Fully cosmological virtual massive galaxies at z = 0: accretion history

Vicent Quilis

in collaboration with:

J. Navarro-González, E. Ricciardelli, A. Vazdekis

Departament d'Astronomia i Astrofísica
Universitat de València

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The simulation:

(Quilis, MNRAS, 2004)

GAS + DM + AMR + STARS + CHEMISTRY + AGN + MHD

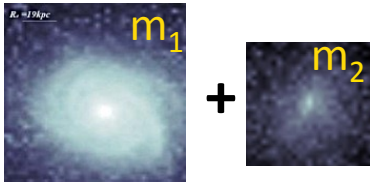
Initial conditions:

- ΛCDM cosmology: Ω_m= 0.25, Ω_Λ= 0.75, Ω_b= 0.045, h = 0.73
- z = 50
- computational box: 44 Mpc
- 7 levels of refinement (spatial resolution 2.7 Kpc)
- coarse grid 128^3 cells (level 0)
- DM particles 512^3 (mass resolution 10^8 $M_\odot$)

Sample: $M_\star > 10^{11}$ $M_\odot$ at z=0, located in the highest resolution grid (resolution 2.7 kpc)

21 galaxies: 11 have undergone a significant merger during their life (**MERGER** galaxies), whereas 10 have experienced an almost quiet life (**QUIET** galaxies)

merger definition:



if $m_2/m_1 > 0.025$ then
merger !!!! if $m_2/m_1 > 0.3$ major merger (21%)
else
smooth accretion

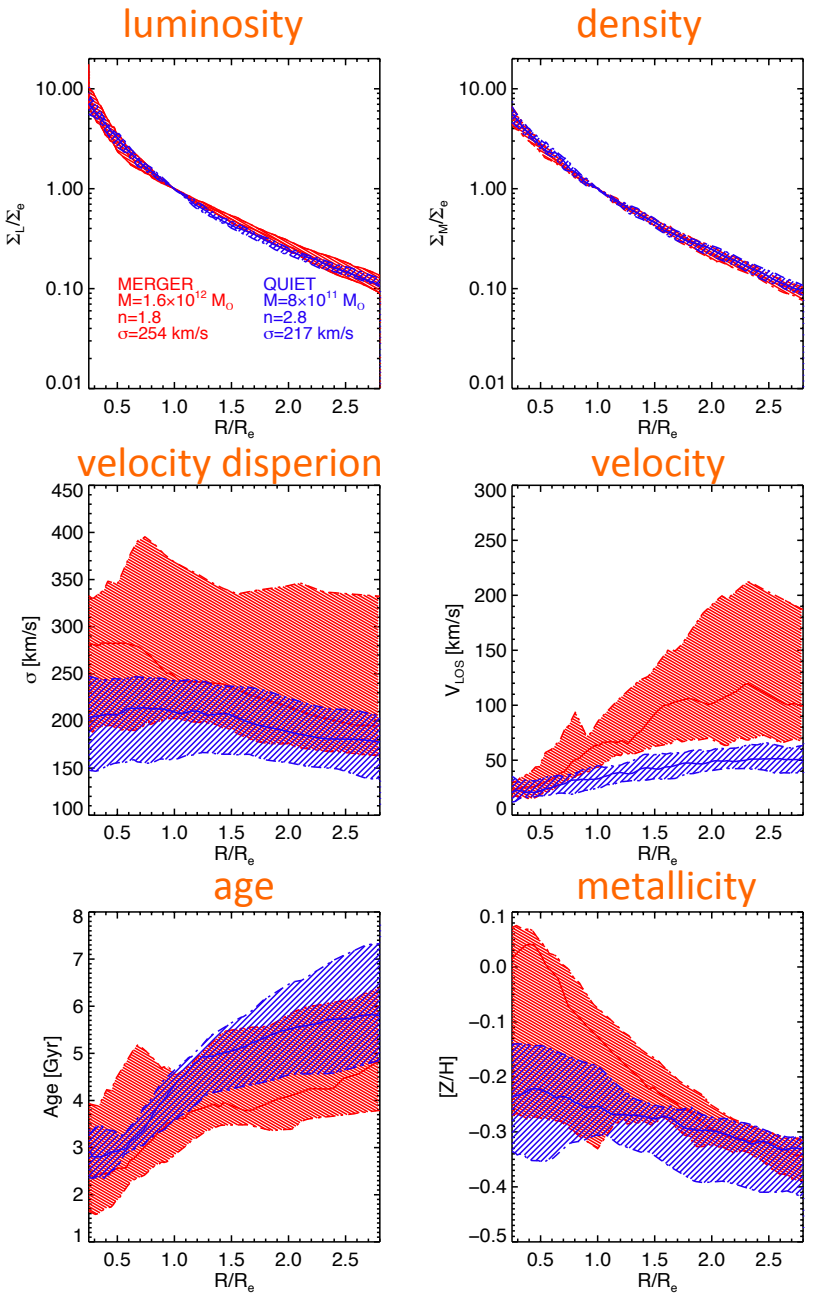
MASSIVE GALAXIES: gradients

Median 1-D profiles MERGER vs QUIET.

