Galaxy Transformation at the Faint End of the Luminosity Function

a local perspective

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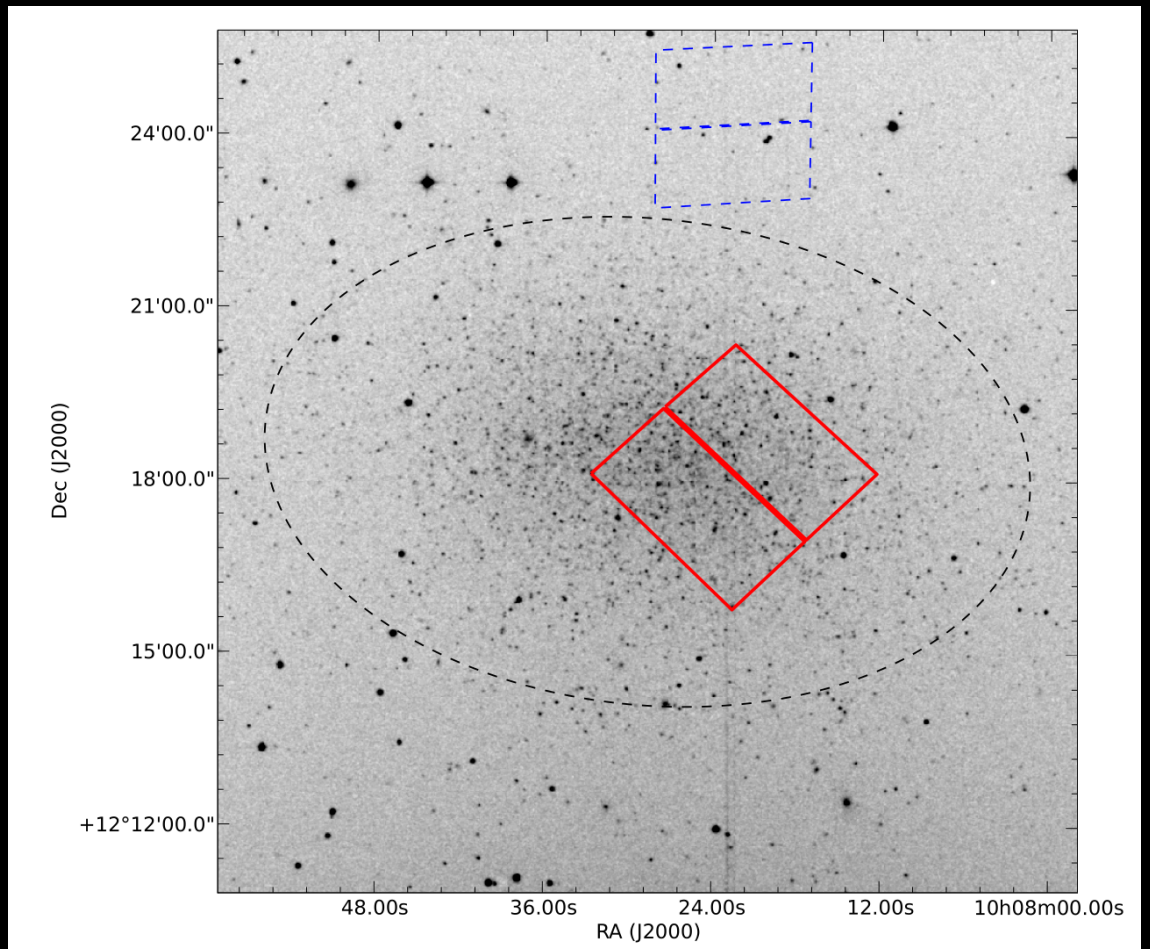
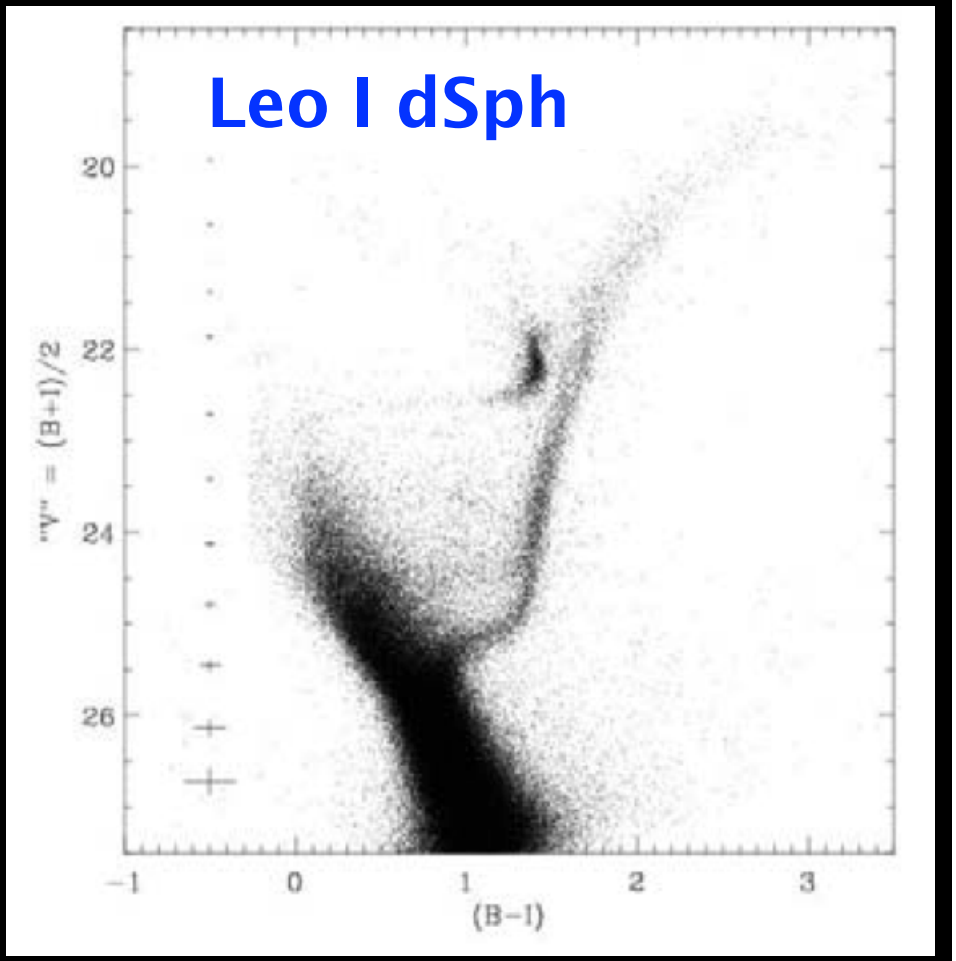
A mostly HST perspective

