Mass, Structure and Quenching

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UCSC Galaxy Formation Workshop 13 Aug. 2014

Quenching Models

Centrals:

- Virial shock heating in halos > $M_{crit} \sim 10^{12}\ M_\odot$ } Halo
- Gaseous inflow to a compact bulge ➞ starburst ➞ gas exhaustion
  - Major mergers
  - Gravitationally unstable disc
- Morphological quenching: bulge stabilises the disc

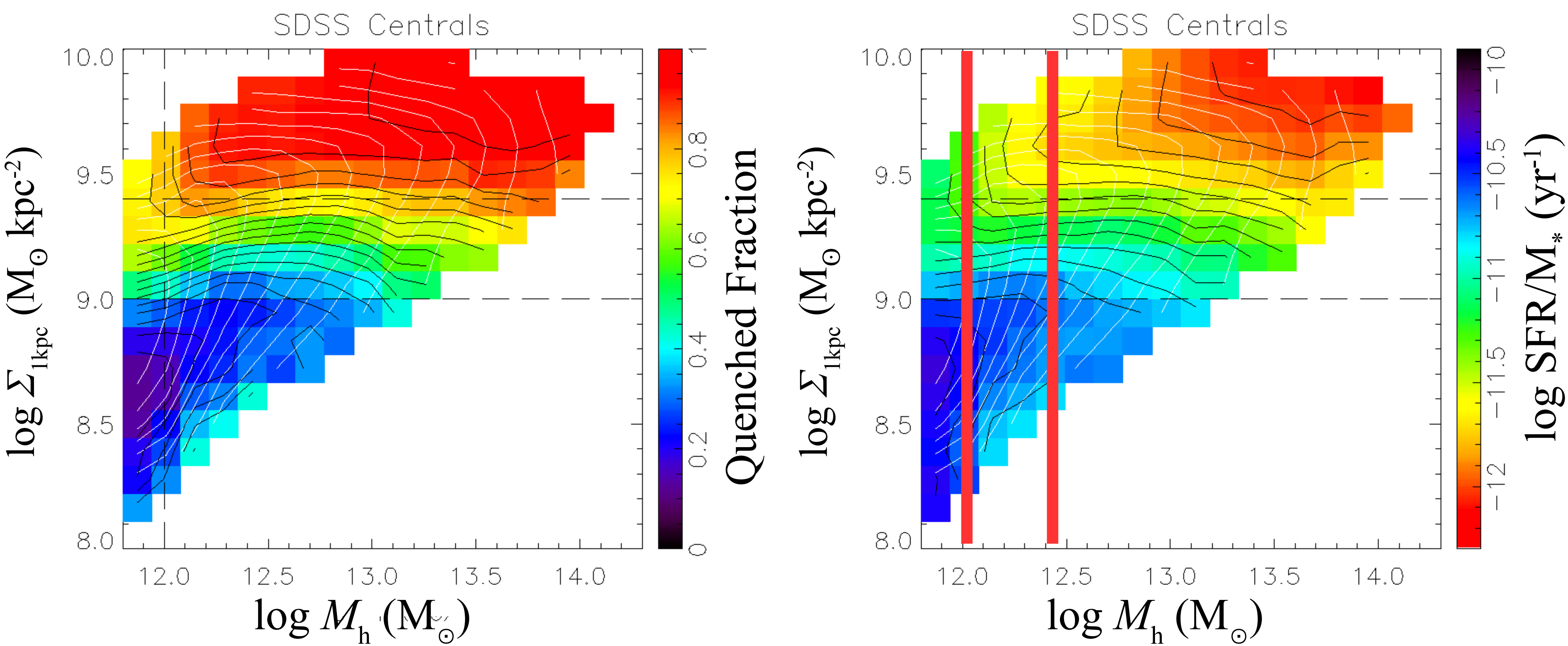
} Galaxy

- AGN heating } Galaxy + Halo

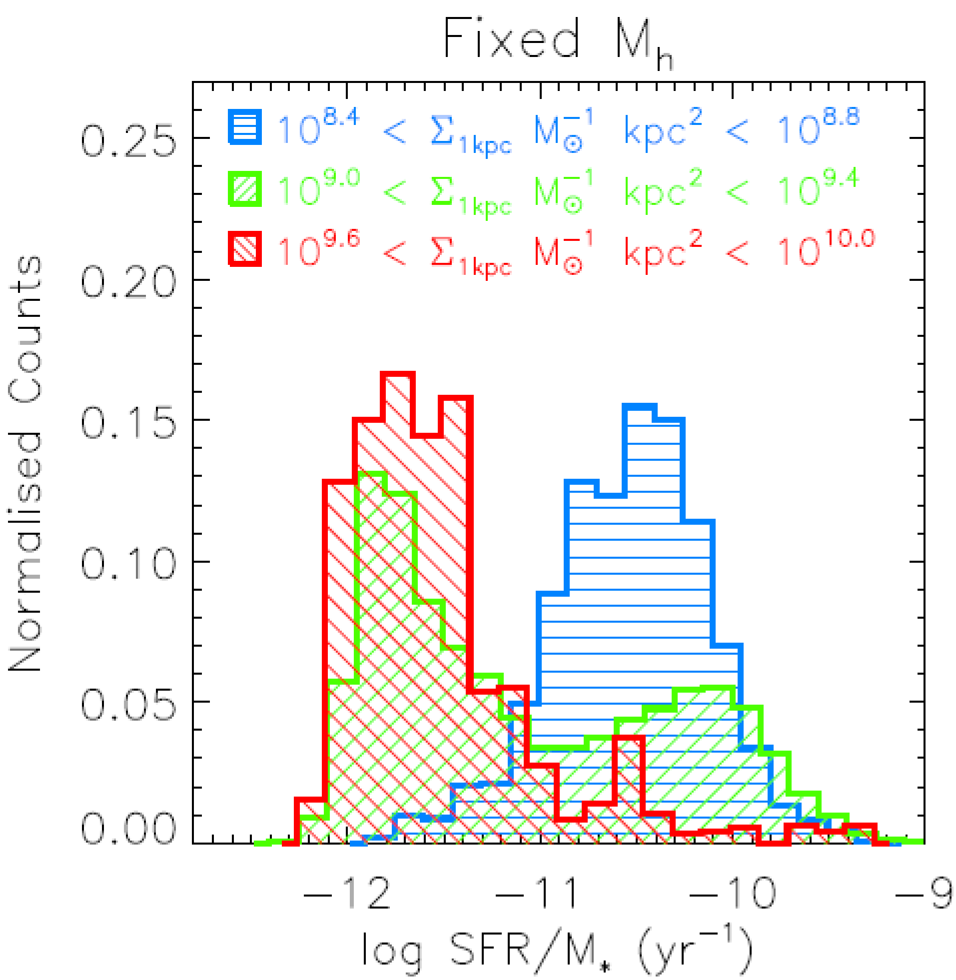
Satellites:

