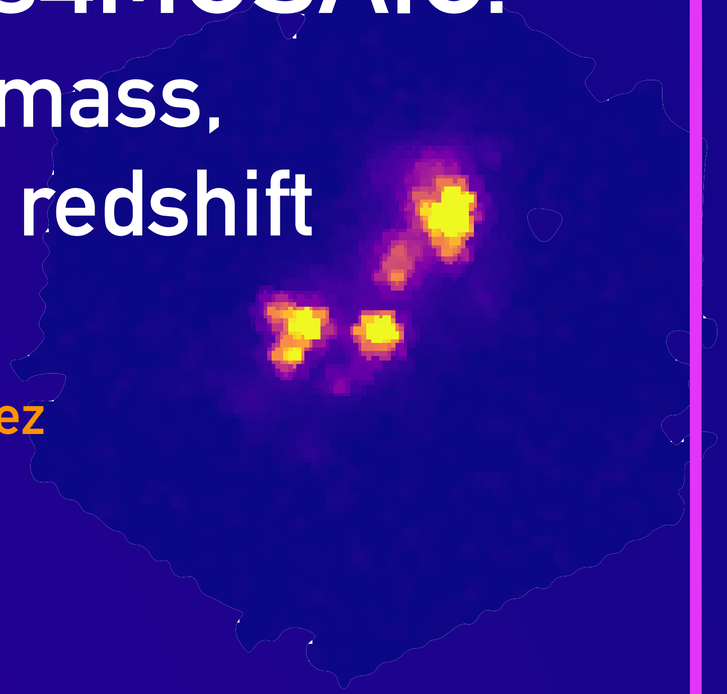
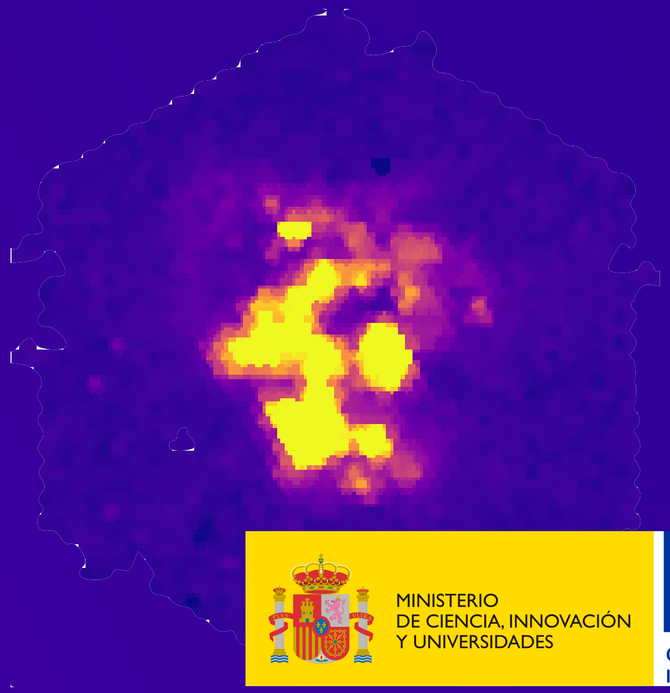
Preliminary Results from Dwarfs4MOSAIC:
A two-dimensional study of low-mass, high star-formation galaxies at low redshift



PhD thesis supervised by:
Jesús Gallego Maestro and Nicolás Cardiel López

María Chillarón Víctor



IV Reunión Científica de GUAIX
December 17th 2025

MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

Cofinanciado por la Unión Europea

AGENCIA ESTATAL DE INVESTIGACIÓN

MOSAIC
A unique instrument for the biggest telescope

GUAIX

IPARCOS

PID2021-123417OB-I00, funded by MCIN/AEI10.13039/501100011033/FEDER, EU

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- Dwarfs4MOSAIC ITP
- Some of the progress made this year
  - Spectral line analysis tools
  - MEGARA Data Reduction Pipeline improvements: megaradrpsimul
  - MEGARA Data Reduction Pipeline improvements: numina-crmasks
- What’s coming next

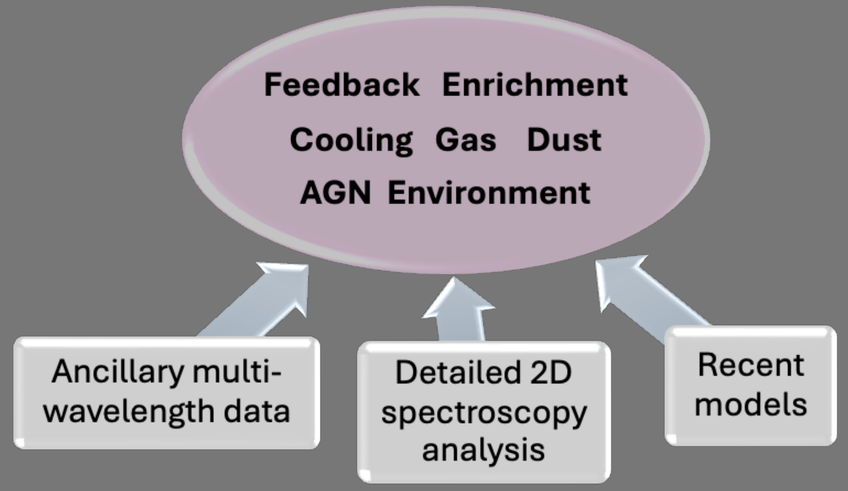
Dwarfs4MOSAIC ITP

La Palma International Time Program

MOSAIC
A unique instrument for the biggest telescope

A pilot study for MOSAIC at ELT
A 2D study of low-mass star-forming galaxies as low-redshift analogs to reionization-epoch primeval galaxies.

PI Jesús Gallego



Dwarfs4MOSAIC ITP

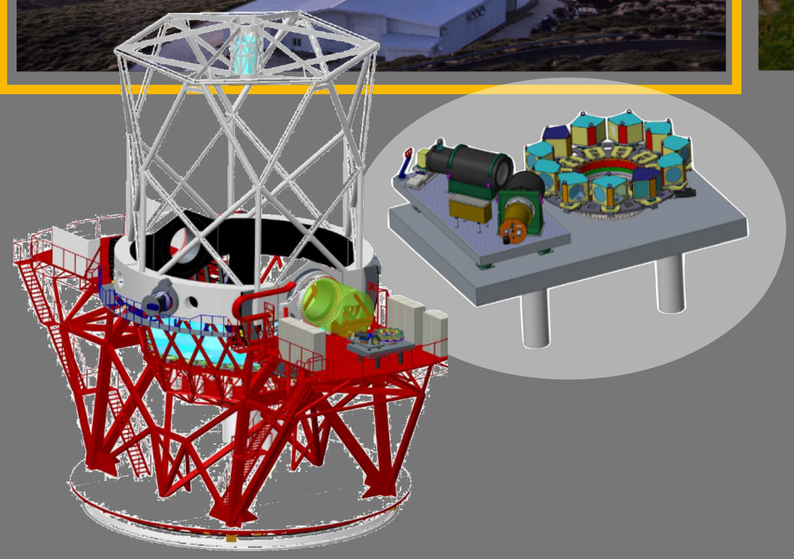
La Palma International Time Program

SBS 0335-052W
Mrk1486
J1105+4444

Dwarfs4MOSAIC ITP

La Palma International Time Program

SBS 0335-052W
Mrk1486
J1105+4444



MEGARA instrument and Gran Telescopio Canarias.
Credit: Gran Telescopio Canarias (GTC)

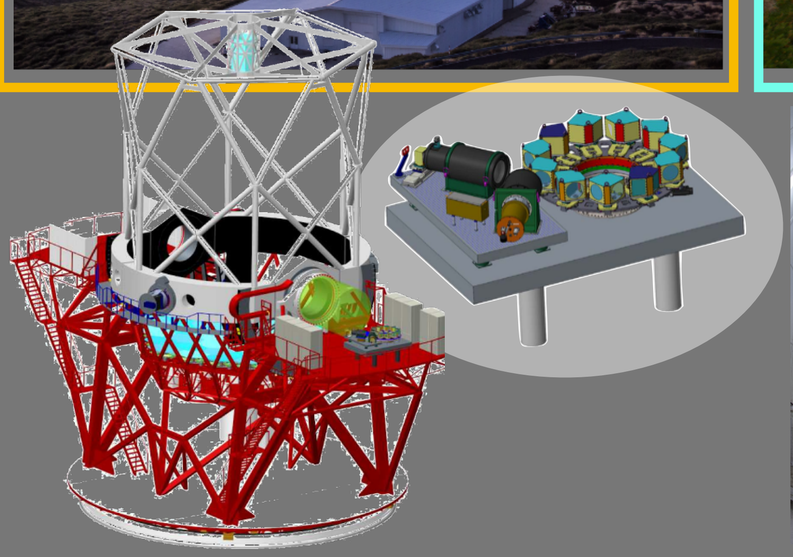
10.4m Gran Telescopio Canarias
Spectrograph based on fibers
* IFU mode
623 spaxels (567 LCB + 56 sky) of 0.62''