Dan Weisz, Michael Boylan-Kolchin, Julianne Dalcanton, Evan Skillman, Andy Dolphin, Cliff Johnson, Dustin Lang, Alan McConnachie, Ryan Leaman, Saundra Albers, et al…

CAASTRO - Changing Face of Galaxies - 2016/09/23

Why act locally?



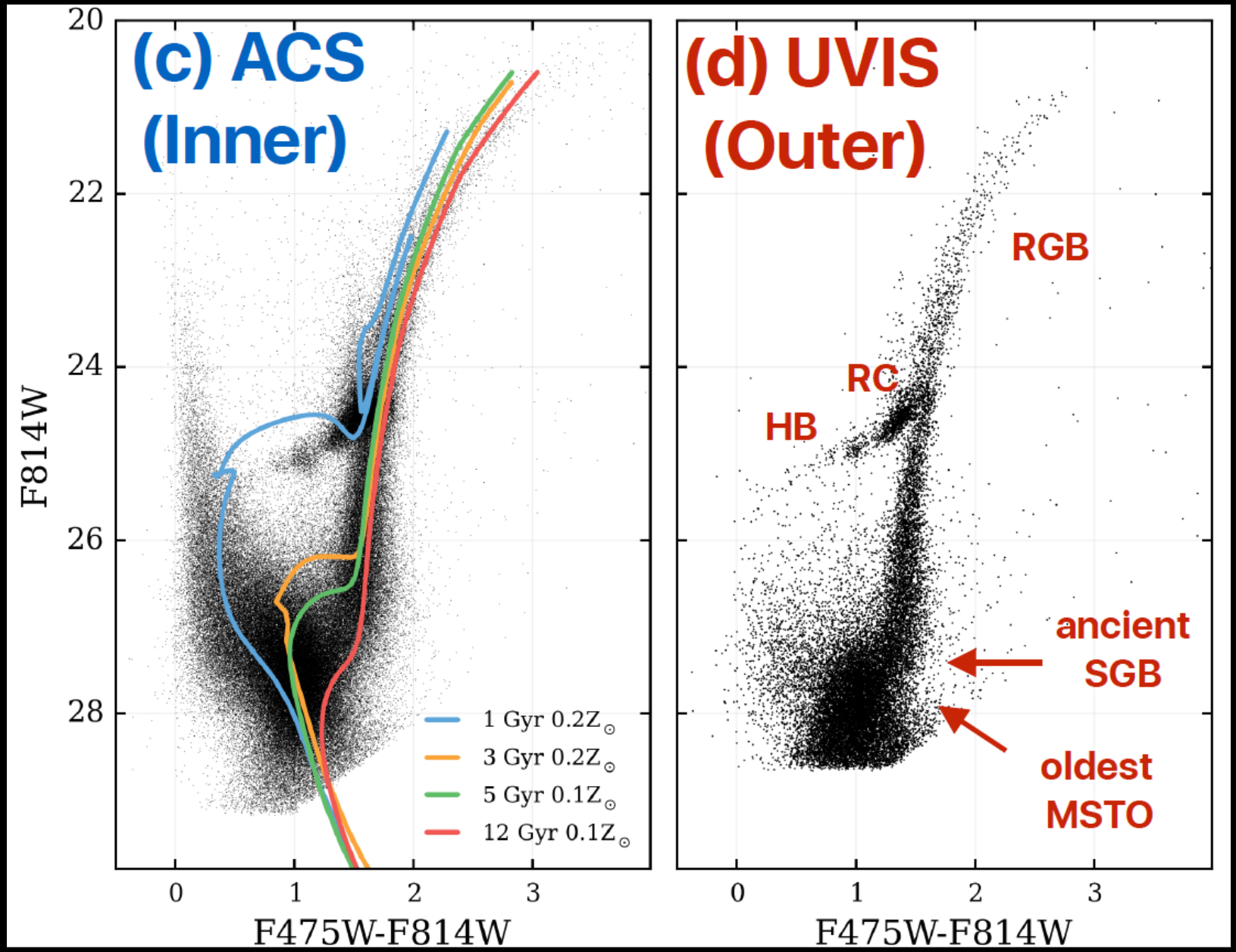


On the order of 100 Local Group galaxies with $10^3 \lesssim M_\star/M_\odot \lesssim 10^8$

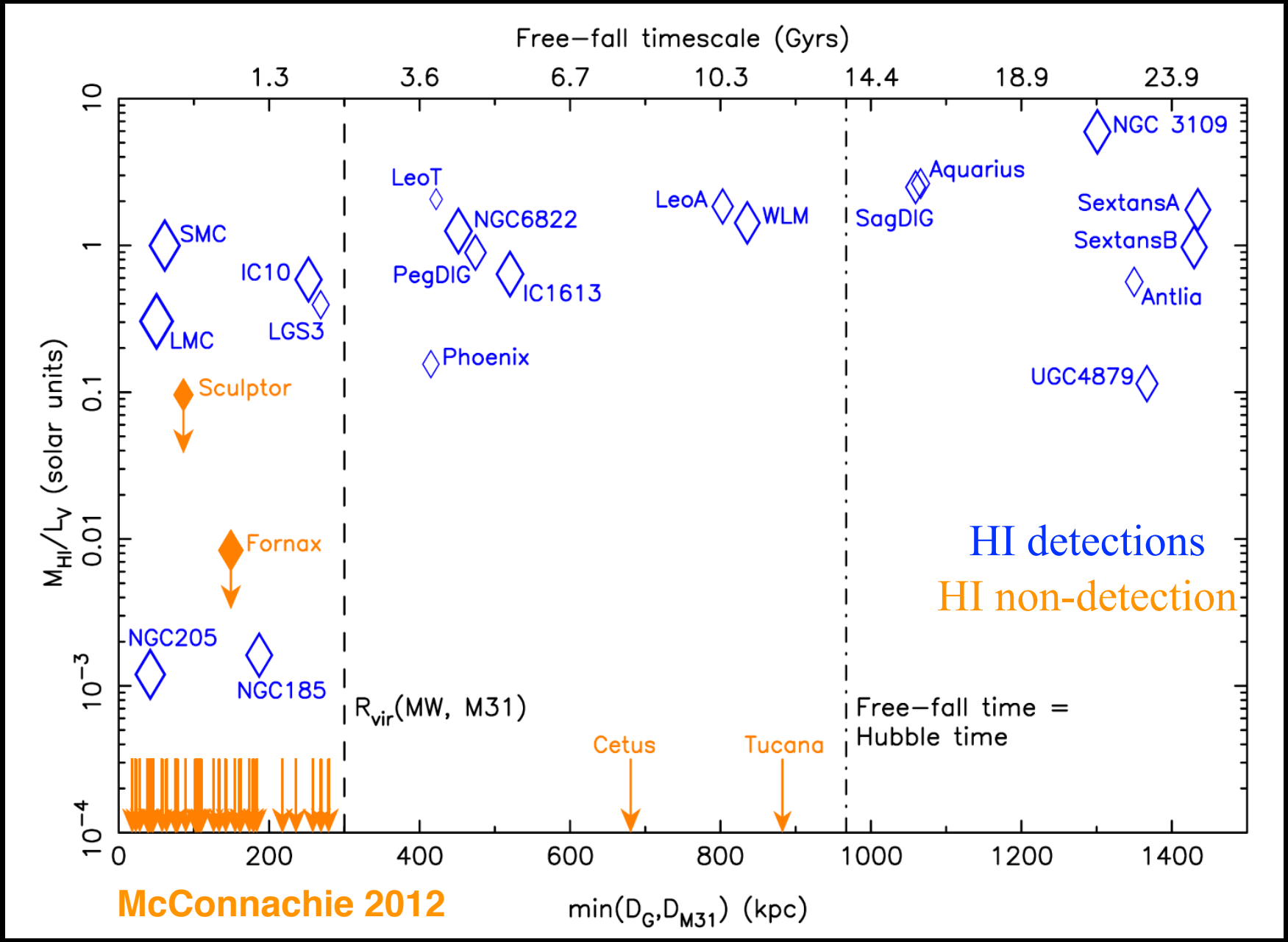
Lab for examining the guts of dwarfs as probes of galaxy evolution.

