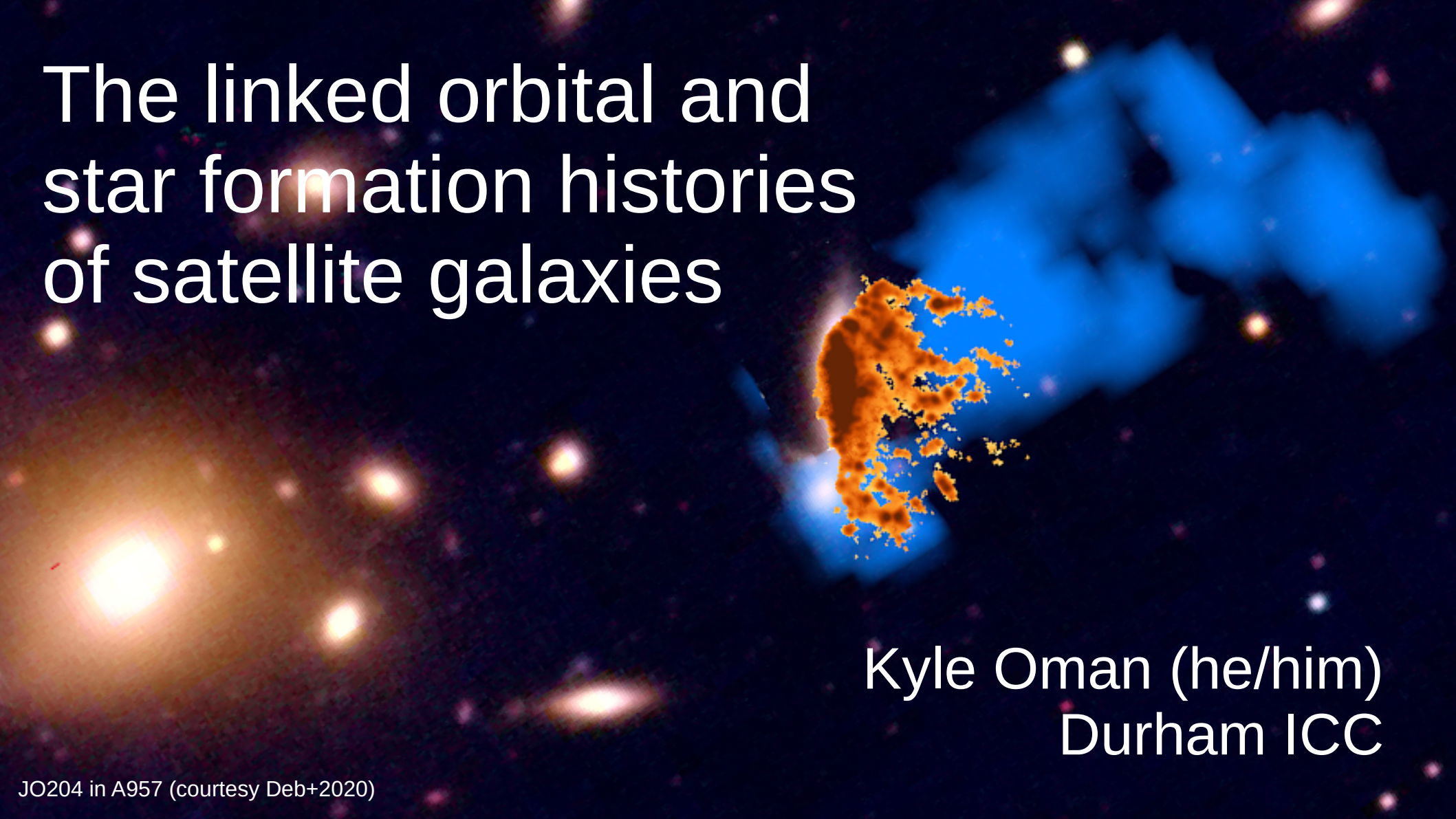
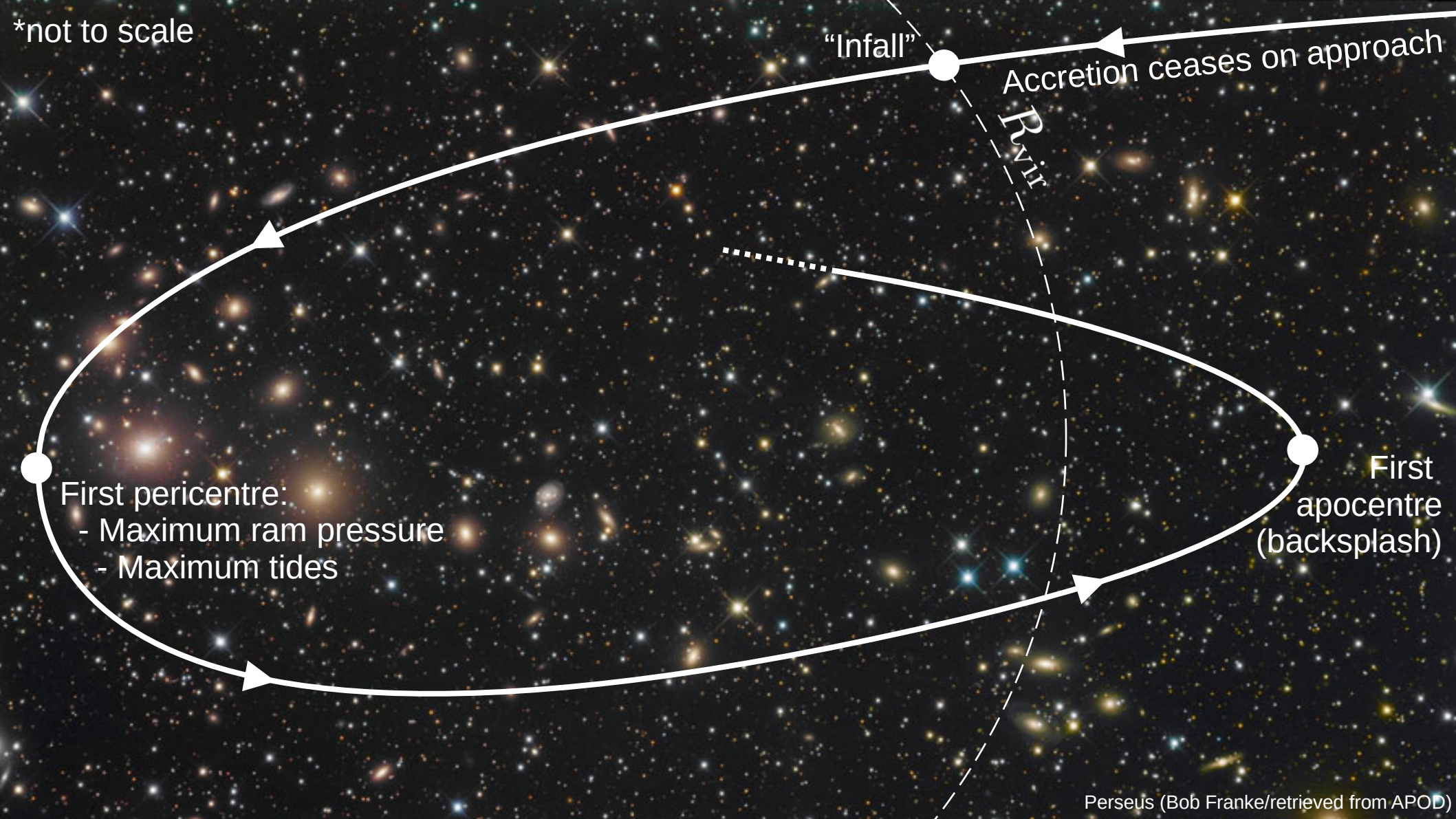
The linked orbital and star formation histories of satellite galaxies