VPH Name	Setup	R_{FWHM}	$\lambda_1 - \lambda_2$ (Å)	λ_c (Å)
VPH405-LR	LR-U	6028	3653 - 4386	4051
VPH480-LR	LR-B	6059	4332 - 5196	4800
VPH675-LR	LR-R	6099	6094 - 7300	6747

Dwarfs4MOSAIC ITP

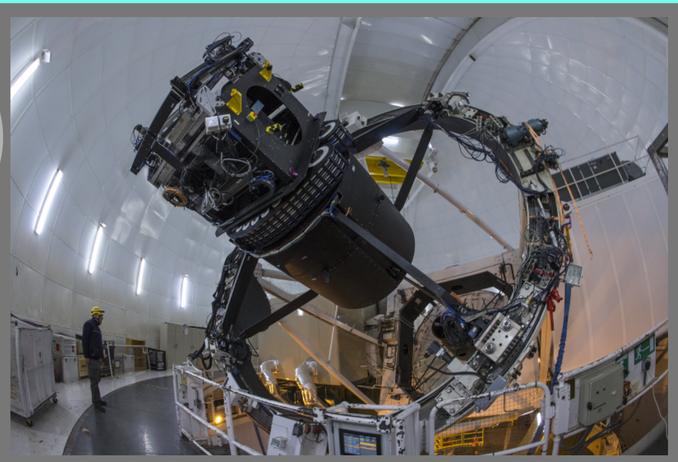
La Palma International Time Program

MEGARA @ GTC



MEGARA instrument and Gran Telescopio Canarias.
Credit: Gran Telescopio Canarias (GTC)

WEAVE @ WHT



WEAVE on the WHT. Credit Javier Méndez

M81DwarfB
UGC4483
UGC9128
NGC4163
UGC6456
VCC0545
VCC1348
VCC1389

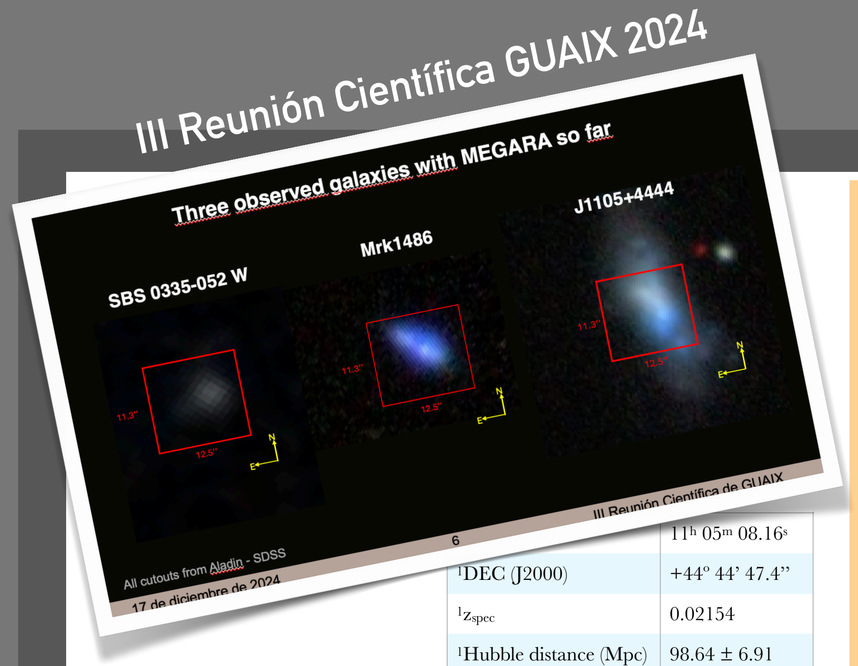
SBS 0335-052W
Mrk1486
J1105+4444

4.2m William Herschel Telescope
* LIFU (large integral-field unit)
603 fibers (547 + 56 sky) of 2.6''
Low-resolution observations:
- Blue arm (3660-6060 A)
- Red arm (5790-9590 A)

Reduction pipeline: CASU Cambridge

Some of the progress made this year

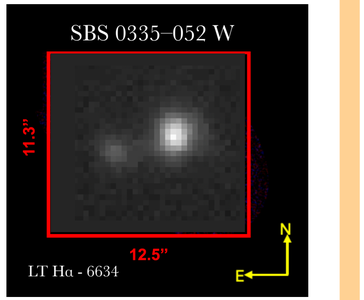
MEGARA galaxies

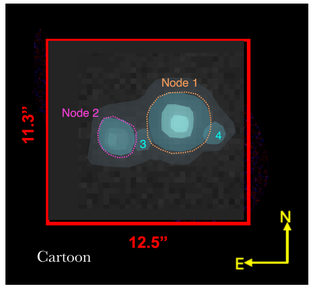


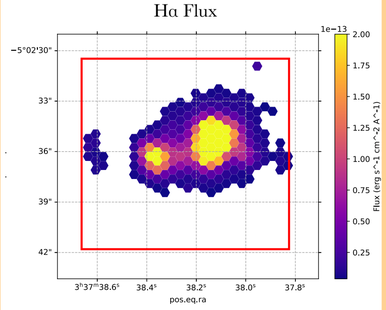
[1]RA (J2000)	$03^h\ 37^m\ 44.06^s$
[1]DEC (J2000)	–05º 02’ 40.2”
[1] z_{spec}	0.013585
[1,2]Hubble distance (Mpc)	57.11 ± 4.00
[3]Diameter (arcsec; kpc)	5.2 ; 1.3
[4] 12+log(O/H)	7.22 ± 0.07 (node 1) 7.01 ± 0.07 (node 2)
[5] $M^*/(M^*+M_{gas})$	0.016
[5] M_{dyn} ($M_\odot$)	$7.9 \cdot 10^9$
[5] M_{HI} ($M_\odot$)	$5.8 \cdot 10^8$

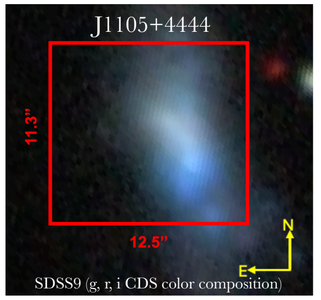
[1]RA (J2000)	$11^h\ 05^m\ 08.16^s$
[1]DEC (J2000)	+44º 44’ 47.4”
[1] z_{spec}	0.02154
[1]Hubble distance (Mpc)	98.64 ± 6.91
[1]Diameter (arcsec; kpc)	40.33 ; 19.79
[2] 12+log(O/H)	8.12
[2] log($M^*/M_\odot$)	8.69
[2] SFR ($M_\odot$/yr)	3.63

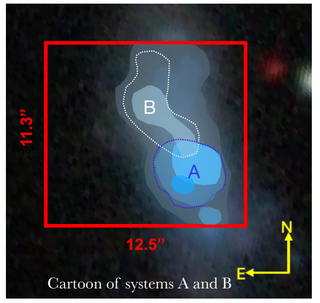
[1]RA (J2000)	$13^h\ 59^m\ 50.90^s$
[1]DEC (J2000)	+57º 26’ 22.99”
[2] z_{spec}	0.033841
[1]Hubble distance (Mpc)	151.20 ± 10.58
[1]Diameter (arcsec; kpc)	13.38 ; 10.08
[3] 12+log(O/H)	7.8
[2] log($M^*/M_\odot$)	9.3 ± 0.2
[4] SFR ($M_\odot$/yr)	3.6 ± 0.7

