UNDERSTANDING THE ORIGIN OF PRESENT-DAY GALAXY HUBBLE TYPES IN DIFFERENT ENVIRONMENTS

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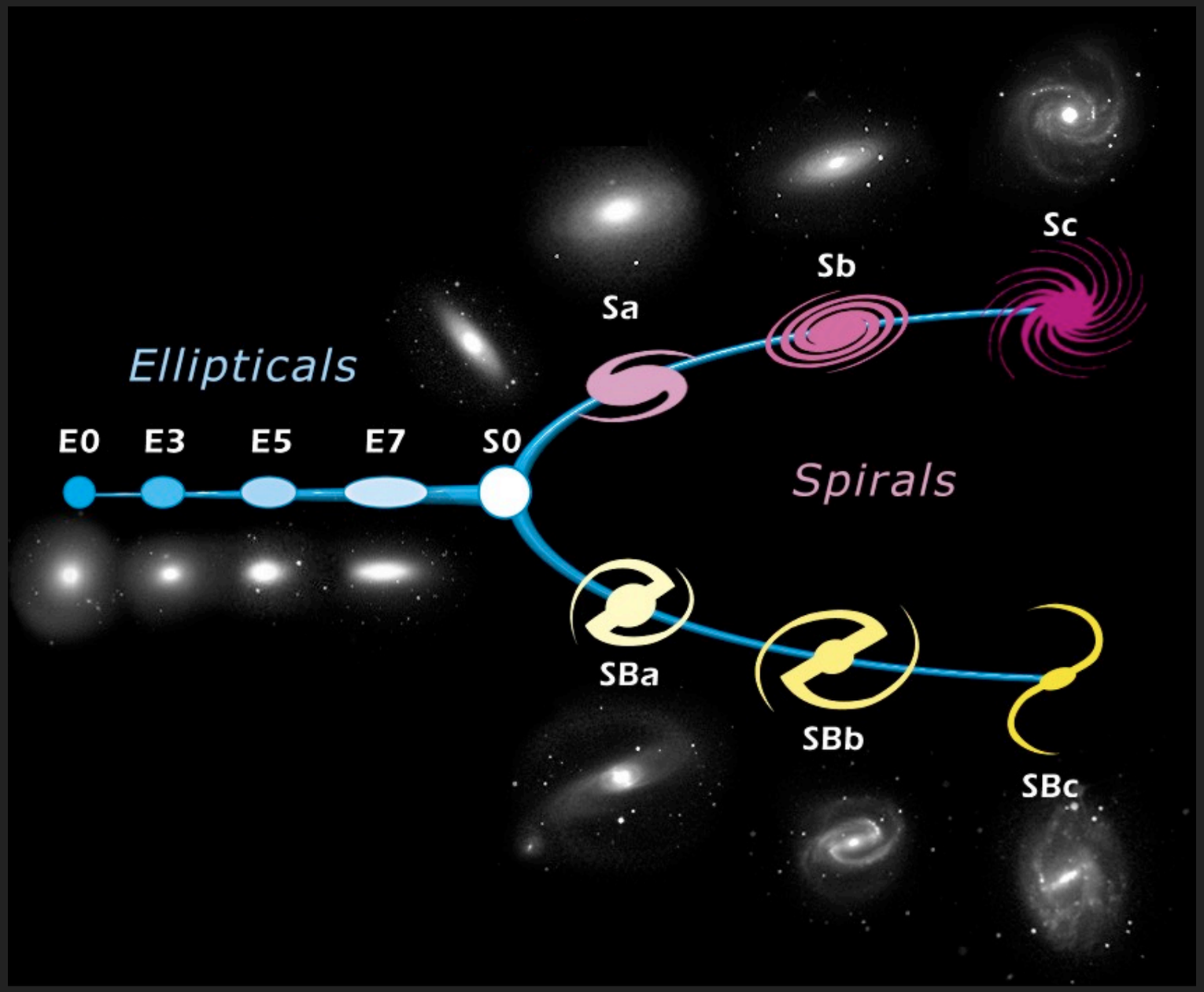
WST workshop - INAF OACN - 11/03/25

Galaxy evolution across the Hubble sequence



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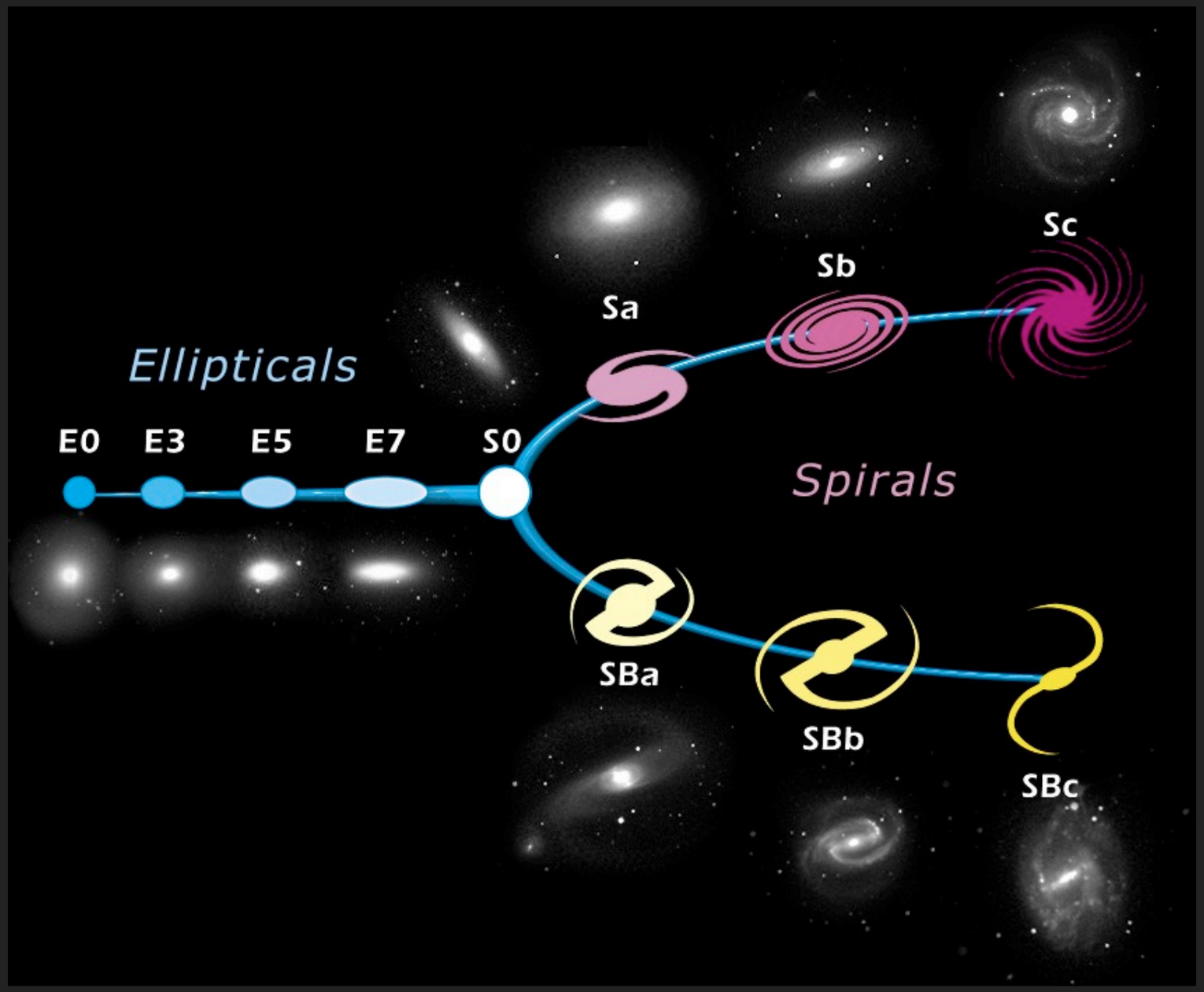

ETG ← LTG

Ell — Len (S0) — S+Irr

galaxy evolution
(preferential direction)

