

Post-starburst galaxies and the origins of galaxy bimodality

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Jim Dunlop ([Edinburgh](#)), Chris Simpson ([LJM](#))

Spiral Galaxy NGC 1309

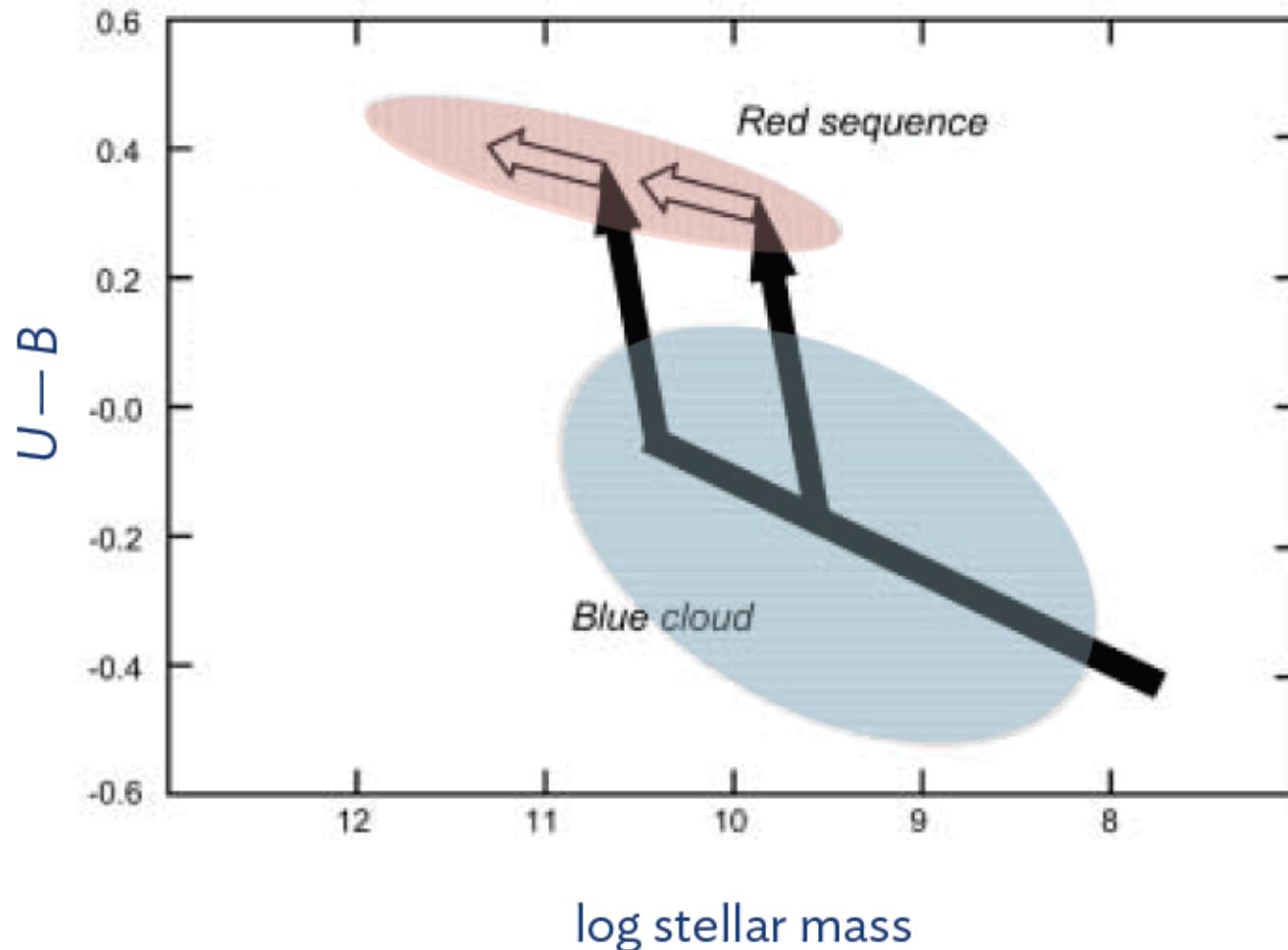


Hubble
Heritage



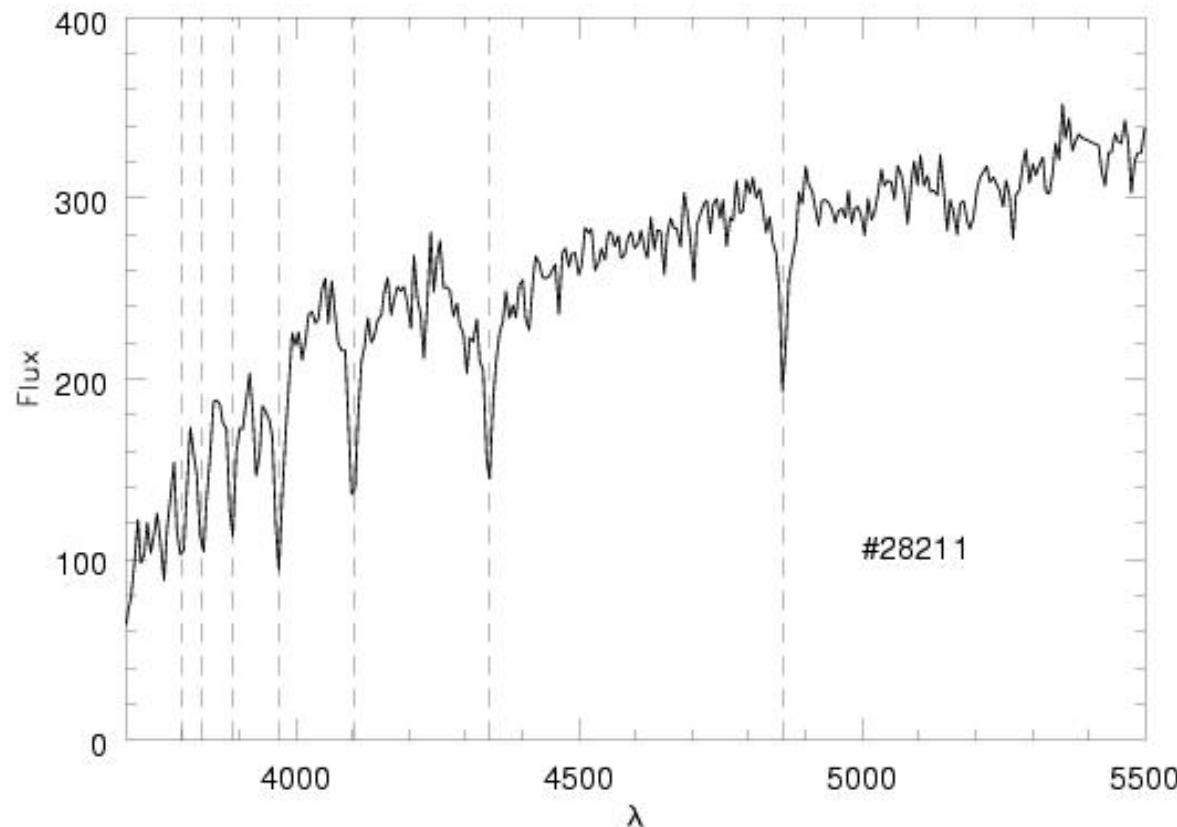
Forming the galaxy red sequence

Faber et al. (2007)

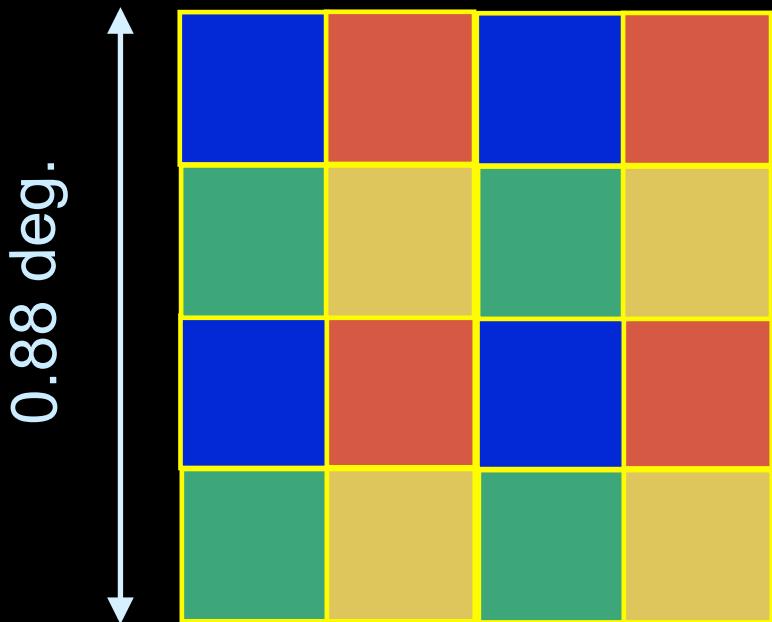


Post-starburst galaxies – a transition population (“E+A” or “K+A”)

Strong Balmer absorption => A stars
Major starburst truncated **abruptly** within last $\sim 1\text{Gyr}$