Kyle Oman (he/him)
Durham ICC

JO204 in A957 (courtesy Deb+2020)

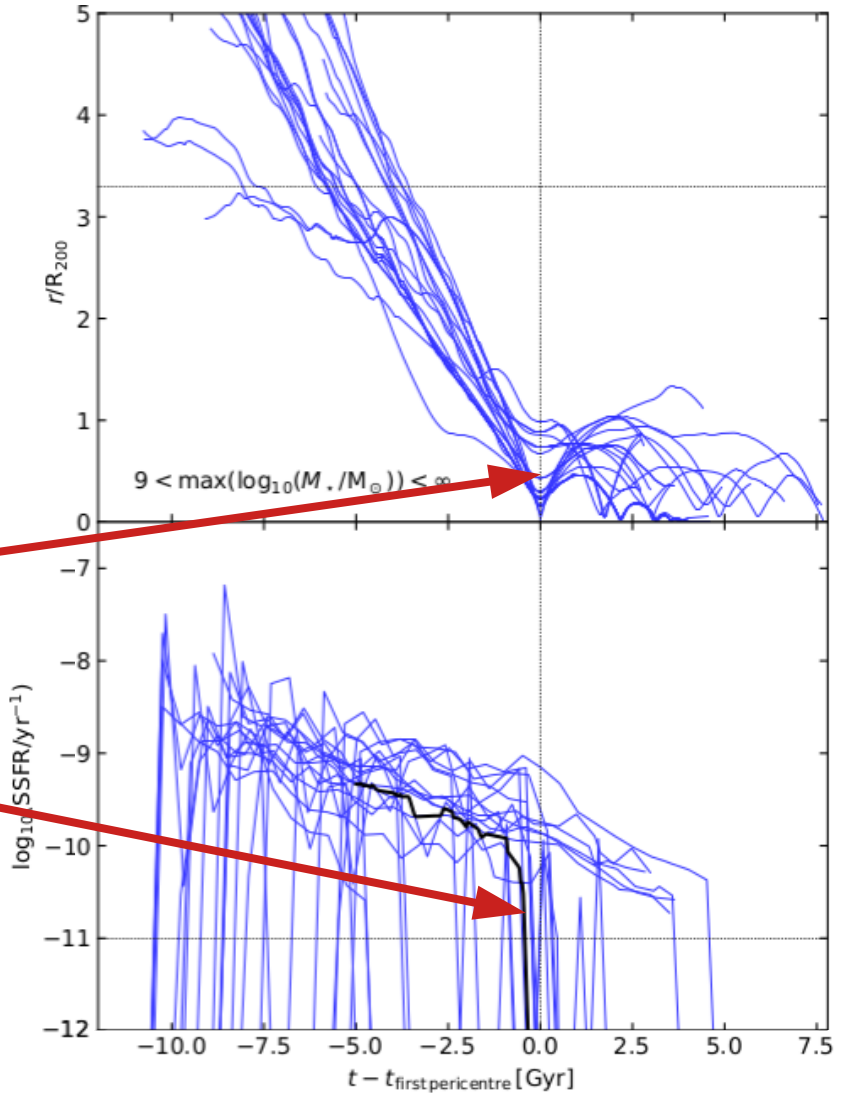

*not to scale
“Infall”
Accretion ceases on approach
R_{vir}
First pericentre:
- Maximum ram pressure
- Maximum tides
First
apocentre
(backsplash)
Perseus (Bob Franke/retrieved from APOD)

Orbital history, star formation history

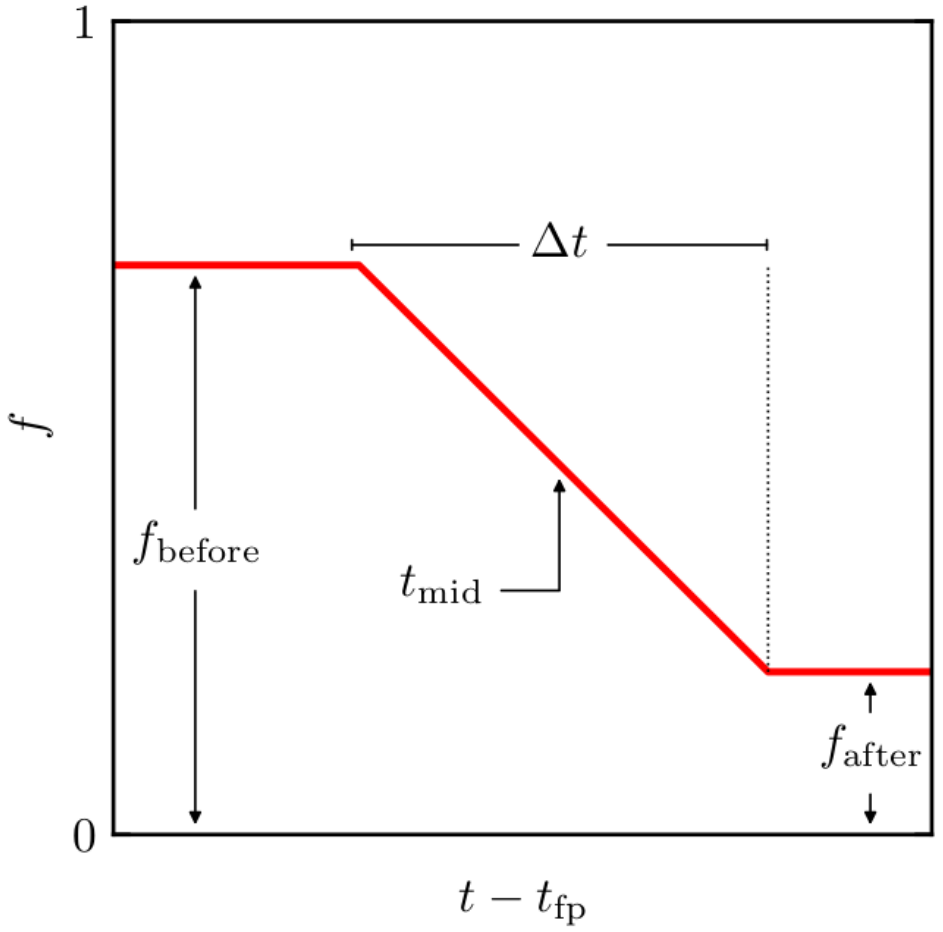
Driven by:
ram pressure?
tides?