Merger galaxies have:

- higher stellar mass and hence higher velocity dispersion at all radii
- lower Sersic indices (indicative of late-type morphology)
- Higher rotational velocity, mainly in the outer regions → fast rotators
- Younger ages and higher metallicities at all radii
- Steeper metallicity gradients

The merging history is a crucial factor in shaping the present-day structure of massive galaxies

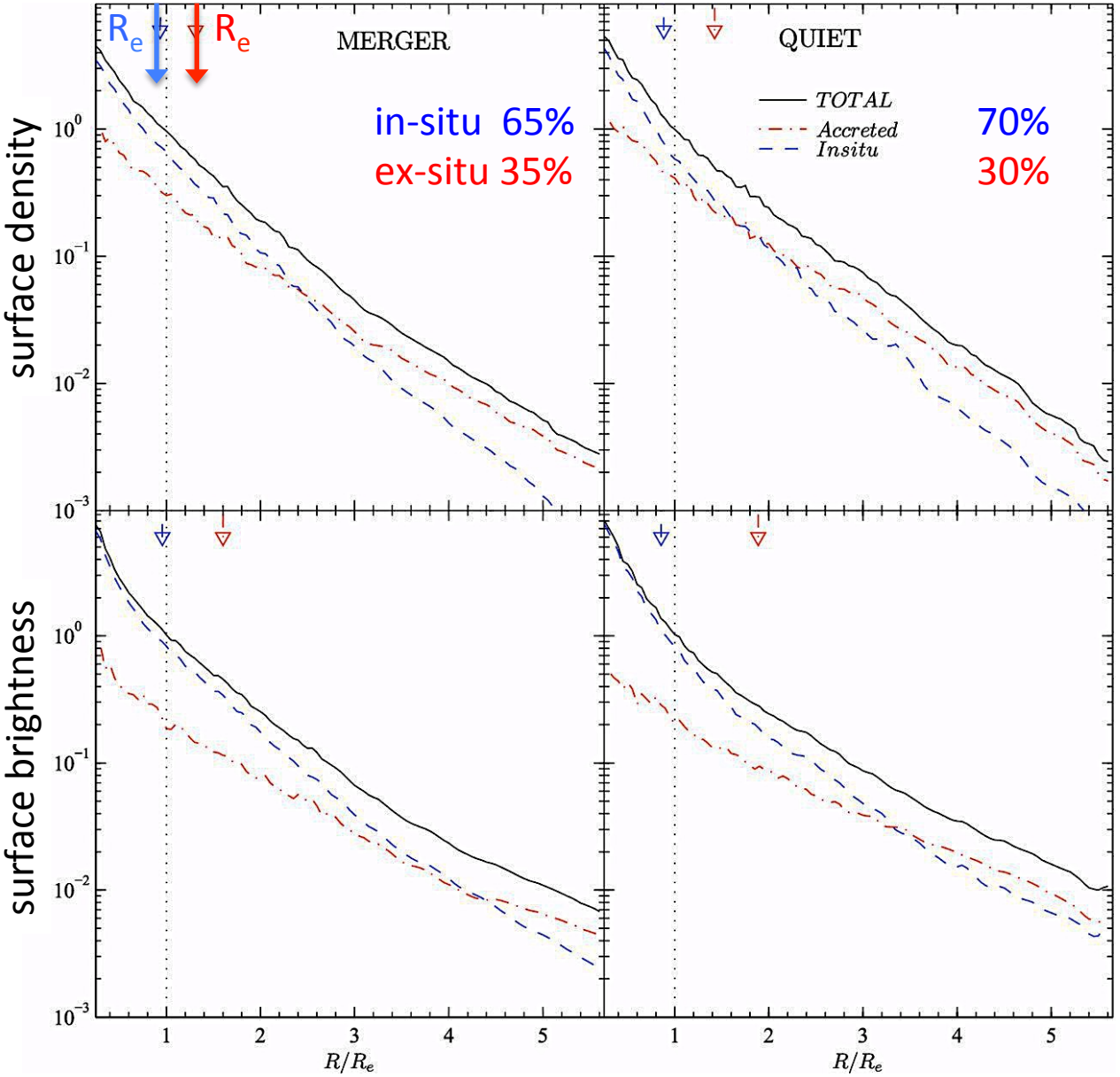


