CALIFA: **C**alar **A**lto **L**egacy **I**ntegral **F**ield spectroscopy **A**stronomical survey

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Estallidos 2010

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CALIFA: Summary I

- Survey of ~600 Galaxies in the Local Universe (0.005<z<0.03), i.e., D<120Mpc.
- IFS using PPAK/PMAS@ 3.5m Calar Alto.
- Mid-resolution (R~1000/2000) spectroscopy between 3700-7000 AA.
- Covering a 90% of the size of the galaxies.

CALIFA: Summary II

AUTHORS OF THE PROPOSAL

CALIFA Board: R.C. Kennicutt (Chair, co-PI)
A.Gil de Paz (co-PI), G. Van de Ven, S.F. Sanchez (PI), J. Vilchez, L. Wisotzki

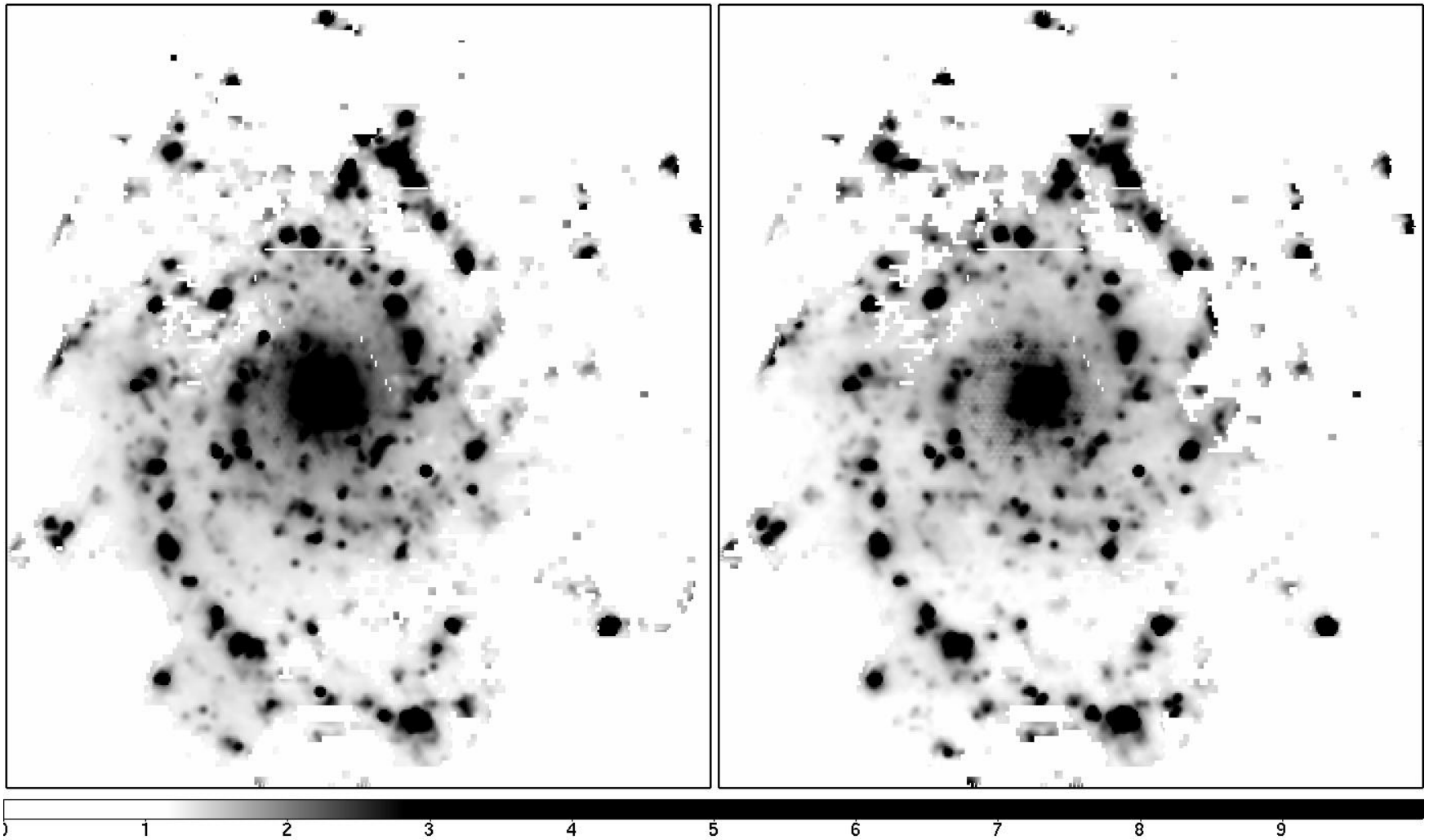
CALIFA Team:
J. Alves (CAHA), E. Alfaro (IAA), A. Alonso-Herrero (IEM), A. Bolton (Hawaii), D. J. Bomans (Bochum U.), A. Boselli (LAM), A. Castillo-Morales (UCM), J. Cenarro (IAC-CEFCA), D. Cristobal (CEFCA), R.-J. Dettmar (Bochum U.), A. Diaz (UAM), J. Bland-Hawthorn (U Sydney), H. Flores (Obs. Paris) K. Freeman (ANU), A. Galazzi (MPIA), B. Garcia-Lorenzo (IAC), R. Gonz&lez-Delgado (IAA), C. Hao (IoA), C. Kehrig (AIP), K. Jahnke (MPIA), B. Johnson (IoA), M. Lehnert (Leiden), A. Lopez-Aguerri (IAC), I. Marquez (IAA), D.Mast (CAHA/IAA), J. Mendez-Abreu (IAC), M. Moles (CEFCA), A. Mourao (IST-Lisbon), S. Pedraz (CAHA), A. Pasquali (MPIA), R. Peletier (Kapteyn), E. Perez (IAA), I. Perez (Kapteyn/Univ. de Granada), A. Quirrenbach (LSW, Heidelberg), F. F. Rosales-Ortega (IoA), M. Rodrigues (IST-Lisbon), M. Roth (AIP), P. Sanchez-Blazquez (IAC), V. Stanishev (IST-Lisbon), S. Trager (Kapteyn), I. Trujillo (IAC), G. van de Ven (IAS, Princeton - MPIA), A. Vazdekis (IAC), M. Verheijen (Kapteyn), J. Vilchez (IAA), J. Walcher (ESO), L. Wisotzki (AIP), S. Zibetti (MPIA).

Until its final approval by the Calar Alto EC, CALIFA is an open collaboration, and therefore any person interested to work on the project is wellcome. If you are interested, please, send an email to the PI or any member of the collaboration.

CALIFA: Science Goals

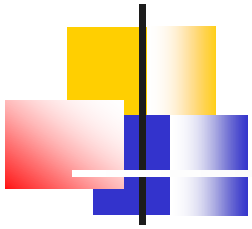
- Model the resolved stellar population in galaxies of any kind and trace the star formation history.
- Determine the nature of the ionized gas and its chemical abundance gradients.
- Determine the 2D kinematic structure of galaxies in the local Universe.

