

Green Pea galaxies seen with VLT/MUSE

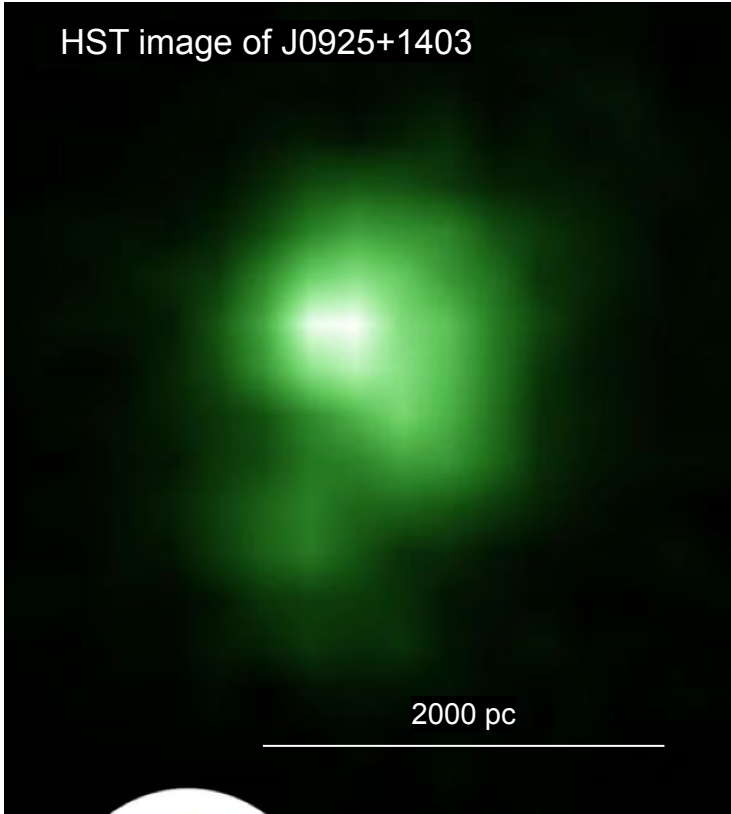
Antonio Arroyo Polonio

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Carolina Kehrig

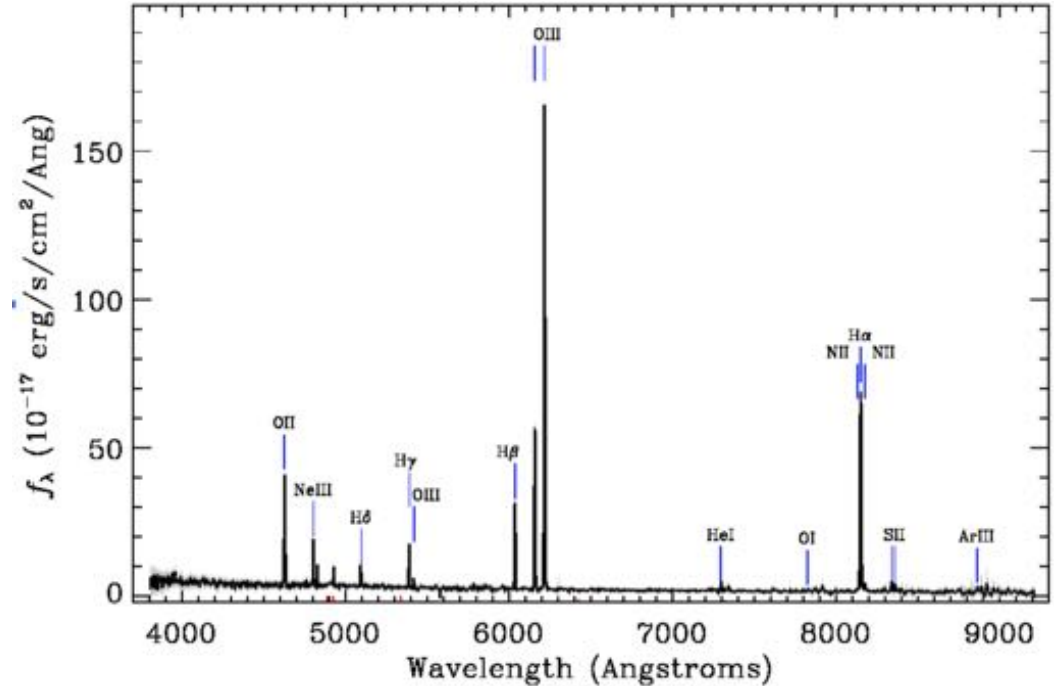


Introduction-Green Peas

HST image of J0925+1403



SDSS spectrum of a green pea galaxy



Introduction-Green Peas

-Green Peas are galaxy starburst at $z=0.112-0.360$

-Discovered by galaxy zoo volunteers

Basic properties

-Upper size limit of 5000 pc in HST images (16% Milky way diameter)

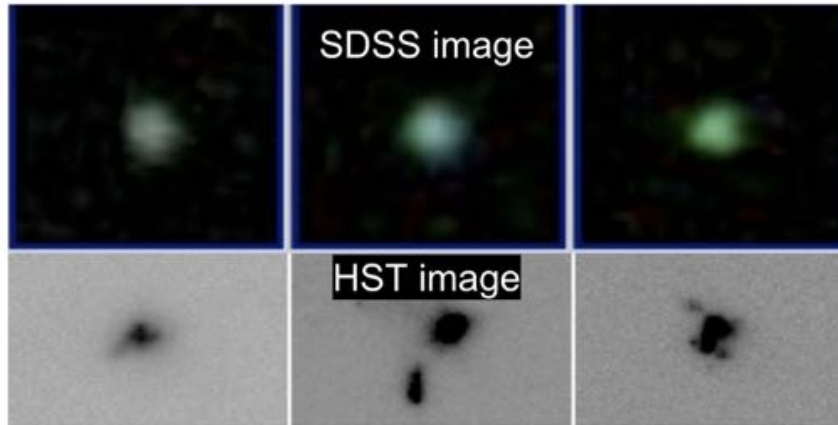
-Reside in low density environments

-Low metallicity $12+\log(O/H) = 7.6-8.4$

-Average mass of $\sim 3,200$ million M_{\odot} ,
star formation rate of $\sim 20 M_{\odot}/\text{yr}$
and thus a depletion time of 160 Myr

-Most of them are Ly α emitters and there are some confirmed LyC leakers among the GPs

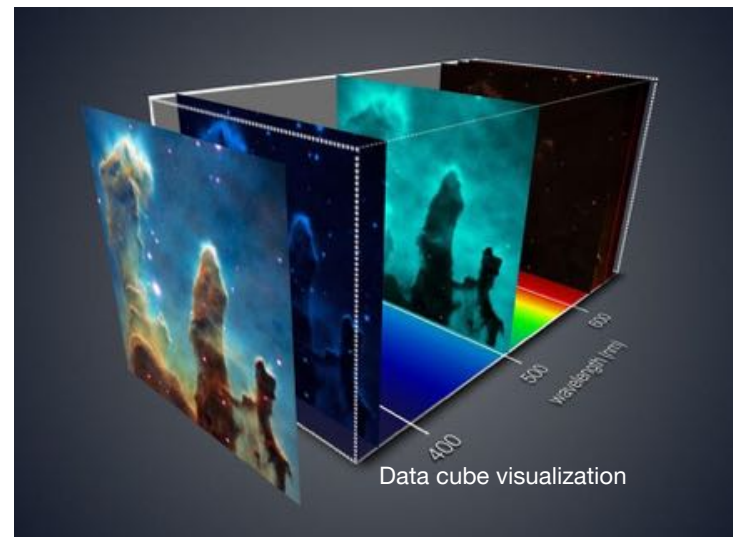
C. Cardamone et al (2009), R. O. Amorín et al (2010), A. Jaskot et al (2014), H. Yang et al (2017)



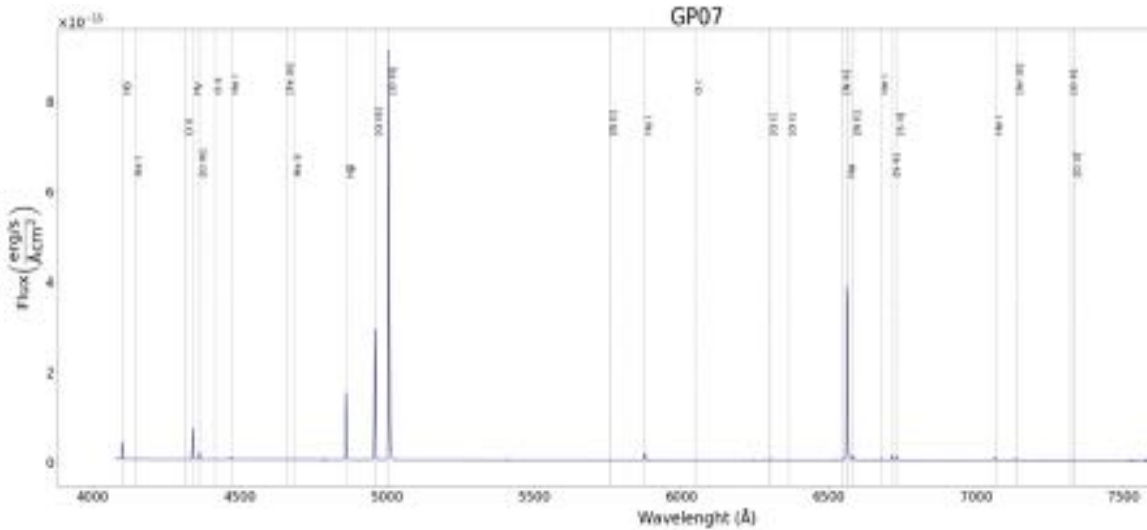
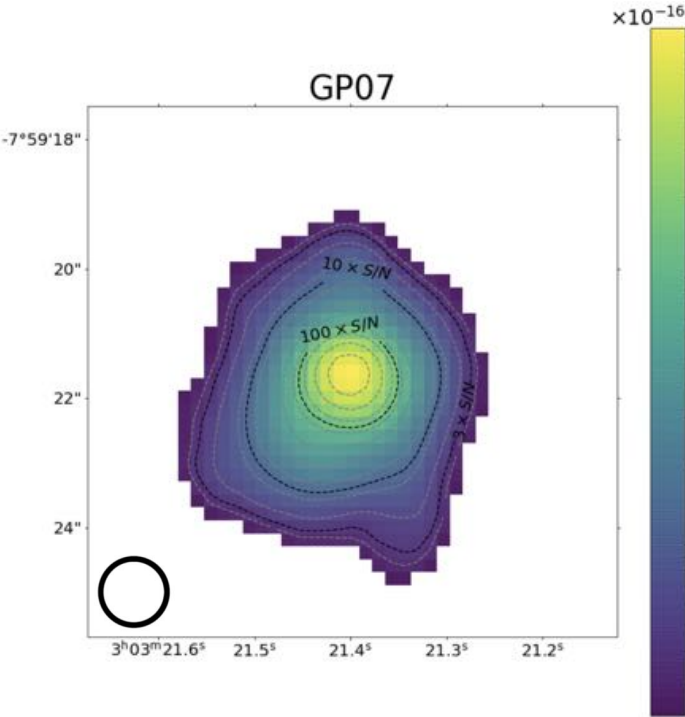
Introduction-MUSE/VLT