Accretion history: density and luminosity profiles

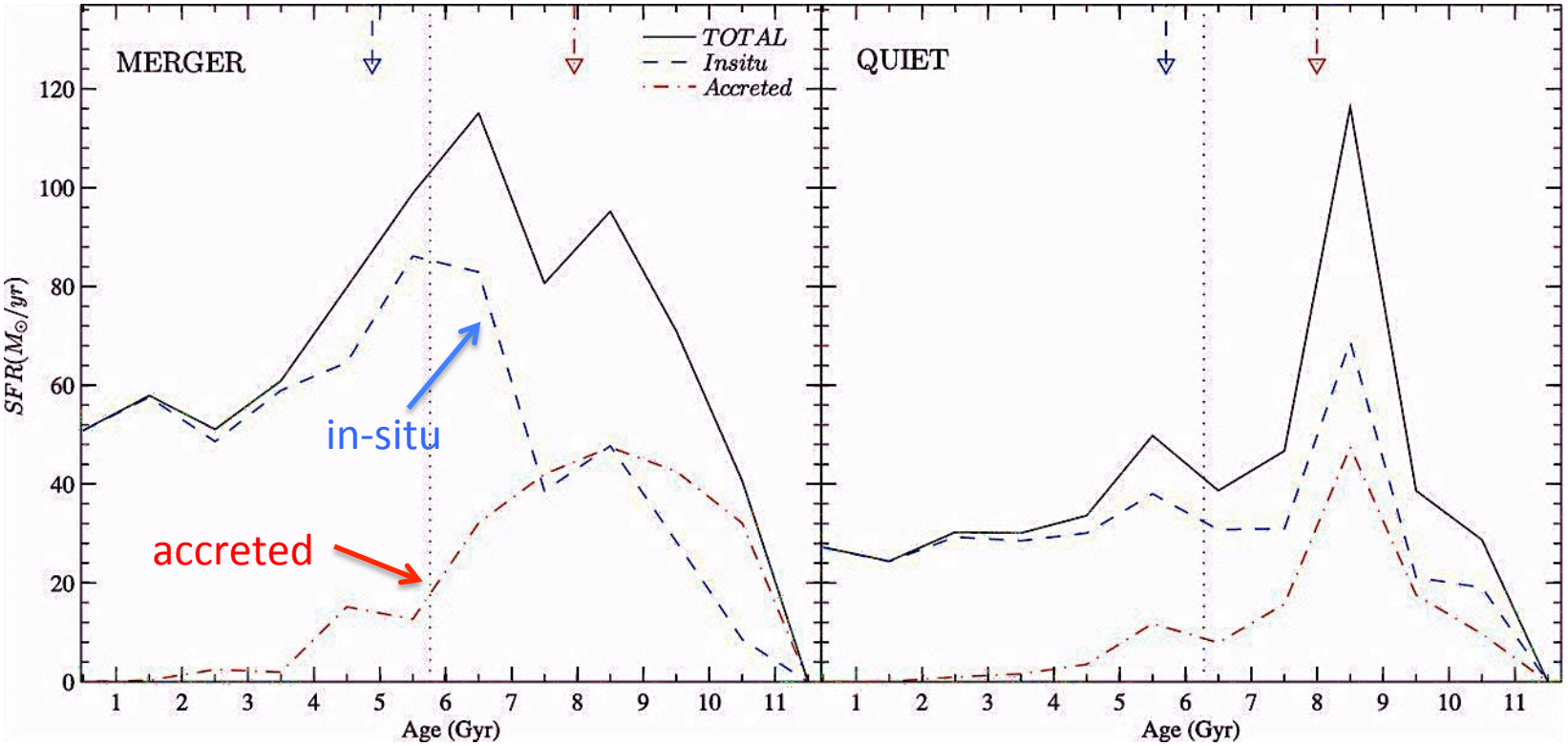
In-situ stars: formed in the main progenitor

Ex-situ: accreted later-on to the main unit

- Both the MERGER galaxies and the QUIET ones have a significant contribution from accreted stars → QUIET galaxies formed by smooth accretion of small units
- In-situ component dominates in the very central region ($r<R_e$)
- Outskirts formed by accretion/merger
- Ex situ stars are less luminous.

