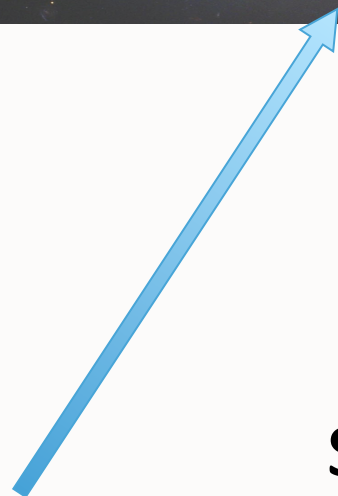




Building the red sequence through gas-rich major mergers at $z \sim 0.5-2$



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★ What process(es) are responsible for turning blue disks into red spheroids?

- Gas-rich mergers
- Secular

★ Why post-starburst galaxies might be interesting

- Only exist following a massive starburst
- Such massive starbursts most plausibly triggered by gas rich mergers
- They are heading for the red sequence

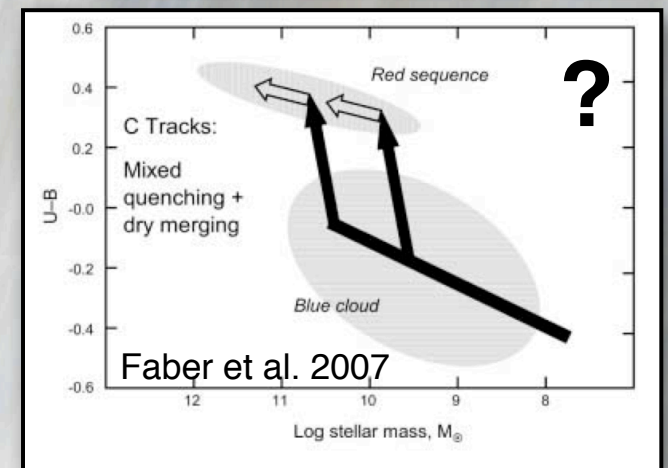
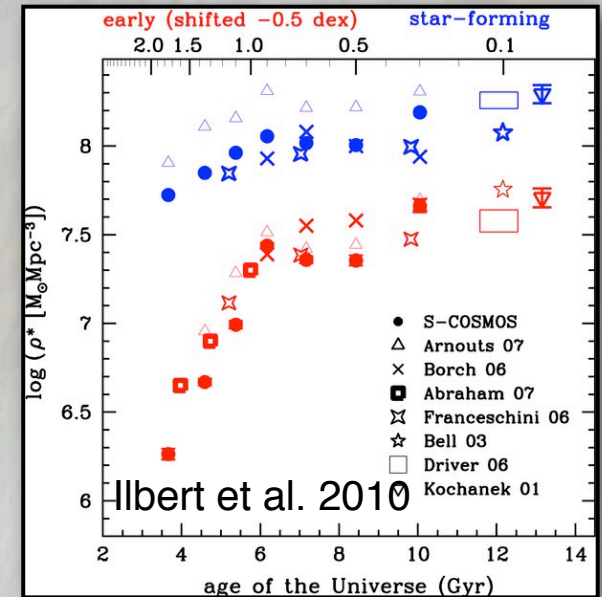
★ Finding post-starbursts at $z \sim 0.7$

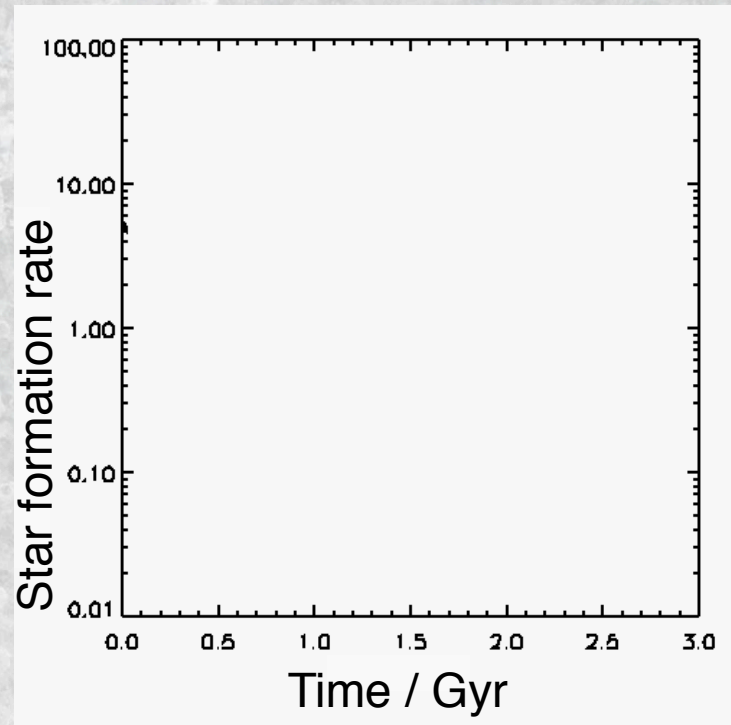
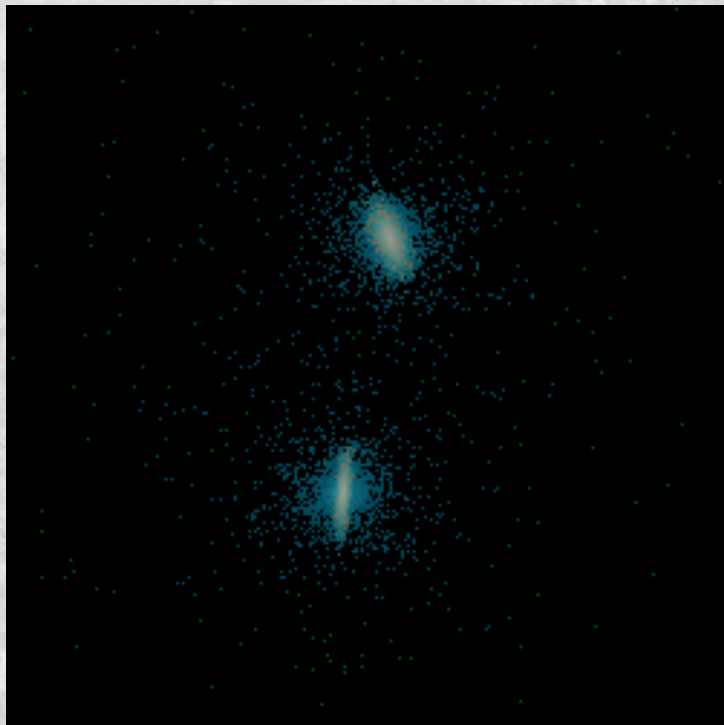
★ Finding post-starbursts at $z > 1$