Observational Parameters	
Spectral range (simultaneous)	0.465-0.93 μm
	2000@0.46 μm
Resolving power	4000@0.93 μm
Wide Field Mode (WFM)	
Field of view	1x1 arcmin ²
Spatial sampling	0.2x0.2 arcsec ²
Spatial resolution (FWHM)	0.3-0.4 arcsec
Gain in ensquared energy within one pixel with respect to seeing	2
Condition of operation with AO	70%-ile
Sky coverage with AO	70% at Galactic Pole
Limiting magnitude in 80h	$I_{AB} = 25.0$ (R=3500)
	$I_{AB} = 26.7$ (R=180)
Limiting Flux in 80h	$3.9 \cdot 10^{-19} \text{ erg} \cdot \text{s}^{-1} \cdot \text{cm}^{-2}$

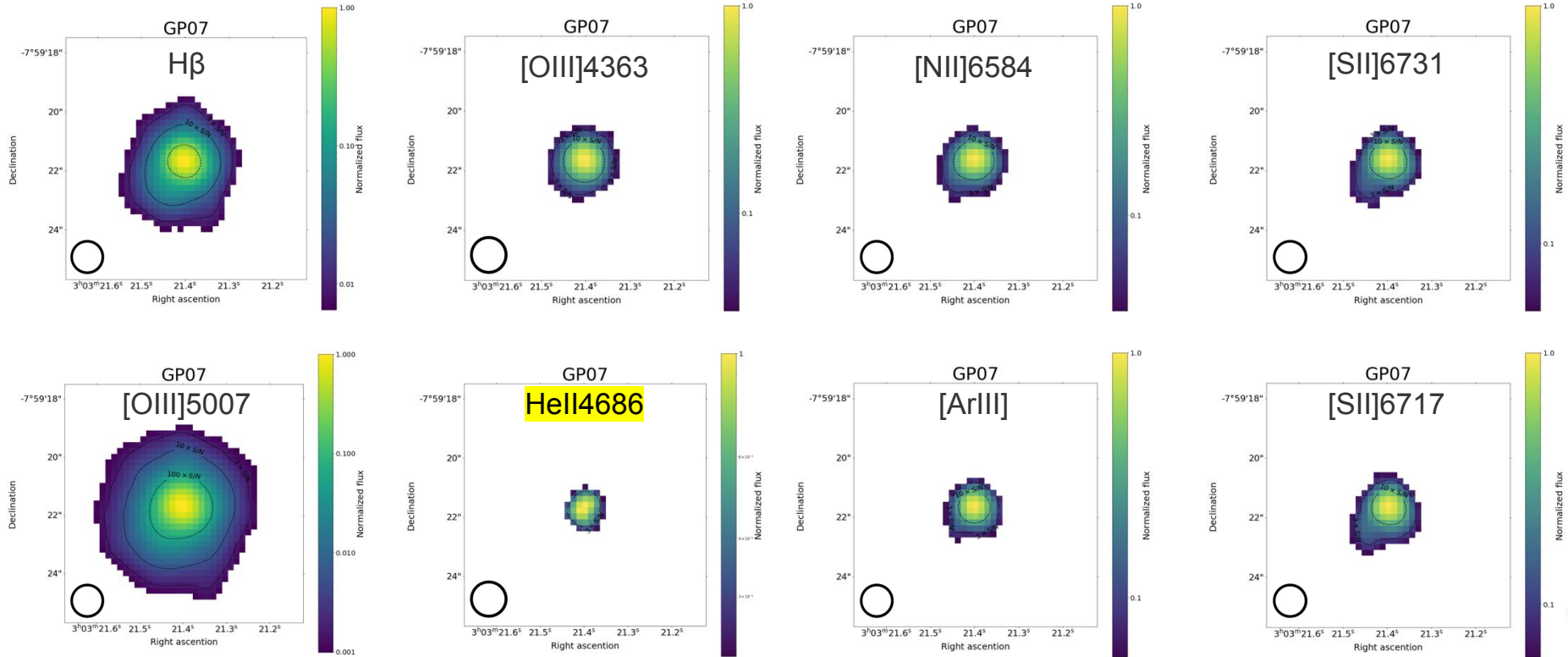


H α maps and spectra

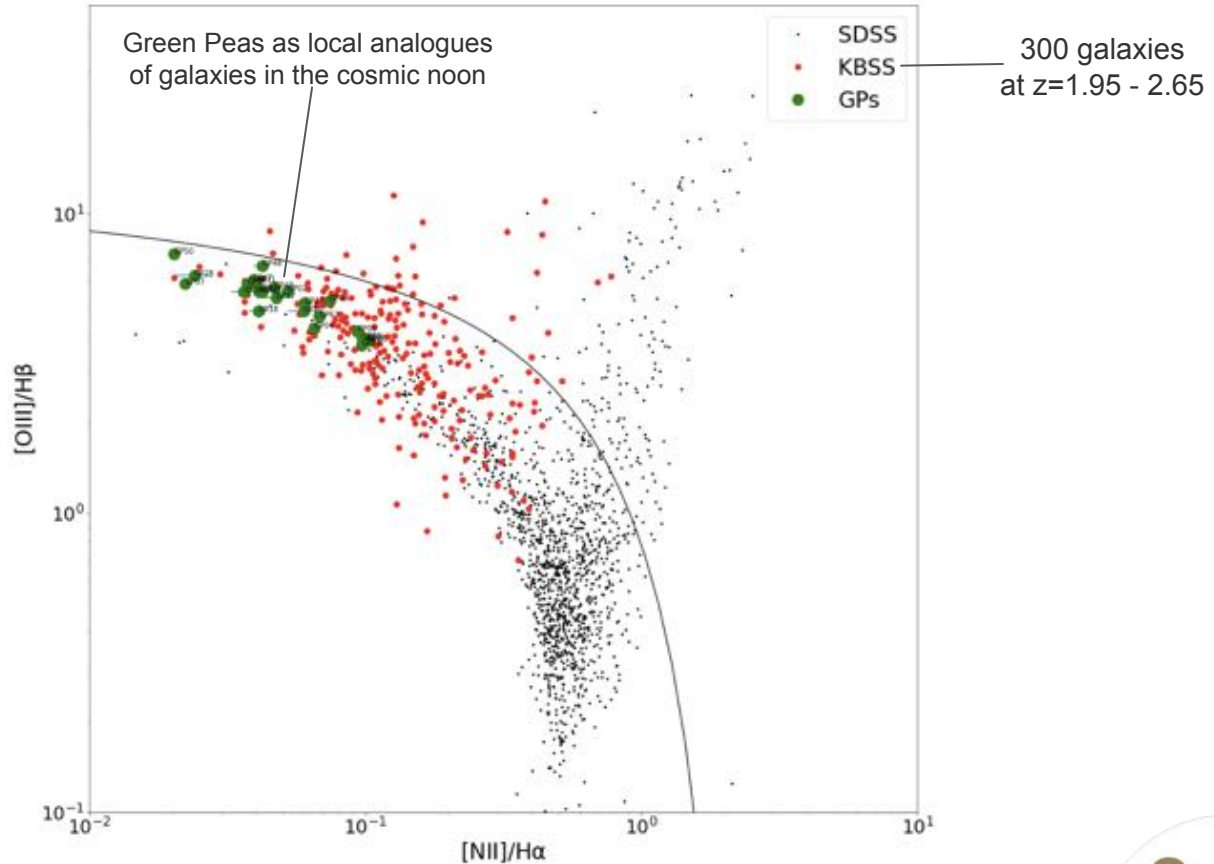


High EW [OIII]-H α = 250 \AA -2000 \AA

Emission line maps



BPT



Star formation

Sample of galaxies at different redshifts from

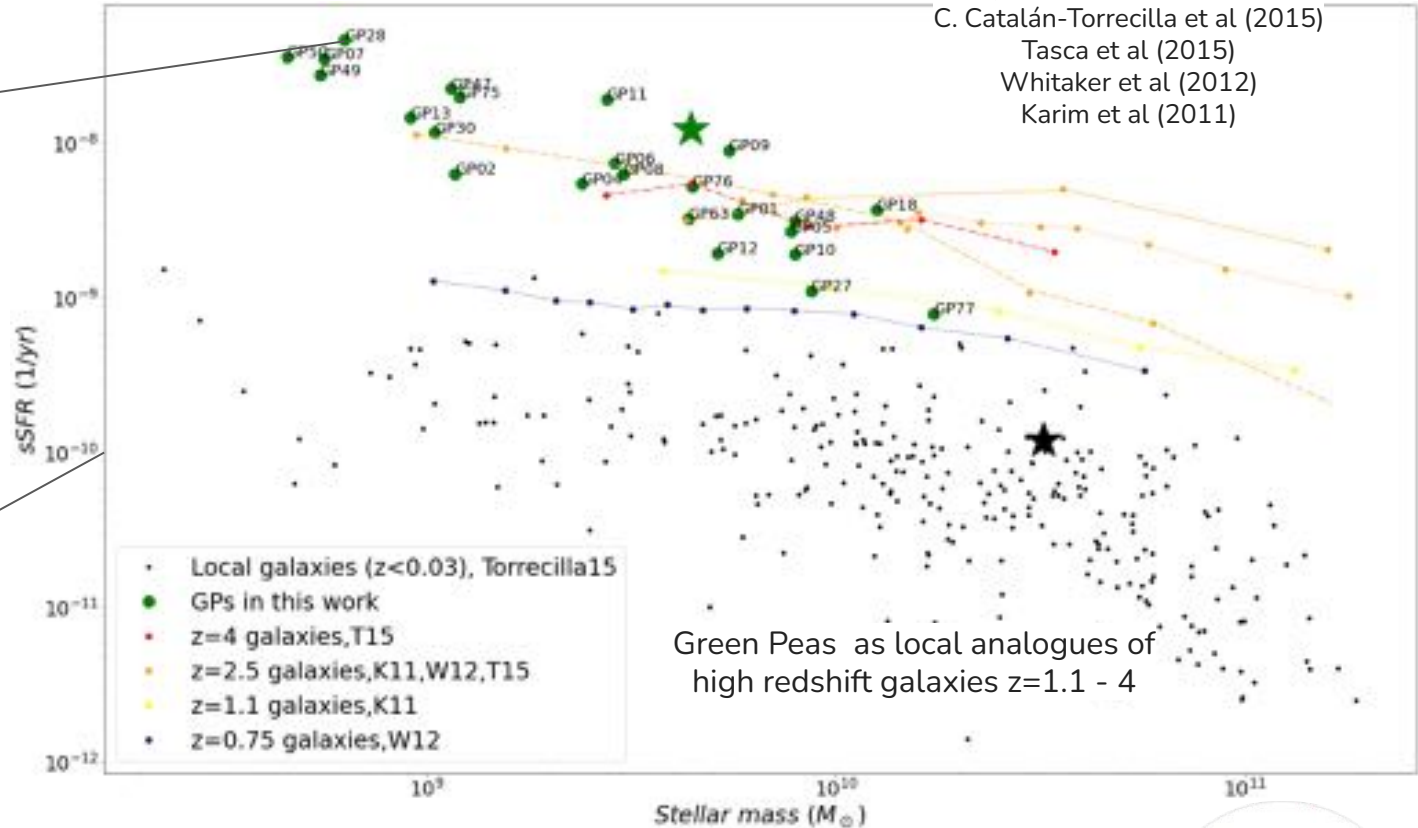
C. Catalán-Torrecilla et al (2015)

Tasca et al (2015)

Whitaker et al (2012)