Proper motions! ➙ Orbit reconstruction, link SFH to interaction times

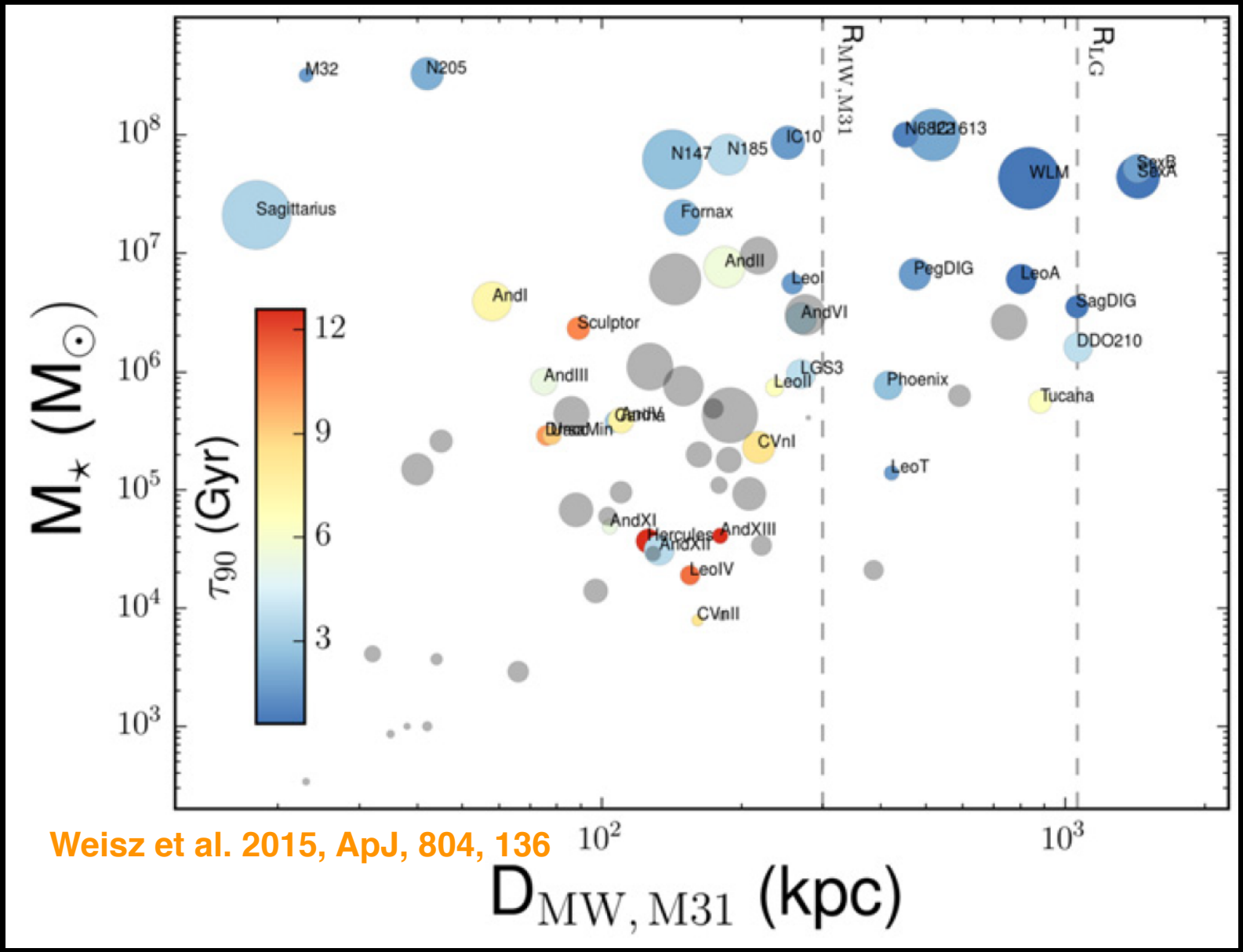
Pegasus dIrr (d = 0.90 Mpc)
Cole et al. in prep



Depth is essential; crowding is the enemy
Isochrones converge during red giant evolution
(nearly insensitive to age)



