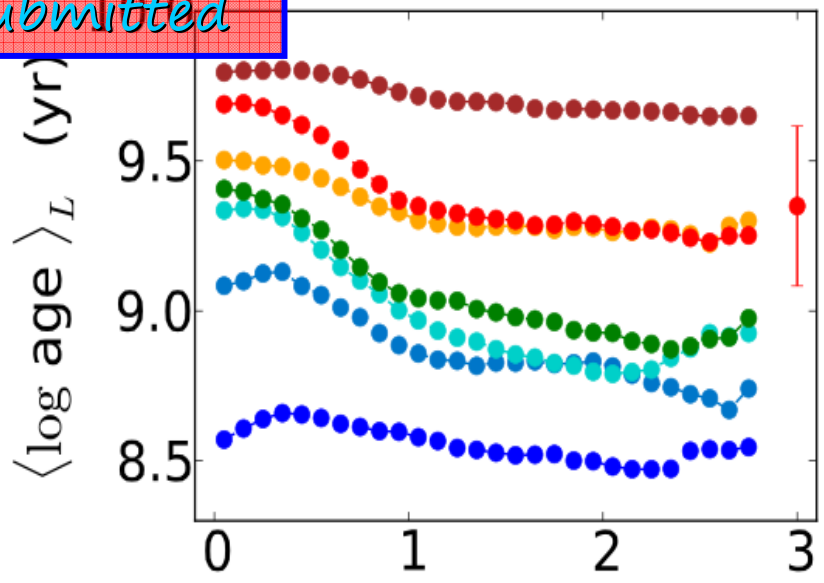
Perez et al., ApJL, 2013



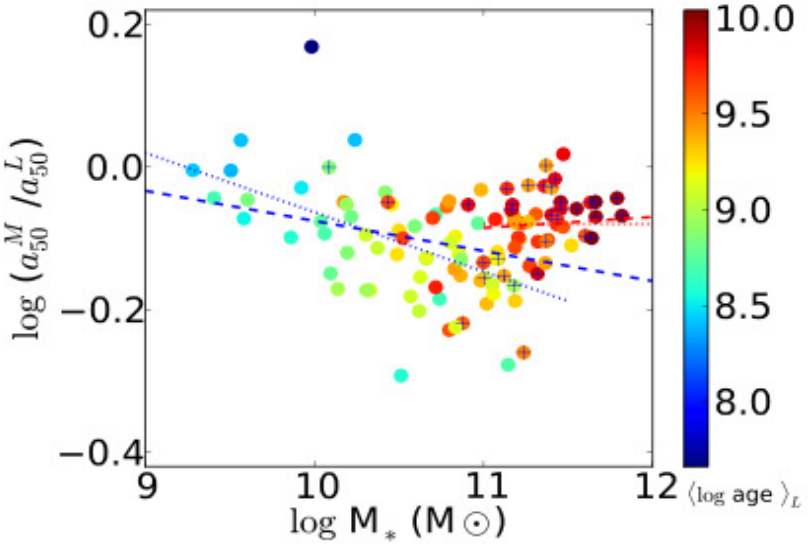


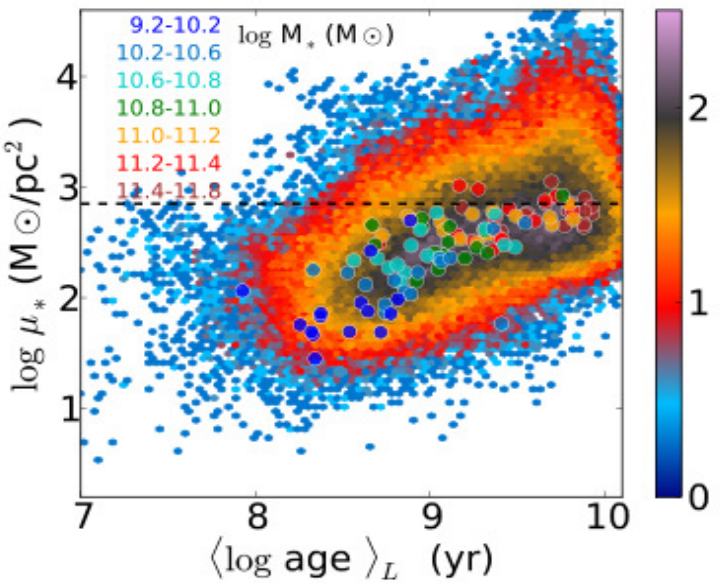
Gonzalez Delgado, et al., submitted



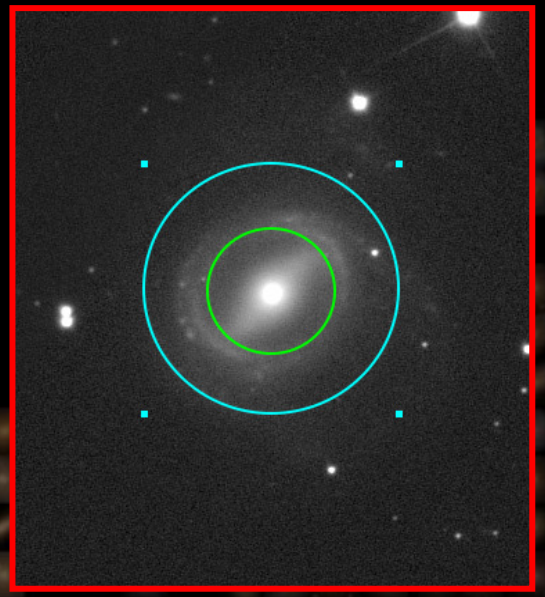


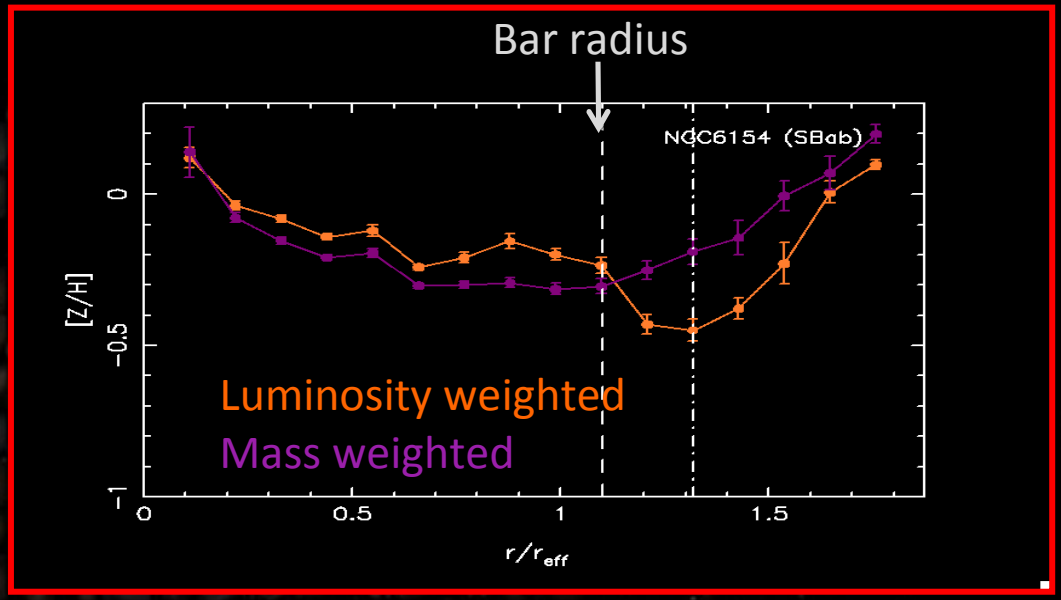
The CALIFA collaboration: The star formation history of CALIFA galaxies

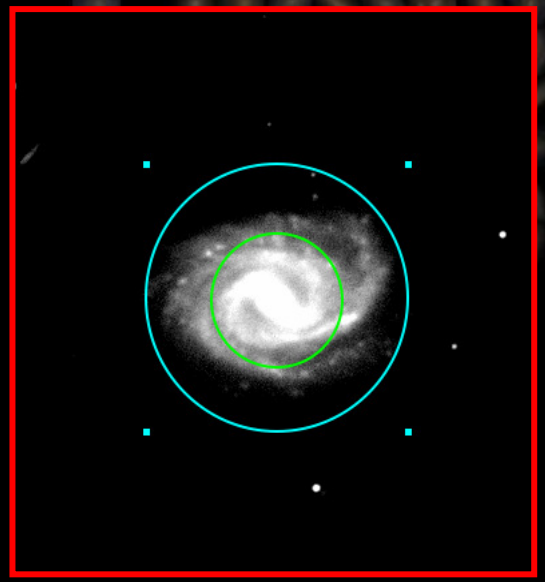


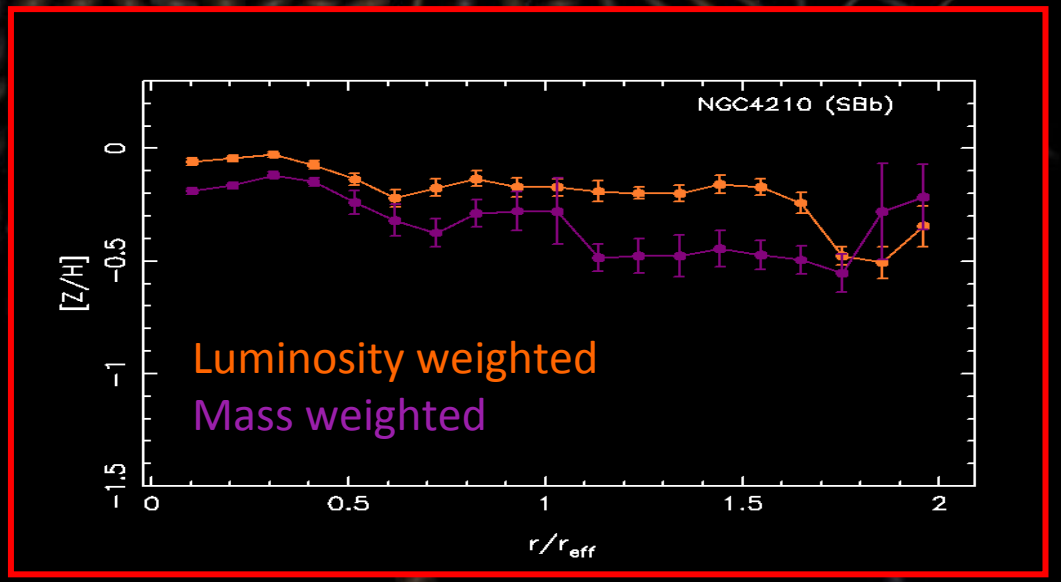


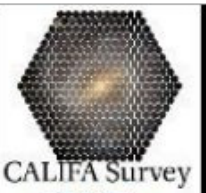
P. Sánchez-Blazquez et al., in prep.