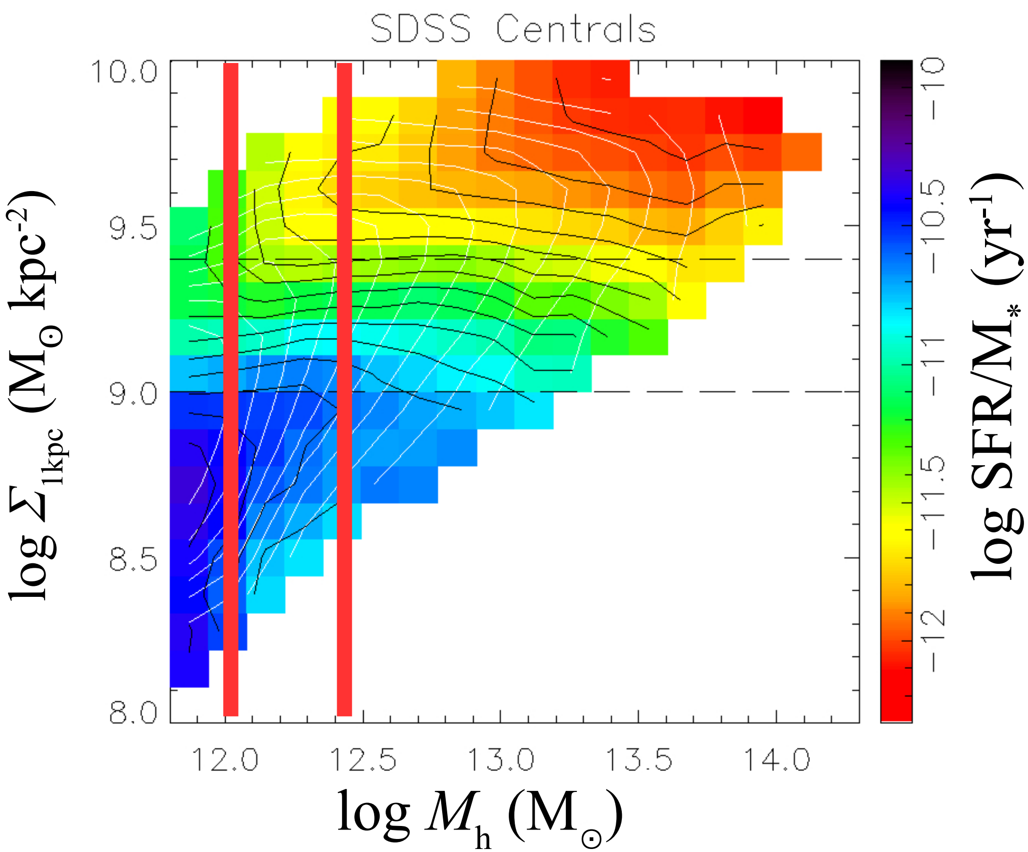
- Ram pressure stripping: gas (strangulation)
- Tidal stripping: gas and stars
- Harrassment: high speed interactions

Mass vs. Morphology: Centrals



Woo et al., (2014) http://arxiv.org/abs/1406.5372





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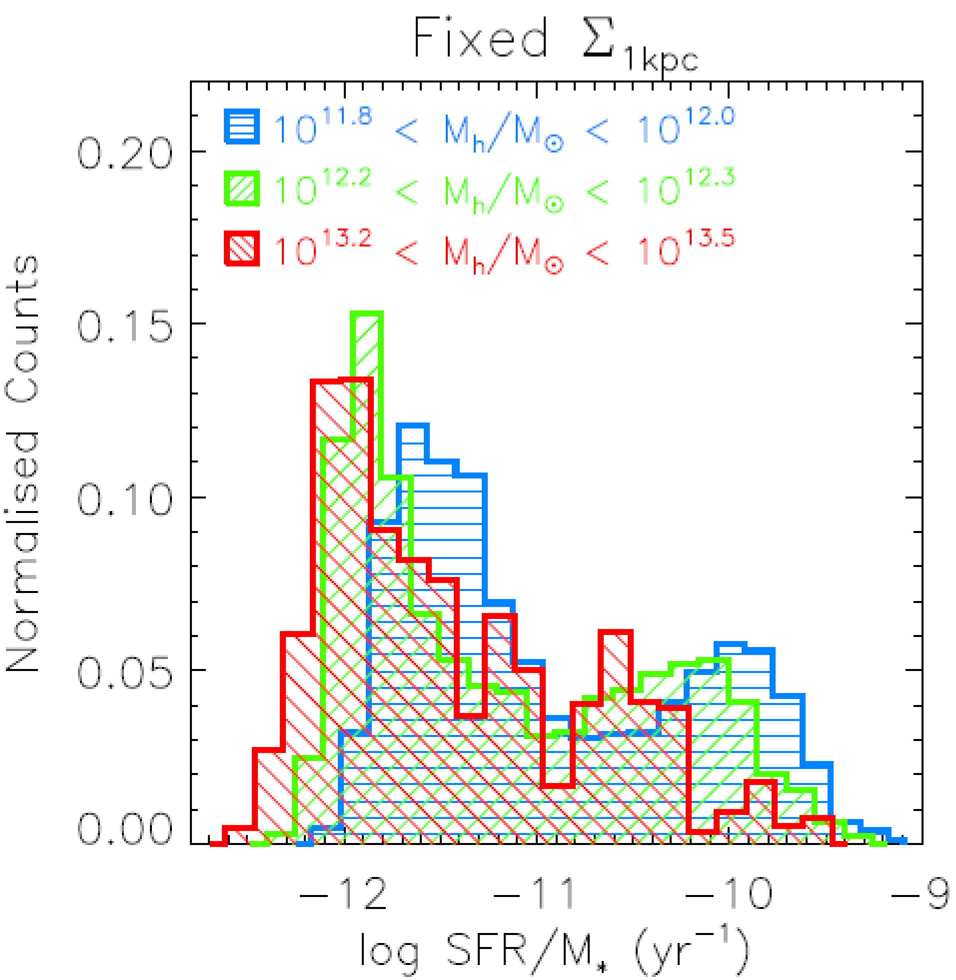