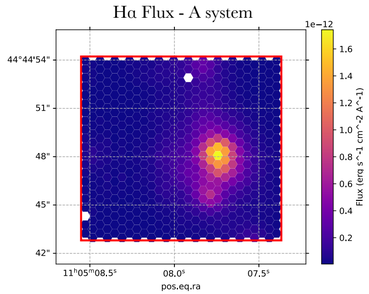


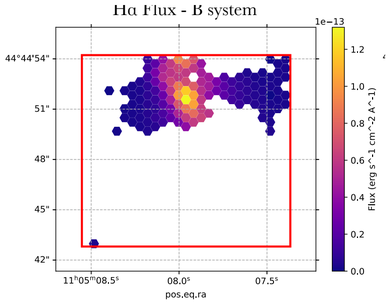


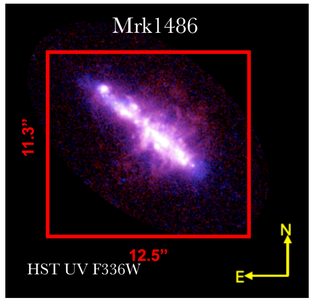


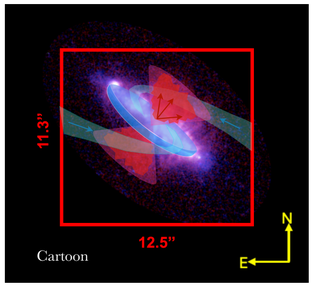


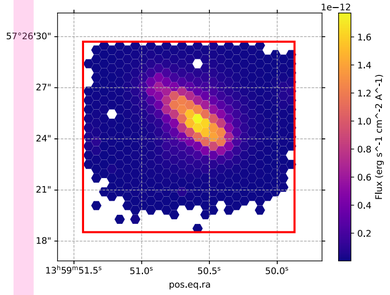






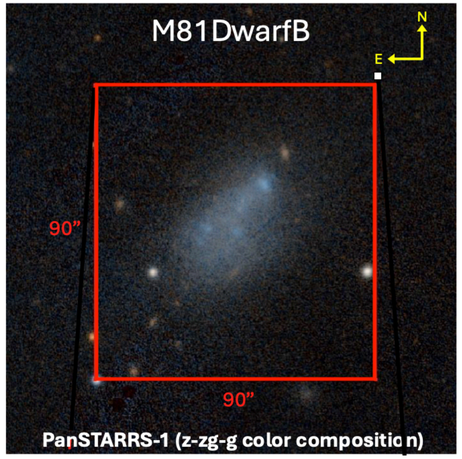


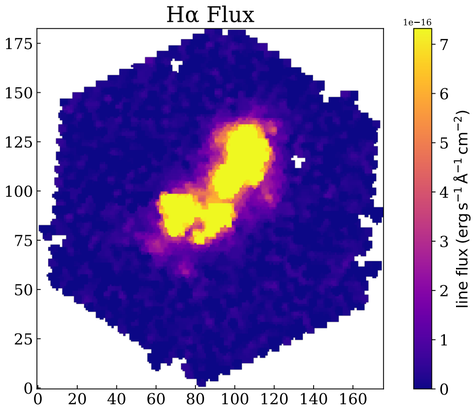


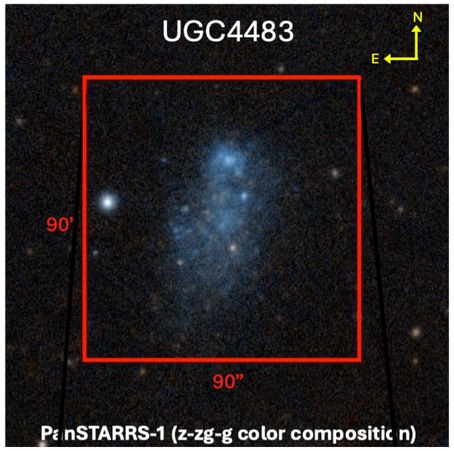


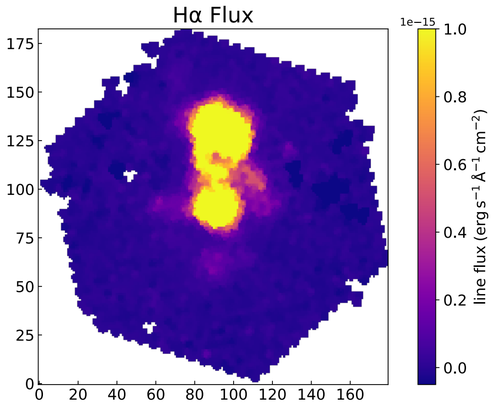
Some of the progress made this year