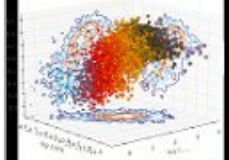




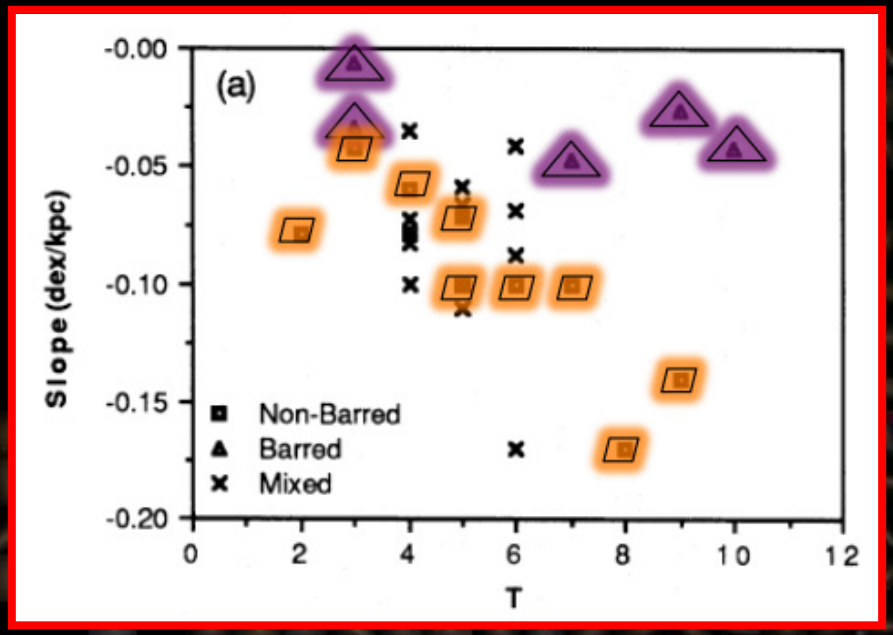


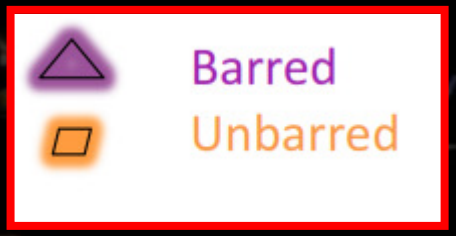




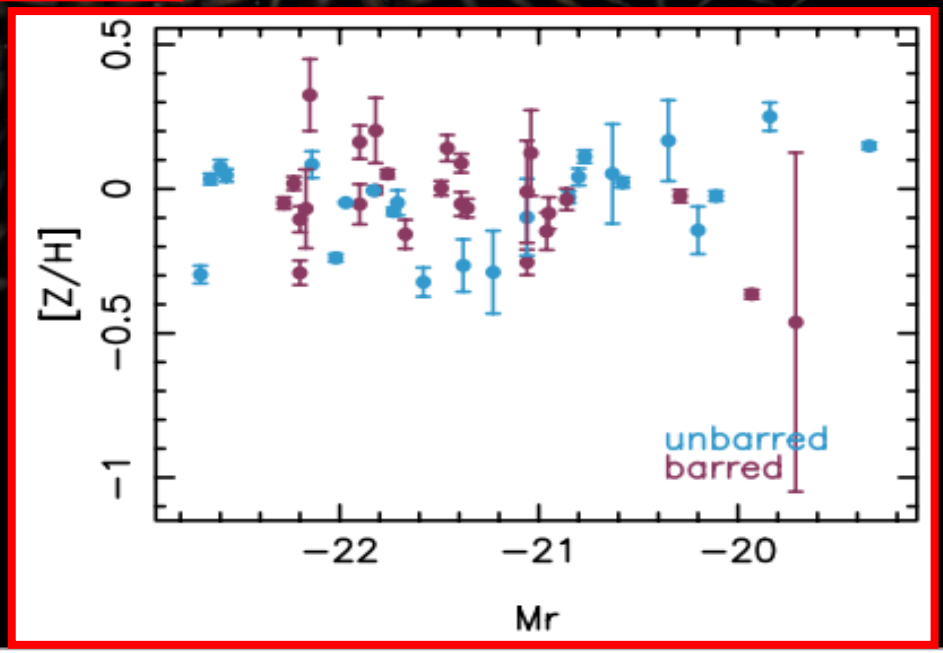


Zaritsky, Kennicutt & Huchra 1994





P. Sánchez-Blazquez et al., in prep.

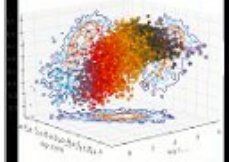


CALIFA Survey

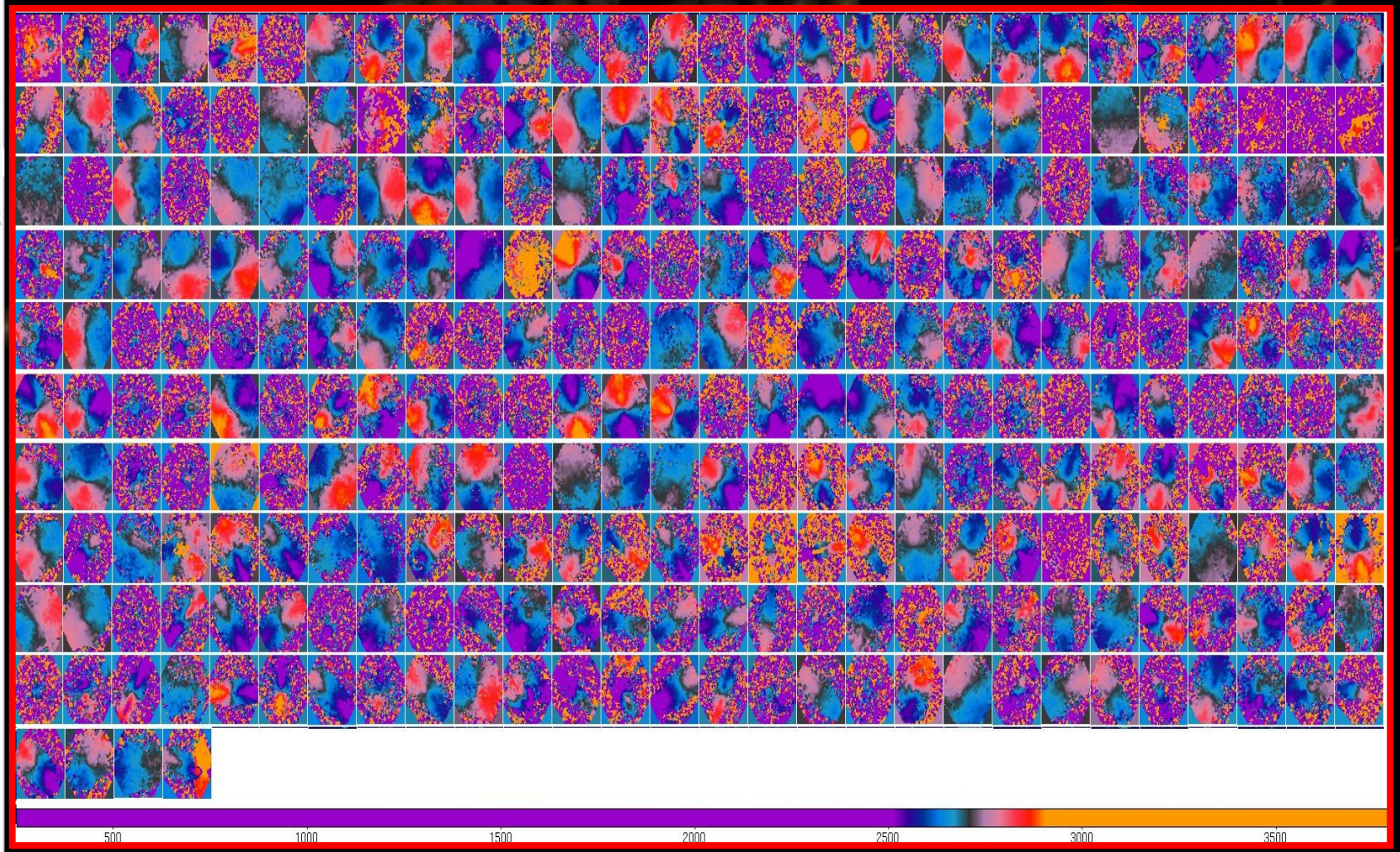
INSTITUTO de ASTROFISICA de ANDALUCIA

CSIC

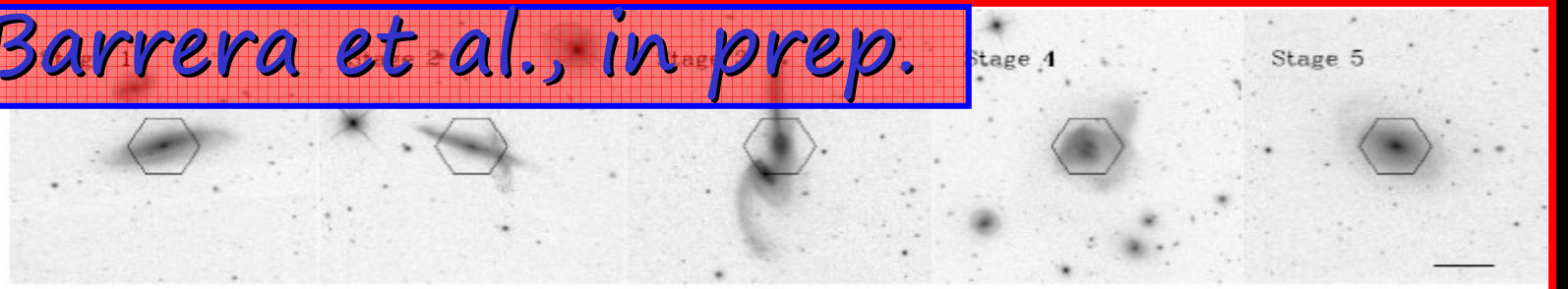
I·A·A

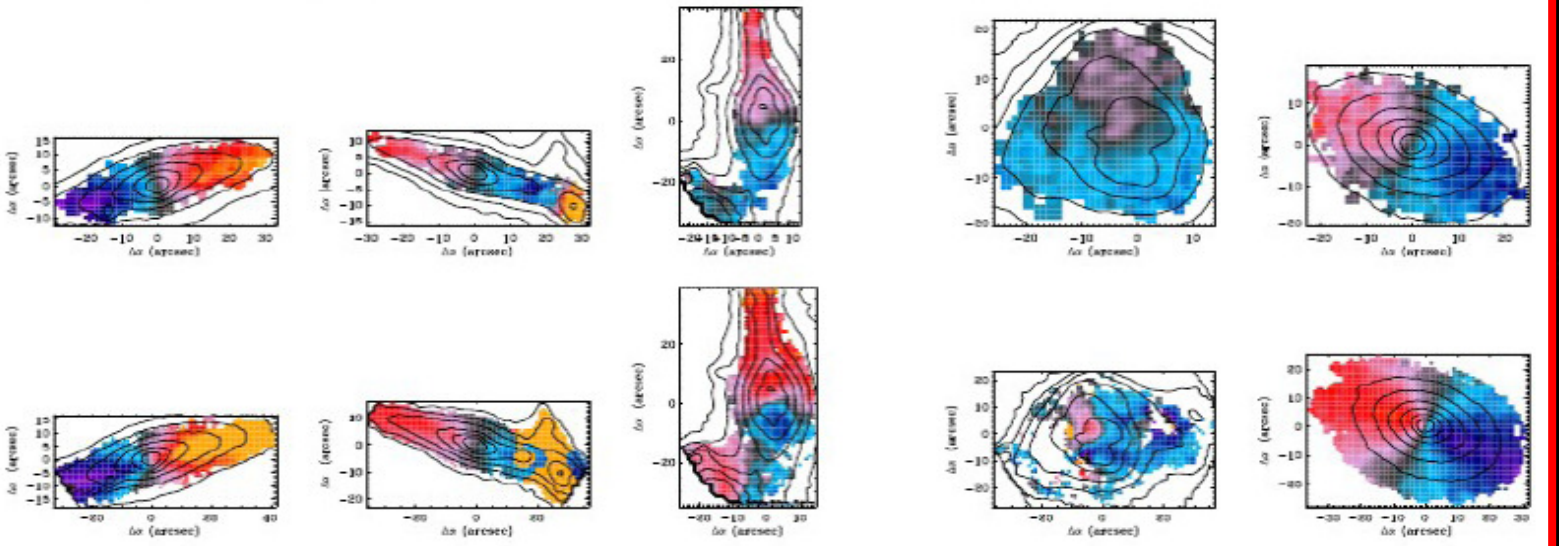


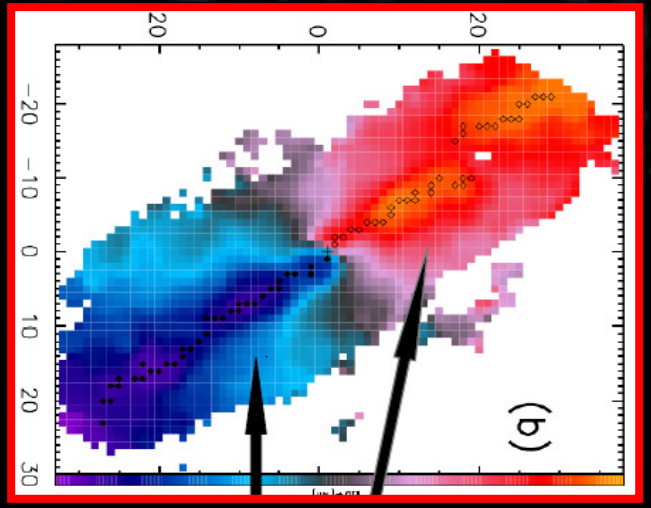
334 Hα velocity maps

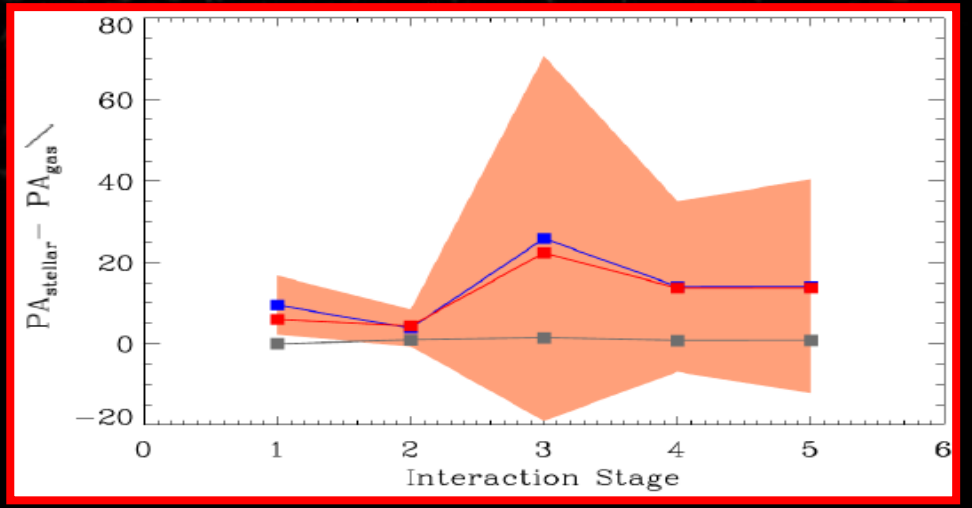


Barrera et al., in prep.

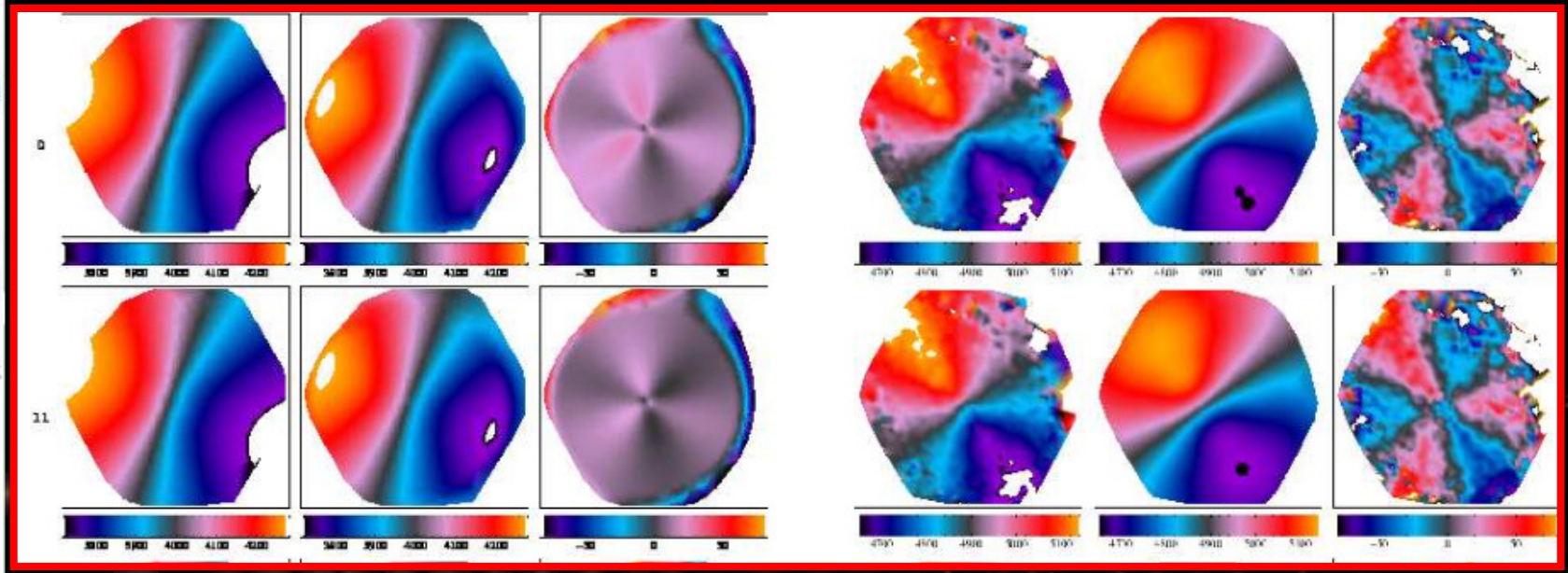


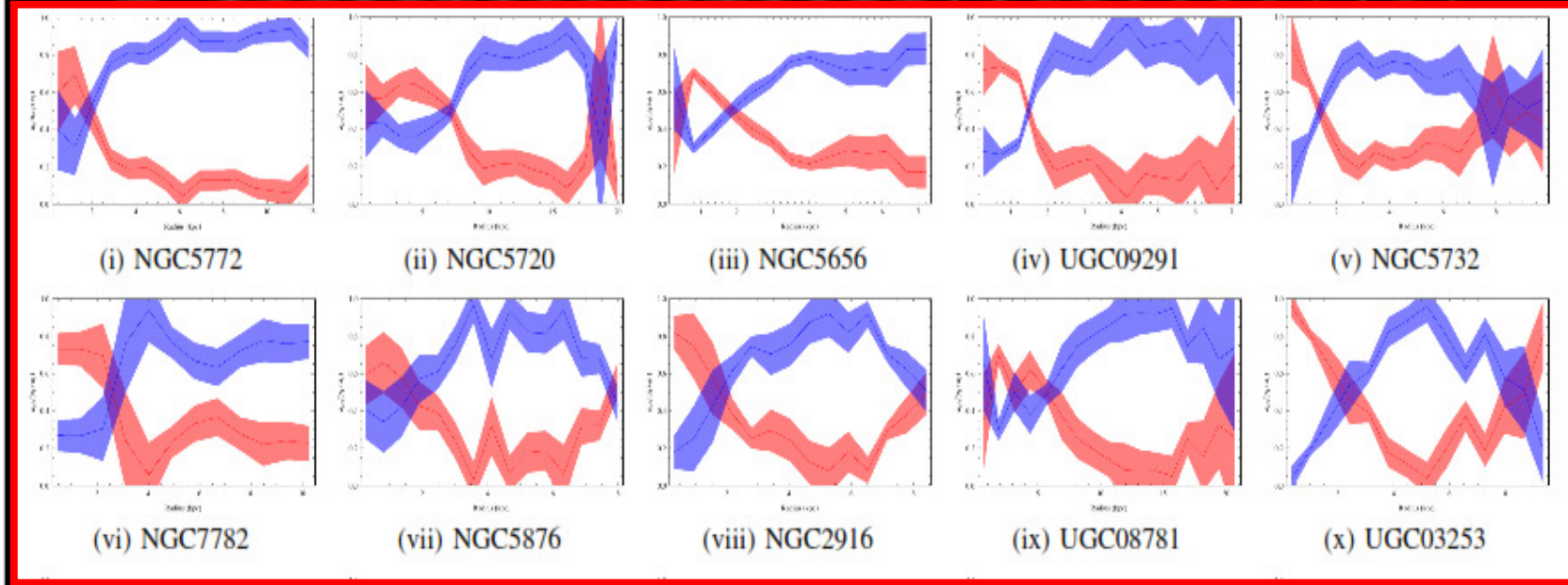






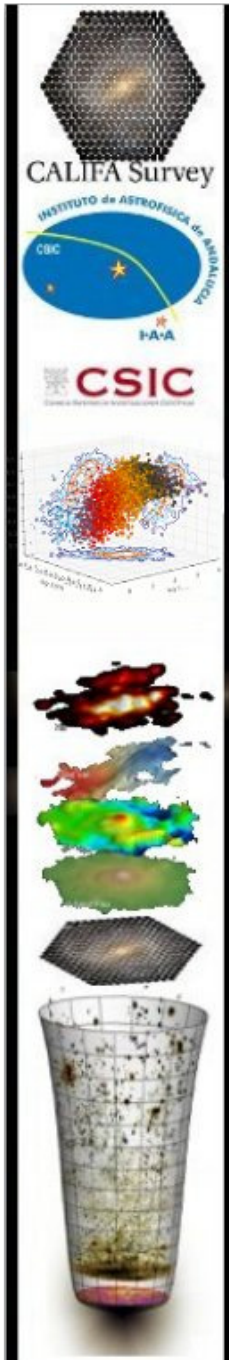
Ellis et al., in prep.



