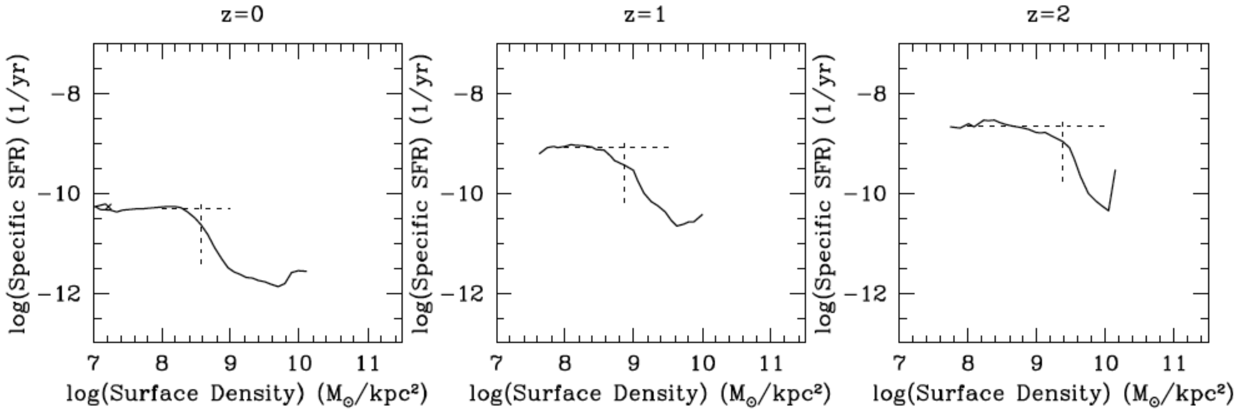
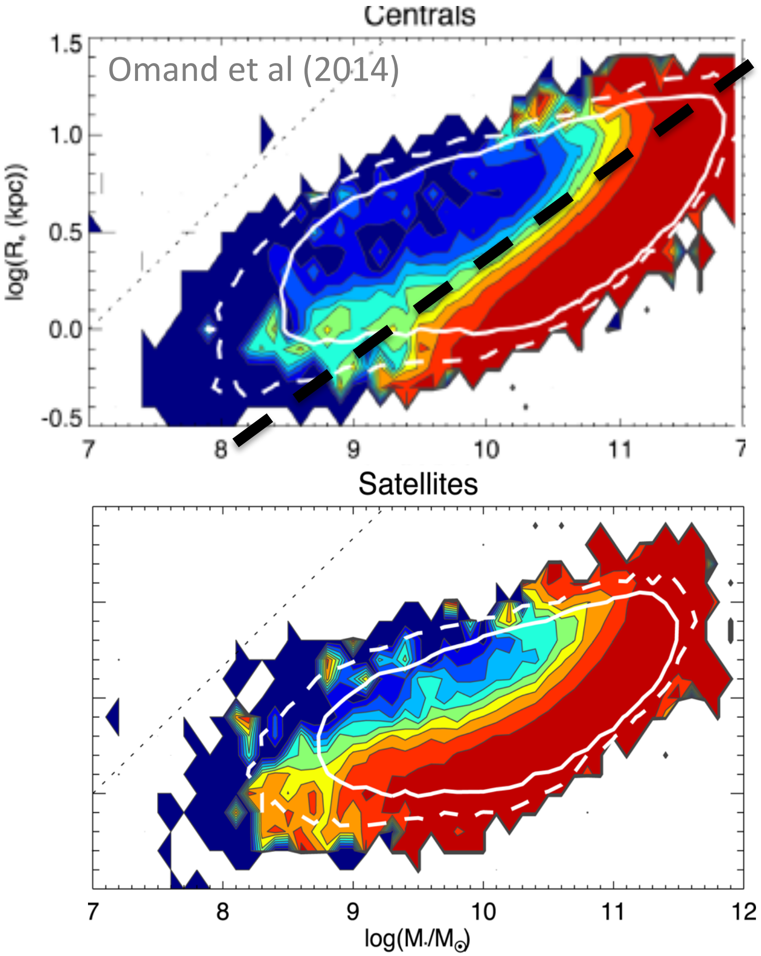