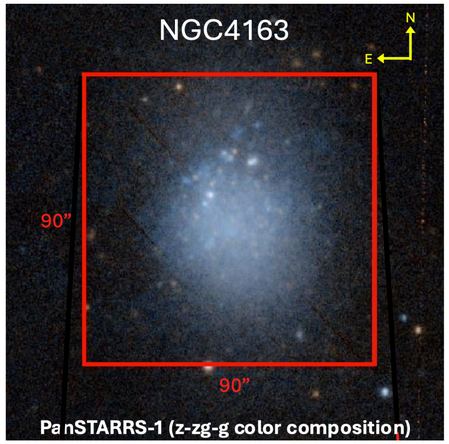
WEAVE galaxies

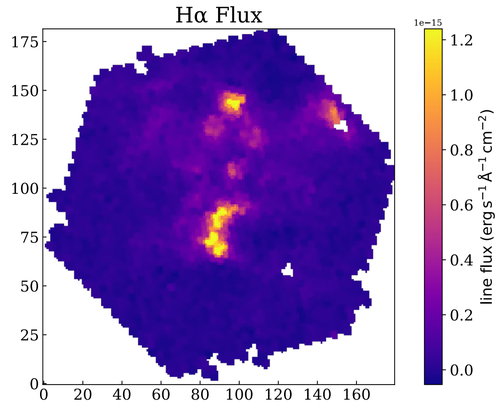


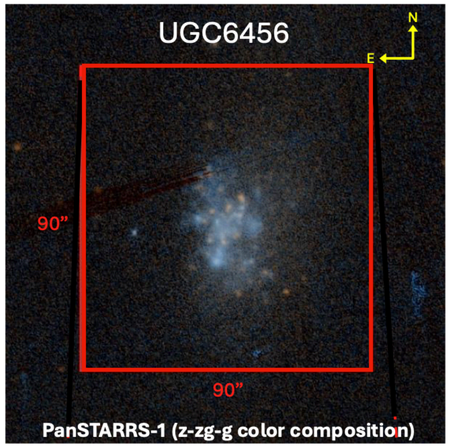


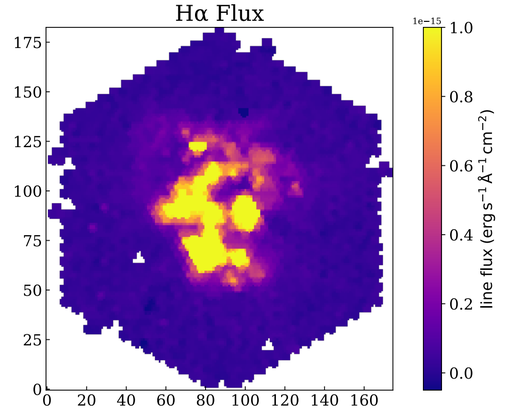






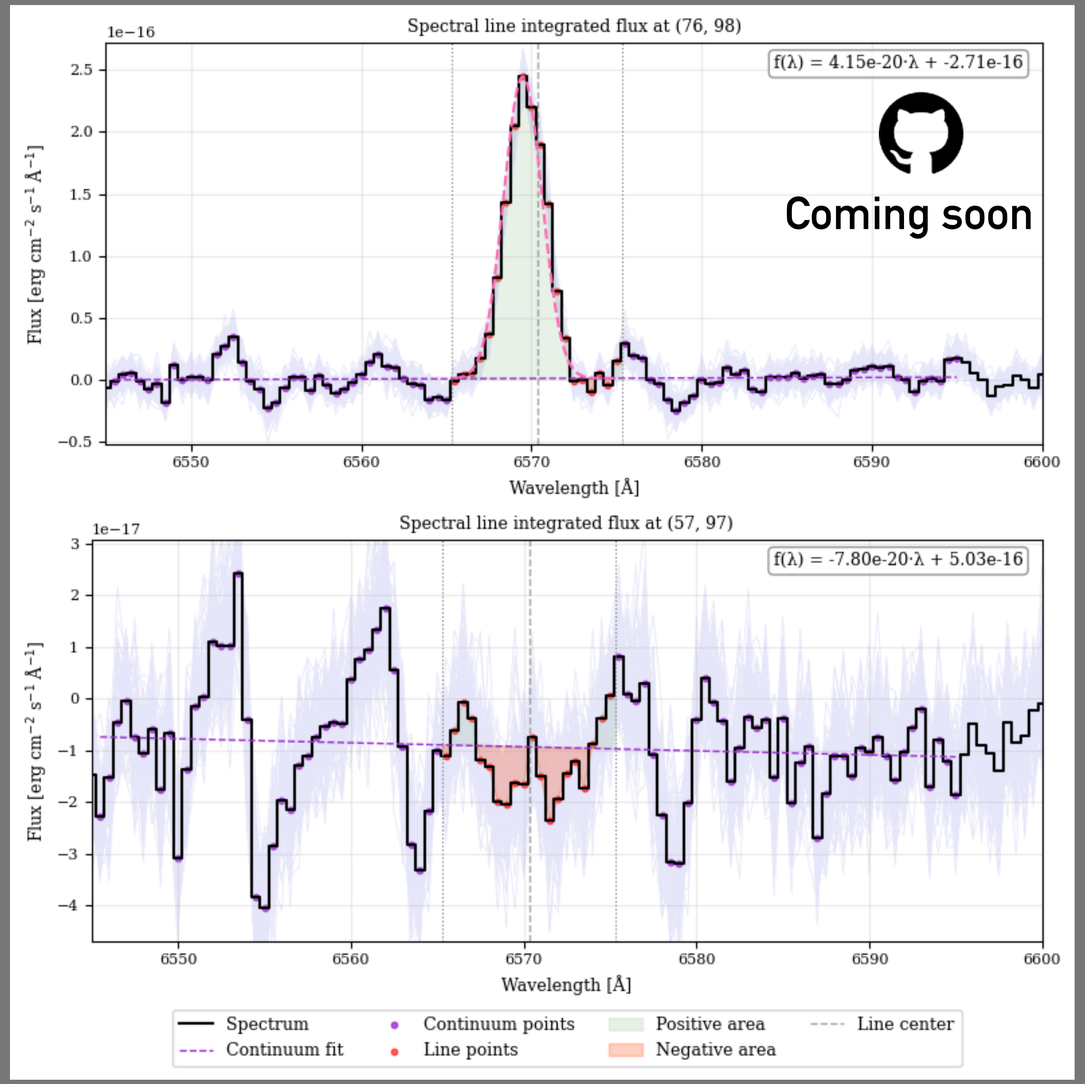






Some of the progress made this year

WEAVE galaxies



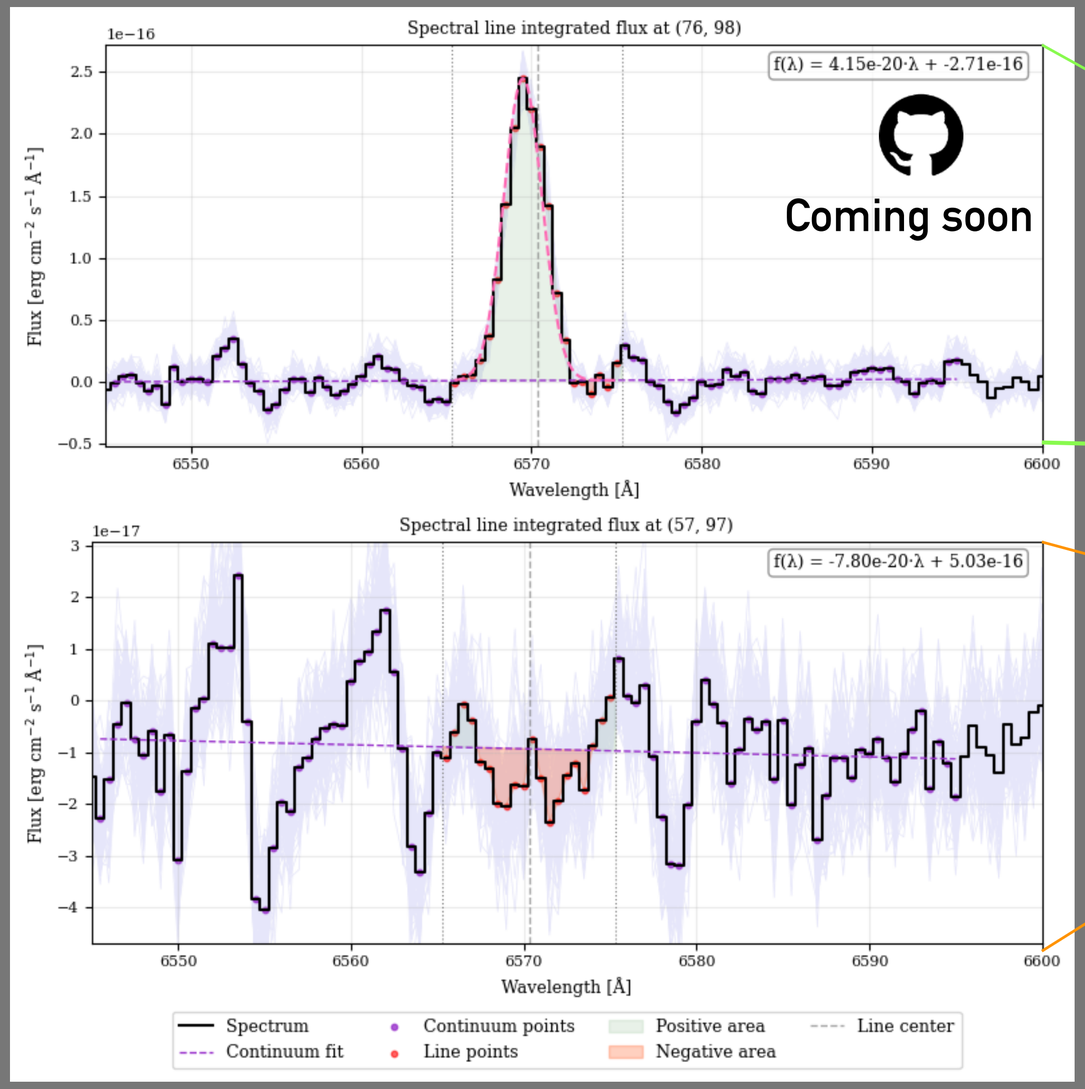
Coming soon

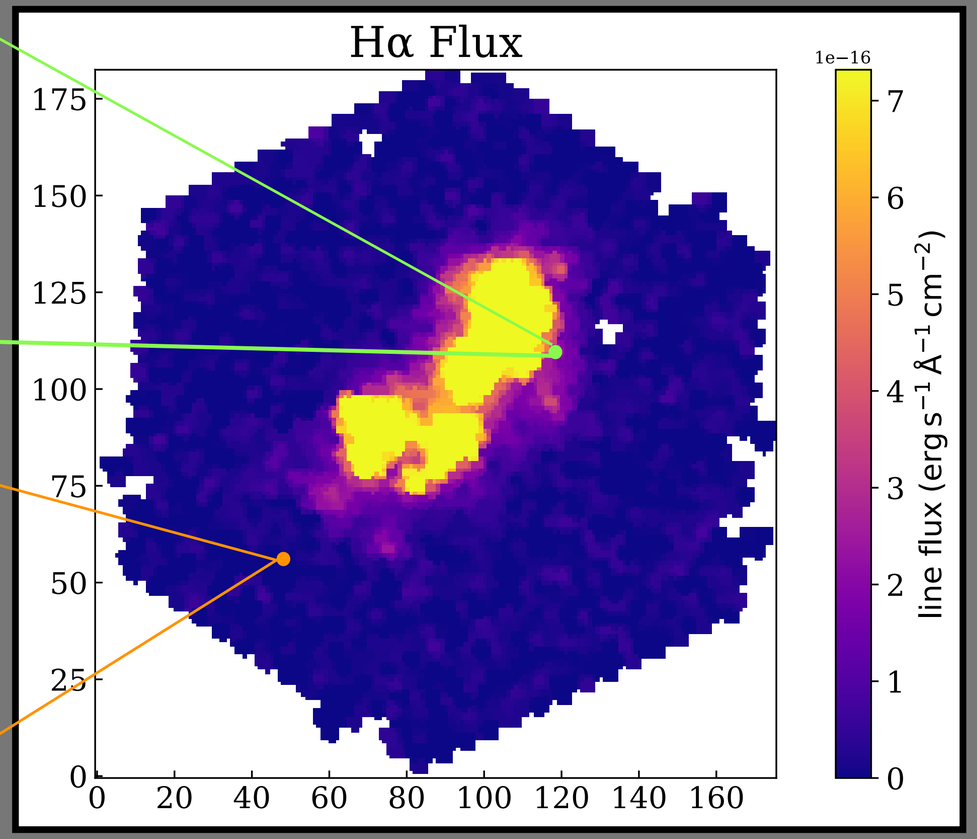
Code for spectral line analysis:

- Line flux measurement using trapezoidal integration
- Gaussian fitting for parameter estimation (σ, amplitude, central wavelength)
- Flux maps, line ratios, and other properties such as velocity or velocity dispersion

Some of the progress made this year

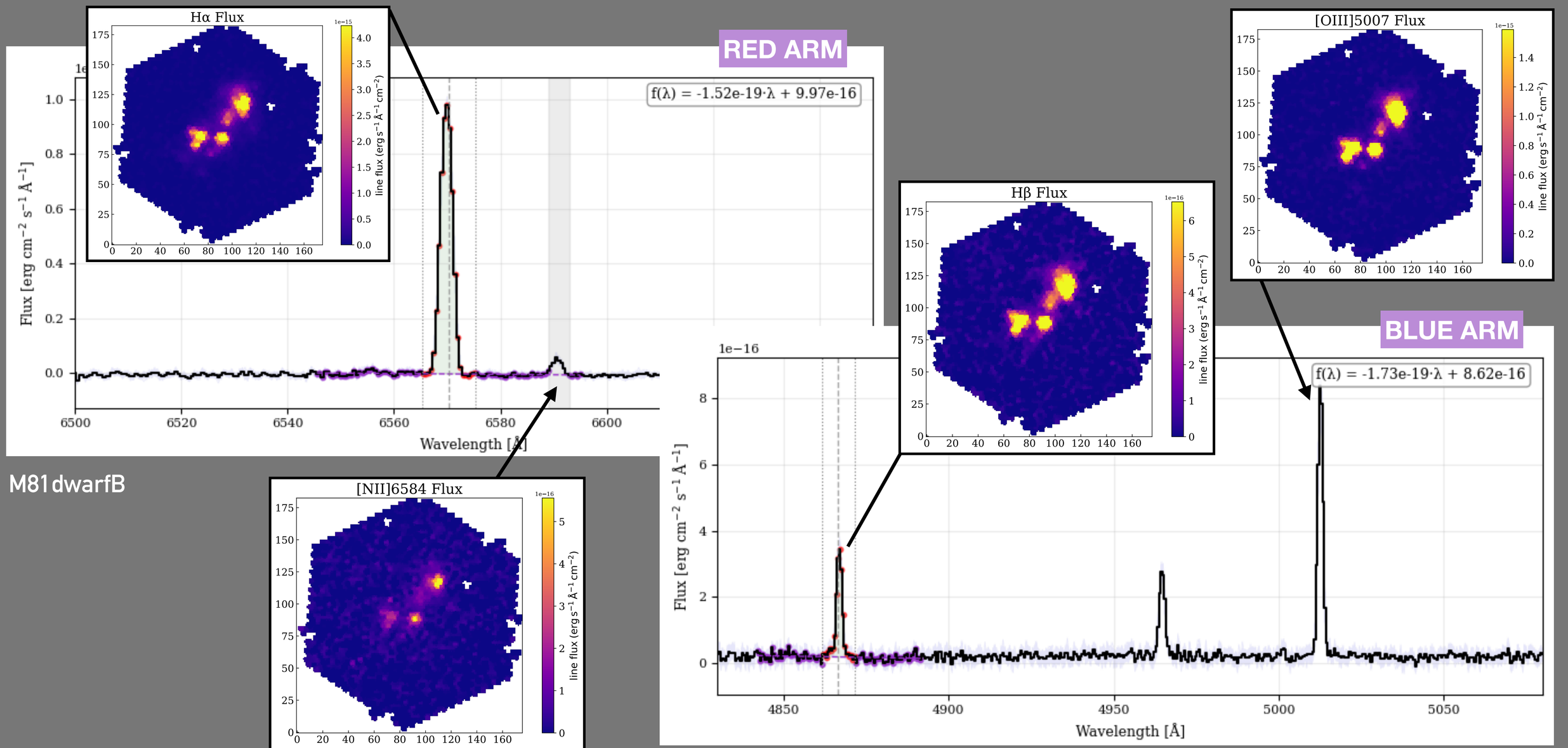
WEAVE galaxies





M81dwarfB

Some of the progress made this year



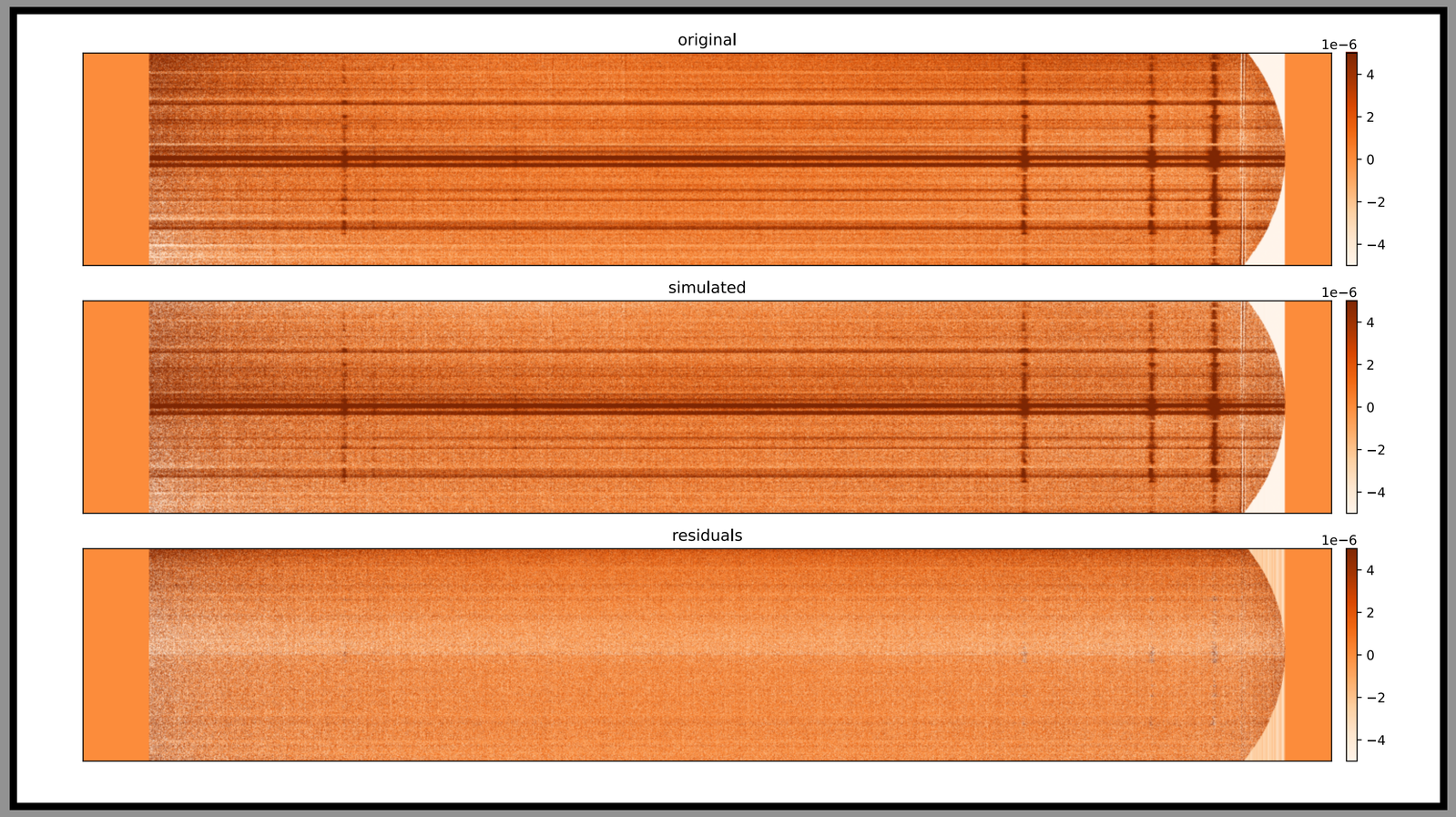
Some of the progress made this year

MEGARA Data Reduction Pipeline

`megaradrpsimul`
mchillaron

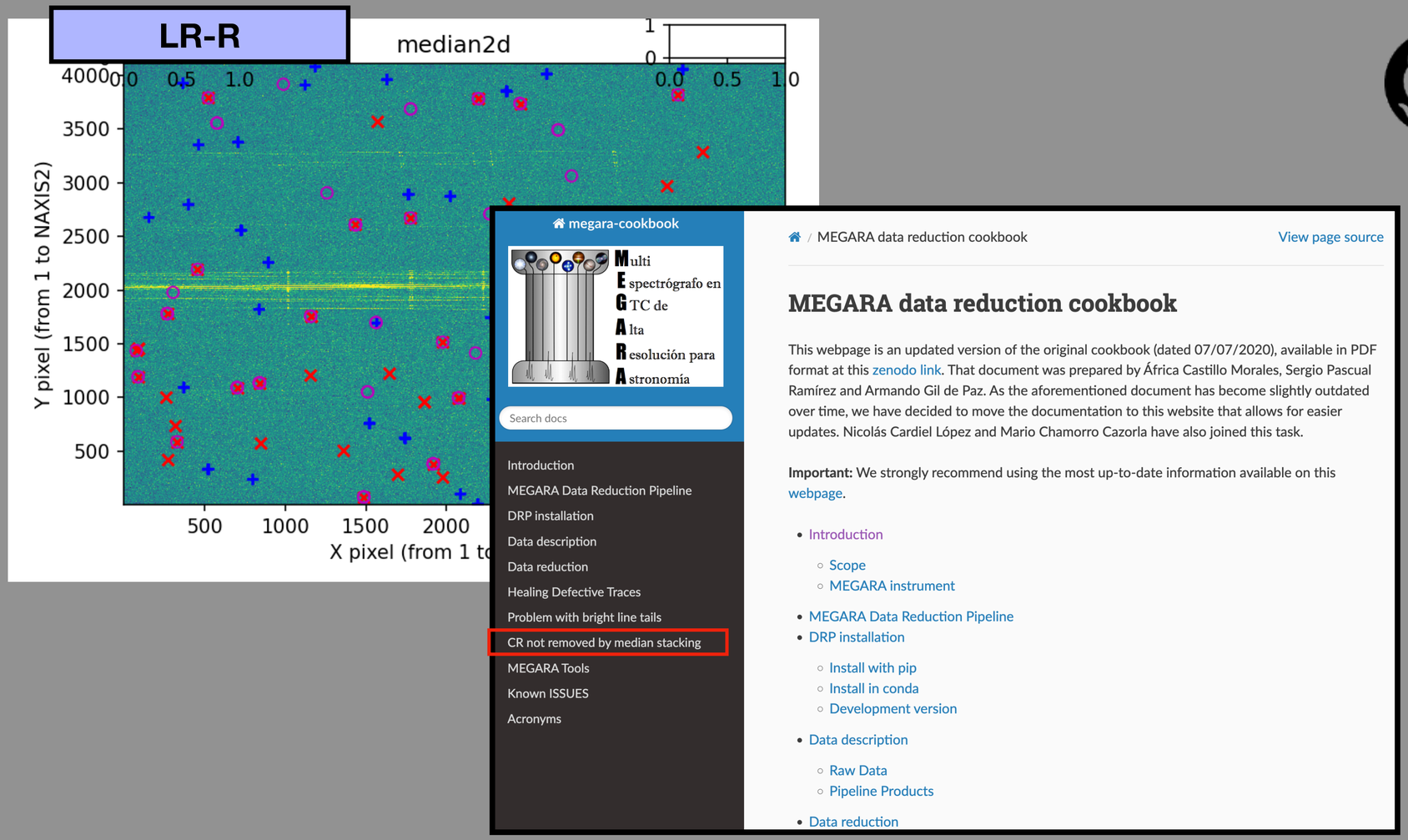
Simulation of raw MEGARA images with Poisson statistics and automated data reduction.