- A new method to characterise the shapes of galaxy SEDs

★ Quantifying their global impact

★ A brief look at their morphologies

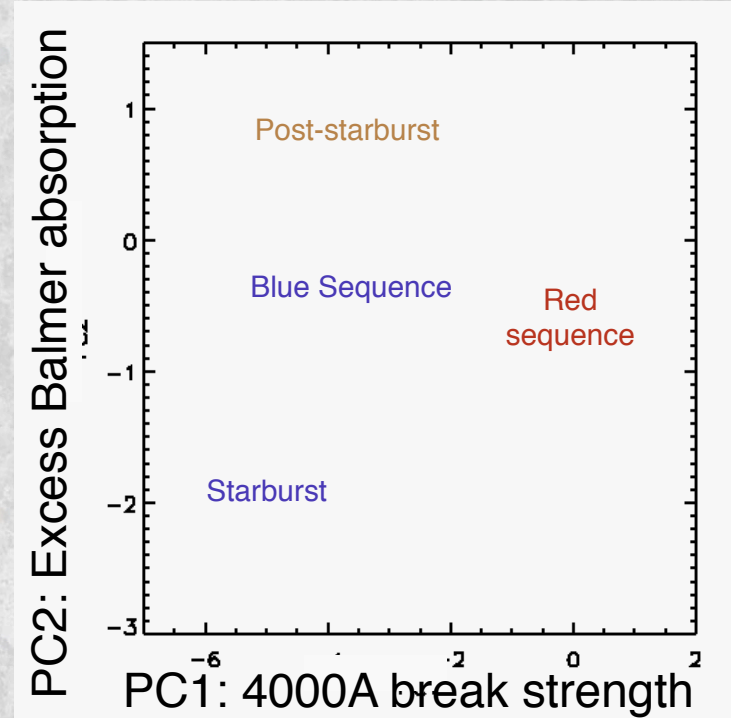
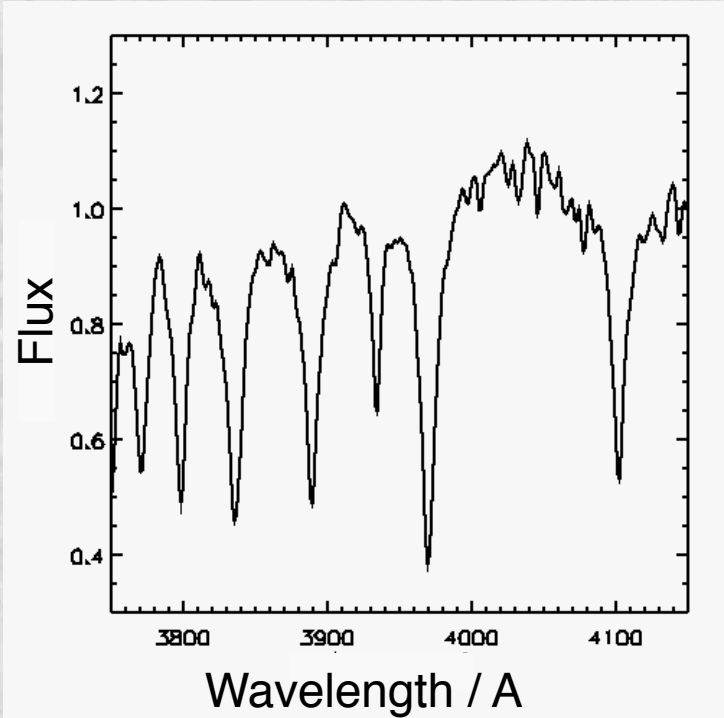