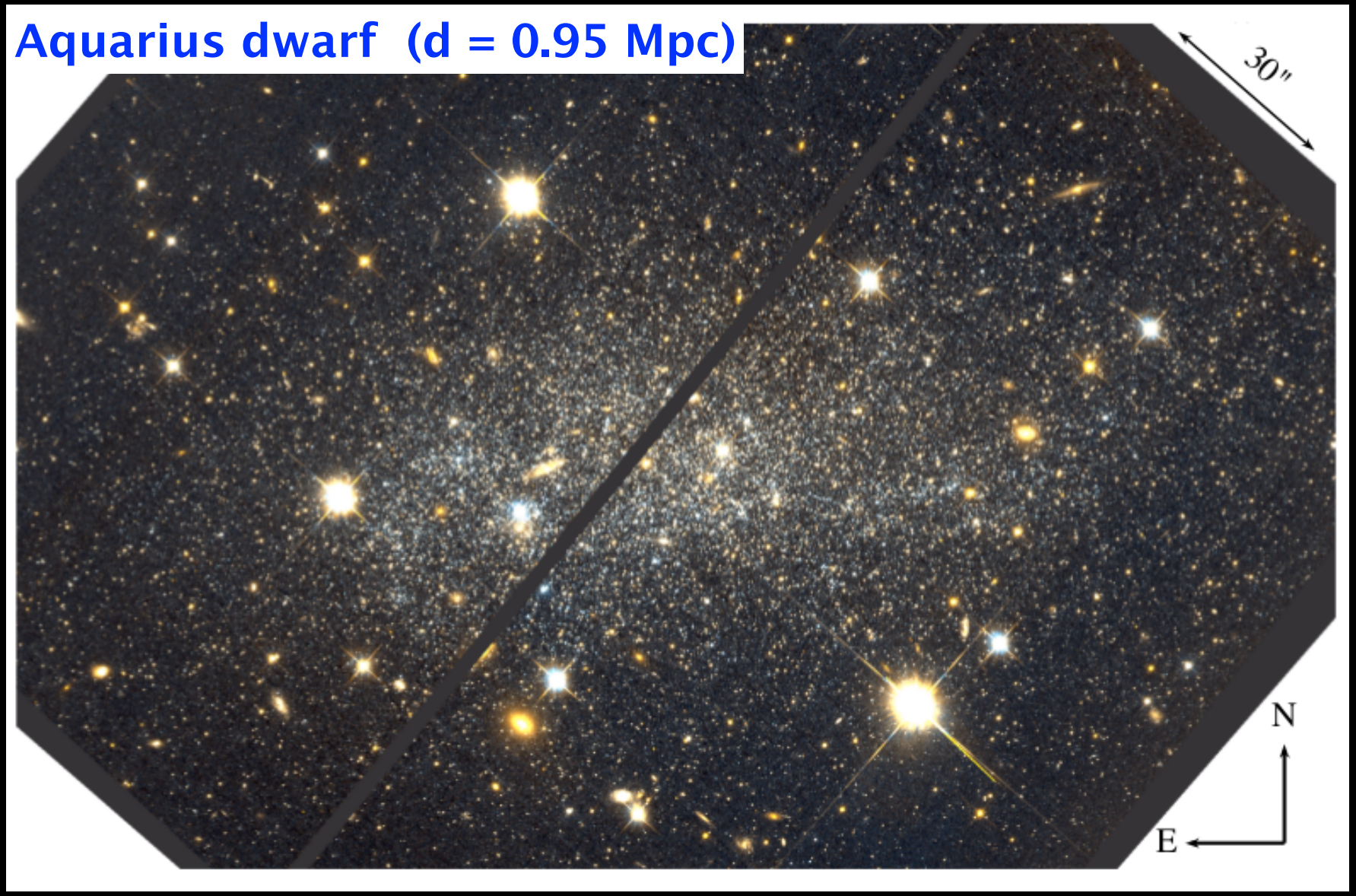
Density-morphology relation in the Local Group



Weisz et al. 2015, ApJ, 804, 136

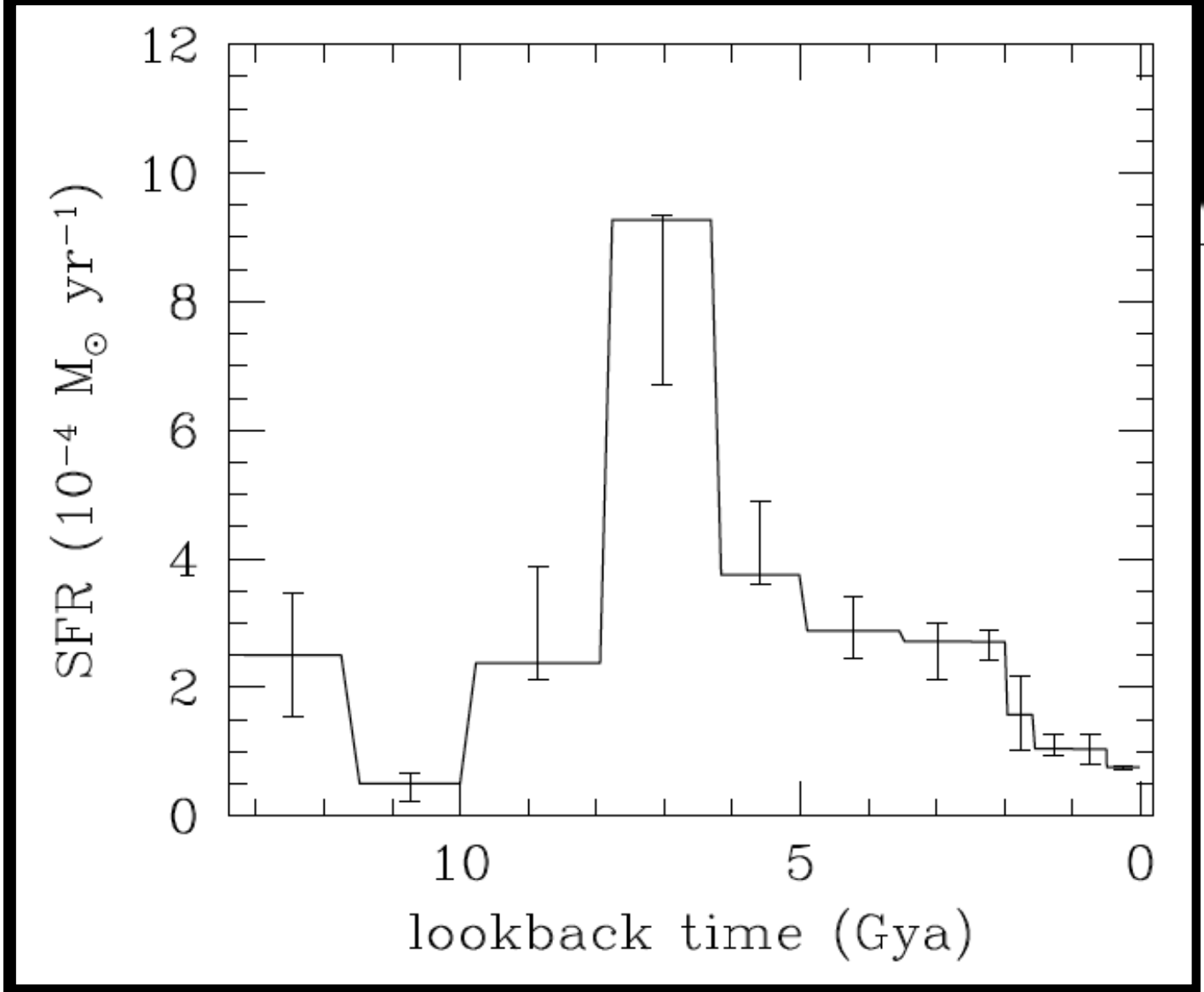
- Low (stellar) mass galaxies quench earlier than high-mass
- Quenched galaxies tend to be satellites
- Possible difference in mean quenching time between MW and M31 satellites (? - TBD)

