

Imprint of Reionization on the SFHs of Dwarf Galaxies

Dwarf Galaxies and the Cosmic Web

Multiple Stellar populations in Dwarf Galaxies

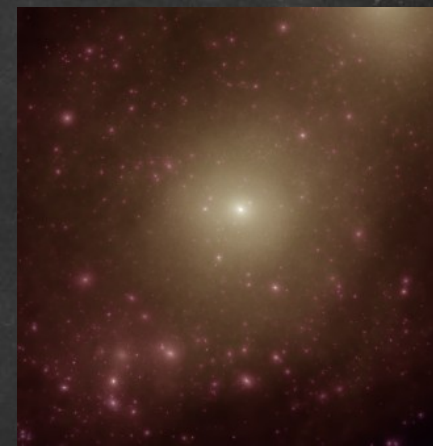
- Alejandro Benítez-Llambay -

Collaboration with:

- Julio Navarro
- Mario Abadi
- Stefan Gottlöber
- Gustavo Yepes
- Yehuda Hoffman

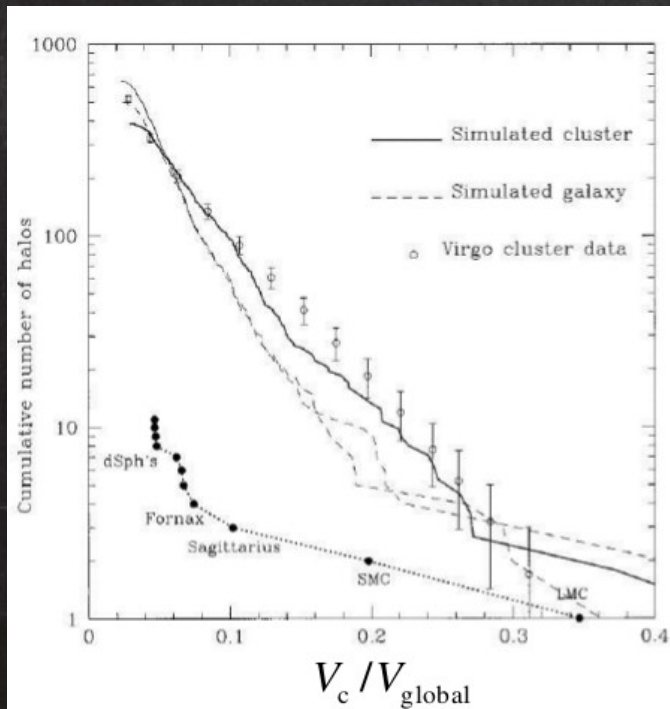


- Luminosity Function
- Mass Function
- Abundance matching

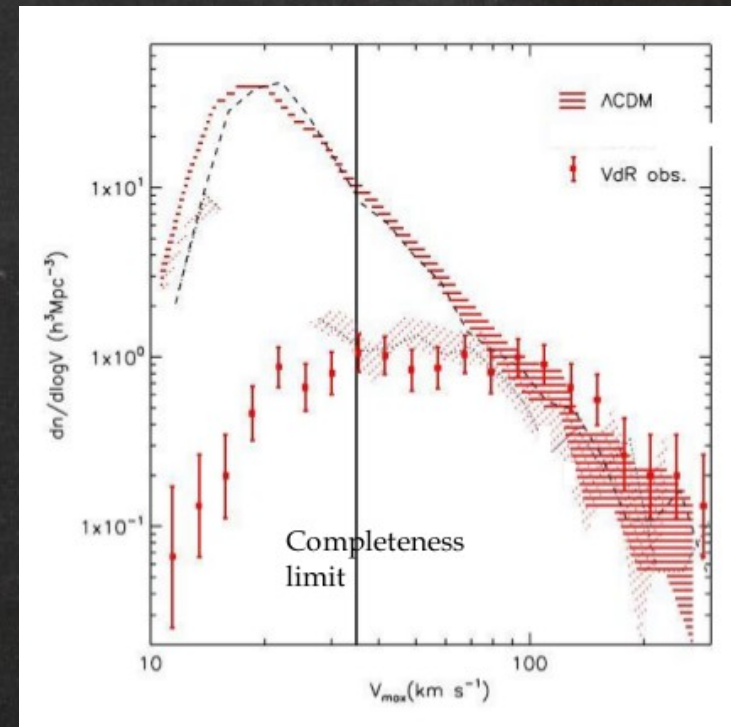


Assuming LCDM:

Subhalos too abundant when compared to satellites:
(Moore et al. 1999; Klypin et al. 1999)



Field dwarfs too abundant when compared to surveys:
(Zavala et al. 2009)