The UKIDSS Ultra-Deep Survey

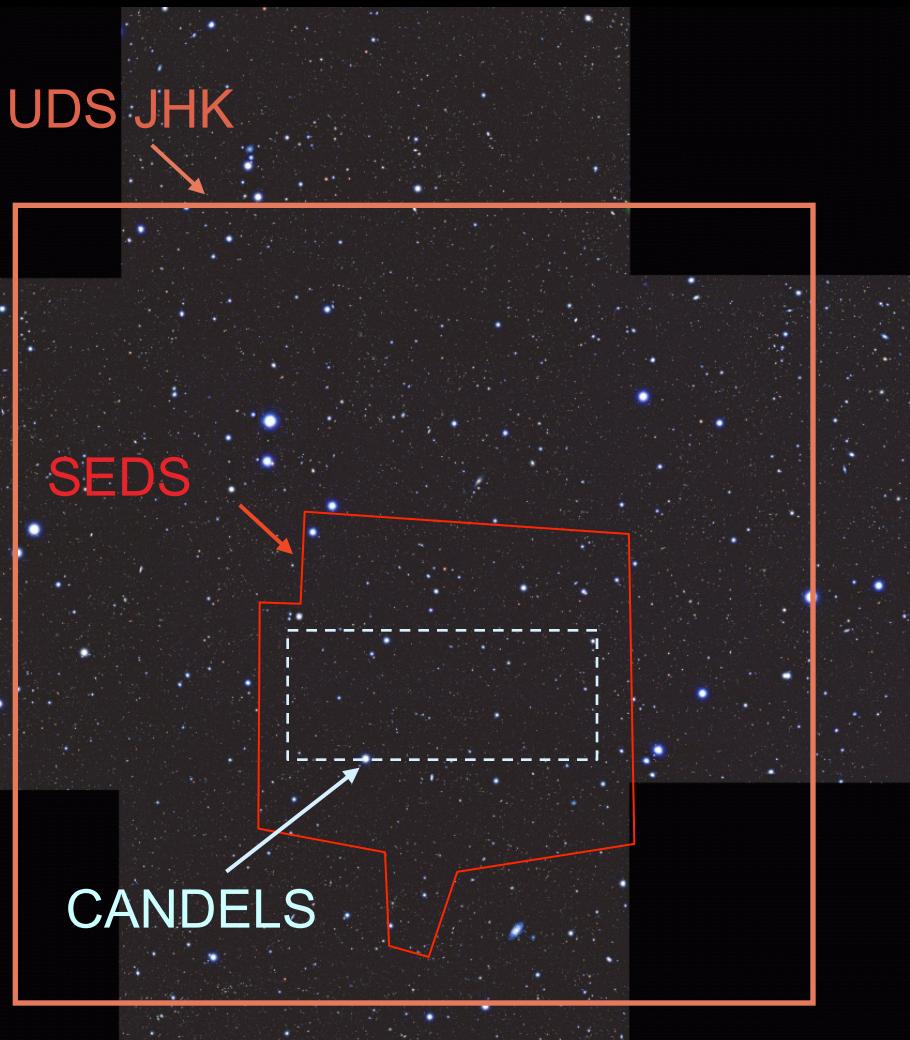


Final data release imminent!

New depths:
 $J=25.4$, $H=24.8$, $K=25.3$
(AB, 5σ , 2" apertures)

Deepest IR survey over this area.

Key imaging data in the UDS



Optical (CFHT + Subaru)

$U=27.2$, $B=27.5$, $V=26.7$, $R=27.0$,
 $i'=26.8$, $z'=26.0$ (AB)

Near-IR (UKIRT + VISTA)

$J,H,K \sim 25$ (AB), $Y \sim 24.2$ (AB)

Near-IR (Spitzer IRAC):

SPUDS: ~ 24 (AB) $3.6, 4.5\mu\text{m}$
 $(0.8 \deg^2)$

SEDS: ~ 26 (AB) at $3.6, 4.5\mu\text{m}$
 $(0.17 \deg^2)$

Mid-IR (Spitzer IRAC)

$\sim 80\mu\text{Jy}$ $24\mu\text{m}$ (SPUDS)

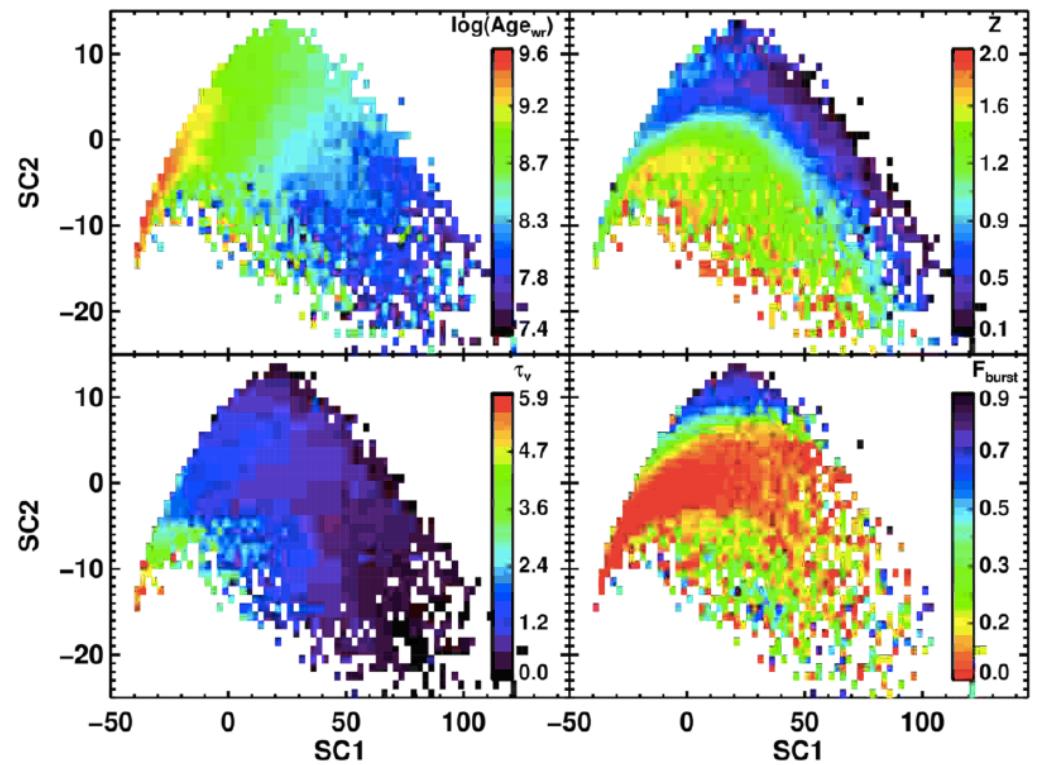
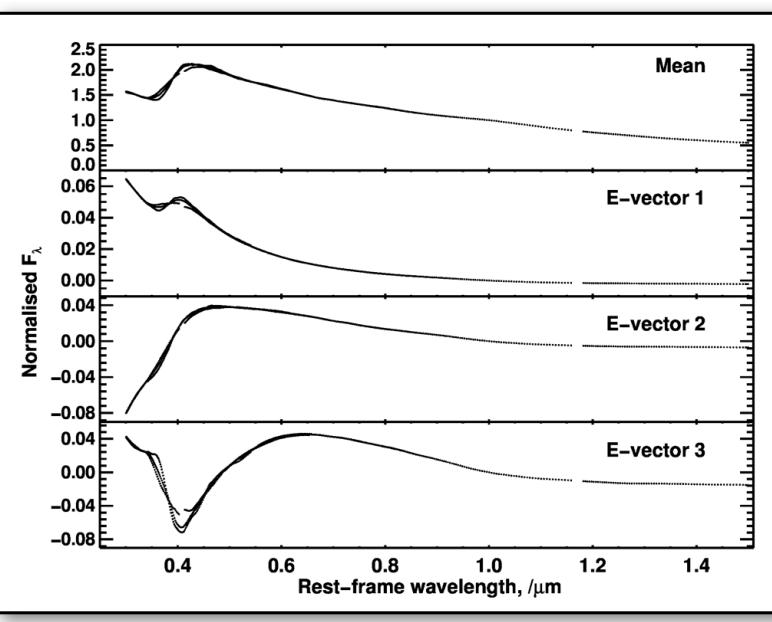
X-ray:

XMM-Newton 100ks + 6x50ks

Radio:

