Stellar-to-halo mass relation of cluster galaxies

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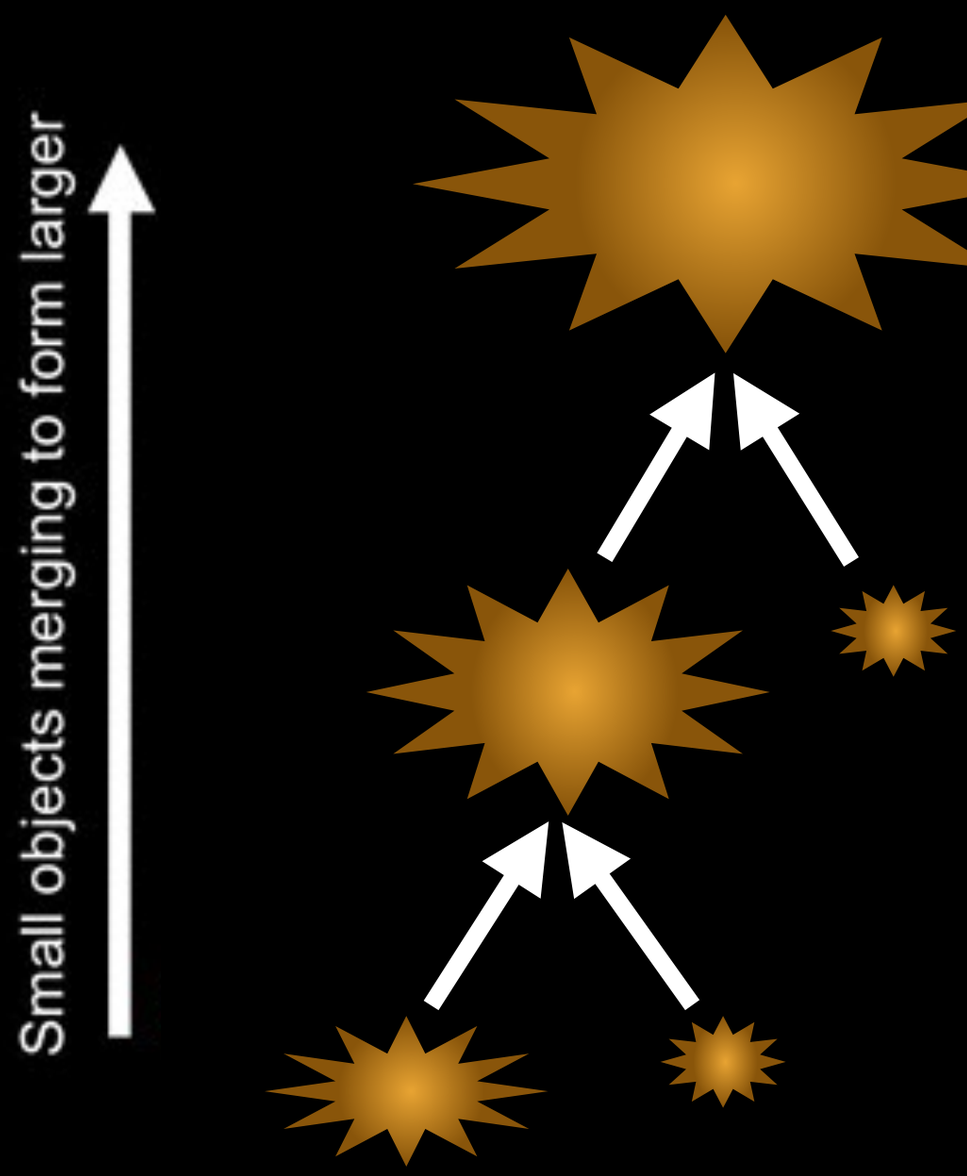
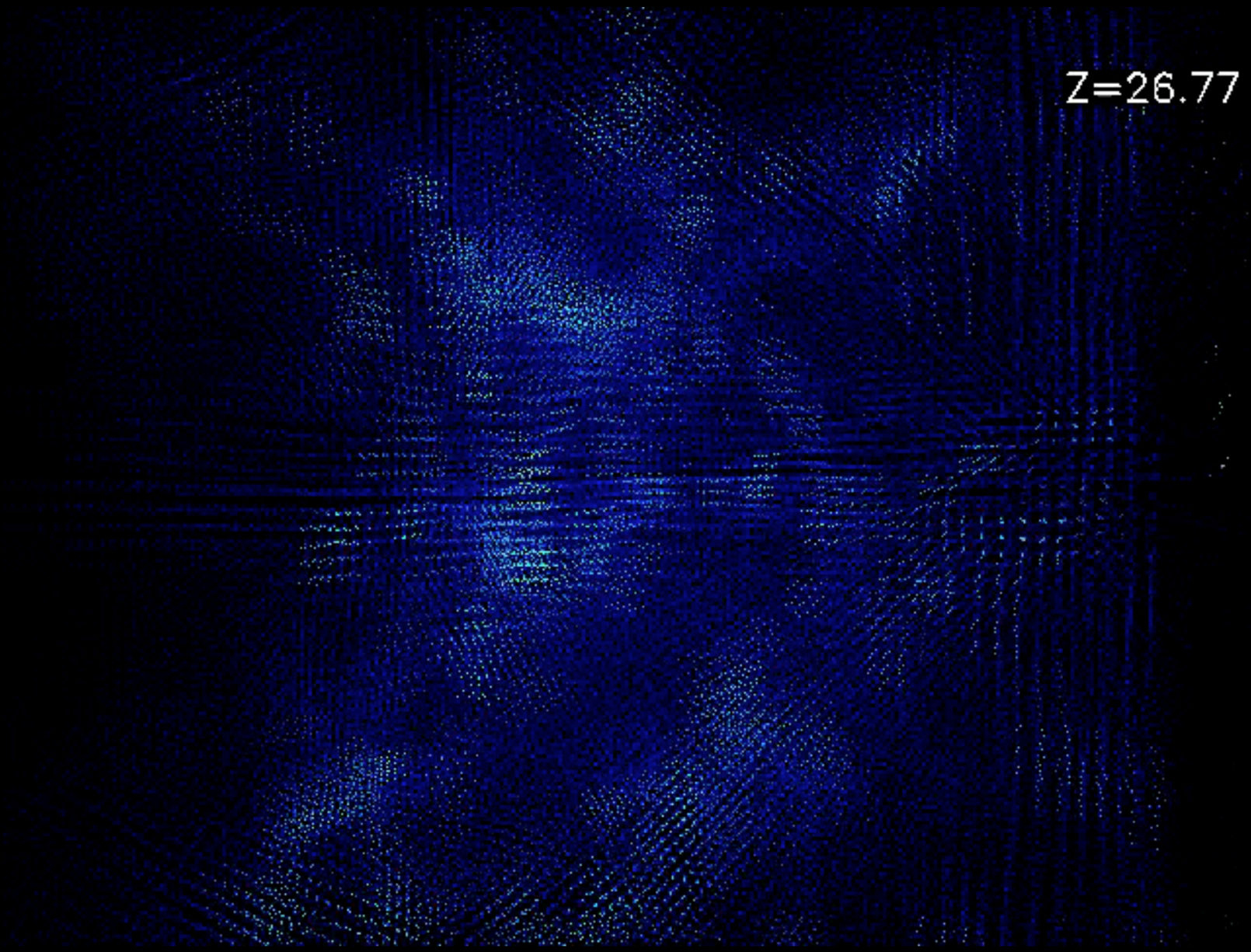
Hierarchical cluster formation