Franx et al 2008

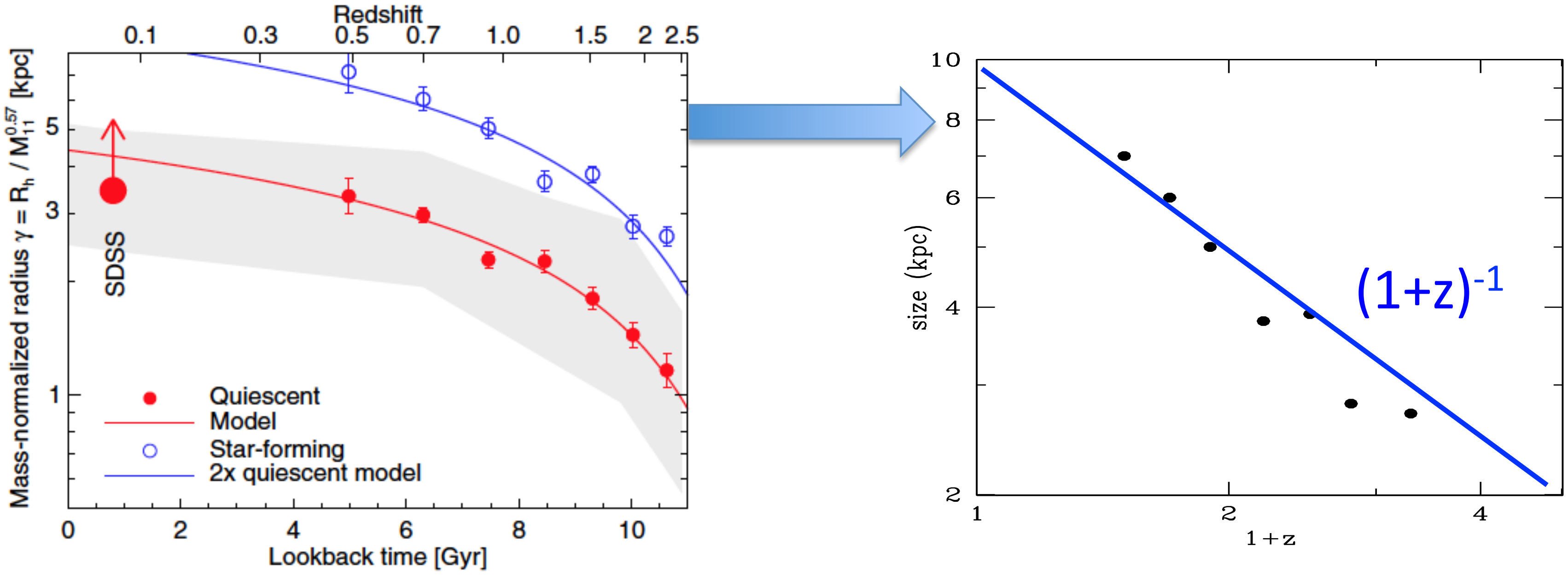


constant $\Sigma = mR_e^{-2}$

Apparent importance of stellar density in quenching

But we know that the surface densities of star-forming galaxies were higher in past because they are smaller at a given mass.

Sizes of star-forming “disks” at a given mass scale roughly as $(1+z)^{-1}$



e.g. Newman et al 20012 (@ M = 10^{11} M_O)

- At a given stellar mass, the size of star-forming galaxies scales roughly as $(1+z)^{-1}$
- This <u>requires</u> inside out growth (individual galaxies smaller in the past) and an overall link between epoch and stellar density

A simple toy model (see Lilly & Carollo 2015)

Main Sequence sSFR $$sSFR_{MS} = 0.07\left(\frac{m}{3\times10^{10}}\right)(1+z)^2 \ \ \mathrm{Gyr}^{-1}$$