Galaxy type fractions depends on

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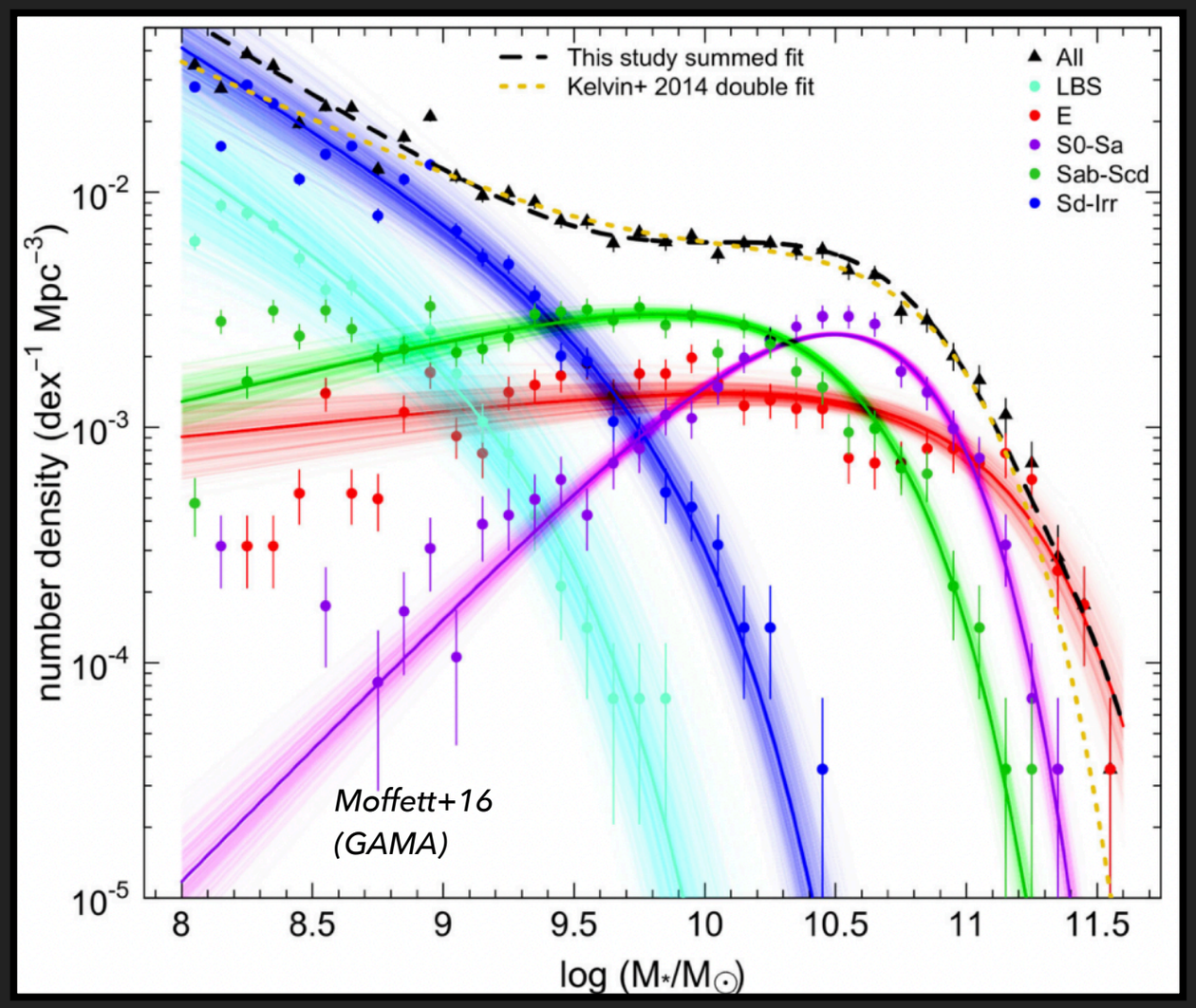
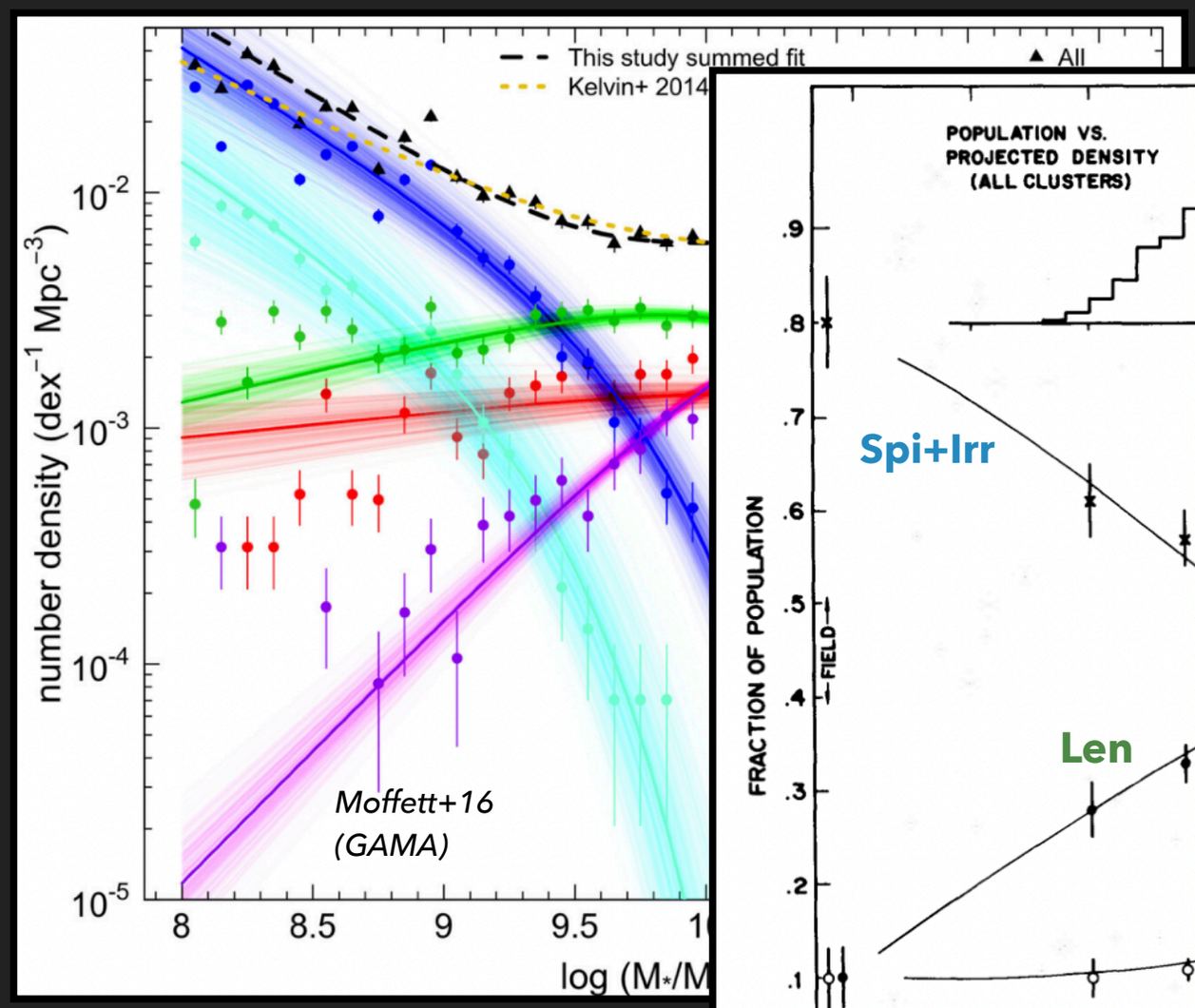


stellar mass

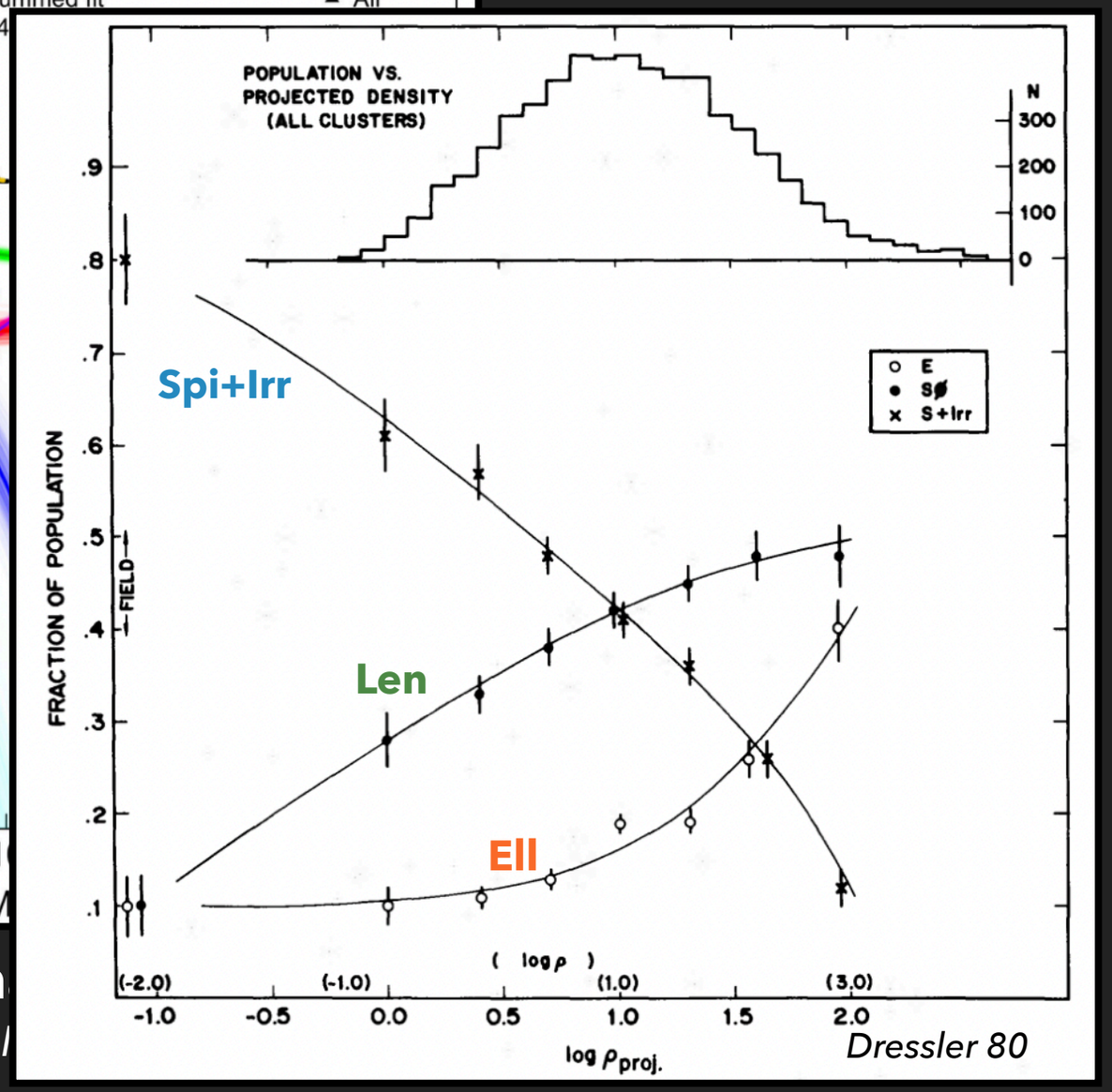
(Desai+07, Bernardi+10, Kelvin+14, Moffet+16)