CALIFA: Secondary Goals.



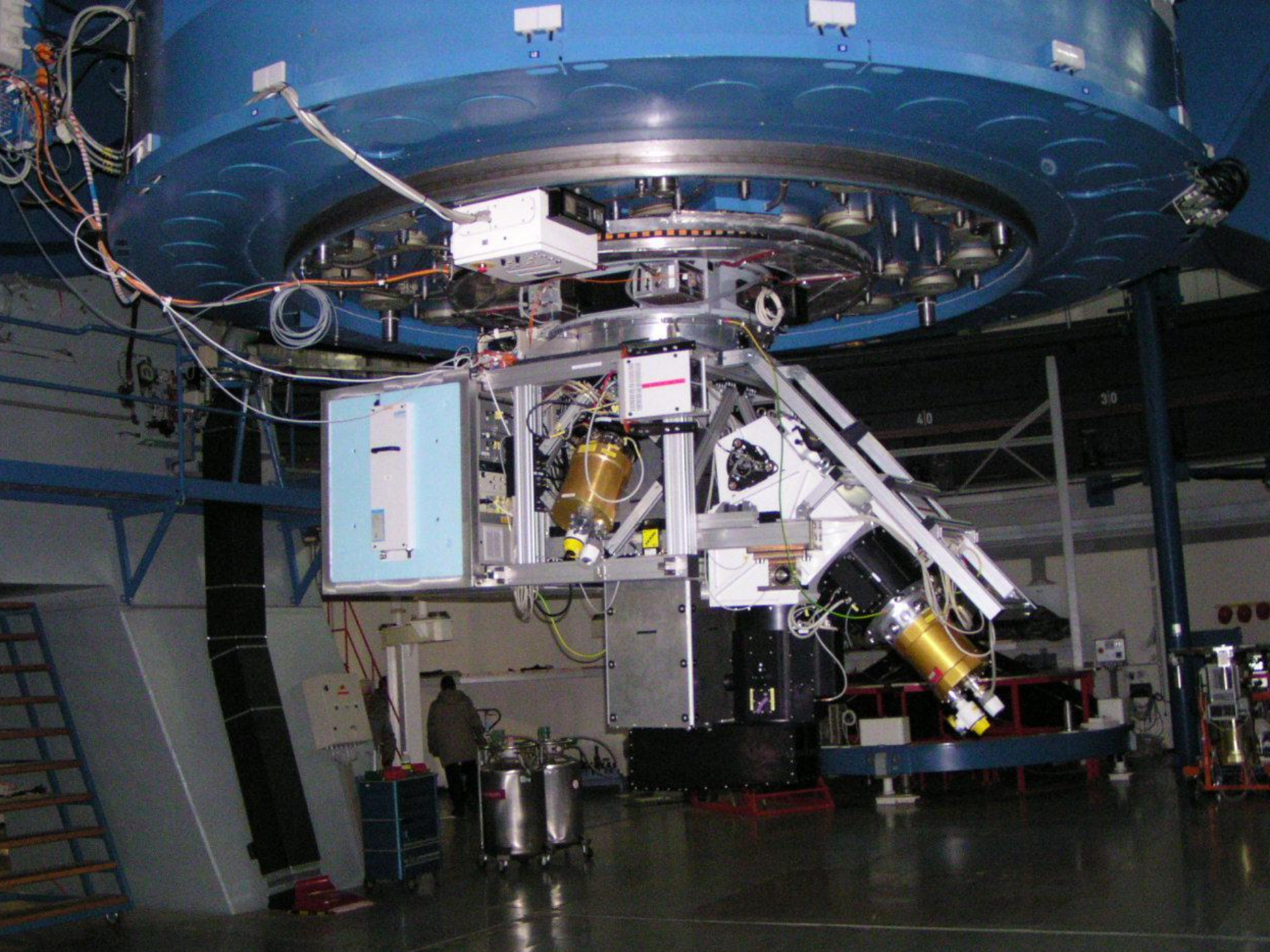
CALIFA: Legacy

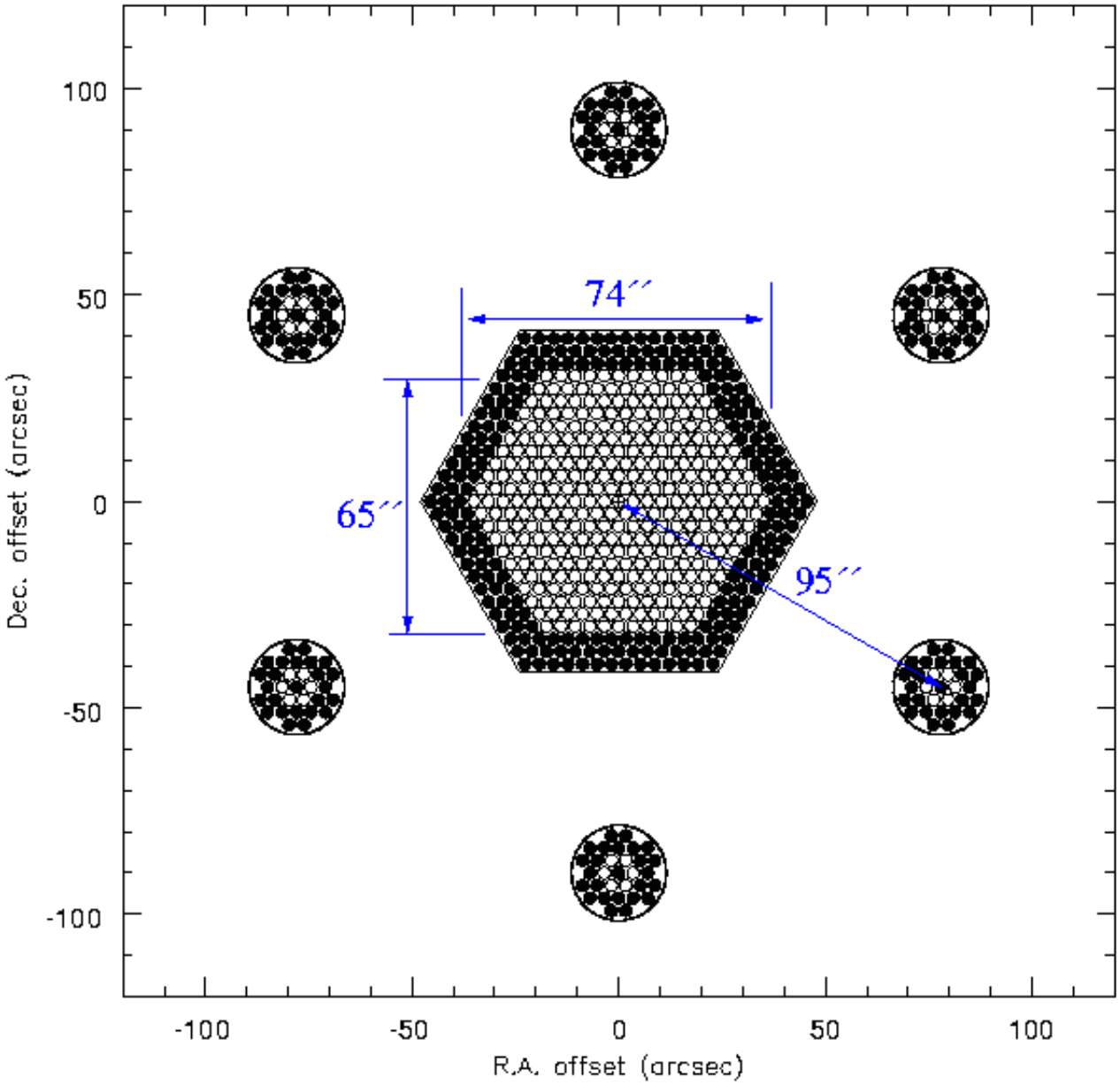
- Data will be freely distributed to the community once they have been accurately reduced.
- A careful quality control scheme will be developed to validate the data in terms of:
  - S/N and depth.
  - Wavelength Calibration.
  - Flux Calibration.