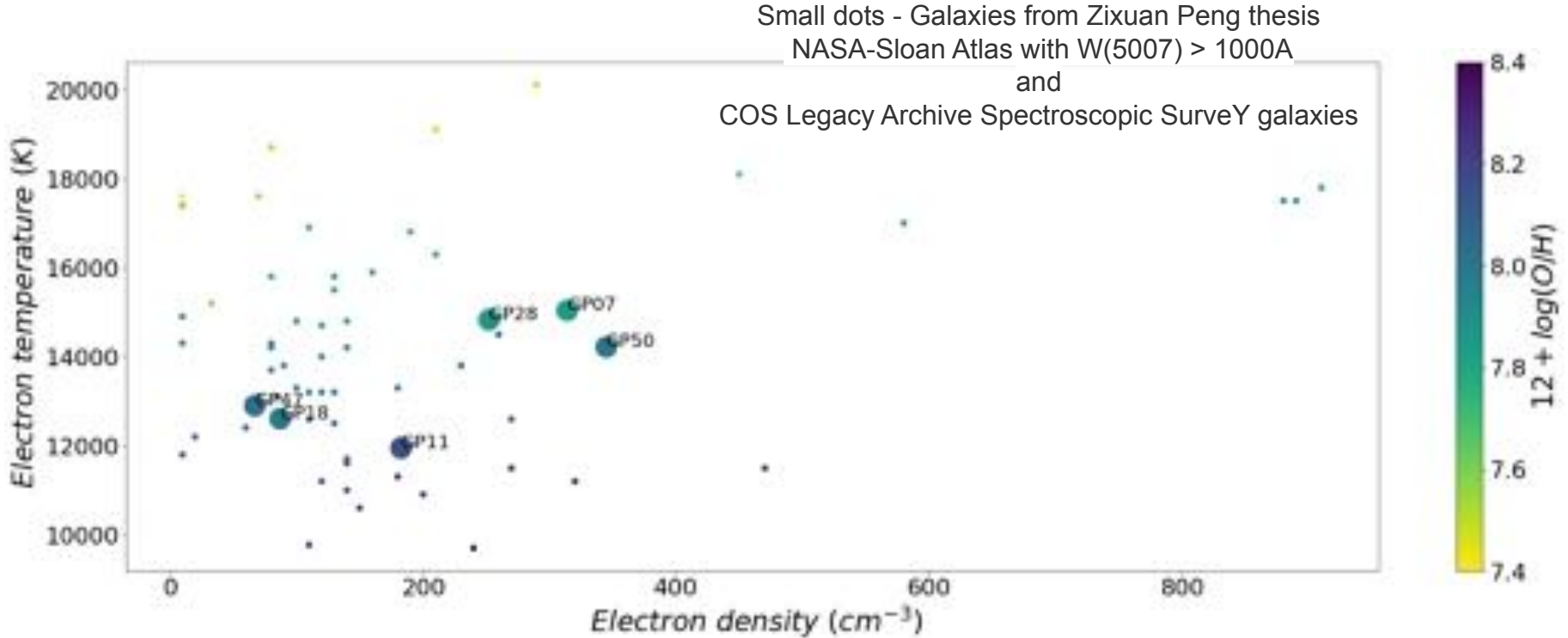
Karim et al (2011)

sSFR goes up to 46.77 (1/Gyr)
Depletion time 21.38 Myr



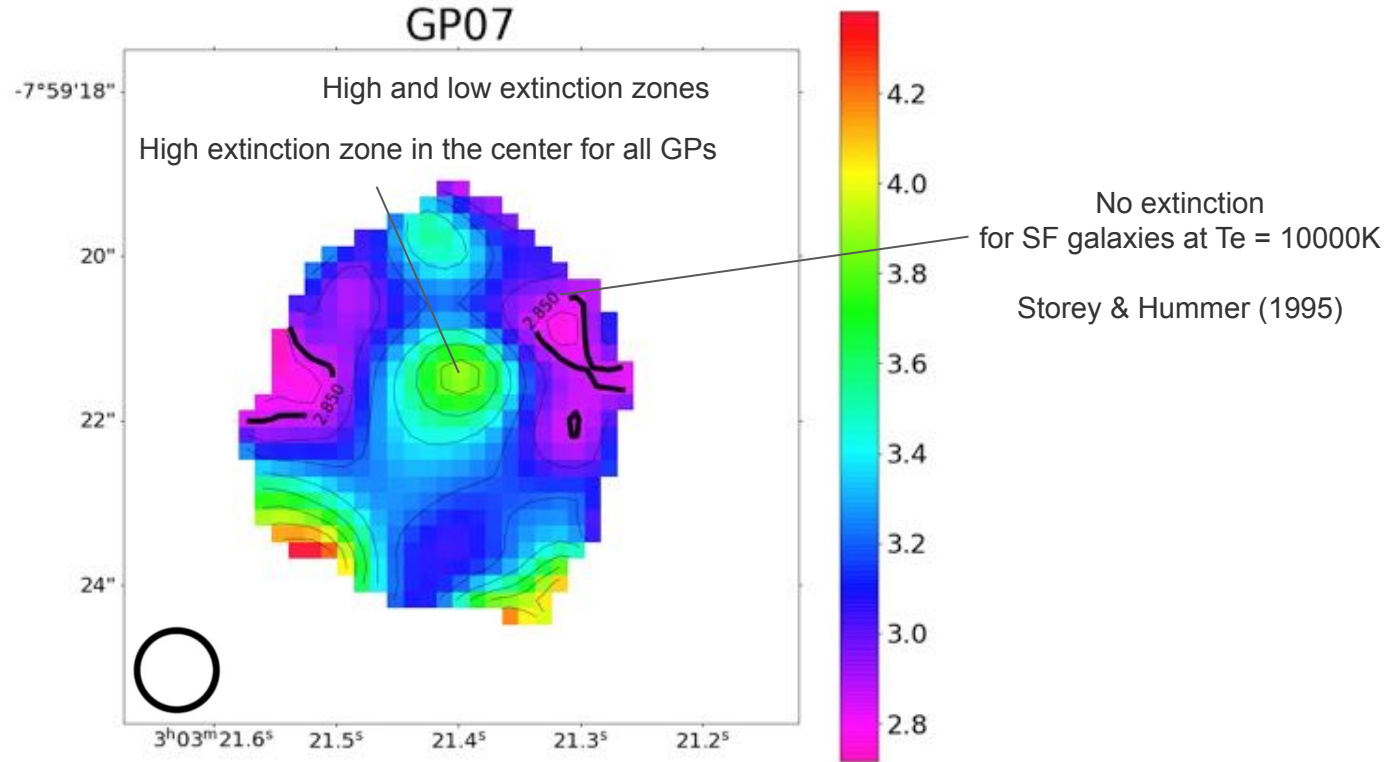
Typical sSFR-0.1 (1/Gyr)
Depletion time 10 Gyr
Close to the age of the universe
13.7 Gyr