Uncertainty estimation through bootstrapping: error estimation by repeating the analysis multiple times, each time using a new resampled dataset reconstructed from the original data.



Some of the progress made this year

MEGARA Data Reduction Pipeline



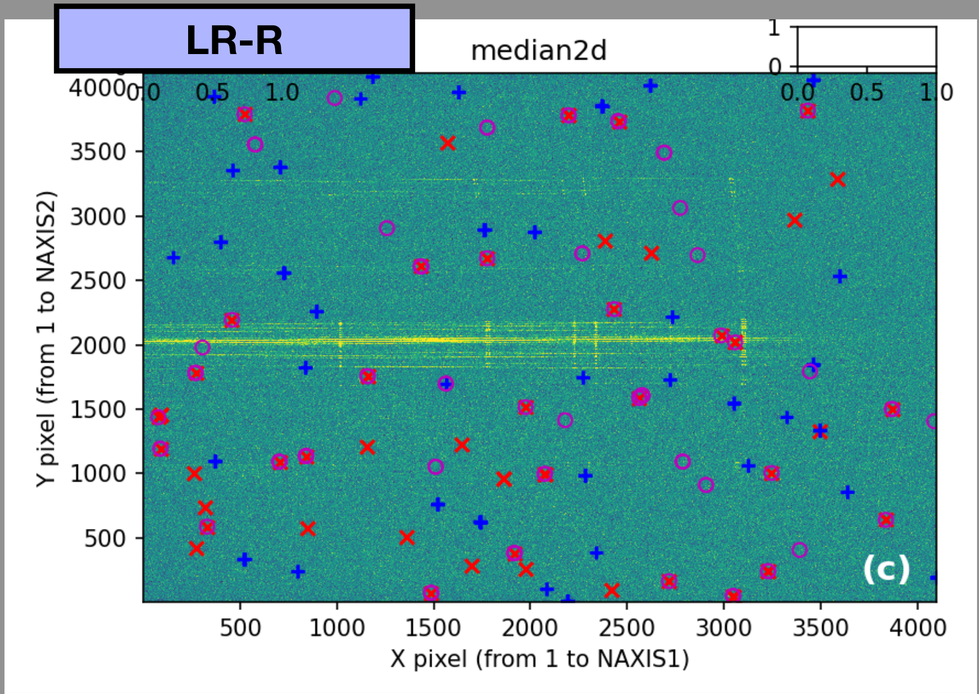
crmasks
guaix-ucm/numina
nicocardiel

Median combination effectively cleans pixels affected by cosmic rays when they are present in only a single exposure.

Pixels affected by cosmic rays in more than one exposure (double or triple CRs) have been found to remain uncorrected in the final image.