CALIFA: Legacy

- Tools to analyze the data will be also distributed:
  - Visualization tools.
  - Fitting tools.
- Multi-wavelength follow-ups has been foreseen:
  - Wise/Spitzer.
  - Radio.
  - Galex.





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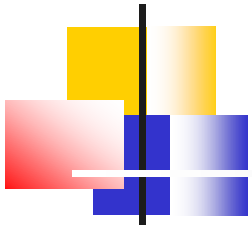
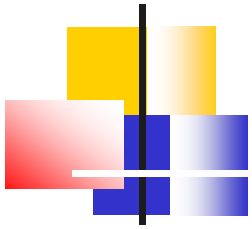
Three

on.



PMAS: R3D, the pipeline

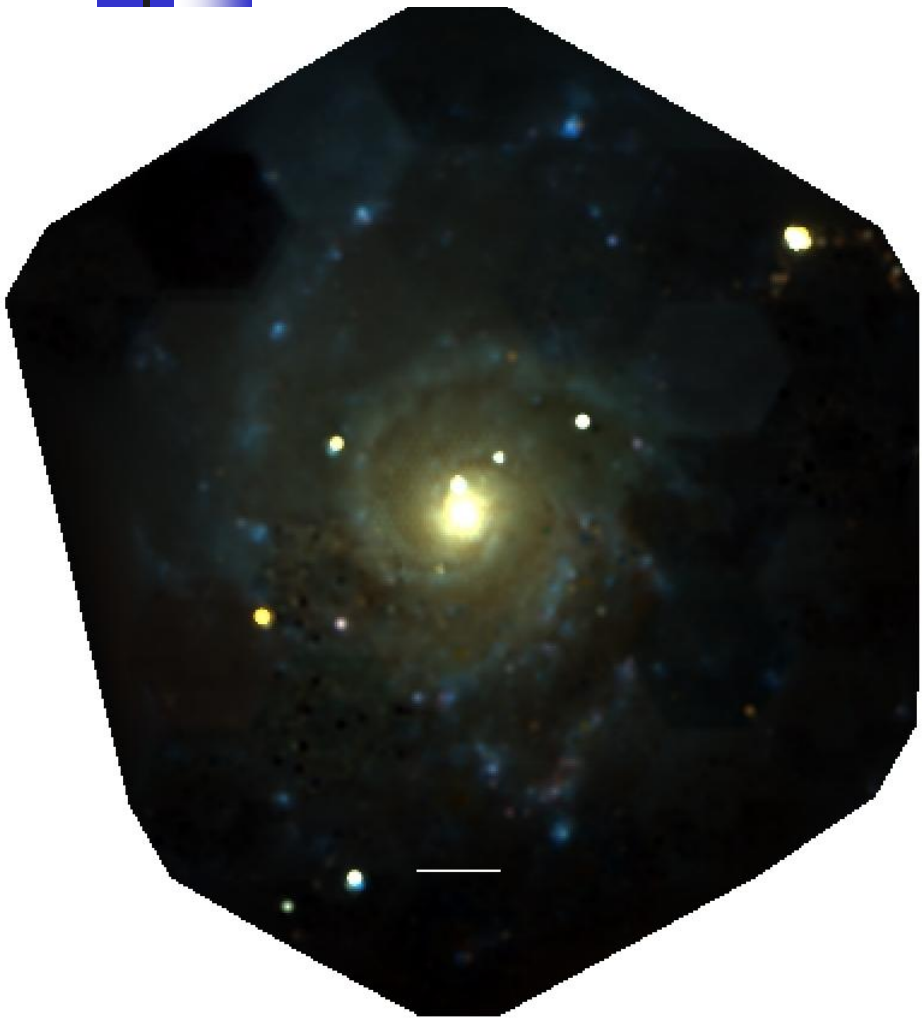
- Full reduction in a single package:
  - Bias subtraction, CCD flat-field correction.
  - Spectra extraction.
  - Wavelength calibration.
  - Fiber-to-fiber transmission correction.
  - Flux calibration (spectrophotometry).
  - Rearranging the spectra in their spatial position.
  - Fully automatic (for a fix setup).