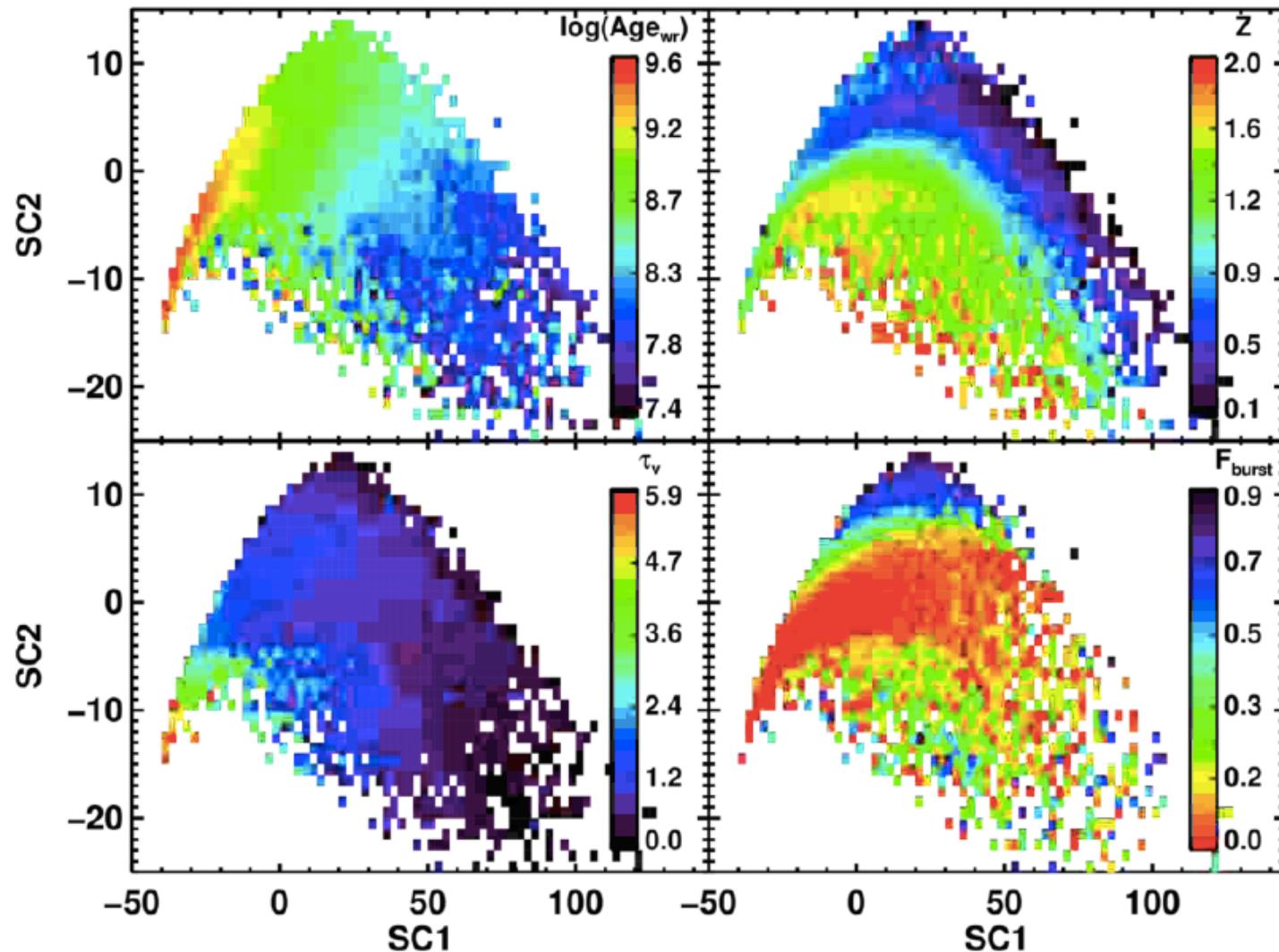
VLA 12 μJy rms 1.4Ghz

Classifying galaxies with PCA “super-colours”



Wild, Almaini et al. 2014

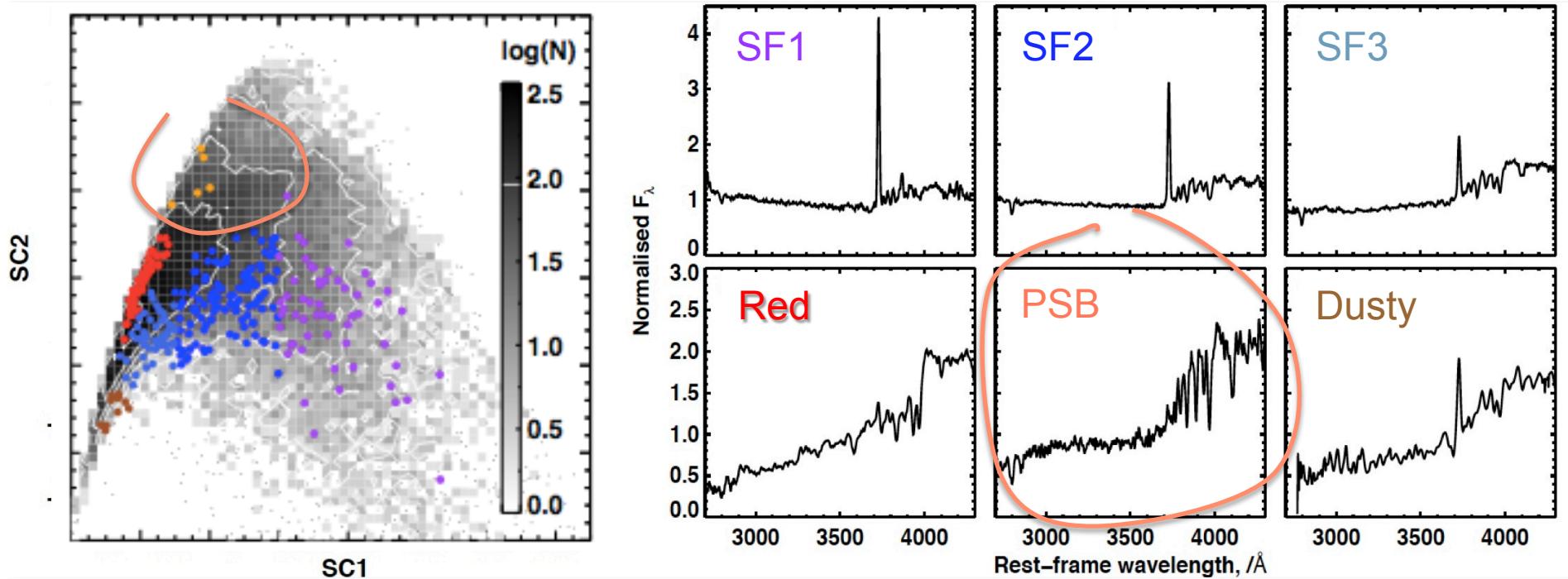
Classifying galaxies with PCA “super-colours”



Wild, Almaini et al. 2014

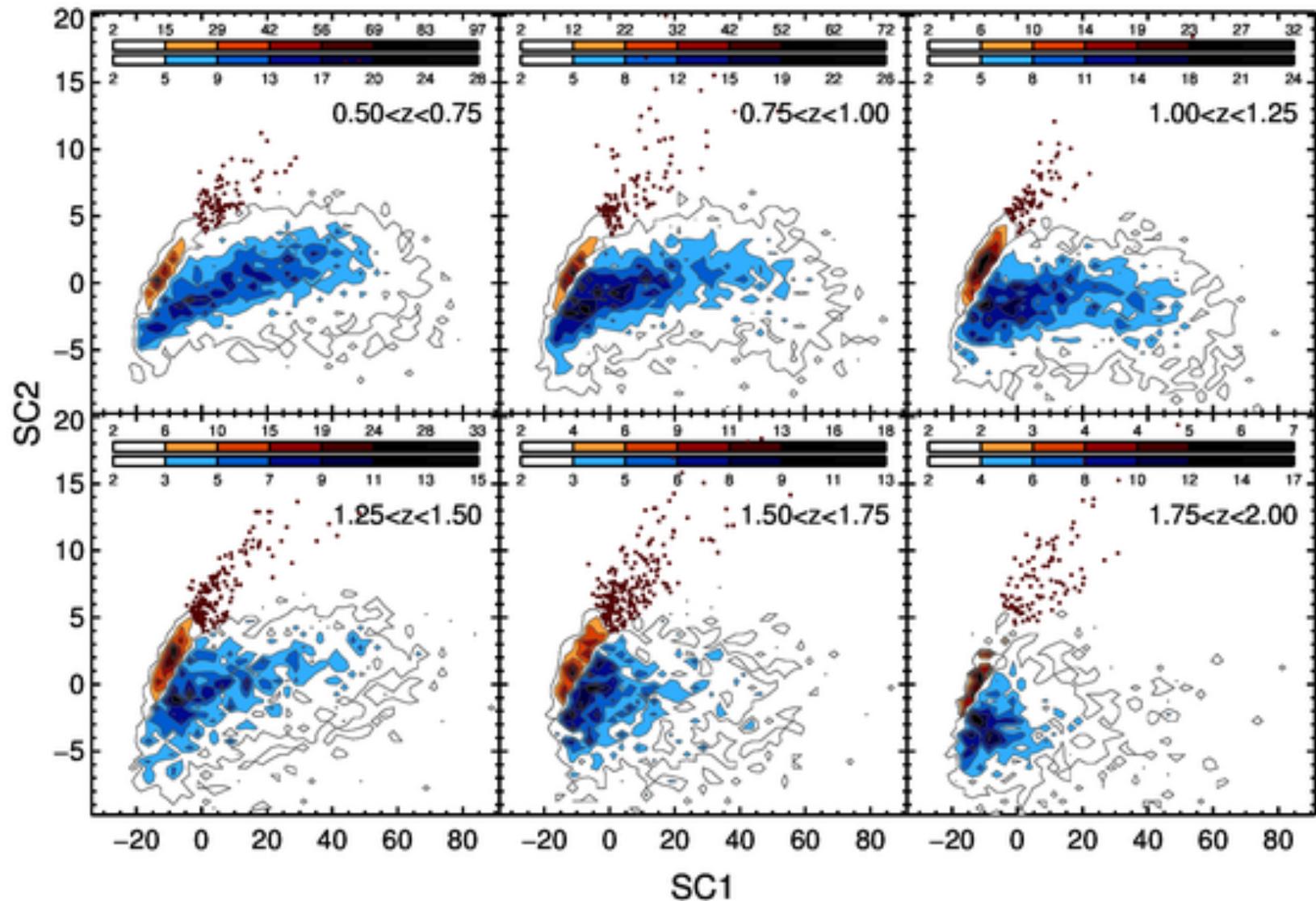
Validation with VLT spectroscopy (UDSz)