A low-z picture

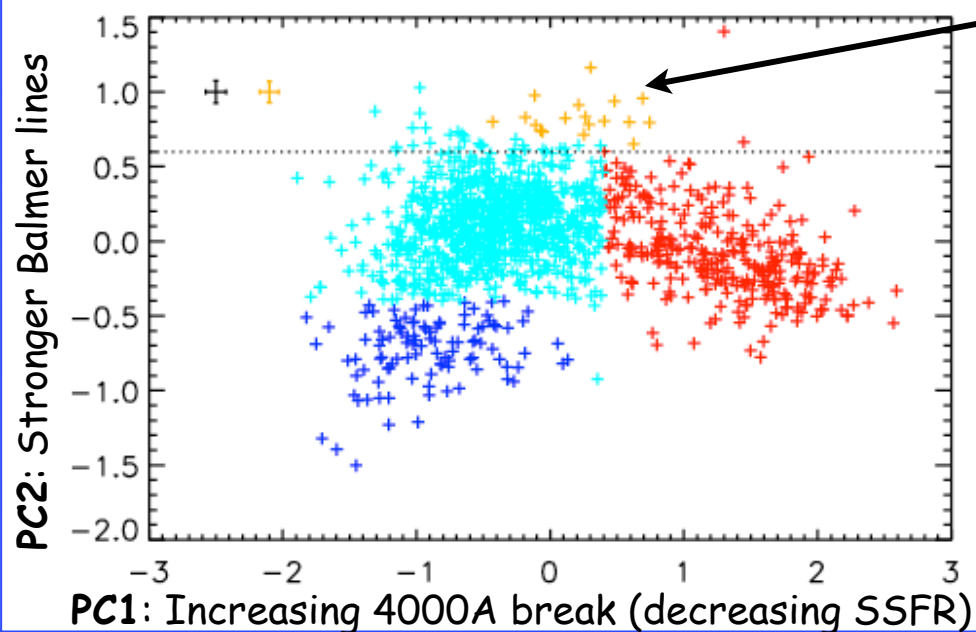
At high z may get significant "starburst" at time of formation

Both should give post-starburst signatures



Post-starbursts: Spectroscopic selection

$0.5 < z < 1.0$: VVDS



- Number of PSBs
- Stellar mass
- No residual SF
 - Heading for red-sequence
- Duration of detectability from toy or SPH models

Blue \rightarrow red mass flux via PSB phase vs. total

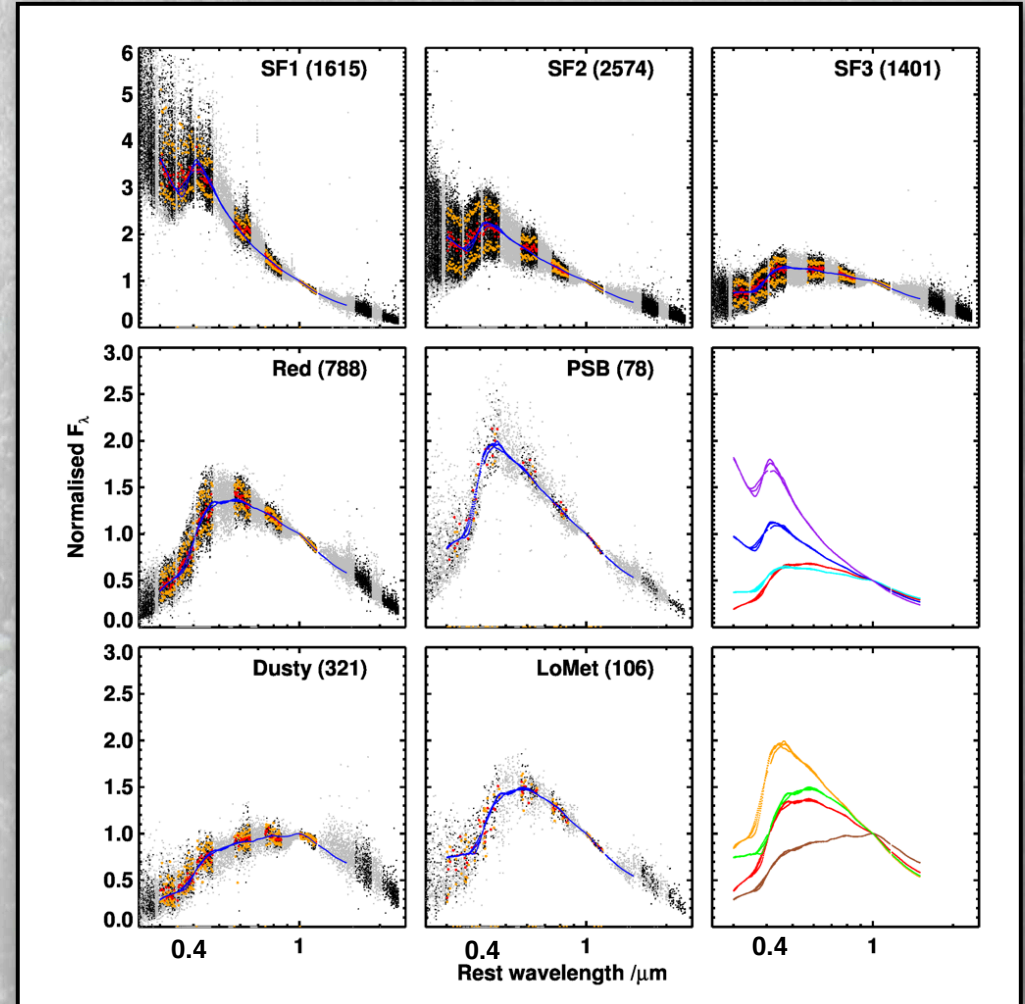
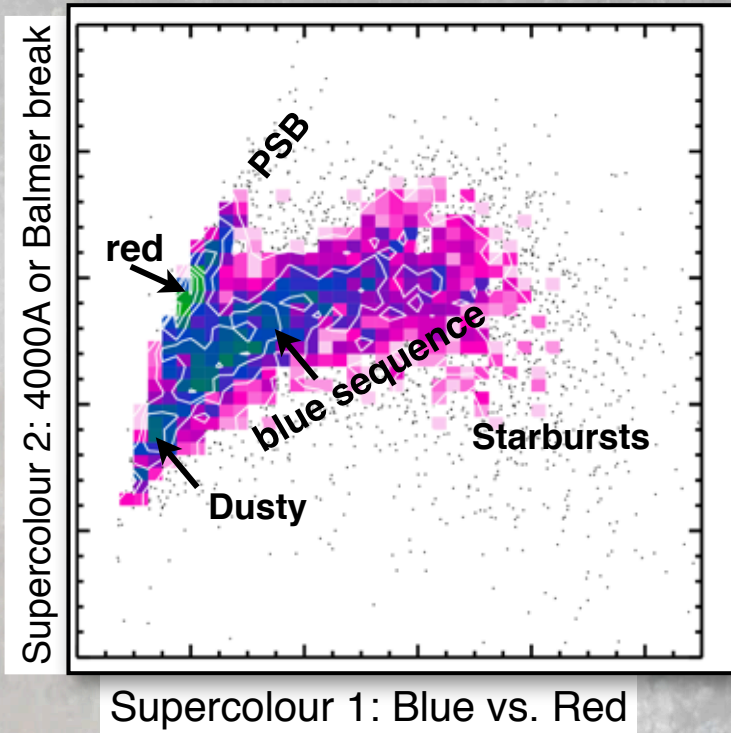
$$40\% < \frac{\dot{\rho}_{B \rightarrow R, PSB}}{\dot{\rho}_{B \rightarrow R}} < 80\%$$