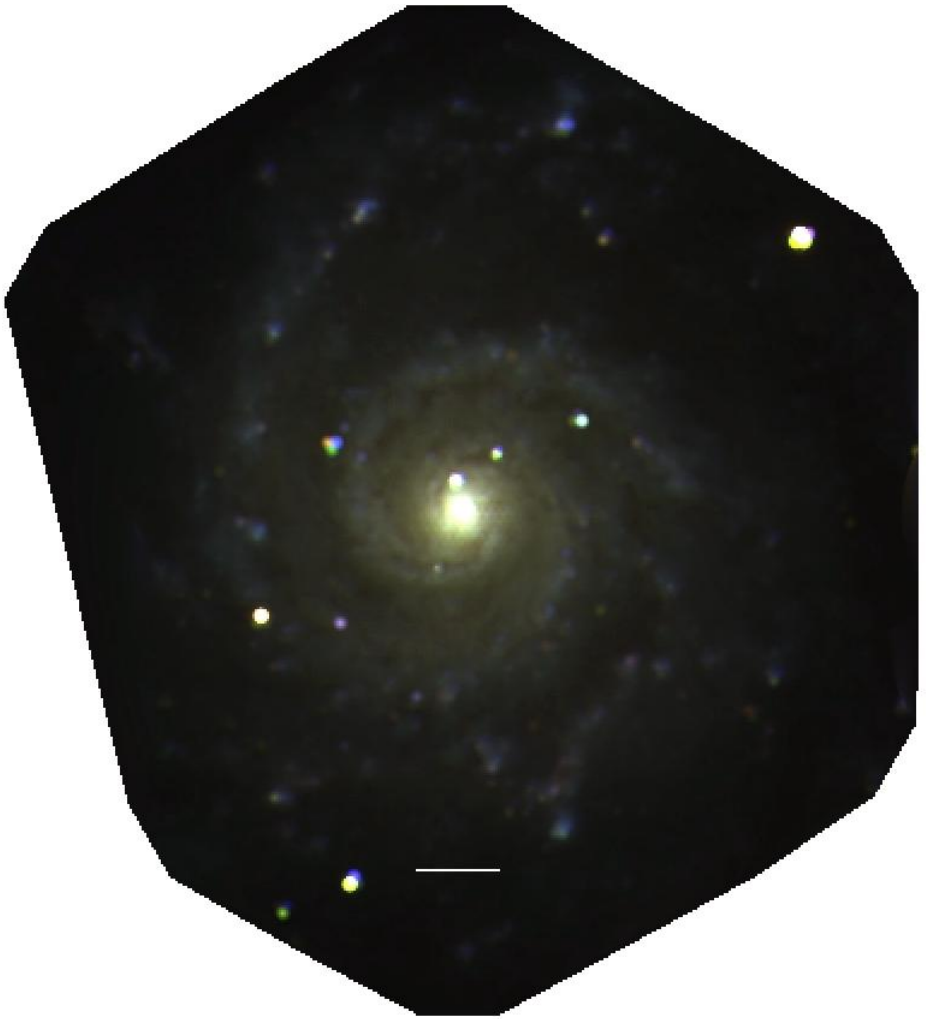


CALIFA: Software Tools.

- R3D, the pipeline is completely implemented (80% of the PMAS articles used it).
- FIT3D. A program to fit SSP and emission lines to derive 2D distributions of the different properties:
  - Age/Met/Dust distributions.
  - Flux, Velocity and Dispersion maps for the different emission line spices.
- Calar Alto Archive operational already.

Eg, M74, PPAK vs. SINGS



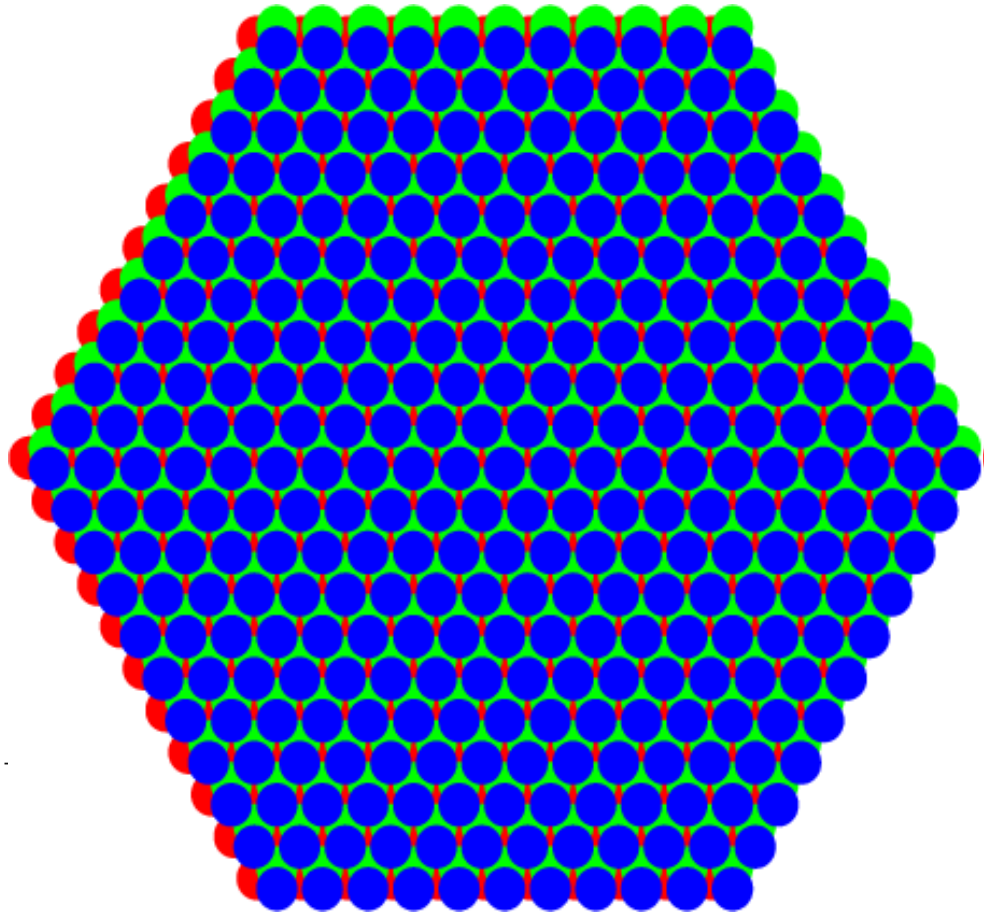


PMAS/PPAK: Comparison

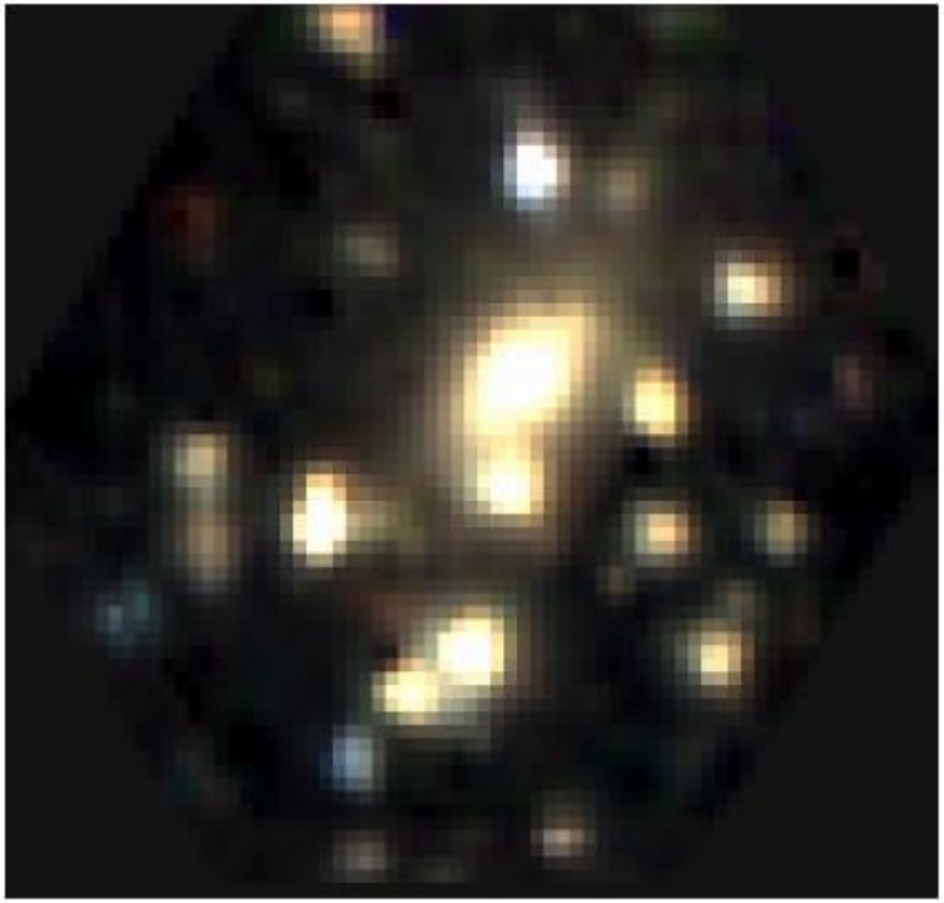
- SAURON@WHT (North Hemisphere):
  - PPAK FOV is 300% larger (33”x41”).
  - The spectral coverage for the same resolution is much larger in PPAK.
  - The spatial resolution of SAURON is better (0.94”).
  - Efficiency is similar.
  - It is a propietary instrument, only accesible to the SAURON team.
  - It has performed the largest IFU survey, so far: 50 E/SO and Sa with bulge galaxies.