$0.9 < z < 1.4$

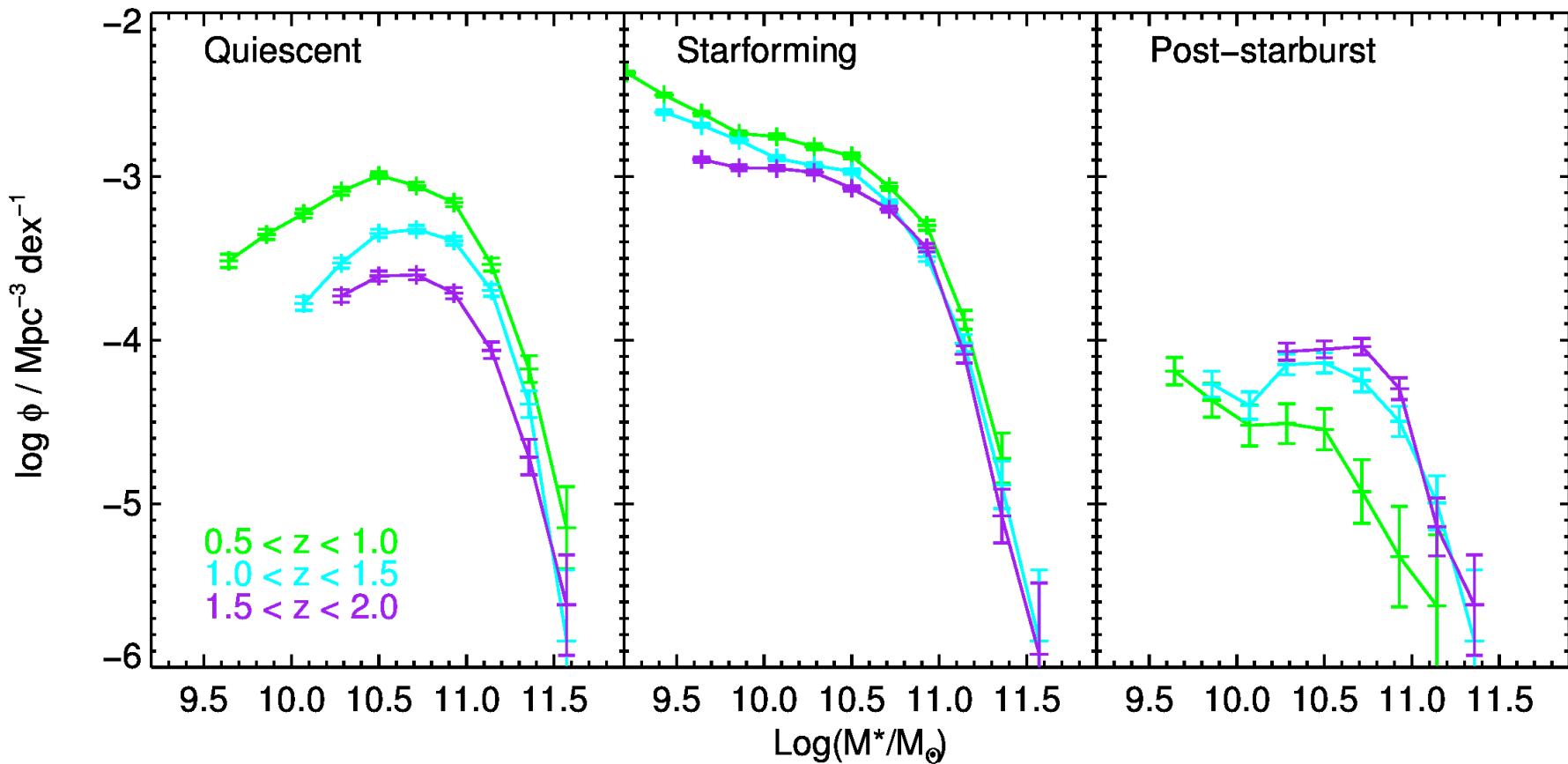


Wild, Almaini et al. 2014

Identification of 759 PSB candidates

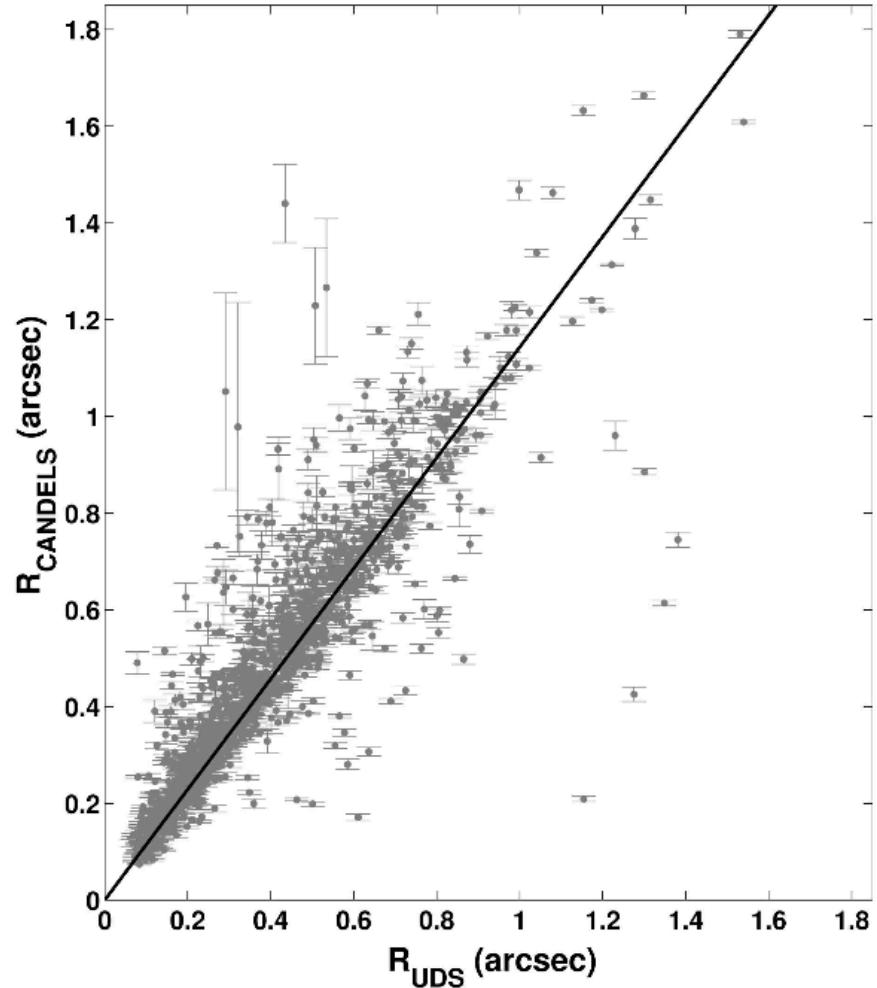
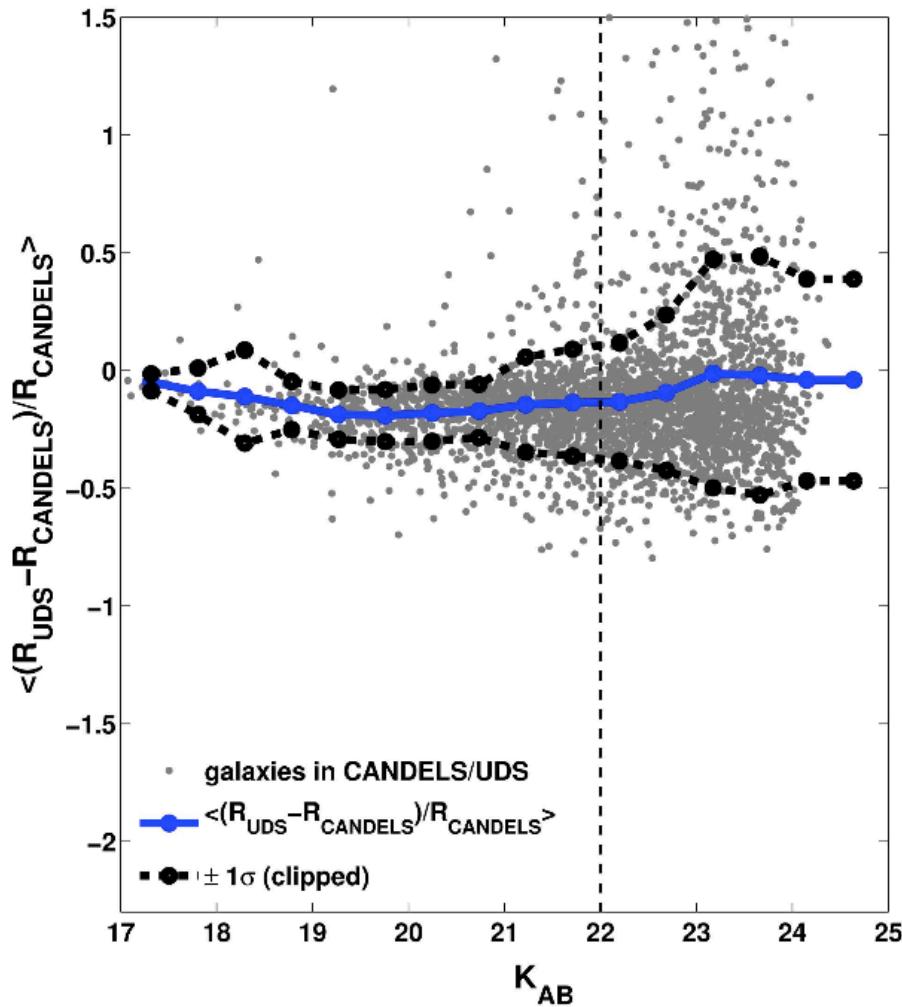