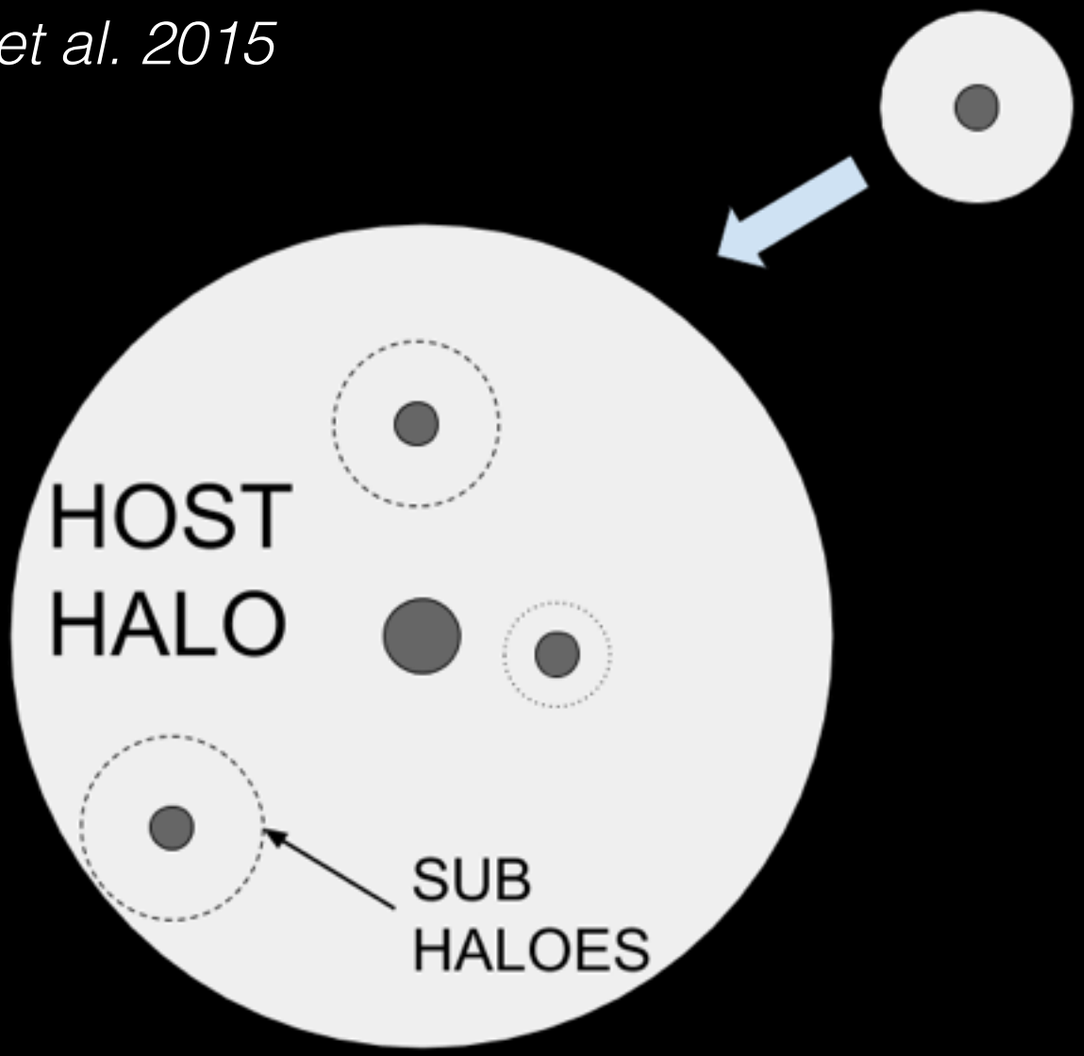
Credits: NASA

Hierarchical cluster formation

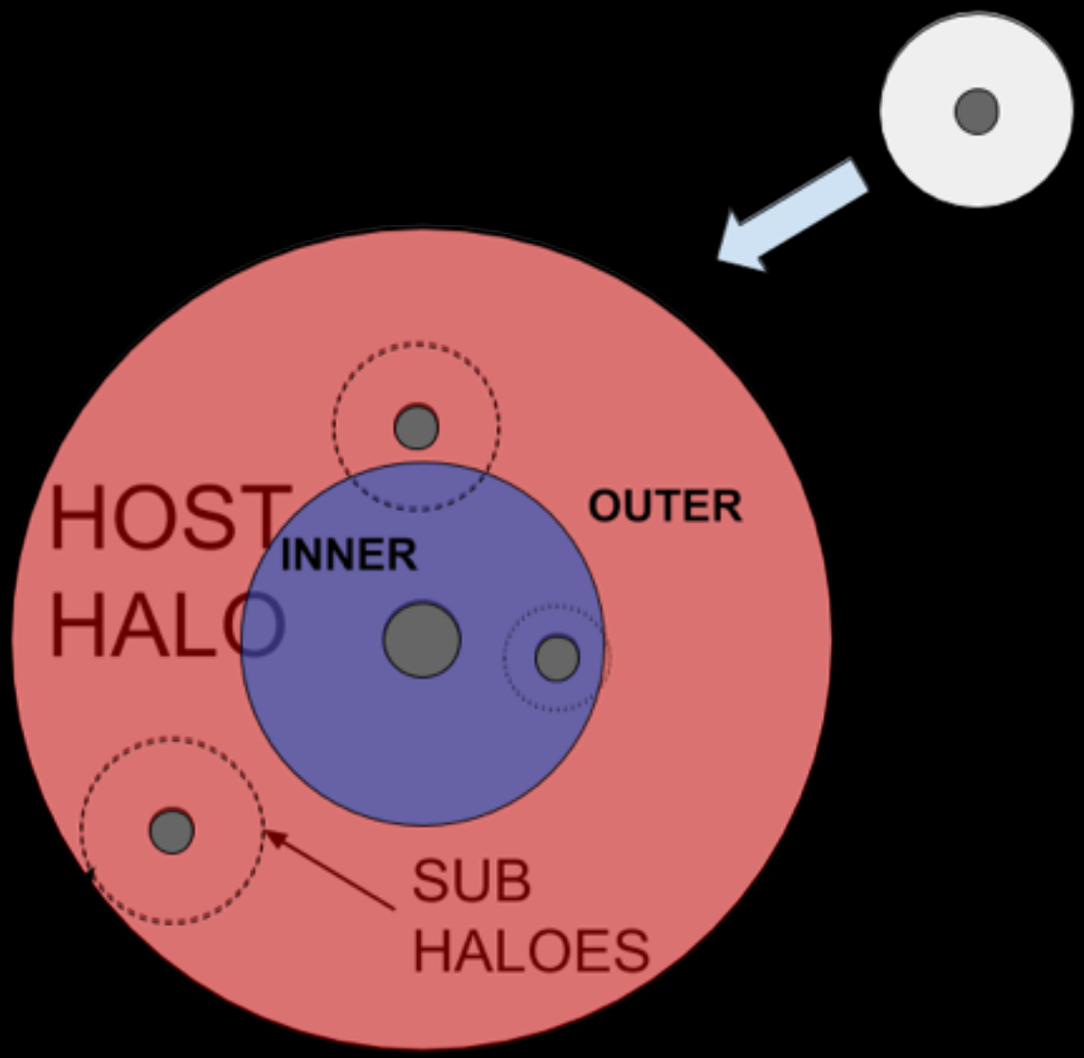


Yepes et al 2002

See also:
Gillis et al. 2013
Li et al. 2015
Sifón et al. 2015



How is the dark matter halo affected during infall?