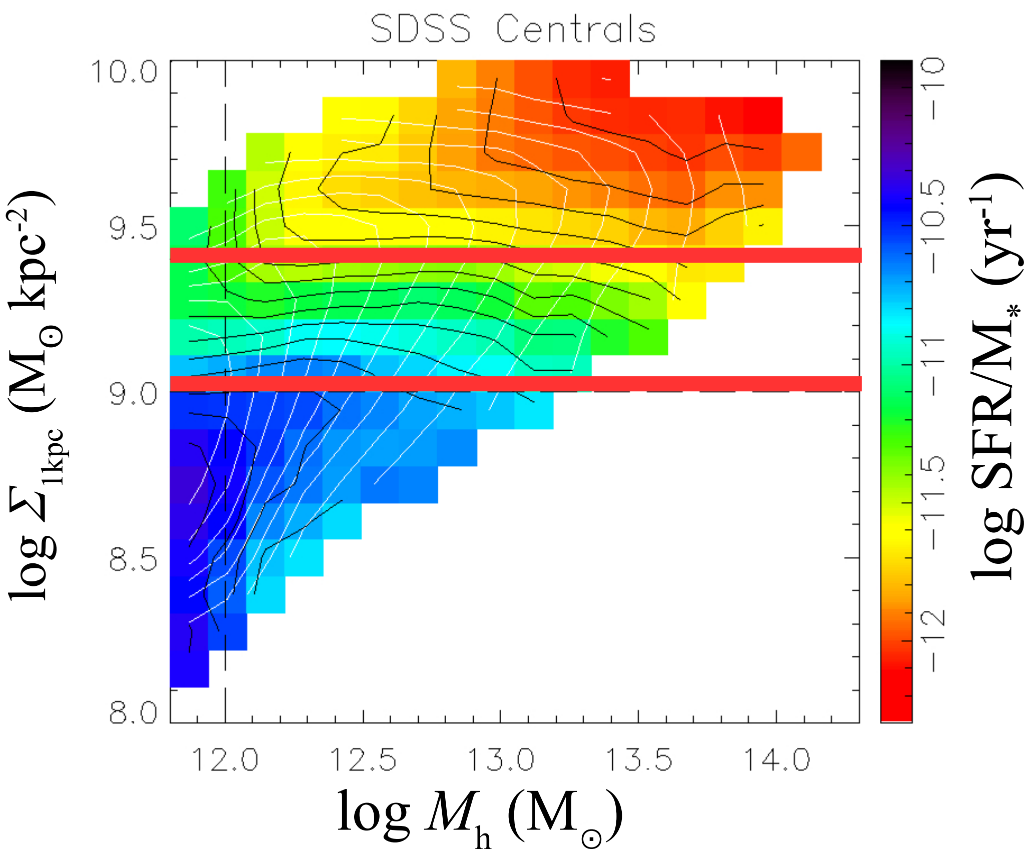

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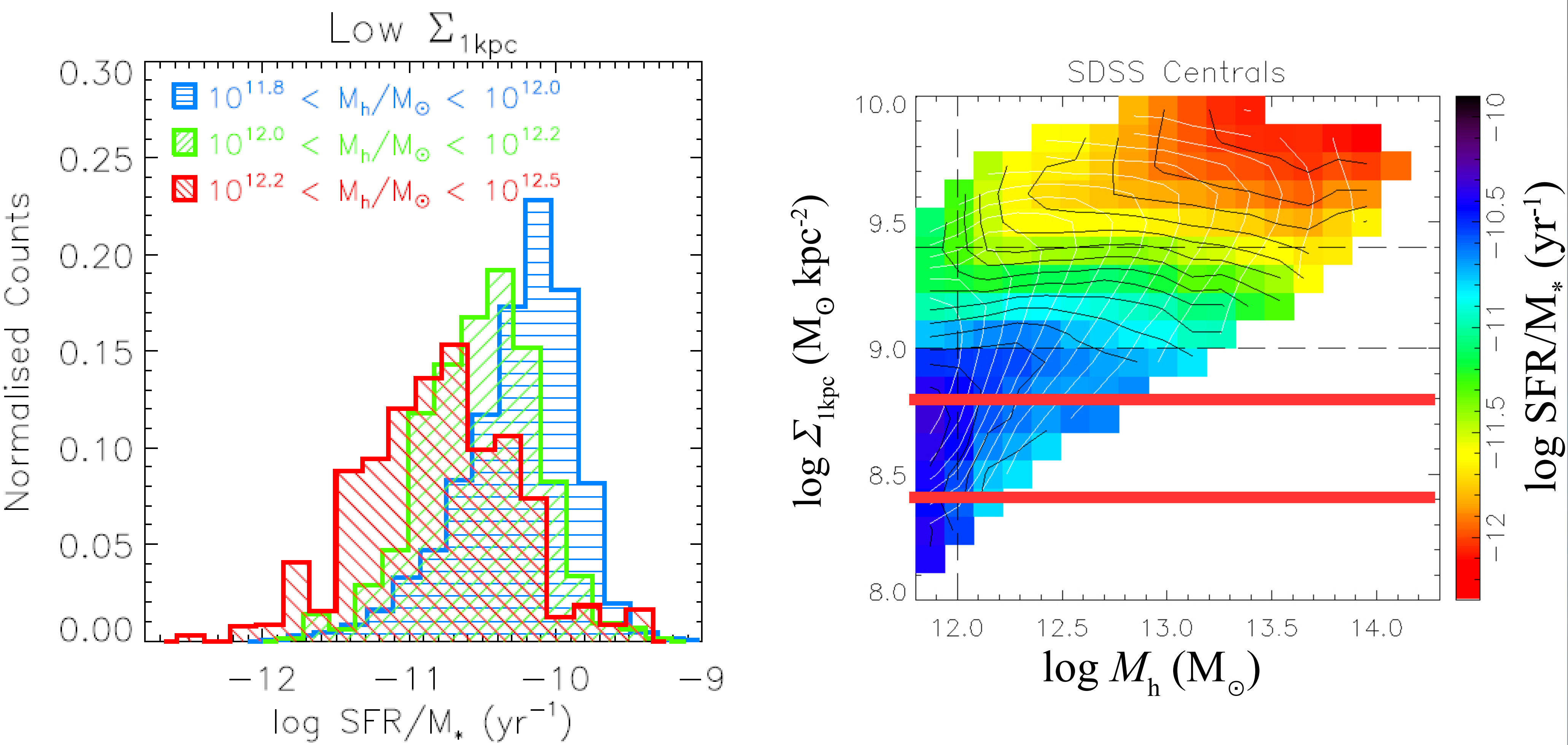