- Luminosity Function

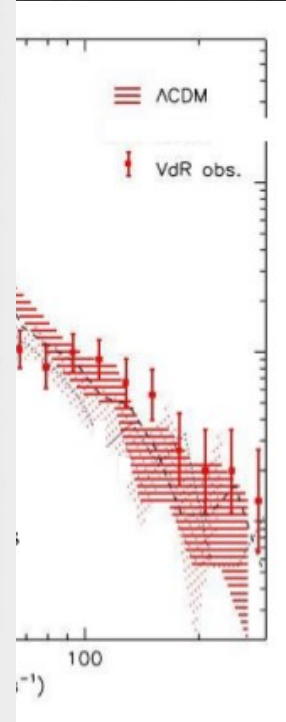
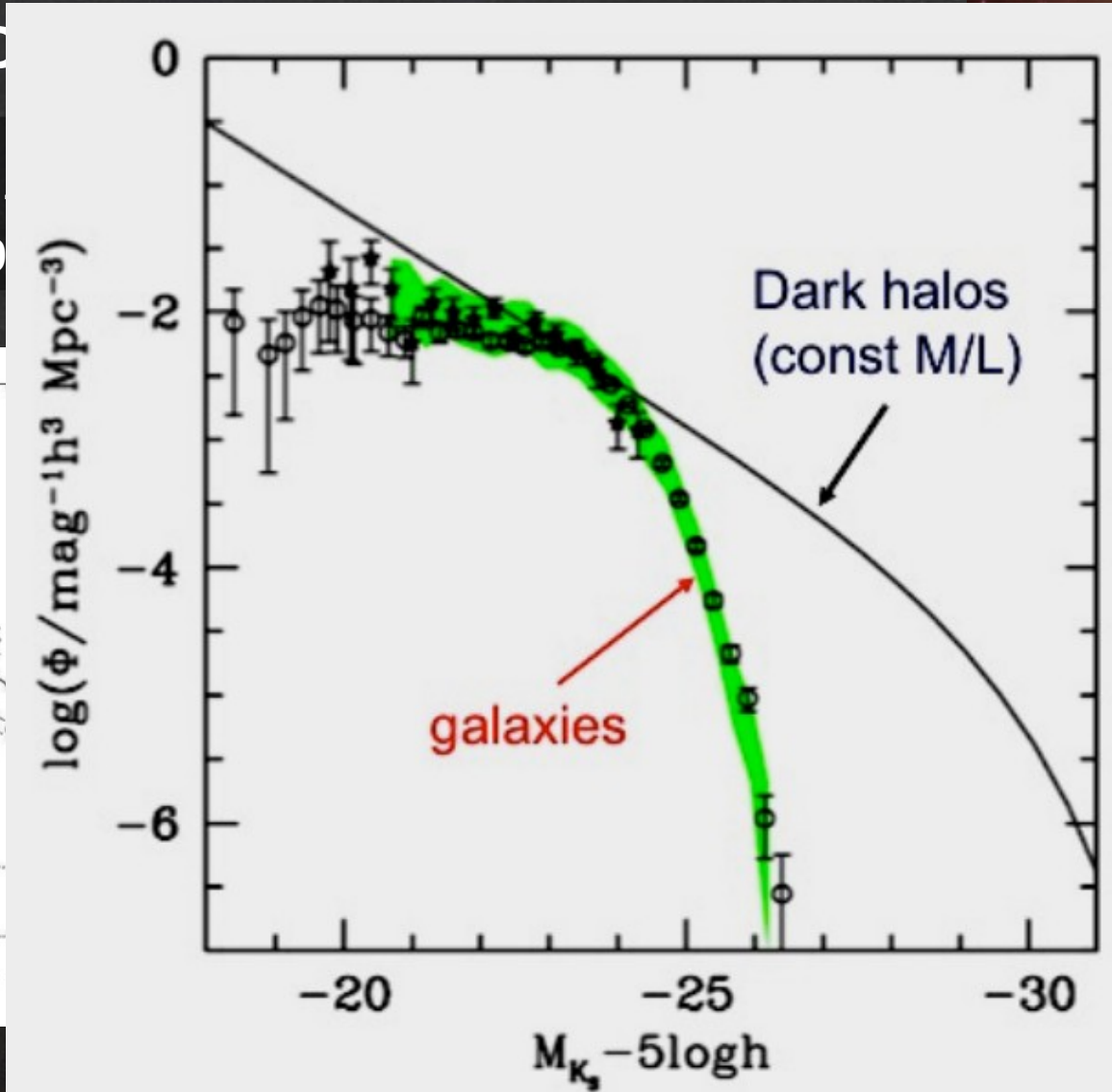
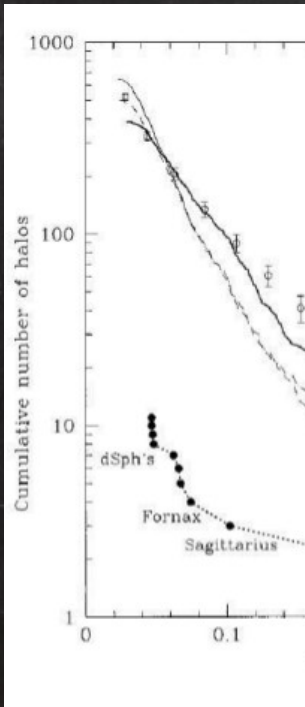
- Mass Function

- Abundance matching

Assuming LCDM

Subhalos too
compared
(Moore et al. 1999)

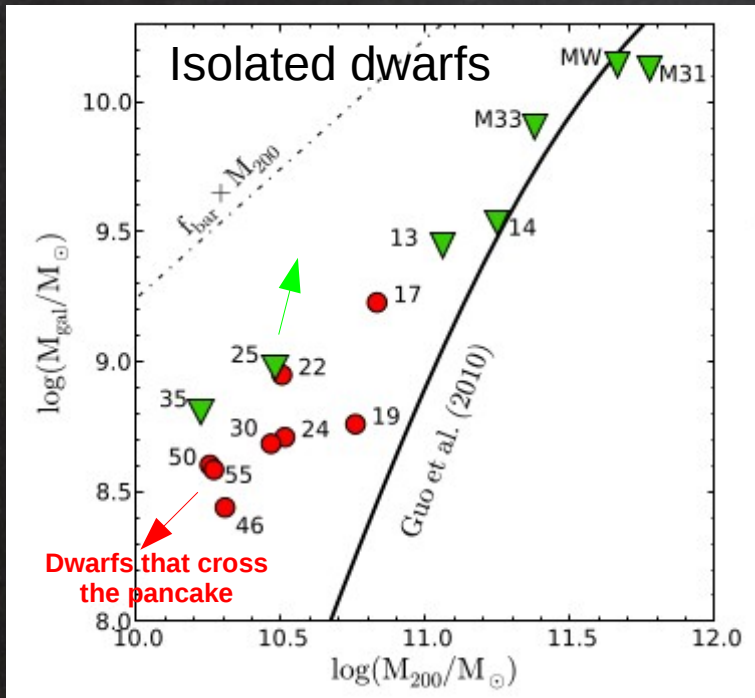
Abundant when
surveys:
(2009)



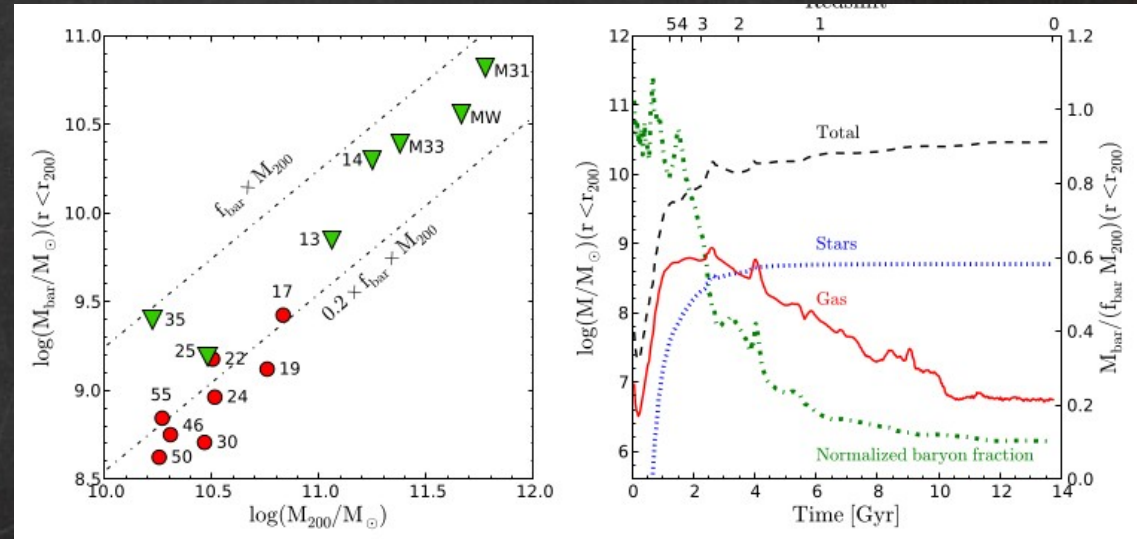


- CLUES Simulation -

The **Constrained Local Universe Simulations (CLUES)** evolve a region that resemble The Local Group of Galaxies in the WMAP3 – WMAP5 cosmology.
 - SPH-Gadget2+reionization+star formation+feedback-driven winds



Red galaxies pass through the main filament at high speed. Green ones do not.