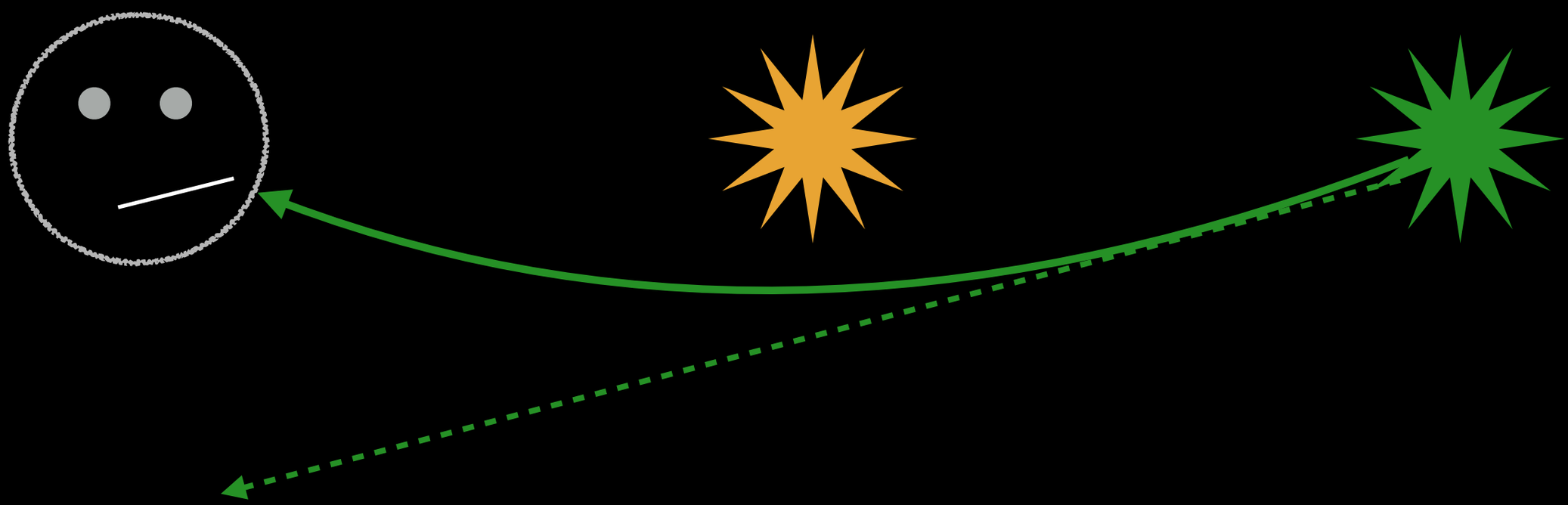
We need :

- Projected distance to cluster centre R_{sat} ~ infall redshift
(*eg vandenBosch 2015*)
- Stellar mass ~ infall mass (*eg Nagai&Kravtsov 2005*)
- Subhalo mass

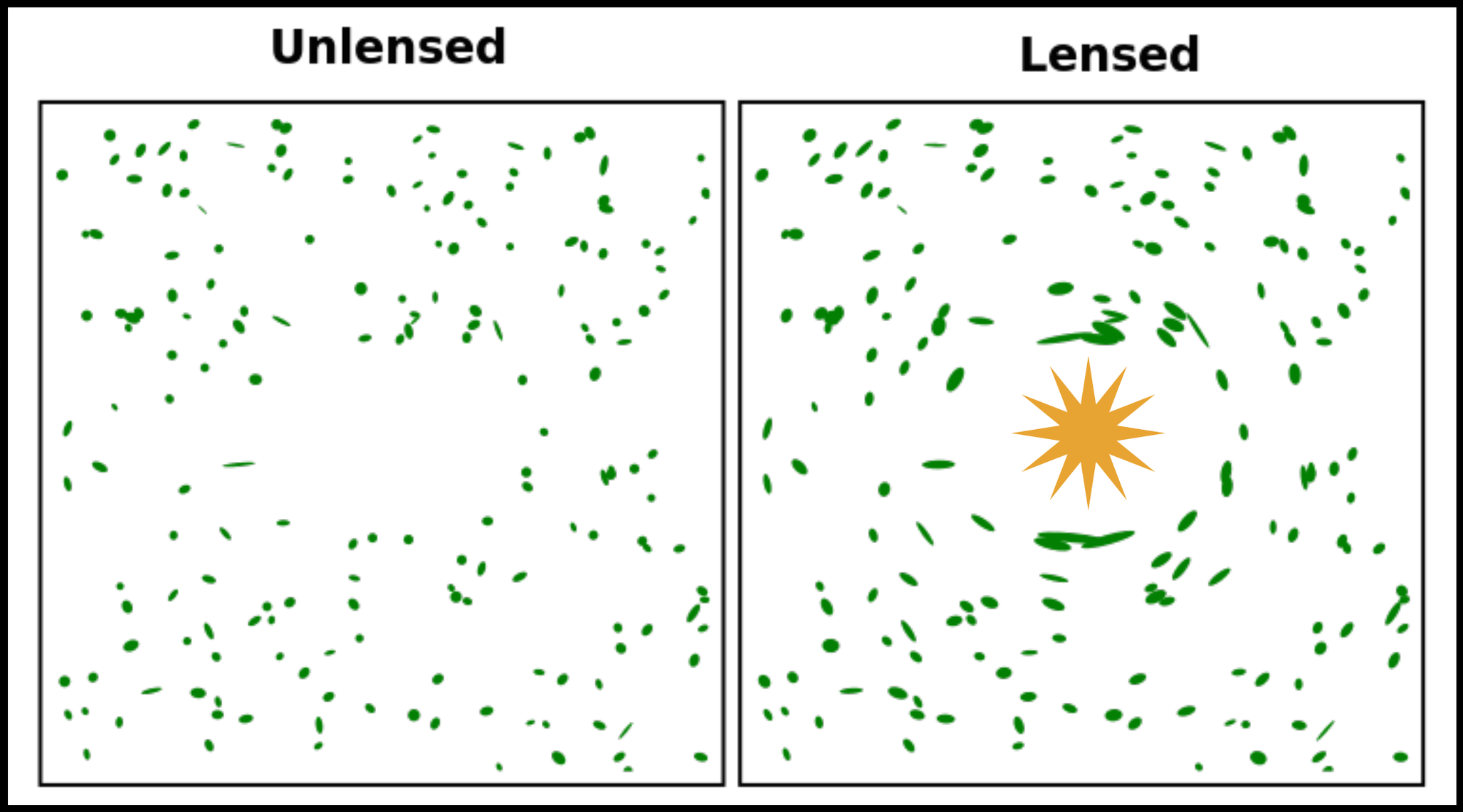
—> **M_{sub}/M_{star}** in the **inner** part of the cluster vs in the **outer** part