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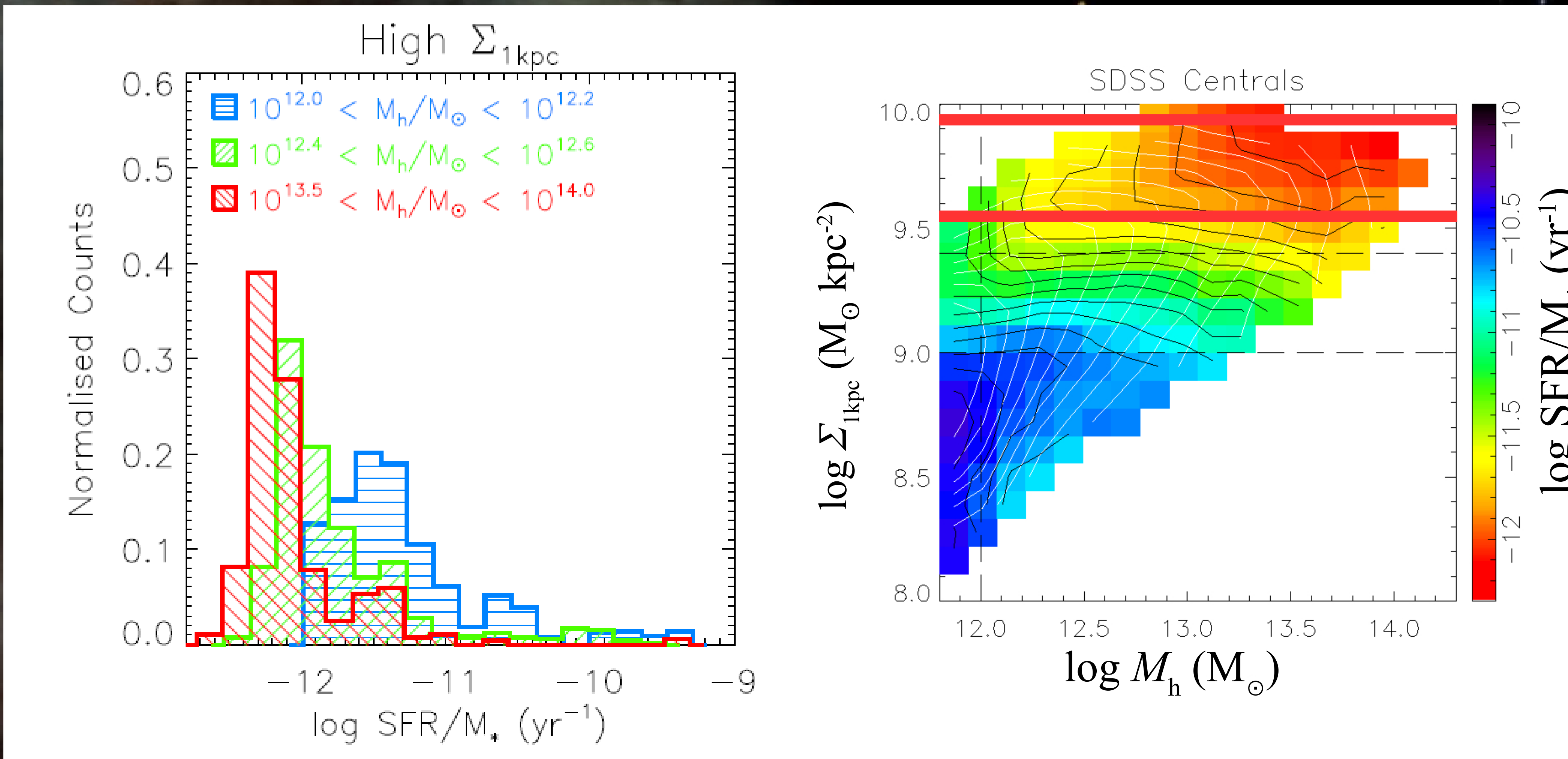

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Quenching Results for Centrals

- Σ_{1kpc} correlates with f_q
  - Σ_{1kpc} predicts the shape of the SSFR distribution
- M_h correlates with SSFR
  - M_h predicts the shift of the SSFR distribution without changing its shape

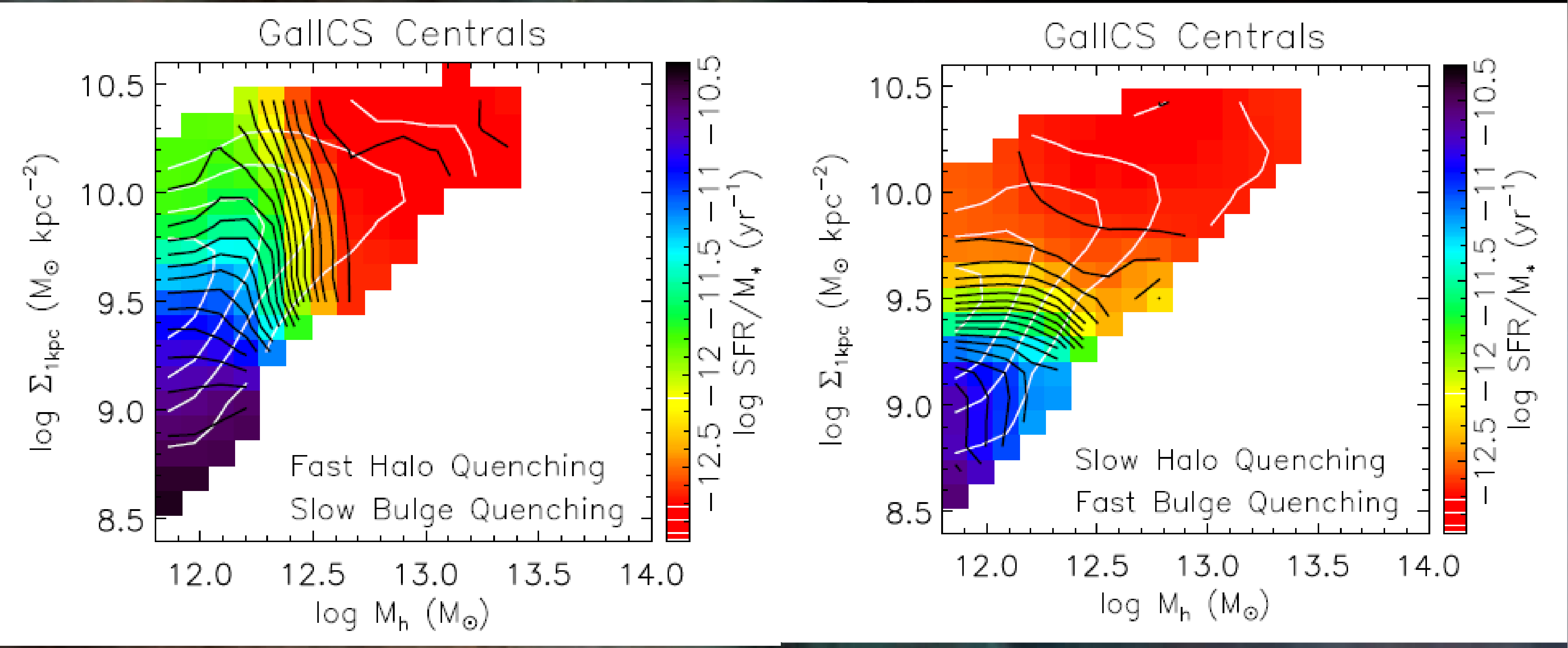
Interpretation of Results

- Proposition:
  - Increase of f_q is related to the transfer across bimodality; quick
  - Decrease of SSFR is related to the *slower* fading of star formation
- Therefore Σ_{1kpc} -quenching is fast and M_h -quenching is slow
- Makes sense because:
  - Virial shock heating is expected to cut off accretion; remaining gas is expected to continue forming stars
    - Timescales can be ~ 2-3 Gyr or higher
  - Mechanisms that result in high Σ_{1kpc} are expected to be violent (VDI, mergers)
    - Once gas is consumed M_h could play maintenance role of quenching (prevents new gas from falling in)
- Can test these ideas in a SAM...

