The Dirt on Dry Mergers

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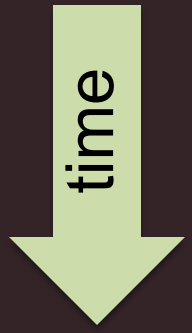
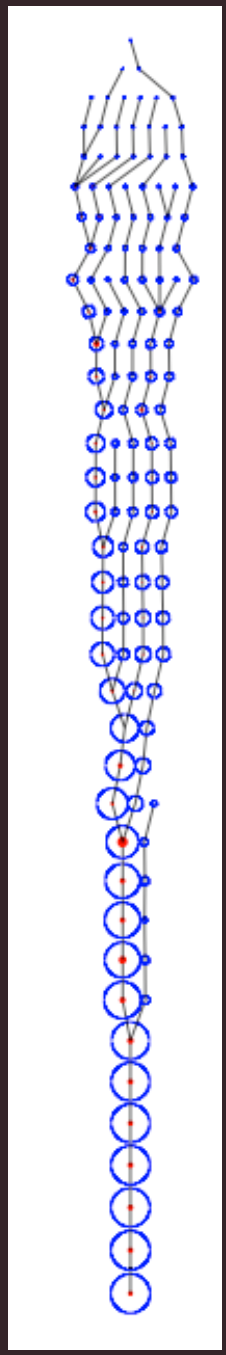
How and when did elliptical galaxies form?

Naive Expectation:
Most massive galaxies form last, and should be young.

Reality:
Most massive galaxies have old stellar populations.

Solution:
Form stars early, assemble them late in dry mergers.





Wechsler et al. 2002

Do dry mergers really happen?

Surely we can find examples somewhere in 9 square degrees.