First pericentre

Drop in star formation rates

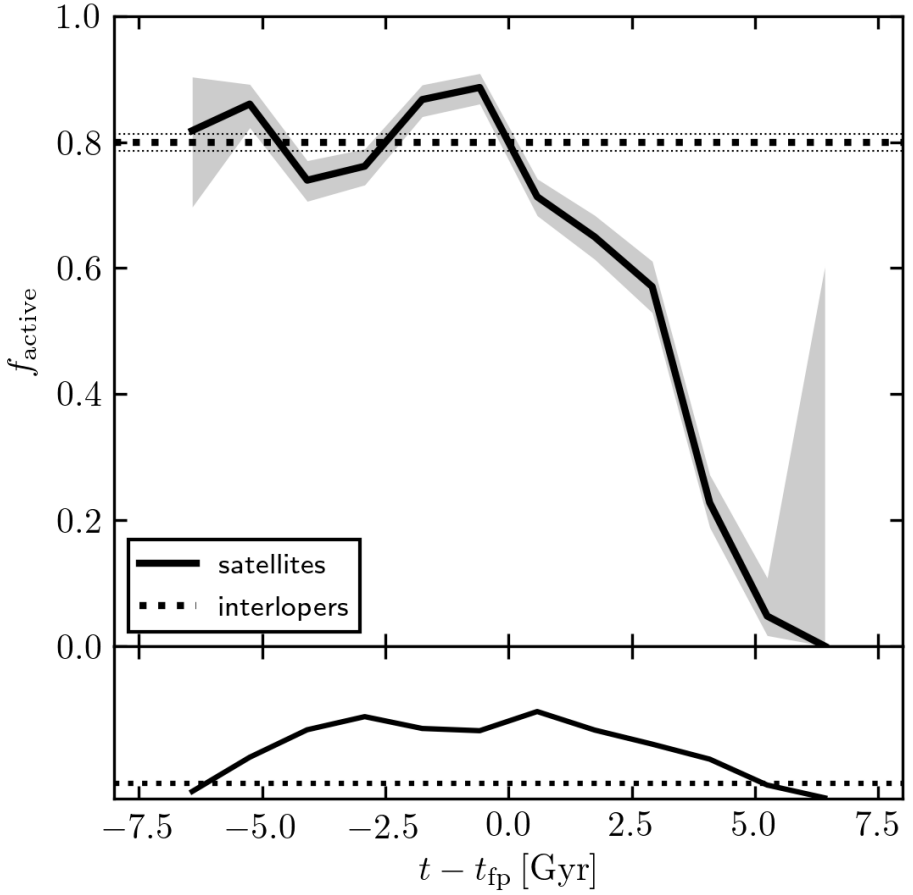


The model


1
0
f
Δt
f_{before}
t_{mid}
f_{after}
$t - t_{\mathrm{fp}}$

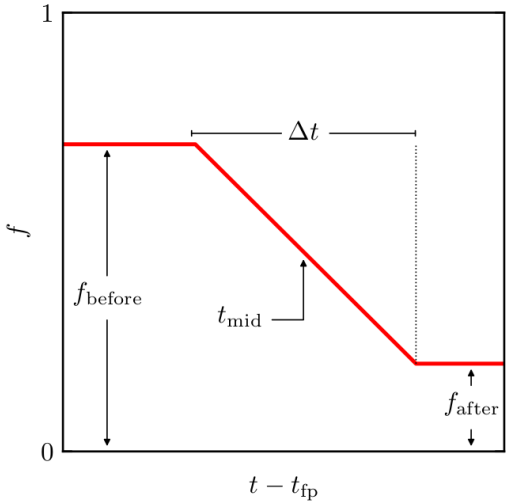
Testing on mock data

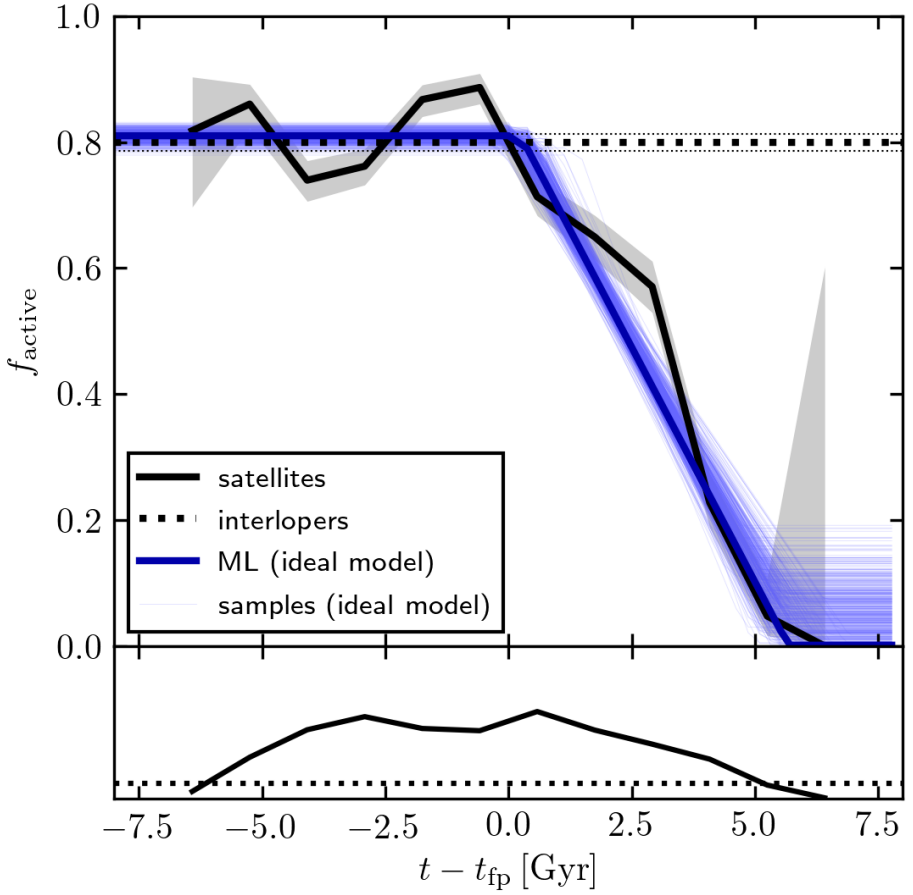
- Select simulated galaxies around clusters at z~0.6
- Track forward/ backward to determine time since/ until first pericentre t-t_{fp}
- Bin by t-t_{fp} and determine fraction of active (star forming) galaxies