Dark matter halo mass

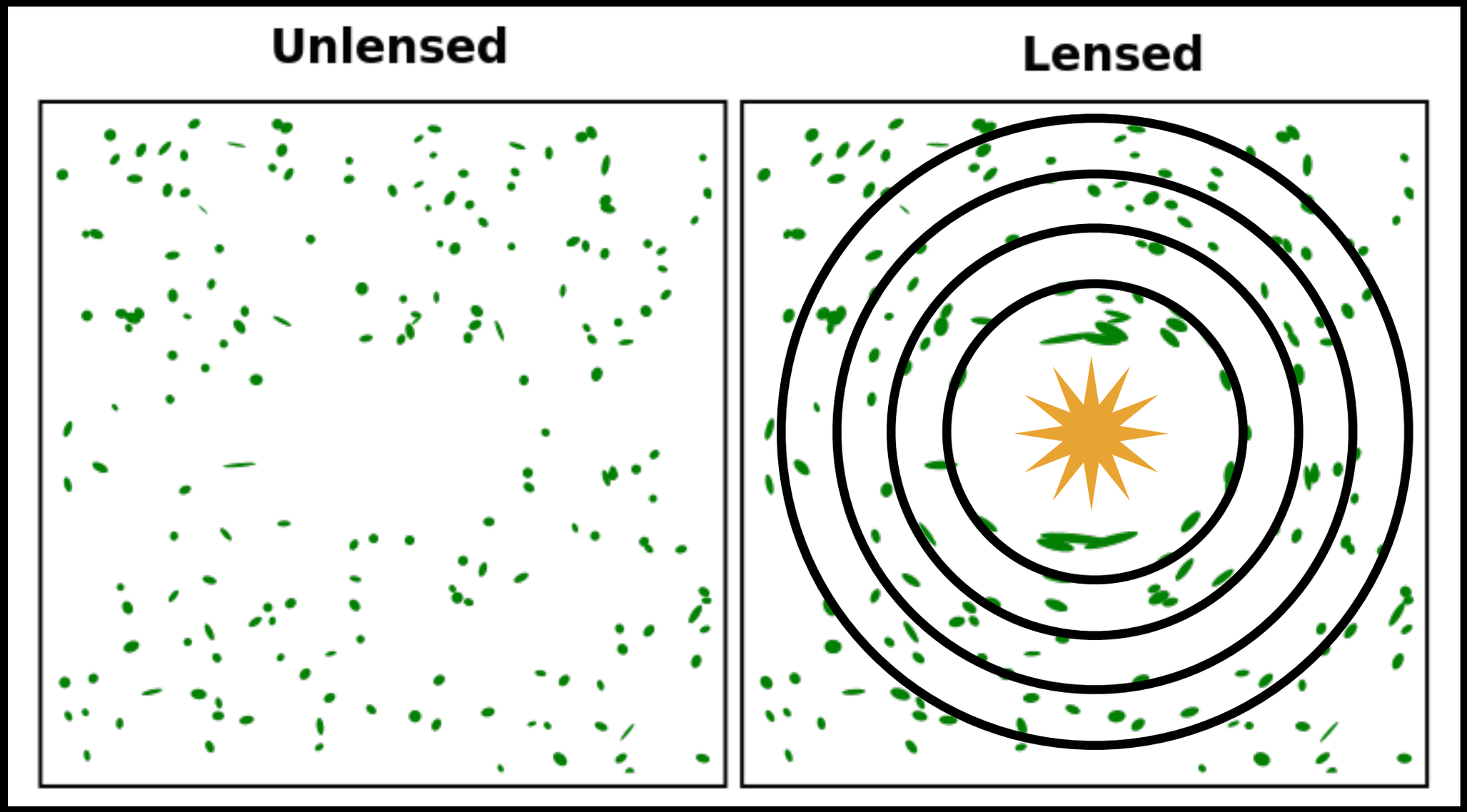
—> Gravitational lensing



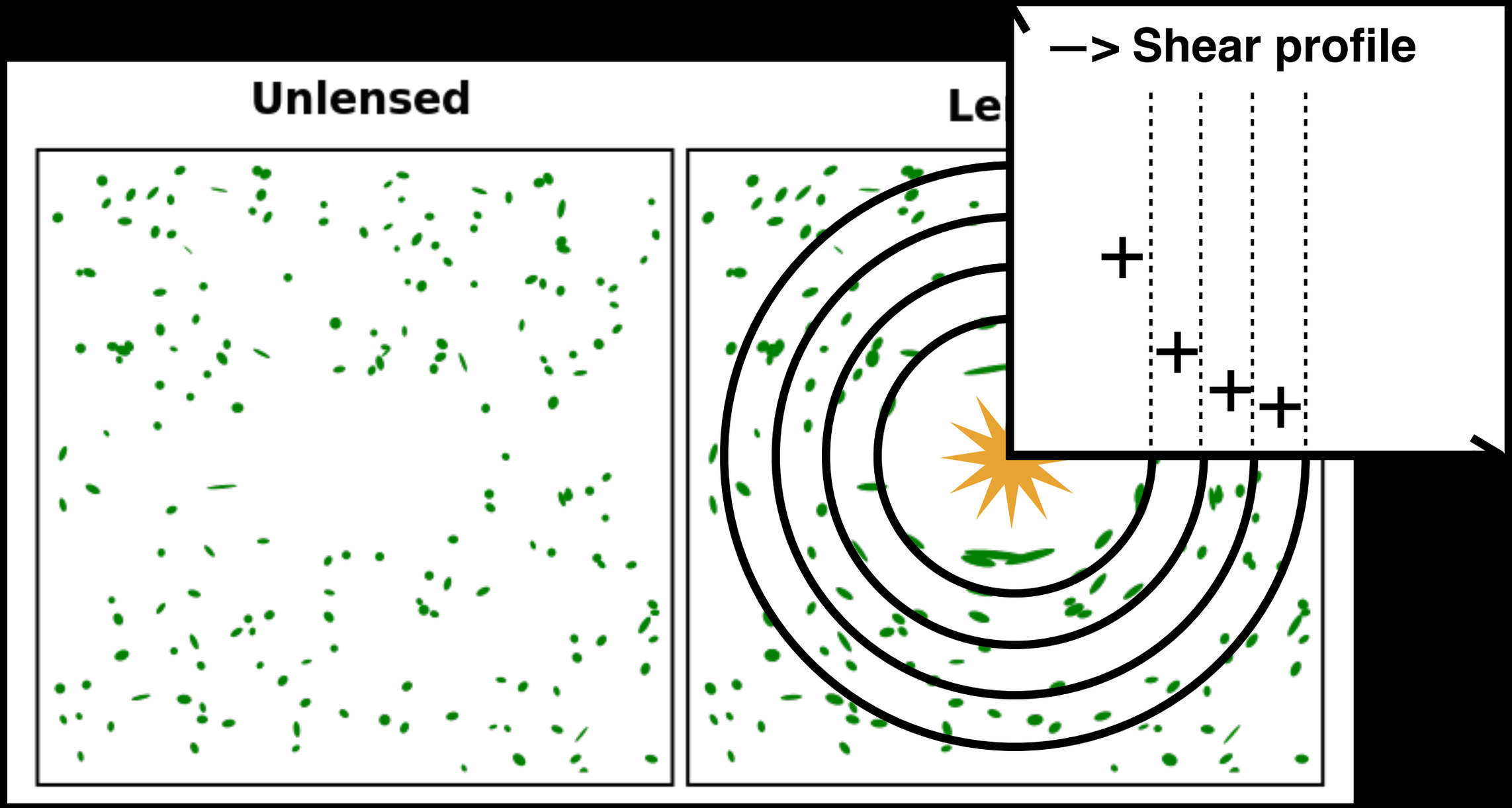
Weak lensing



Weak lensing

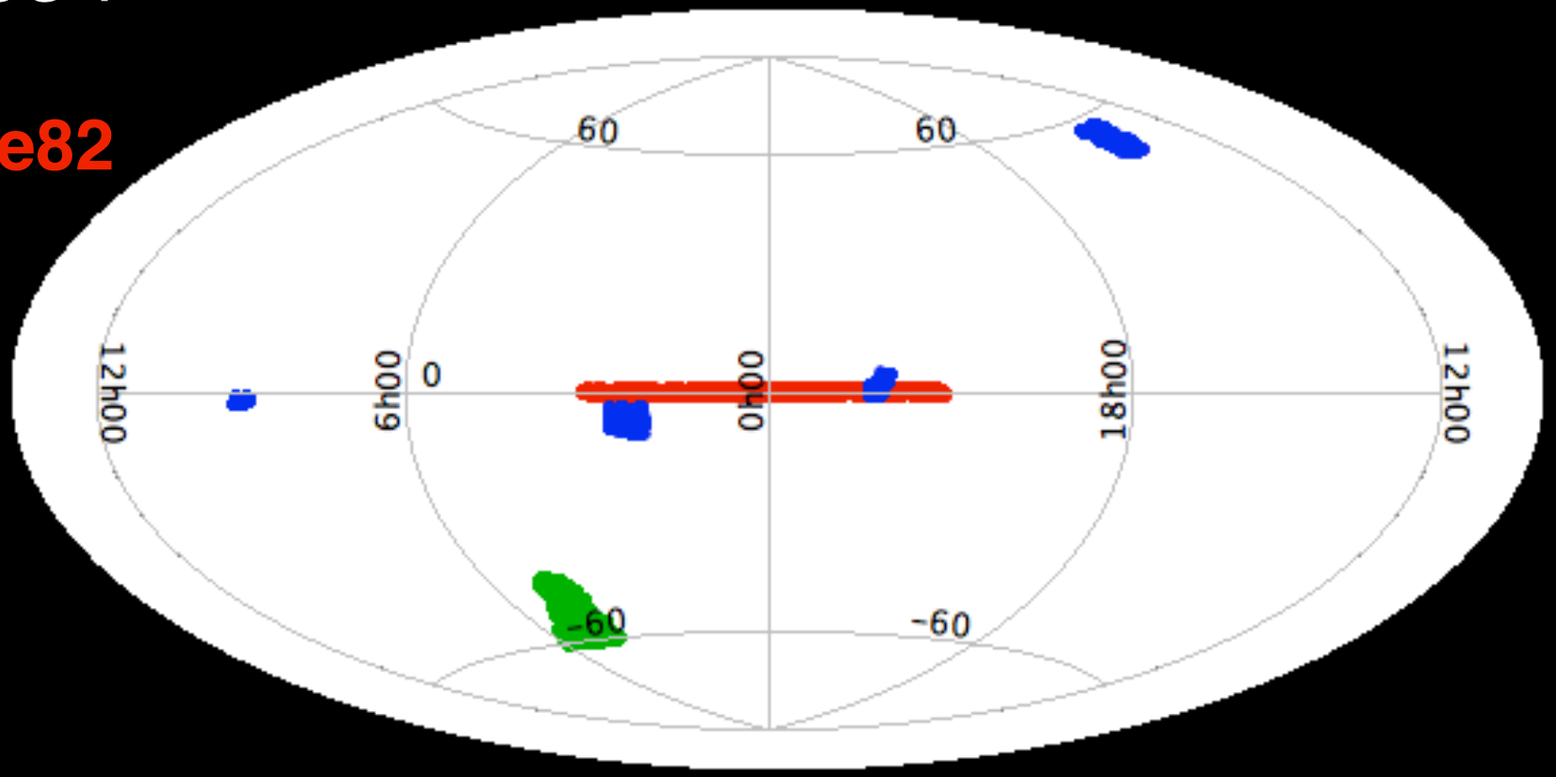


Weak lensing



The lenses

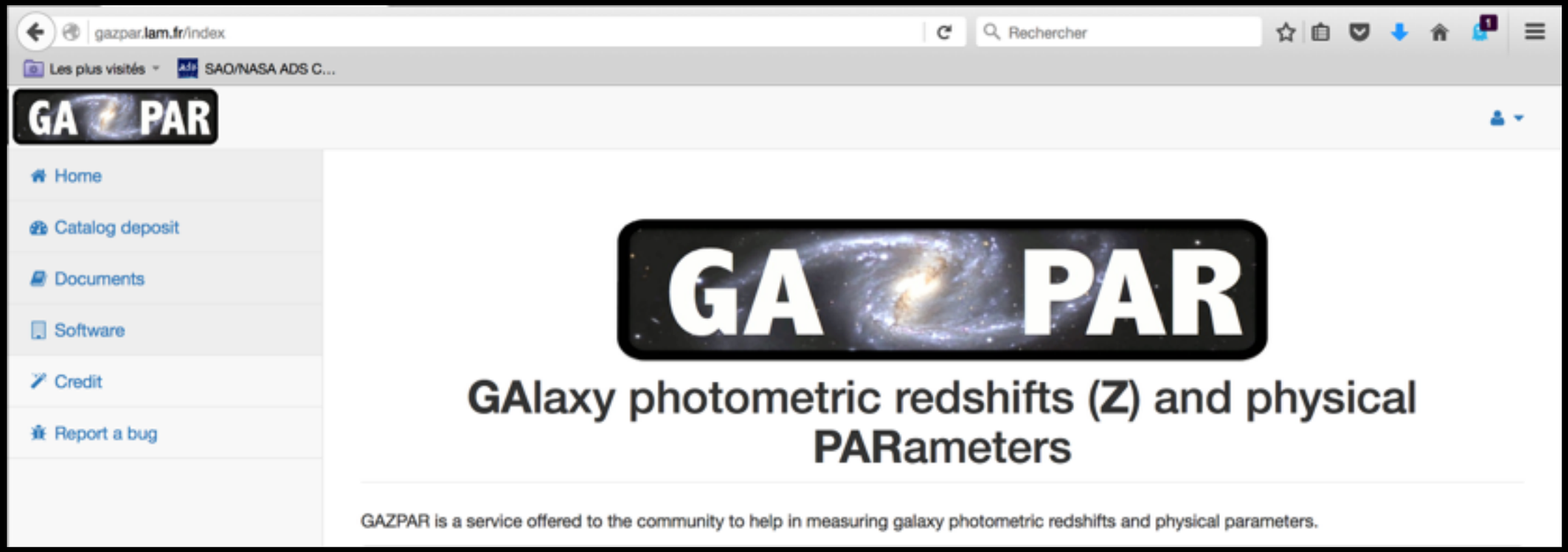