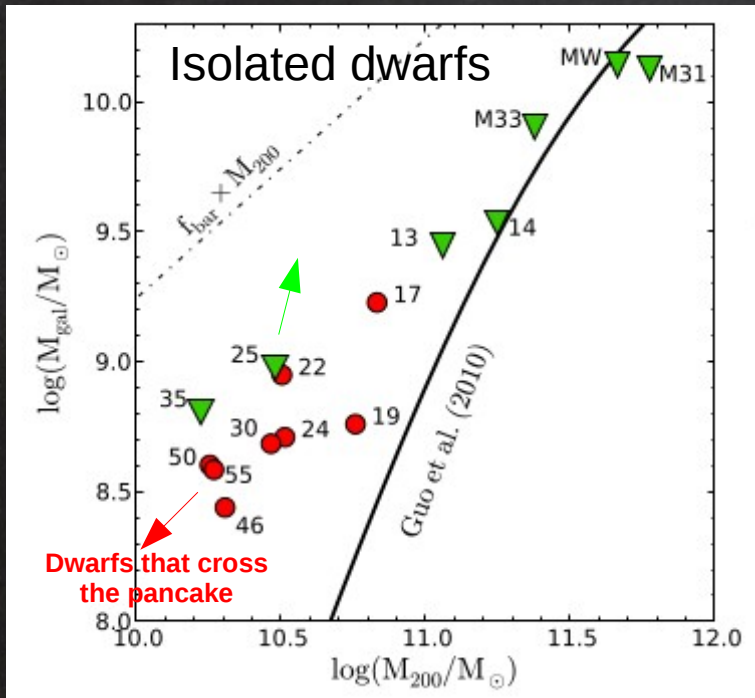
Note the dispersion in stellar mass at a given M200.

Benitez-Llambay et al. 2013

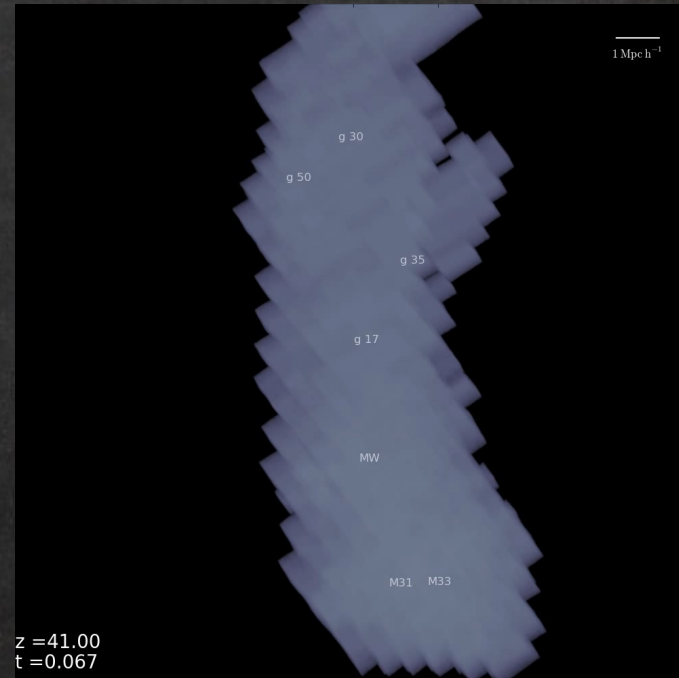


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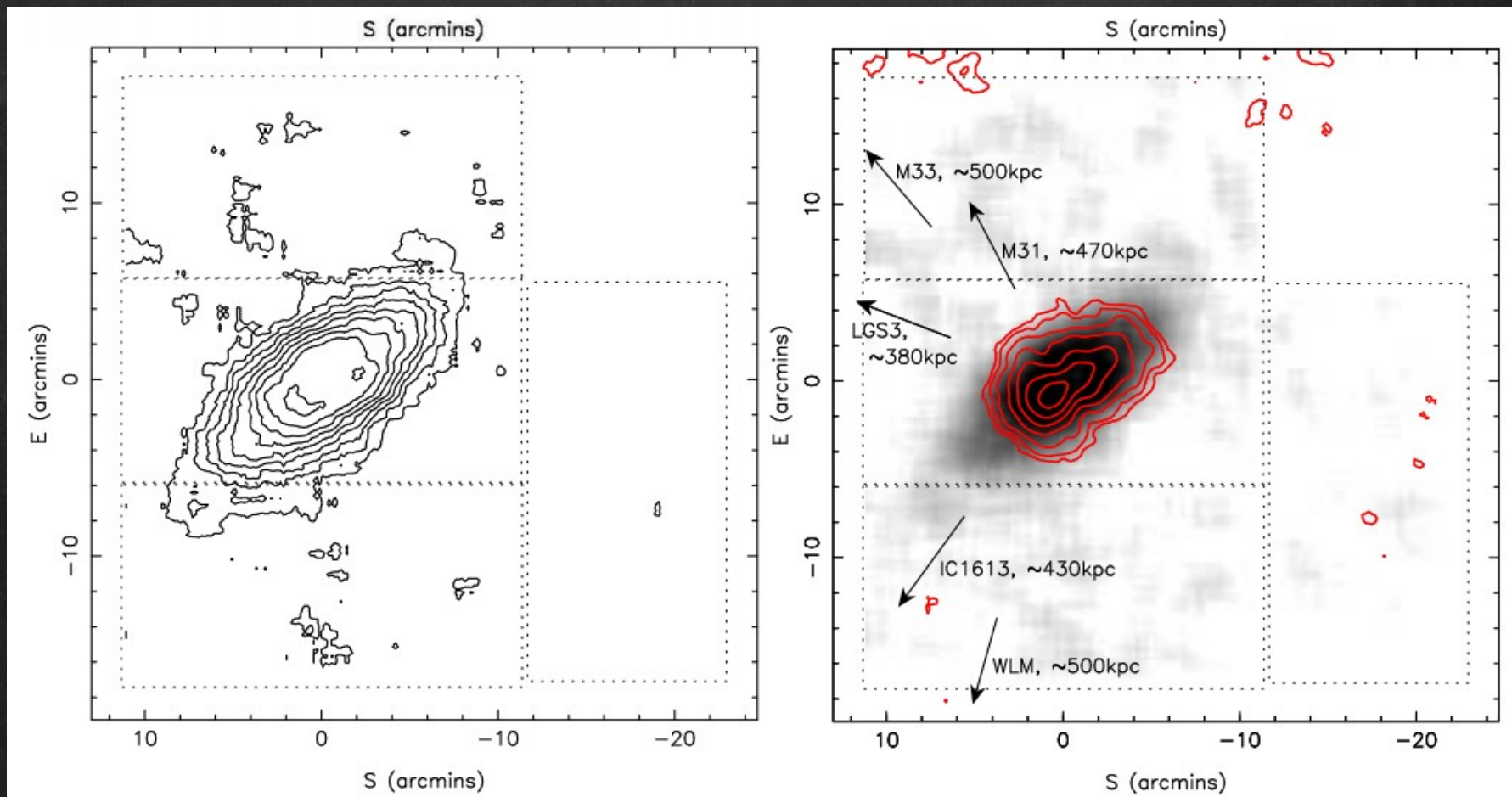
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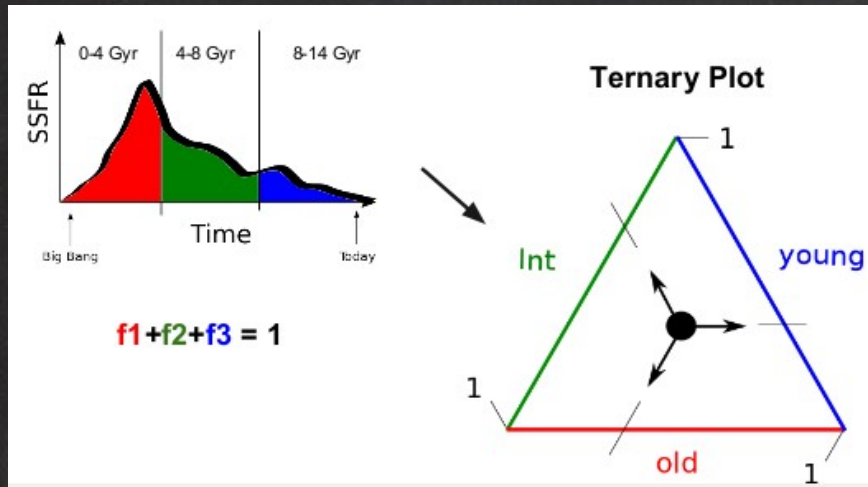
Benitez-Llambay et al. 2013