Wild, Walcher, Johansson et al. 2009

- ★ “high” z most interesting (where red-sequence is growing)
- ★ Spectroscopy is expensive (deep enough to see stellar continuum)
- ★ Post-starburst galaxies are rare (need large surveys)

Post-starbursts: photometric selection

UKIDSS ultra-deep survey
 $0.9 < z < 2.0$

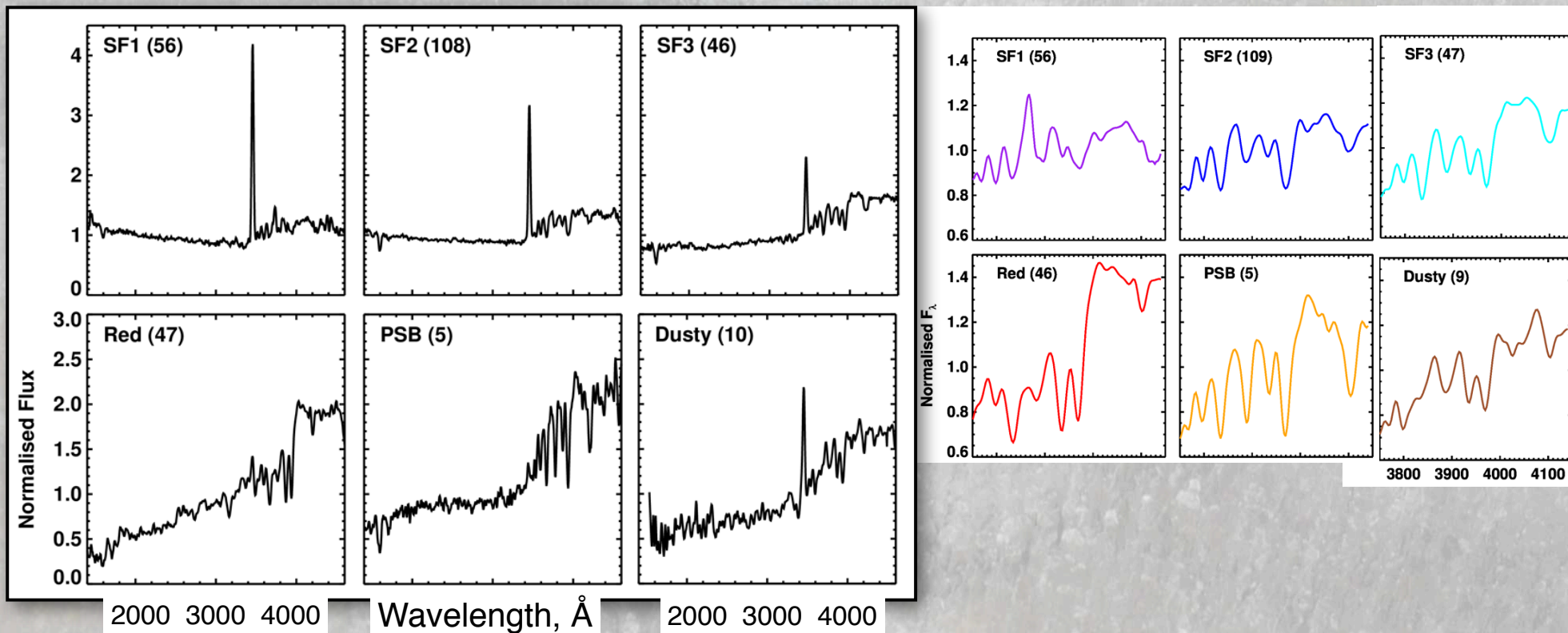


★ Optimally defined linear combinations of filters

- Uses a Principal Component Analysis and sparse sampling (Connolly & Szalay 1999)
- Redshift independent + models not enforced through a k-correction
- Only 3 supercolours describe 99.98% of the variance in the (model) dataset