Galaxy type fractions depends on



stellar m

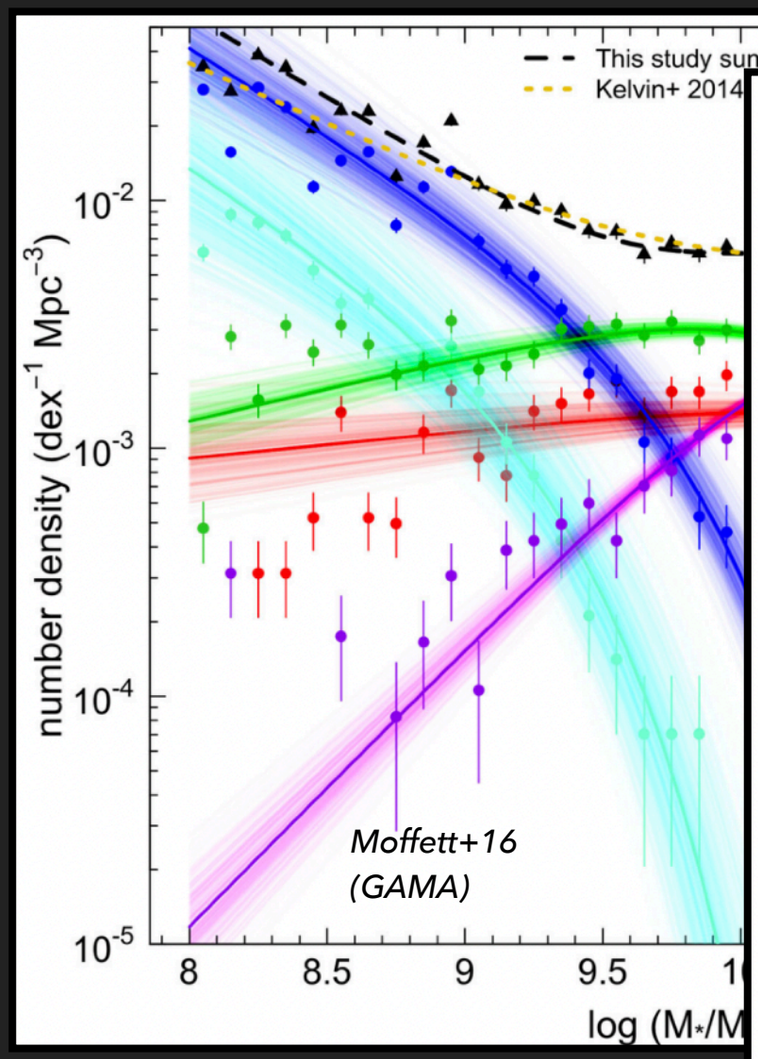
(Desai+07, Bernardi+10, Kel



Environment density

(Oemler 74, Dressler 1980, Goto+03)

Galaxy type fractions depends on



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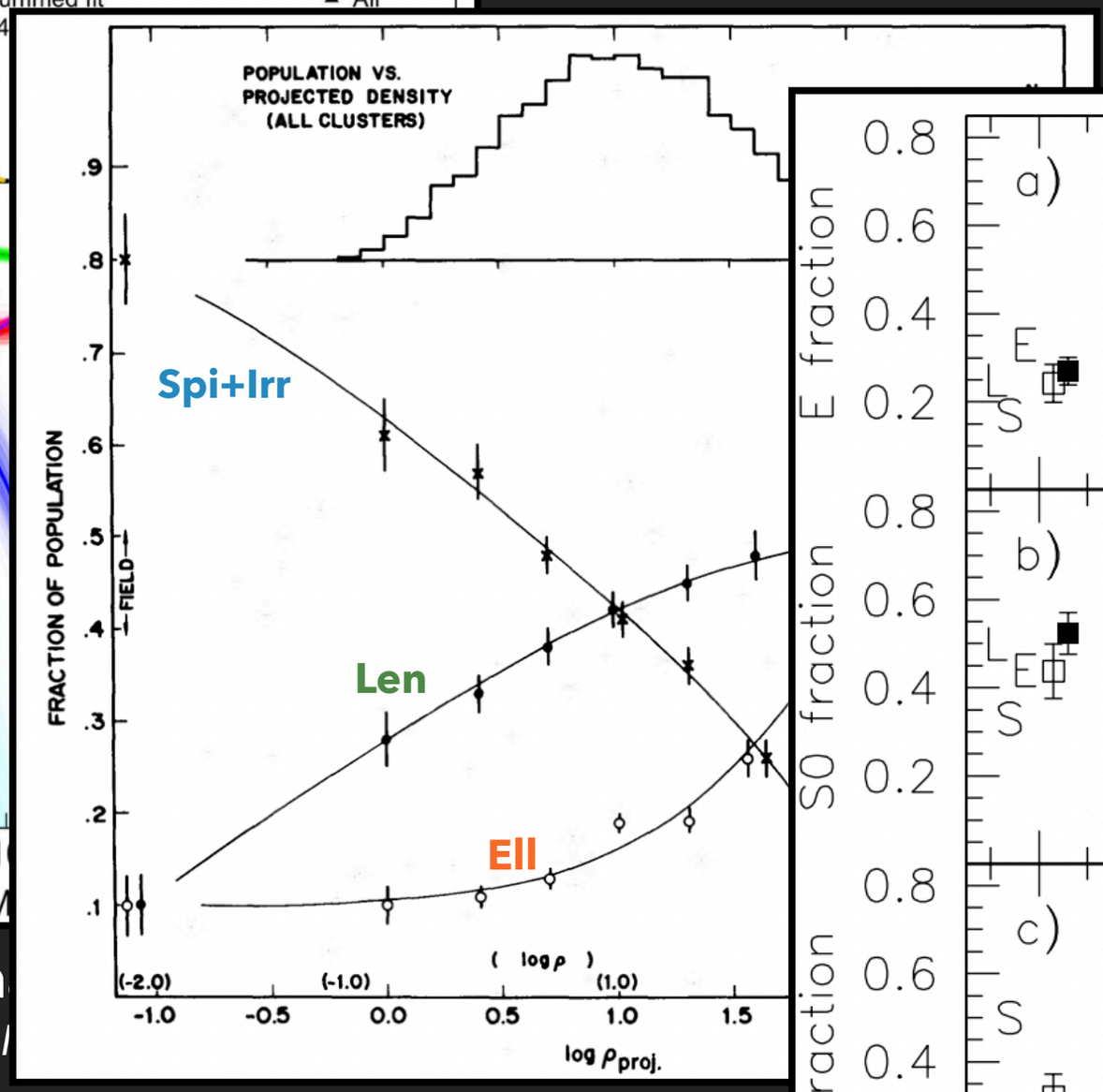

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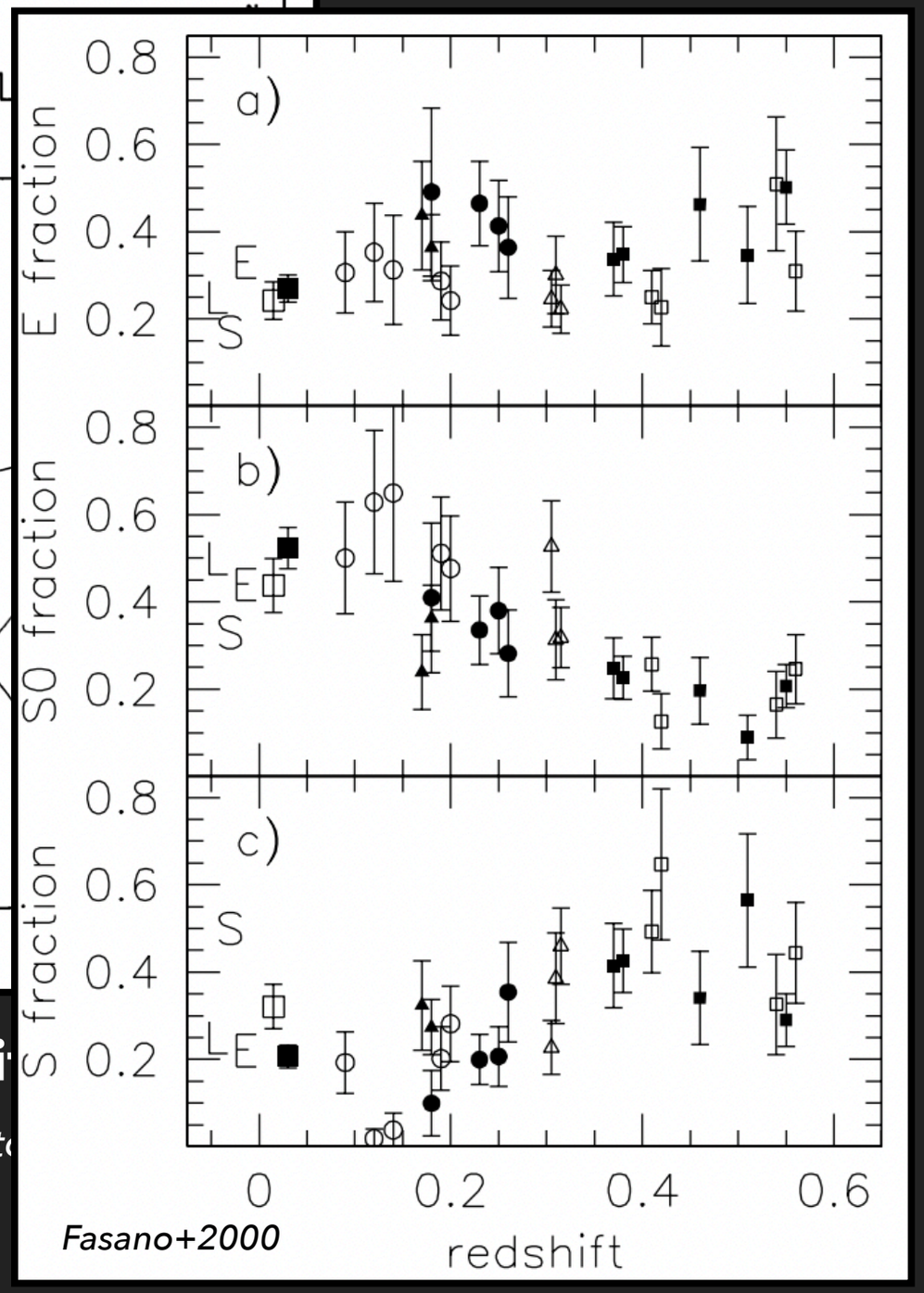
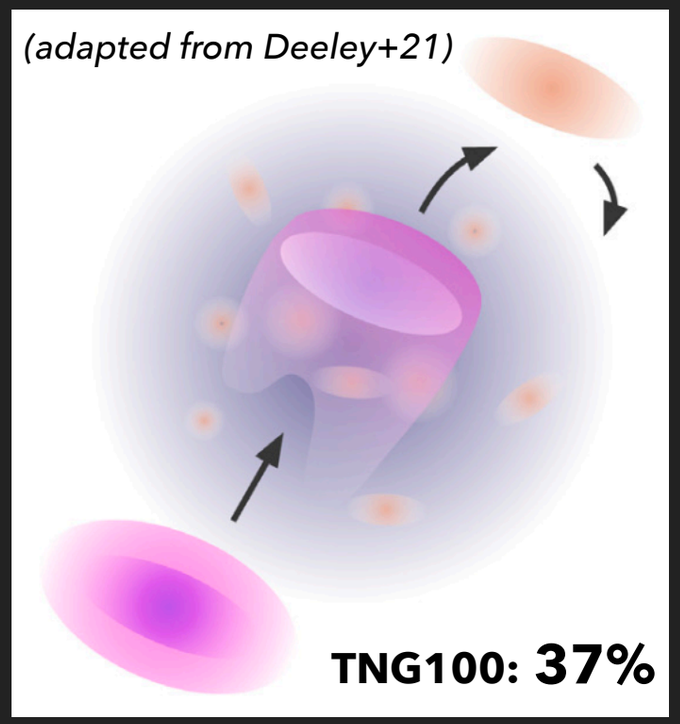