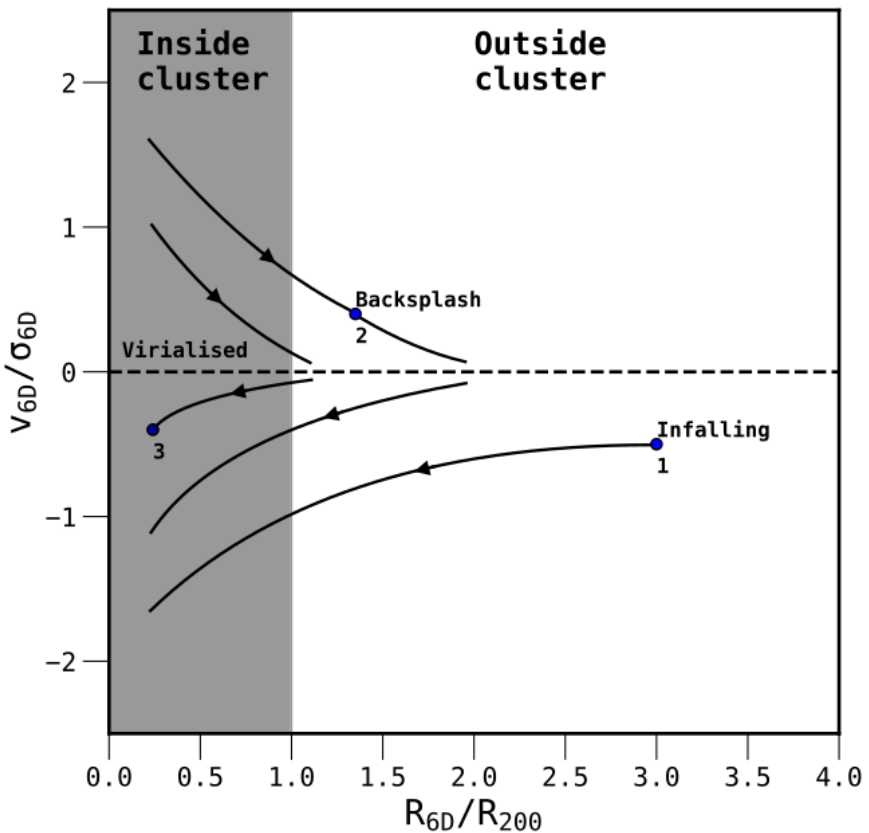
Testing on mock data

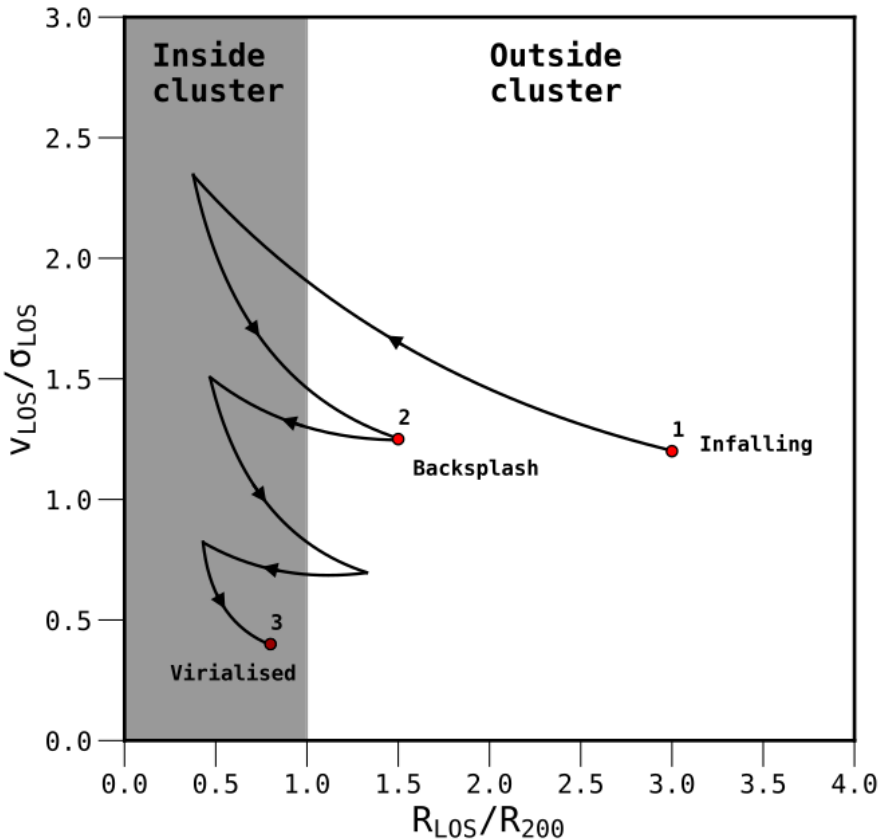
- Suppose for now that t-$t_{\rm fp}$ is magically observable…
- Constrain parameters of the model