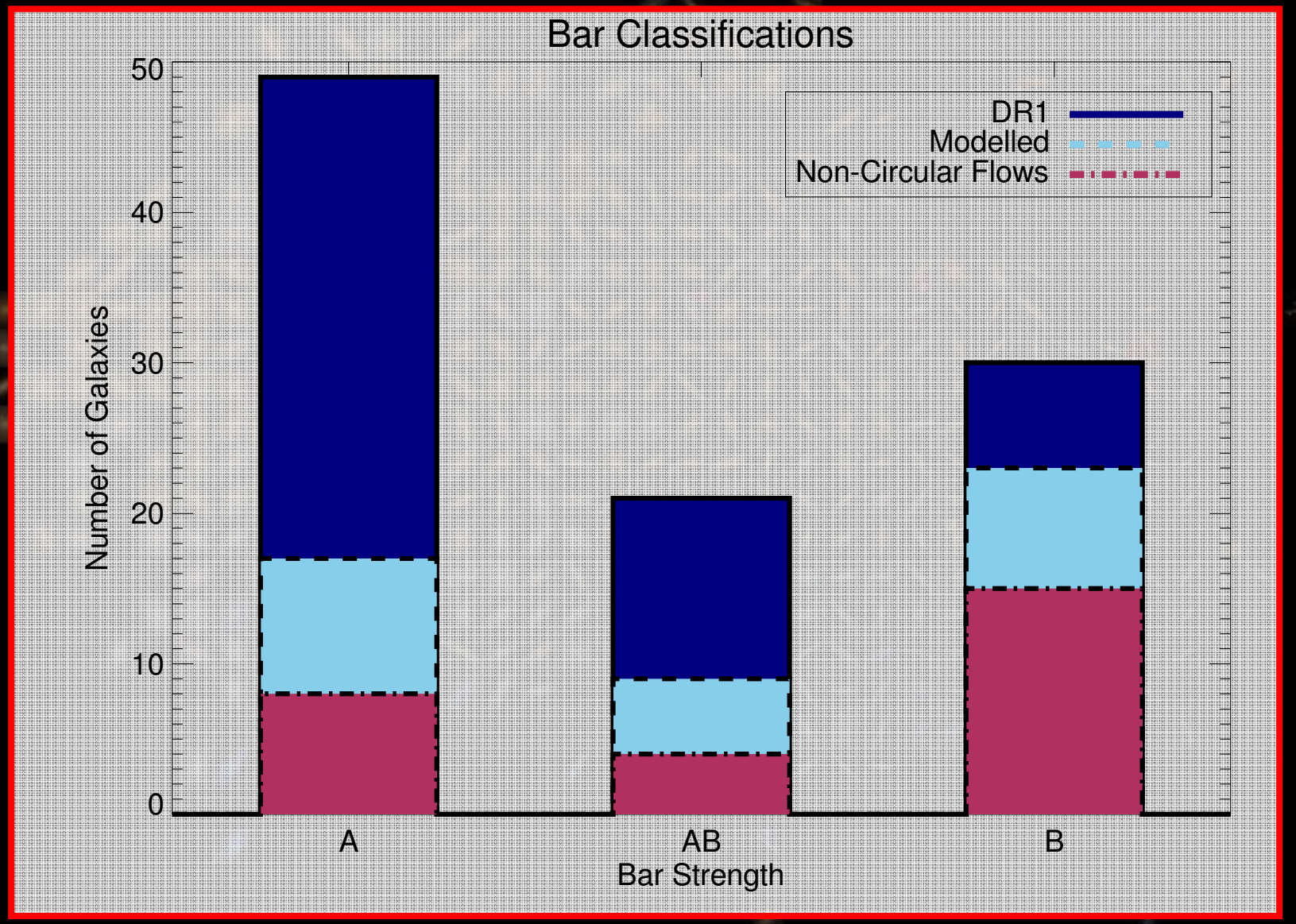


(i) NGC5772 (ii) NGC5720 (iii) NGC5656 (iv) UGC09291 (v) NGC5732

(vi) NGC7782 (vii) NGC5876 (viii) NGC2916 (ix) UGC08781 (x) UGC03253

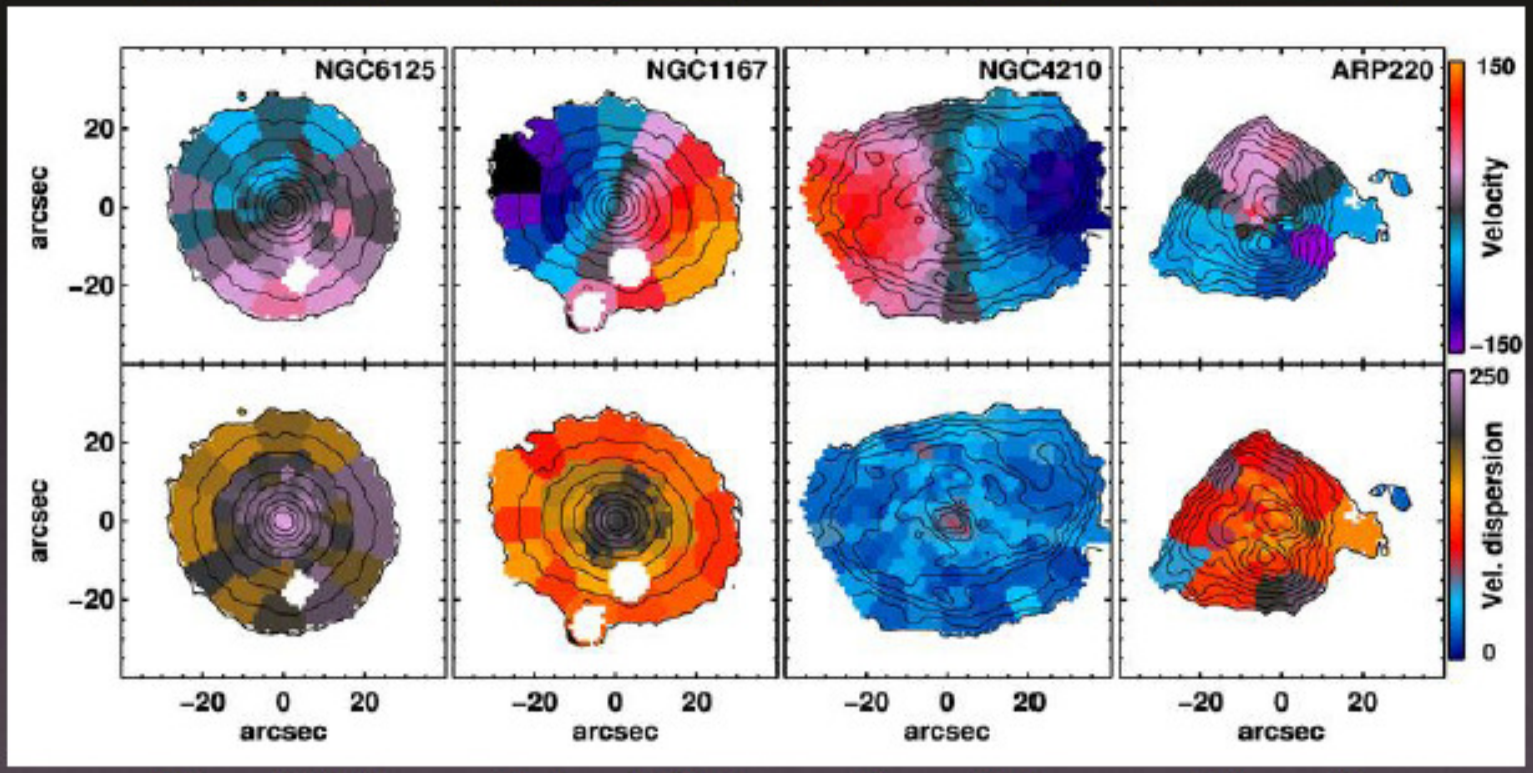


K. Spekkens & L. Holmes, in prep.



CALIFA Survey

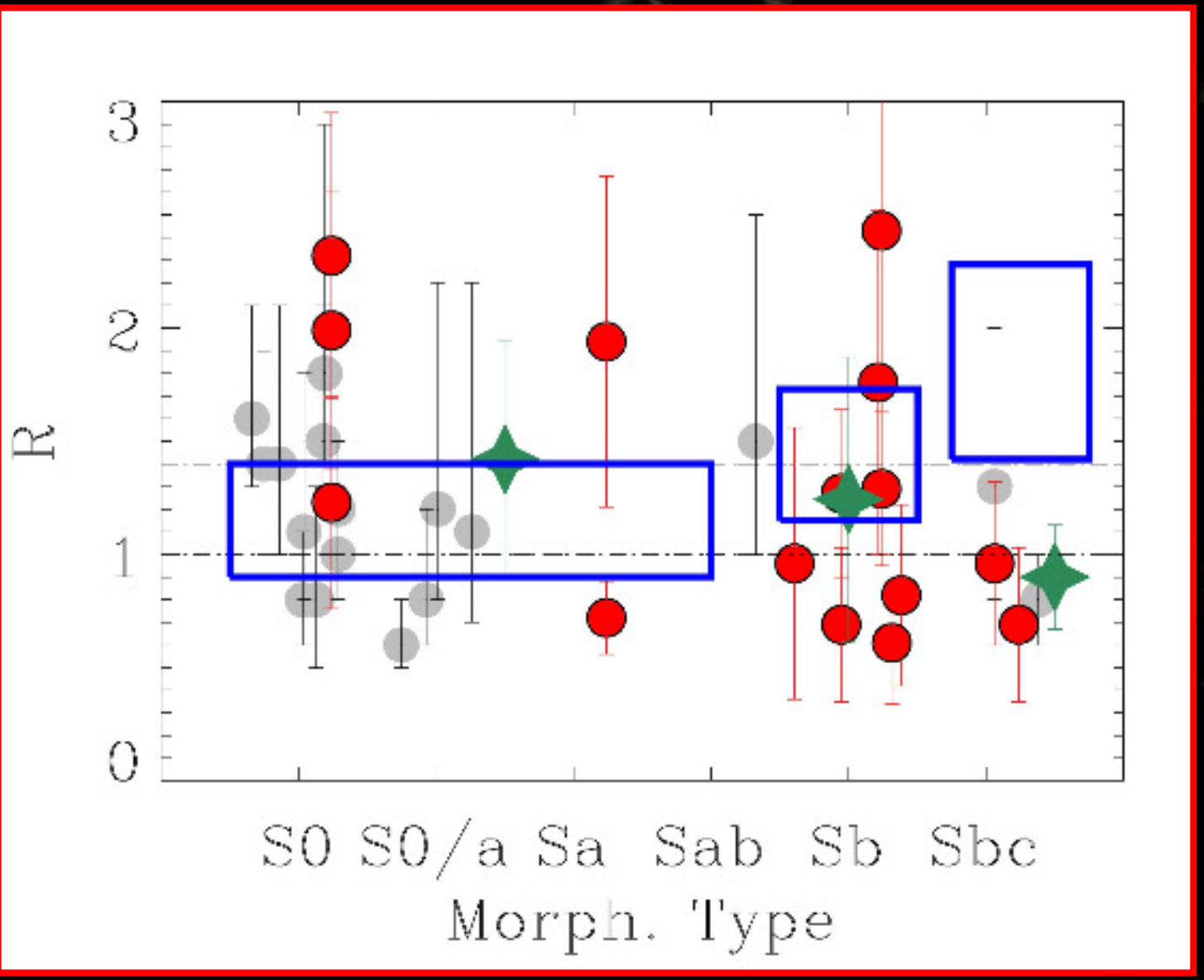
Kinematics

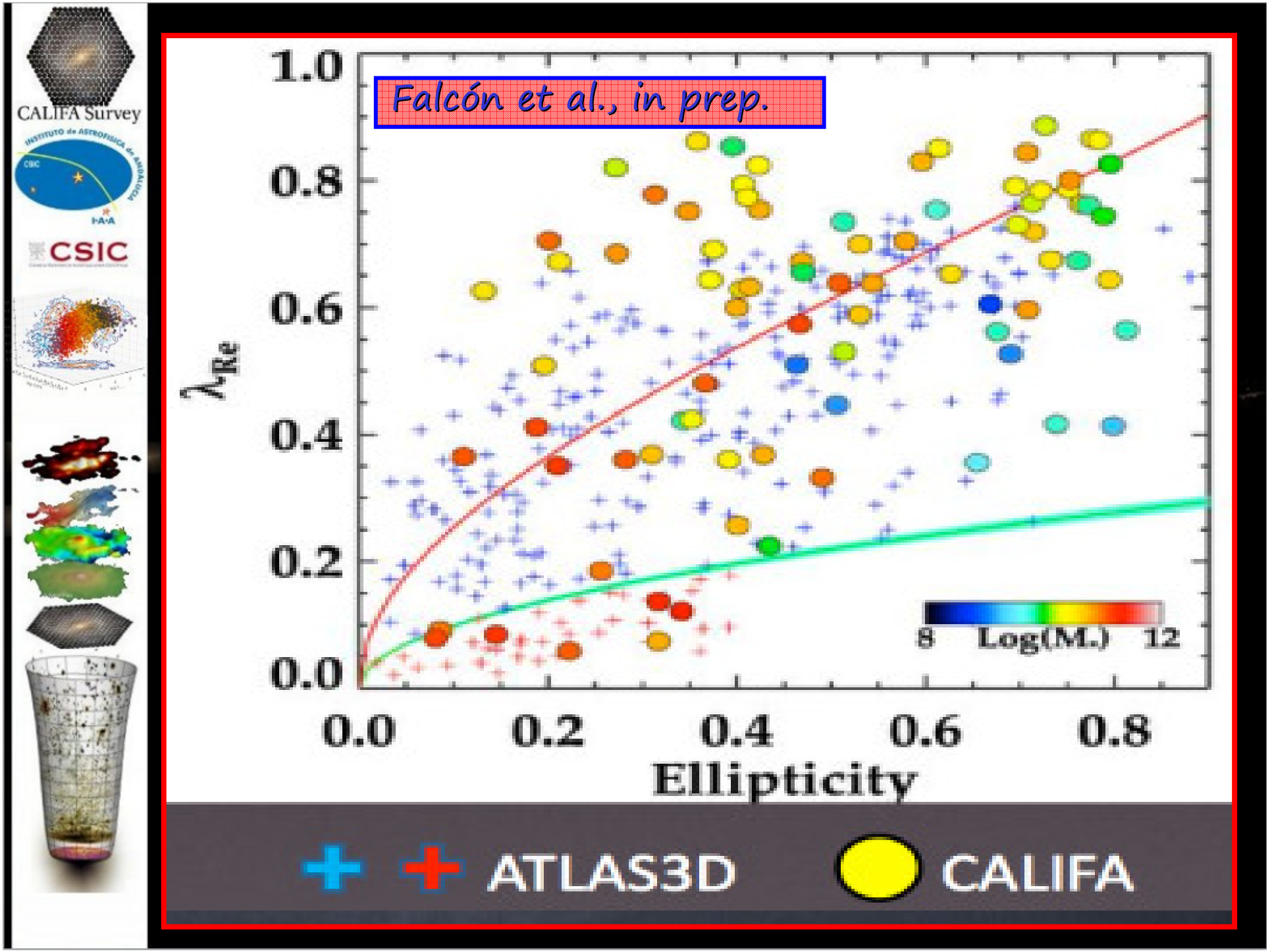


Slow Rotator (low V, high σ) | Bulge + Disk (high V, high σ) | Pure disk (high V, low σ) | Interacting (e.g. ARP220)

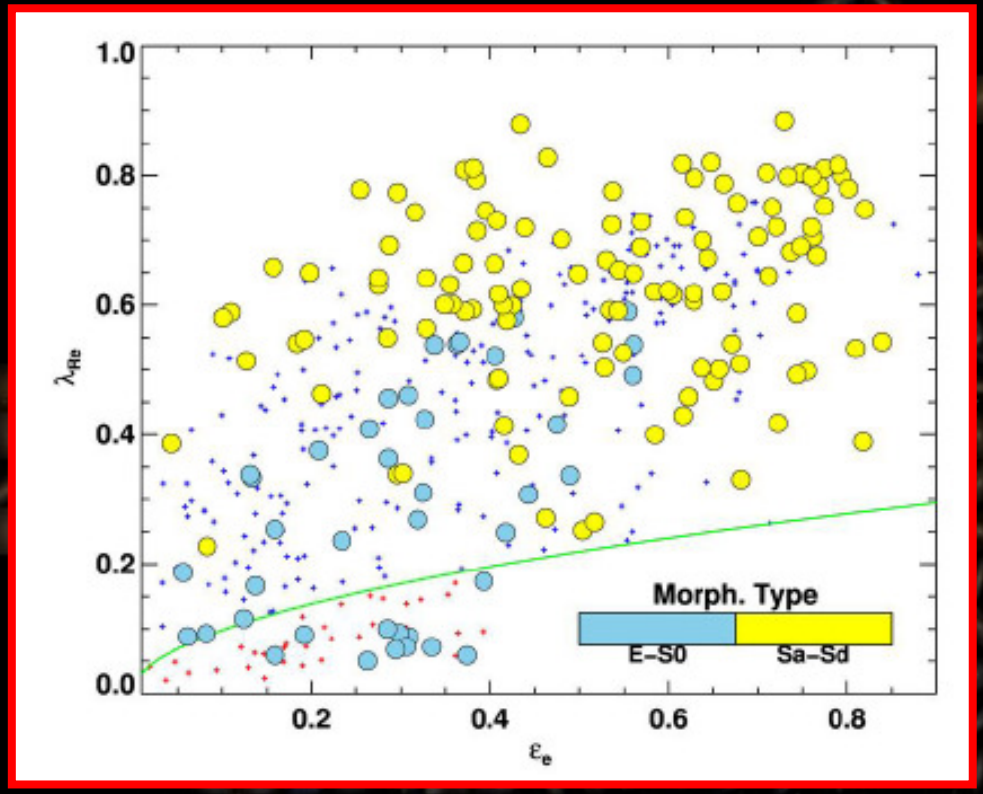
CALIFA Survey

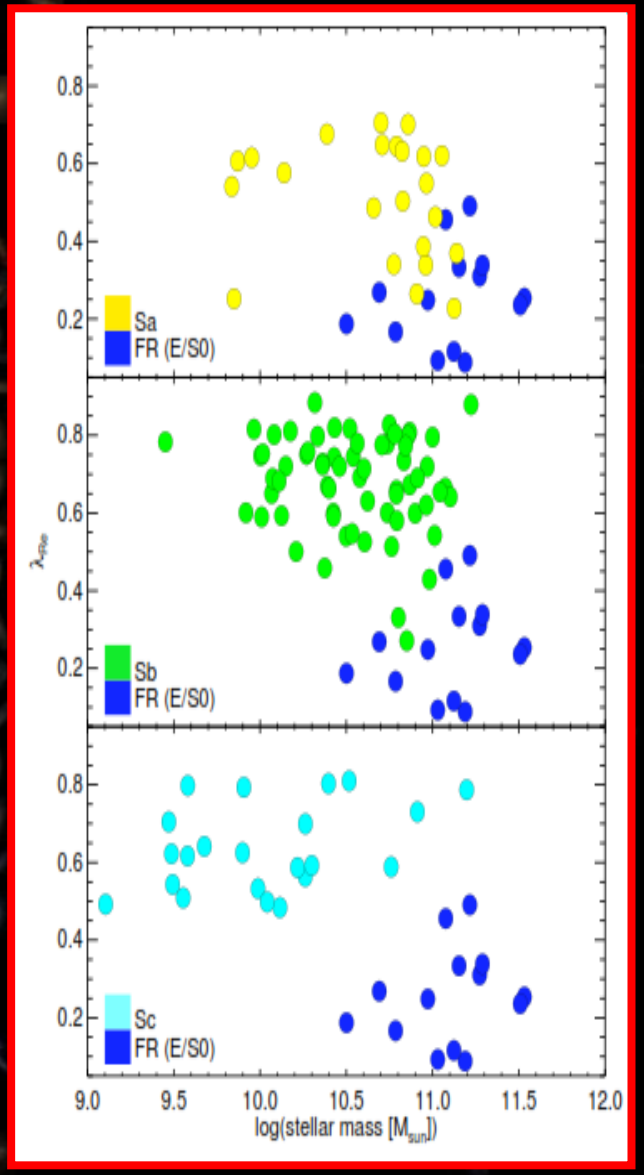
López-Aguerri et al., in prep.



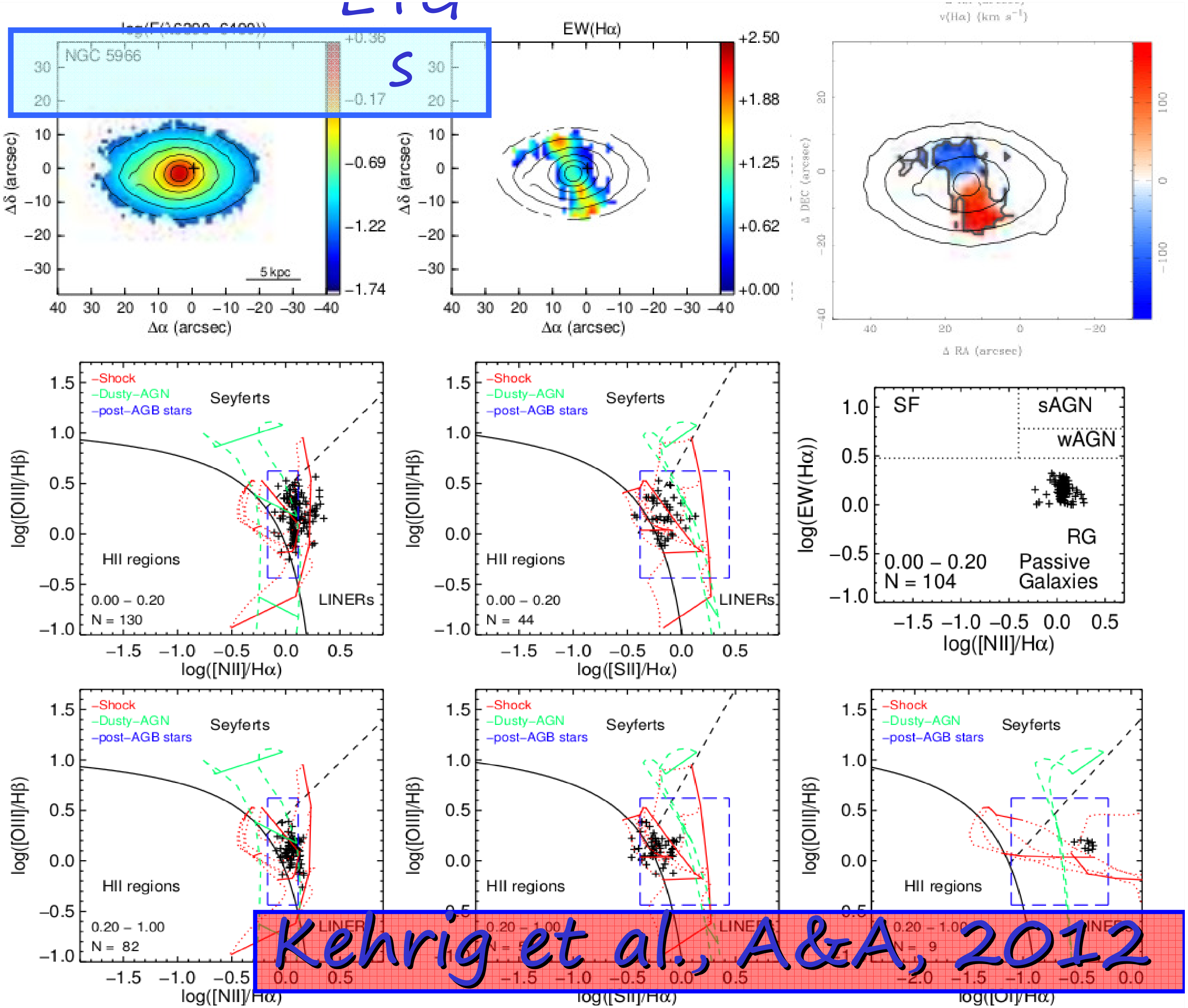

CALIFA Survey
CSIC
Falcón et al., in prep.
1.0
0.8
0.6
0.4
0.2
0.0
λ_{Re}
0.0
0.2
0.4
0.6
0.8
Ellipticity
8
Log(M.)
12
ATLAS3D
CALIFA

SO Projenitors



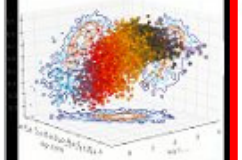


Falcón et al., in prep.