PMAS/PPAK: Dithering.

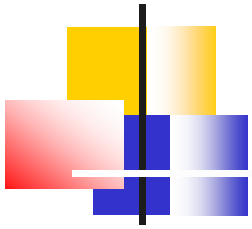
- 3 position dither pattern per pointing.
- Complete spatial covering of the FOV.
- Increase of the spatial resolution.
- Fully implemented in the pipeline.



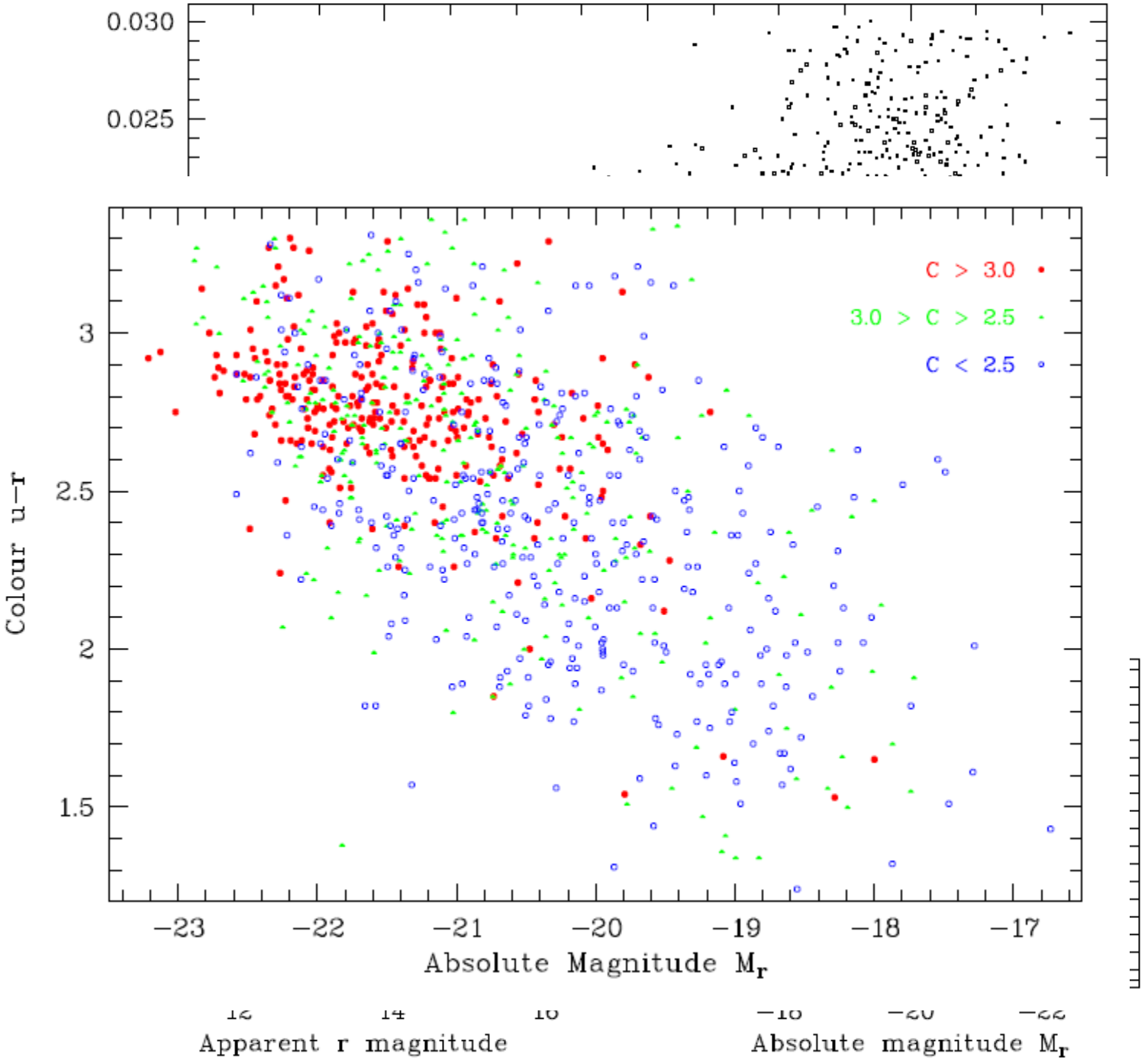
Eg, Abell2218 IFS datacube

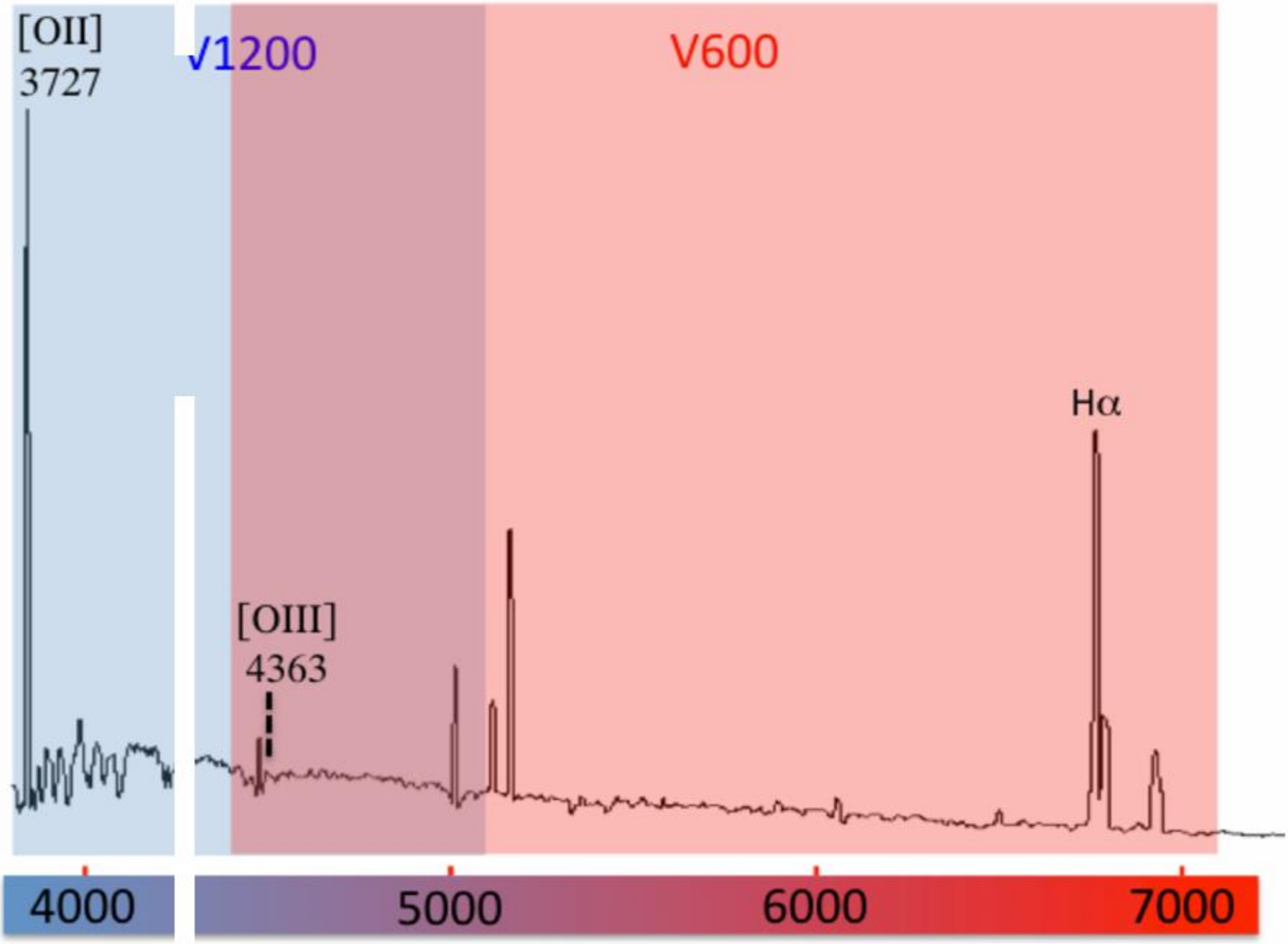


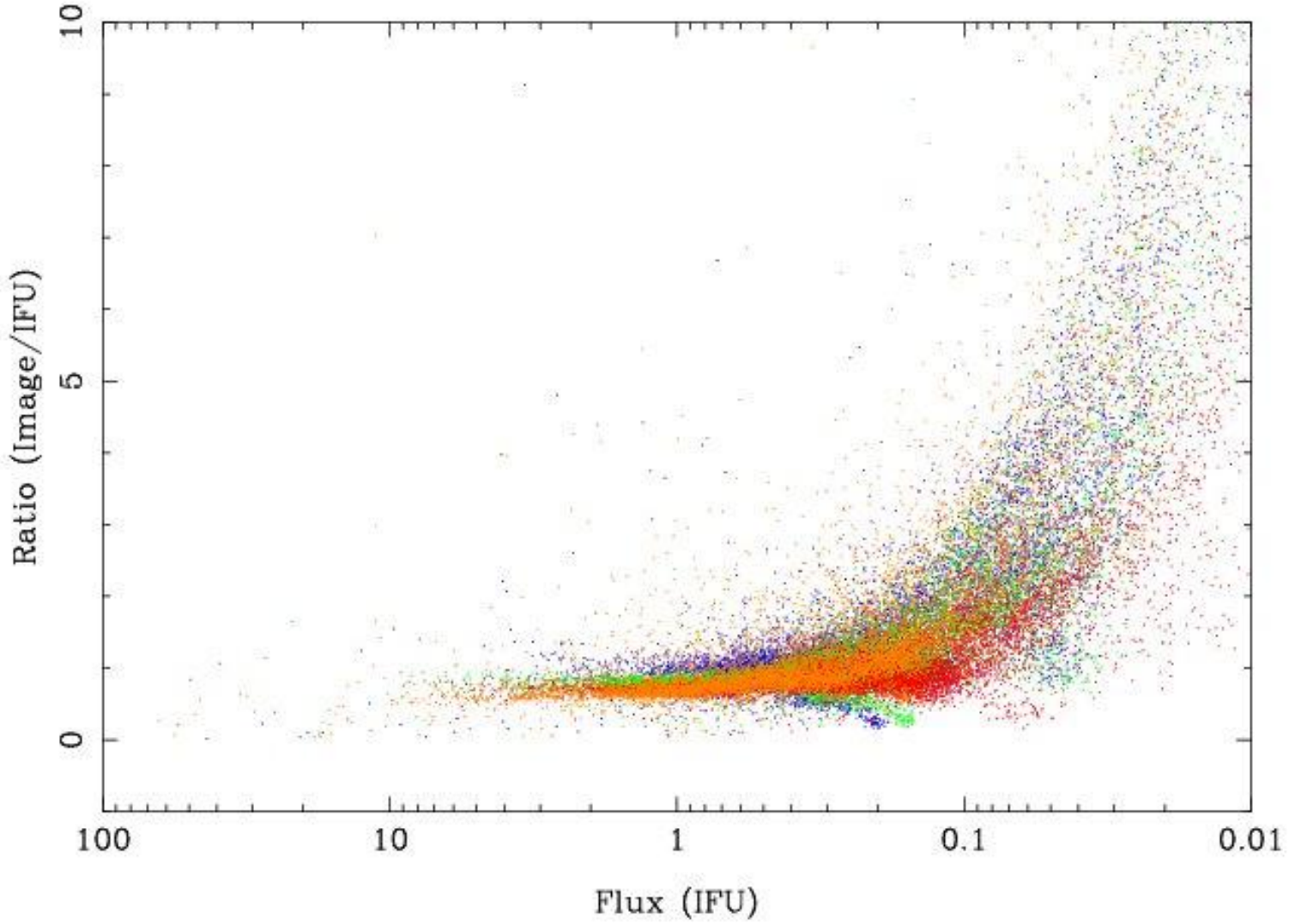
CALIFA: Sample Selection Criteria.