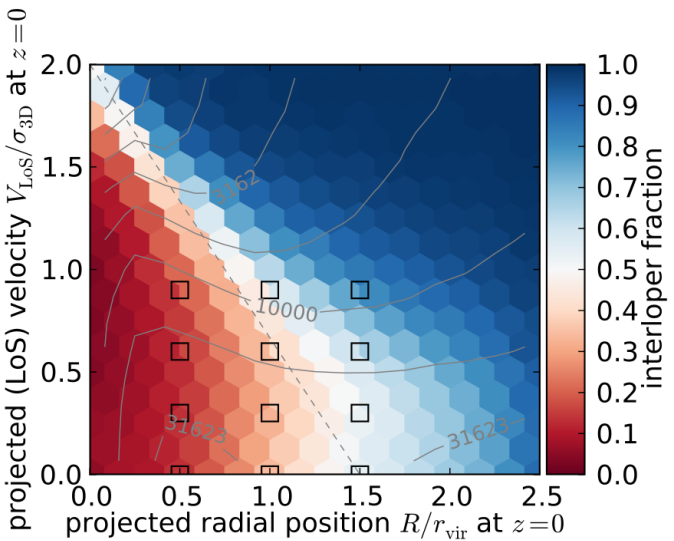
Orbits in (projected) phase space

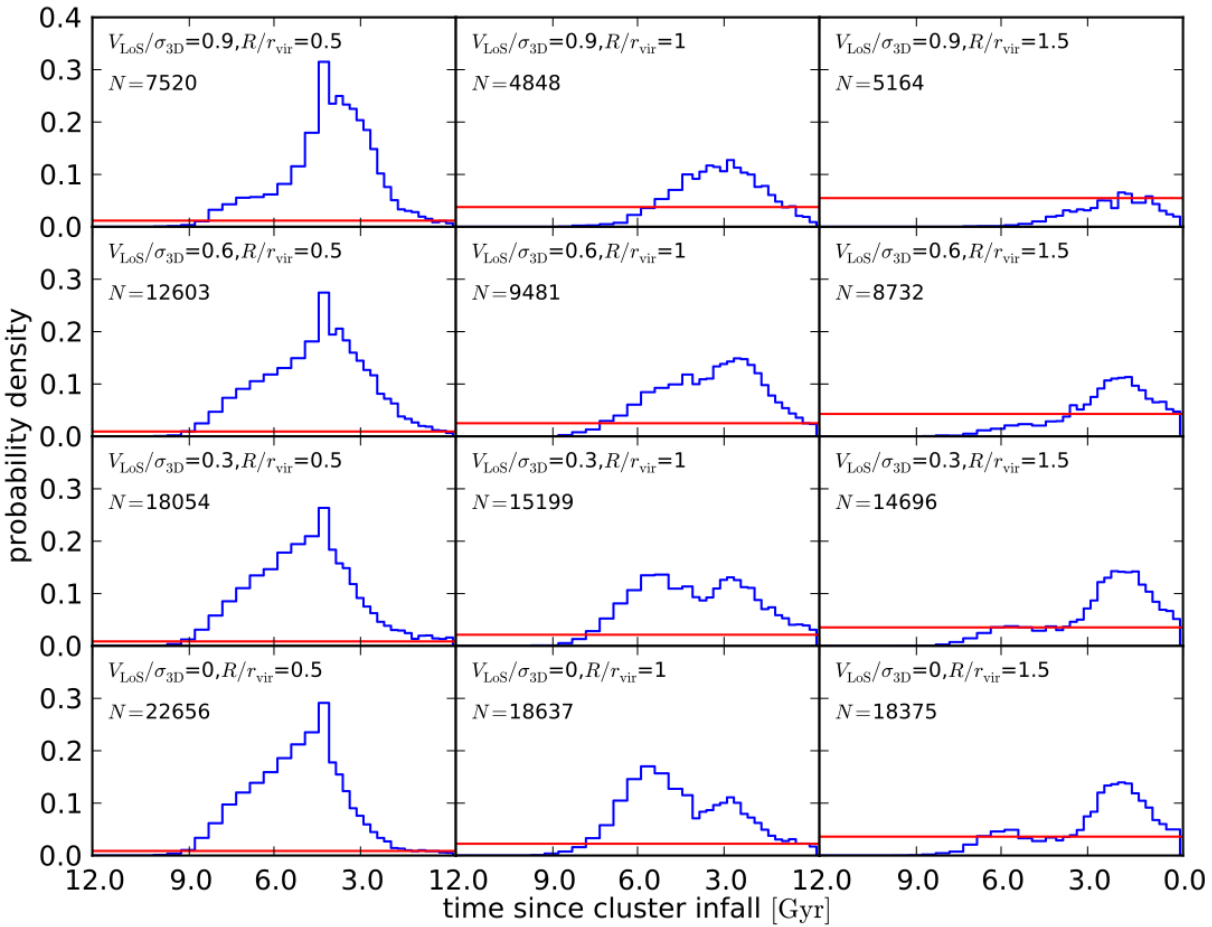




Arthur+2019

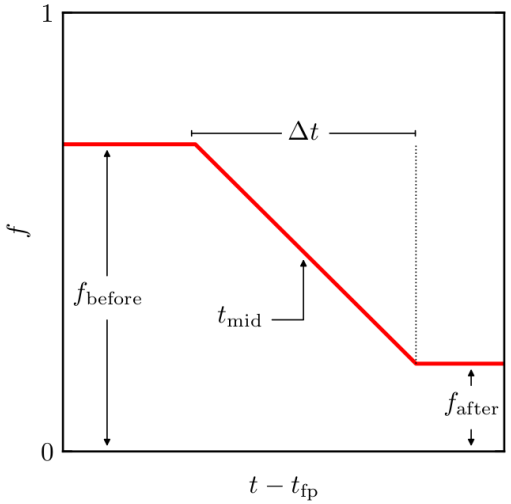
Orbital parameter distributions

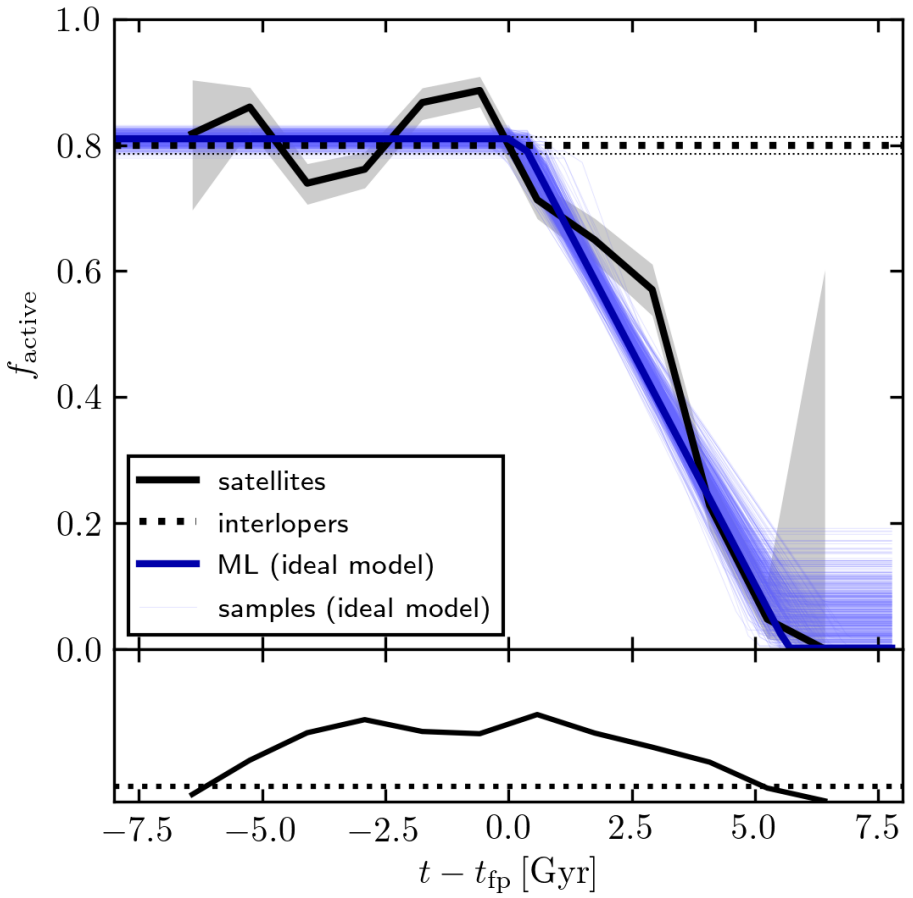




Testing on mock data

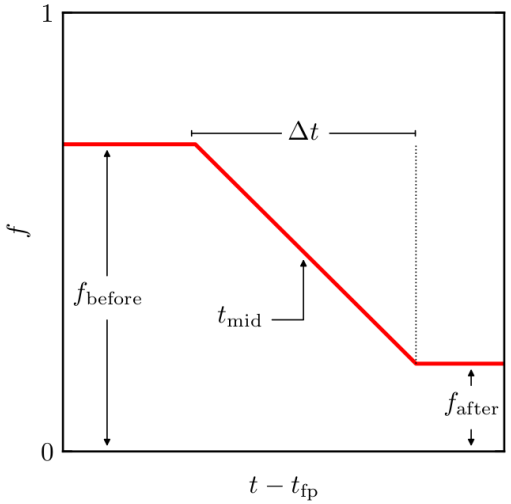
- Now can take into account likely orbits for each satellite.
- Constrain parameters of the model