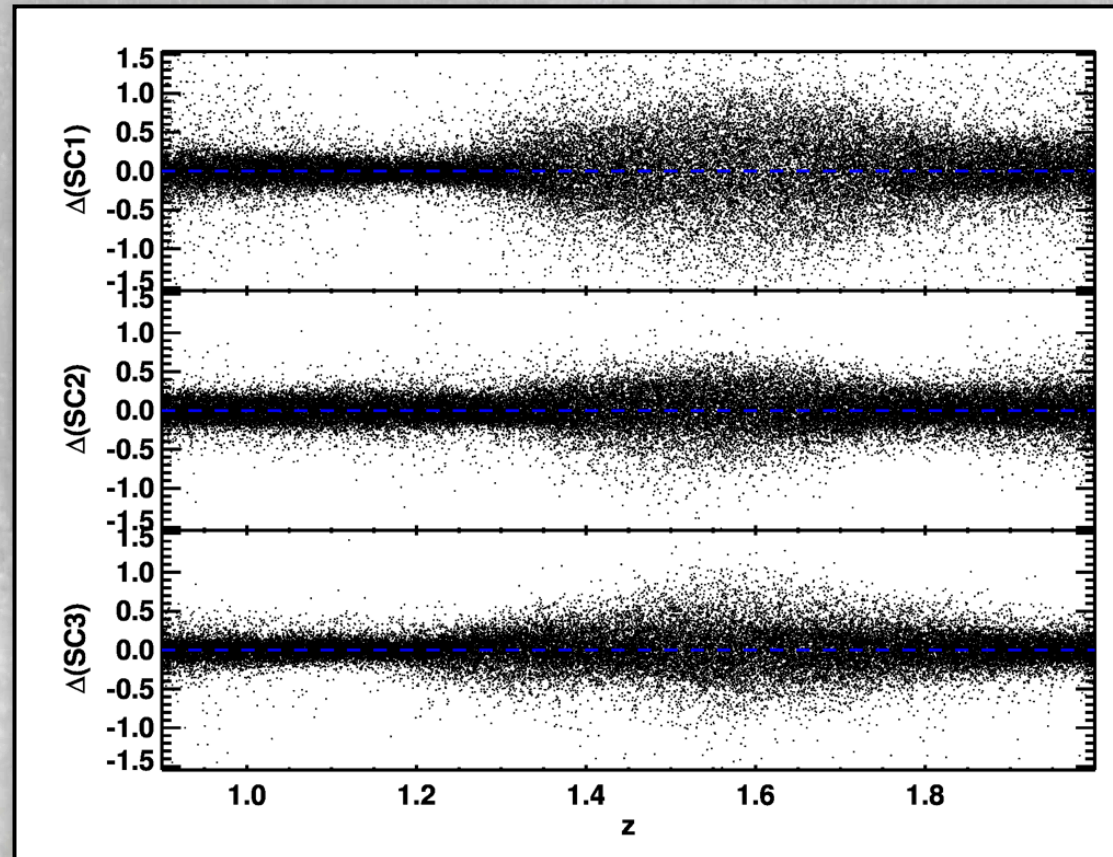
Verification with spectroscopy

Stacked spectra using super-colour selection:
UDS-z $0.9 < z < 1.2$



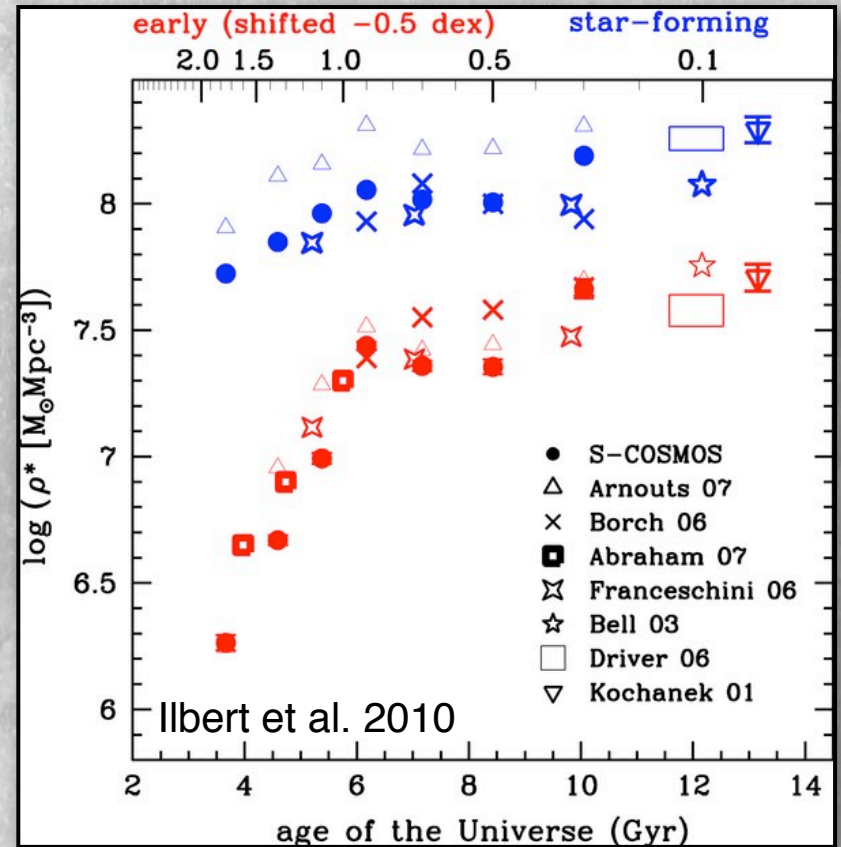