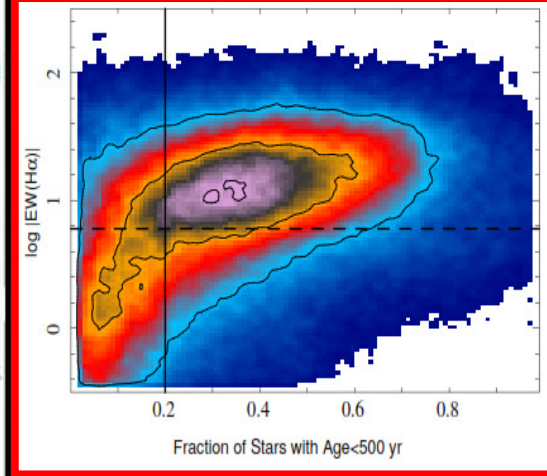


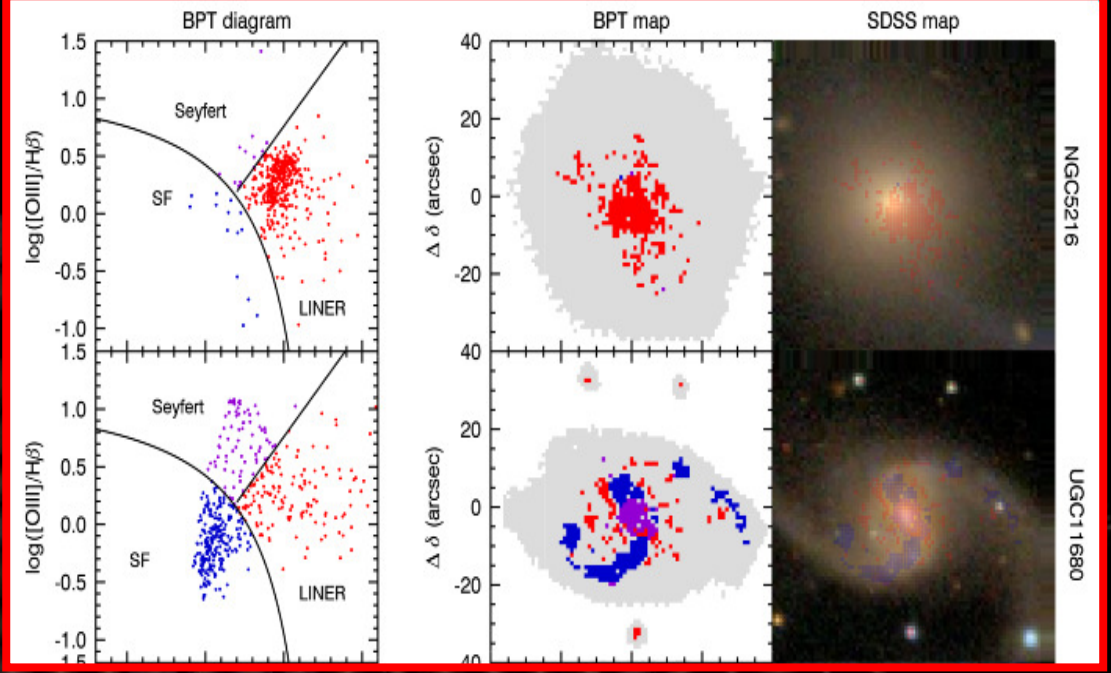
Kehrig et al., A&A, 2012

CALIFA Survey

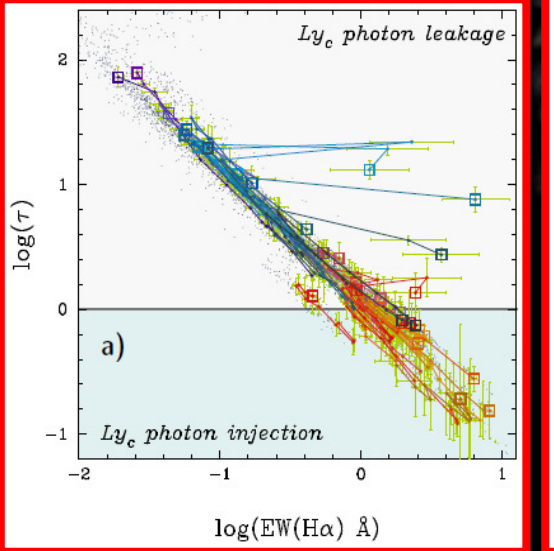


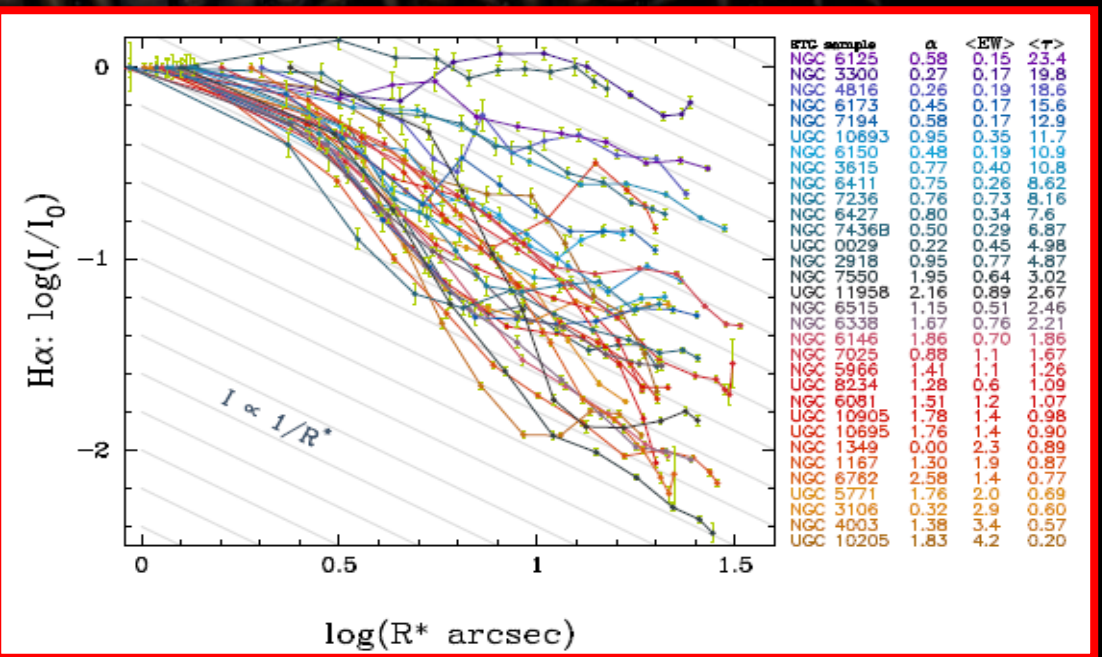
Singh et al., submitted

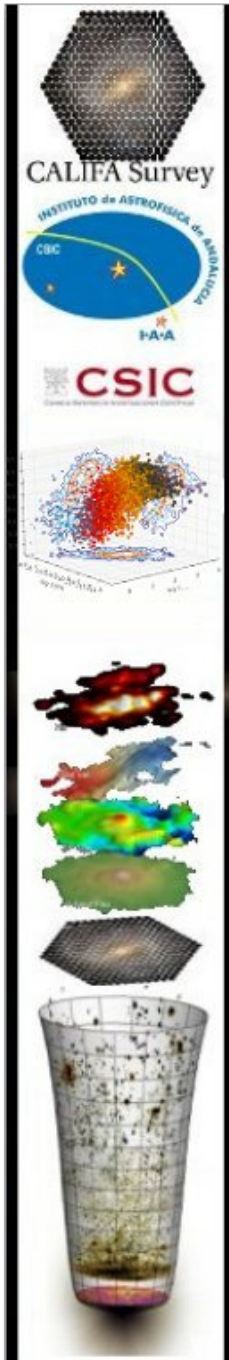




Paparedos et al, A&A, accepted

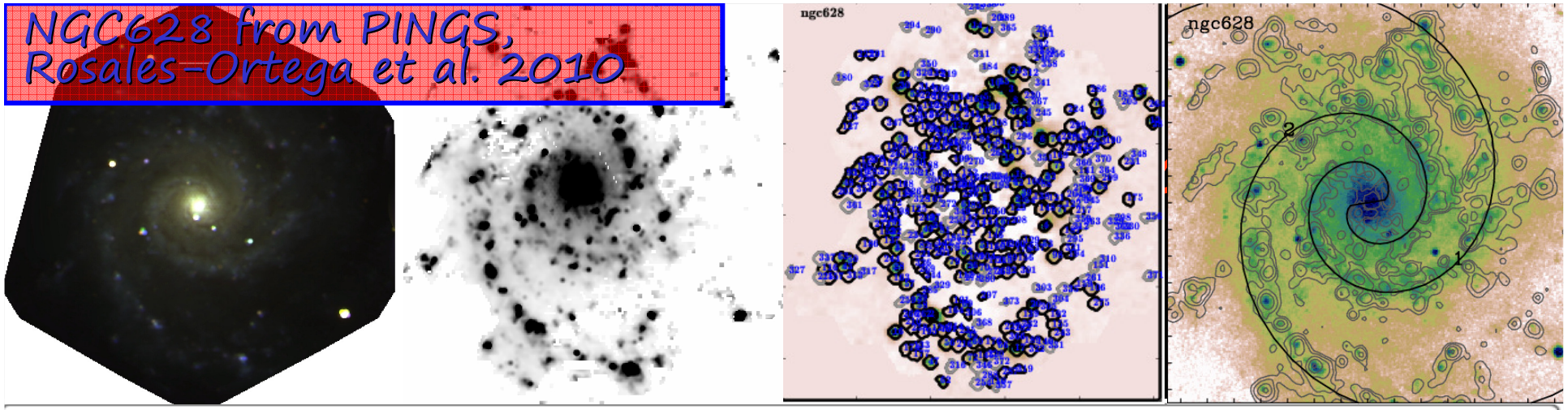




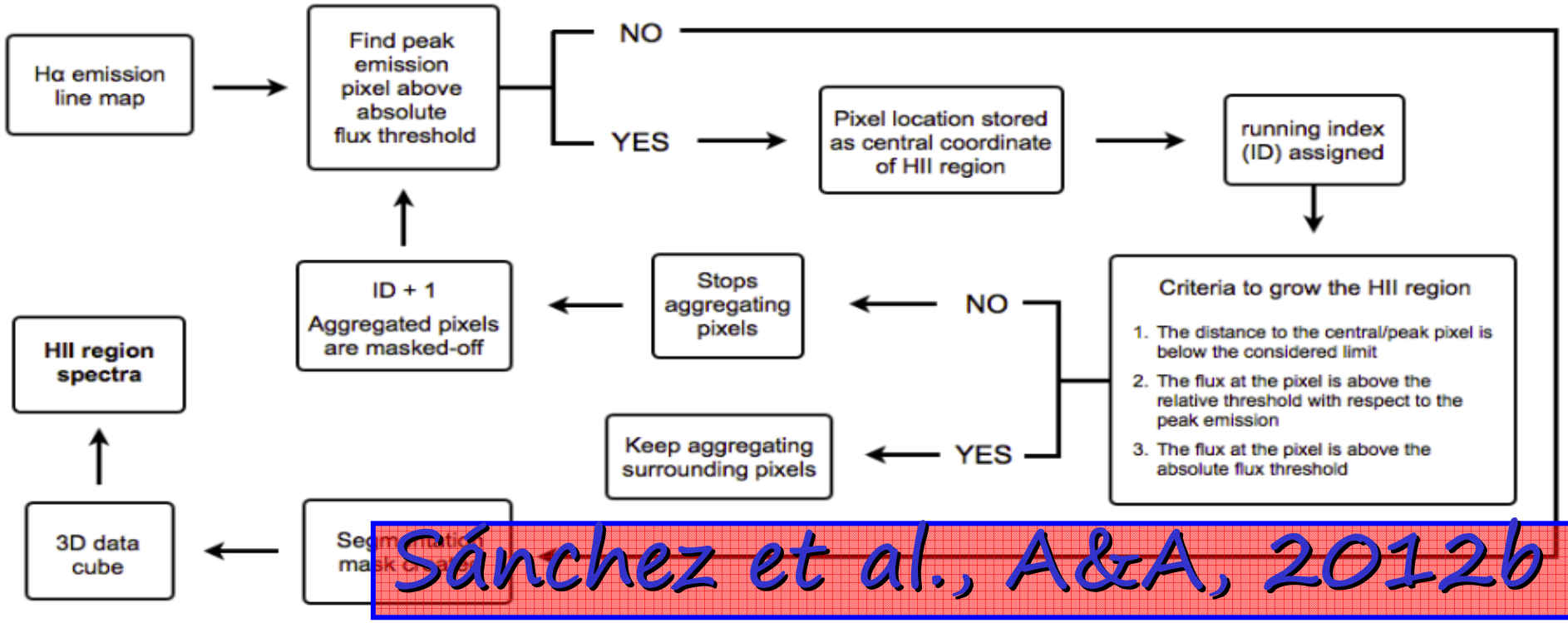


-CALIFA-
Properties of the HII regions

NGC628 from PINGS, Rosales-Ortega et al. 2010

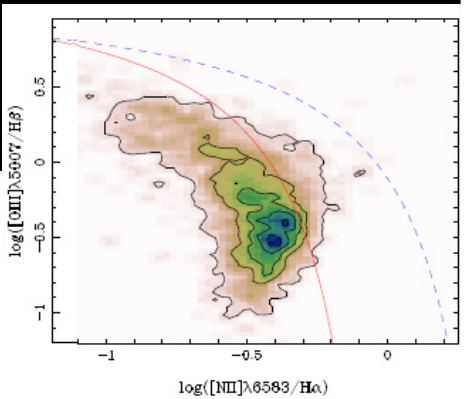


HIIexplorer flow chart

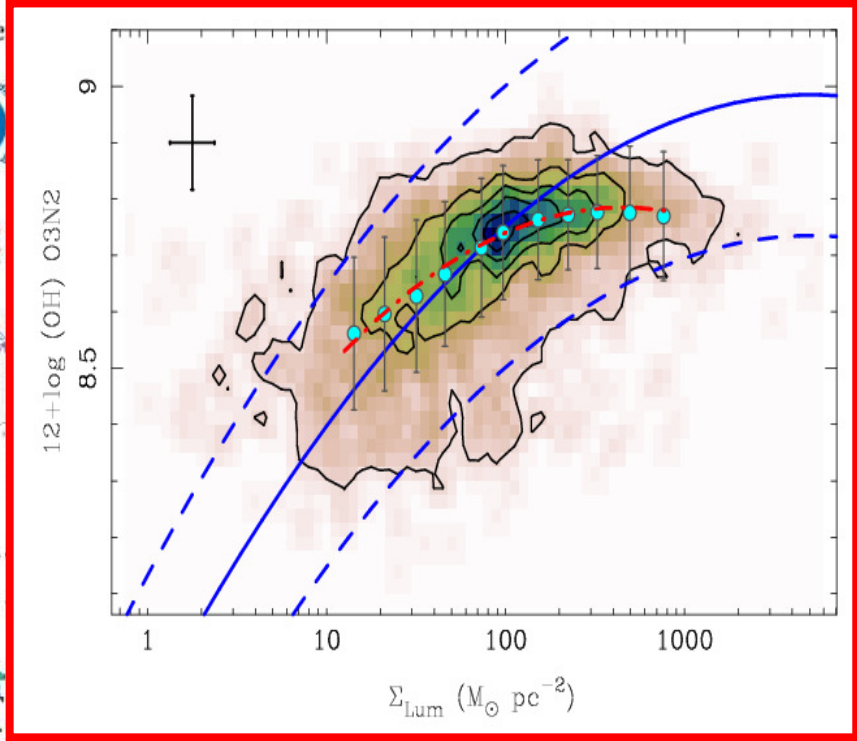


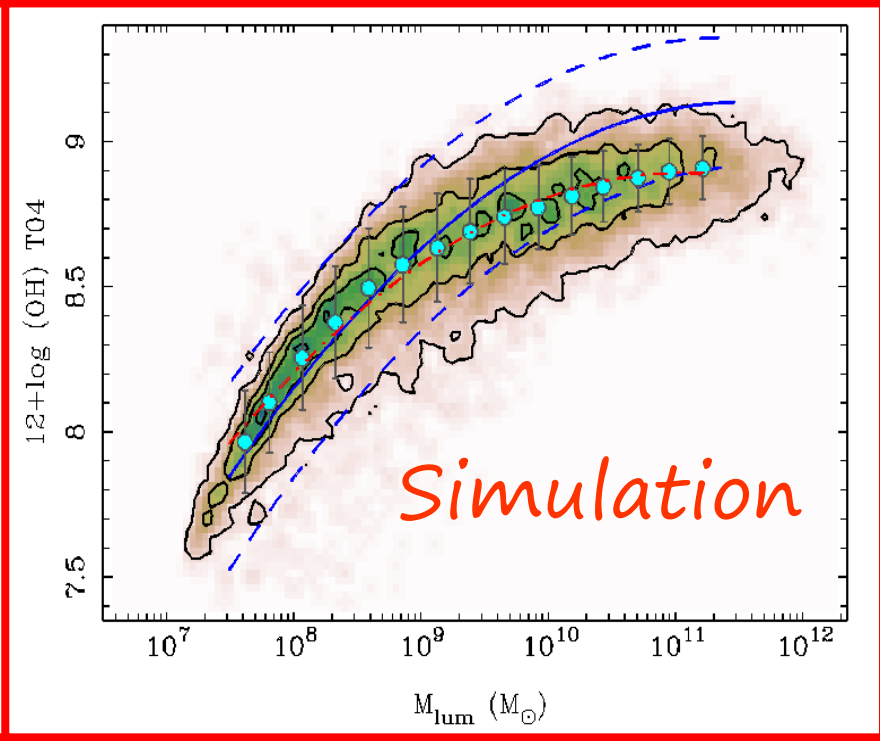
Sánchez et al., A&A, 2012b