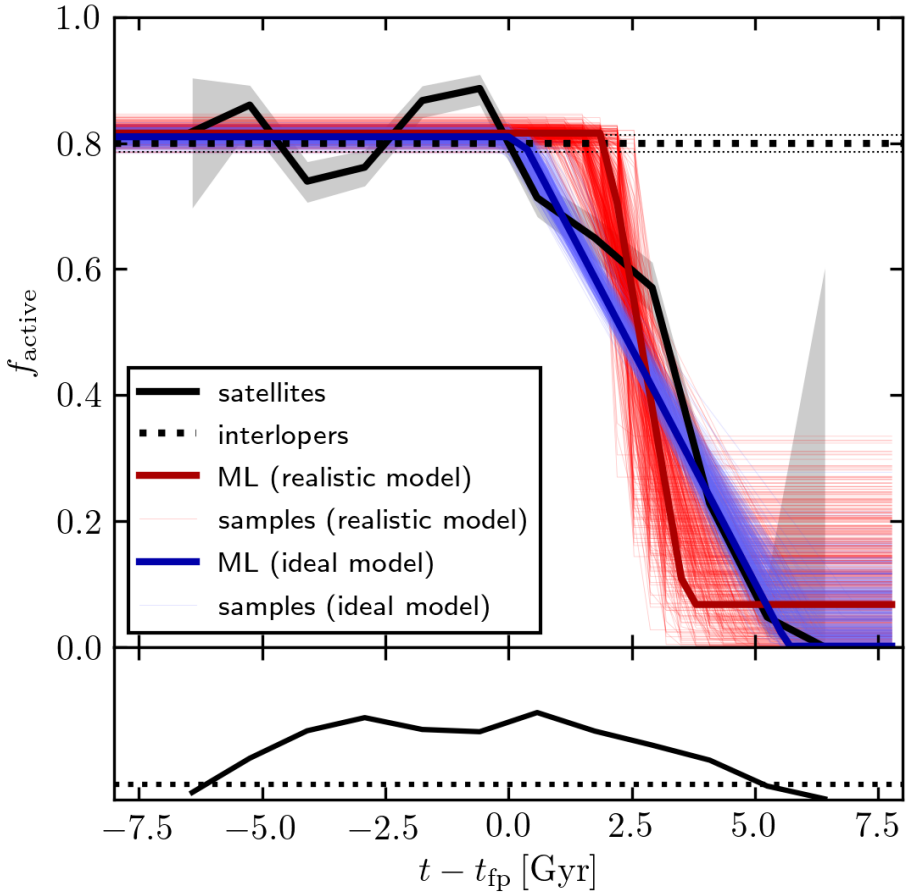




Testing on mock data

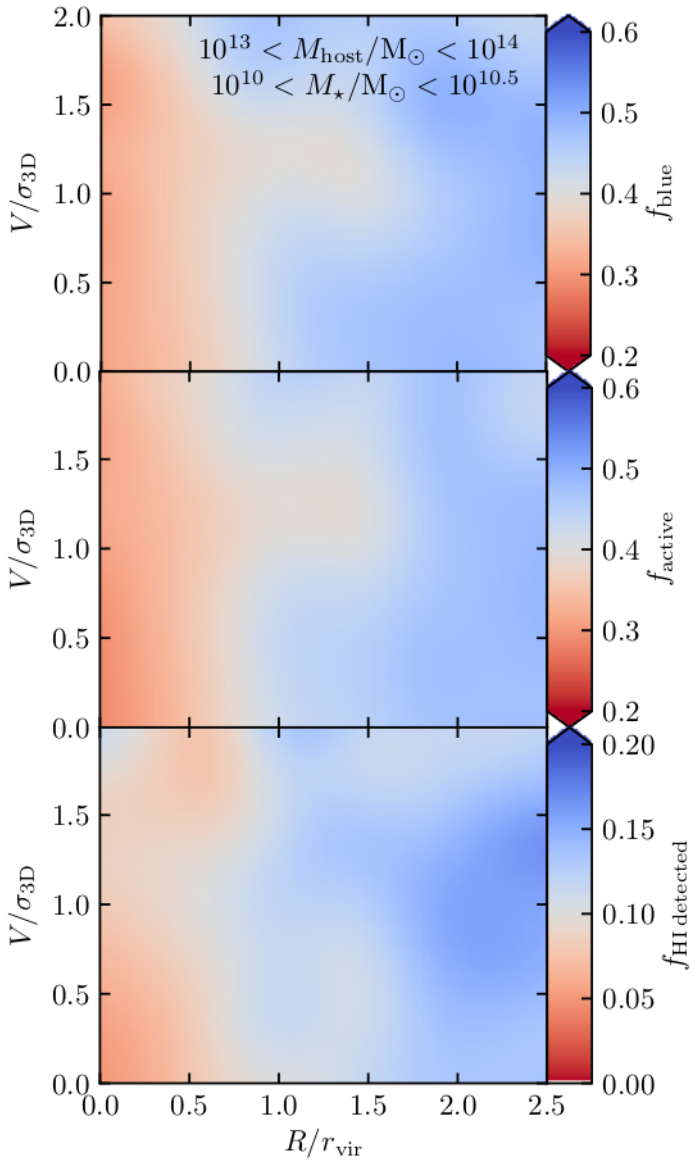
- Now can take into account likely orbits for each satellite.
- Constrain parameters of the model



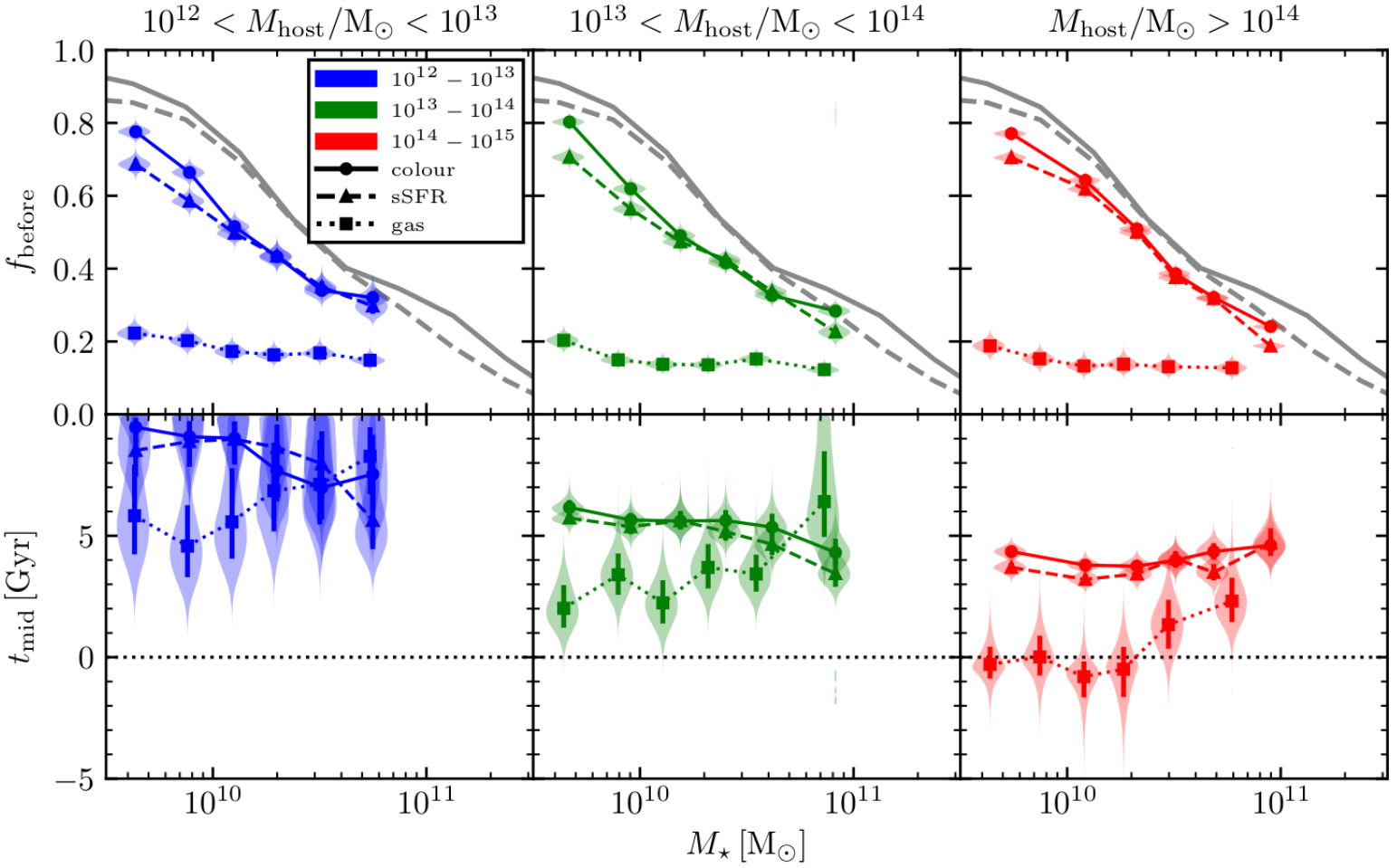


Model input visualised

- For each observed satellite candidate:
  - Radial offset R
  - Velocity offset V
  - One of:
    - (*g*-*r*) colour
    - SFR
    - HI detected?