SAM test: GalICS

- Hatton+ (2003), Cattaneo+ (2007, 2008, 2013)
- The GalICS SAM implements quenching due to:
  - Virial shock heating (Halo):
    - All cold gas removed when M_h reaches M_{crit}
    - Unrealistically strong (immediate)
  - Bulge quenching (Galaxy):
    - Accretion = 0 when $M_{bulge} > M_{disc}$ or $B/T > 0.5$
    - Bulge grows through mergers, disk instabilities
    - Mimics AGN feedback, wet inflows, morphological quenching

SAM test: GalICS



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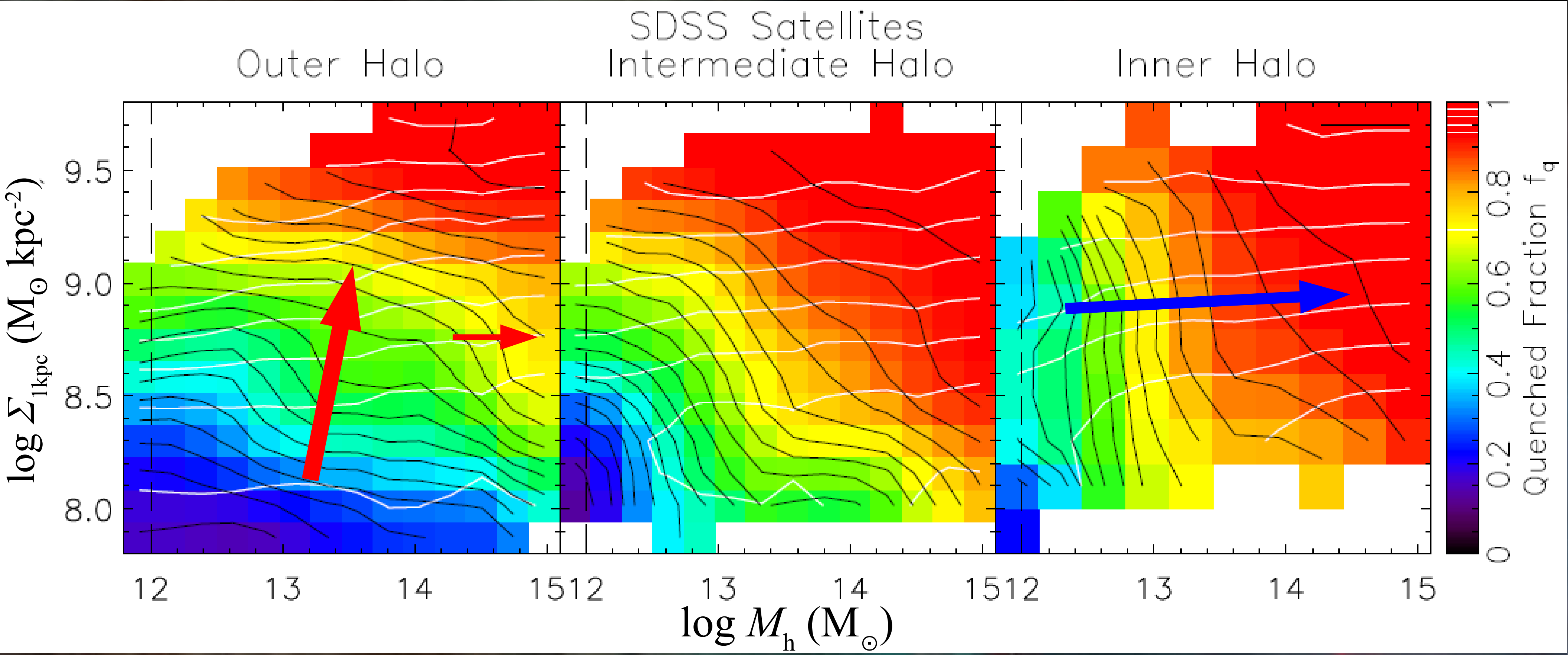
Quenching and Morphology: Satellites



The quenched fraction depends on Σ_{1kpc} in the outskirts of halos.
The quenched fraction depends on M_h in the inner halo.
Almost all satellites are quenched above $10^{12.8}$ $M_\odot$

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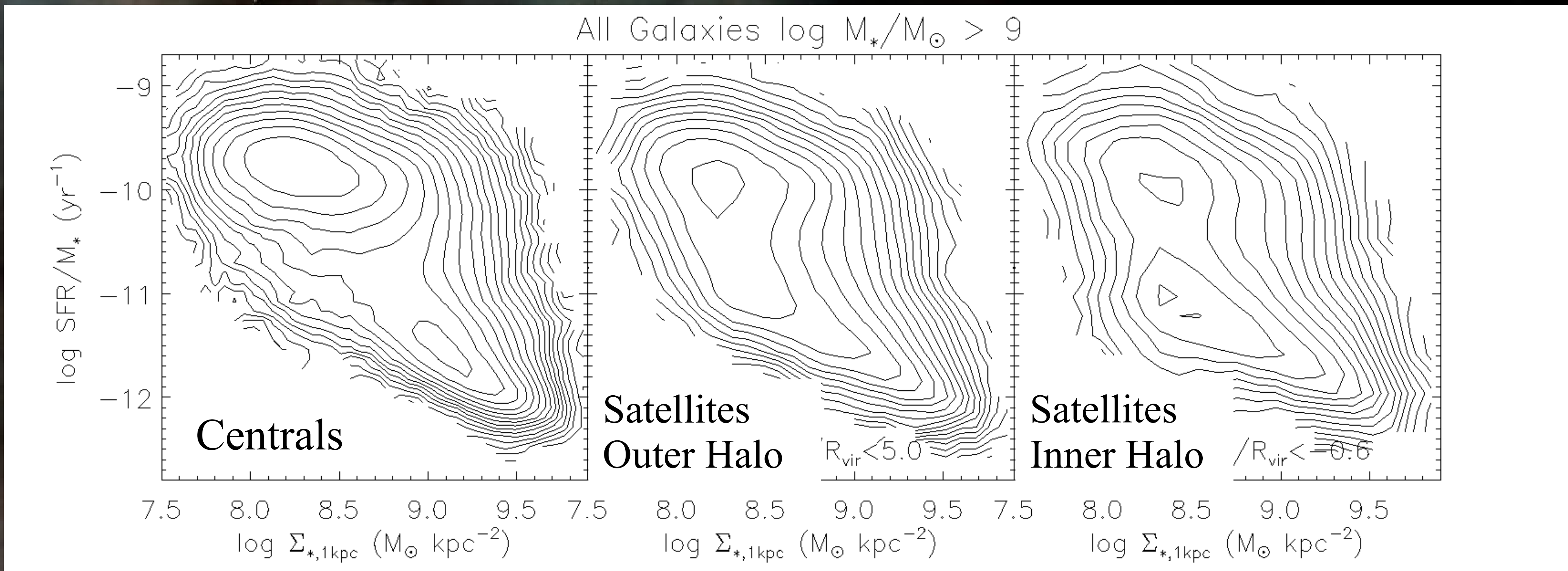
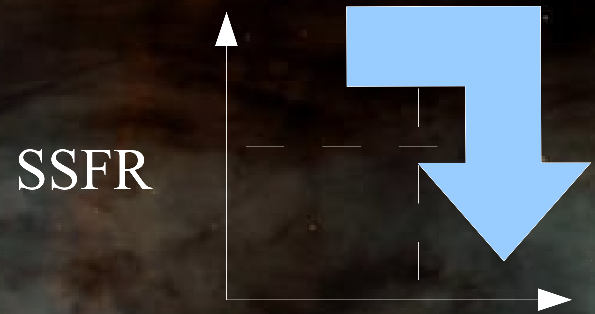
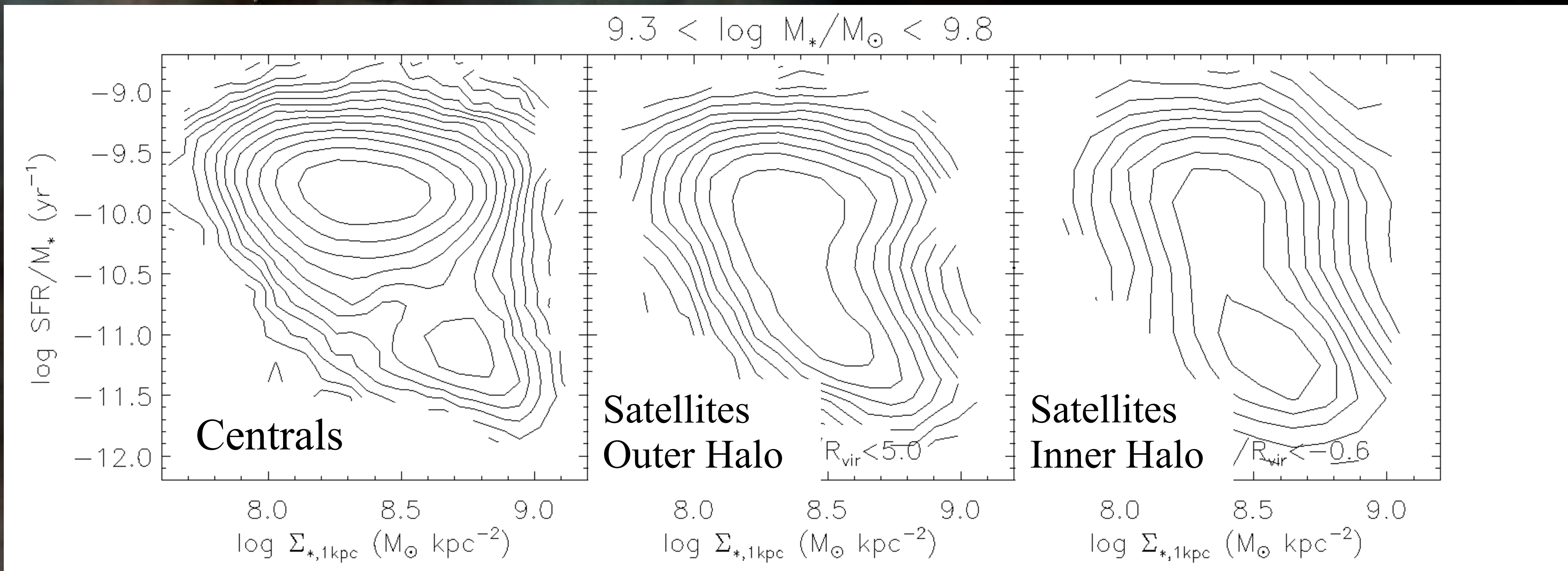