Bootes field

van Dokkum et al. 2005

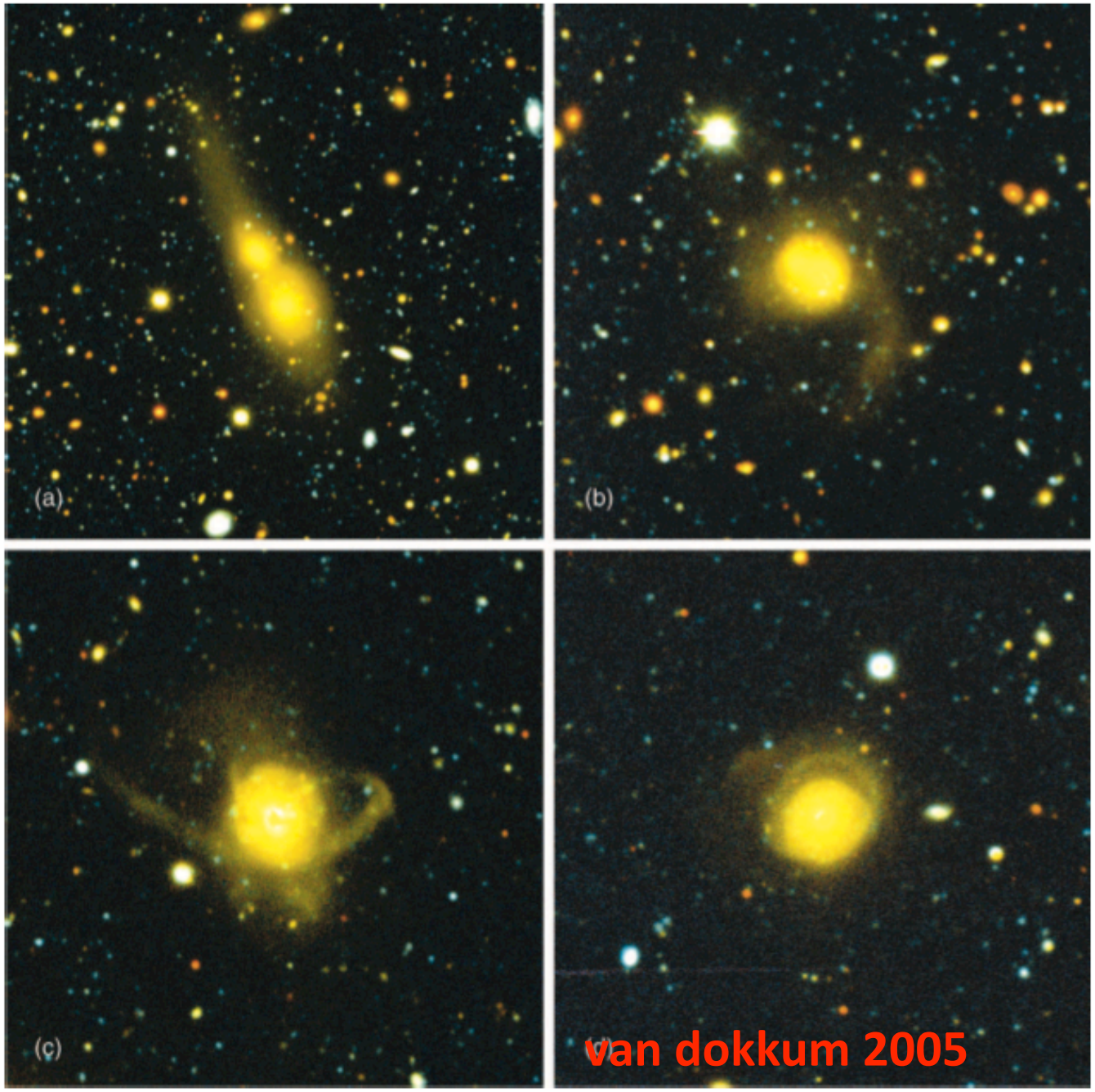
NDWFS+MUSYC

Red, luminous, early-type, nearby

61 Dry merger Candidates

25 Control Galaxies

Dry Merger Candidates



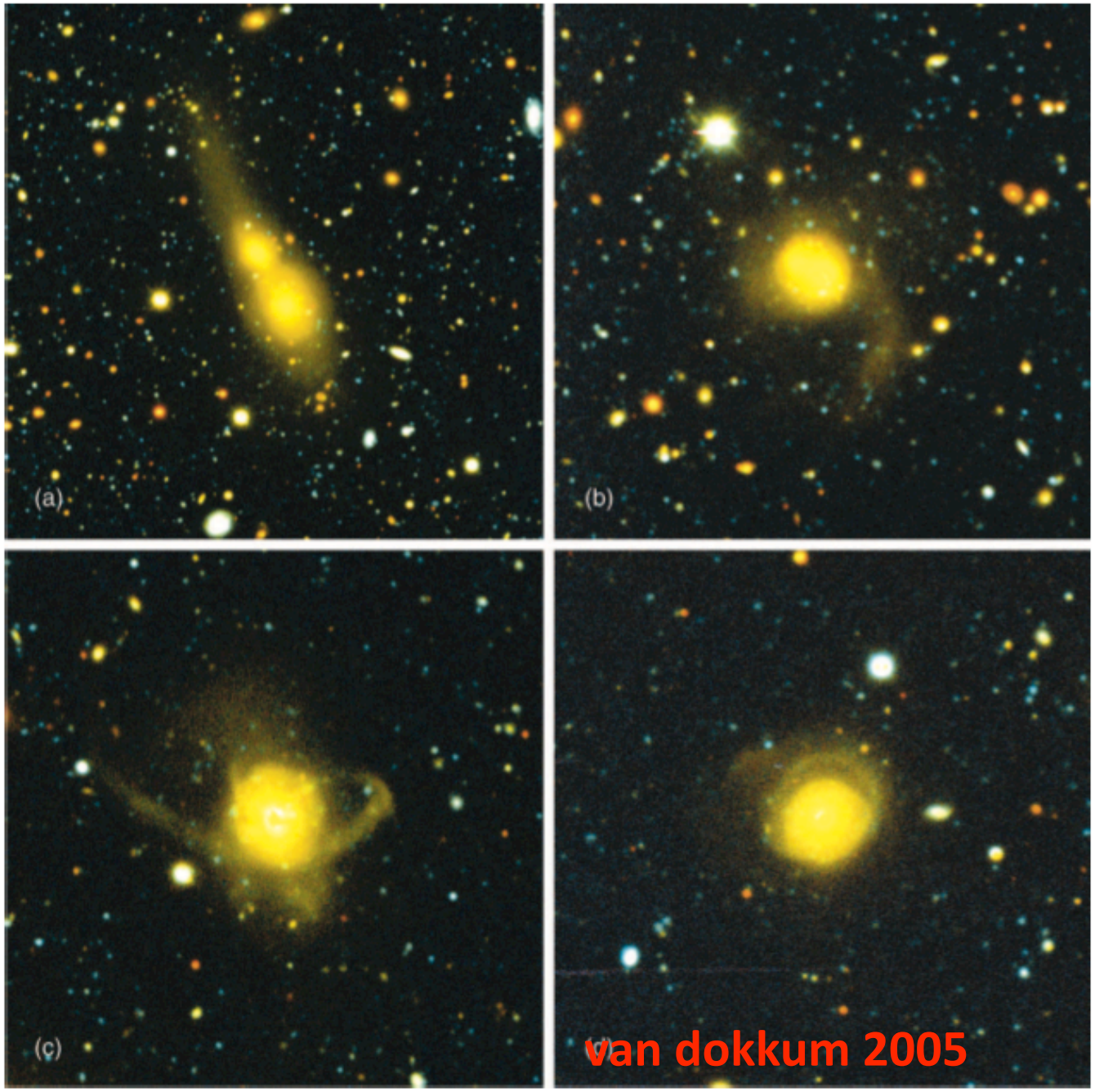