Observational evidences of Cosmic Web Stripping



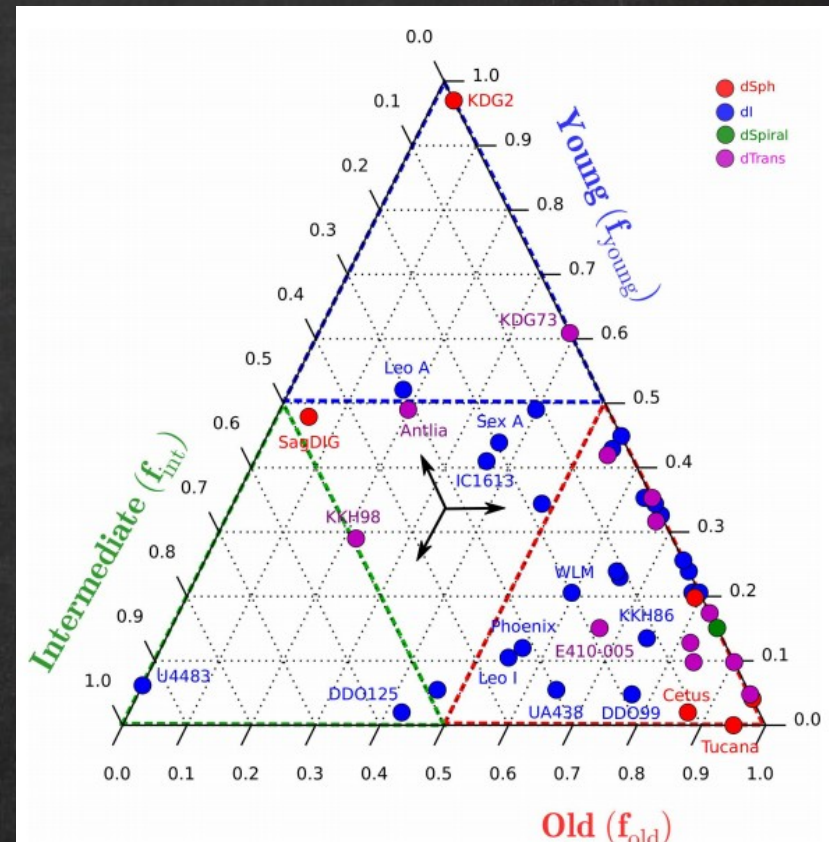
Some isolated galaxies in the Local Group, like Pegasus, show signs of ram pressure Stripping (McConnachie et al. 2007)

Observed Star Formation Histories In the Local Volume



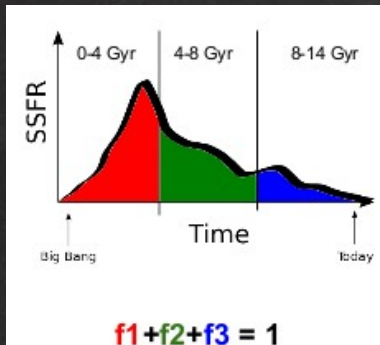
- Dwarfs are mostly old (they populate the red triangle).
- Most of the dwarfs populate the non-intermediate axis (Stars are old+young but there are not intermediate ones).