~3000 ionized regions, feasibility studies+PINGS



The resolved M-Z relation

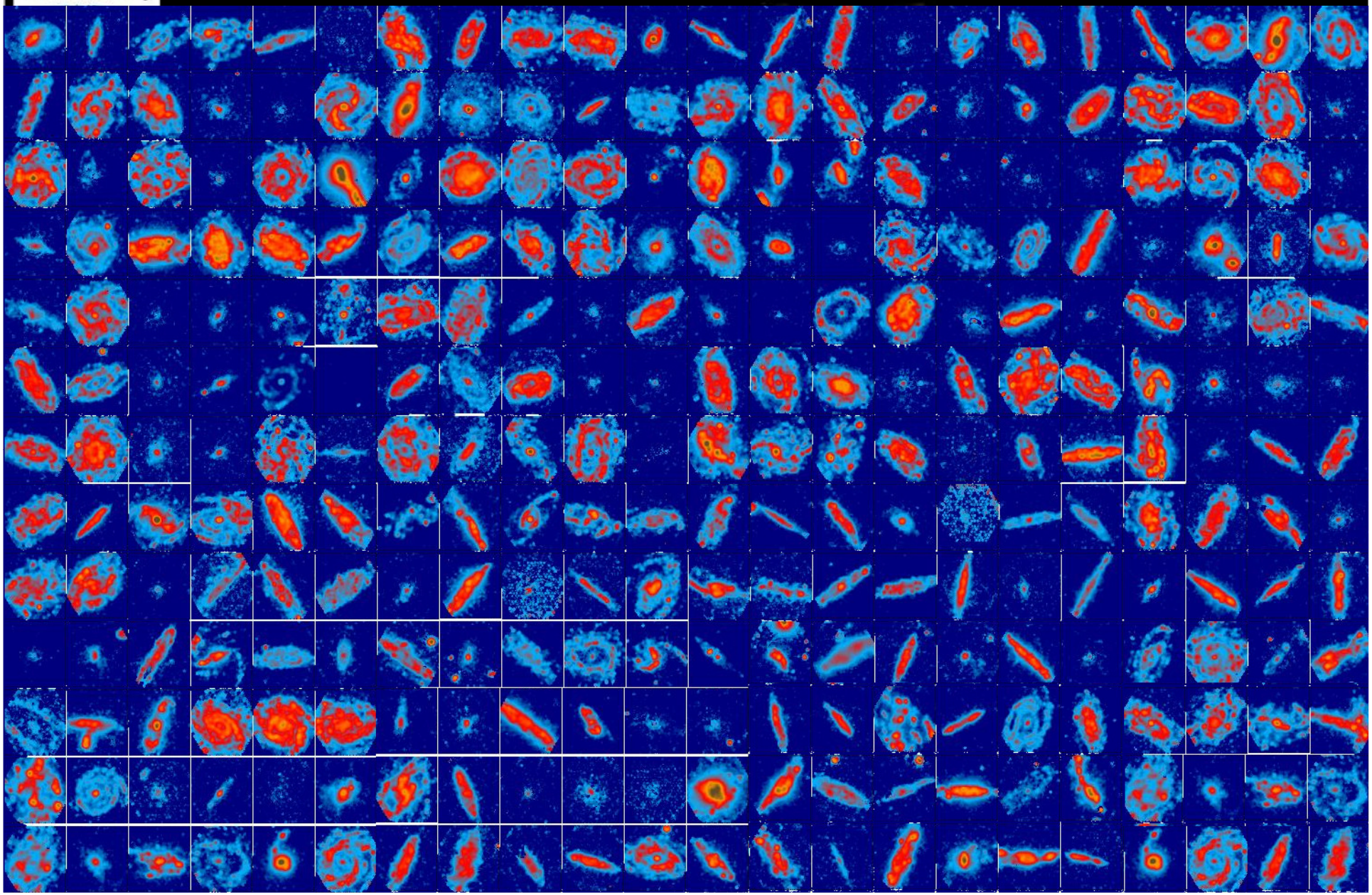




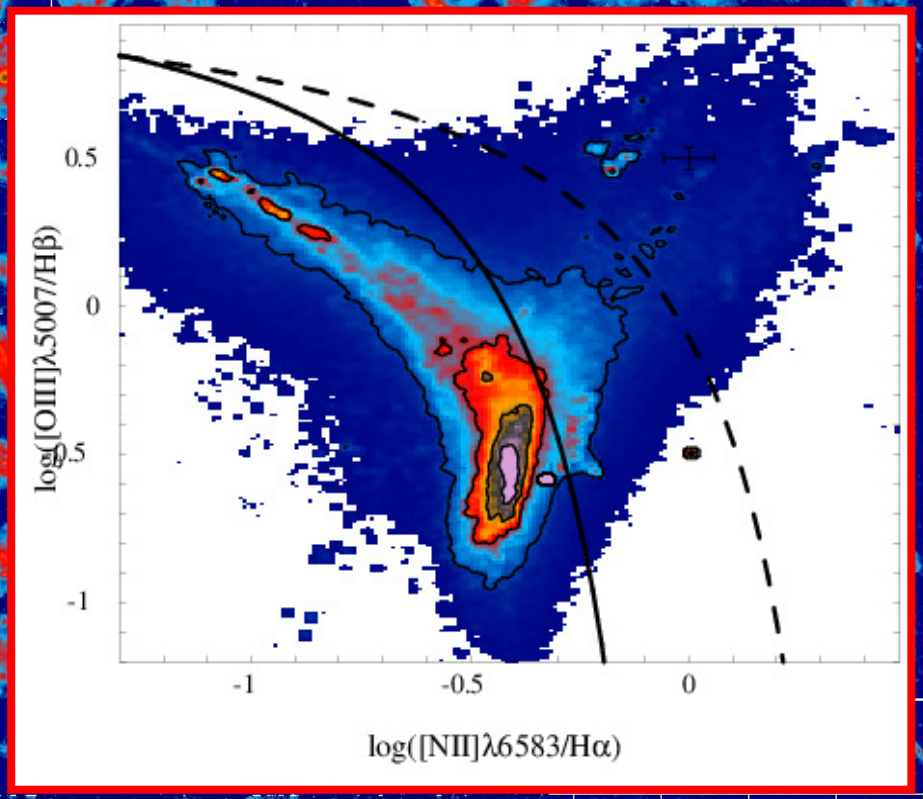
- There is tight correlation between the Mass Surface density and the metallicity.
- We can reproduce the global relation from the local one: Product of the evolution of SFR!

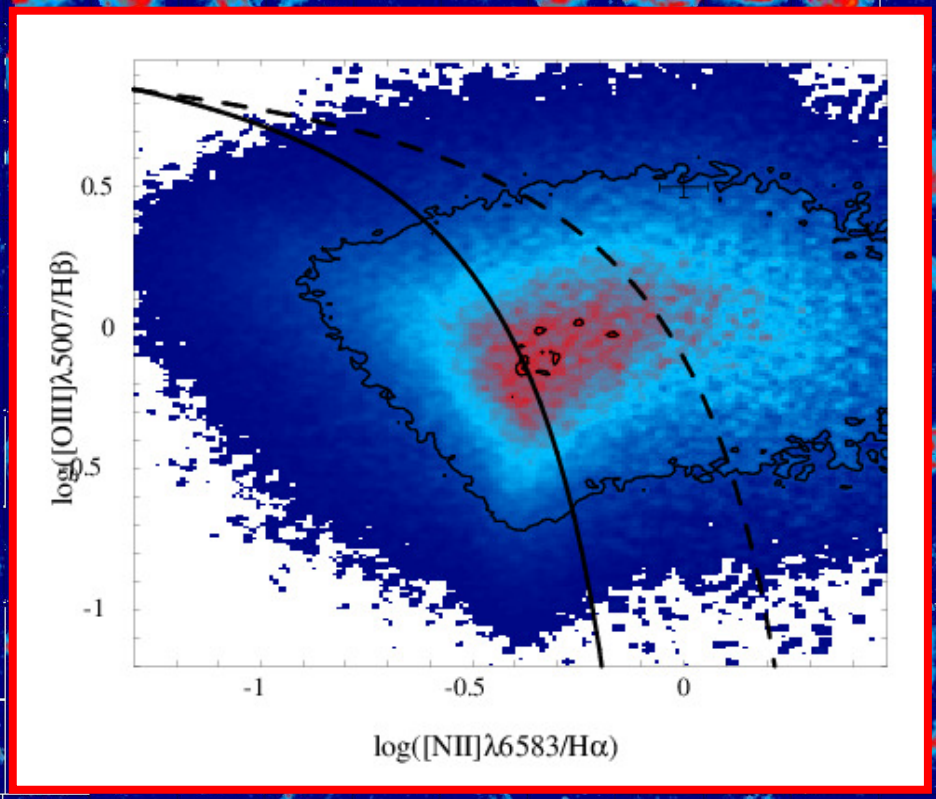
Rosales-Ortega et al., ApJL, 2012

Ionized gas detectd in all galaxies!

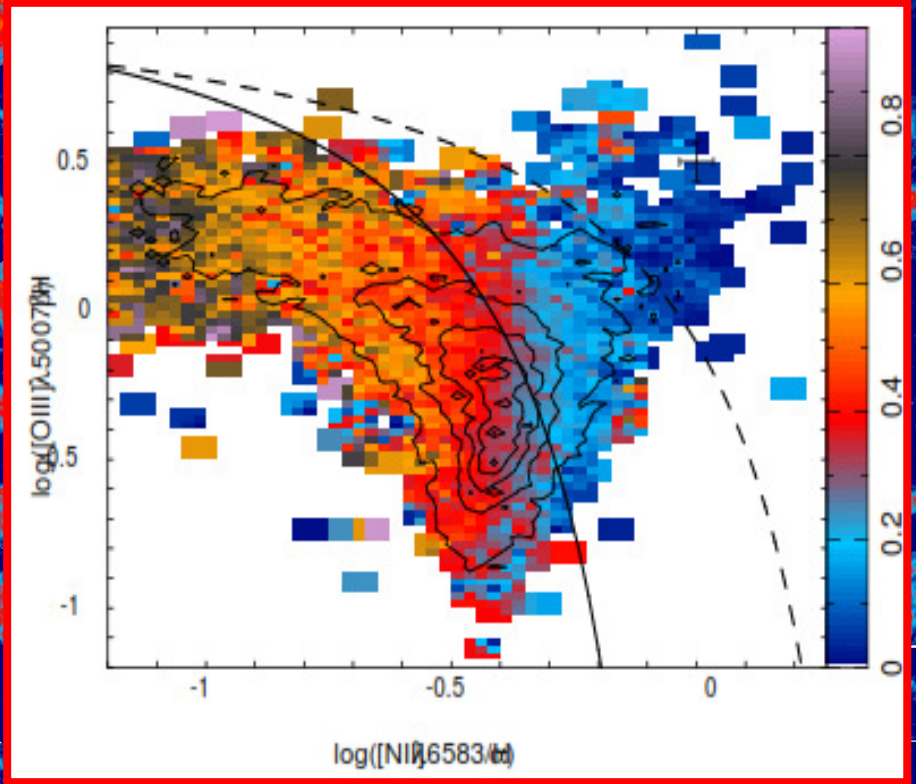


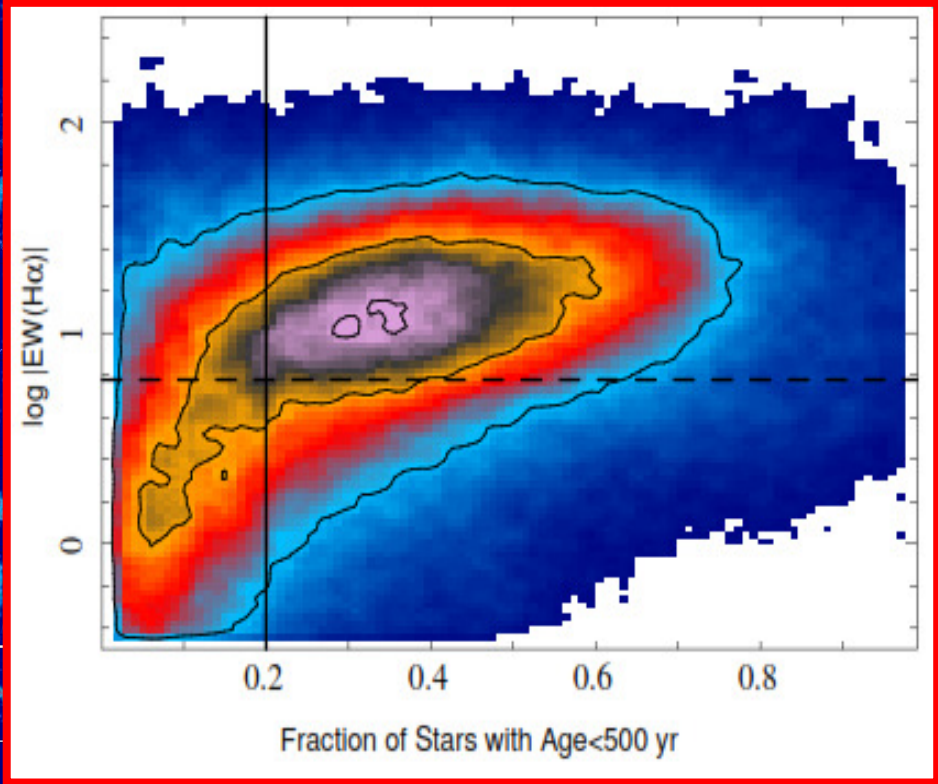
What ionize the gas?



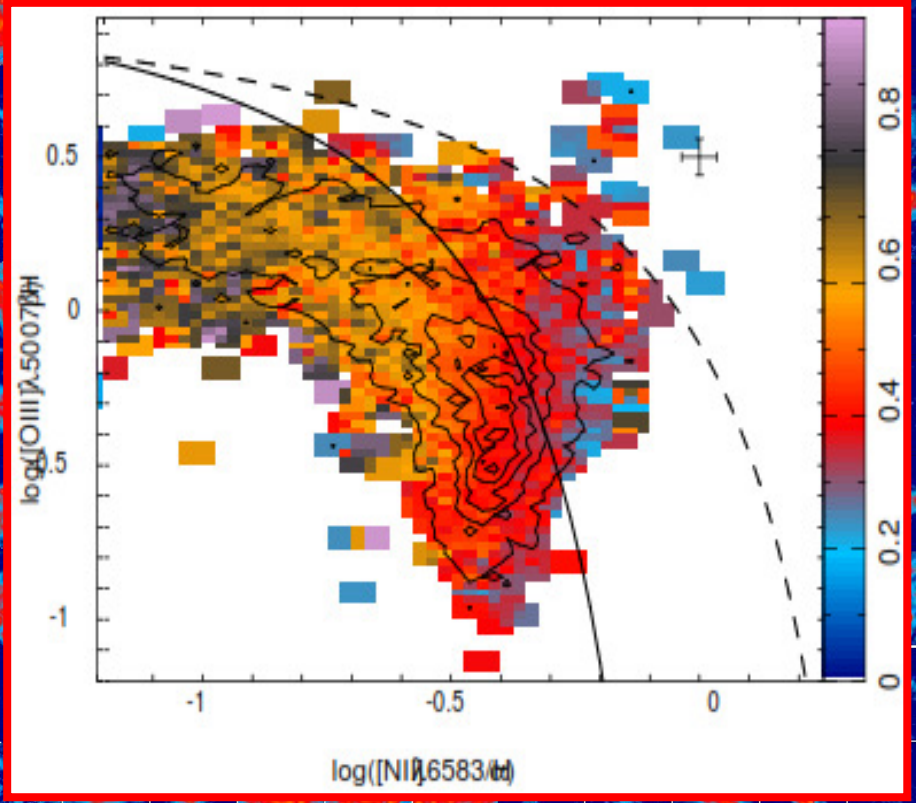


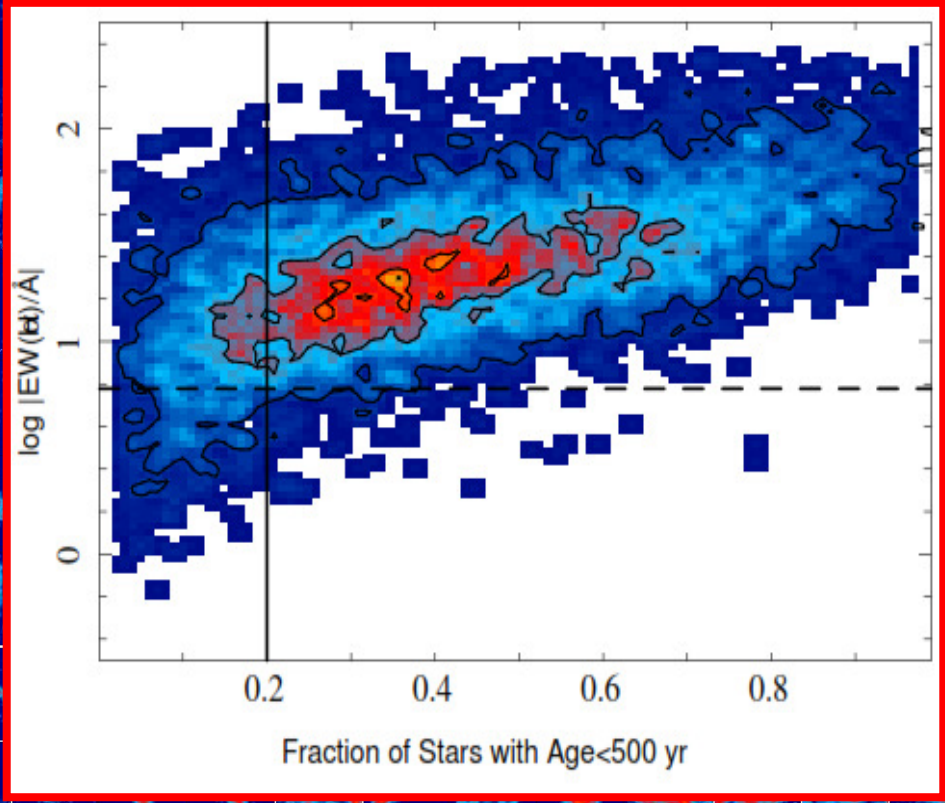
What ionize the gas?