van dokkum 2005

van dokkum et al. 2005

71% of early-type galaxies are morphologically disturbed

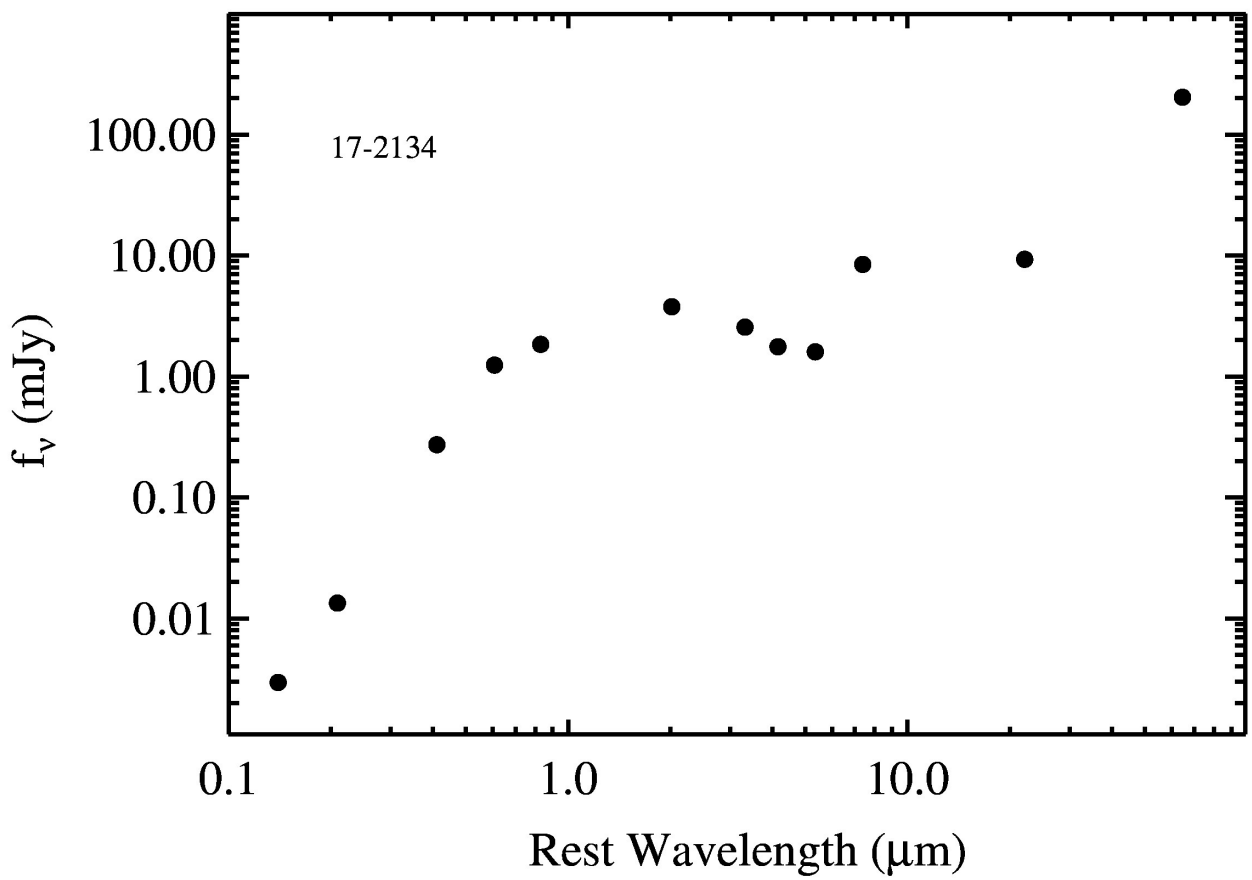
Most of today's field ellipticals formed via (major) dry merger.

Are they really dry?