Redshift

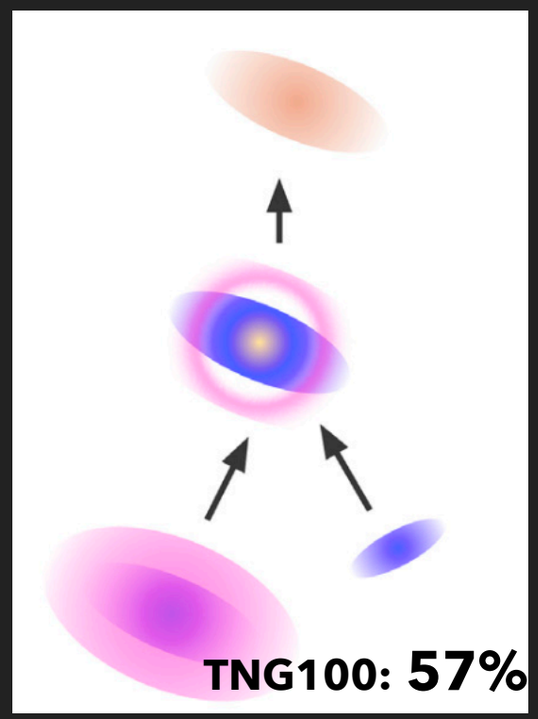
(Dressler+97, Fasano+00, Vulcani+11)

S0 formation pathways

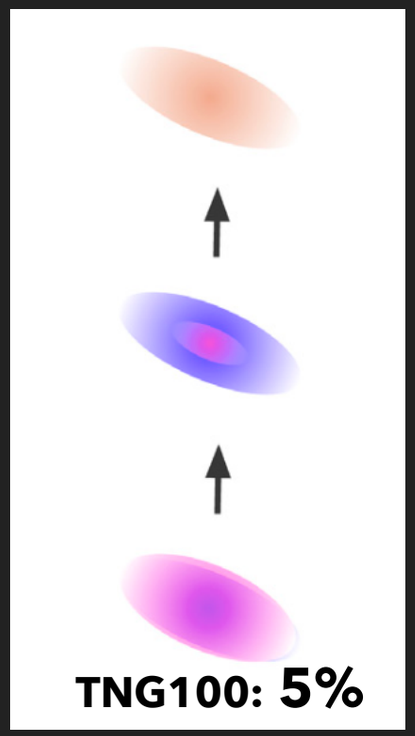
Stripping



Mergers



Gas consumption



S0 formation pathways

Some studies support this dichotomy, some don't.

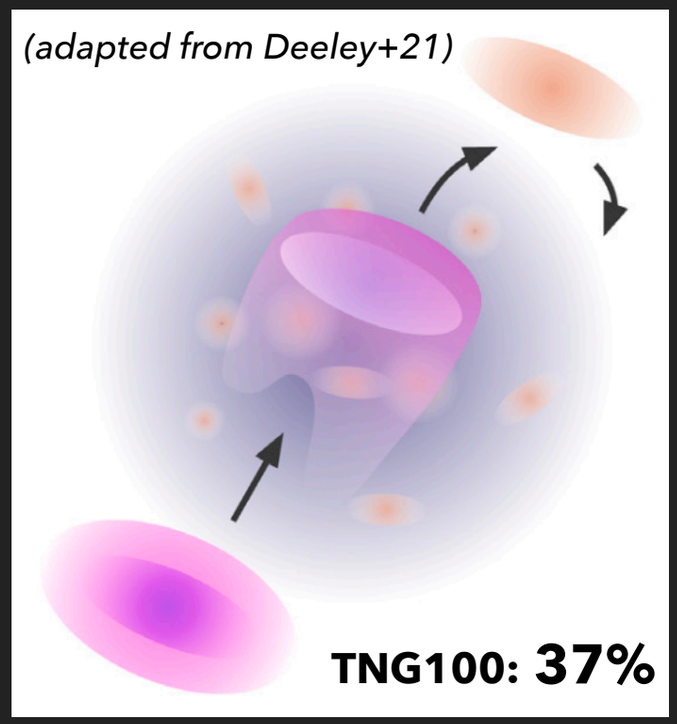
(e.g Coccato et al 2020,2022) *(e.g Fraser-McKelvie+18, Rizzo+18)*

More common in clusters

More common in groups and in the field

Stripping

(adapted from Deeley+21)



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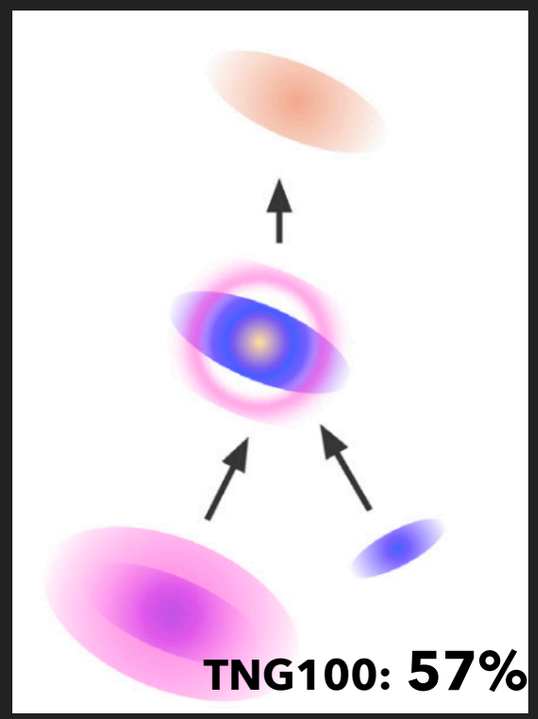

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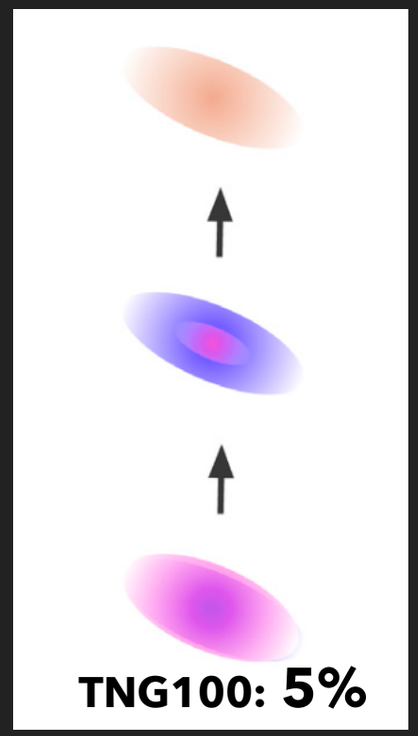