- redMaPPer satellites :
  - 130 deg^2 **CFHT-Stripe82**
  - 154 deg^2 **CFHTLenS**
  - 138 deg^2 **DES-sv**



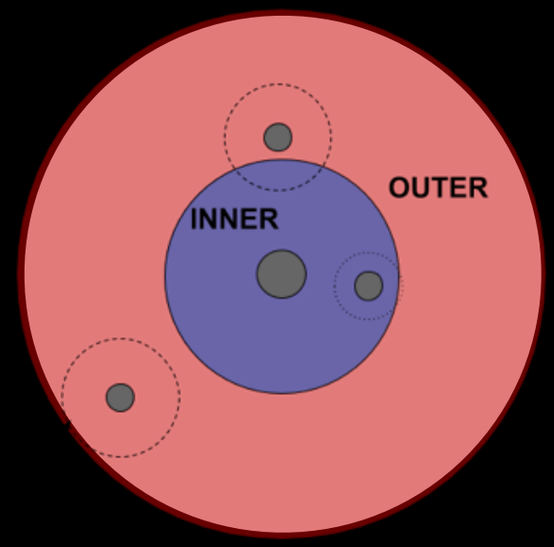
- 2 parameters classification :
  - Stellar mass ~ infall mass
  - Projected distance to cluster centre ~ environment