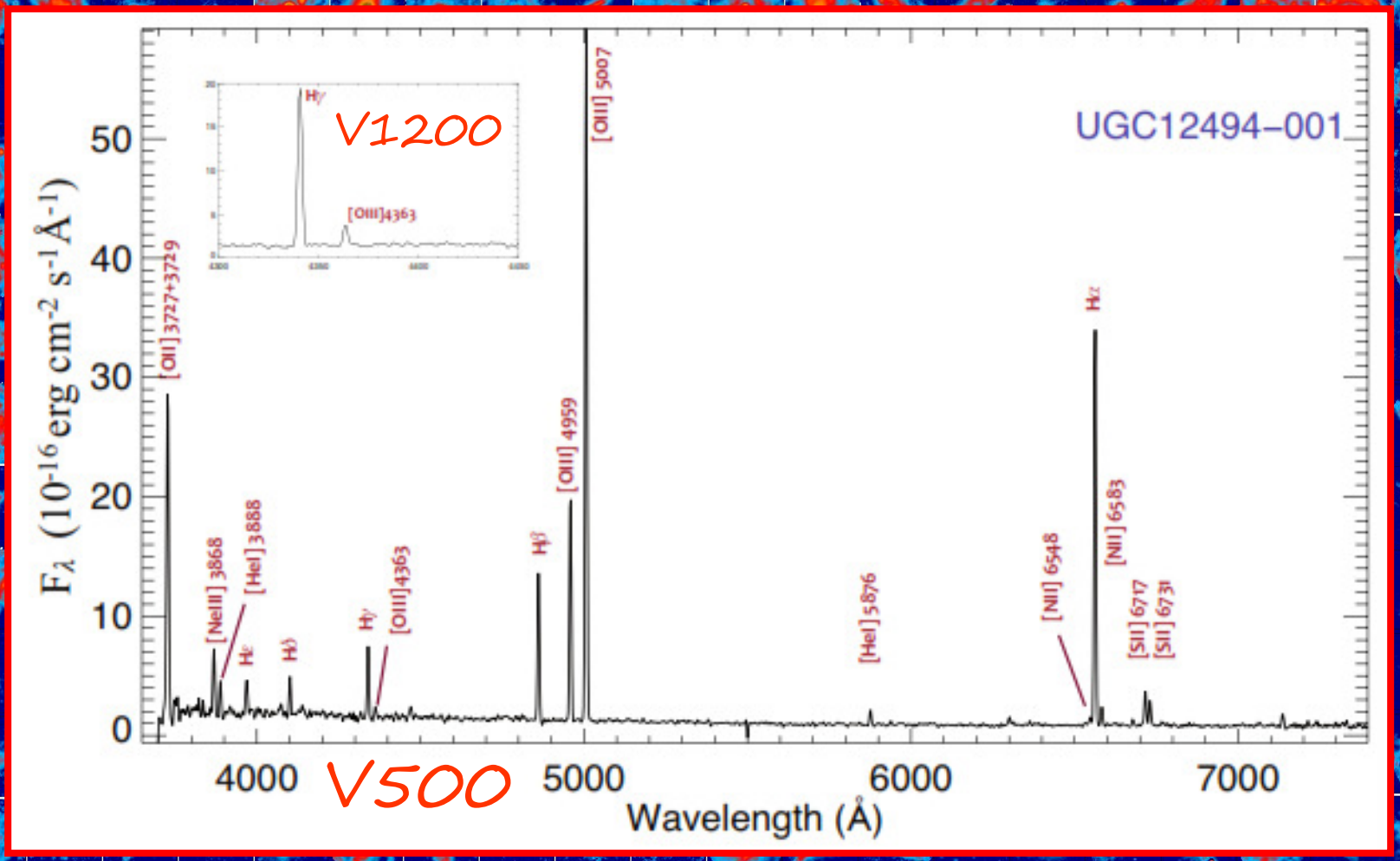


~6500 regions, with CALIFA

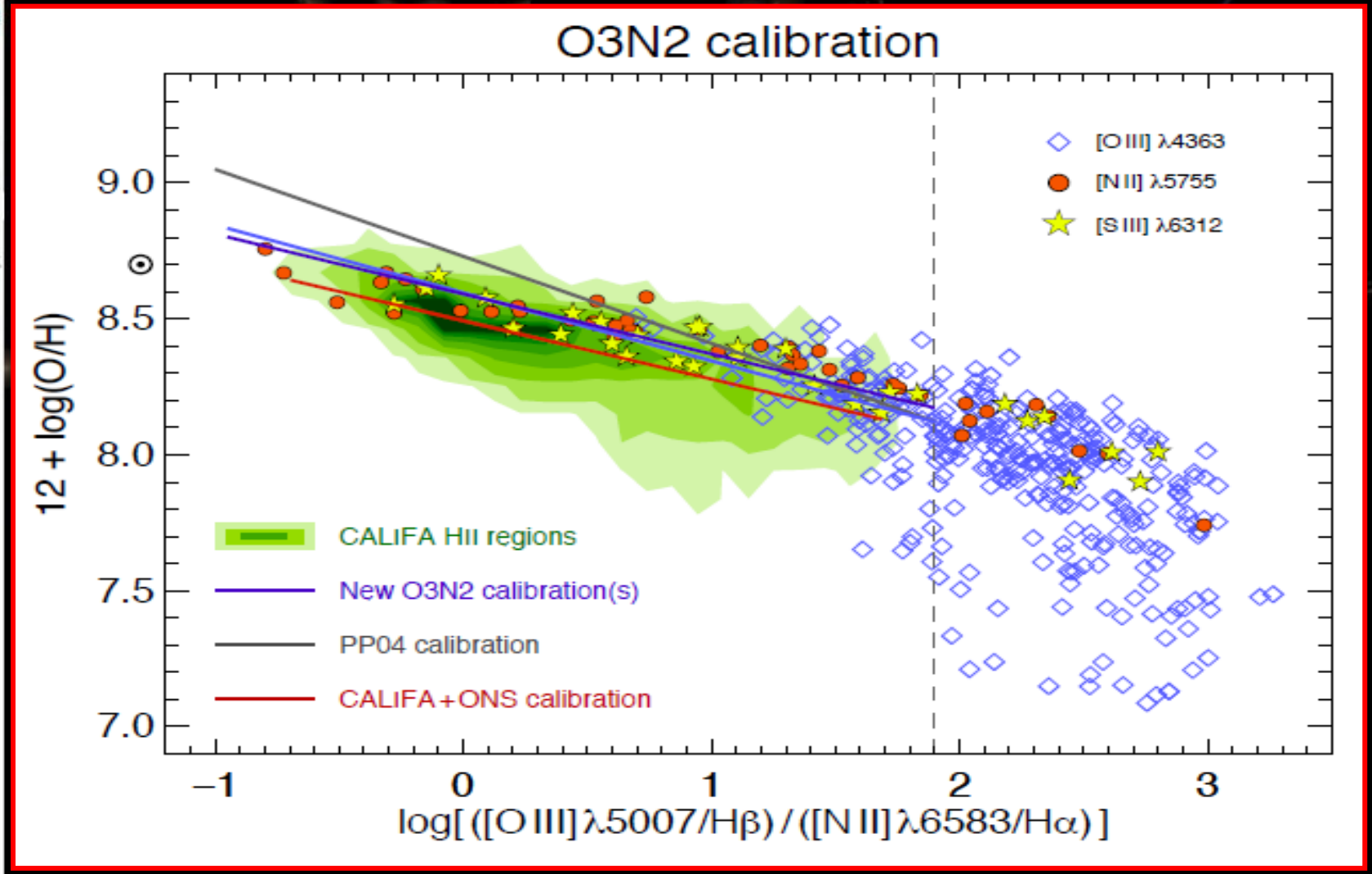




~6500 regions, with CALIFA

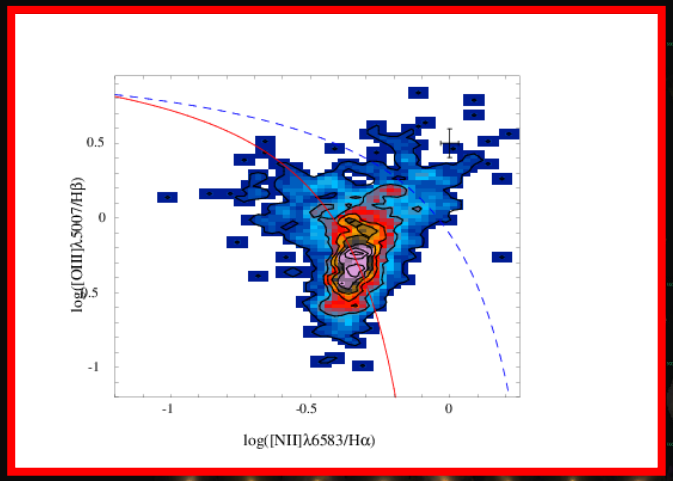


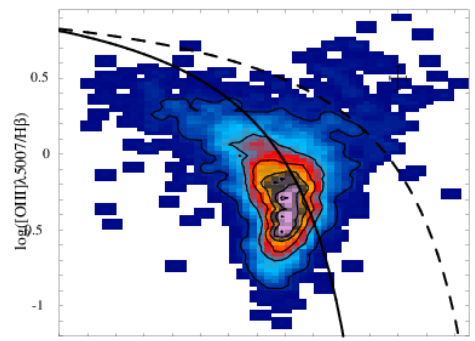
Improved O/H calibrators

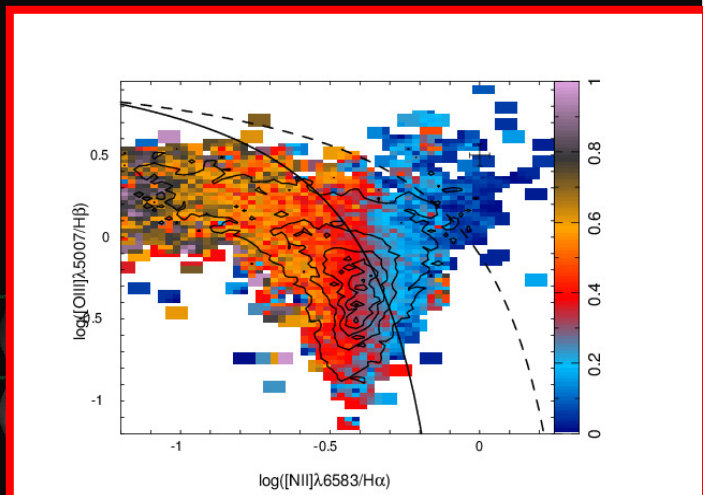


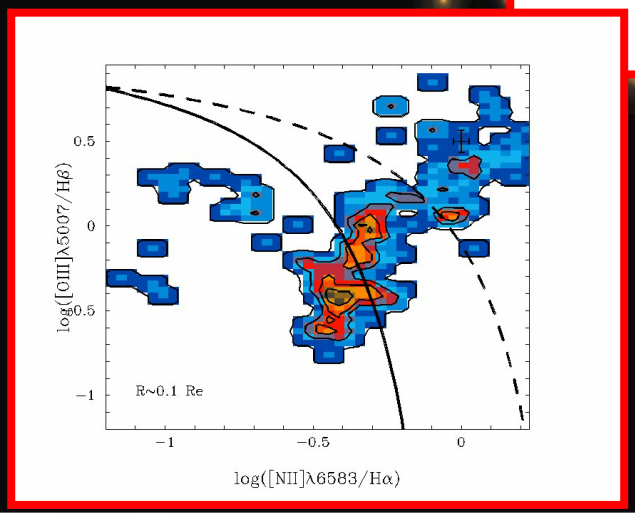
Marino et al., subm.

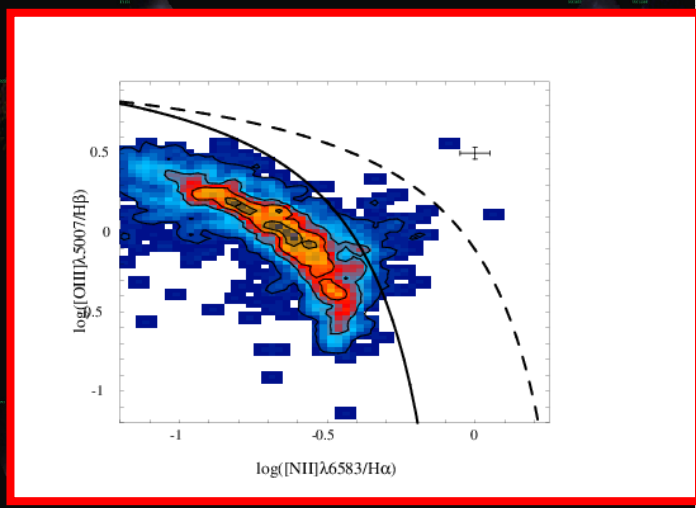
Ionized Gas: Global vs. Local?