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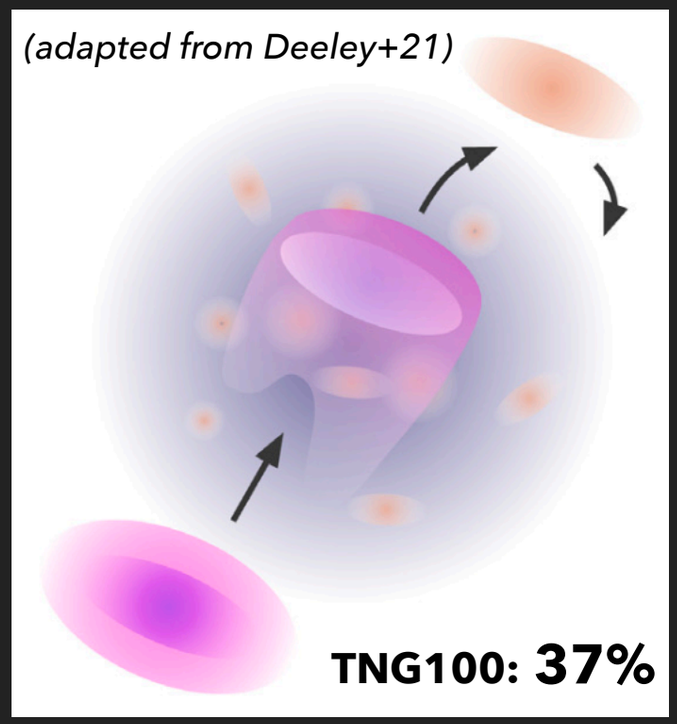
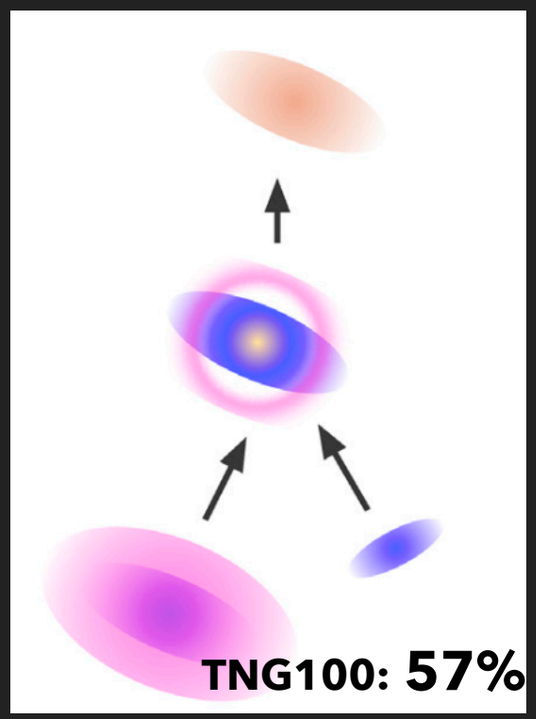
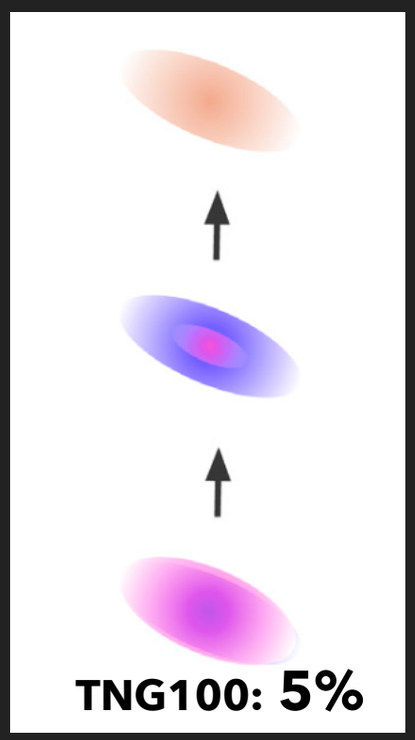
More common in clusters | **More common in groups and in the field**

	Stripping	**Mergers**	**Gas consumption**
(spatially resolved)	*(adapted from Deeley+21)* 		
stellar kinematics	high specific j★	low specific j★	high specific j★
SFH	outside-in quenching over short (<1 Gyr) timescales	discontinuous SFH, inside-out quenching	homogeneous, "slow" quenching over the whole disc

WST science case

(spatially resolved) stellar kinematics + SFH

Large galaxy sample different $M_\star$, environment and z

WST science case

(spatially resolved)
stellar kinematics
+ SFH

→

IFS@WST

←

Large galaxy sample
different $M_\star$, environment and z

WST science case

z=0.05-0.07
(low-z sample)

z~0.3
(intermediate-z sample)

WST science case

(spatially resolved) stellar kinematics + SFH → **IFS@WST** ← **Large galaxy sample different $M_\star$, environment and z**

z=0.05-0.07
(low-z sample)

z~0.3
(intermediate-z sample)

spatial resolution

0.8″ ~ 1 kpc — 0.8″ ~ 3.6 kpc

$M_\star > 10^9\ M_\odot$ — $M_\star > 10^{10.5}\ M_\odot$

spectral resolution

R=3500-> σ_{instr}~35 km/s, adequate for stellar kinematics of galaxies with $M_\star > 10^9\ M_\odot$

redshift evolution (in clusters)

Fraction of S0 in clusters at least doubled during in this z range (3 Gyr!)

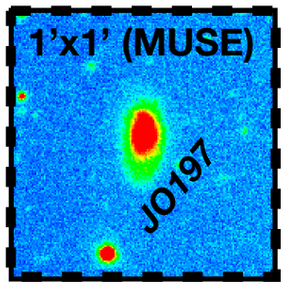
ISM studies (legacy)

all relevant optical emission lines (Hα, Hβ, [OII], [OIII], [NII], [SII]) are visible for λ=3700-9700 Å

Ancillary data + synergies

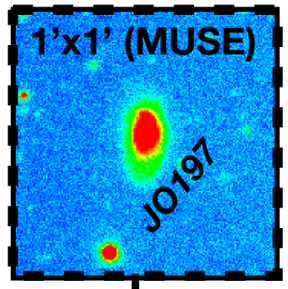
WINGS / OmegaWINGS + MeerKat at low-z, SKA at intermediate-z, Euclid, Rubin..

Why WST?



JO197
Periphery of A754 (z=0.054)
part of the GASP sample (Poggianti+17)
MUSE data

Why WST?



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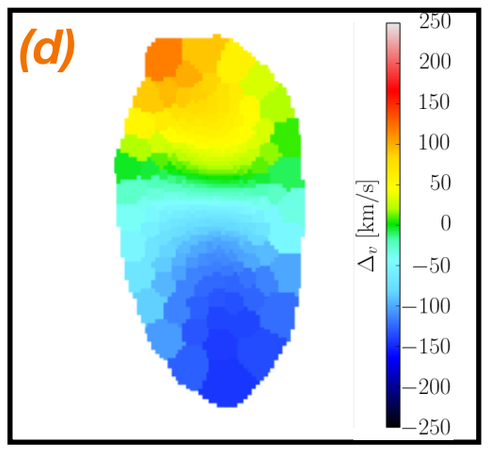
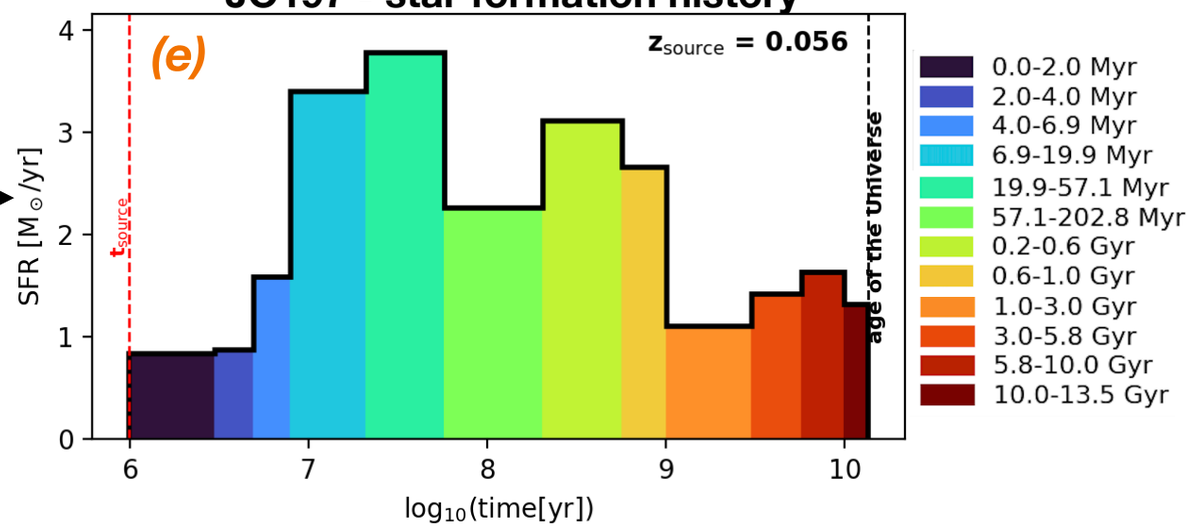
JO197 - stellar velocity field



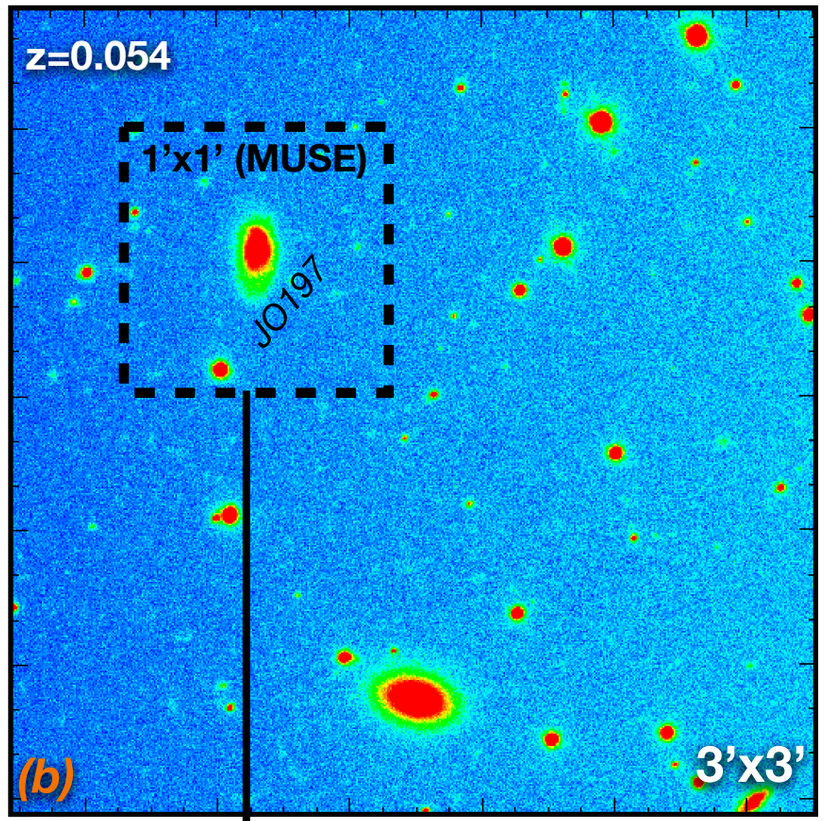
*using **pPXF** (Cappellari 2017)*

JO197 - star formation history



*using **SINOPSIS** (Fritz+2017)*

A754 - outskirts



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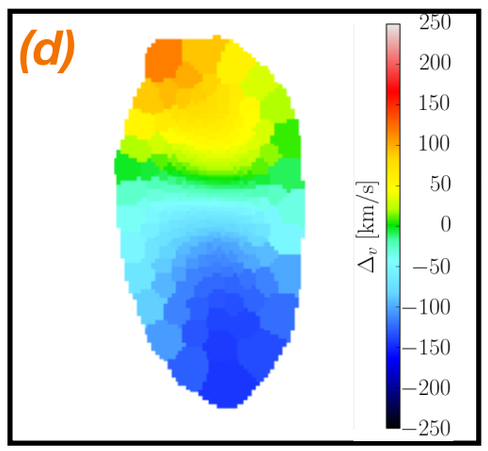