The lenses

—> Stellar masses: Gazpar web service

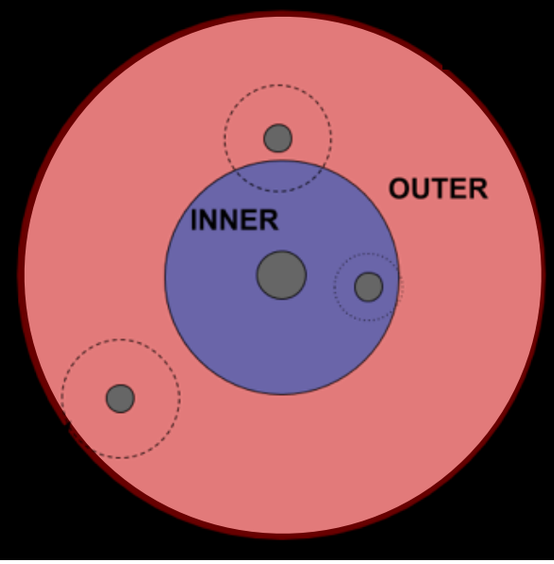


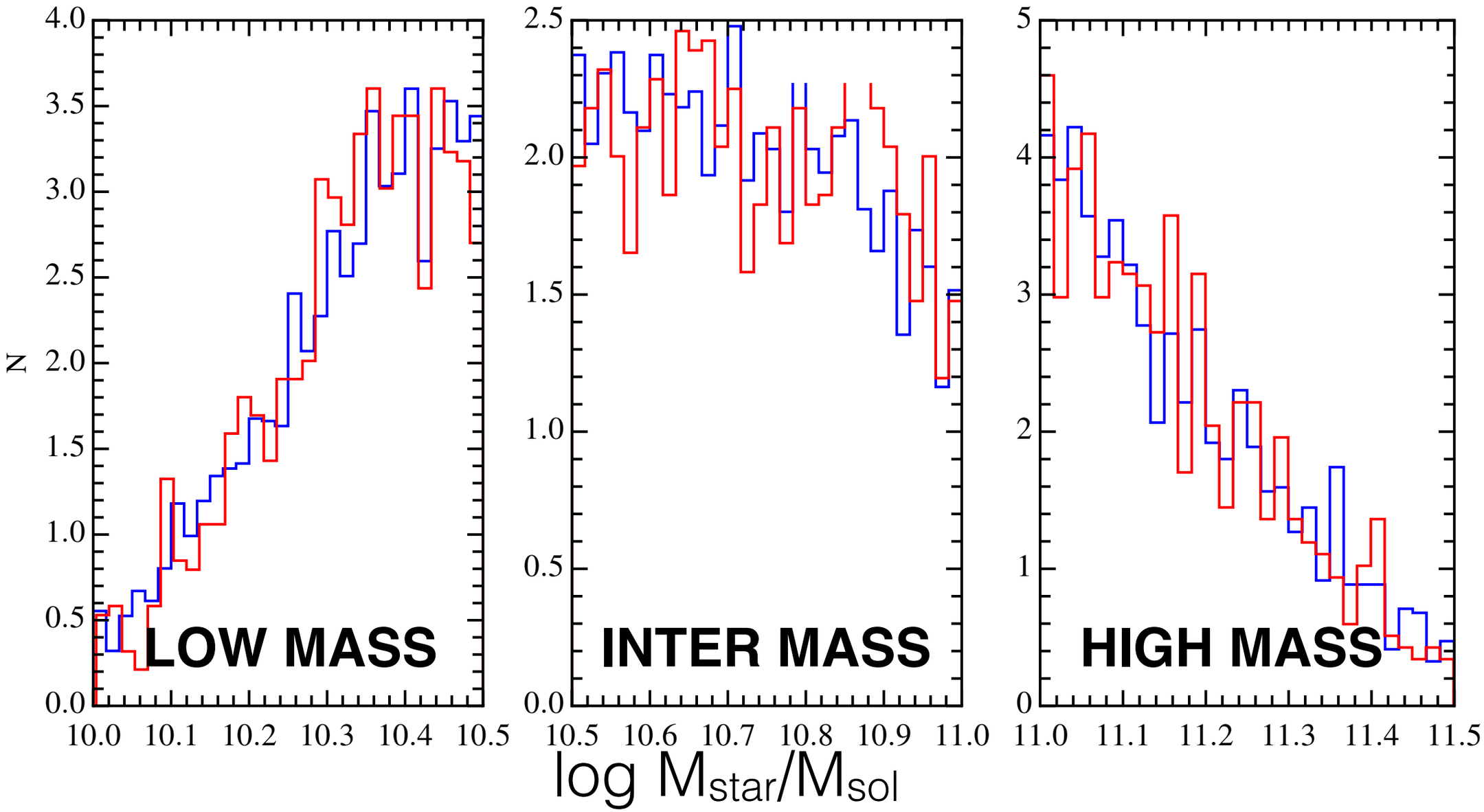
The lenses



$\log M_{star}$	R_{sat}	N_{lenses}	$\langle z_{lenses} \rangle$
10-10.5	0.1-0.55	4,881	0.35
	0.55-1	1,292	0.37
10.5-11	0.1-0.55	6,935	0.37
	0.55-1	1,836	0.36
11-11.5	0.1-0.55	2,126	0.38
	0.55-1	677	0.36

The lenses


OUTER
INNER


N
log Mstar/Msol
LOW MASS
INTER MASS
HIGH MASS
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
10.0
10.1
10.2
10.3
10.4
10.5
2.5
2.0
1.5
1.0
0.5
0.0
10.5
10.6
10.7
10.8
10.9
11.0
5
4
3
2
1
0
11.0
11.1
11.2
11.3
11.4
11.5

Galaxy-galaxy lensing

- Excess surface mass density :

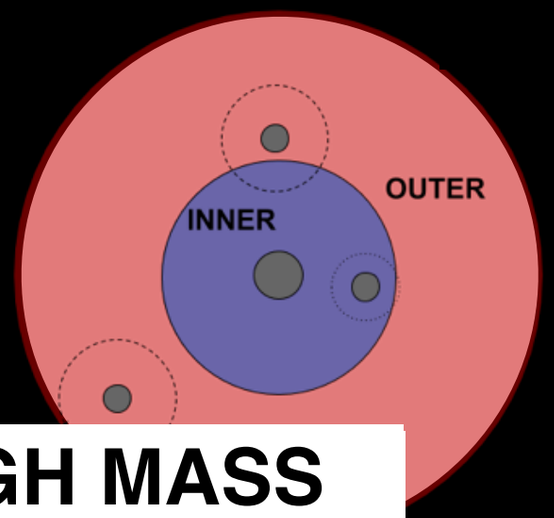
$$\Delta\Sigma(R) = \Sigma_{crit}\gamma_t(R)$$

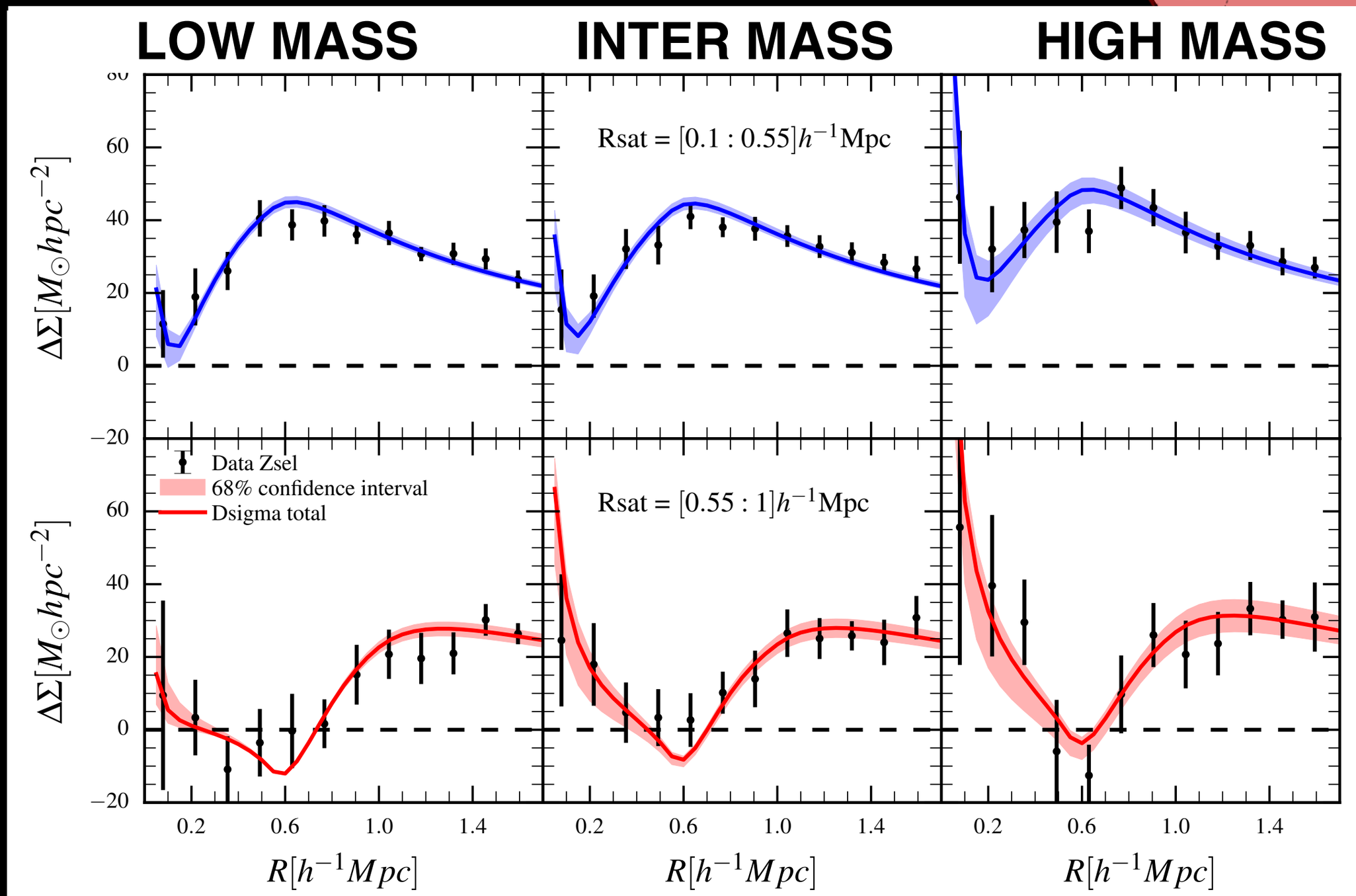
- Modeled by NFW profiles, mass-concentration relation from Neto et al. 2007