Woo et al., in preparation





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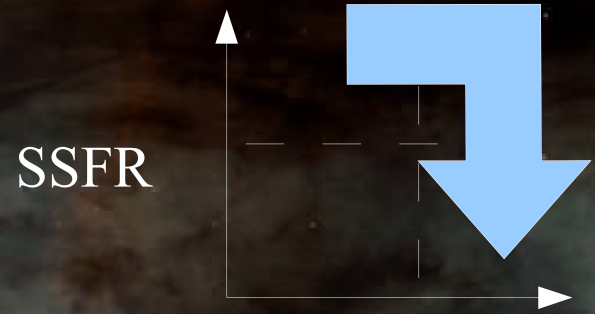

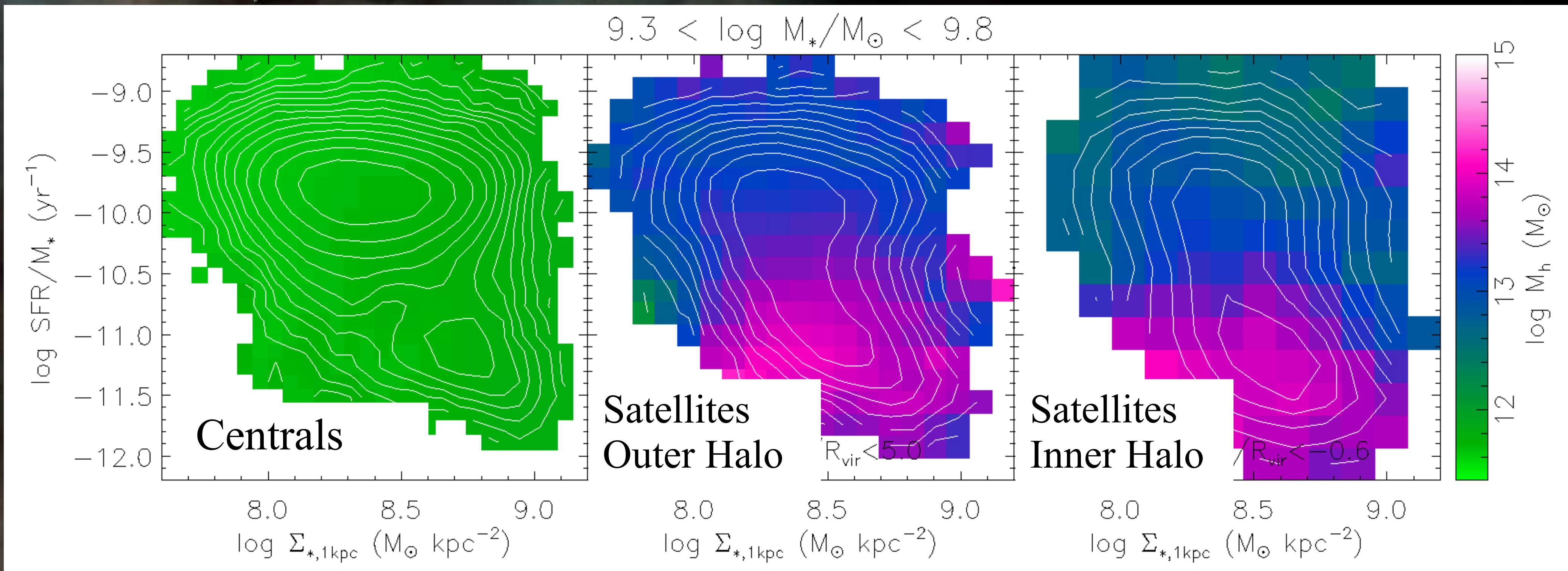

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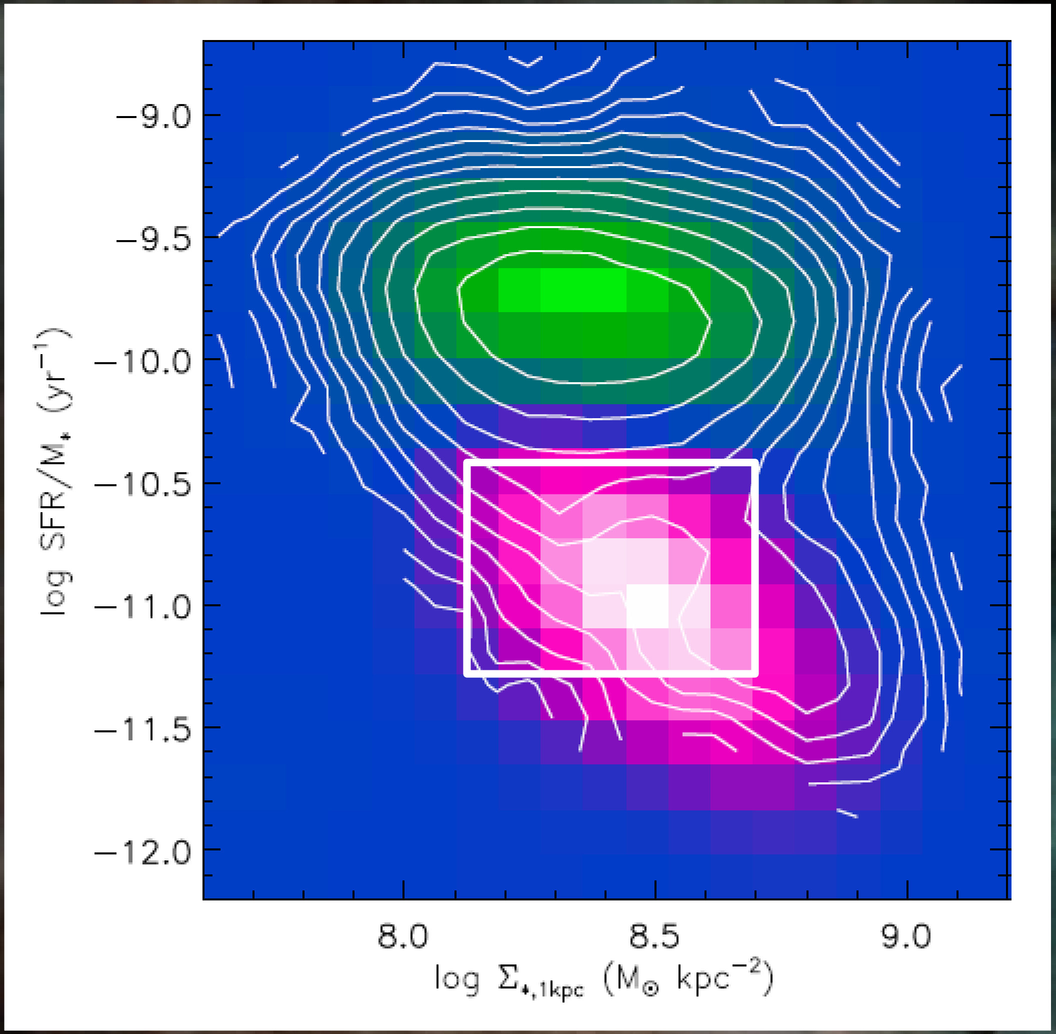