Ionised gas properties



Extinction map

H α /H β

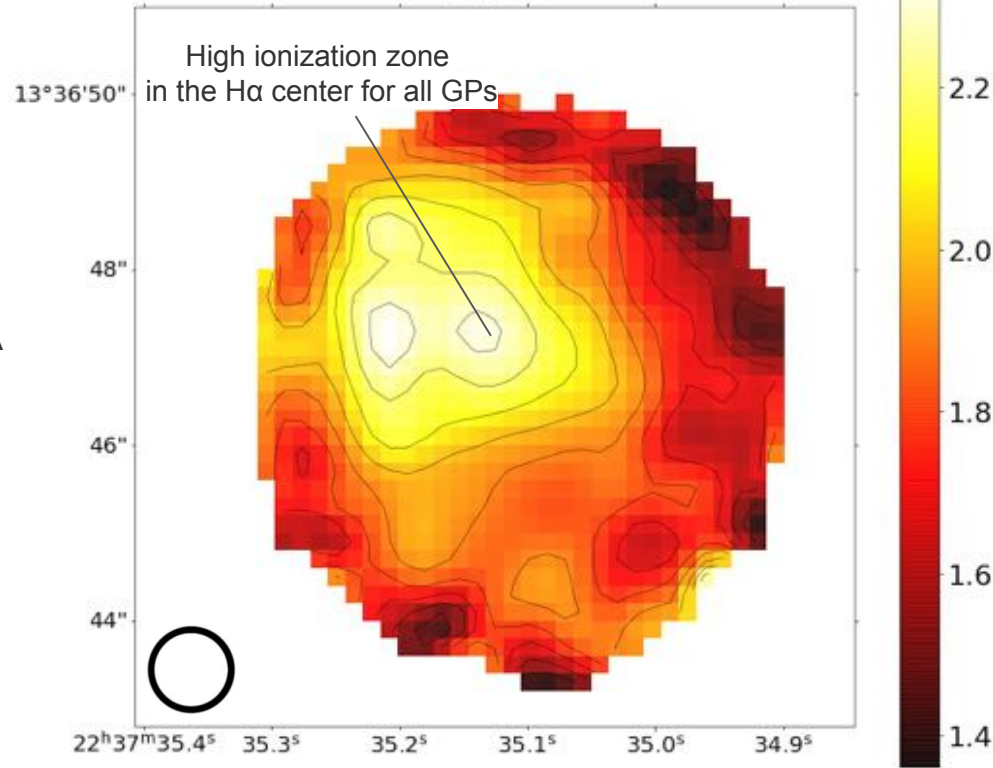


Ionization map

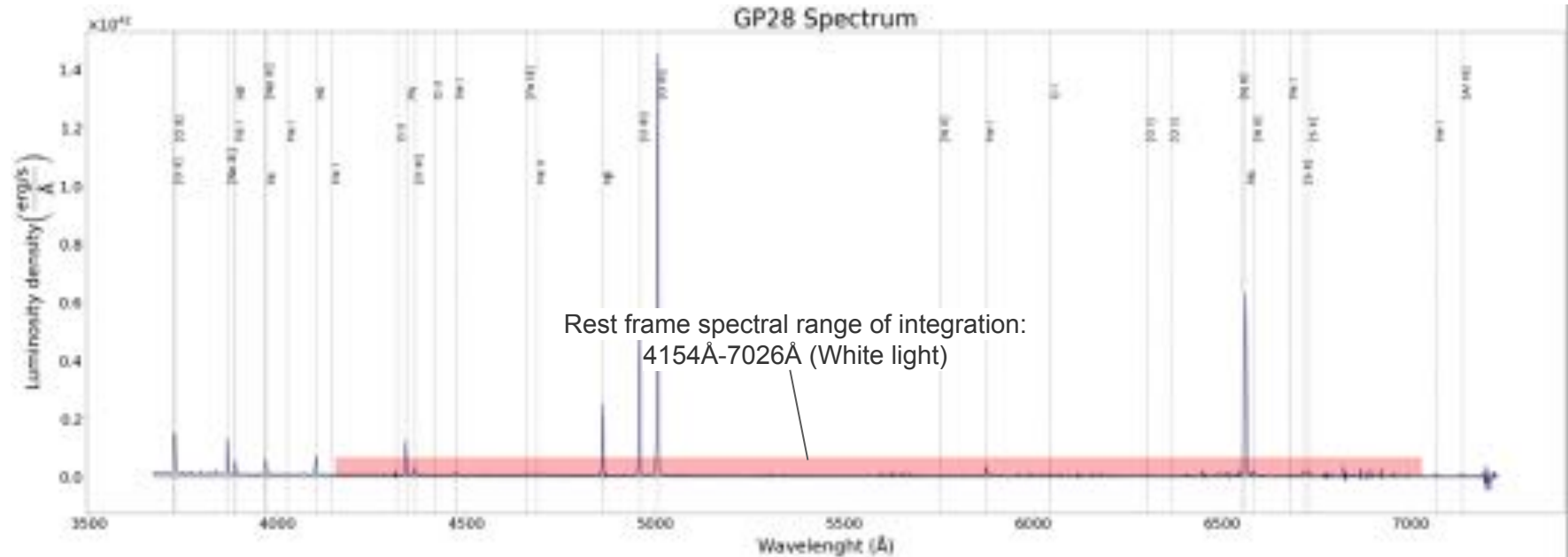
GP18

$[OIII]\lambda 5007\text{\AA} /$
 $[OII]\lambda 3727, \lambda 3729\text{\AA}$

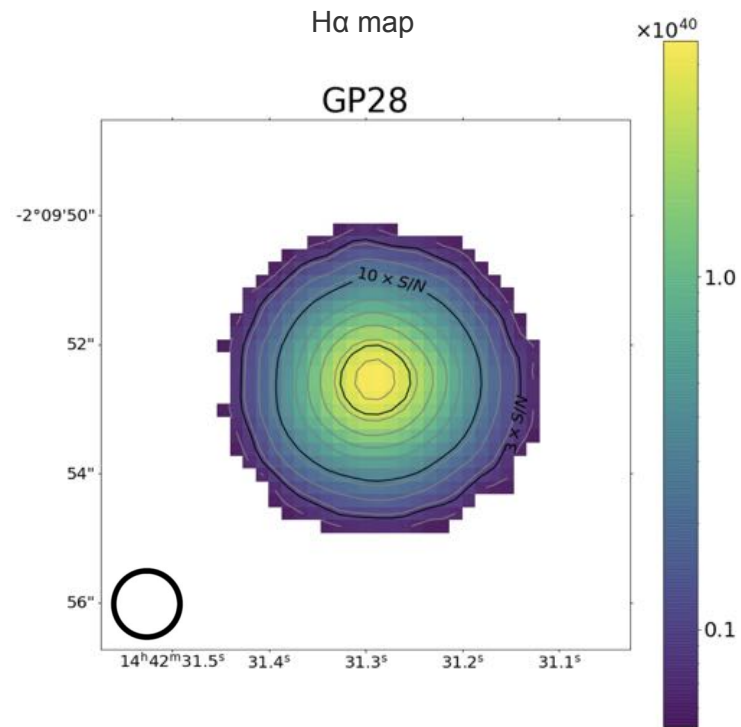
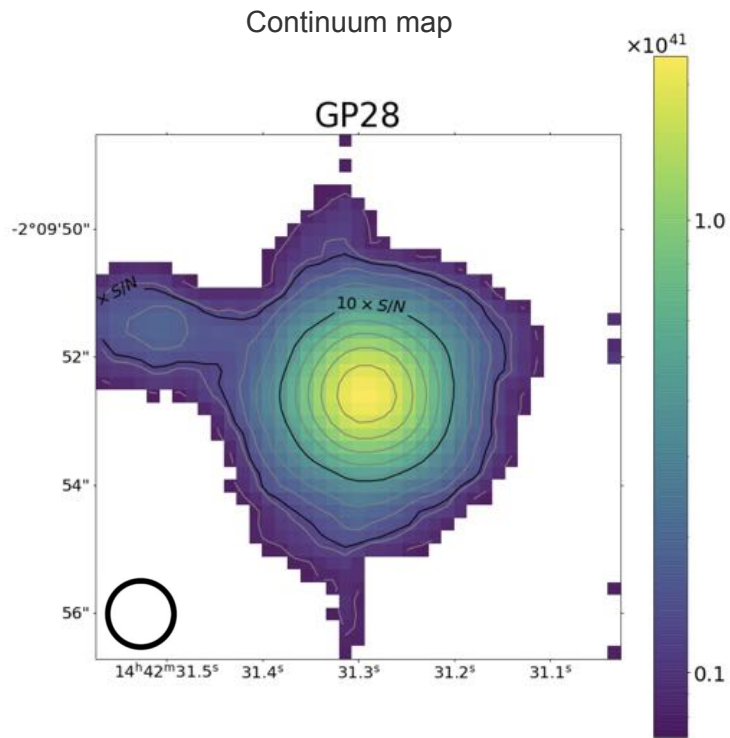
High ionization zone
in the H α center for all GPs