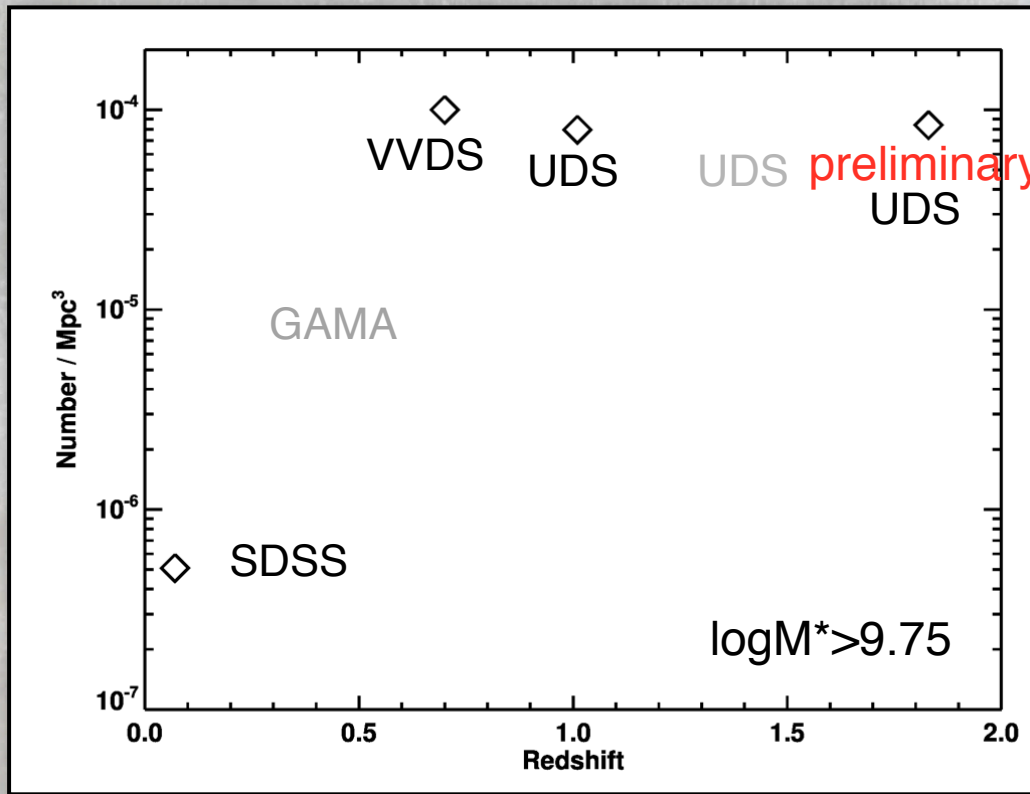
- ★ UDSz provides high quality redshifts for the UDS field
- ★ Verify method by stacking the spectra from different colour region