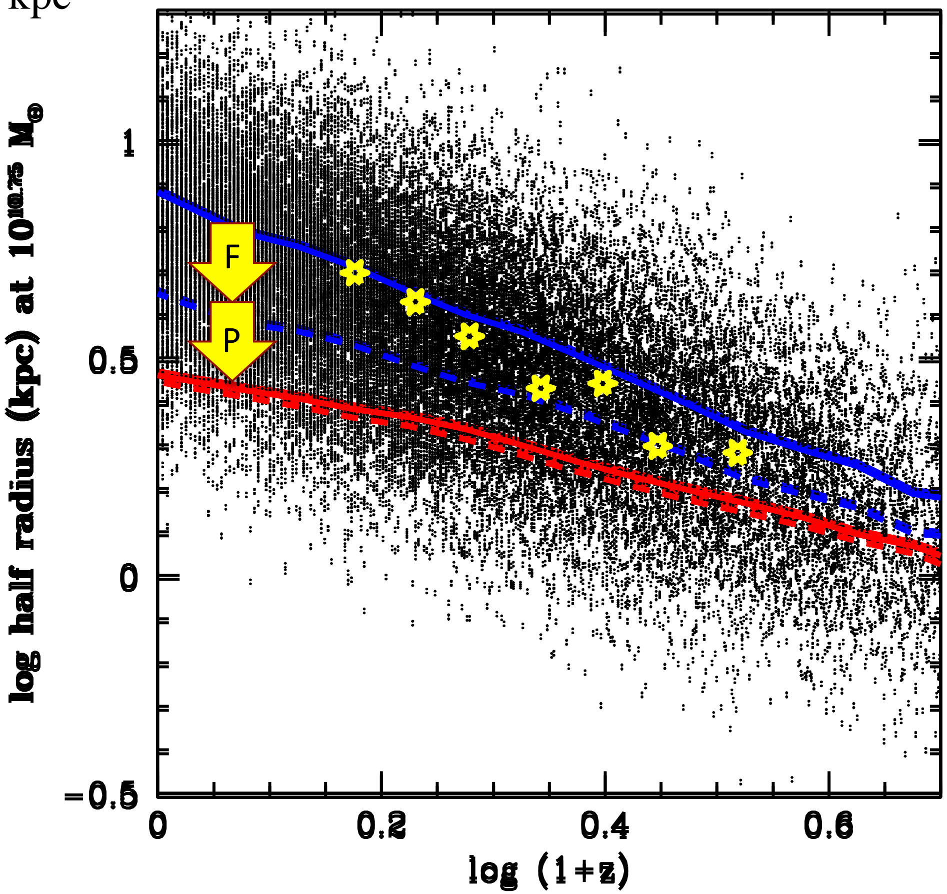
Sizes of disks $$h_{SF} = 5\left(\frac{m}{3\times10^{10}}\right)^{1/3}(1+z)^{-1} \ \mathrm{kpc}$$