Model constraints: SDSS + ALFALFA



Physical interpretation

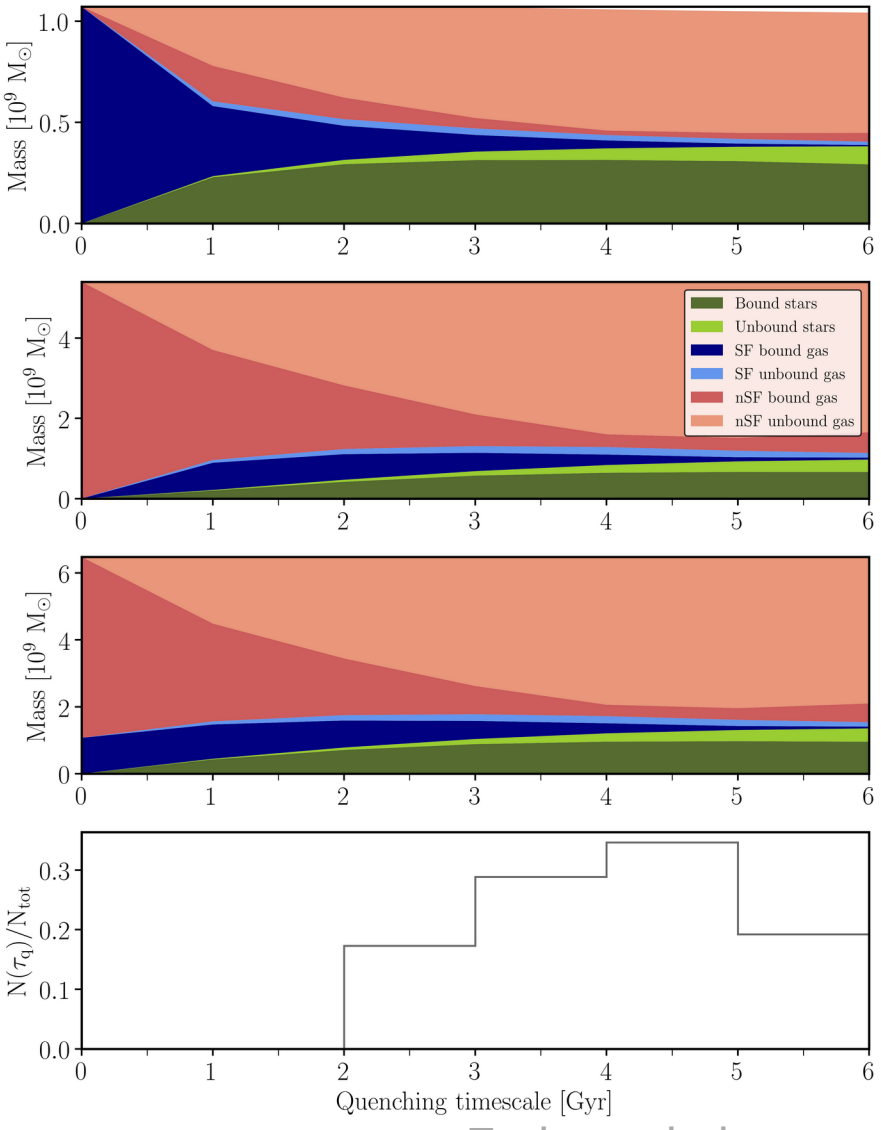
- Clusters:
  - Partial ram-pressure stripping of neutral gas on initial approach, enough to drop out of ALFALFA.
  - Remaining gas fuels star formation for ~3 Gyr after pericentre.
- Groups:
  - Quench some satellites, but most survive ~longer than the age of the Universe?
  - The typical group satellite has not had time to be quenched by its host.
  - Or perhaps the merging timescale < the quenching timescale.

Summary

- Clear detection of the sequence of environmental processing:
  - Gas stripped (non-detections from ALFALFA)
  - Star formation shuts off (Balmer lines disappear, reddening)
- Broadly consistent with the ‘delayed-then-rapid’ picture for quenching, but find longer timescales than most others.
- Contrast with contemporary simulations where quenching tends to be early, ~during the first passage, especially in clusters.

arXiv: 2009.00667

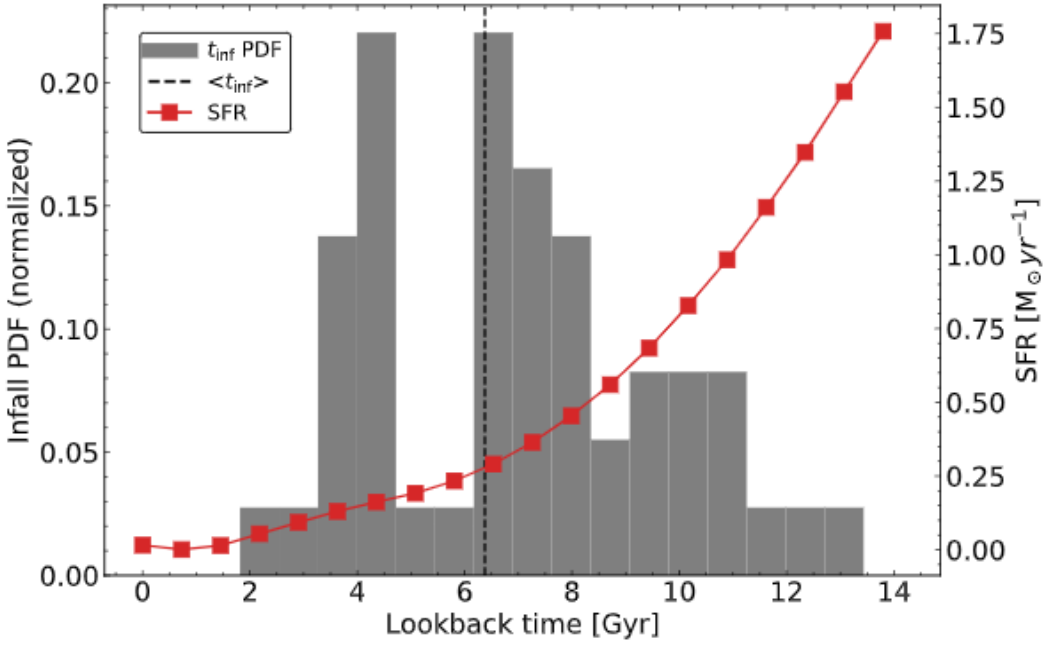
Physical origin of the quenching timescale