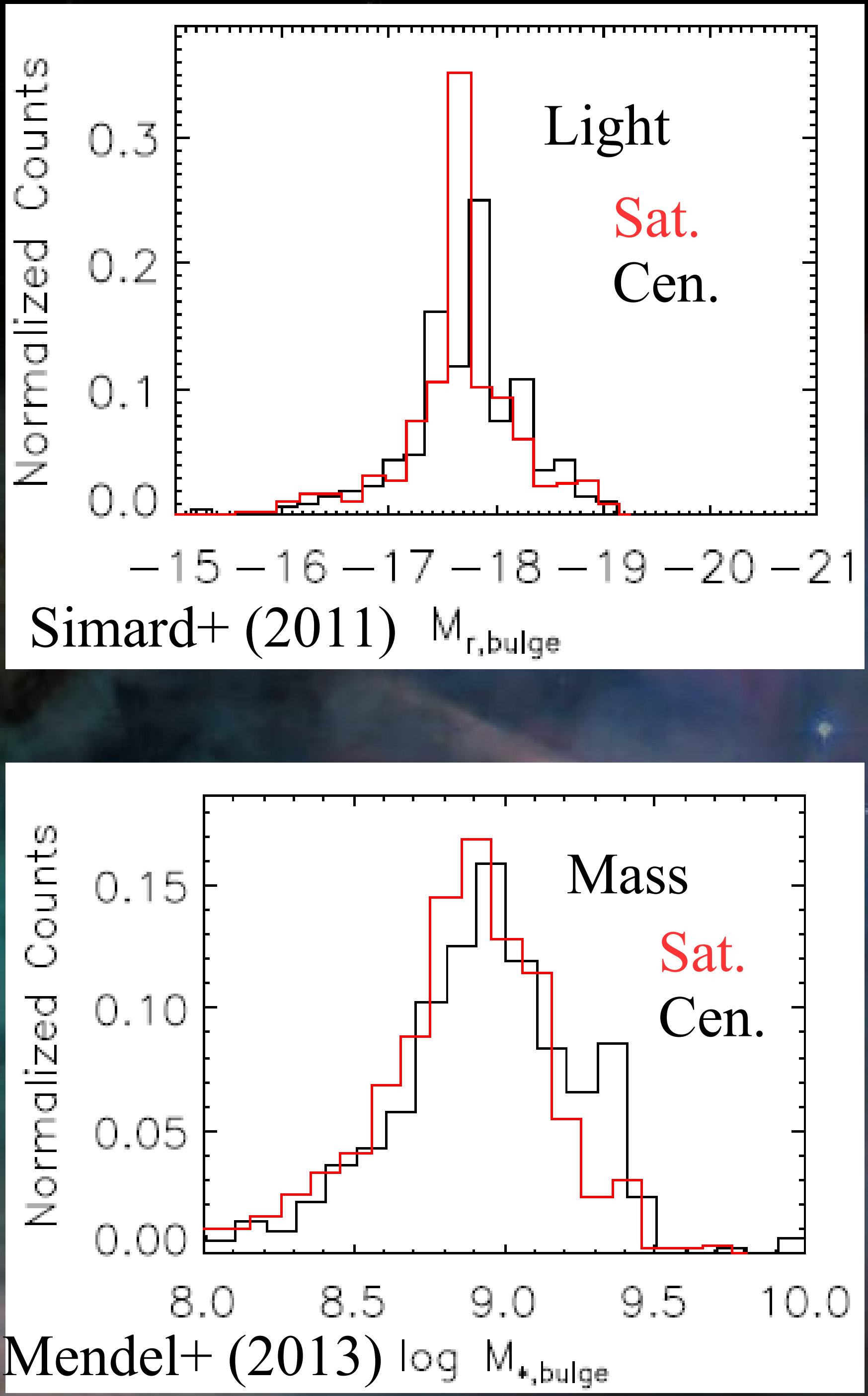

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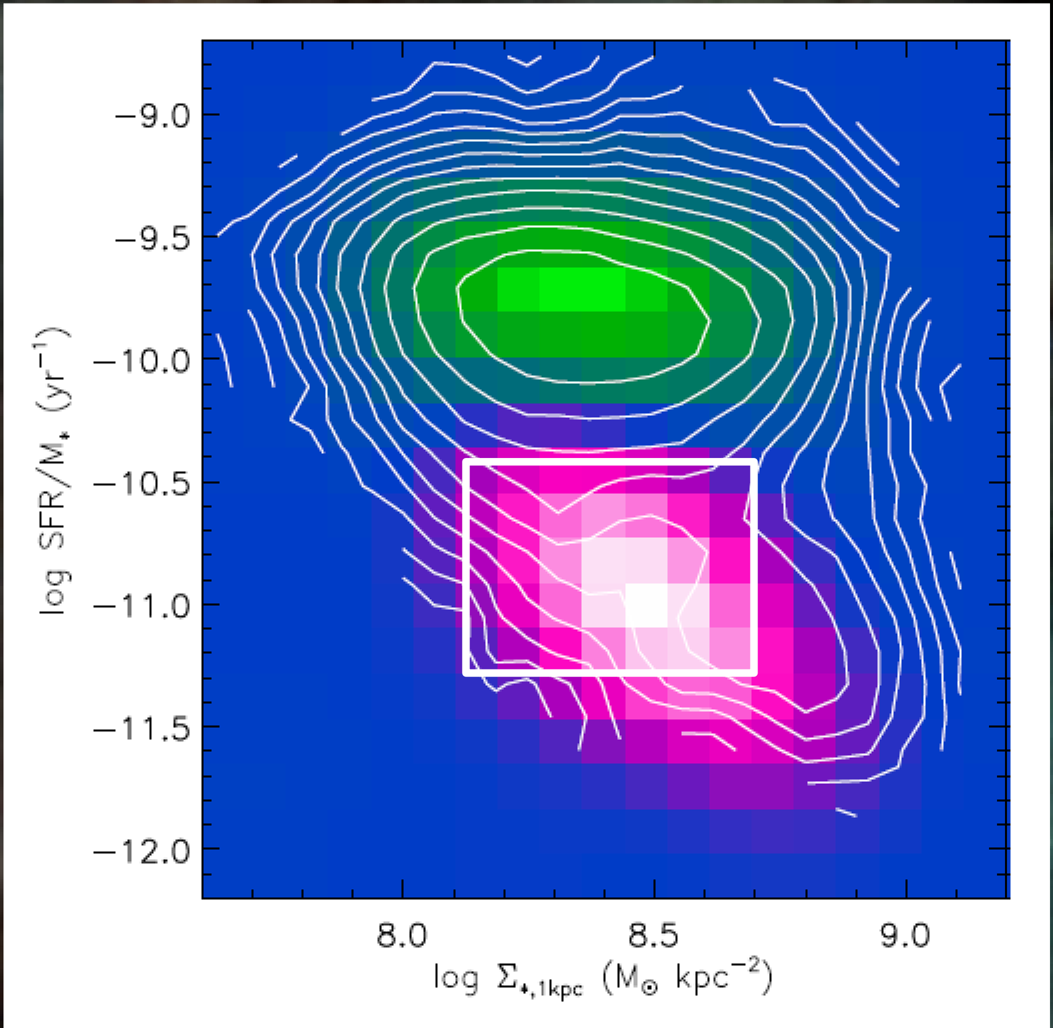

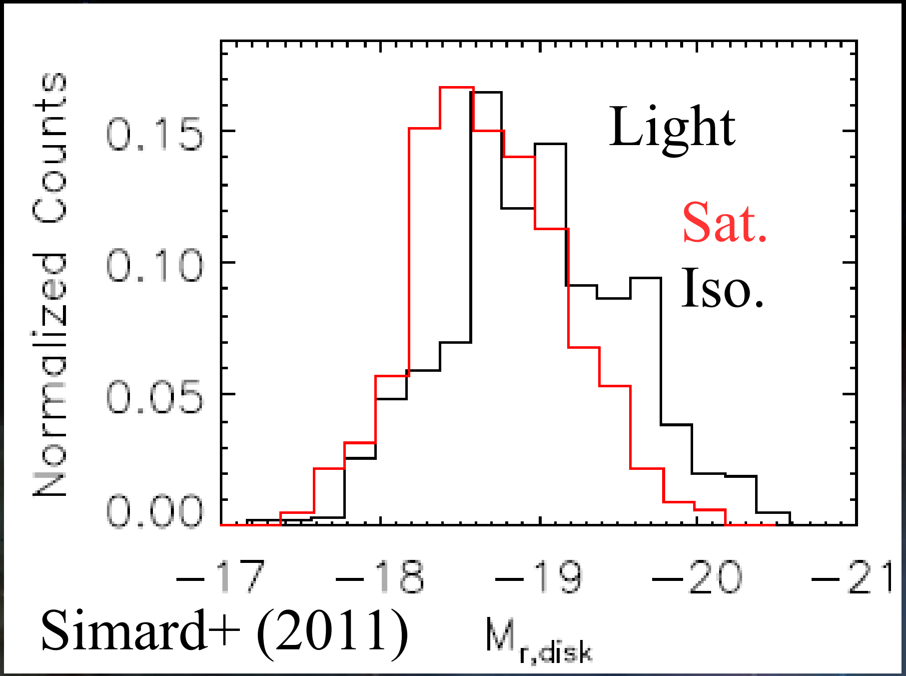

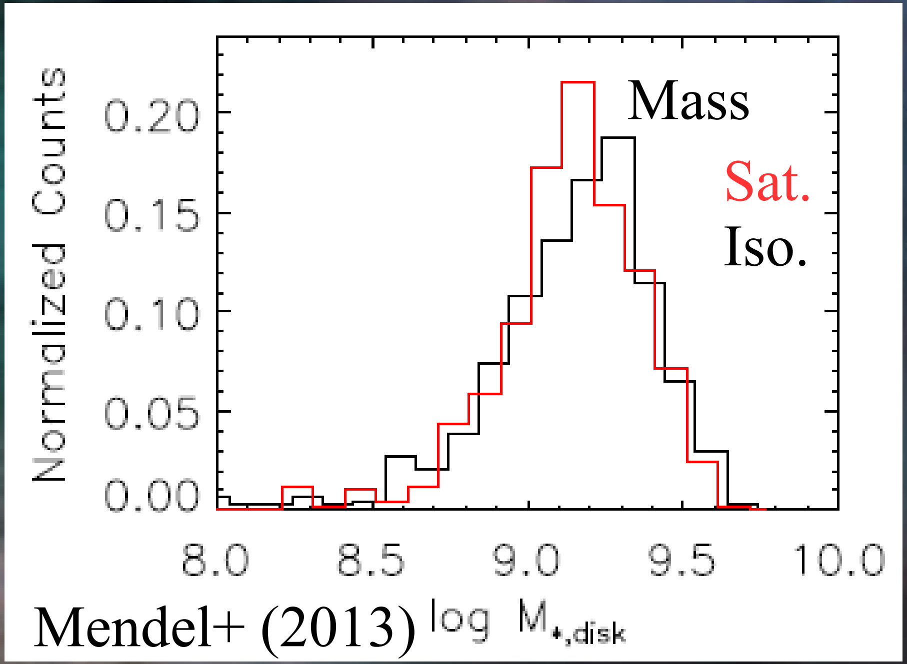

Woo et al., in preparation

Quenching Results for Satellites

- Outer regions of haloes: Σ_{1kpc} correlates with f_q
  - Satellites only recently fell in; have not had time to experience the slow halo quenching
- Inner regions of haloes: M_h correlates with f_q
- Quenched satellites have lower Σ_{1kpc} than quenched centrals of the same mass.
  - Bulge light and mass are comparable
  - Disk mass is comparable but disk light is dimmer

Evidence that satellite quenching is disk fading without bulge growth