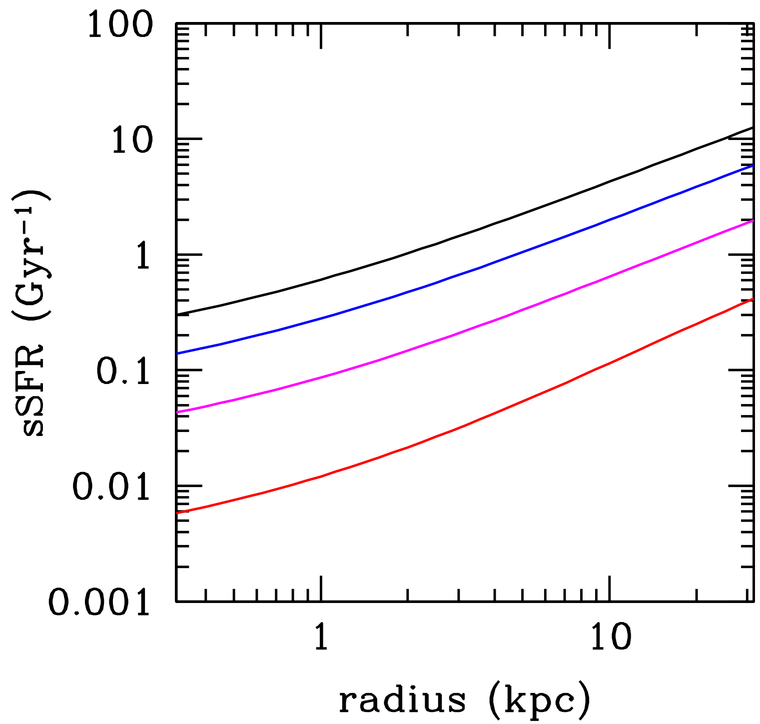
Peng et al mass-dependent quenching

$$Pdm = \frac{dm}{M^*}$$

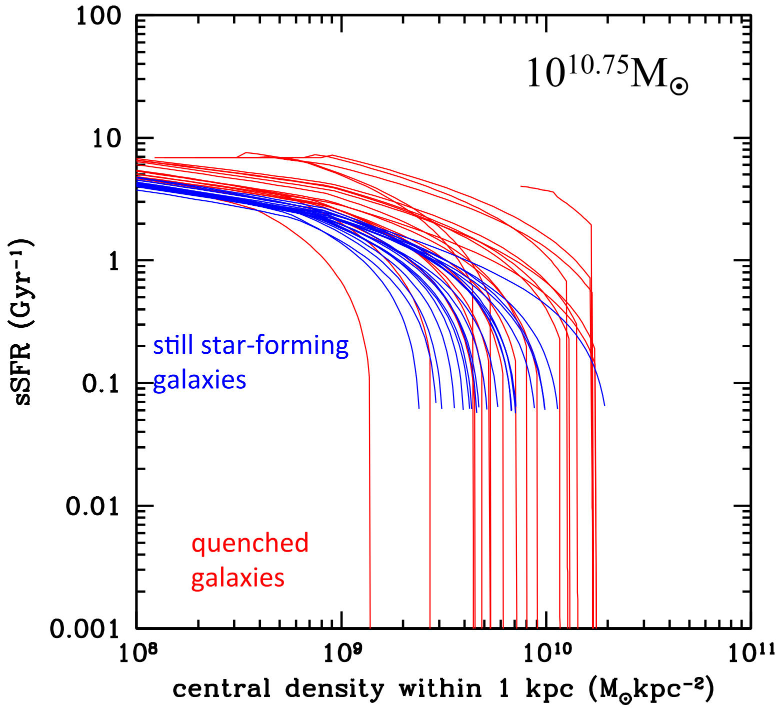
$$P_{sat}dm = \varepsilon_{sat}\frac{dm}{m}(1+z)^{-1}$$

Output: Passive galaxies are typically factor of two smaller than star-forming ones.
Due to both fading of disks (F) and "progenitor bias" (P)



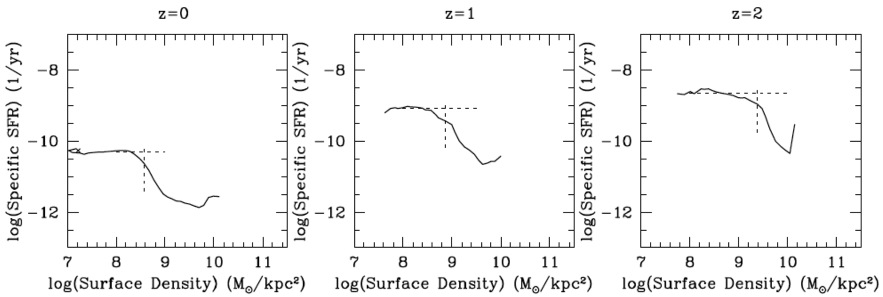


sSFR gradients within galaxies (nothing to do with inside out quenching)