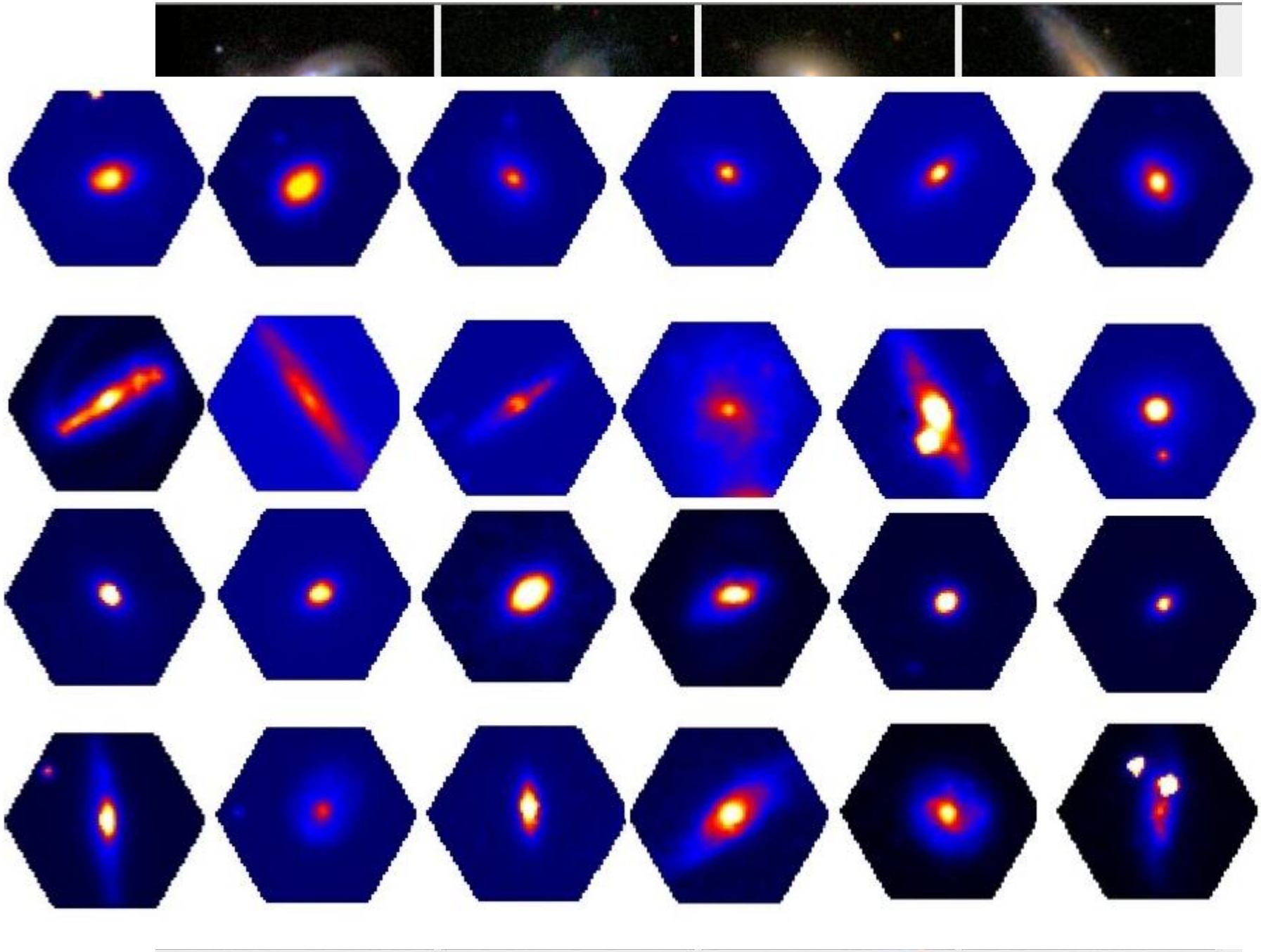


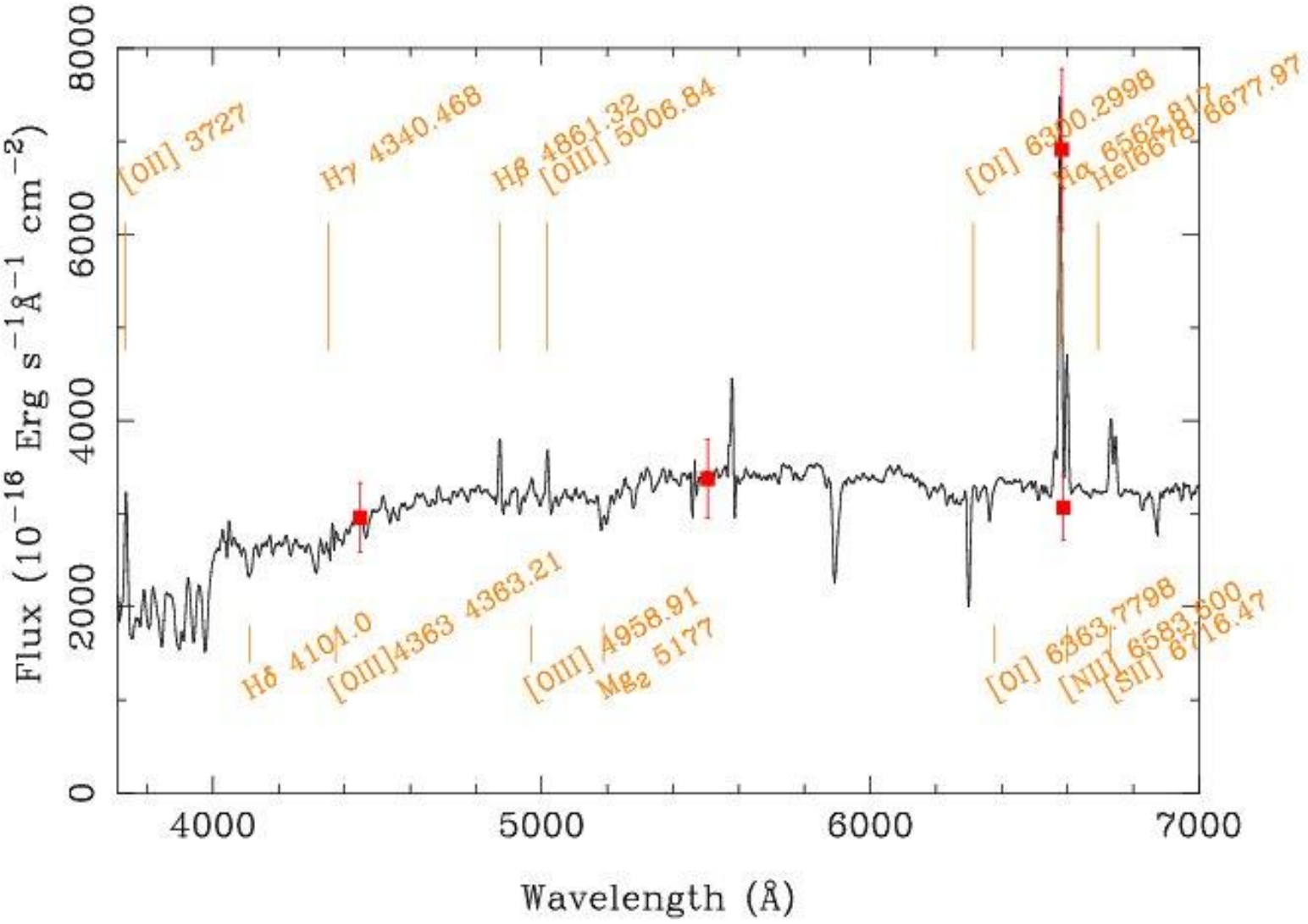
- Match the Science Goals:
  - No type selection.
  - Homogeneous covering of the Color-Magnitude Diagram.
- Maximize the 2D information.
- Cover the maximum of the galaxy size.
- Ensure the proper sky-subtraction.
- Ensure the proper S/N.