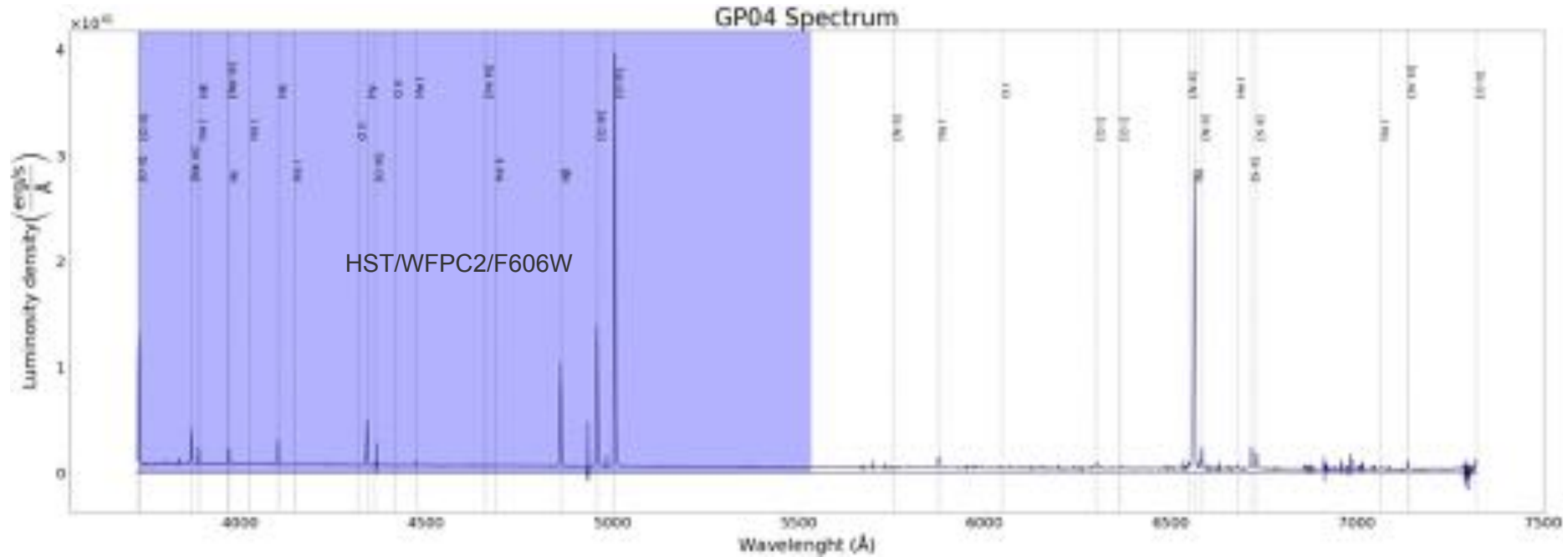
Continuum vs H α maps



Continuum vs H α maps



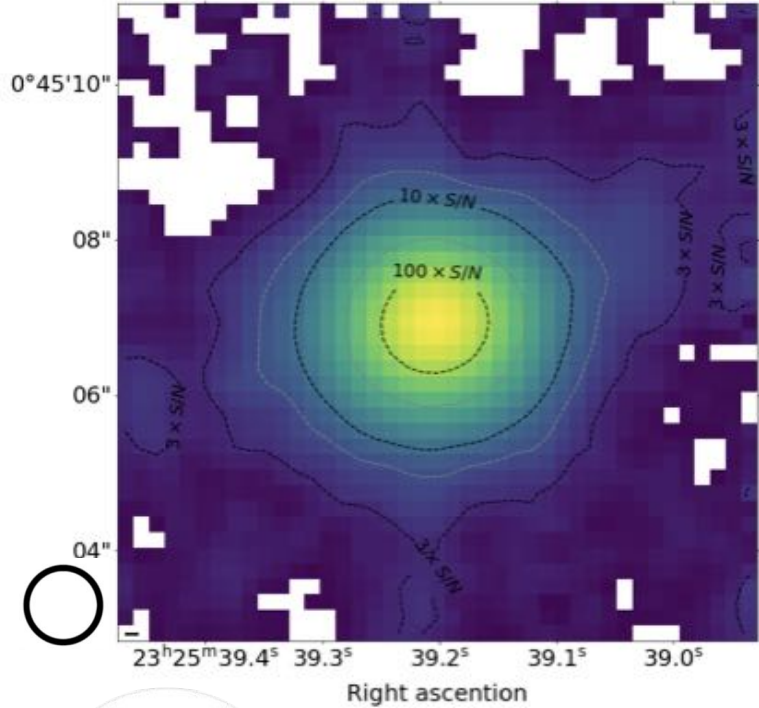
Hubble vs VLT images



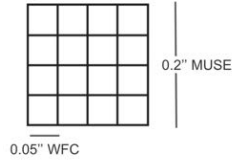
Hubble vs VLT images

VLT/MUSE 2800s exp

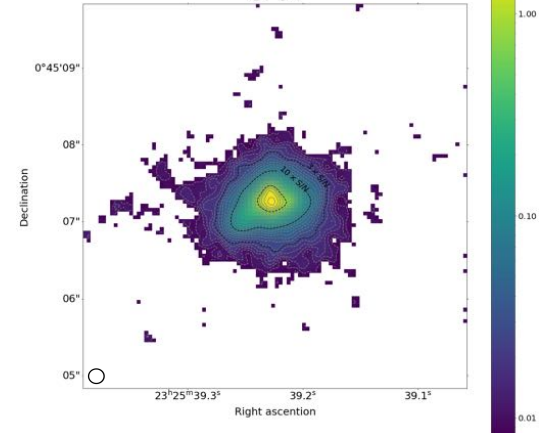
GP04



Spaxels sizes



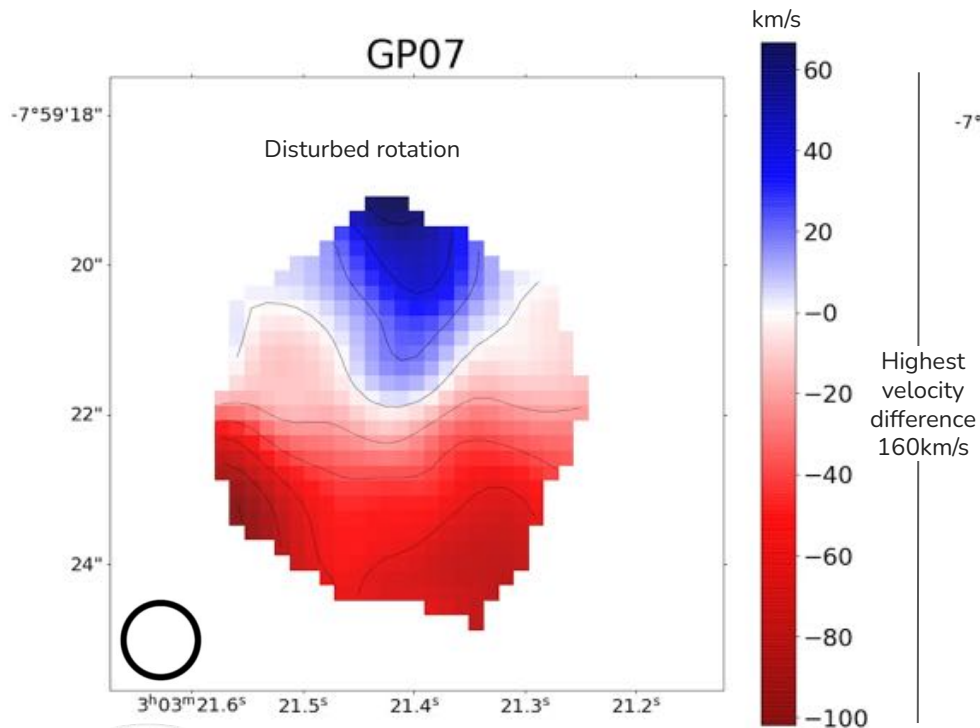
Hubble map
HST/WFPC2 3600s exp
GP04



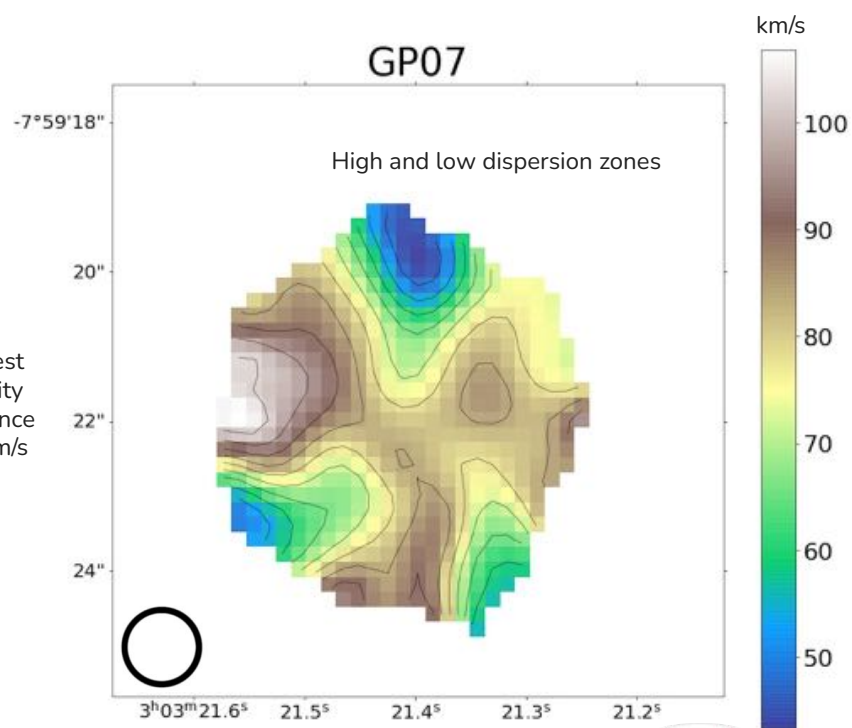
VLT collect more light (telescope area times exp. time)
but HST refine it better (much better spatial resolution)

Kinematics

Velocity field