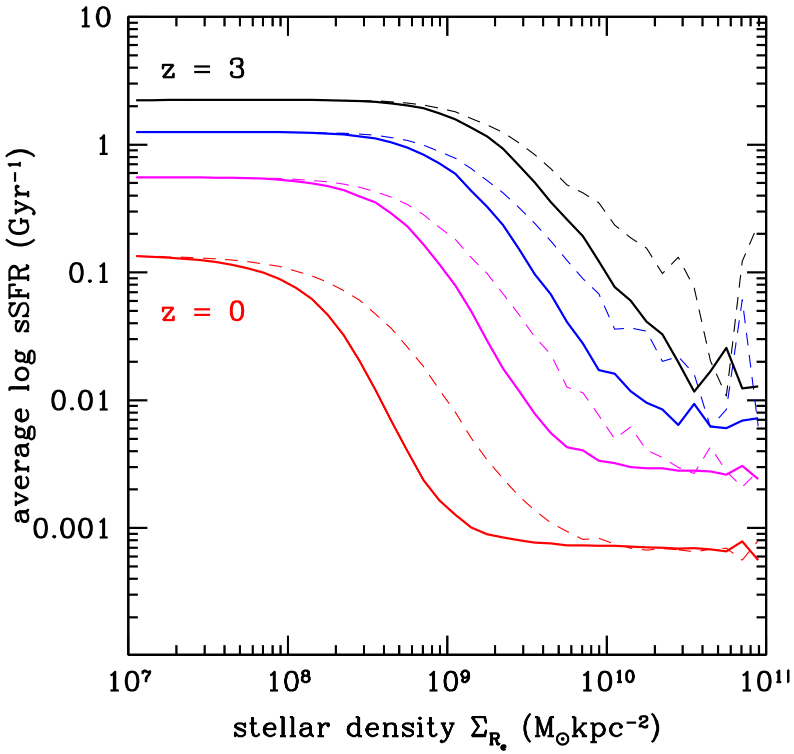


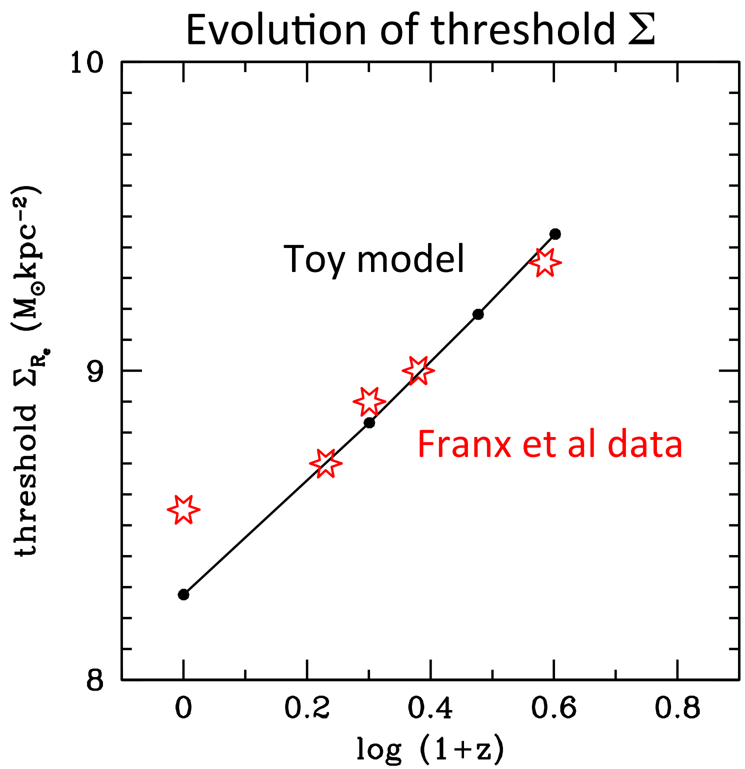
Histories of representative galaxies: Note the apparent characteristic quenching density of $\Sigma_{1kpc} \sim 10^{10} M_\odot kpc^{-2}$