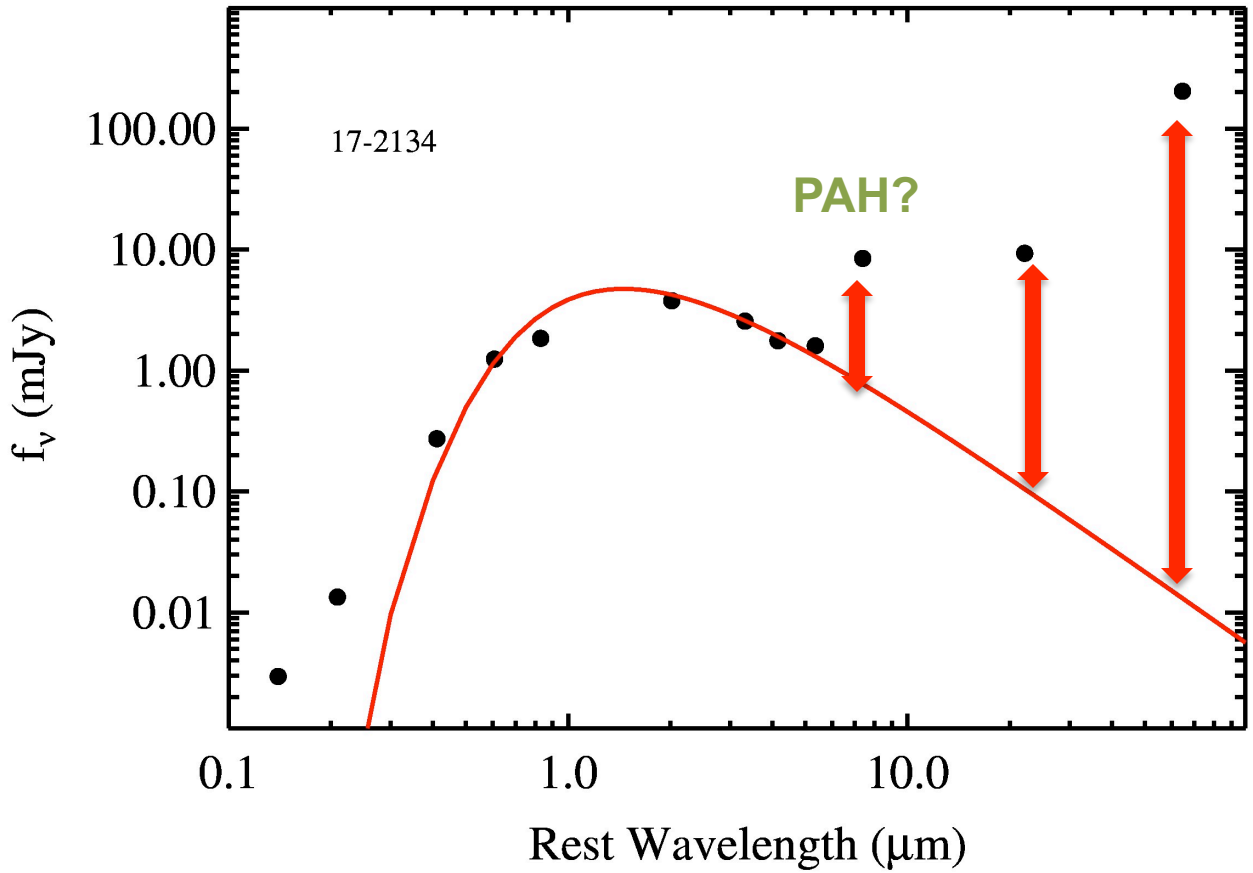


van dokkum 2005

Look in the Infrared

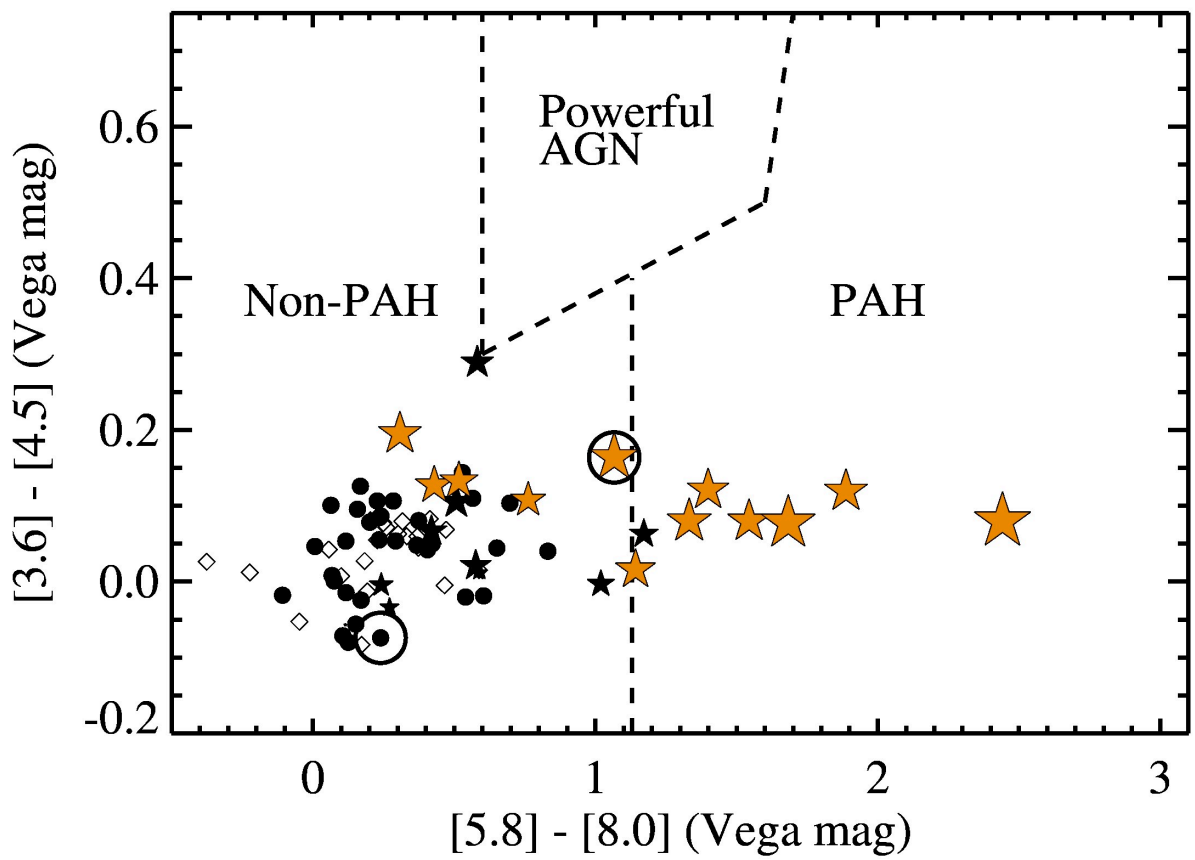


Look in the Infrared



Significant Infrared excess over stellar blackbody.

Spitzer-8 indicates heating by star formation!