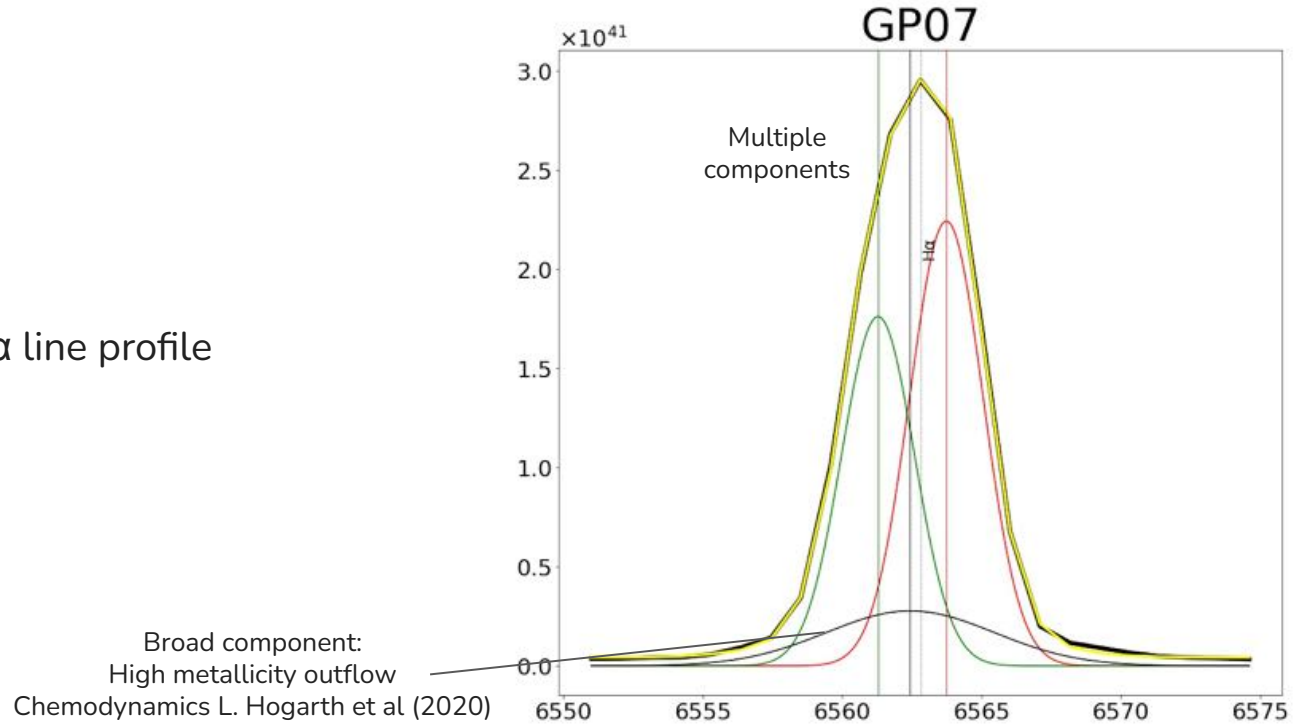


Velocity dispersion field



Kinematics

H α line profile



Conclusions

- GPs are local analogues of galaxies in the cosmic noon
- Present ionization, excitation and dispersion substructures
- Continuum more extended and complex than emission lines
- HST - VLT synergy
- Complex kinematics

Thank you for your attention!

RGB image

GP07

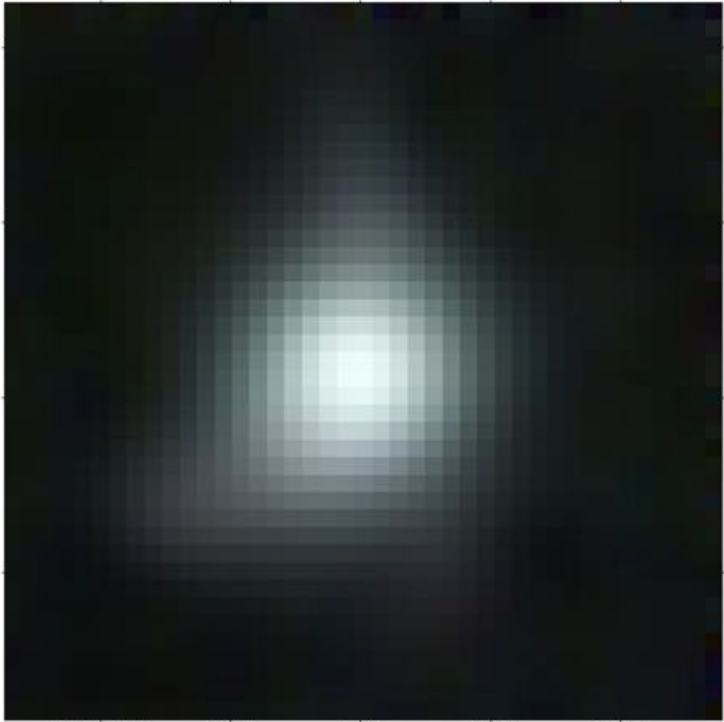
-7°59'18"

20"

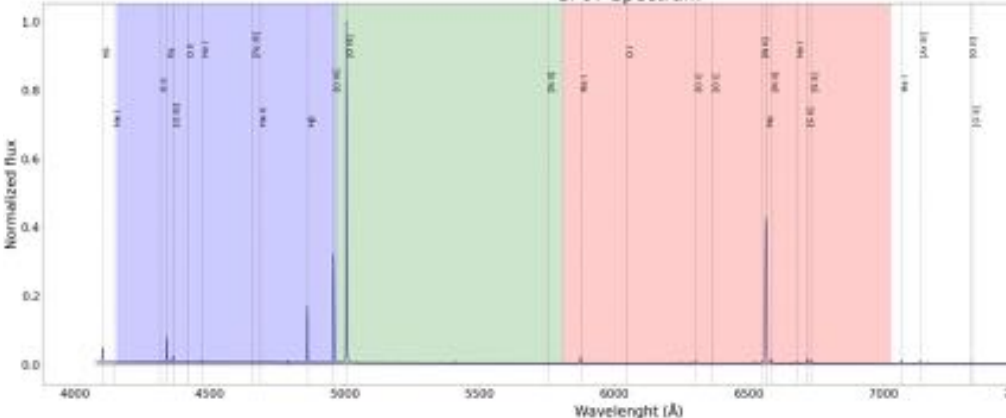
22"

24"

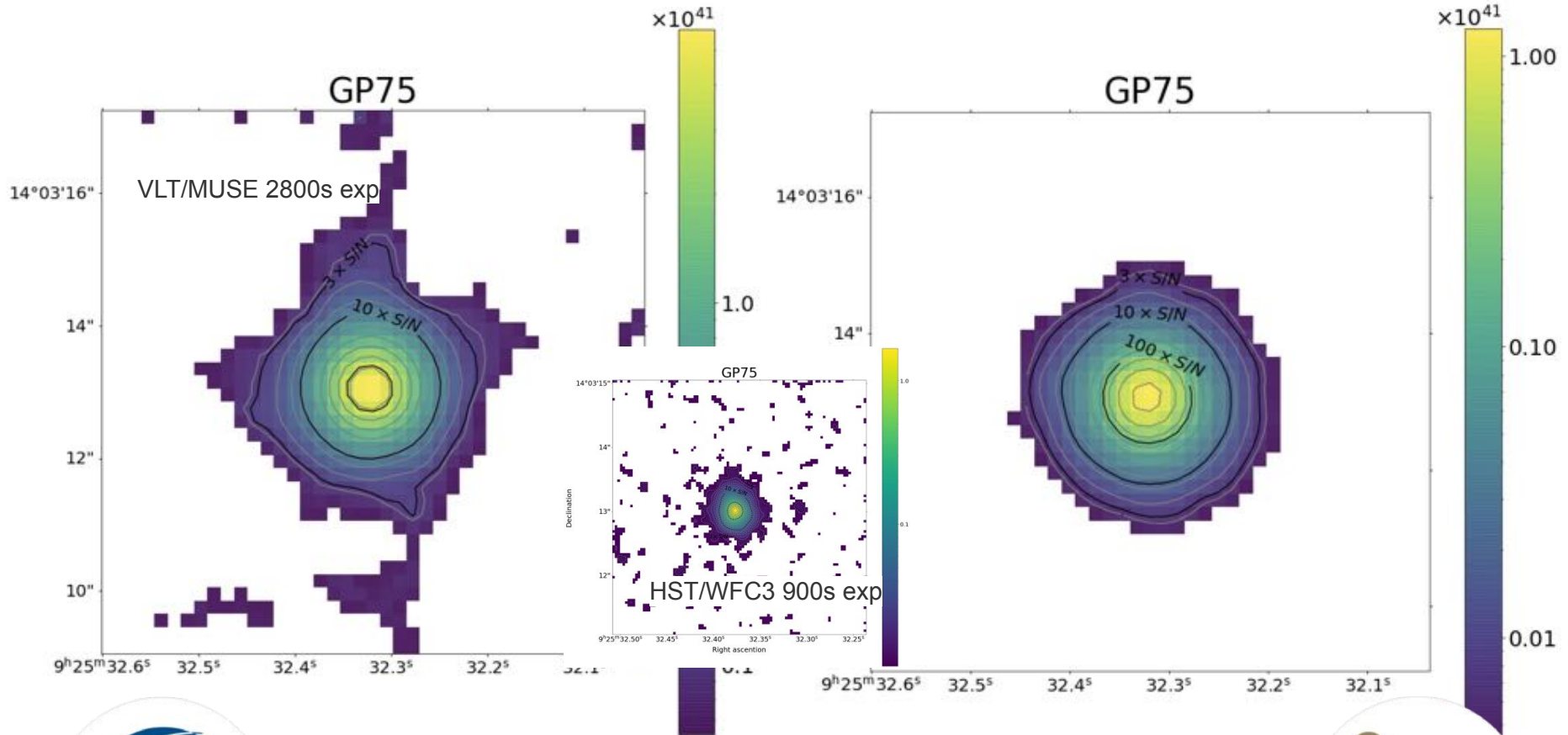
3^h03^m21.6^s 21.5^s 21.4^s 21.3^s 21.2^s