What about the isolated dwarfs?



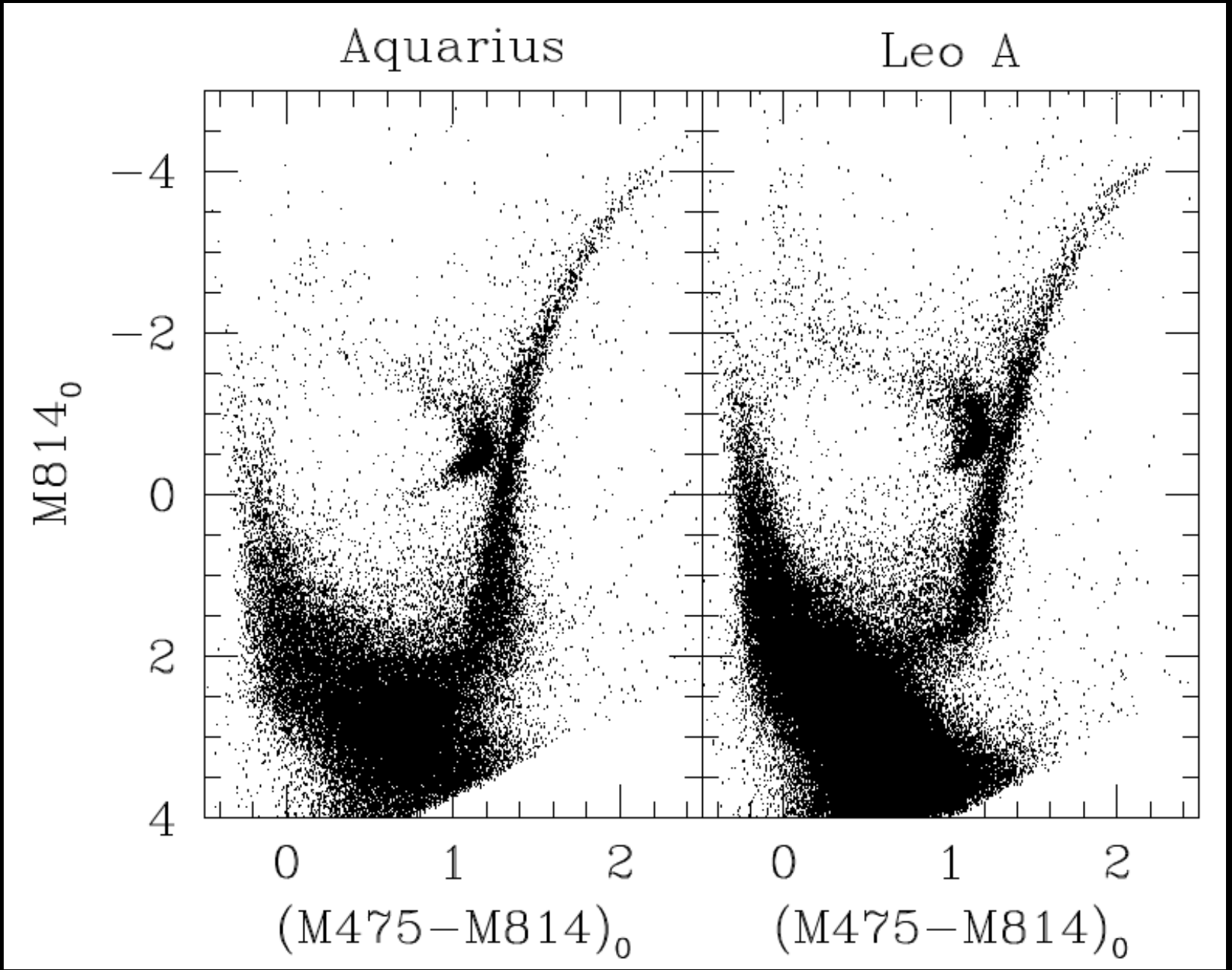
"transition type" galaxy: HI but no Hα, $10^{6.5}$ $M_\odot$ in stars