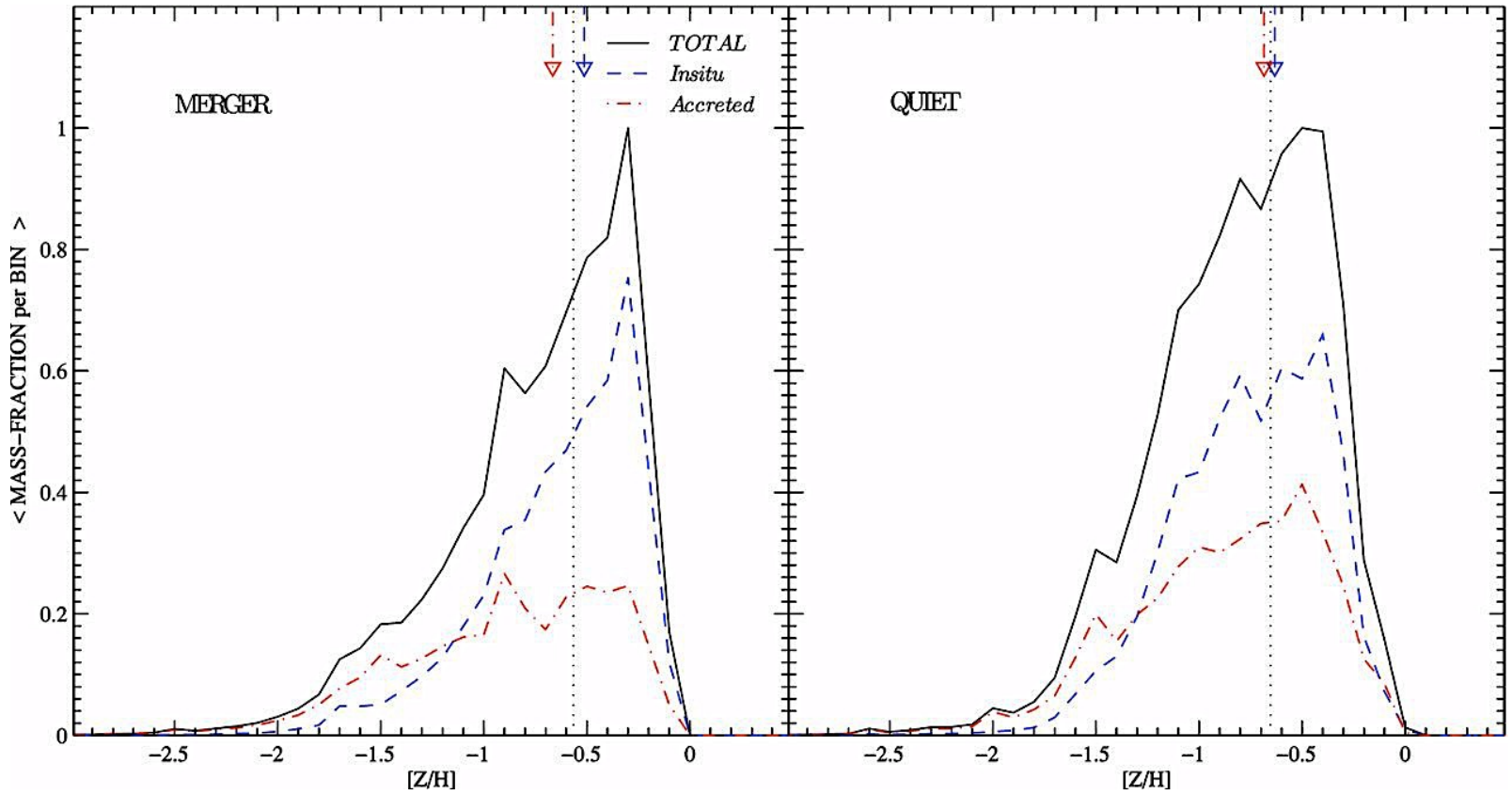


Accretion history: star formation histories



- Accreted stars are older than in situ stars: on average ex situ ~3 Gyr older than in situ
- Star formation ceased 4 Gyrs ago in accreted population
- In situ star formation occurs at all times