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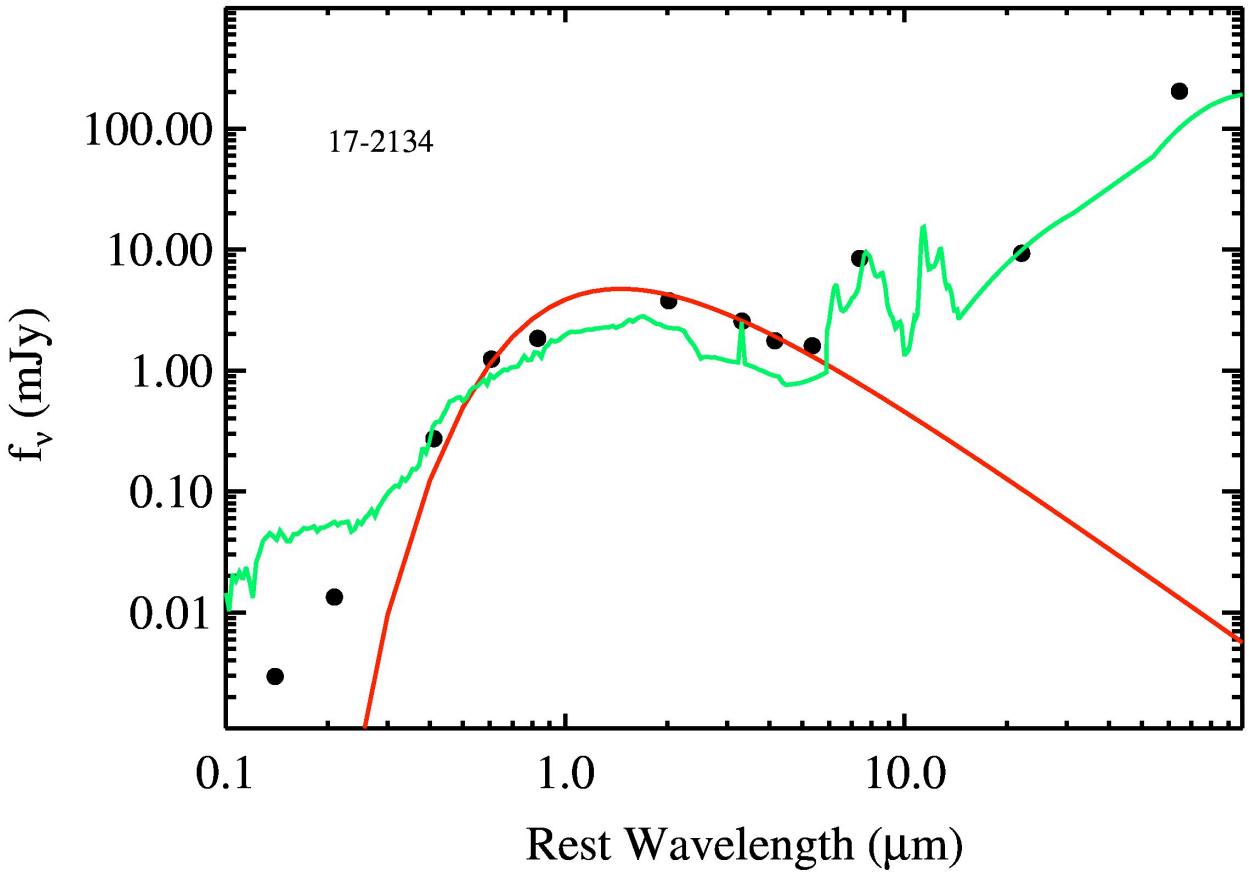