Easy to visualise loss of information



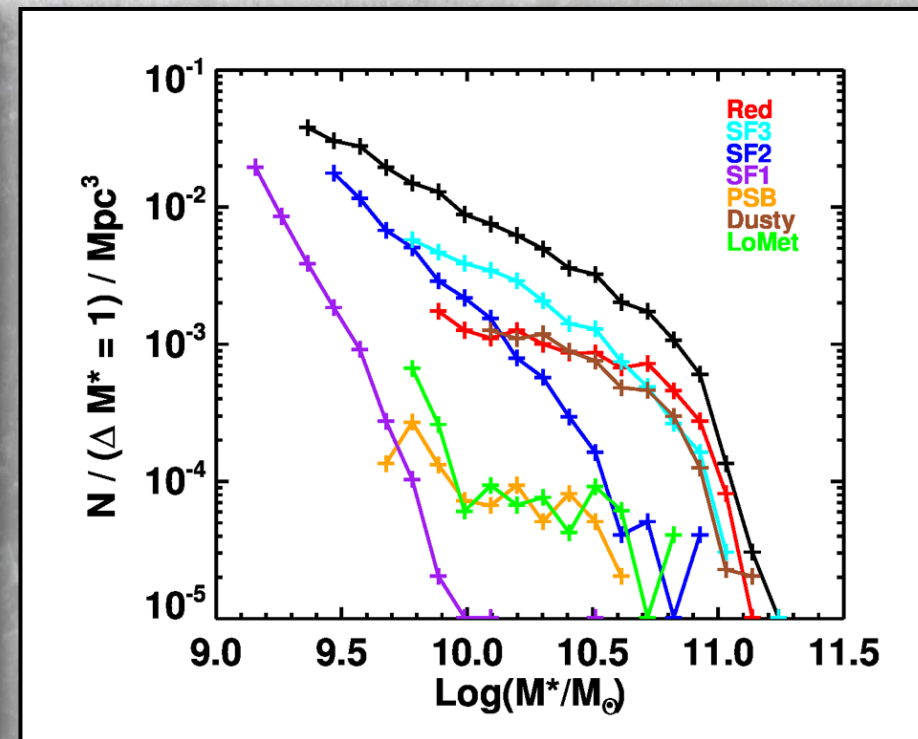
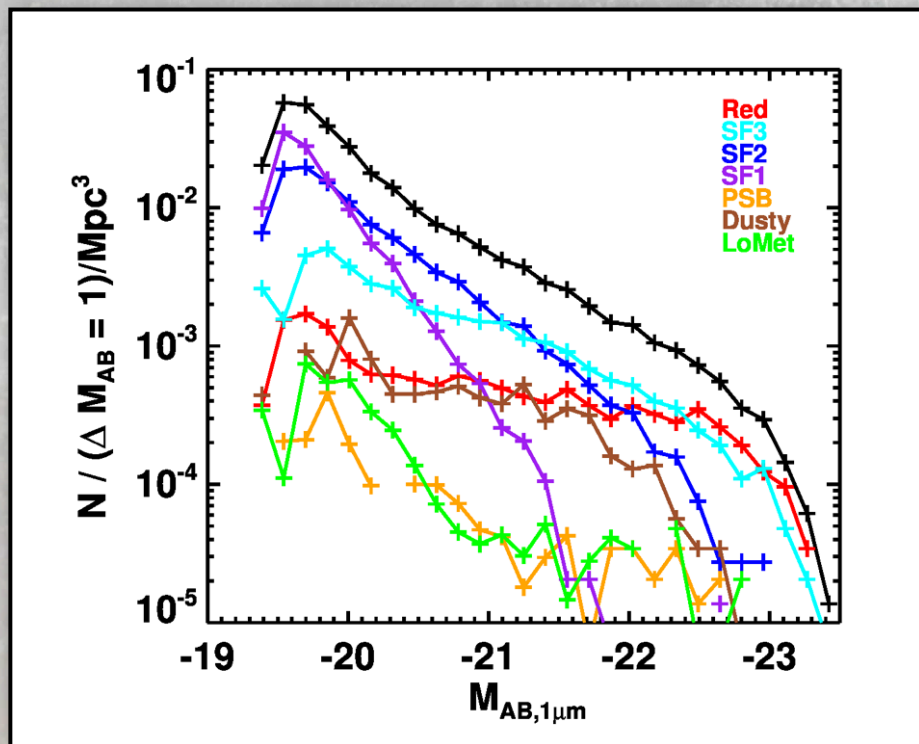
- ★ Ability to reconstruct shape of SED from observations depends on:
 - filter availability
 - redshift
 - shape of SED

Quantifying their importance



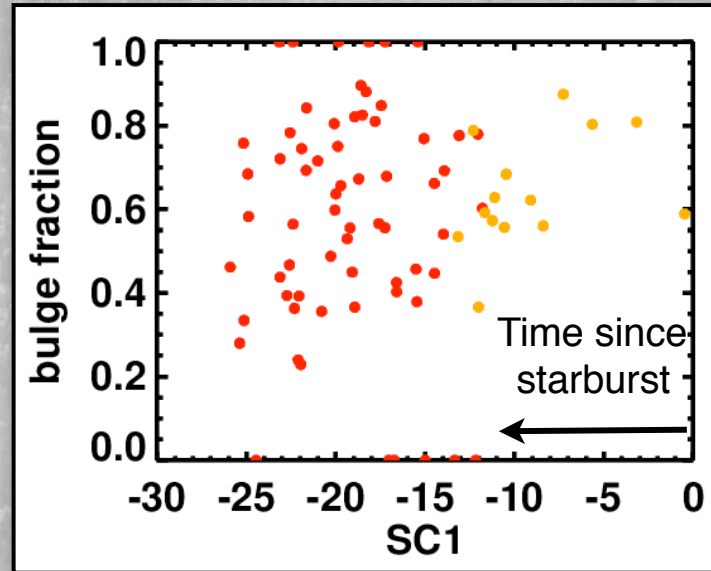
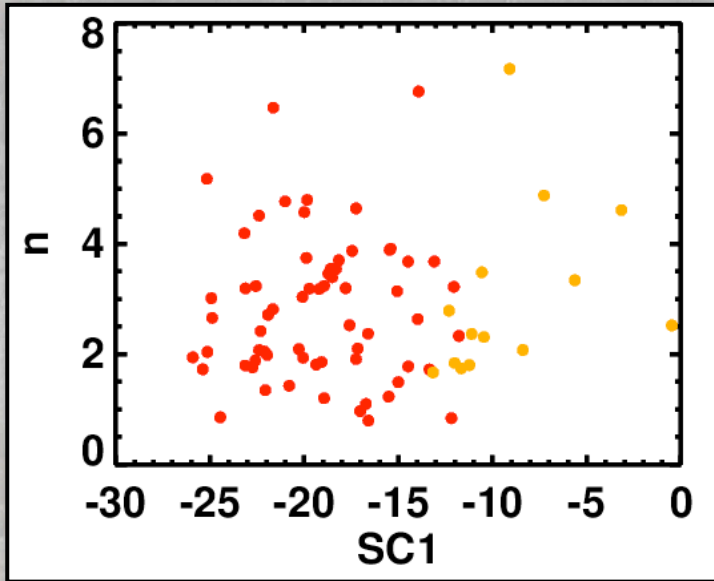
- ★ Precipitous decline in number at redshift where mass transfer to RS stops
 - Far greater than decline in major merger rates $\sim(1+z)^{2.2}$ e.g. Xu+2012
- ★ Formation stage ($z \sim 2$) vs. merger stage ($z \sim 1$) : why constant n?