Massive post-starbursts more common at $z > 1$



Wild et al. (in prep)

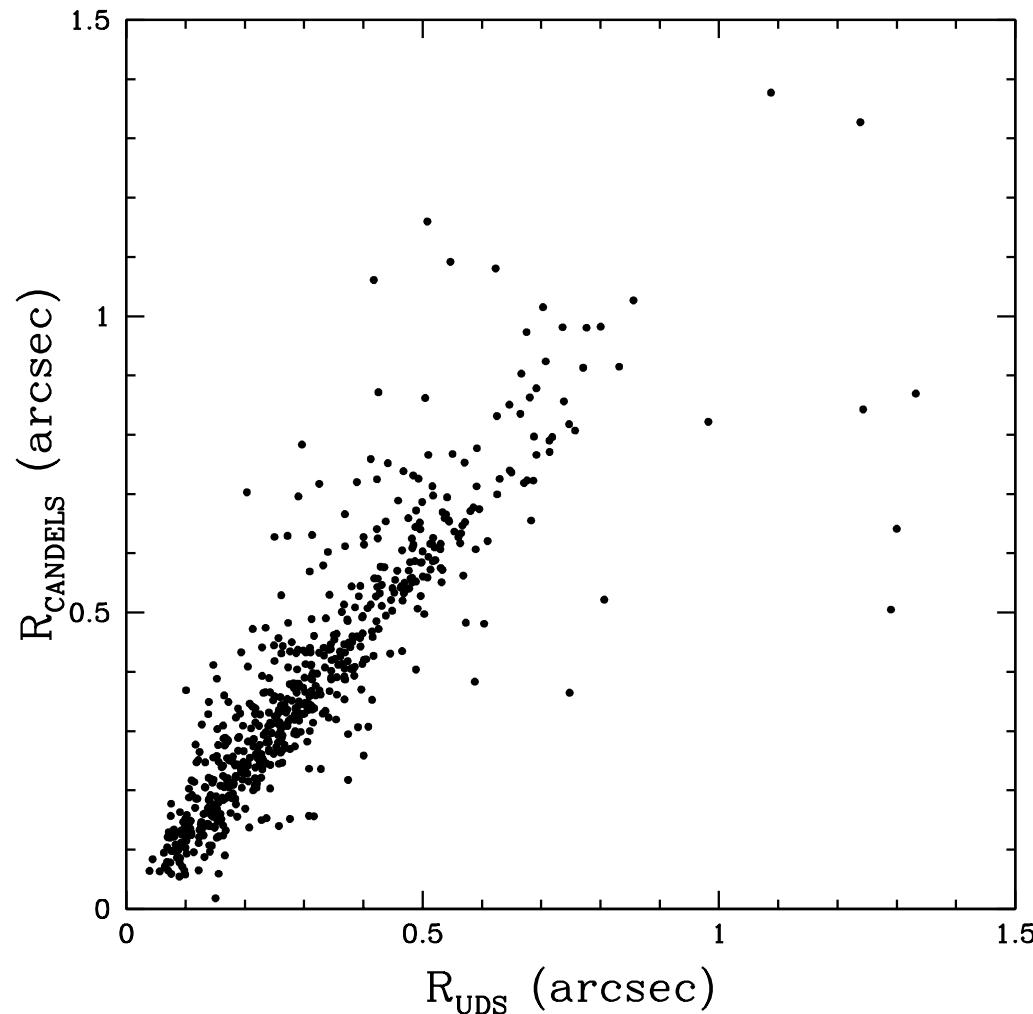
Measuring basic morphological parameters (GALAPAGOS/GALFIT)



Lani et al. 2013

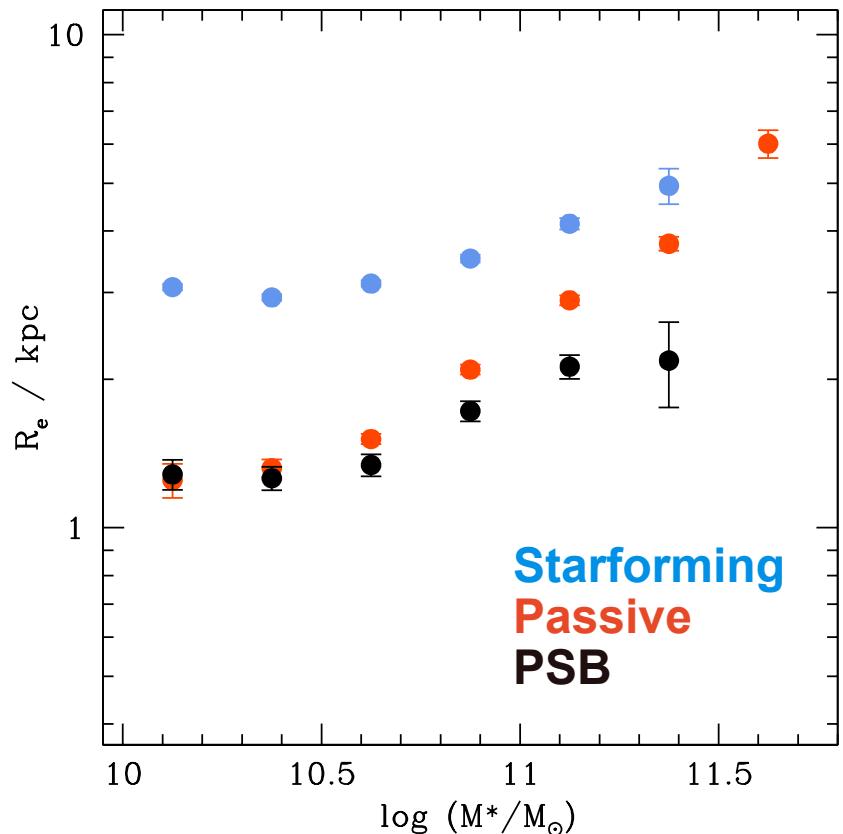
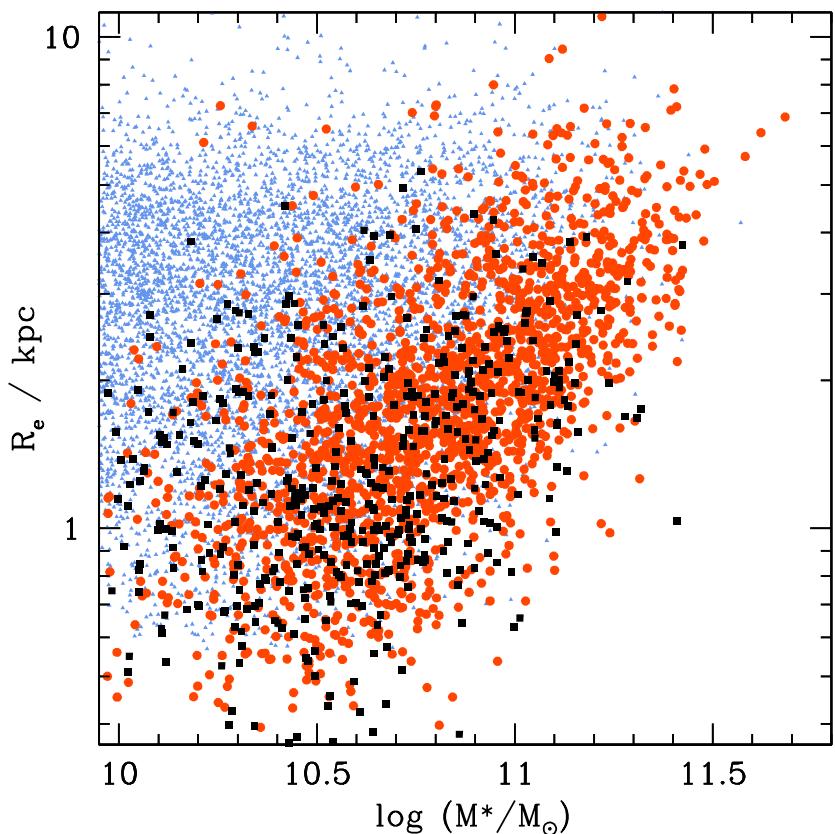
Measuring galaxy sizes – ground vs space (GALAPAGOS/GALFIT)