Accretion history: metallicity distribution

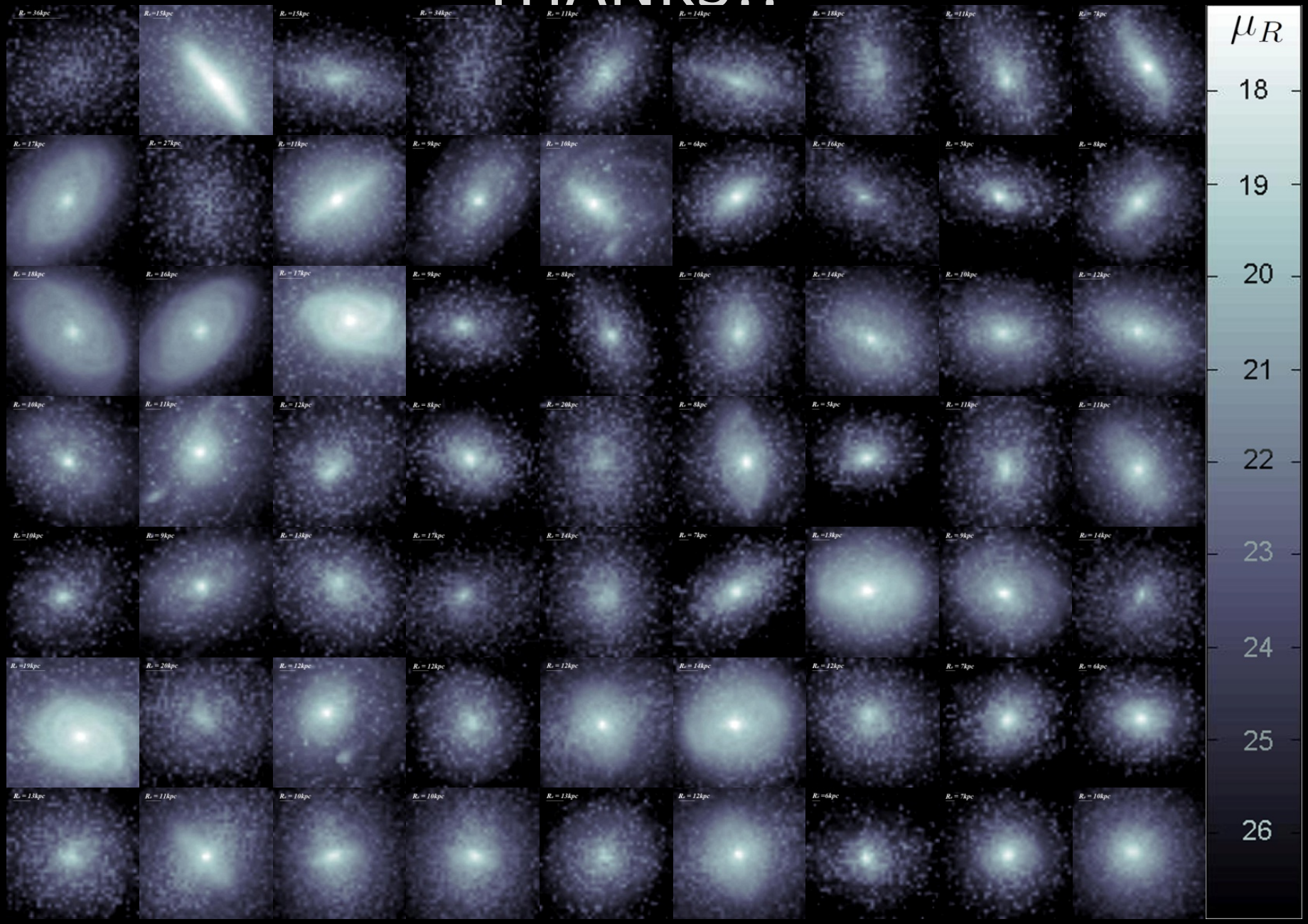


- Mean metallicities of two populations are very similar
- Metallicities distributions are quite different:
  - In situ stars are skewed towards large metallitices, specially in galaxies that have suffered mergers
  - The accreted component spans a wide range of metallicities

Conclusions

- We have studied both the in situ and ex situ populations depending on the merging history.
- Merger galaxies have a higher fraction of accreted stars.
- The spatial distribution of in situ and ex situ populations is quite different in both merger and quite galaxies.
- In situ stars are always the dominant population in the inner parts, whereas ex situ stars overtake in the outermost parts.
- Merger galaxies present a slight excess of accreted stars in the central region associated to the mixing action of mergers.
- Accreted stars are always older and less metallic than the in situ stars.

THANKS!!



M*/M halo study