Nearby dwarfs whose SFHs have been measured

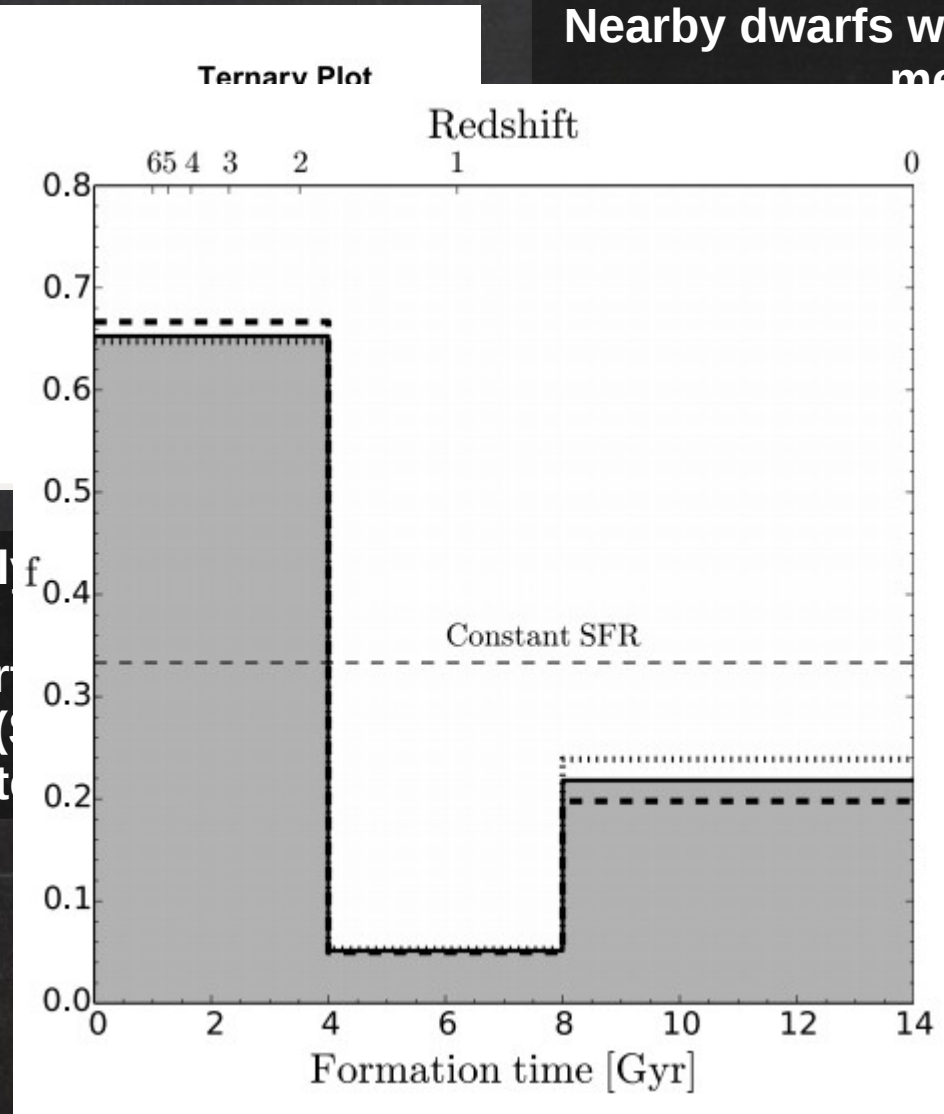


Most of the SFHs taken from
(Weisz et al. 2011)

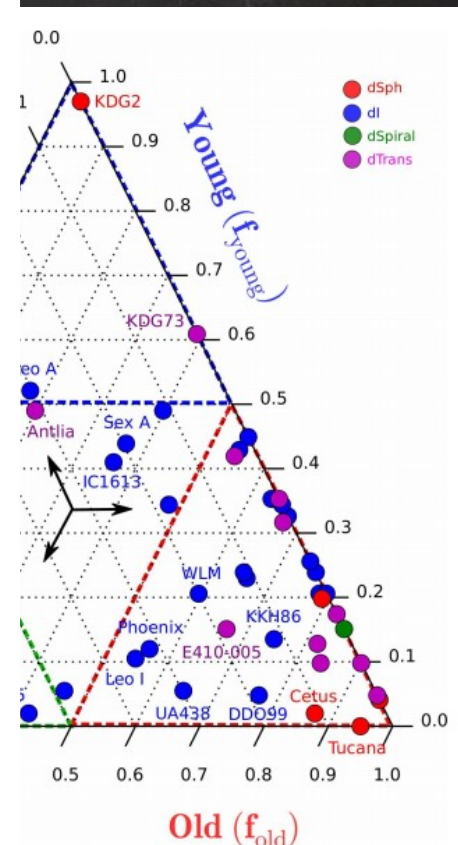
Observed Star Formation Histories In the Local Volume



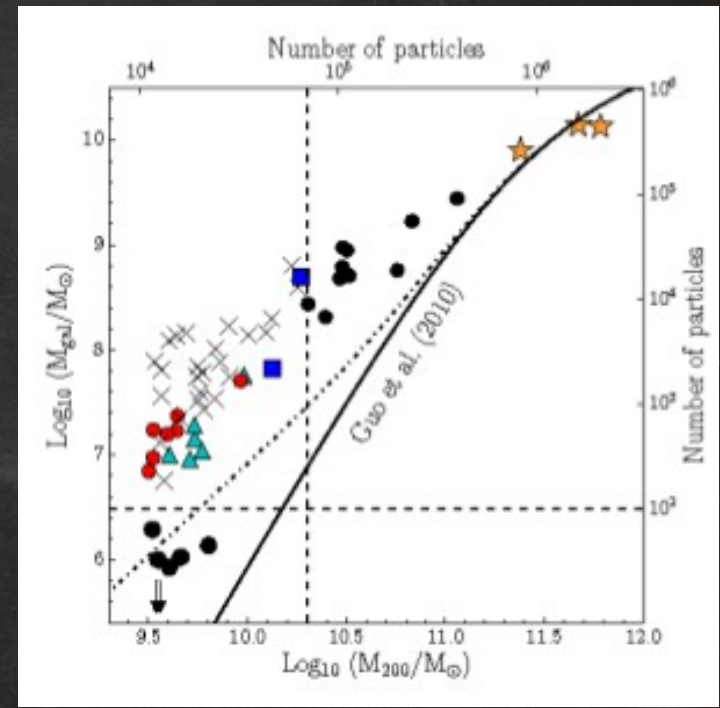
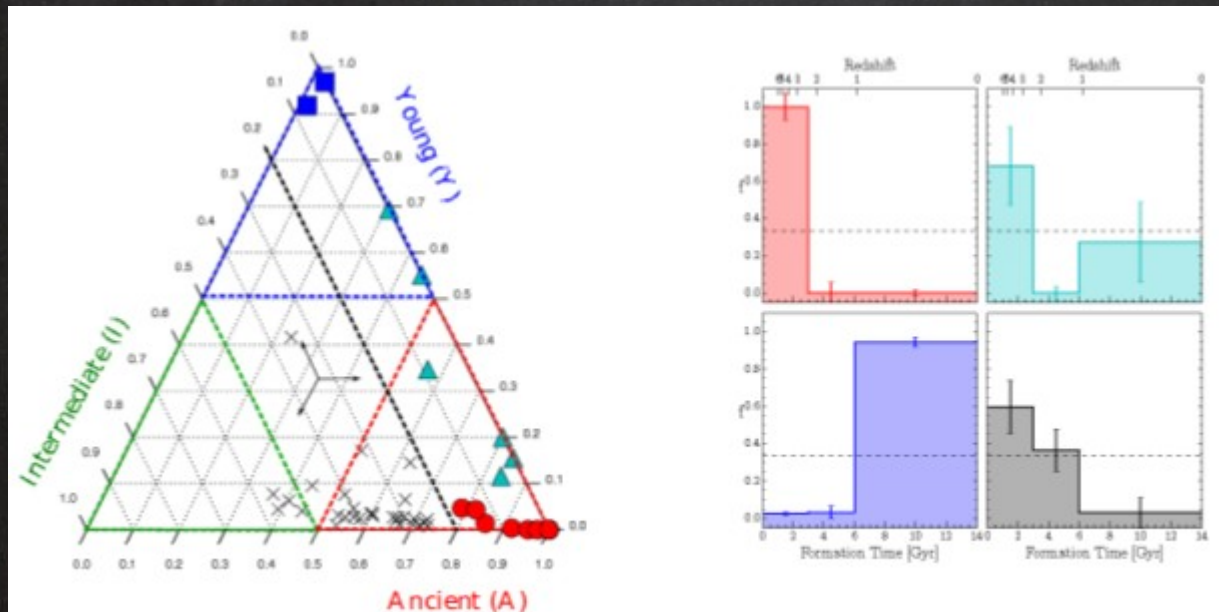
- Dwarfs are mostly in the red triangle).
- Most of the dwarf galaxies are in the intermediate axis (but there are not int