The quenching stellar density thresholds follow from size evolution…

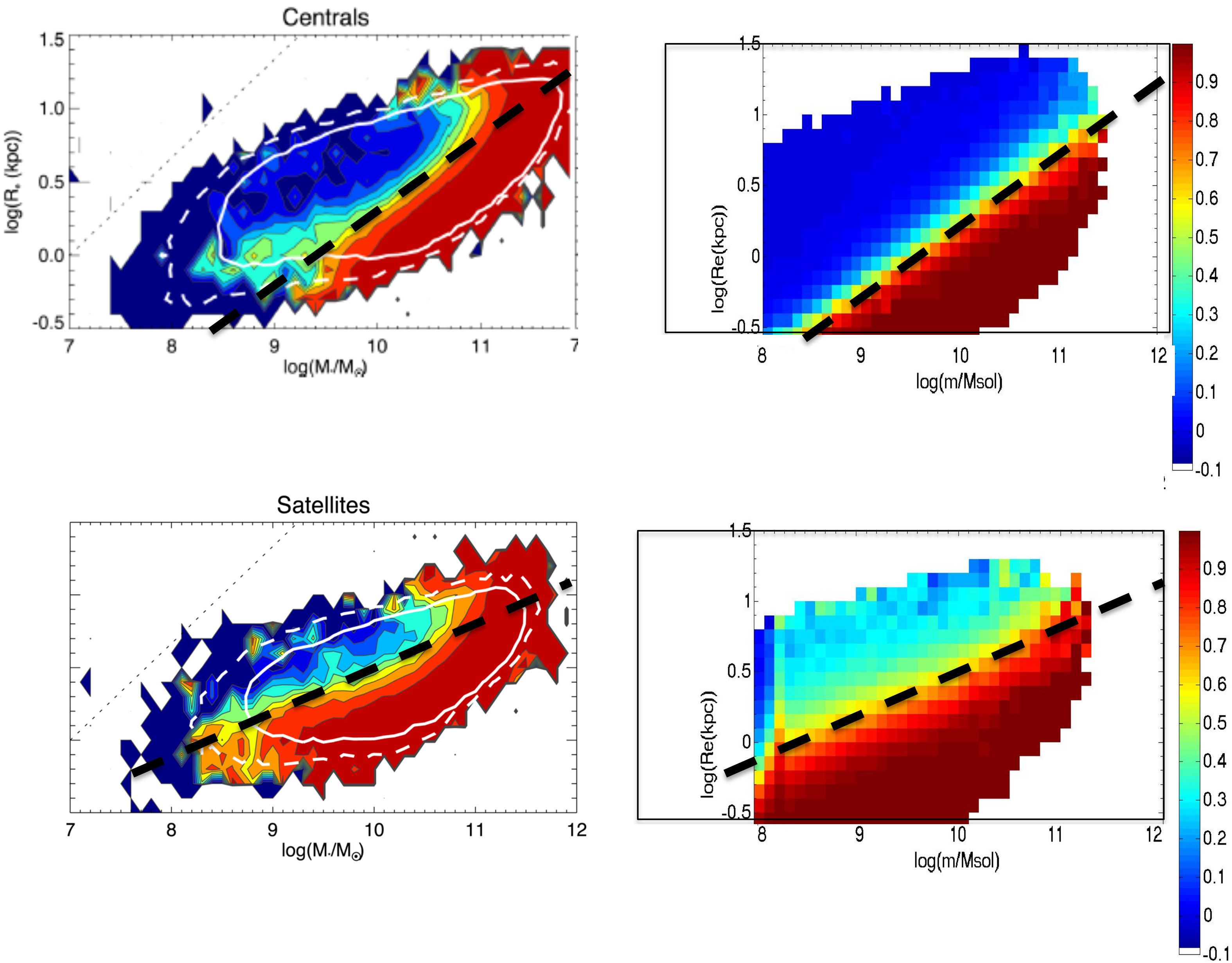


Franx et al (2008)