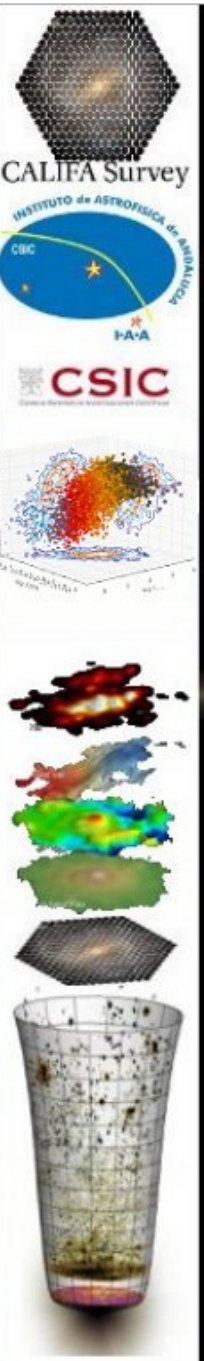


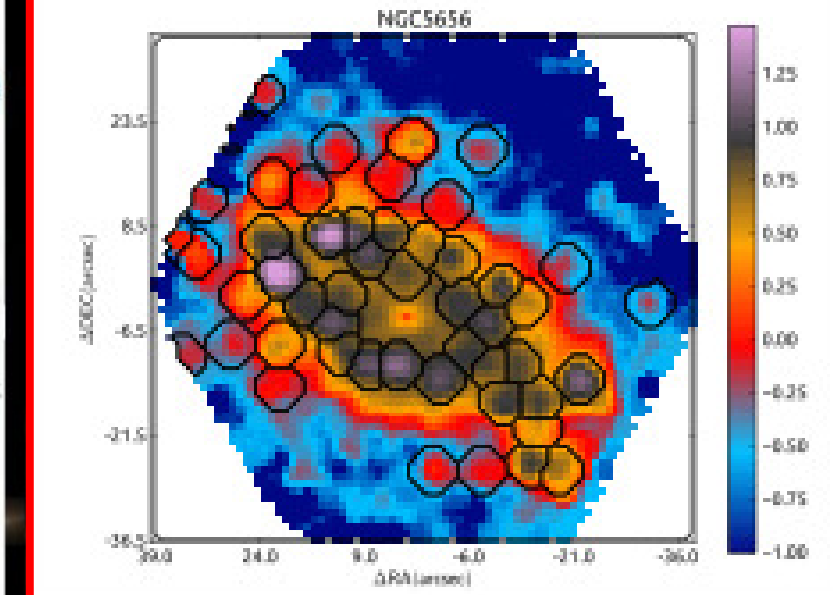


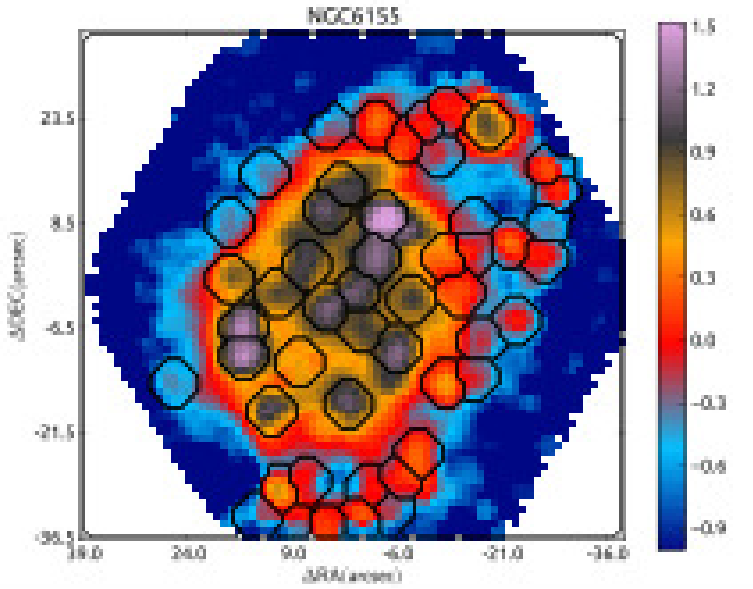


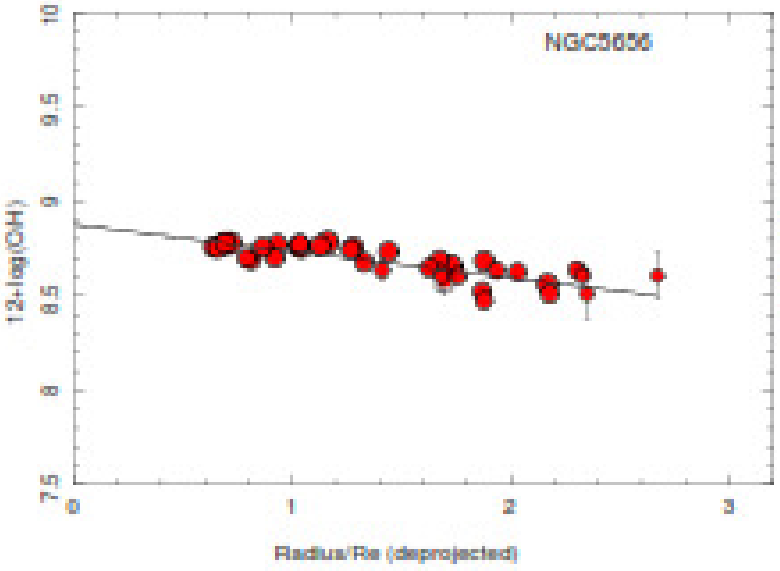


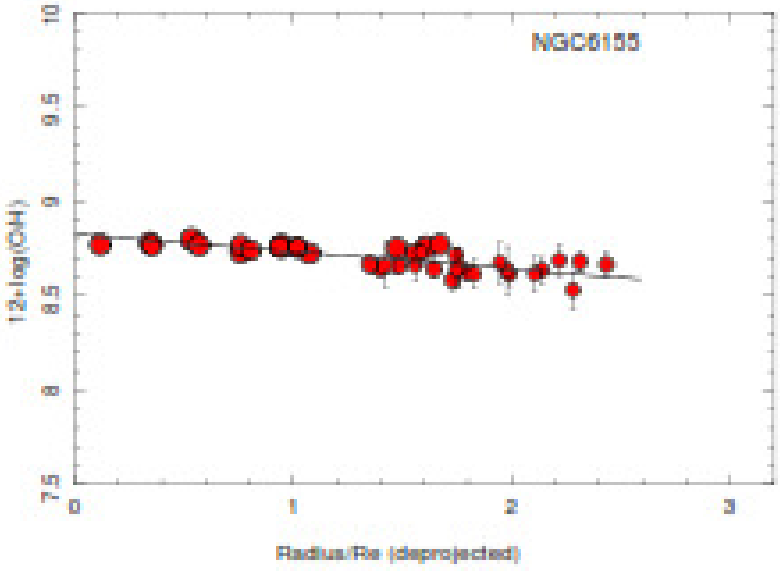
~6500 regions, with CALIFA





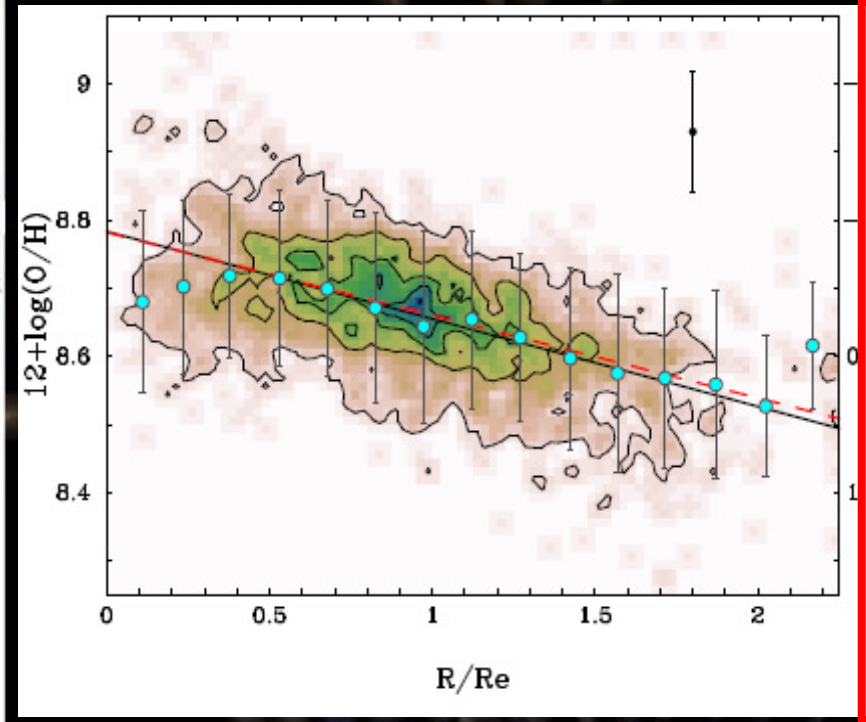


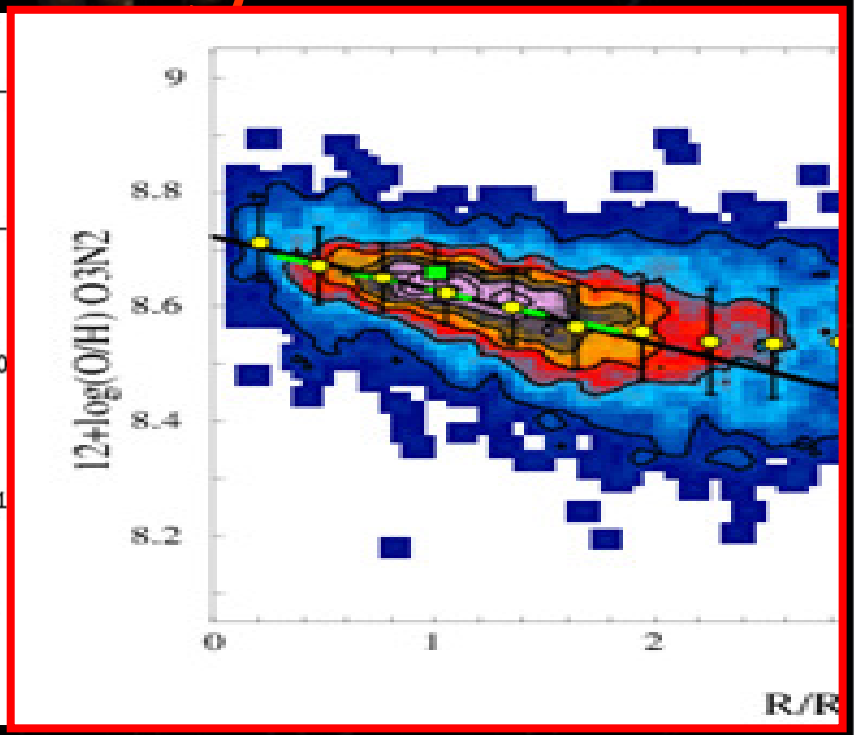




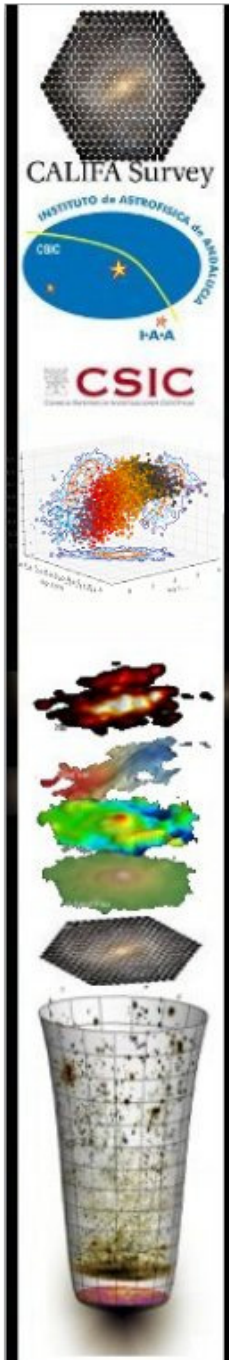
Sánchez et al., A&A, 2012b

O/H Abundance gradients

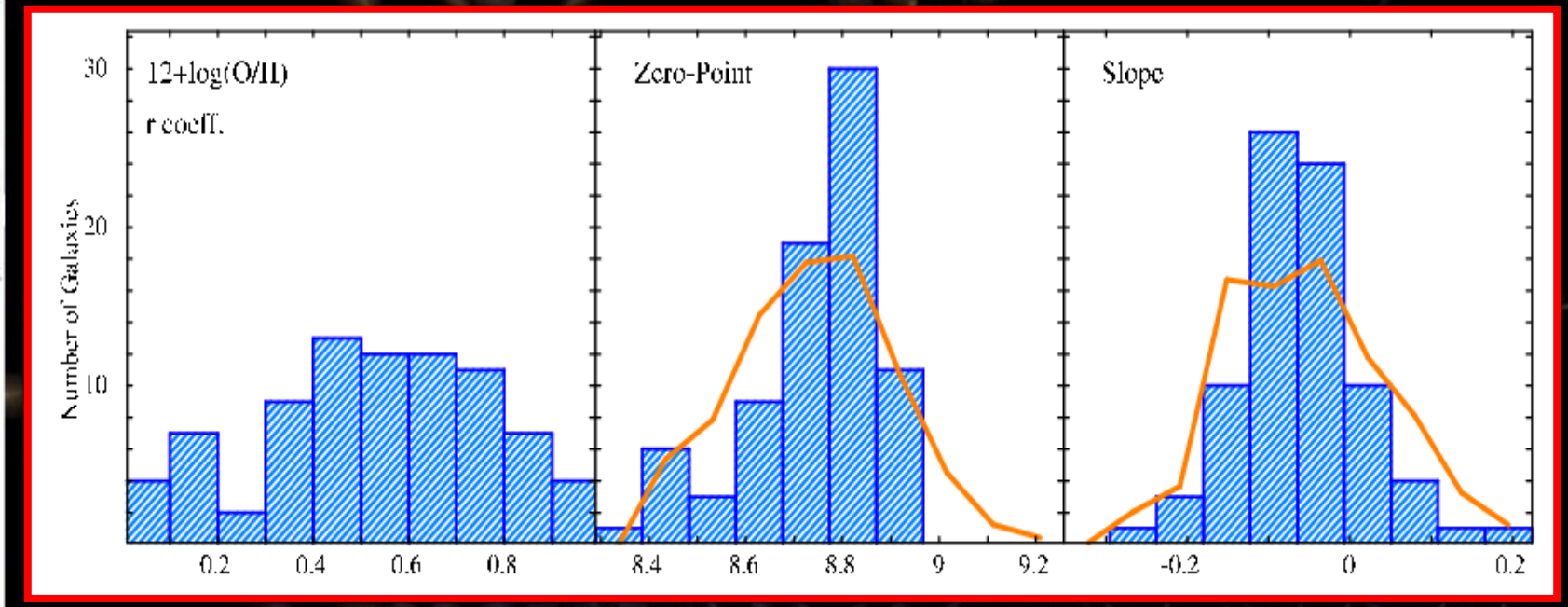




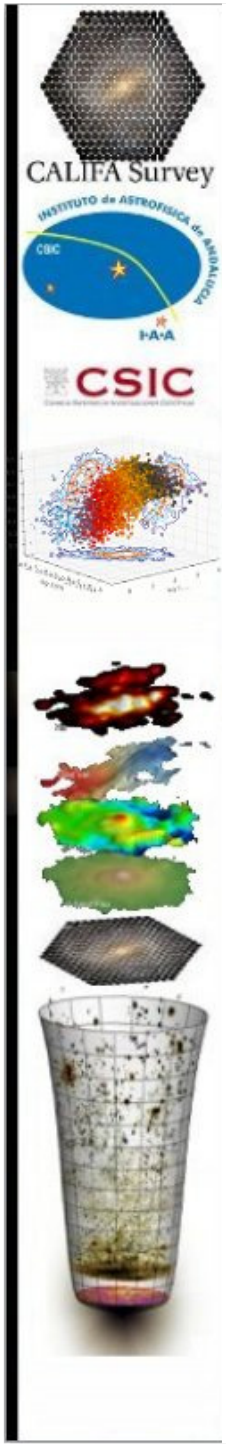
- All Abundance gradients are compatible with being a subsample of Gaussian distribution.
- Slope ~ -0.12+-0.10 dex/Reff.
- No significant difference found by galaxy types: Barred/unbarred, Grand-design/flocculent.



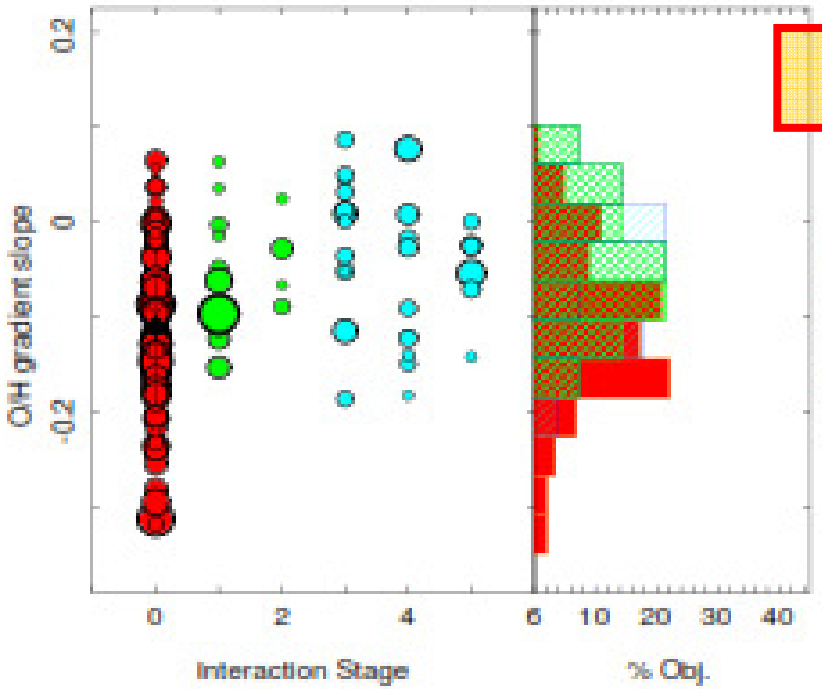
O/H Abundance gradients With CALIFA galaxies

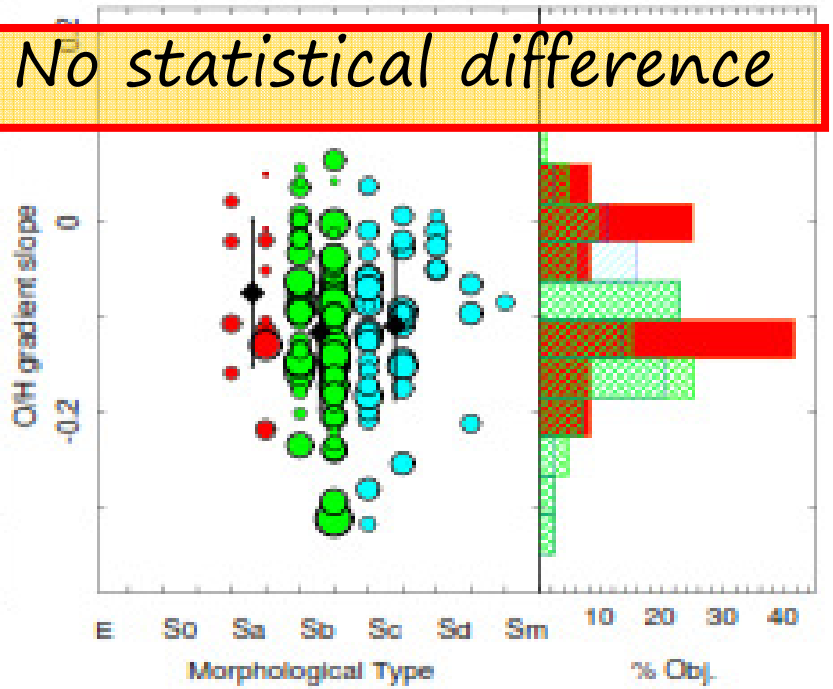


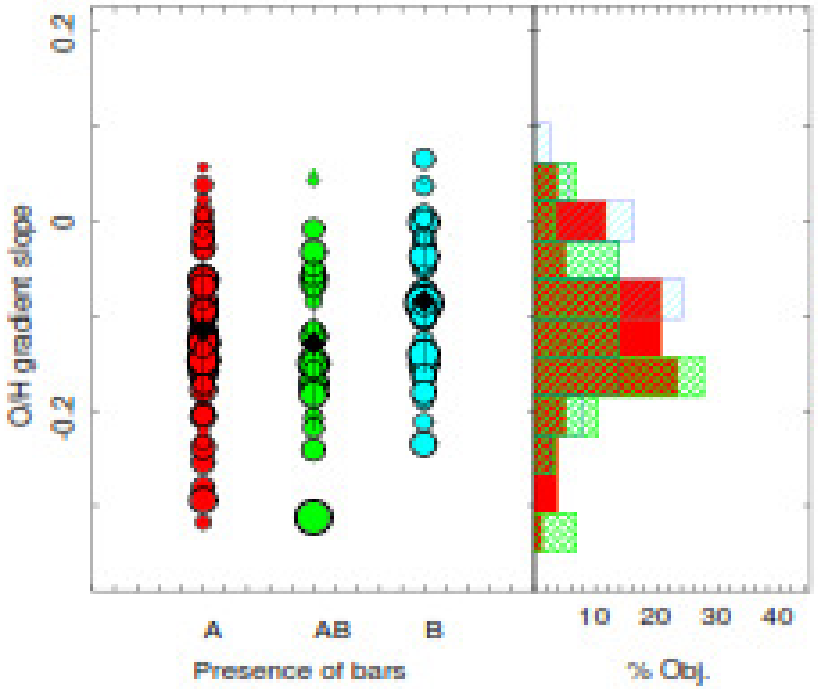
- Gradients determined at 0.3<R/Re<2.1.
- 207 galaxias, ~6500 regions.
- Gradients distribution compatibles with of single Gaussians.
- Slope ~ -0.11+-0.08 dex/Reff.