Nearby dwarfs whose SFHs have been measured



- CLUES Simulation -

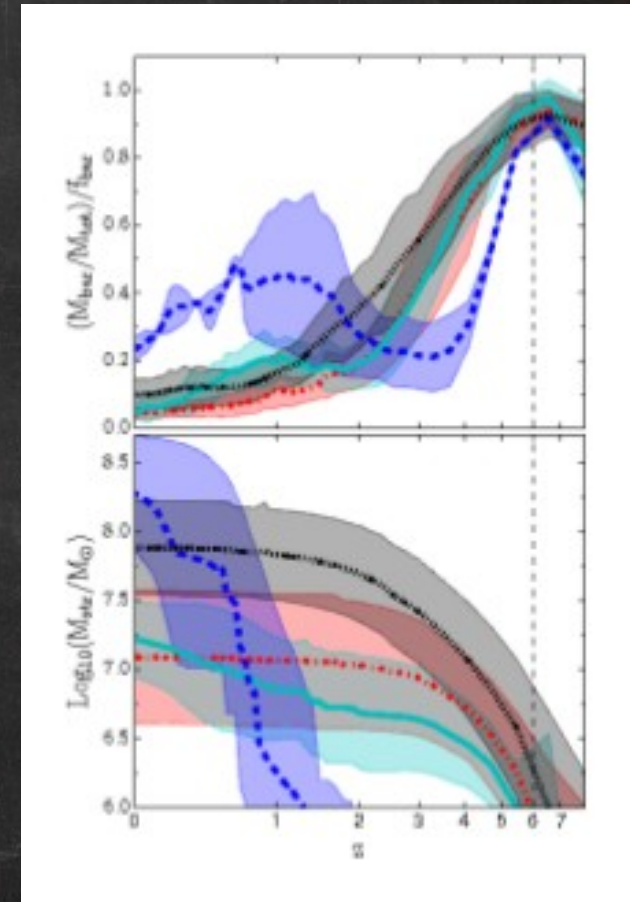
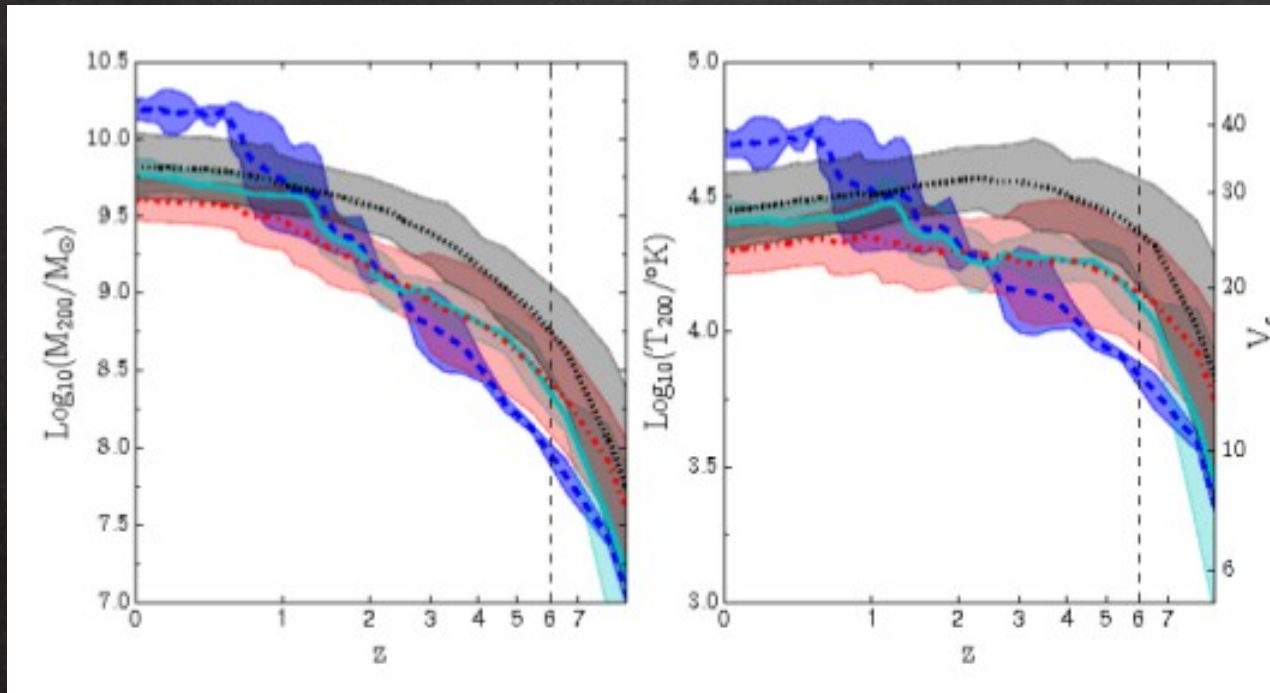
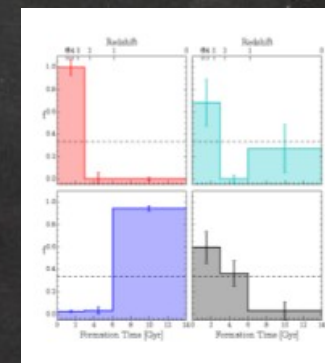


- Simulated dwarfs are mostly very old.
- We have a few examples of galaxies lying on the non-intermediate axis.

Benitez-Llambay et al. 2014



- CLUES Simulation -



- Delayed galaxies have smaller masses at the reionization time. They do not form stars but they loose their baryons at high redshift quicker than the older ones!!