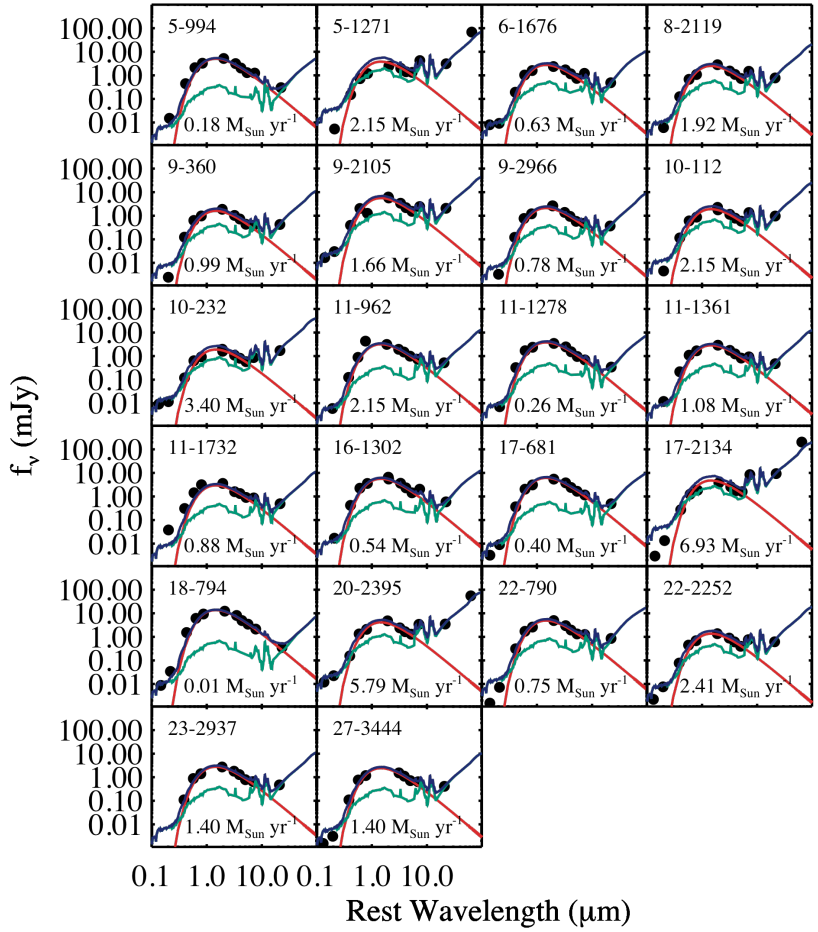
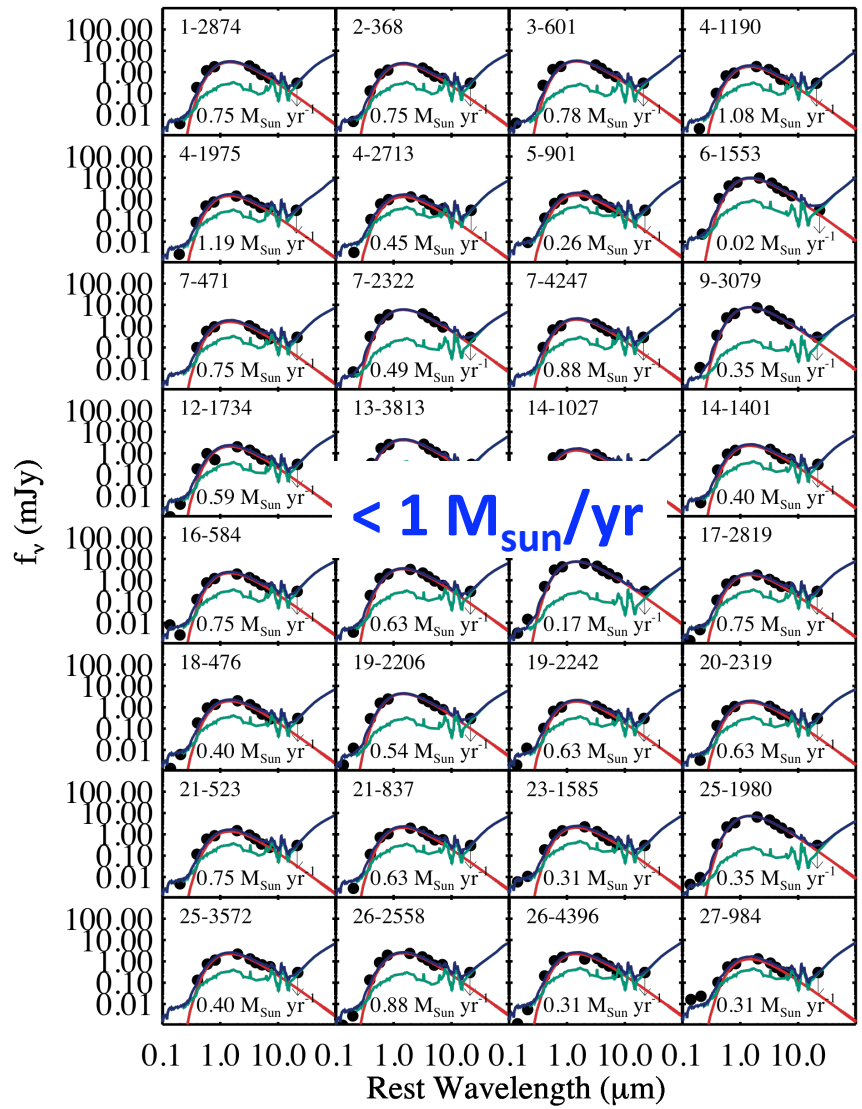