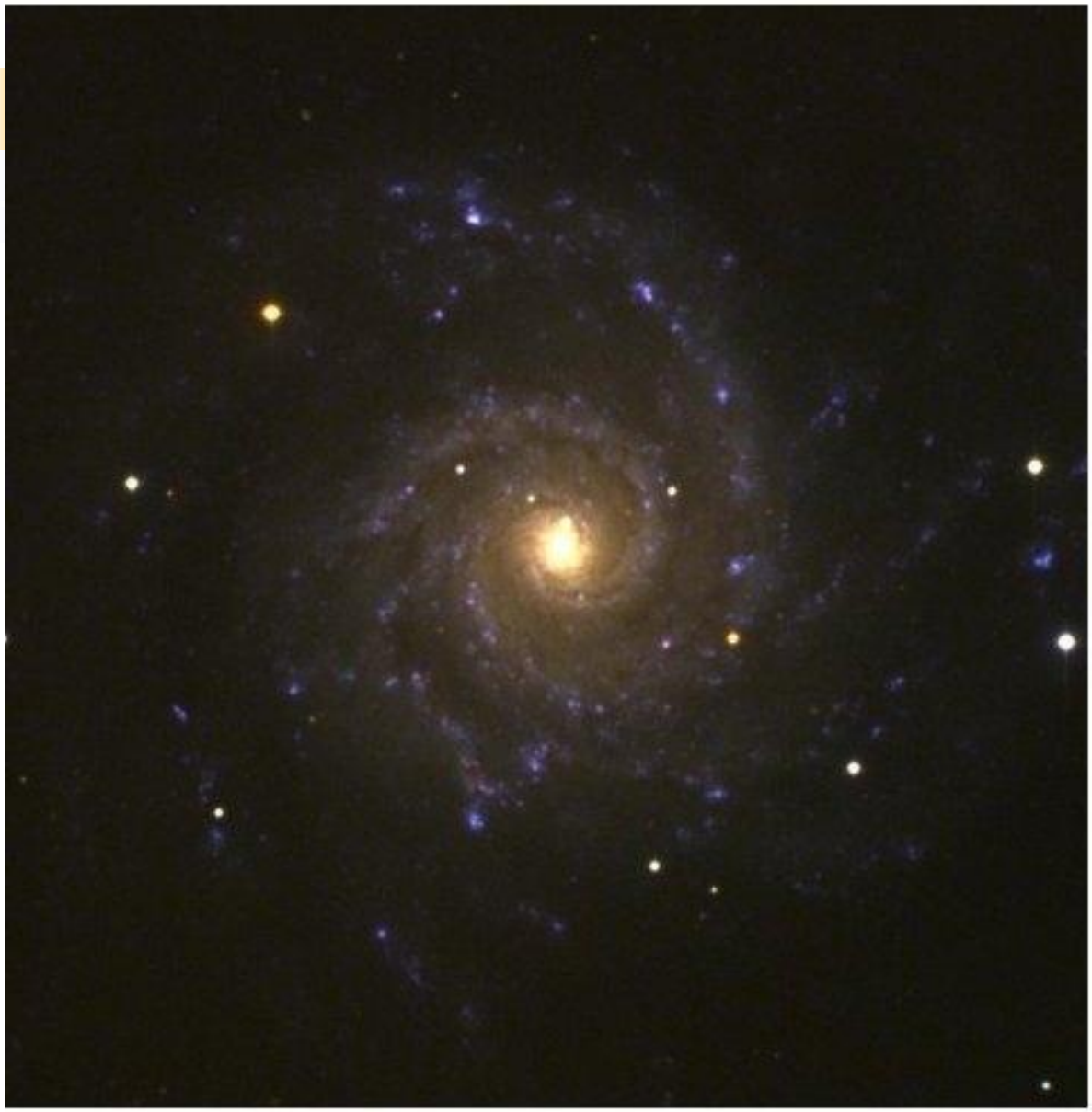

0.030
0.025
C > 3.0
3.0 > C > 2.5
C < 2.5
3
2.5
2
1.5
Colour u−r
−23
−22
−21
−20
−19
−18
−17
Absolute Magnitude M_r
Apparent r magnitude
Absolute magnitude M_r


[OII]
3727
√1200
V600
Hα
[OIII]
4363
4000
5000
6000
7000


Ratio (Image/IFU)
10
5
0
100
10
1
0.1
0.01
Flux (IFU)




[OII] 3727
Hγ 4340.468
Hβ 4861.32
[OIII] 5006.84
[OI] 6300.2998
Hα 6562.817
HeI6678 6677.97
Hδ 4101.0
[OIII]4363 4363.21
[OIII] 4958.91
Mg2 5177
[OI] 6363.7798
[NII] 6583.600
[SII] 6716.47
Flux (10^{-16} Erg $s^{-1}Å^{-1}$ cm^{-2})
0
2000
4000
6000
8000
4000
5000
6000
7000
Wavelength (Å)


Z=0.001
Z=0.05
Z=0.2
Z=0.5
Z=1.0

NGC3820

NGC4109

Flux (10^{-16} Erg s^{-1} cm^{-2} Å^{-1})

UGC1087 Flux

0.1 0.2 0.3 0.4

7 S/N

60 80 100

Flux (10^{-16} Erg s^{-1} cm^{-2} Å^{-1})

50 100 150

4000 4500 5000 5500 6000 6500

Wavelength (Å)

CALIFA: On Going…

- Updated Information at:
  - http://www.caha.es/sanchez/legacy/oa/
- I would like to thank to all the CALIFA Team, and in particular the working team at CAHA/CEFCA:
  - Dra. Esther Mármol.
  - Dr. Damian Mast.
  - Dra. Kerttu Viironen.
  - Dña. Raffaella Marino.