$1 < z < 2, M_* > 10^{10} M_\odot$



High-z post-starburst galaxies are ultra-compact

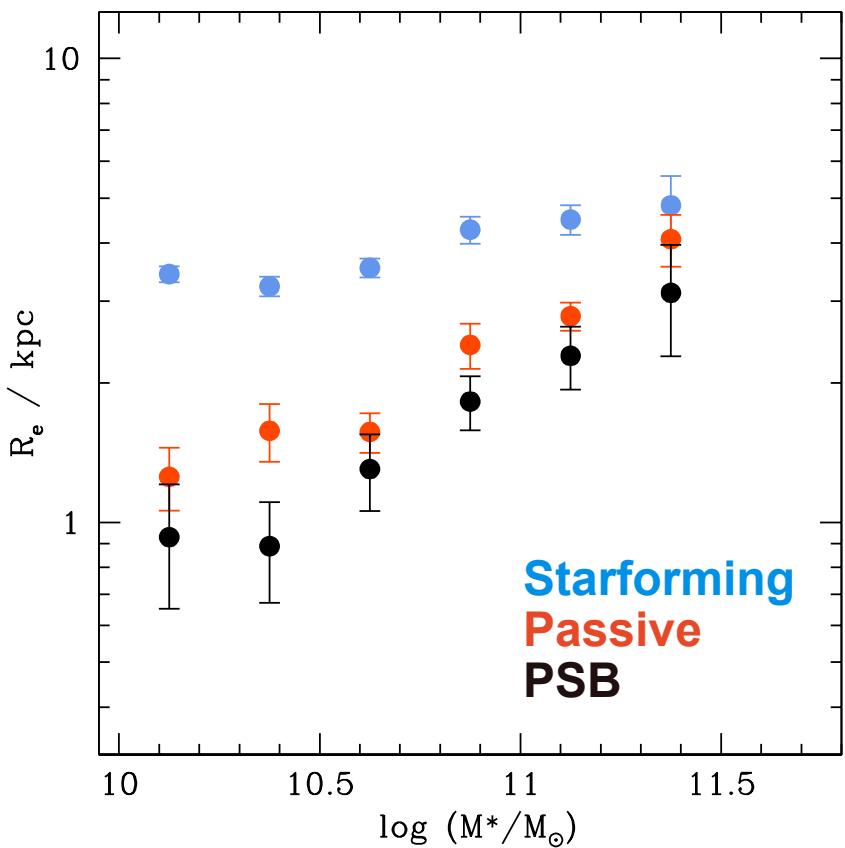
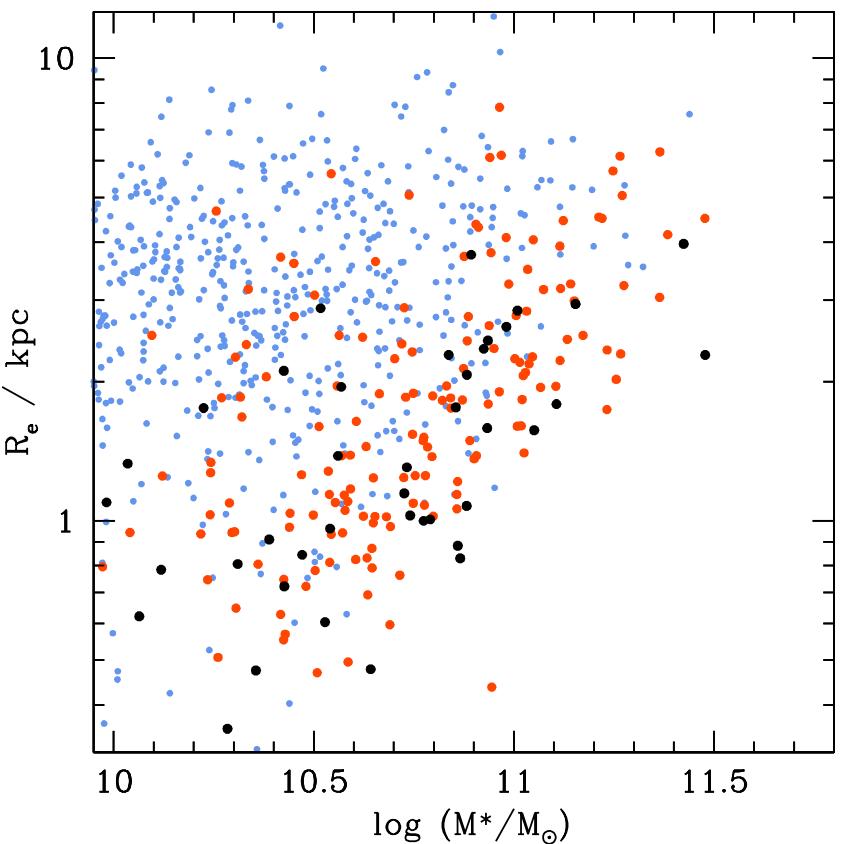
$1 < z < 2$



Almaini et al. (in prep)

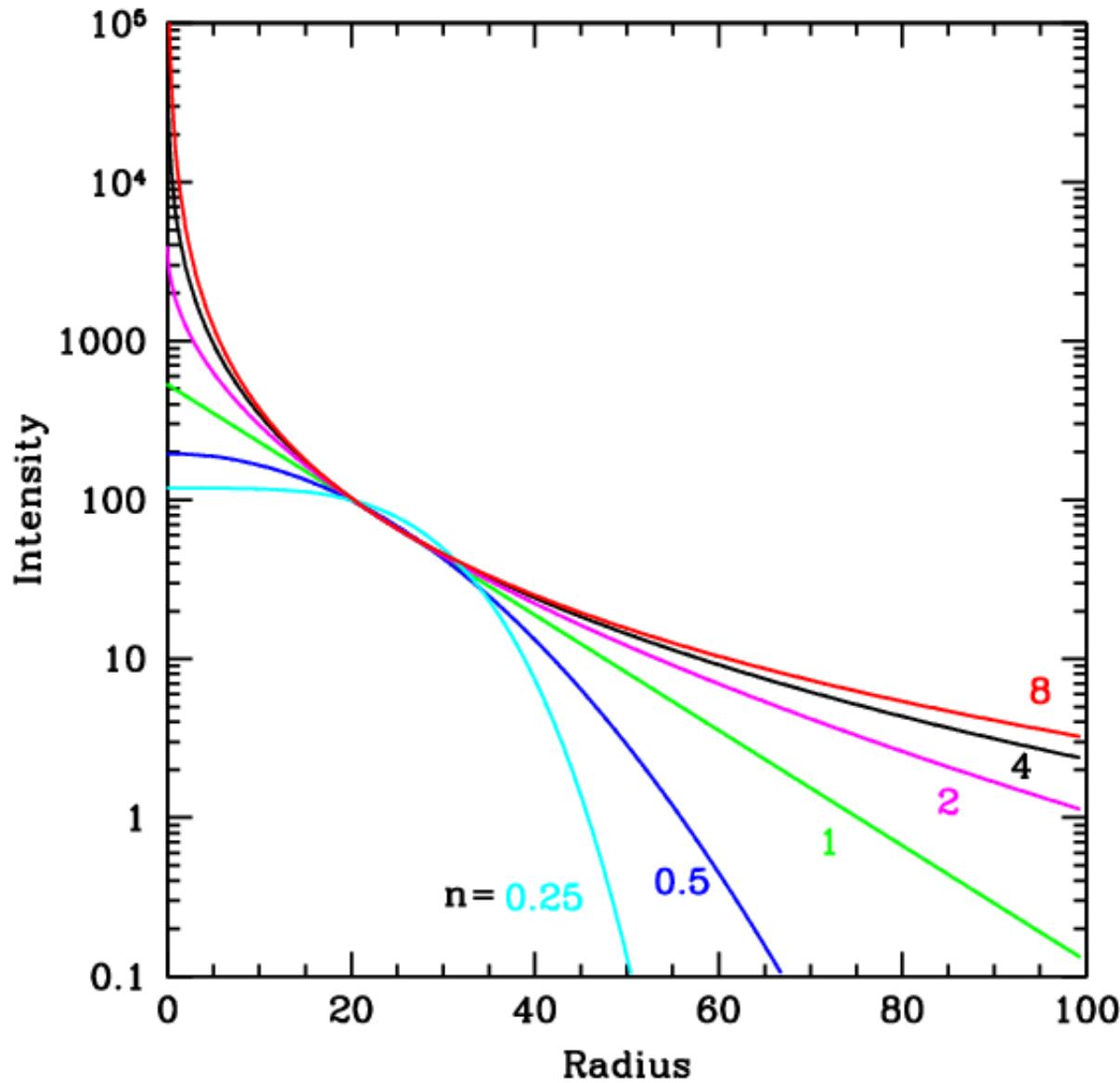
HST CANDELS confirms compact PSBs

1<z<2



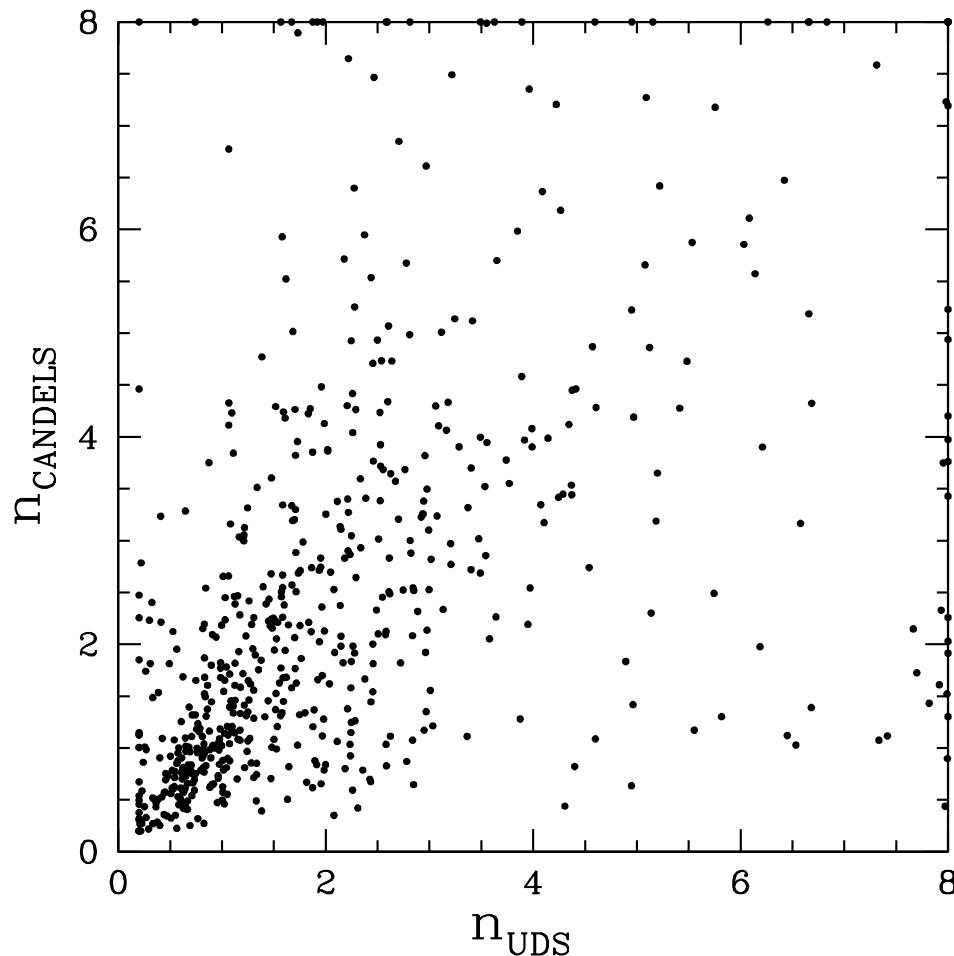
Almaini et al. (in prep)