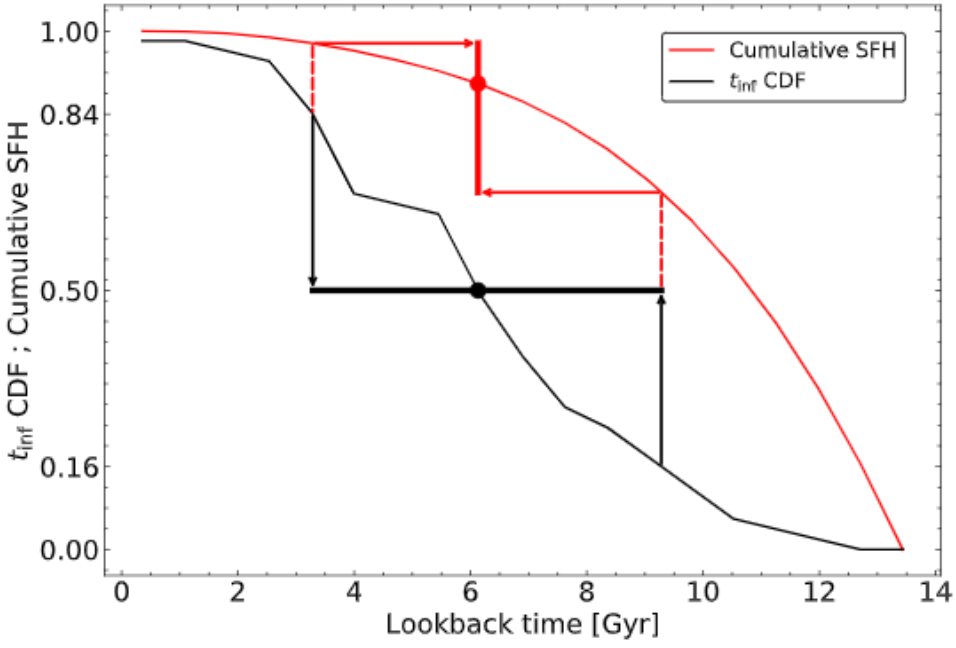


Zadvornyi+ in prep

The future: individual SFHs

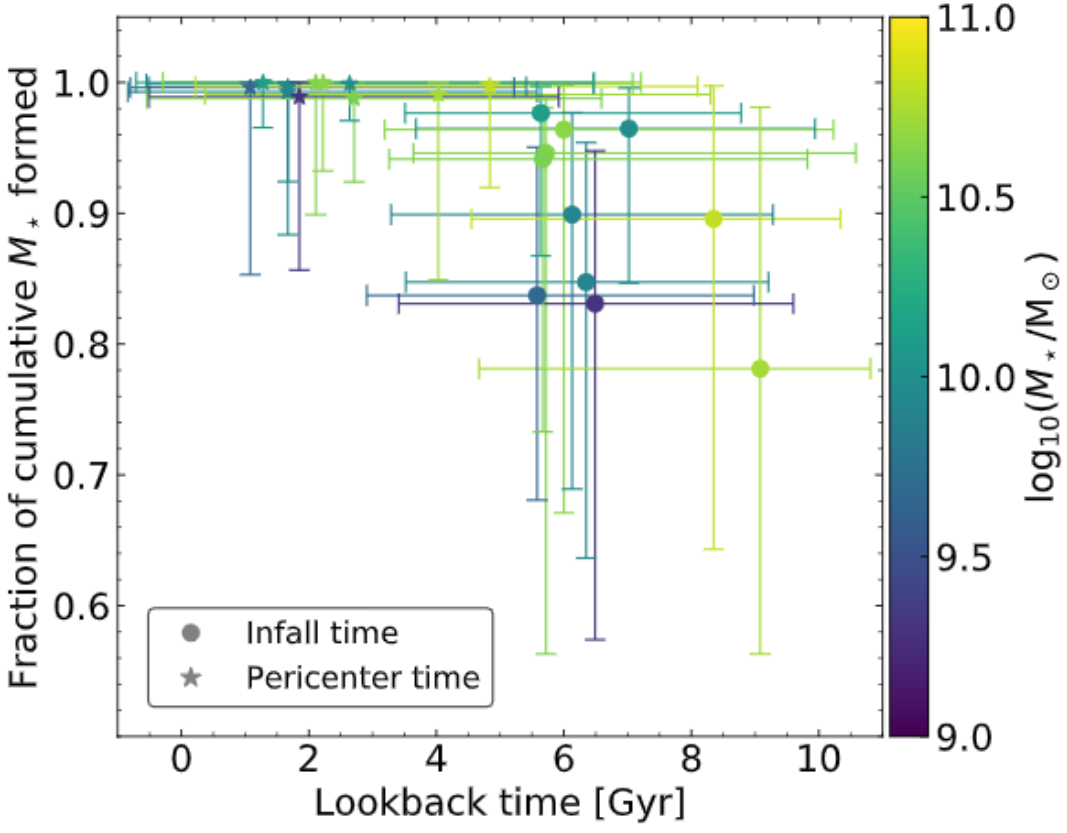
Coma satellite GMP 3254

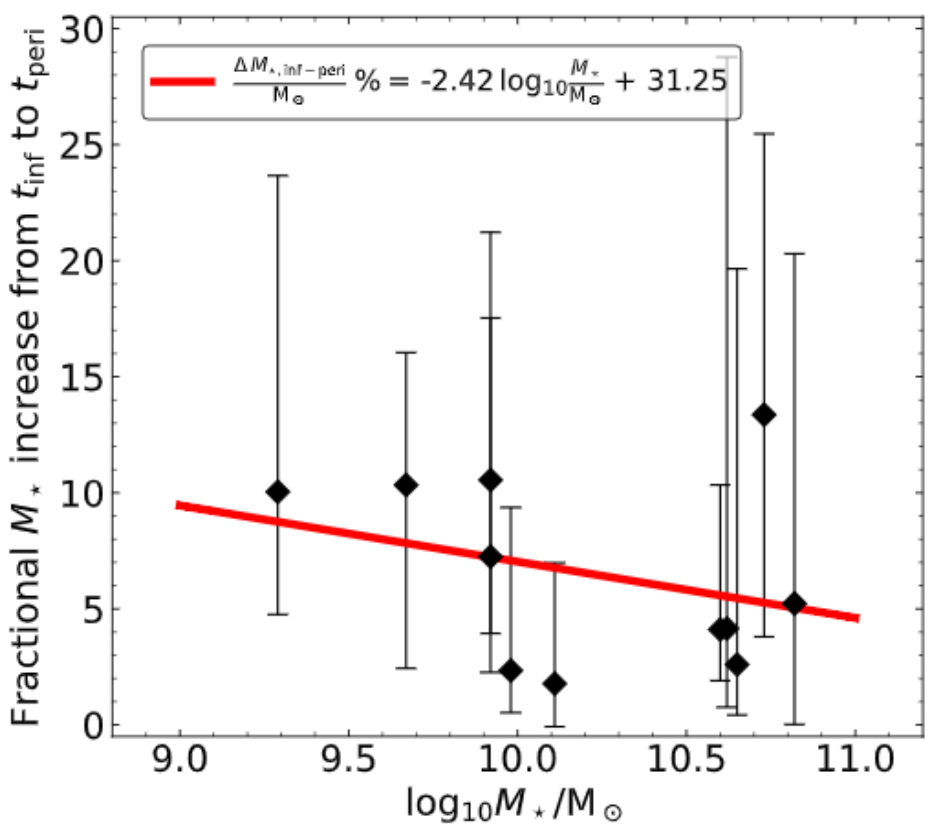




Upadhyay+ in prep

The future: individual SFHs





Upadhyay+ in prep