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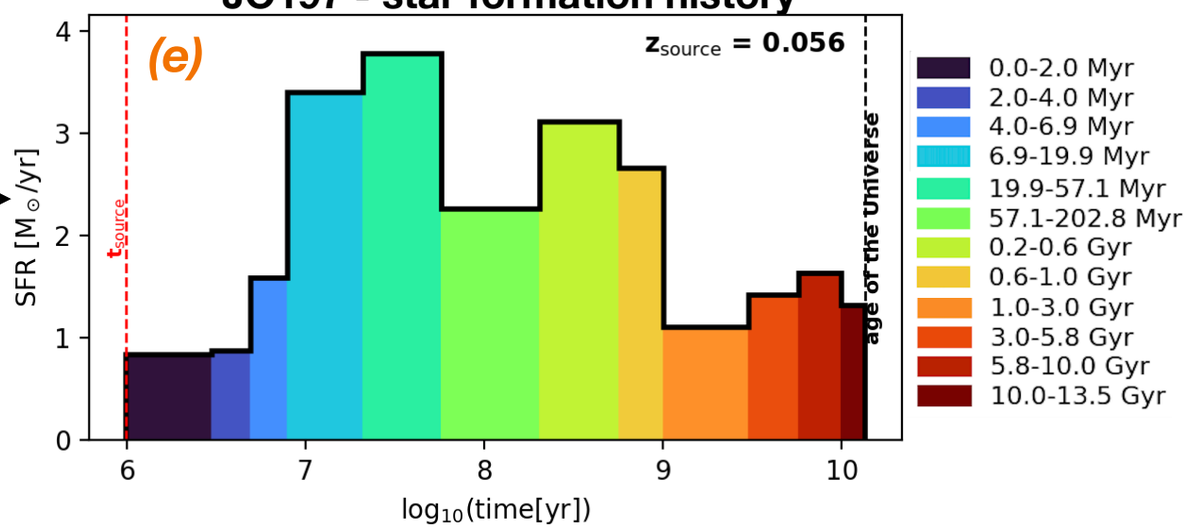
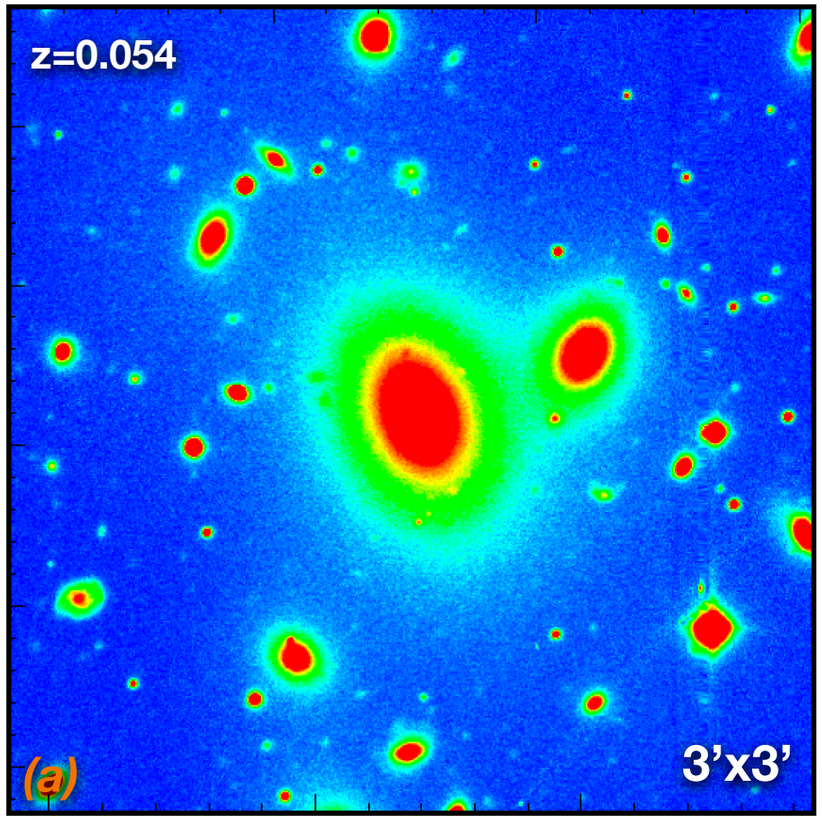
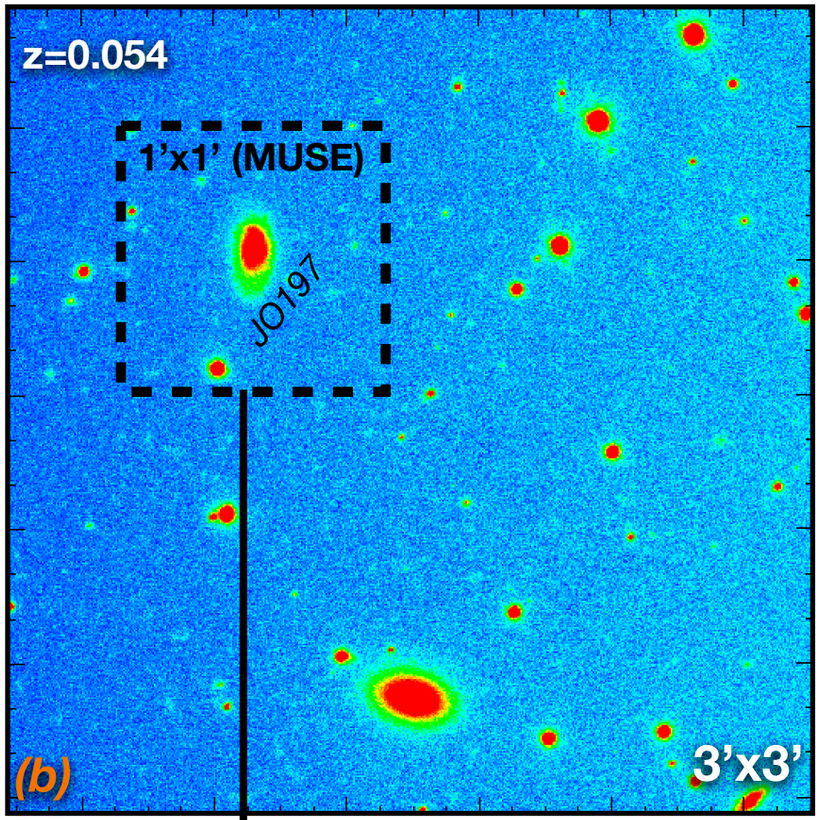


A754 - central regions

A754 - outskirts





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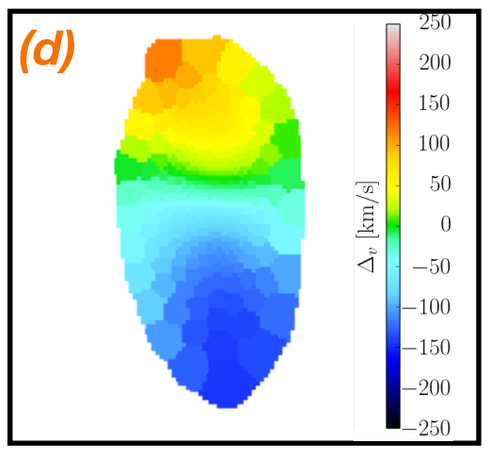