Benitez-Llambay et al. 2014

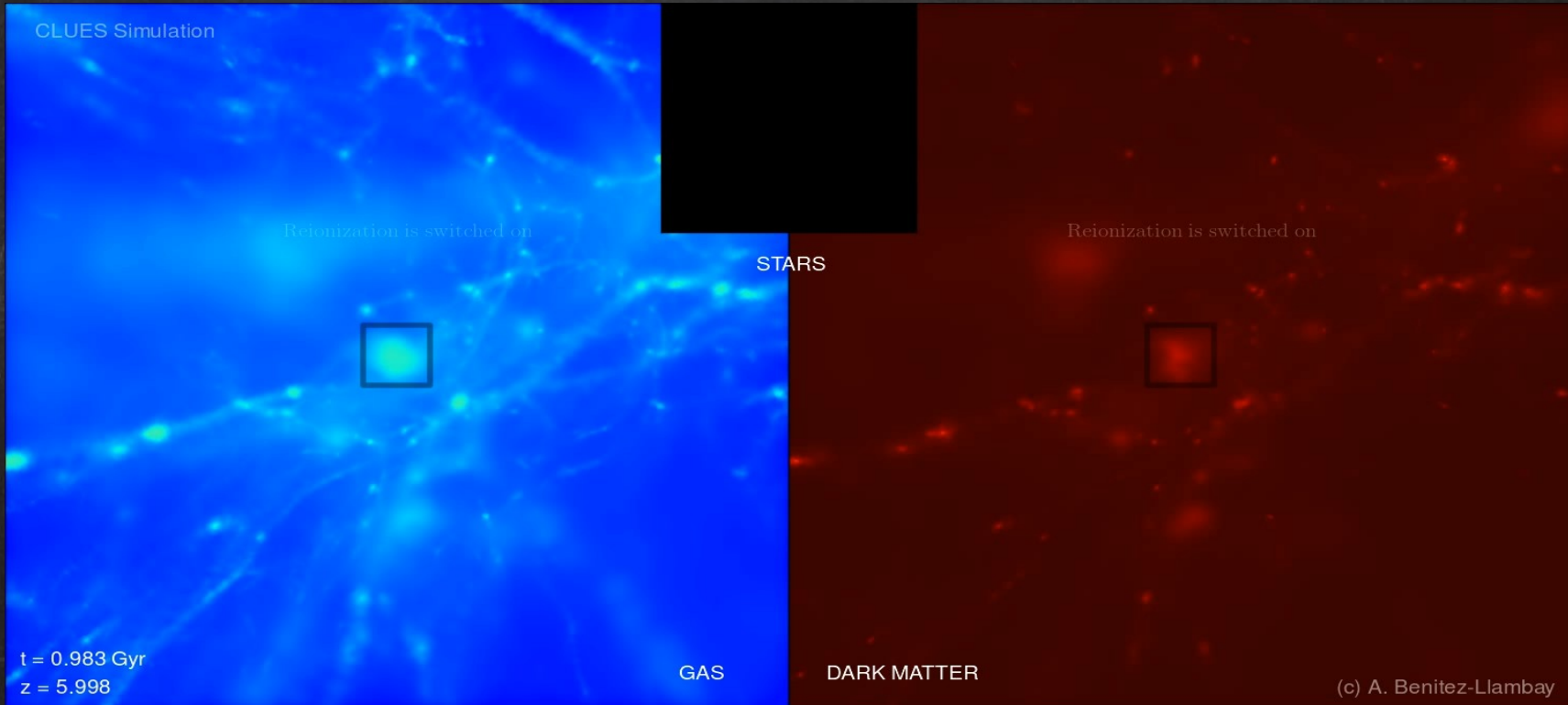


- CLUES Simulation -

Gas density

Stars

Dark matter density



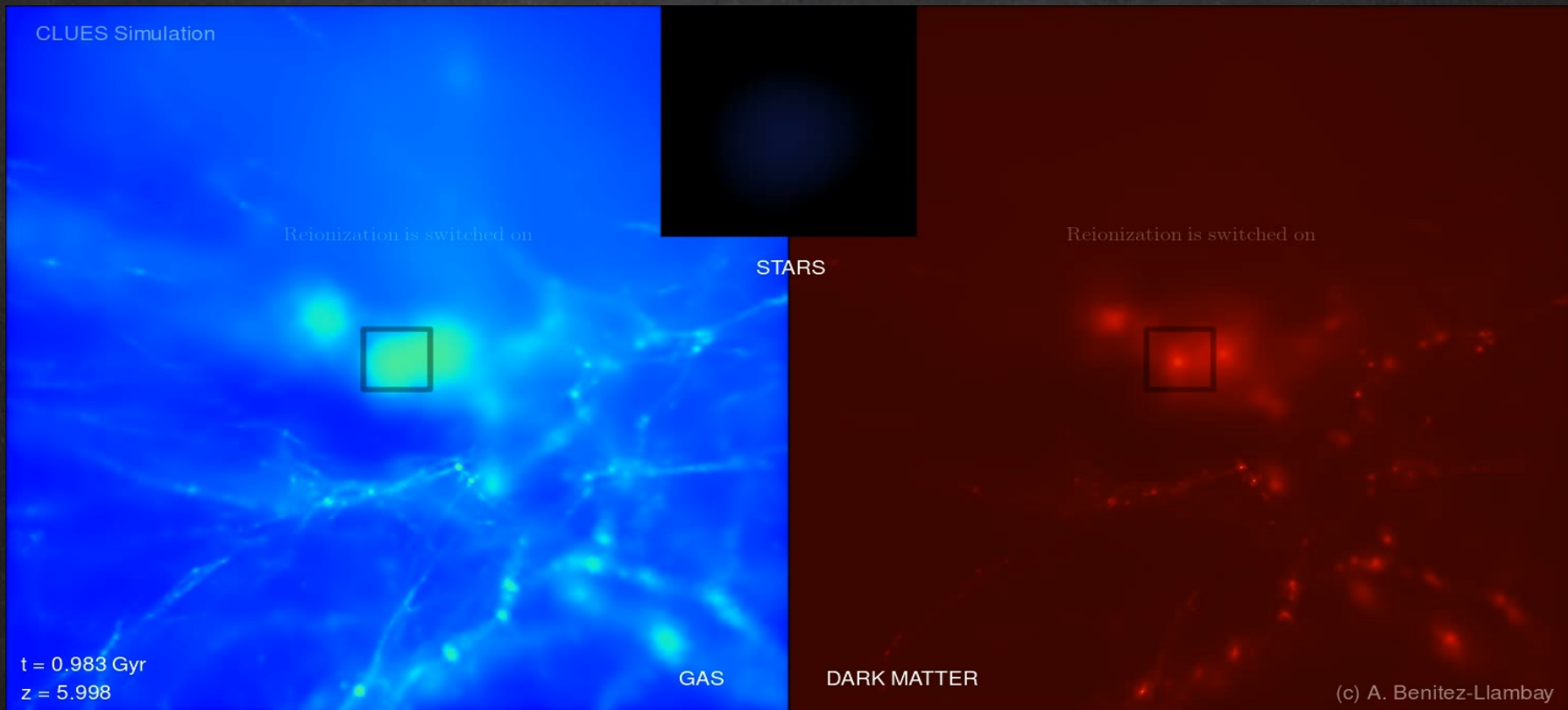


- CLUES Simulation -

Gas density

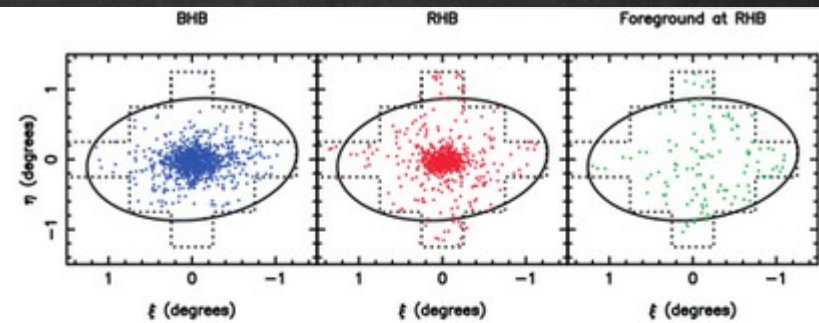
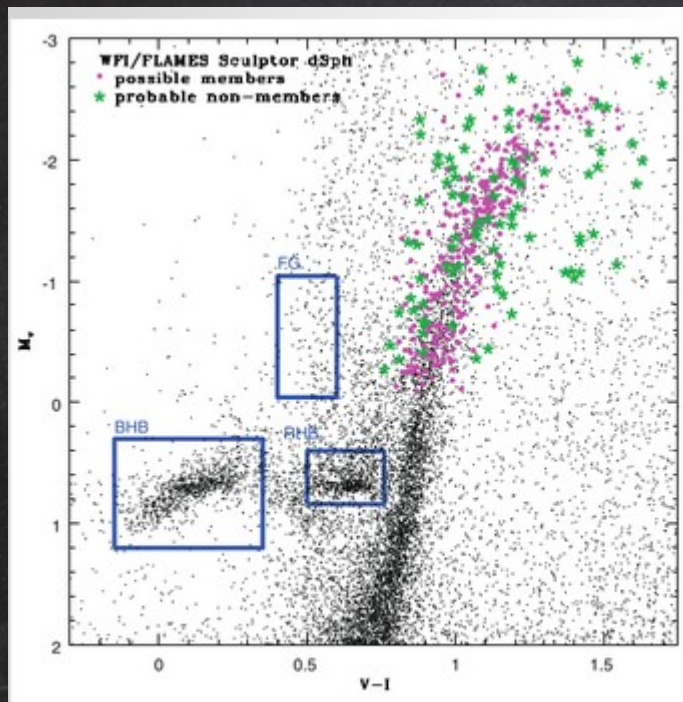
Stars

Dark matter density

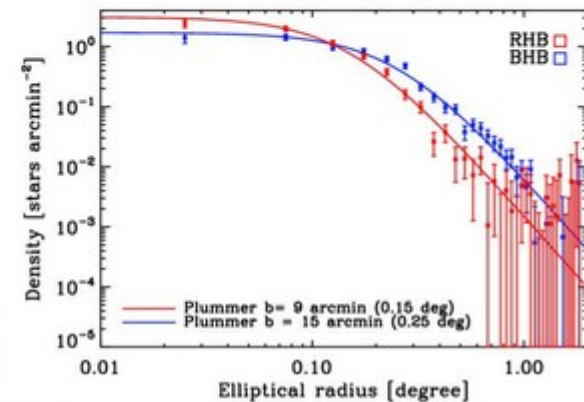


- Multiple Stellar Populations -

Tolstoy et al. 2004

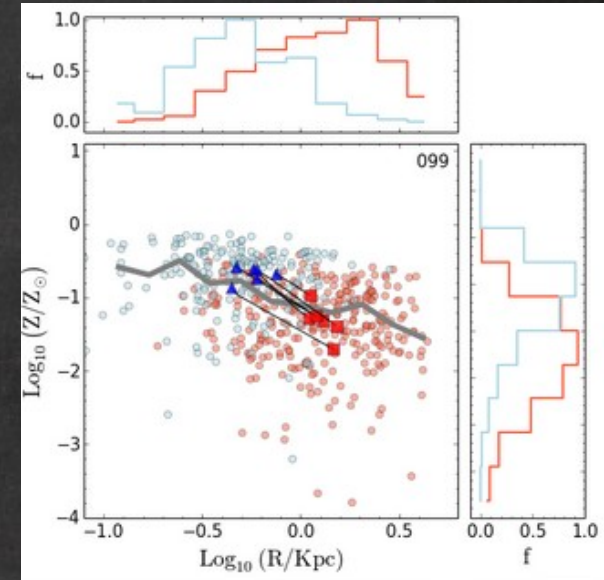
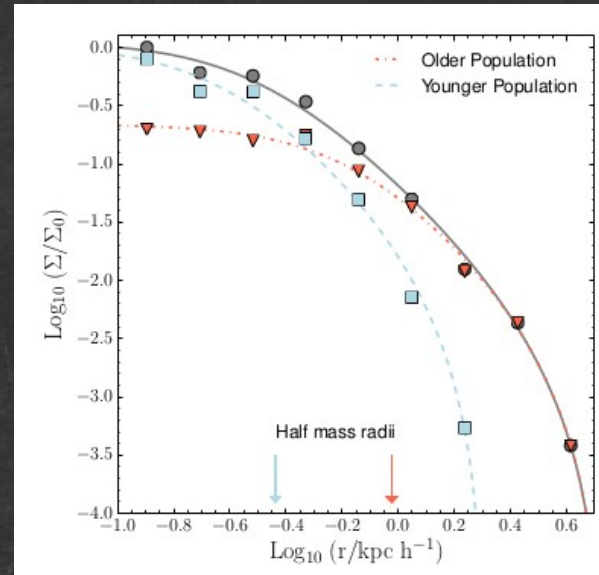
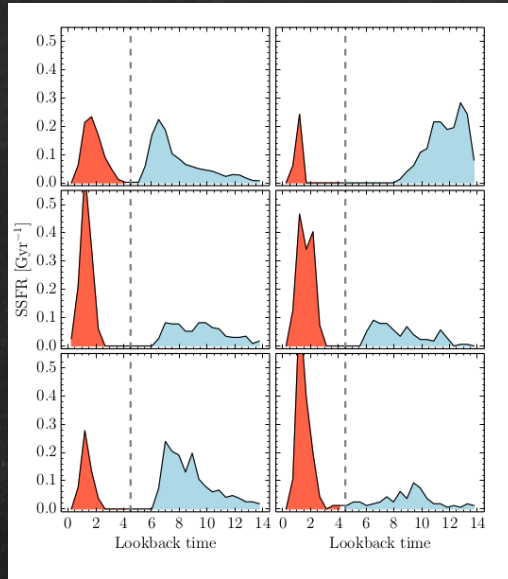


- Metal rich/younger population is more centrally concentrated than the older/metal poor counterpart.



See also, e.g., Battaglia et al. 2006, 2011; McConnachie et al. 2007

- CLUES Simulation -



- Split the stellar content into a young and an old populations
- Young stellar population more centrally concentrated than the older one
- More metal rich population more centrally concentrated
- Systematic behavior in all two component simulated dwarfs.

SUMMARY AND CONCLUSIONS

Cosmic Web Stripping

- “Cosmic Web Stripping” is an extra mechanism for reducing galaxy formation efficiency on small scales and a source of scatter in the M^* -Mhalo relation.
- It does shape the star formation history of dwarfs: Stellar winds and CWS can efficiently remove gas from low mass halos and truncate star formation.

Reionization

- Reionization can prevent stars from forming in halos that have low virial temperatures at early times.
- The gas does not escape the system and can be accreted later on. Star formation starts as the system grows massive enough.
- An early star formation episode that is truncated by either winds or web stripping followed by accretion of gas supplied by a dwarf that retained gas during the reionization is consistent with observed SFHs (Multiple stellar populations, in which the younger and metal rich population is more centrally concentrated than the older one naturally arise).