Chary & Elbaz 2001

Excess can be (mostly) accounted for by star formation.

The NDWFS Bootes Sample

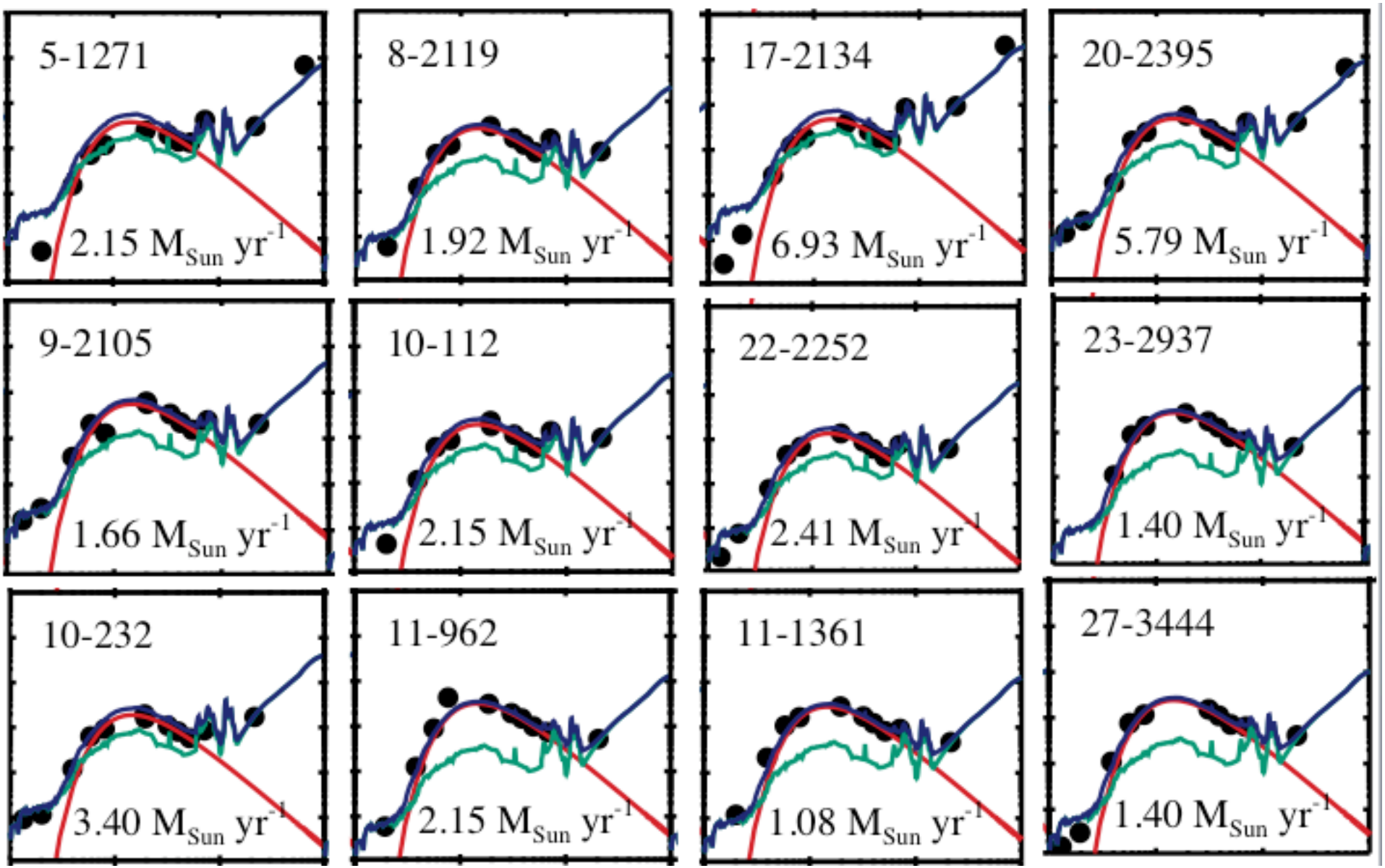




Spitzer MIPS-24 detected

undetected

Spitzer-24 reveals residual star formation in ~25% of sample.