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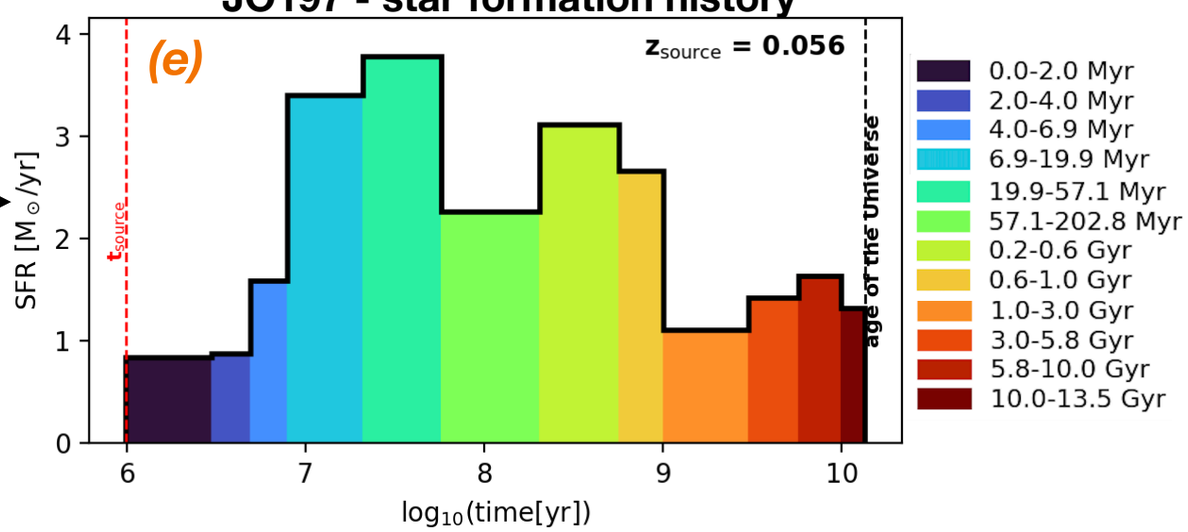
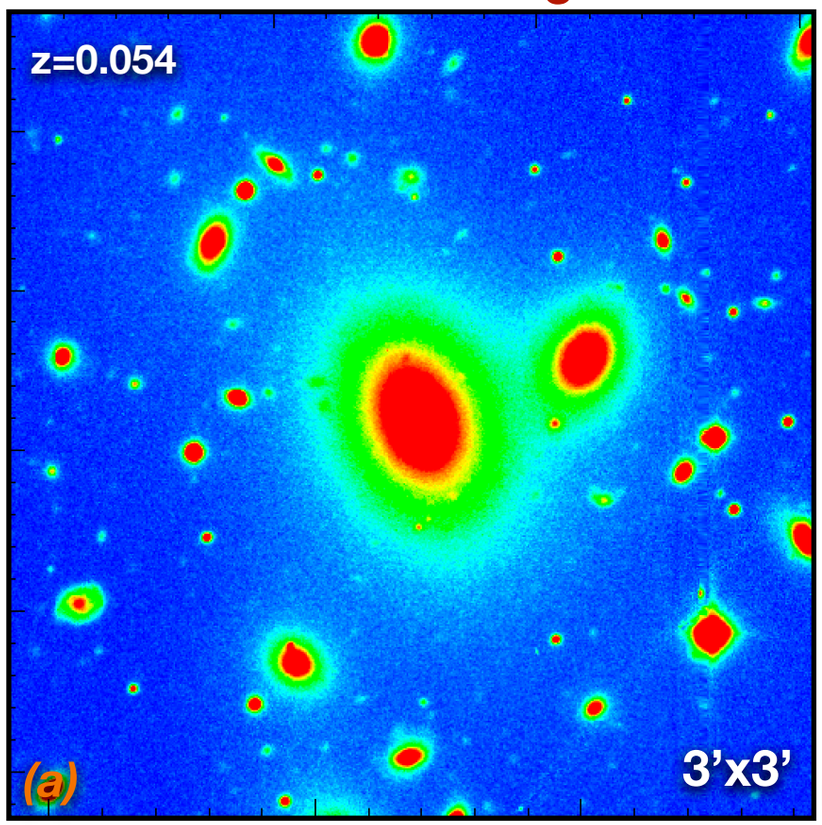
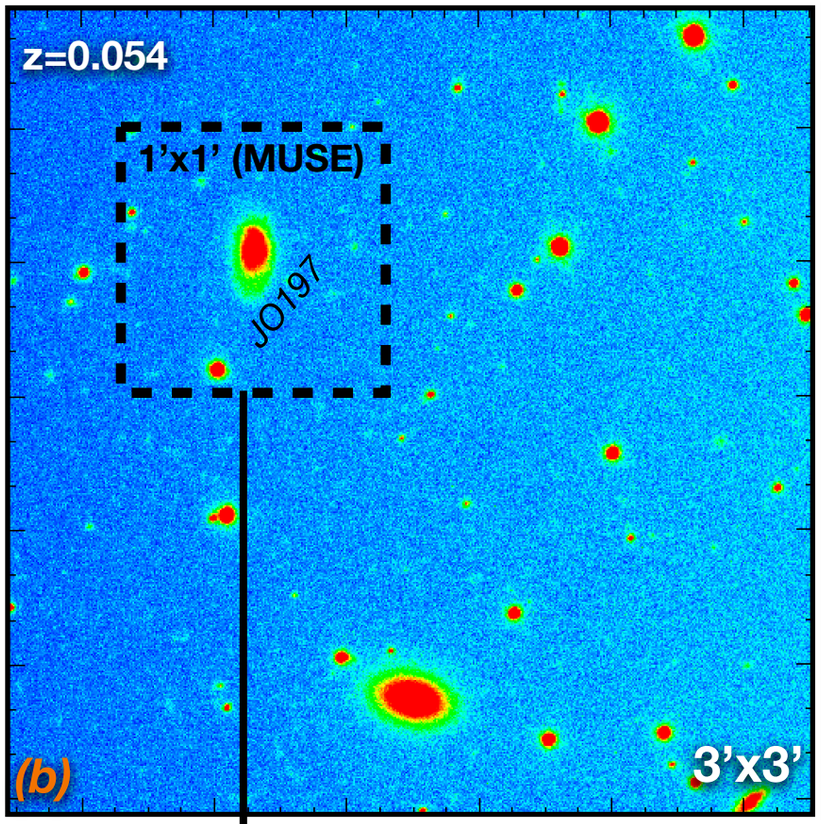


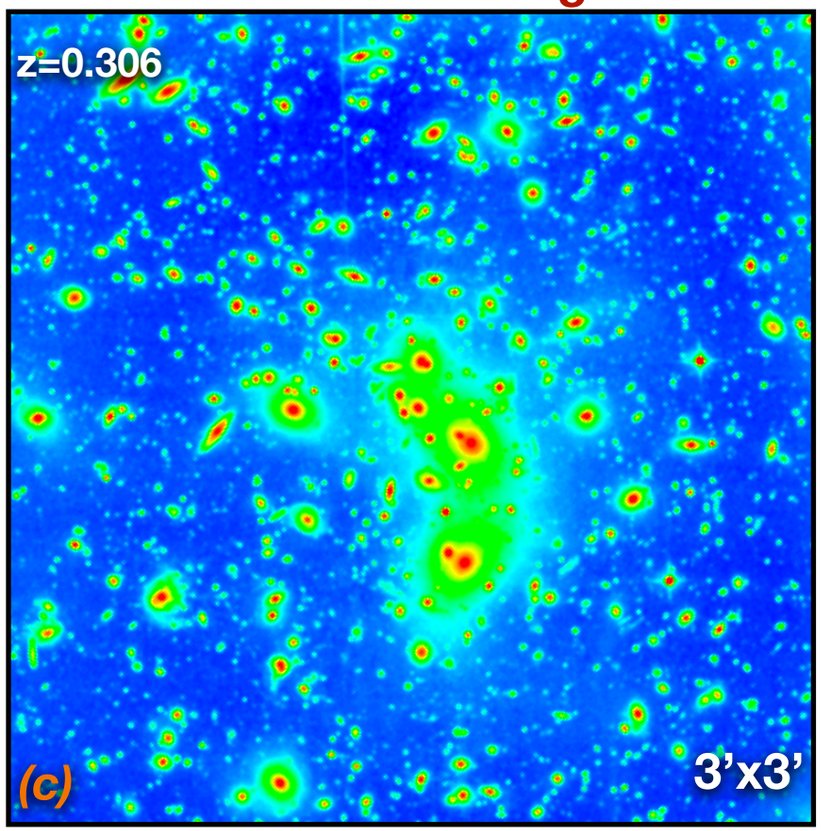
A754 - central regions

A754 - outskirts

A2744 - central regions







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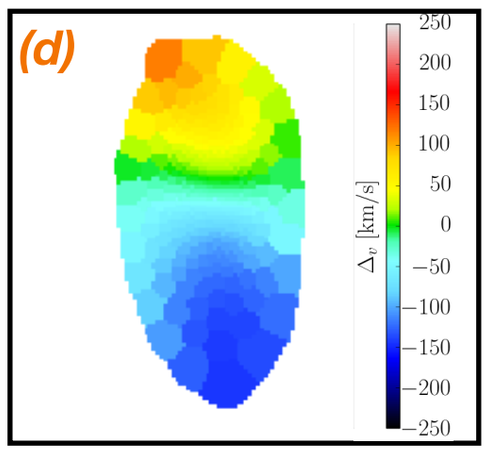

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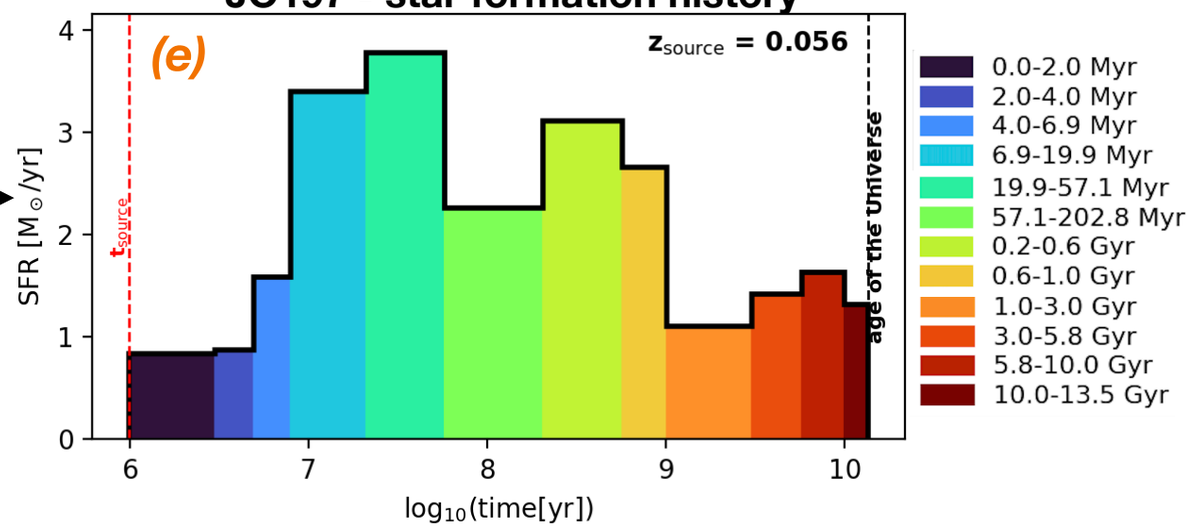