GP07 Spectrum

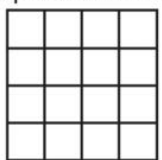


Hubble images



Hubble images

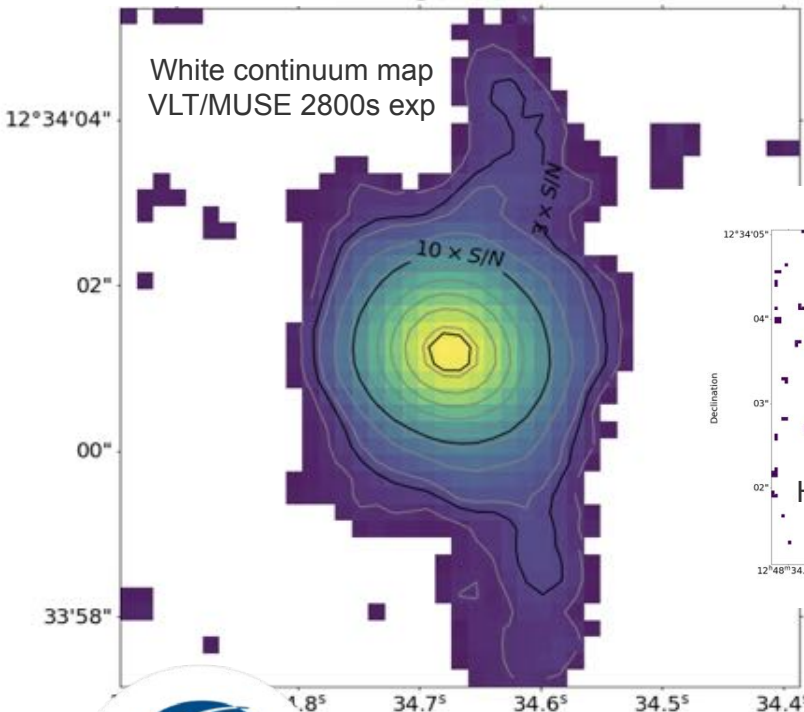
Spaxels sizes



0.2" MUSE

0.05" WFC

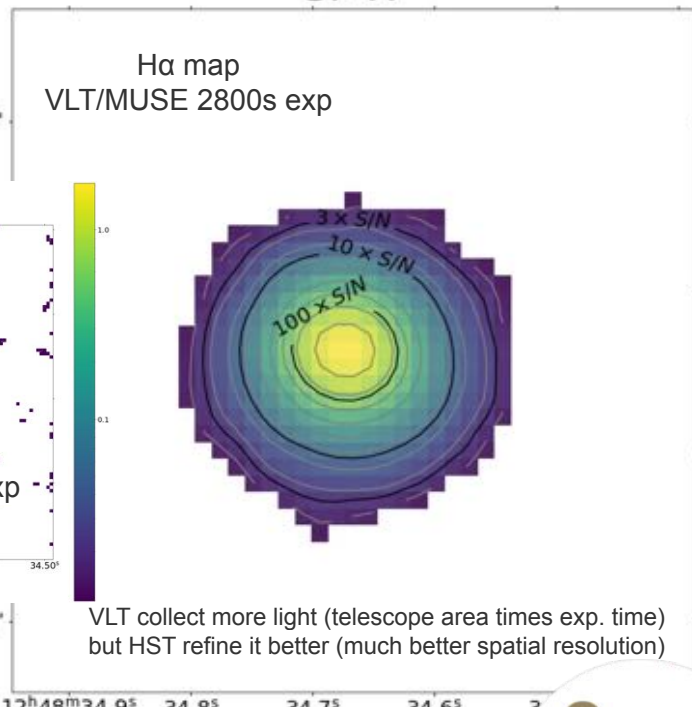
GP47



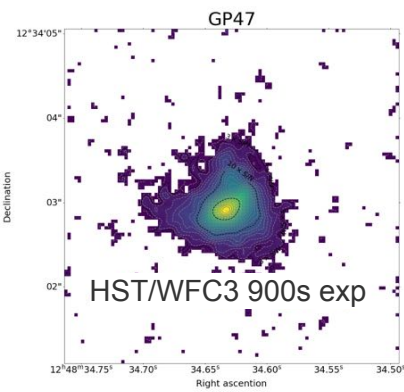
$\times 10^{41}$



GP47



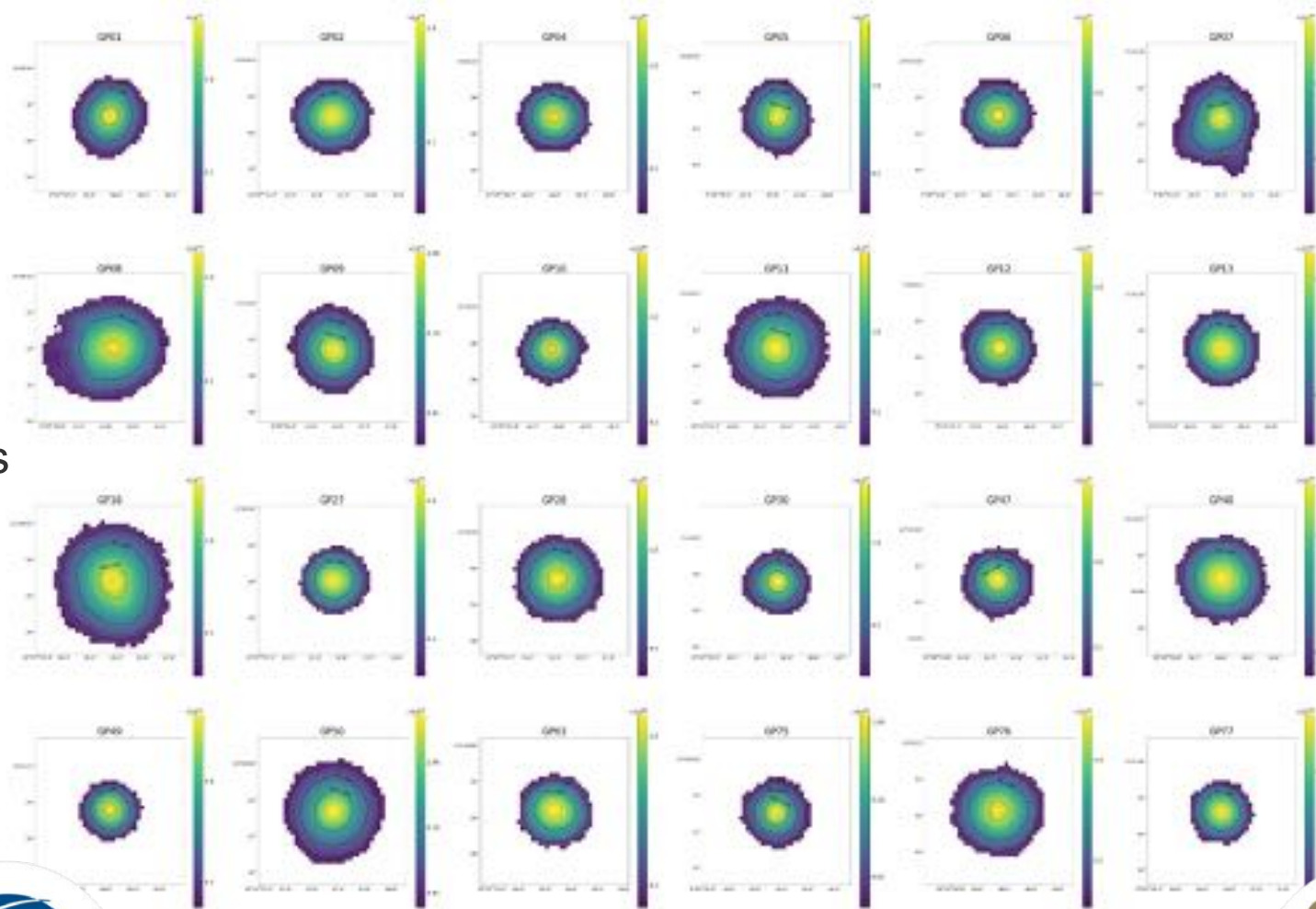
$\times 10^{40}$



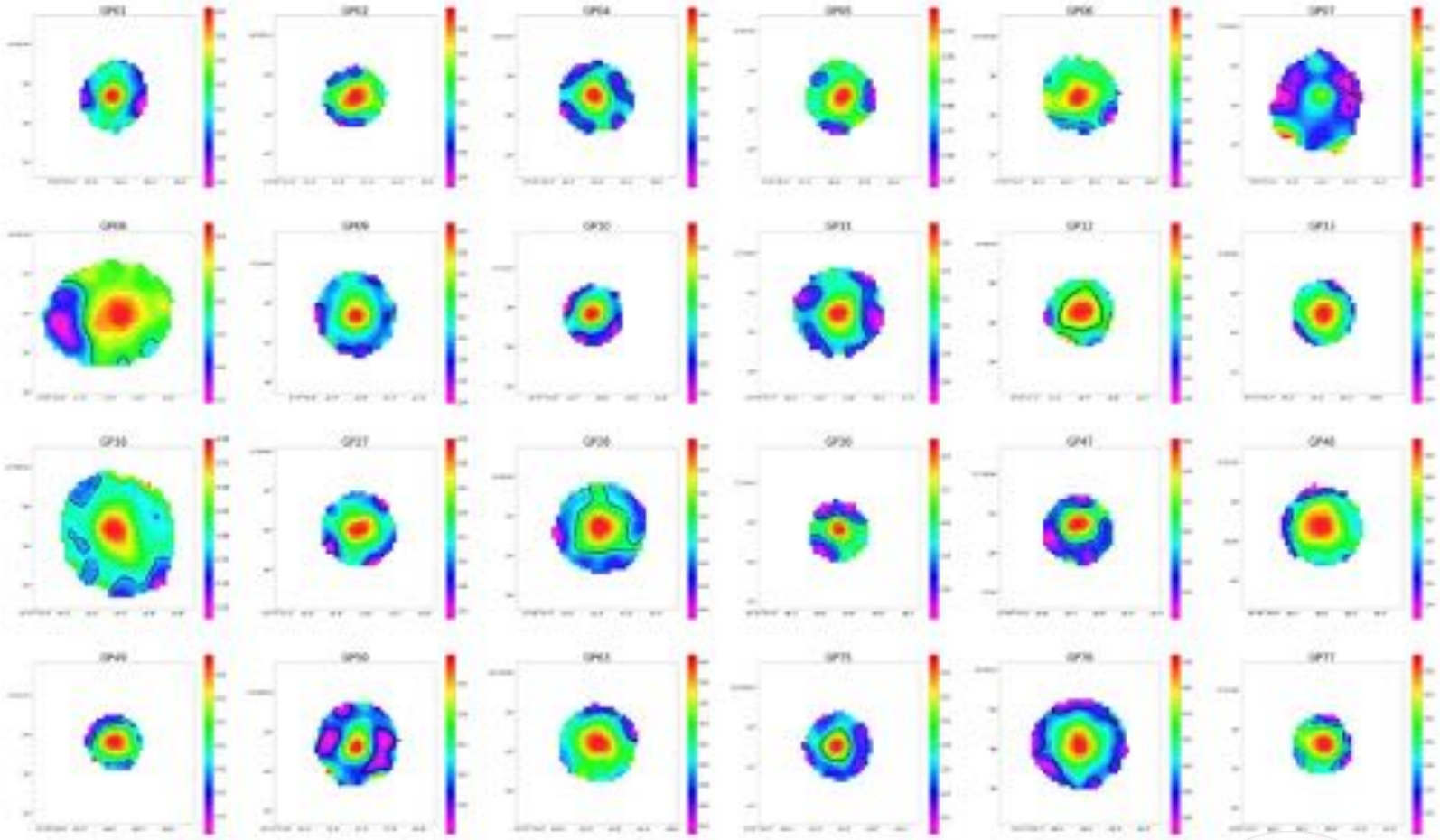
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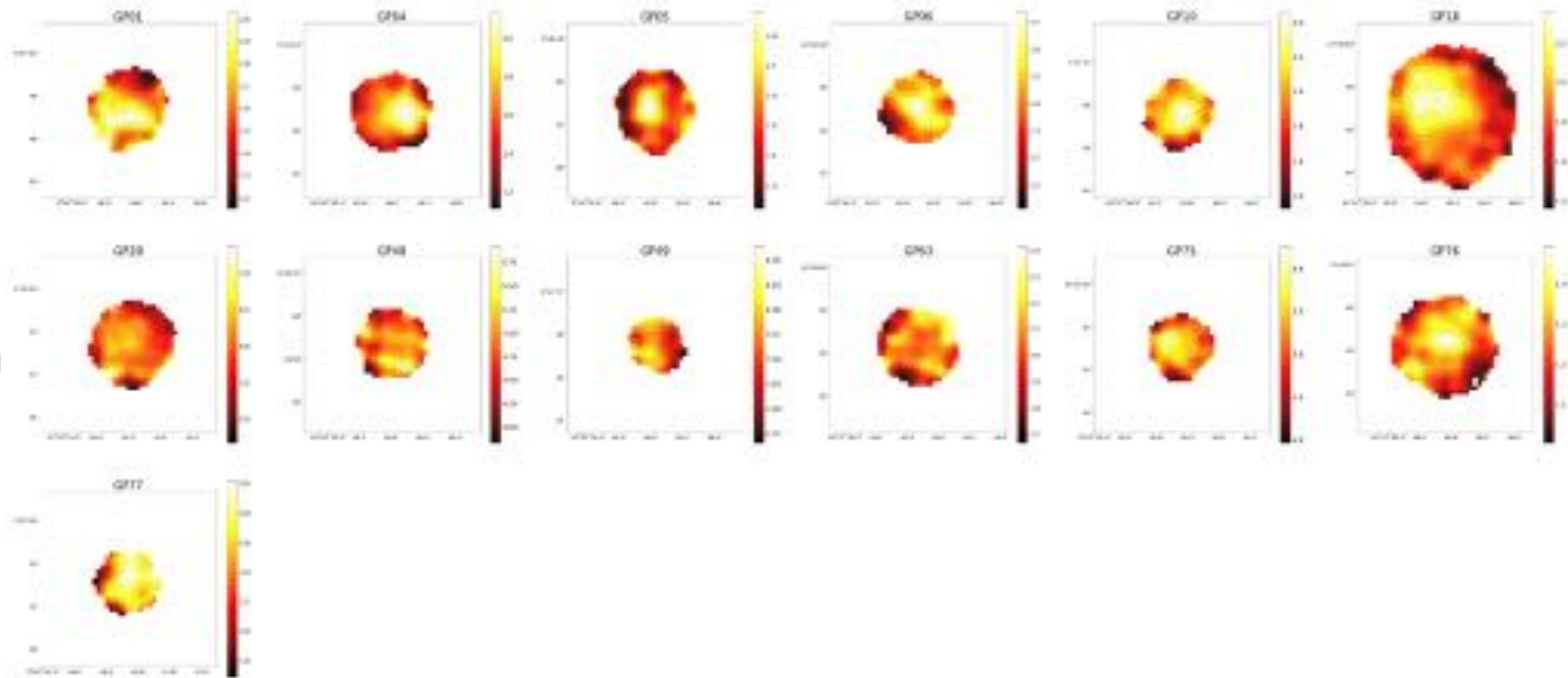
H α maps