… and the apparent role of stellar density arises naturally



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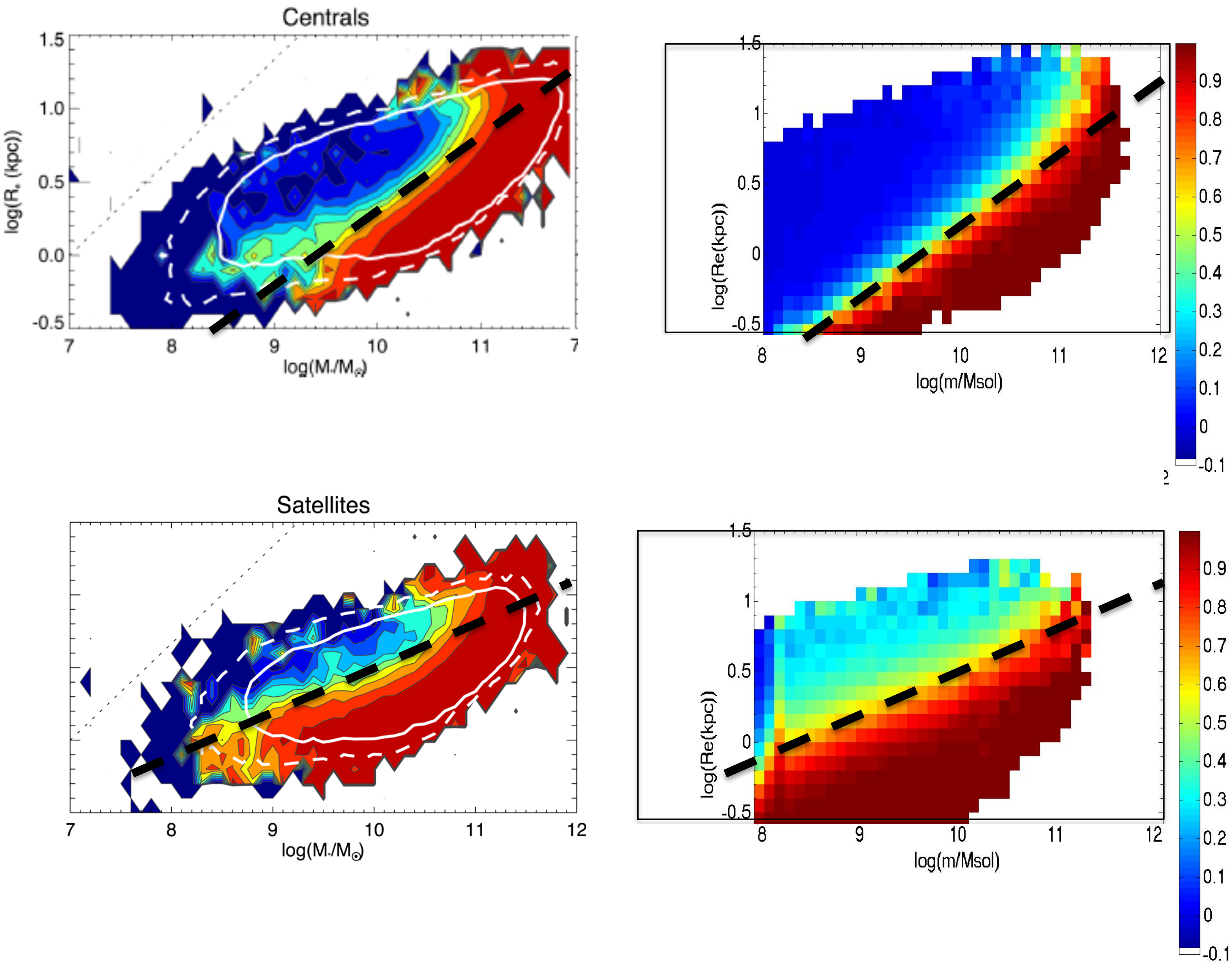

With a very naïve effect of mergers on quenched galaxies: Δm = +0.2 dex, ΔR_e = +0.2 dex