Sérsic galaxy profiles



Measuring Sérsic Indices – ground vs space

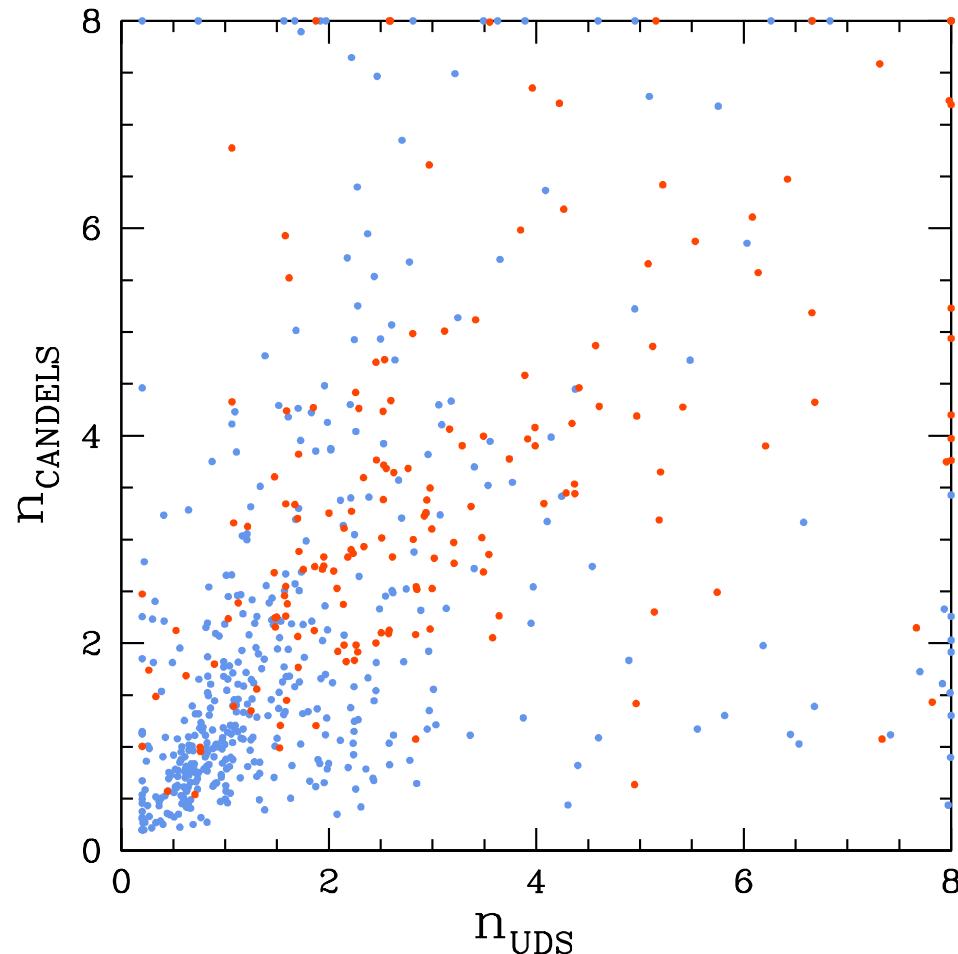
$1 < z < 2, \quad M_* > 10^{10} M_\odot$



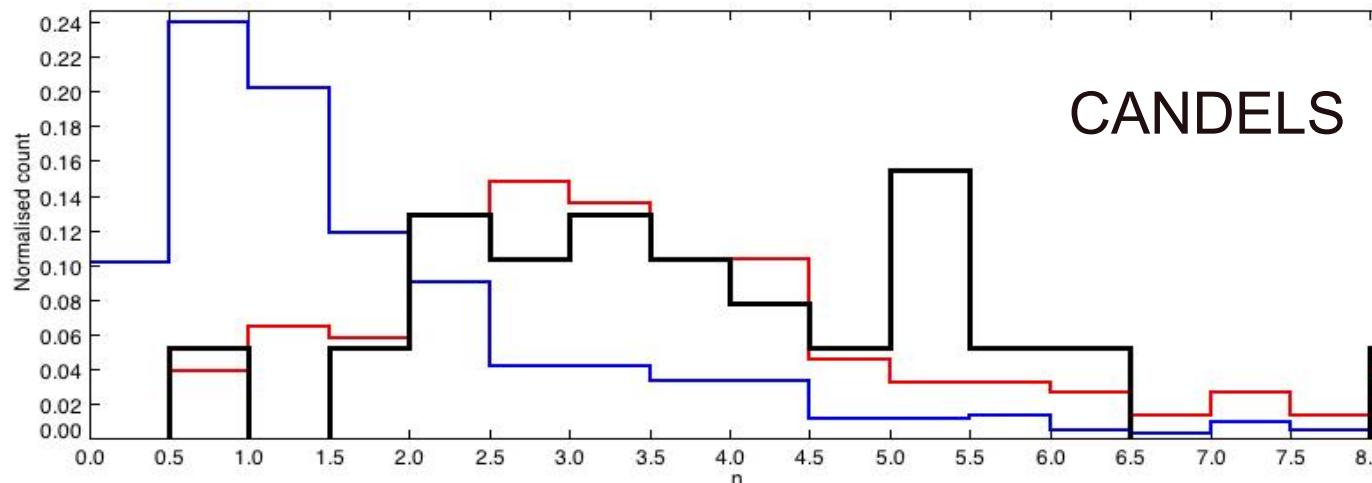
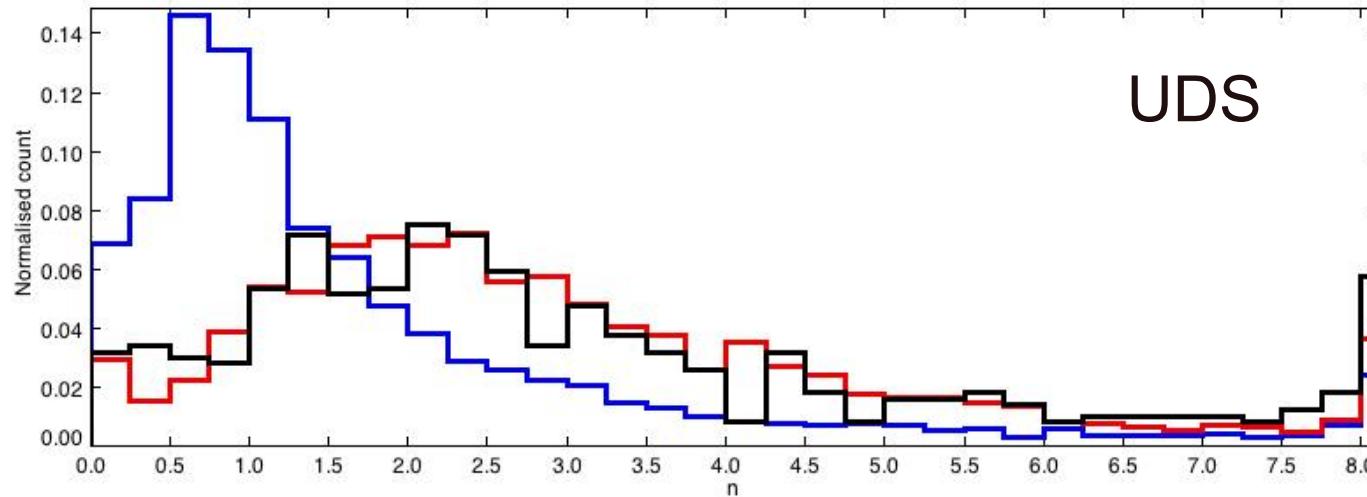
Almaini et al. (in prep)

Measuring Sérsic Indices – ground vs space

$1 < z < 2$, $M_* > 10^{10} M_\odot$ starforming vs passive



Sérsic index distributions (SF, passive, PSB)