Luminosities and masses



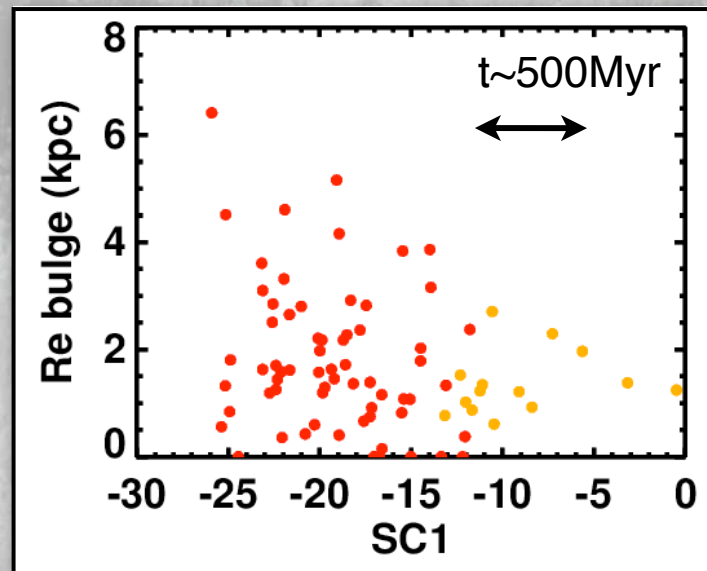
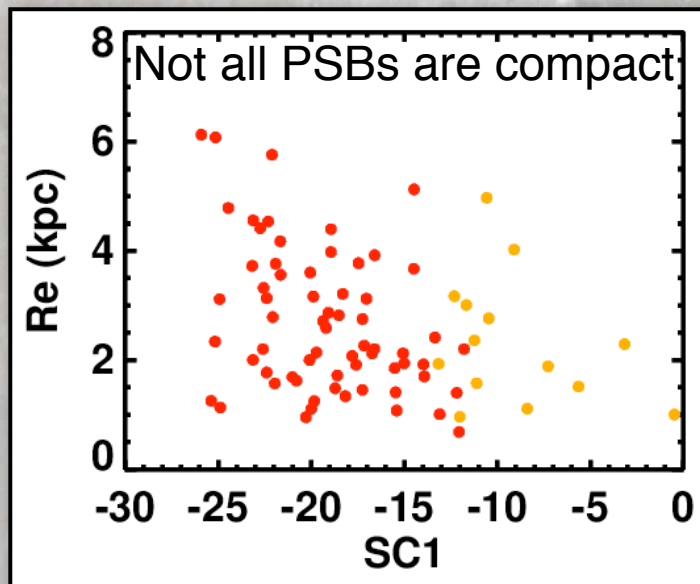
- ★ Post-starburst galaxies can build up the low-mass end of the red sequence
- ★ No post-starburst galaxies with $\text{log } M^*/M_{\text{sol}} > 10.6$ in this sample

Post-starburst morphologies



$M^* > 10^{11} M_{\odot}$ in
CANDELS-UDS
(HST NIR imaging)

Morphological
parameters from
Victoria Bruce,
Edinburgh



Conclusions

- ★ Post-starburst galaxies are a strong candidate as a transition population from blue to lower-mass end of red sequence
 - Need a gas-rich major merger to see such strong spectral features
- ★ The mass flux through the post-starburst phase could account for significant fraction of the growth of the red-sequence
- ★ They are not all compact
- ★ The number density of post-starburst galaxies drops precipitously at the same redshift as the red-sequence stops building
- ★ We can now detect post-starburst galaxies with confidence from high-quality broad band photometric data, matched to spectroscopic PSBs
 - Increased wavelength coverage needed at some redshifts
- ★ Several outstanding questions:
 - Gas contents: Subsequent rejuvenation of star-formation? Dependence on mass?
 - Burst mass fractions: formation vs. mergers
 - How is the final shut-down achieved? At low-z no evidence for expulsion of gas by AGN. Heating?