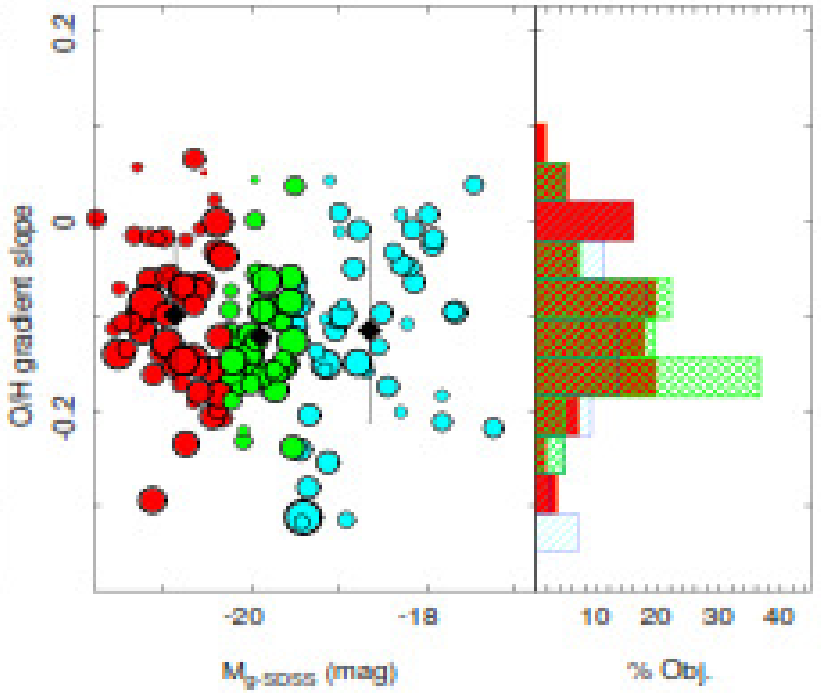


No statistical difference

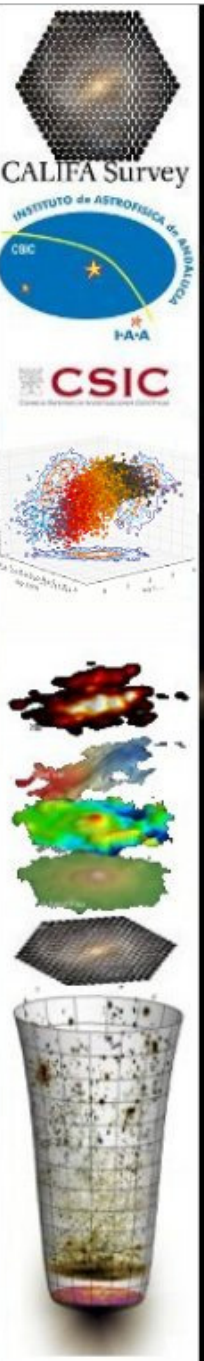




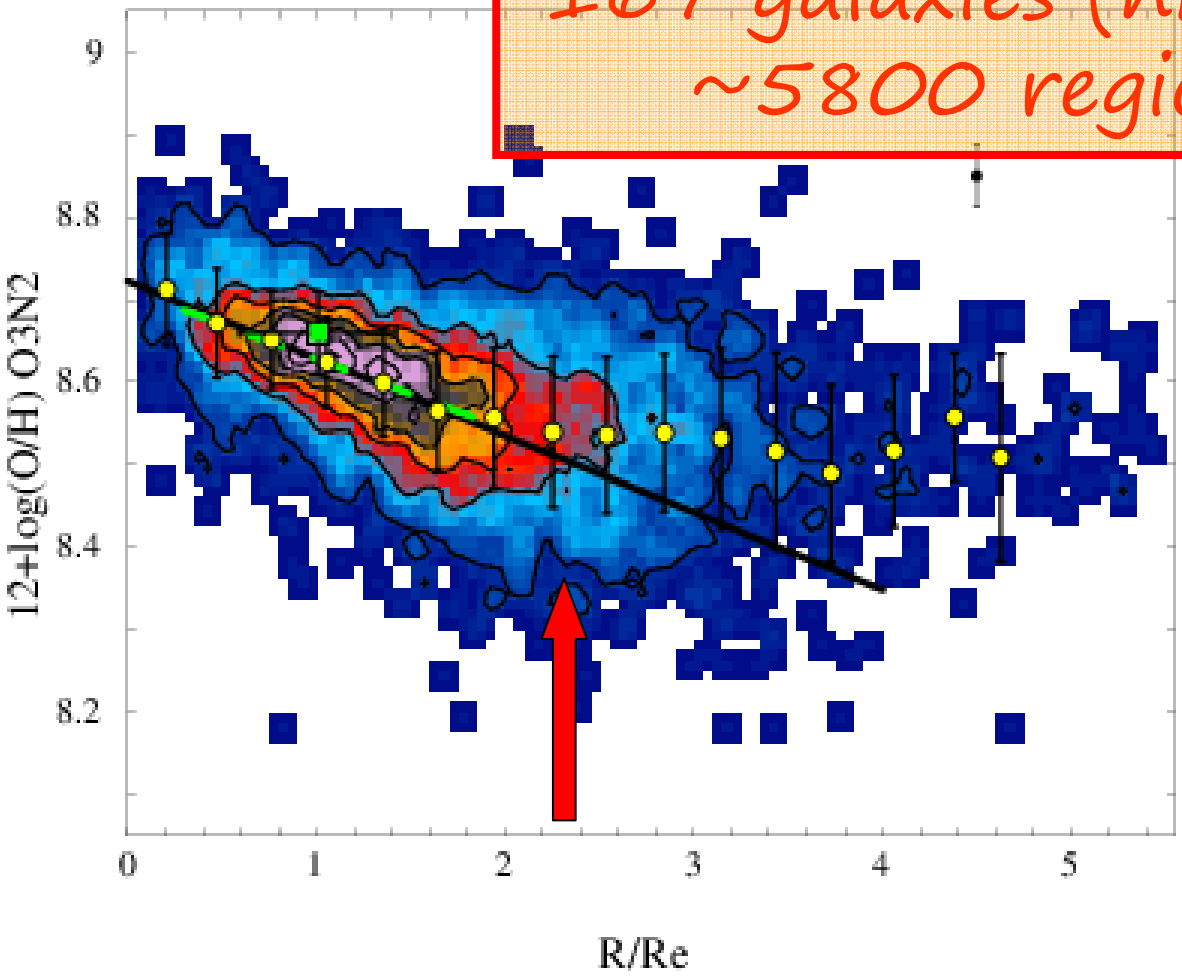


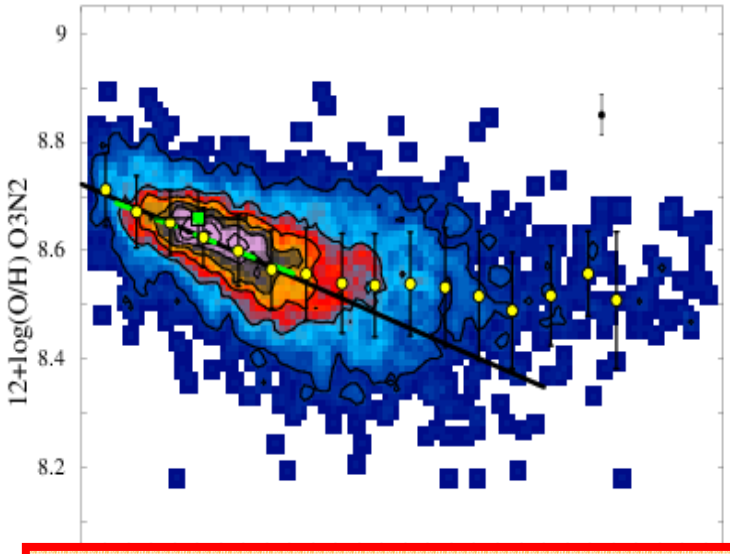


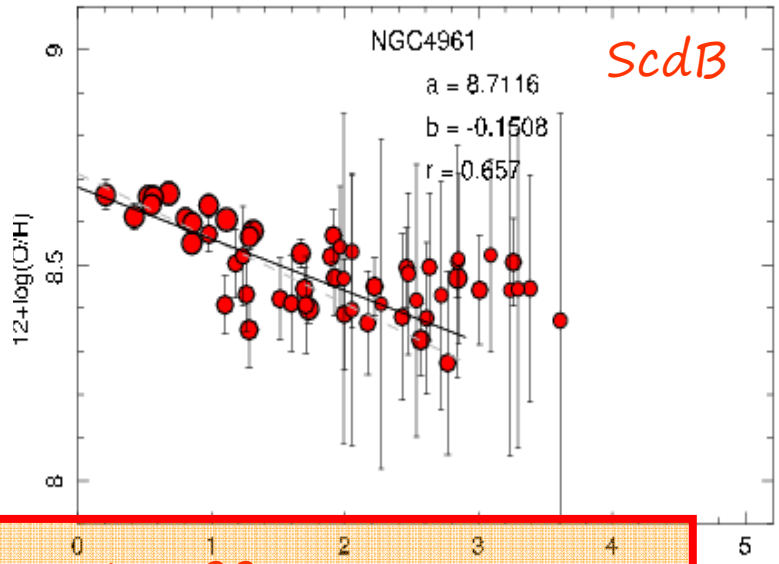
O/H Abundance gradients



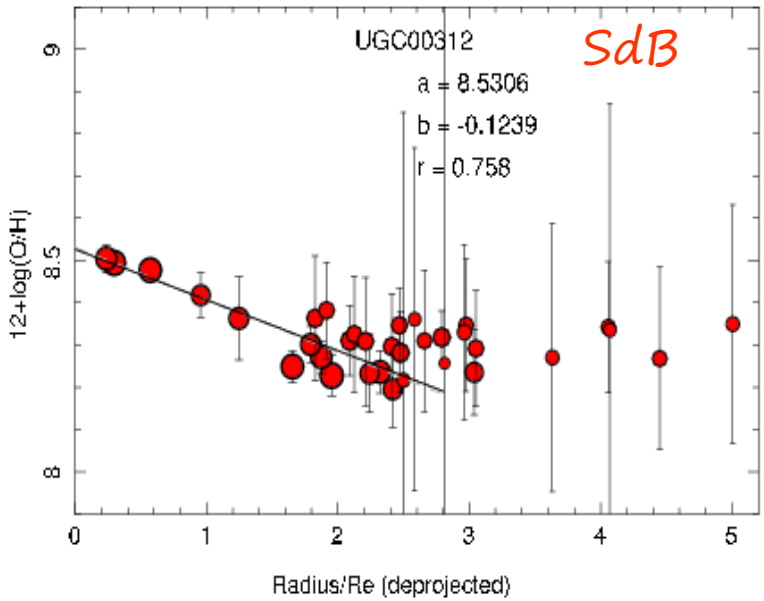
167 galaxies (nHii>4)
~5800 regions

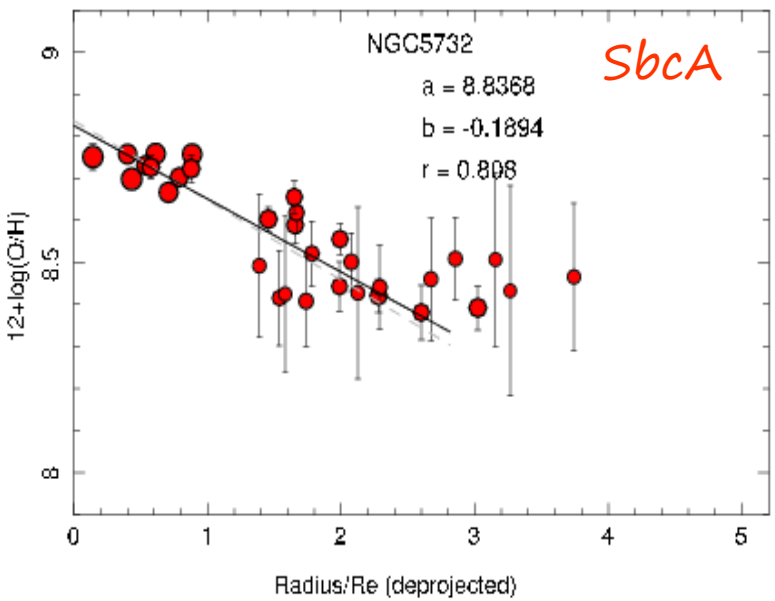






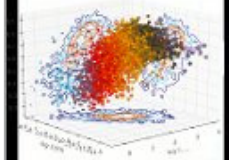
Not an statistical effect!

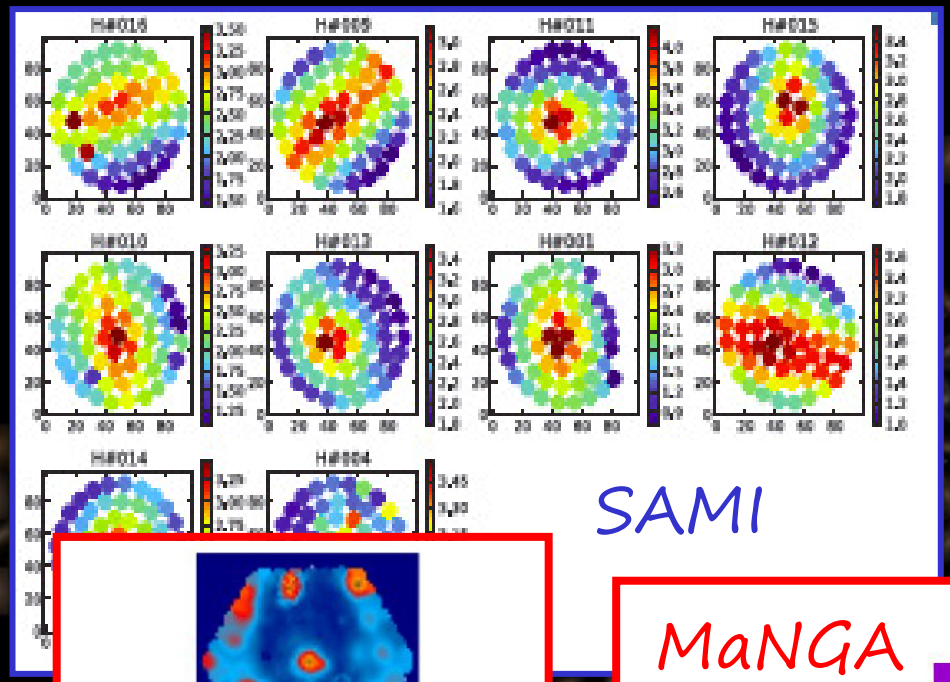




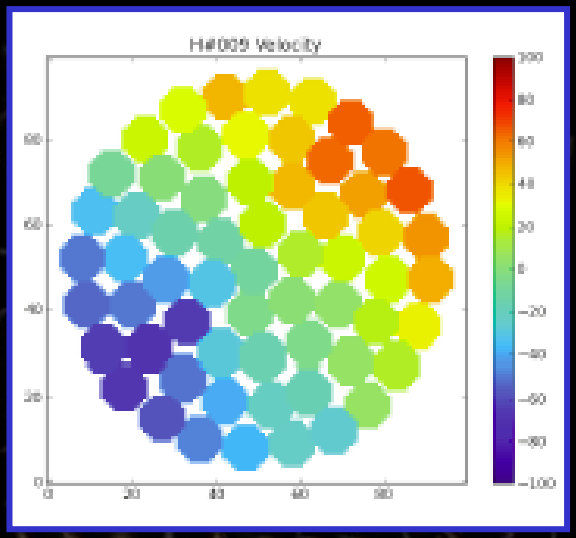
After CALIFA...

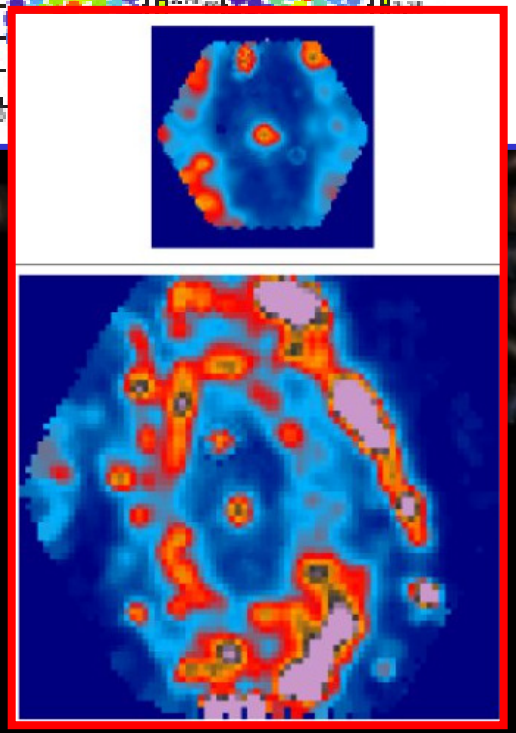
CALIFA Survey



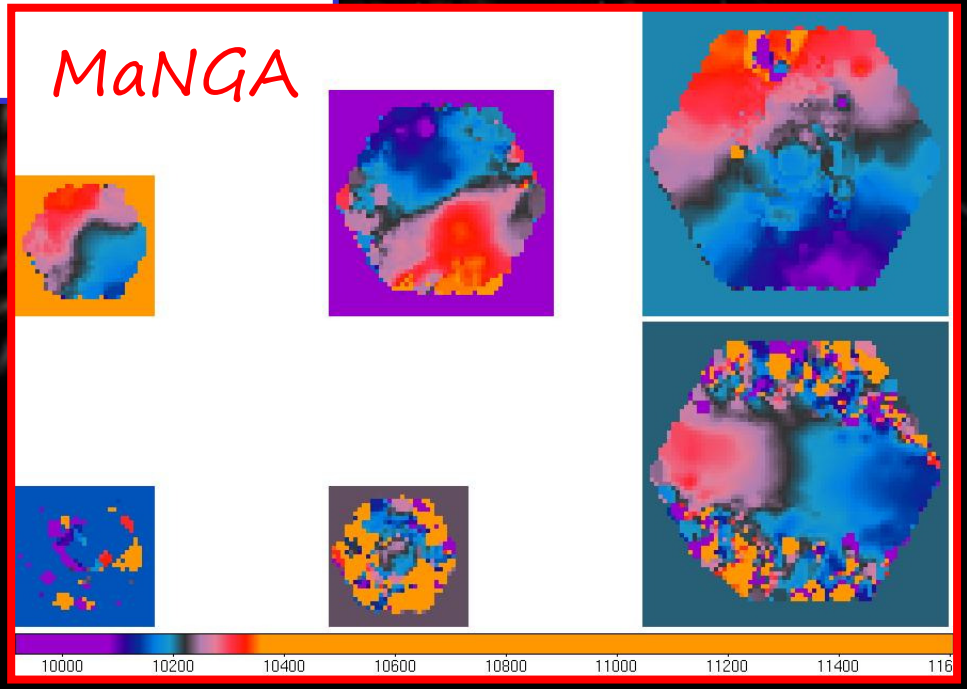


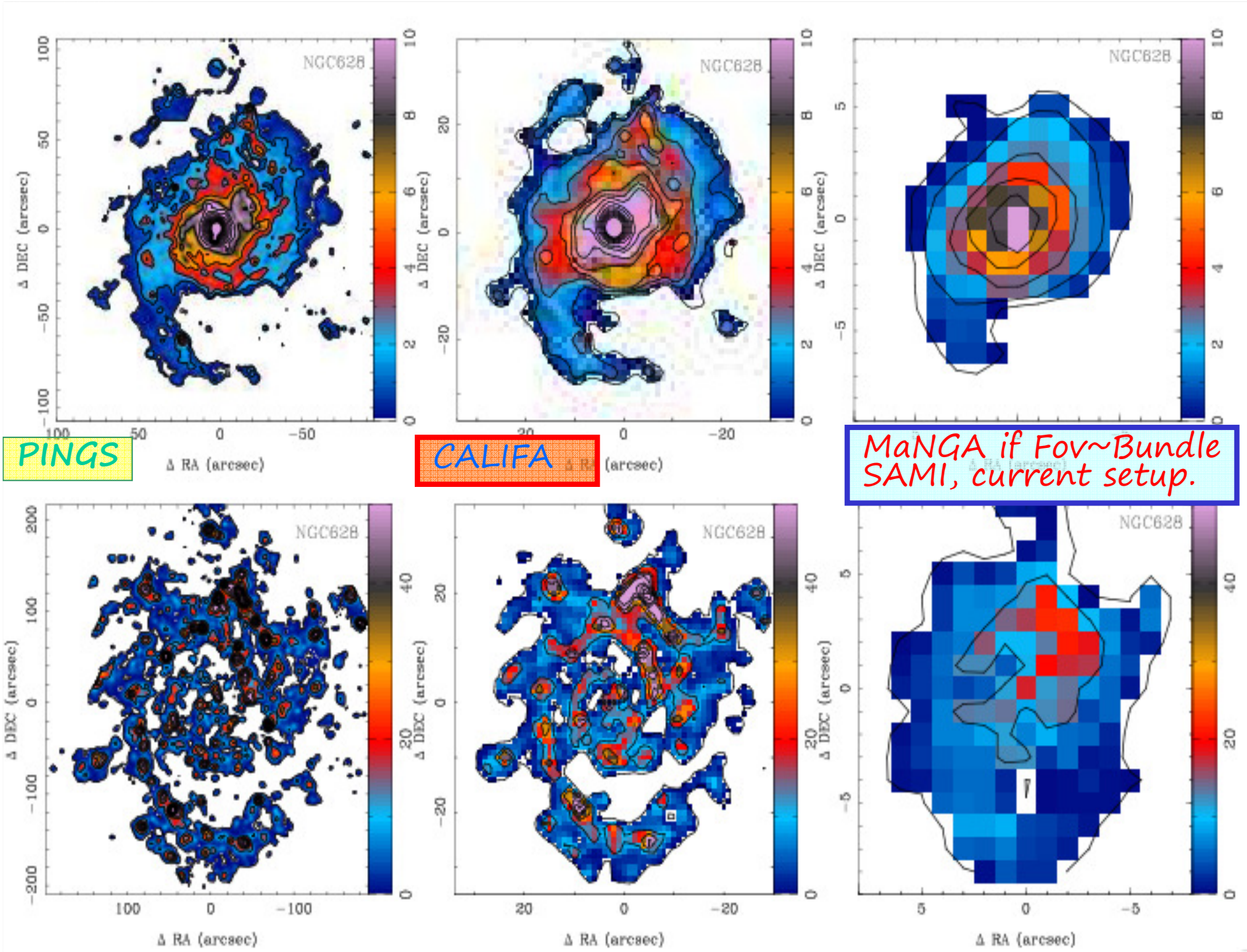
SAMI



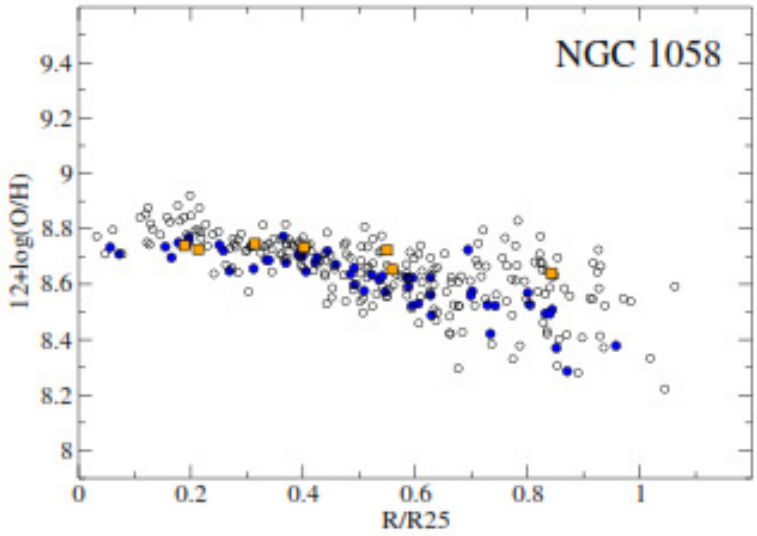


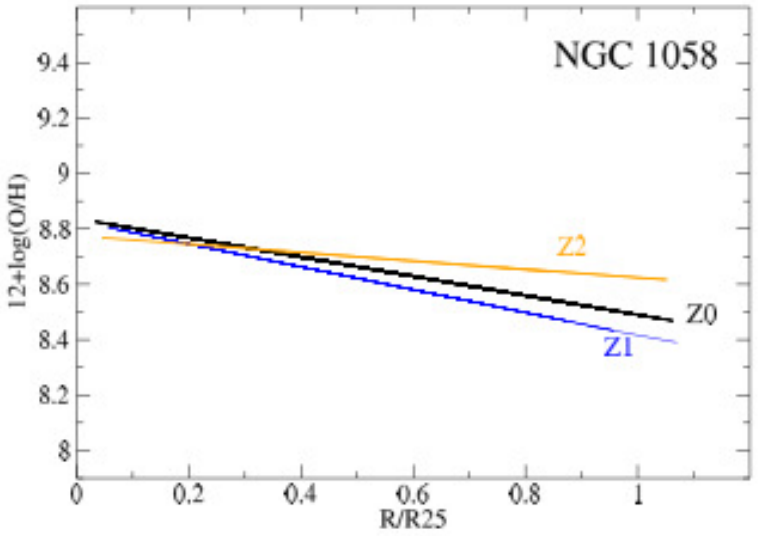
MaNGA

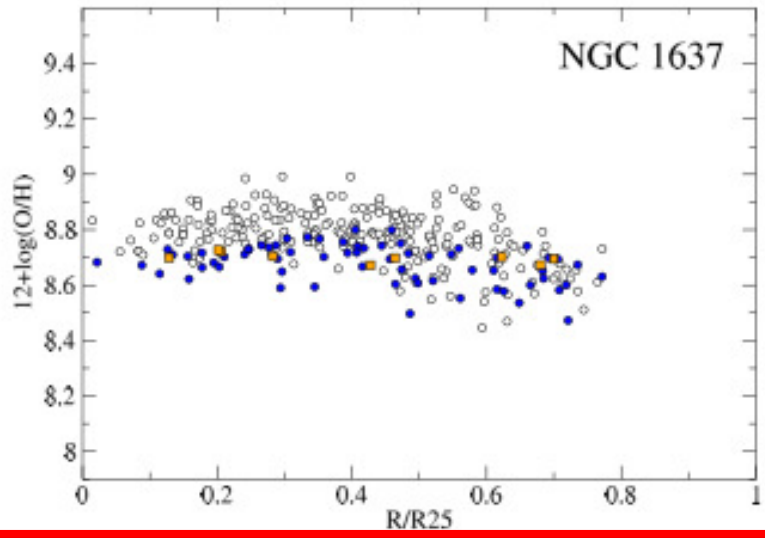


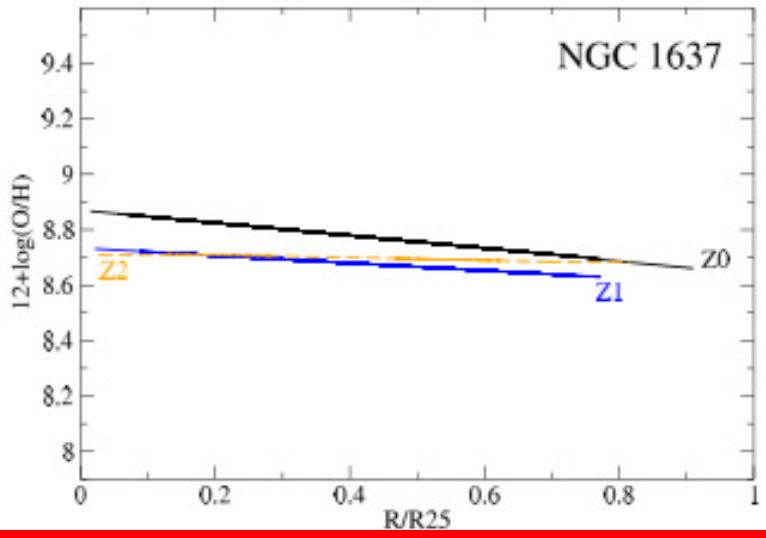

NGC628
Δ DEC (arcsec)
Δ RA (arcsec)
PINGS
CALIFA
MaNGA if Fov~Bundle
SAMI, current setup.

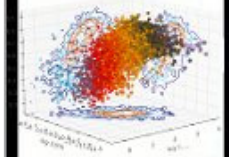
Effects in abundance...











Summary

- CALIFA is an unique dataset for the understanding of galaxy evolution.
- We have detected the largest catalog of HII regions (~10.000):
  - HII regions have memory of the SFH.
  - A fundamental relation between the Mass-Density and the Abundance.
  - Common gradient of the Abundance independent of galaxy morphology.
  - All results are consistent with an inside-out growth of disks.
  - The ionized gas, stellar population and kinematics are self-consistent.