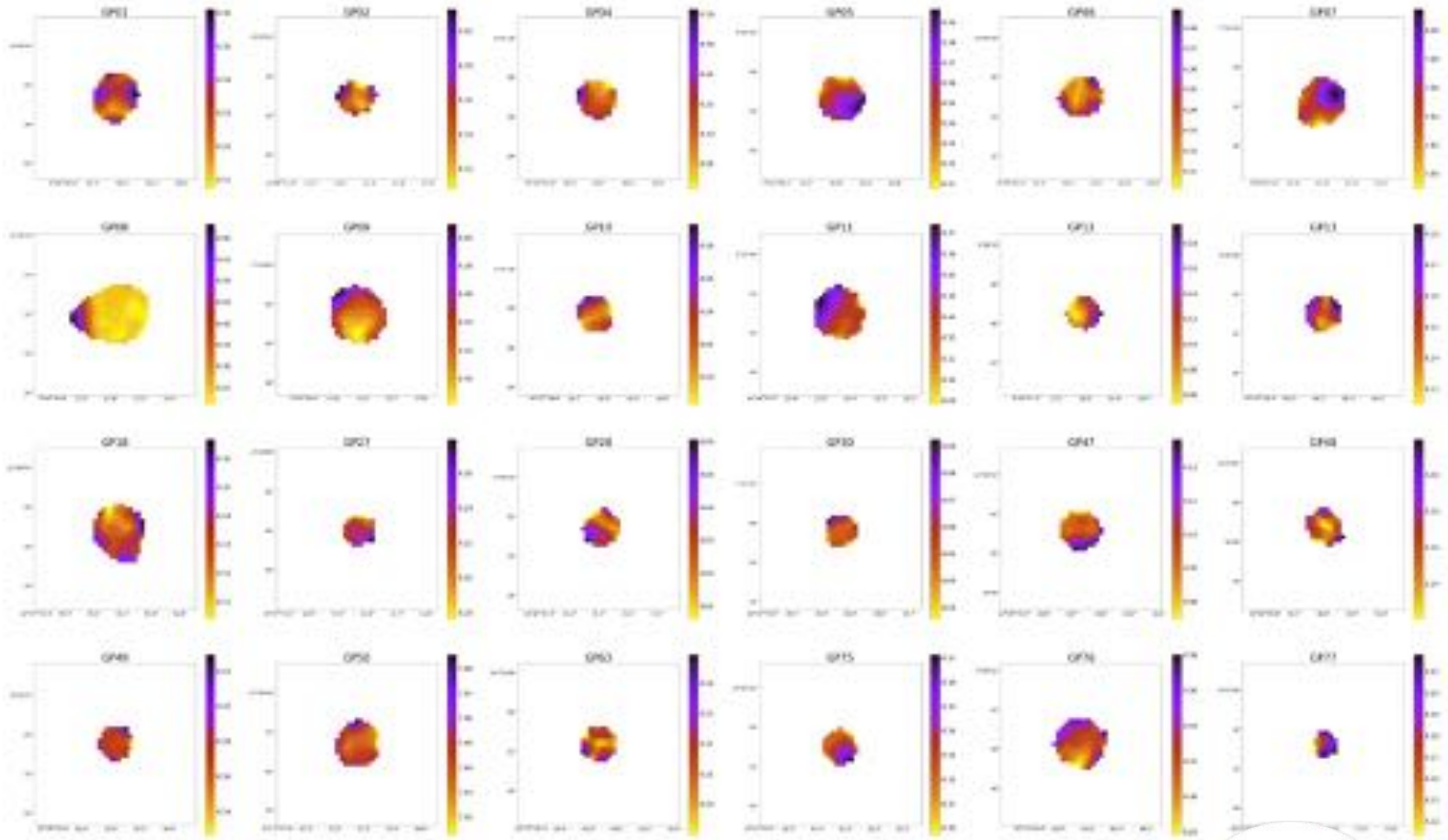
Extinction
maps



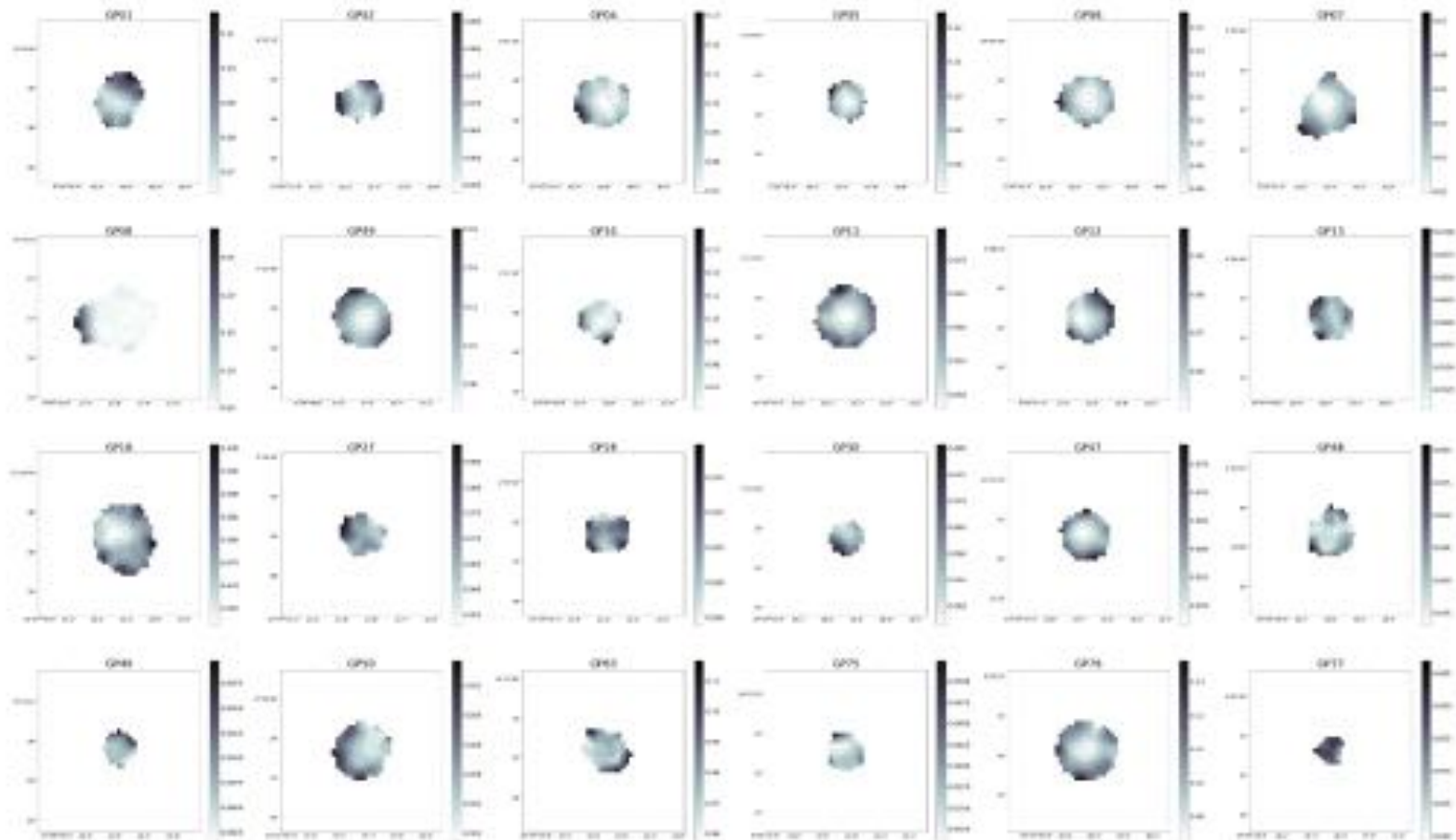
Ionization maps



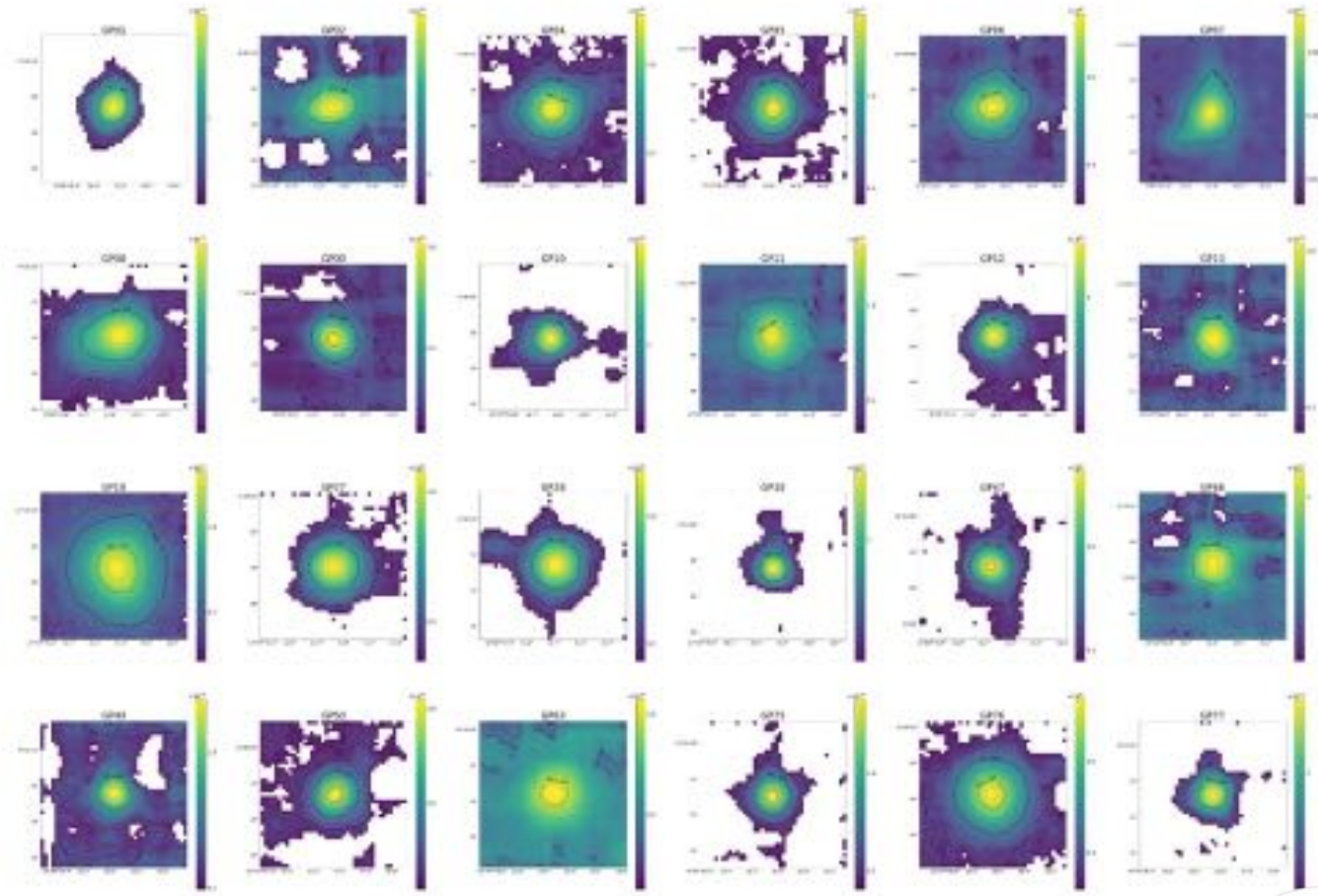
Metallicity maps



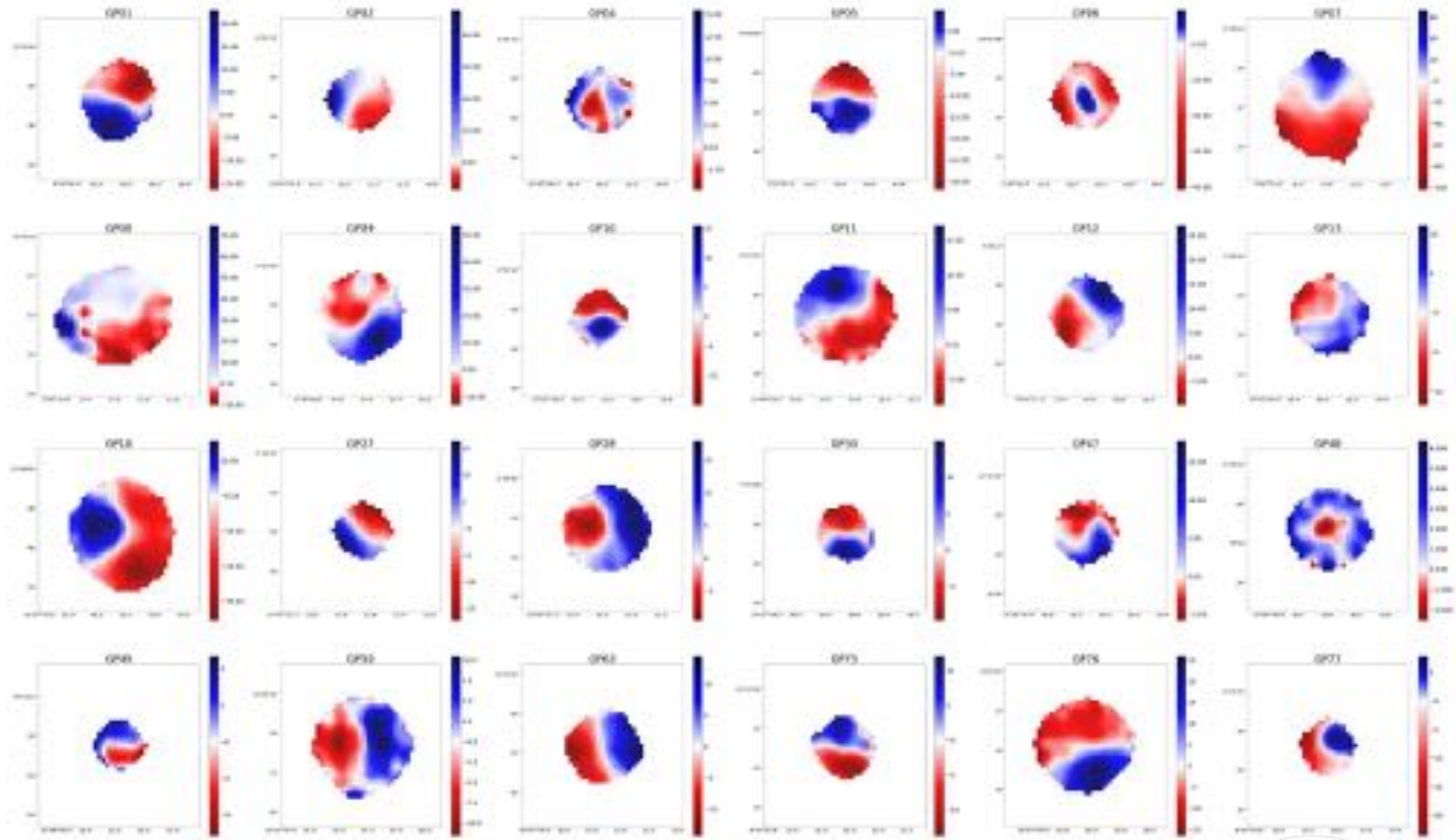
Tracers
maps



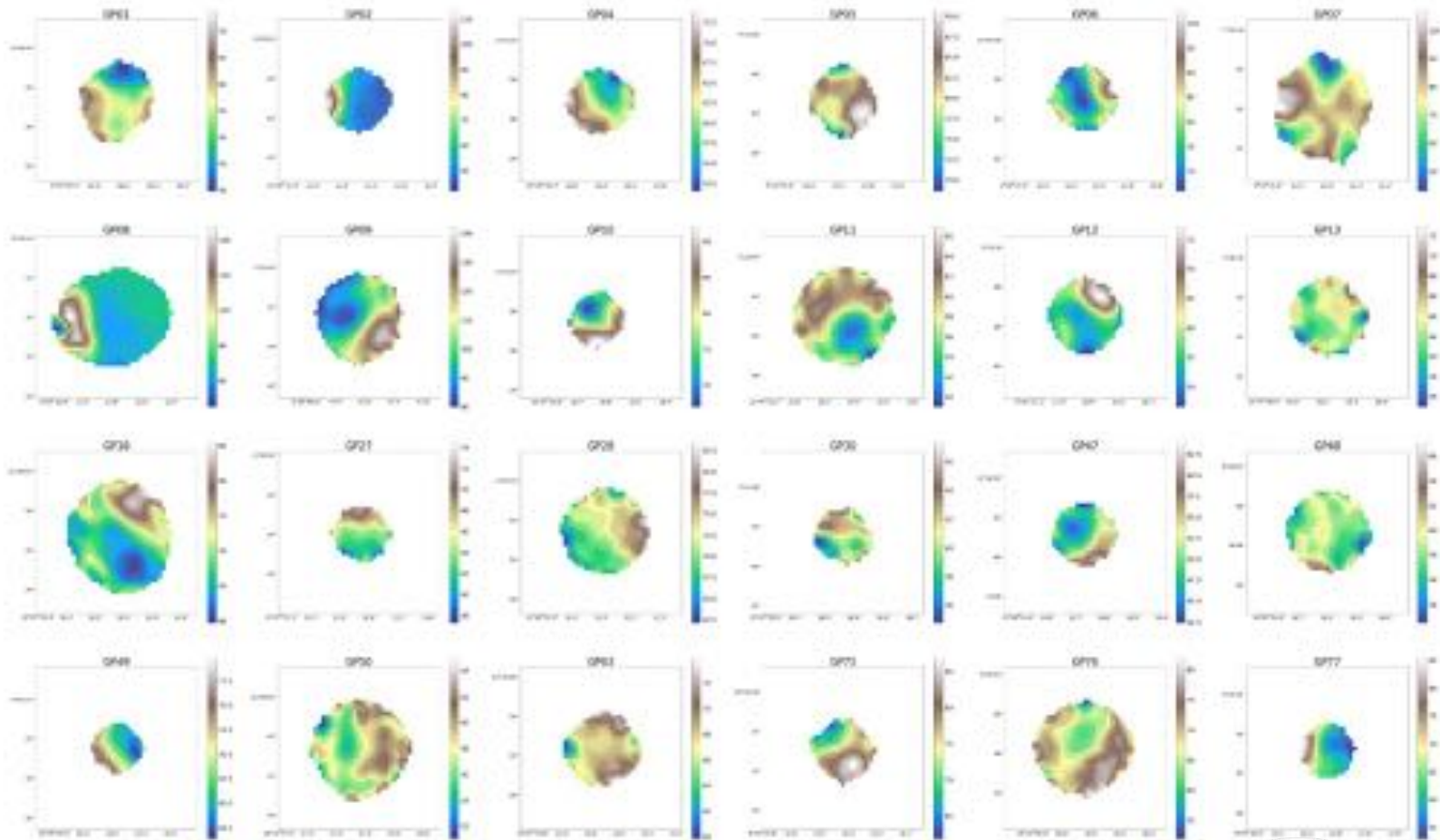
Continuum maps



Velocity maps



Dispersion maps



Thank you for your attention!