$$\Delta\Sigma(R) = \Delta\Sigma_{star} + \Delta\Sigma_{1h} + \Delta\Sigma_{host} + \Delta\Sigma_{2h}$$

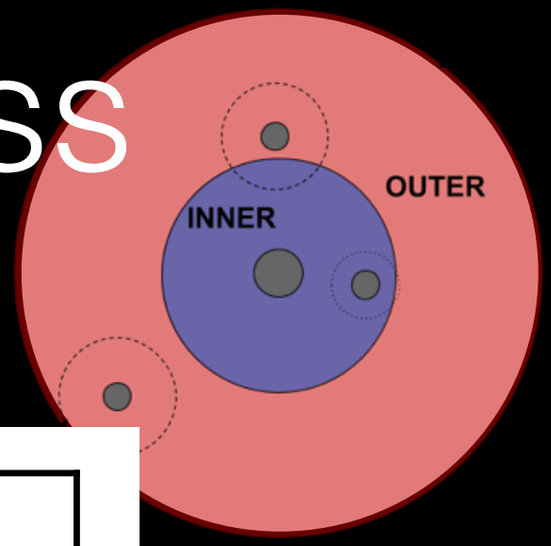
- Parameters to fit : mass of the subhalos $\mathbf{M_{sub}}$ and mass of the host halos $\mathbf{M_{host}}$