Some of the progress made this year

MEGARA Data Reduction Pipeline



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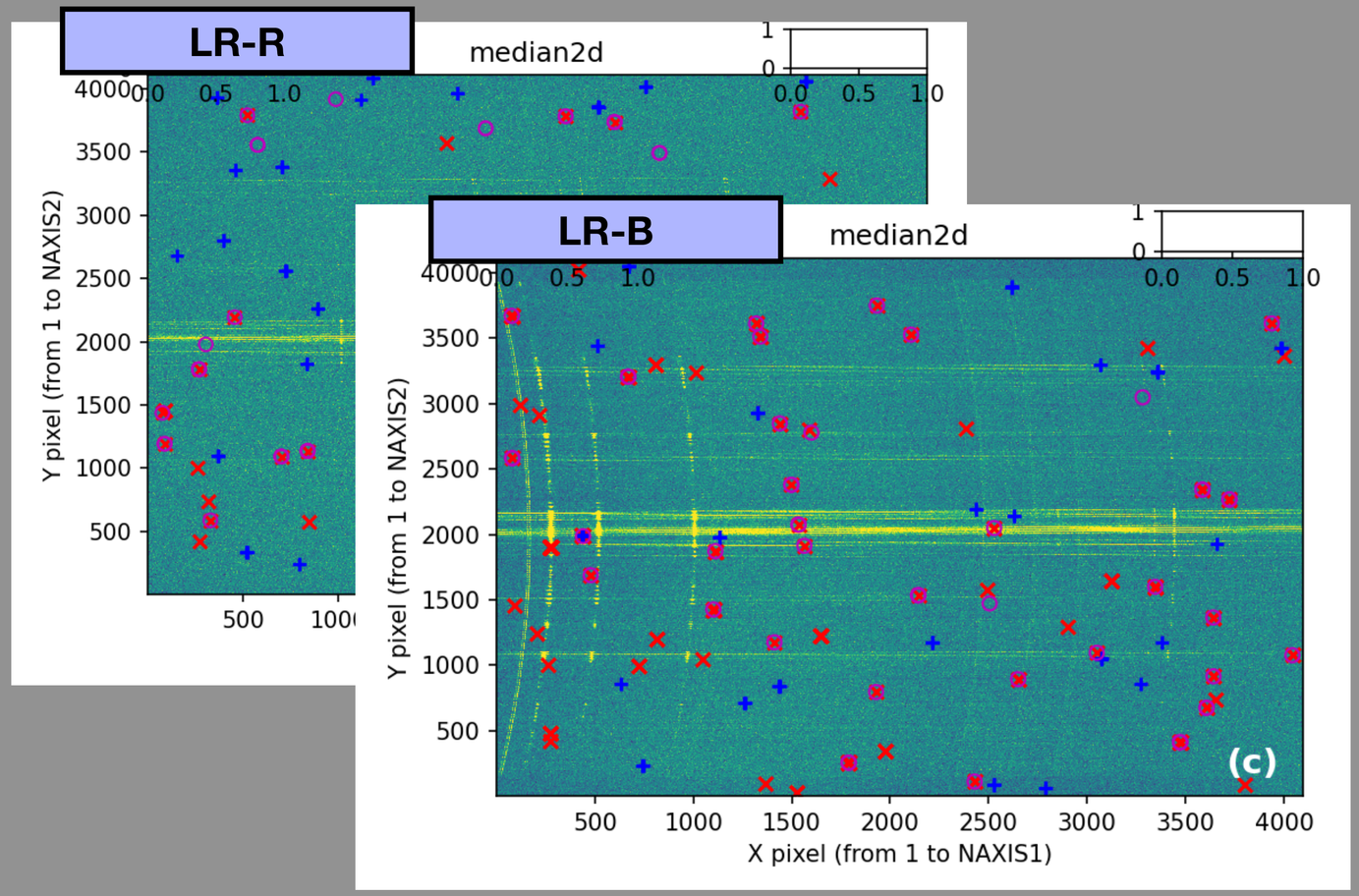
Some of the progress made this year

MEGARA Data Reduction Pipeline



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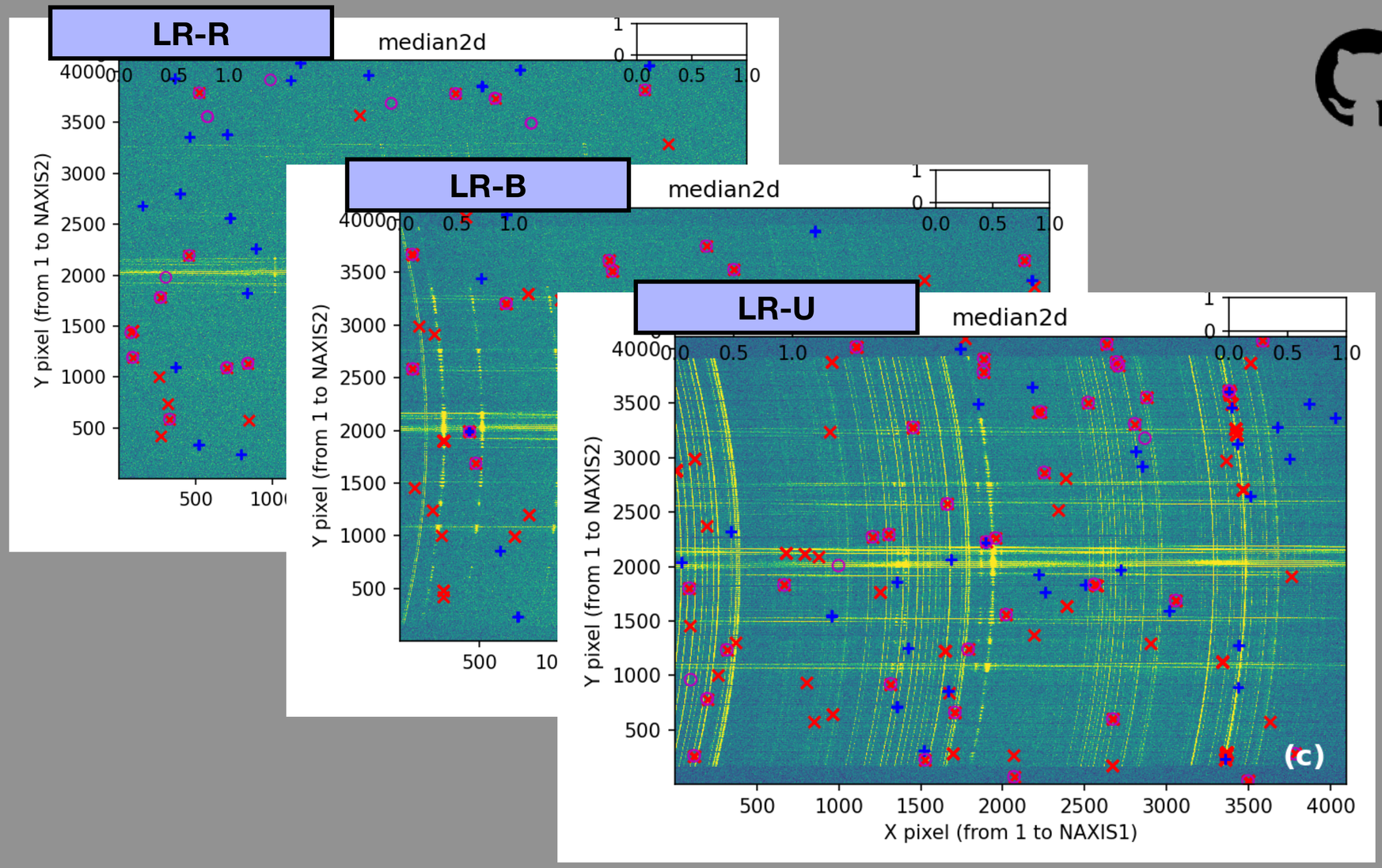
Some of the progress made this year