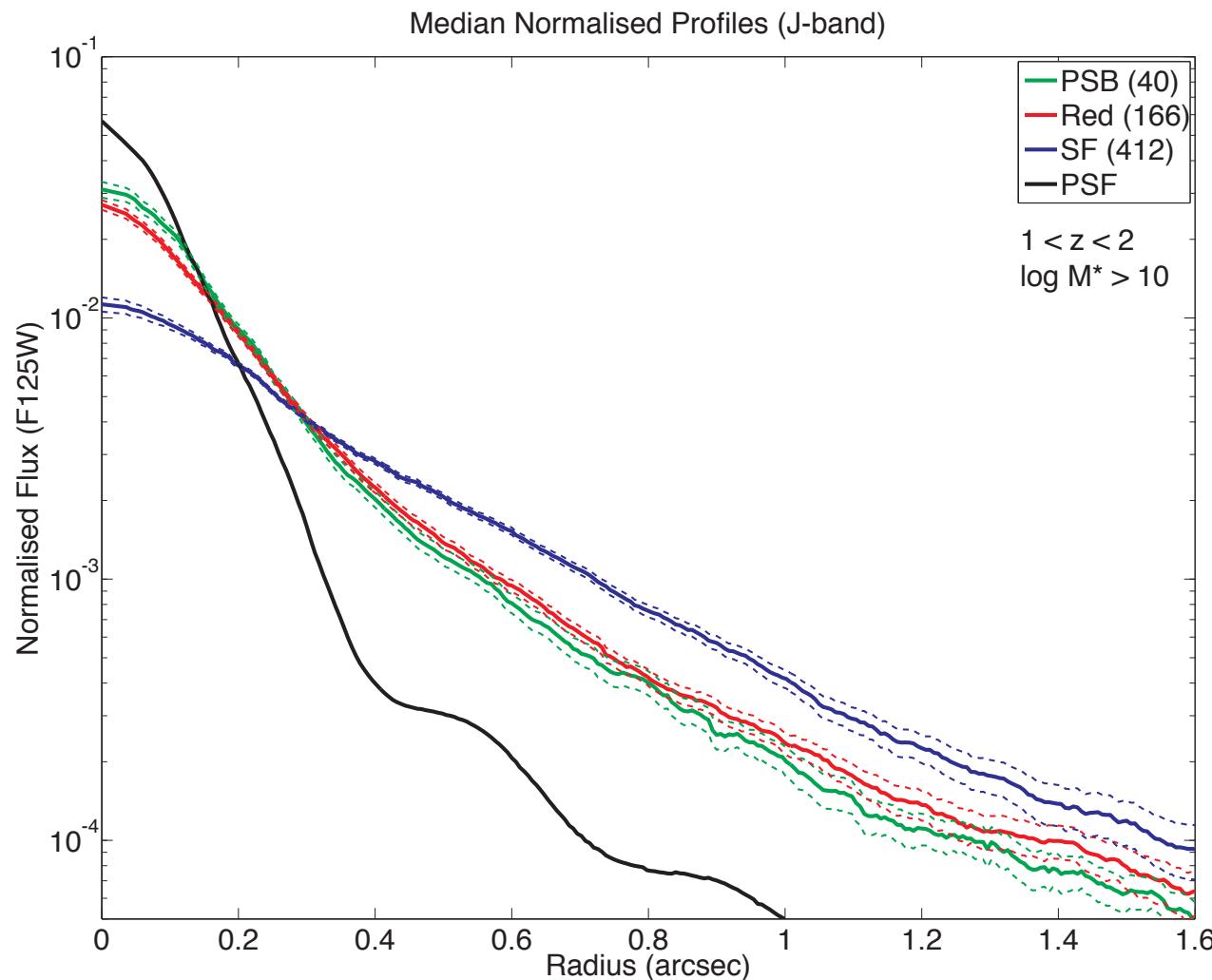


Summary and conclusions

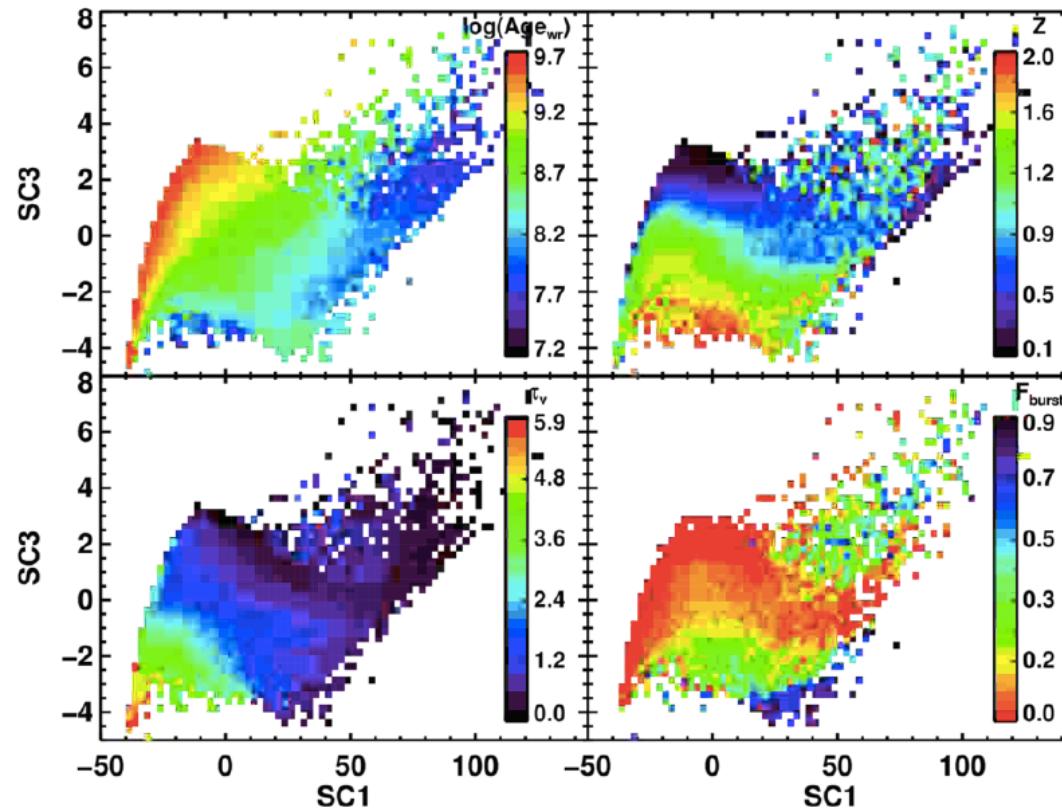
- New PCA method for classifying galaxy SEDs
 - Identified ~500 post-starburst candidates at $z > 1$
 - Could account for large fraction of red sequence build-up
 - *New: PSBs are highly compact*
 - *New: PSBs have high Sérsic indices*
- ⇒ *Newly-formed ultra-compact spheroids*
- ⇒ *Recently quenched, during same event that transformed morphology? Gas richer mergers?*

Fin

Work in progress: CANDELS radial profiles (David Maltby)

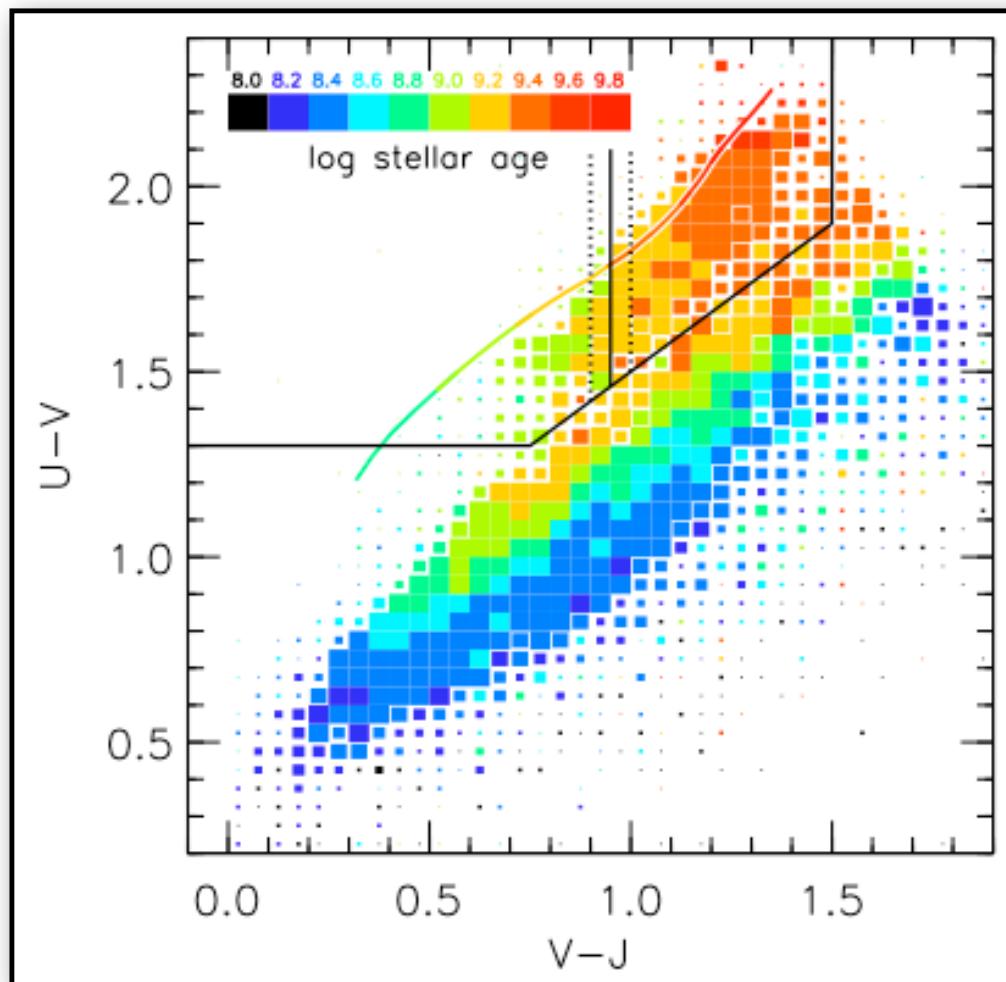


SC3 provides powerful measure of metallicity



Wild et al. 2014

Photometric selection: previous state-of-the-art



Whitaker et al. (2012)