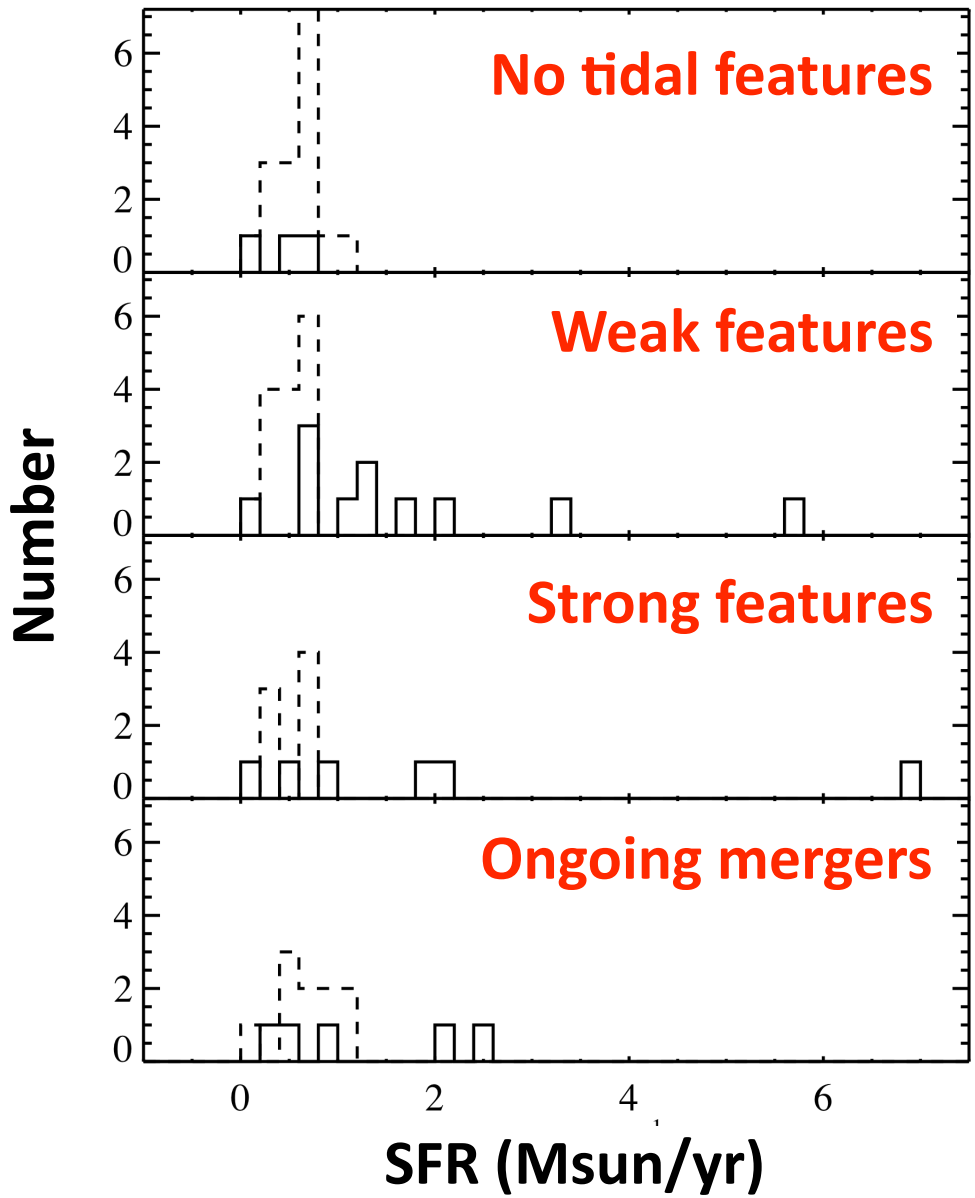
Dare we infer gas masses?

After extrapolating, etc:

Gass mass~10^8 M_{sun}

Moist major merger or accretion of dwarf galaxy?

This star formation frosting is likely triggered by mergers.



Summary

1. One quarter of dry merger candidates have enough gas to fuel SFR > 1 M_{sun}/yr.
2. This corresponds to residual star formation on top of a massive old stellar population.
3. Dry mergers or minor mergers?
4. This residual star formation is linked to signatures of merger activity.