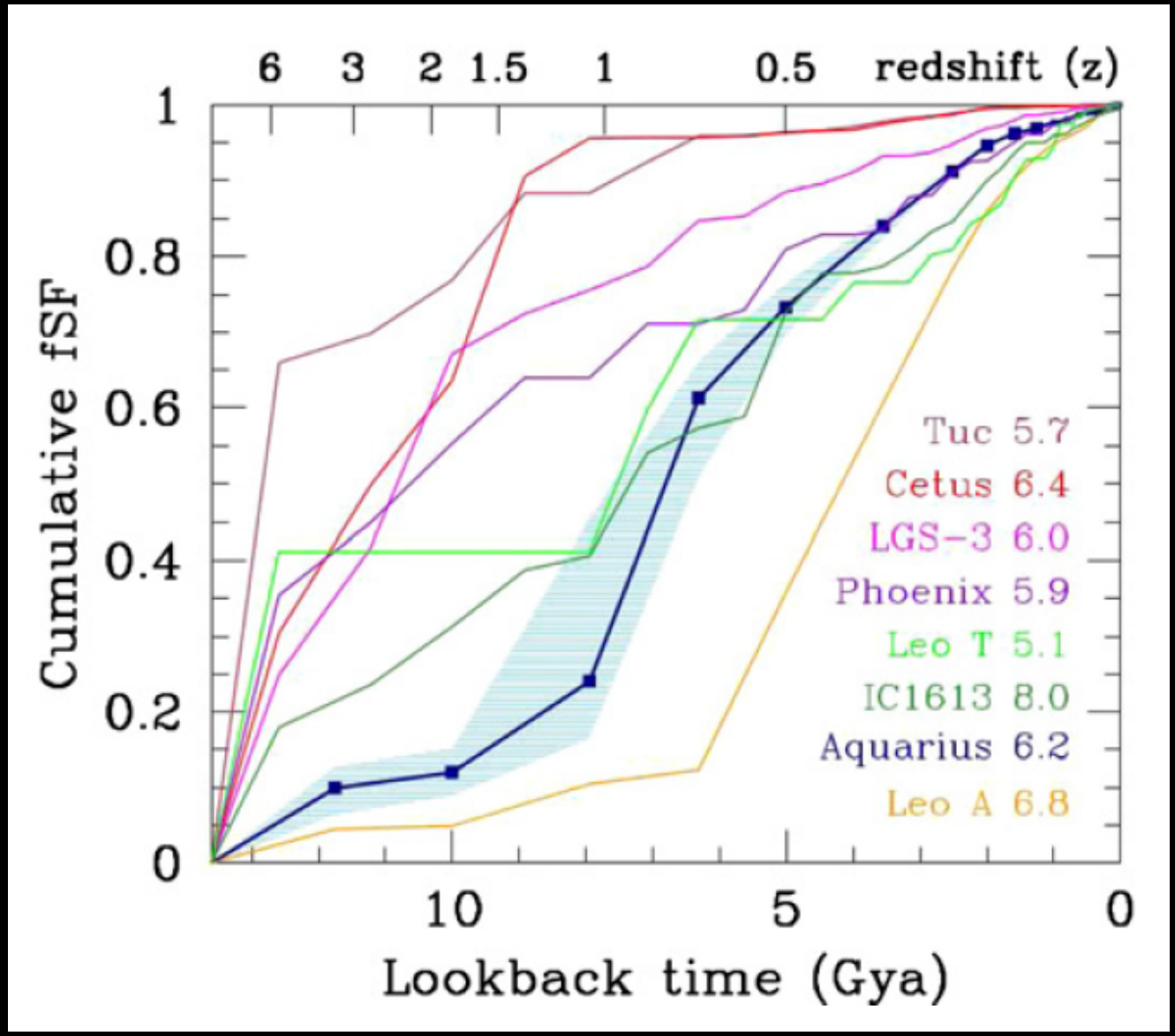
Cole et al. 2014, ApJ, 795, 54



Cole et al. 2014, ApJ, 795, 54

Delayed SF in isolated dwarfs





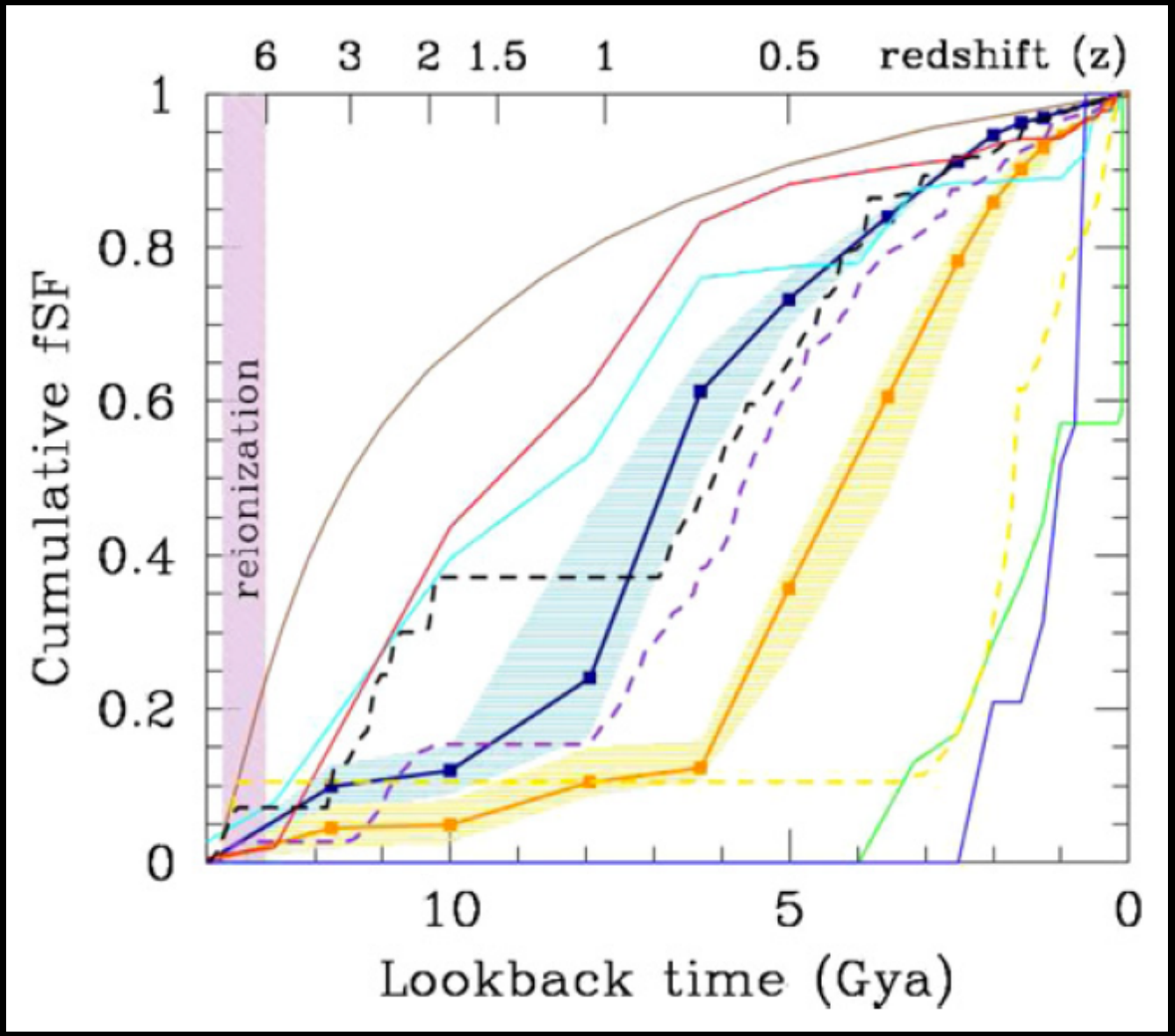
The two most isolated galaxies with CMDs of sufficient quality are also the two "youngest".

Among the other galaxies, if there is a trend in stellar mass, it's not super-obvious — stochasticity.

SFH Data:

- blue: Aquarius
- gold: Leo A

- smooth curve: Fakhouri et al. (2010) mean CDM assembly history
- solid lines: Shen et al. (2014)
- dashed lines: Brooks & Zolotov (2014)



Simple models fail to predict the SFH of isolated dwarfs.
Realistic models are getting closer!

- Local Group galaxies can be a powerful probe of galaxy evolution with 10% age resolution across a Hubble time and direct measurement of chemical evolution (+ orbits!)

- The majority of known LG galaxies don't have deep enough CMDs to fully exploit this capability (esp. M31 satellites, isolateds).

- Among well-measured galaxies, low-mass dwarfs [statistically] quench earlier than high-mass dwarfs, and quenched dwarfs tend to be preferentially found within the virial radius of MW/M31.

- Work in progress: Do M31 and MW satellites have systematically different star formation histories?
  How common is late blooming among the isolated systems?
  Does the time of first major SF event in "isolateds" correlate with first infall to the LG virial radius?