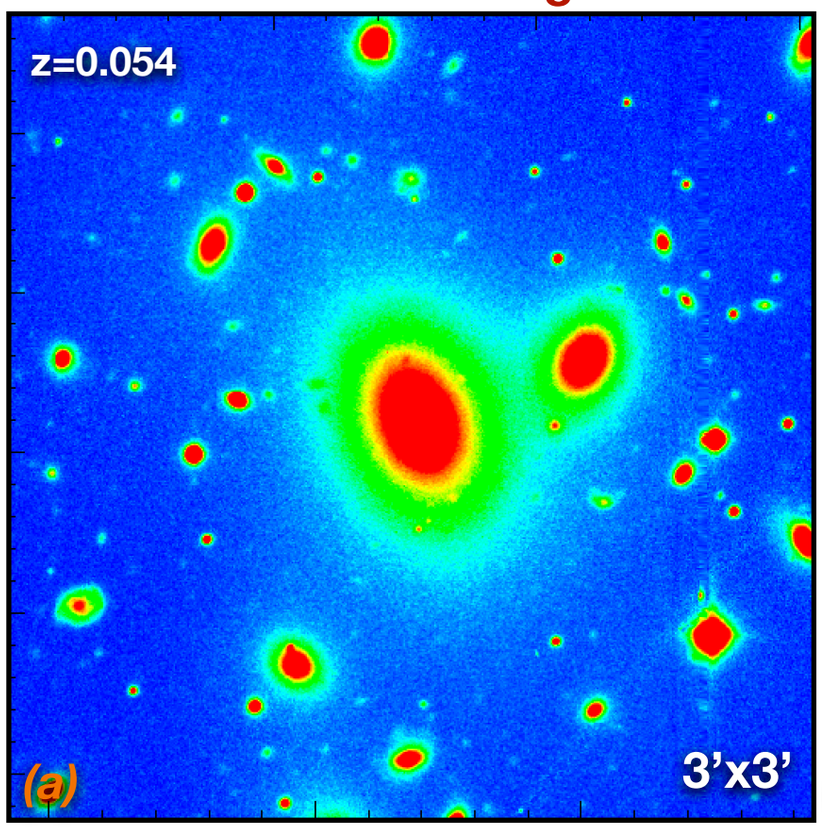
Estimates for galaxy clusters

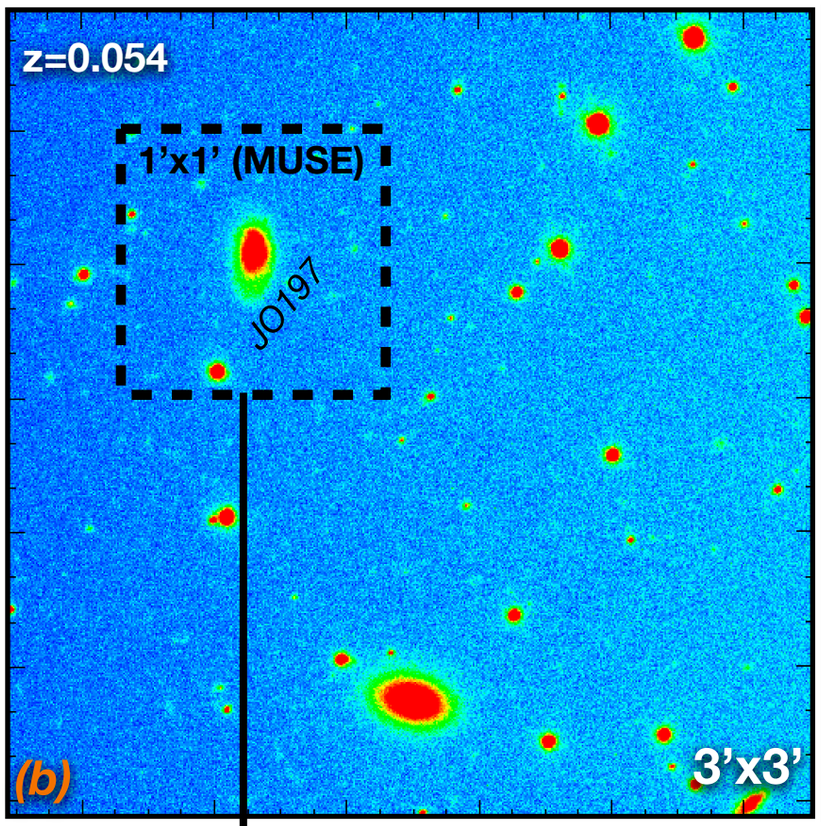
	low-z	intermediate-z
N of resolved galaxies per pointings	30 in cores 5 in the outskirts	80 in cores 10 in the outskirts

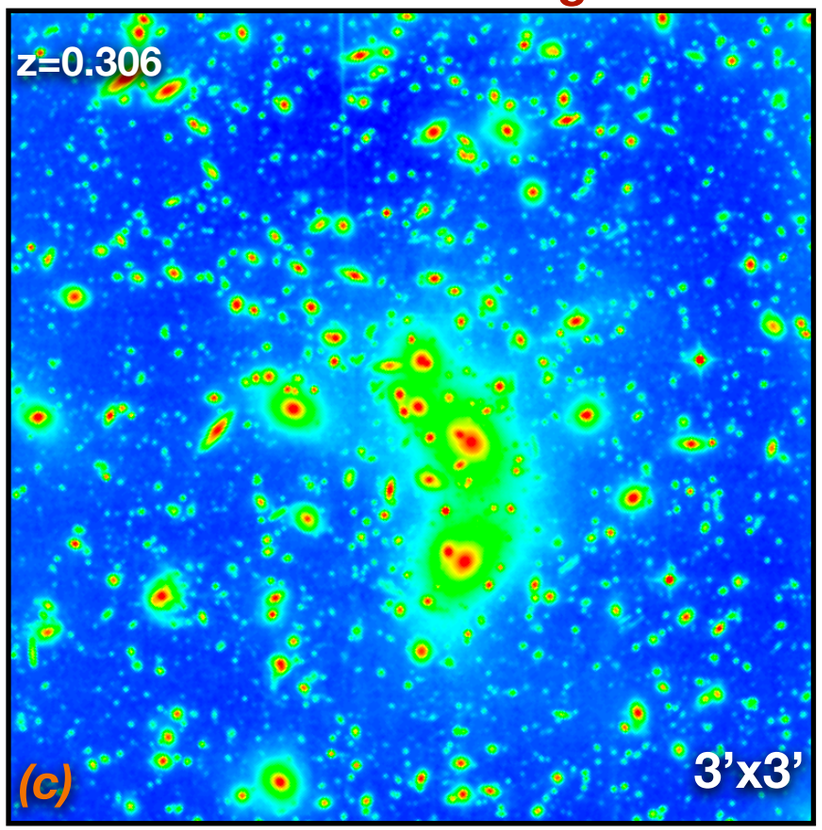
A754 - central regions

A754 - outskirts

A2744 - central regions







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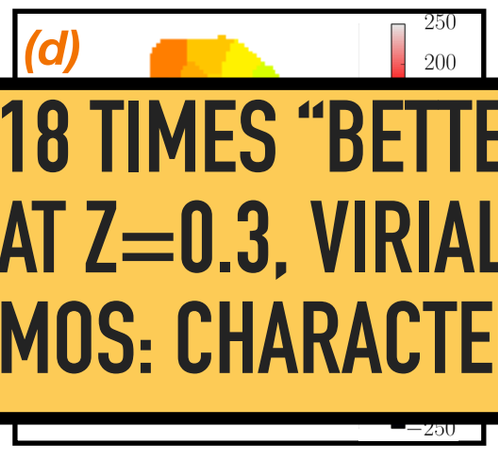

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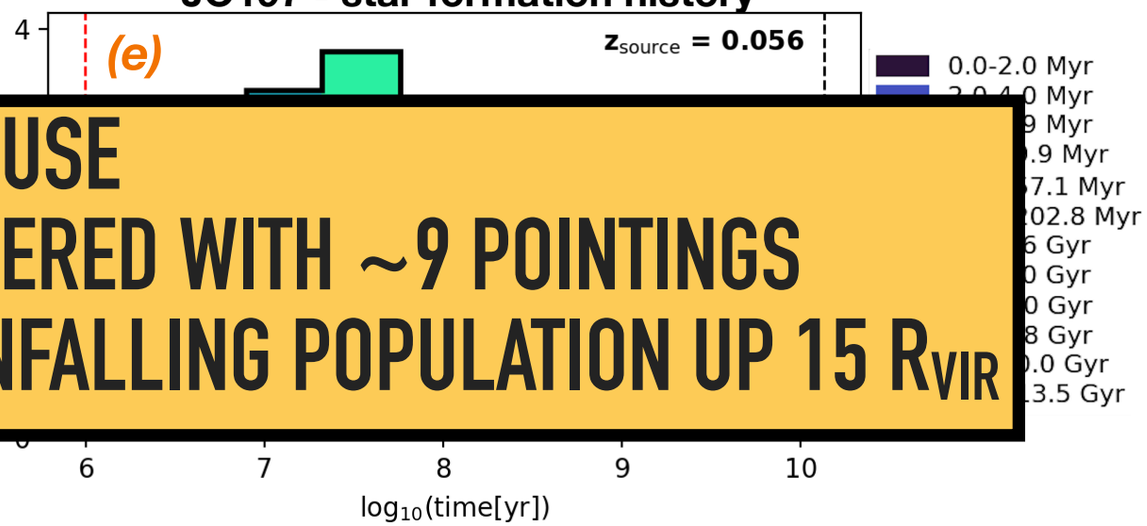

- 18 TIMES “BETTER” THAN MUSE
- AT Z=0.3, VIRIAL AREA COVERED WITH ~9 POINTINGS
- MOS: CHARACTERISE THE INFALLING POPULATION UP 15 R_{VIR}

Estimates for galaxy clusters

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Scientific questions

- **Understanding the morpho-kinematic evolution of the galaxy cluster population from z~0.3 to z~0.06 by comparing morphology, kinematics and SFH of the cluster populations at the two redshift**

- **Characterising the formation channels of lenticulars as a function of their environment by exploiting their spatially resolved information on SFH and stellar kinematics**

- **Building insights on the formation channels of spheroids (classical bulges and ellipticals) as function of their environment and kinematics (fast/slow rotators) by exploiting their SFH.**

- **Characterising the $M_\star$-$j_\star$-$\beta_\star$ relation and understanding the origin of its scatter**

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