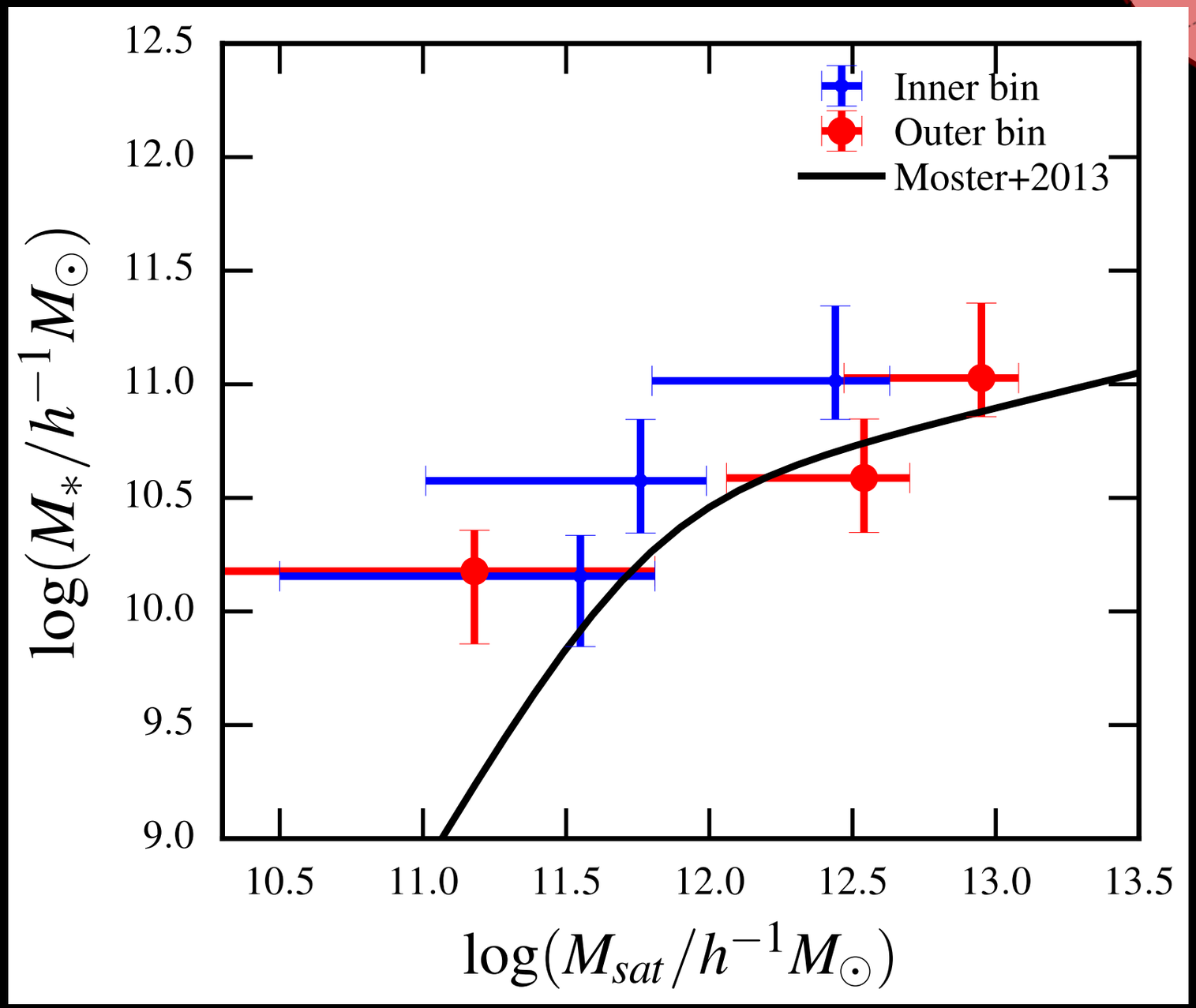
Lensing profiles





Stellar-to-halo mass relation





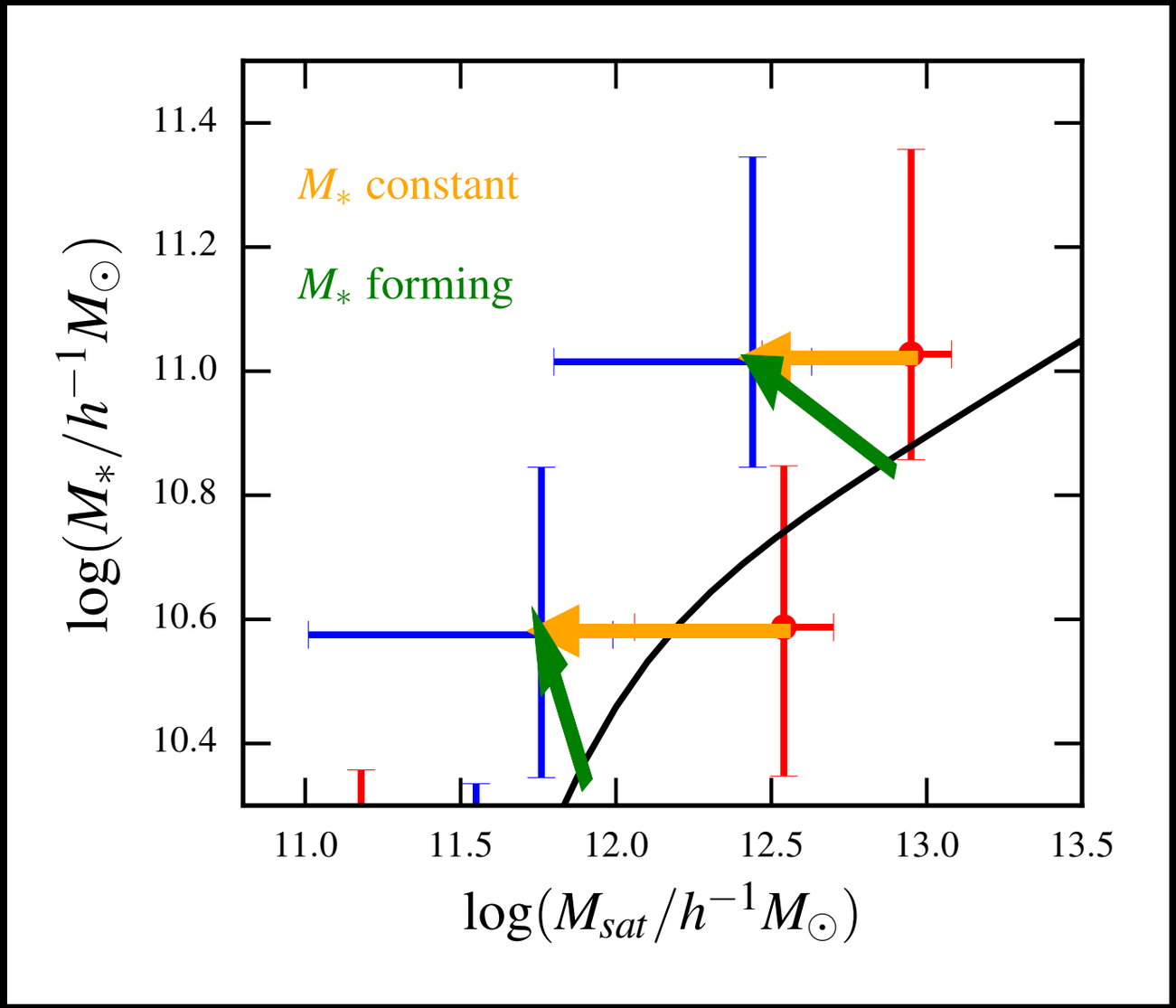
Stellar mass evolution during infall

- **No star formation**

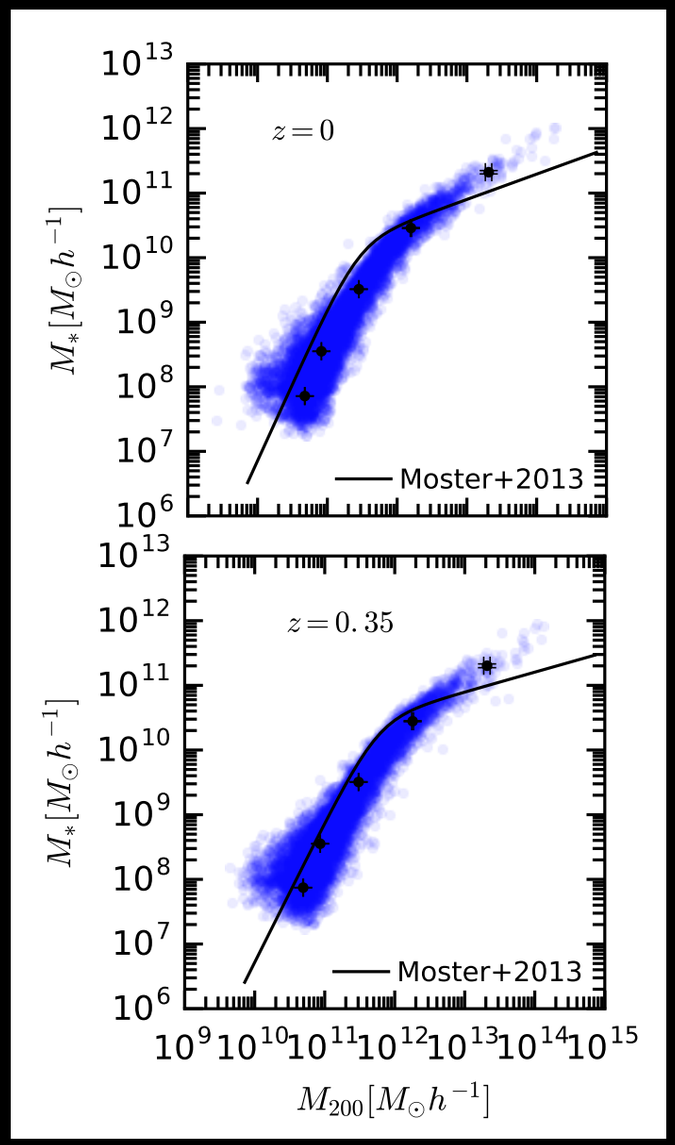
$M_{*,infall} = M_{*}$

- **Star formation**

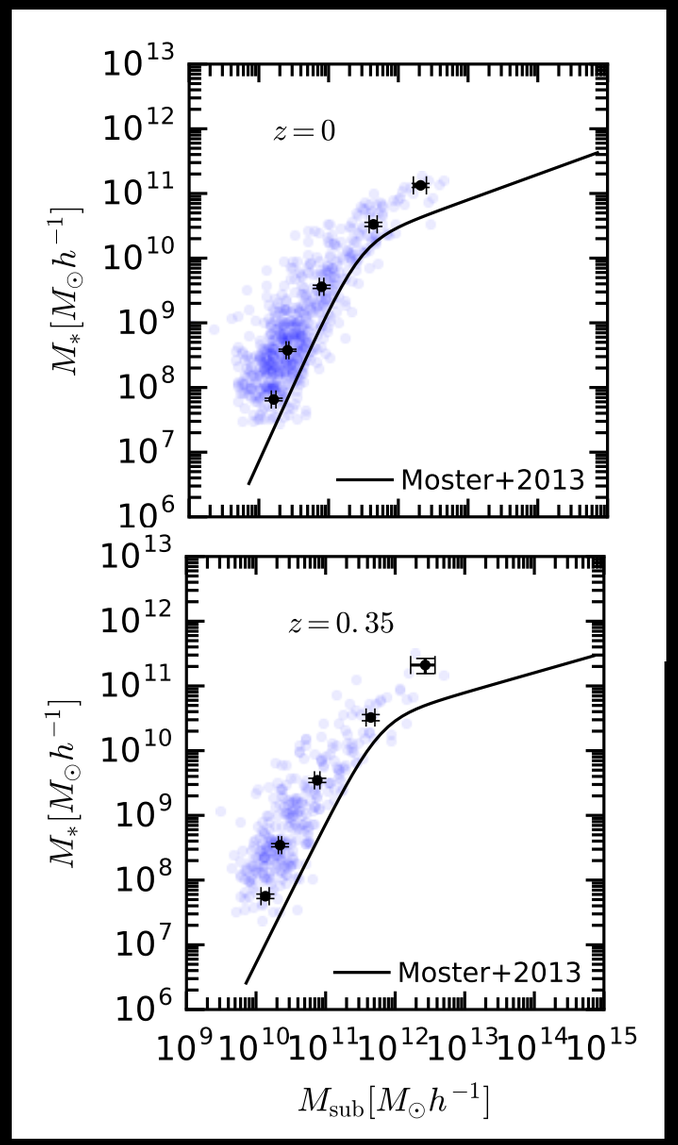
$M_{*,infall} = M_{*} - t_{infall} \times SFR(z_{infall})$



SHMR in the Illustris simulation



Msub/Mh ~0.3 for each M*



Haloes

Subhaloes

Conclusions

- Measure of Msub/Mstar for satellites at different cluster centric distances
- redMaPPer satellites & weak lensing surveys: CS82, CFHTLenS, DES-sv
- Dark matter tidal stripping shifts the stellar to halo mass relation to smaller halo masses (arXiv: 1703.03348)
- Future improvements:
  - Need for more data to increase signal/noise
  - Study of coevolution of stellar and dark matter during infall