MEGARA Data Reduction Pipeline



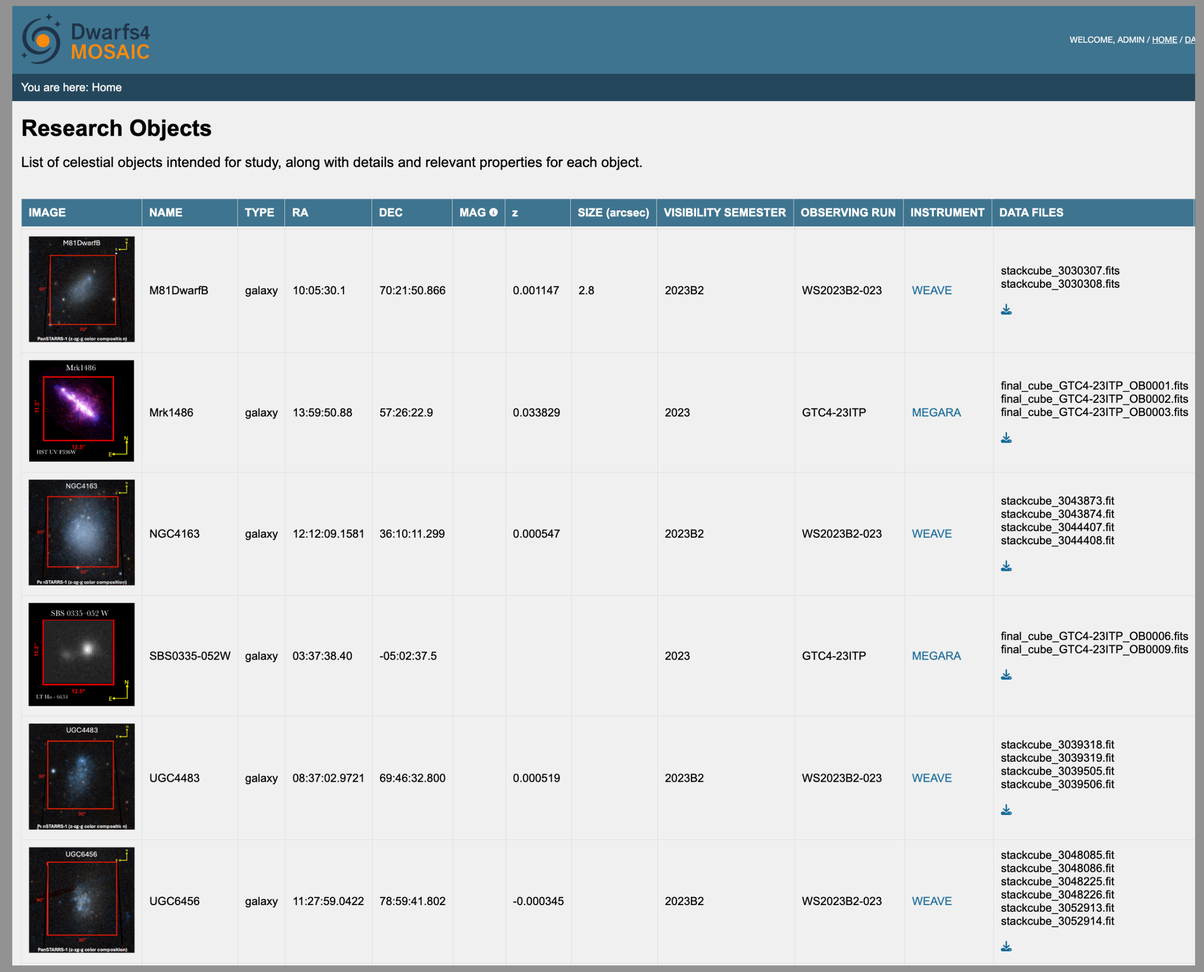
crmasks
guaix-ucm/numina
nicocardiel

Median combination effectively cleans pixels affected by cosmic rays when they are present in only a single exposure.

Pixels affected by cosmic rays in more than one exposure (double or triple CRs) have been found to remain uncorrected in the final image.

On the order of 100!

What's coming next



Dwarfs4 MOSAIC

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Research Objects

List of celestial objects intended for study, along with details and relevant properties for each object.

IMAGE	NAME	TYPE	RA	DEC	MAG	z	SIZE (arcsec)	VISIBILITY SEMESTER	OBSERVING RUN	INSTRUMENT	DATA FILES
M81DwarfB	M81DwarfB	galaxy	10:05:30.1	70:21:50.866		0.001147	2.8	2023B2	WS2023B2-023	WEAVE	stackcube_3030307.fits stackcube_3030308.fits
Mrk1486	Mrk1486	galaxy	13:59:50.88	57:26:22.9		0.033829		2023	GTC4-23ITP	MEGARA	final_cube_GTC4-23ITP_OB0001.fits final_cube_GTC4-23ITP_OB0002.fits final_cube_GTC4-23ITP_OB0003.fits
NGC4163	NGC4163	galaxy	12:12:09.1581	36:10:11.299		0.000547		2023B2	WS2023B2-023	WEAVE	stackcube_3043873.fit stackcube_3043874.fit stackcube_3044407.fit stackcube_3044408.fit
SBS 0335-052 W	SBS0335-052W	galaxy	03:37:38.40	-05:02:37.5				2023	GTC4-23ITP	MEGARA	final_cube_GTC4-23ITP_OB0006.fits final_cube_GTC4-23ITP_OB0009.fits
UGC4483	UGC4483	galaxy	08:37:02.9721	69:46:32.800		0.000519		2023B2	WS2023B2-023	WEAVE	stackcube_3039318.fit stackcube_3039319.fit stackcube_3039505.fit stackcube_3039506.fit
UGC6456	UGC6456	galaxy	11:27:59.0422	78:59:41.802		-0.000345		2023B2	WS2023B2-023	WEAVE	stackcube_3048085.fit stackcube_3048086.fit stackcube_3048225.fit stackcube_3048226.fit stackcube_3052913.fit stackcube_3052914.fit

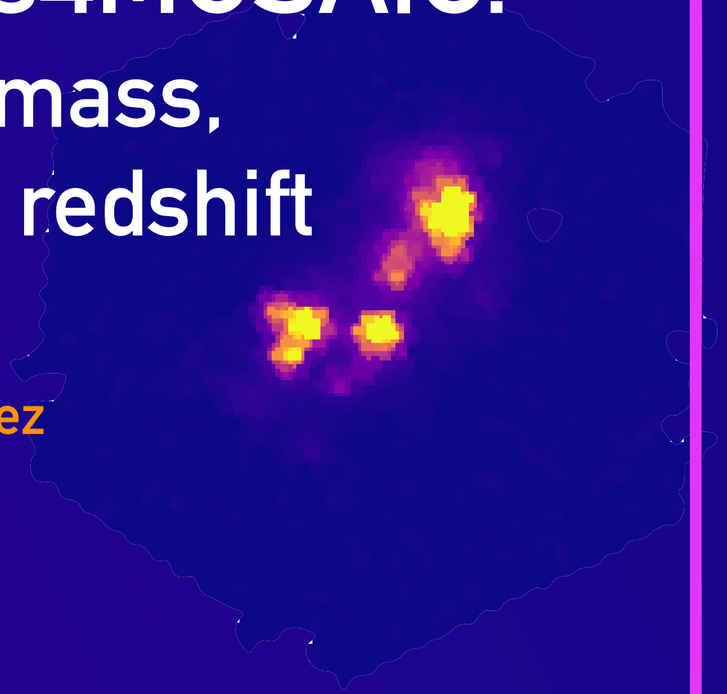
Dwarfs4MOSAIC web repository created for Data Release 1 by Noelia Grande Zafrilla (MSc Thesis 2024–2025)

🔭 **Dwarfs4MOSAIC Data Release 1**

🔭 **Study of gas-phase metallicity gradients in dwarf galaxies**
(Dwarfs4MOSAIC paper with M.Lara-López as leader "*probing mass assembly in low-mass galaxies through gas metallicty gradients*")

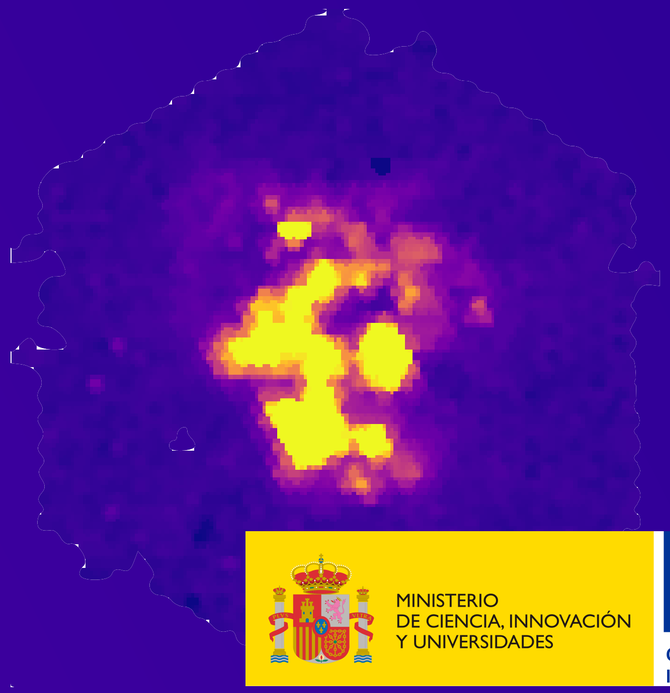
🔭 **Reducing new MEGARA images from Dwarfs4MOSAIC sample**

Preliminary Results from Dwarfs4MOSAIC:
A two-dimensional study of low-mass, high star-formation galaxies at low redshift



PhD thesis supervised by:
Jesús Gallego Maestro and Nicolás Cardiel López

María Chillarón Víctor



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