

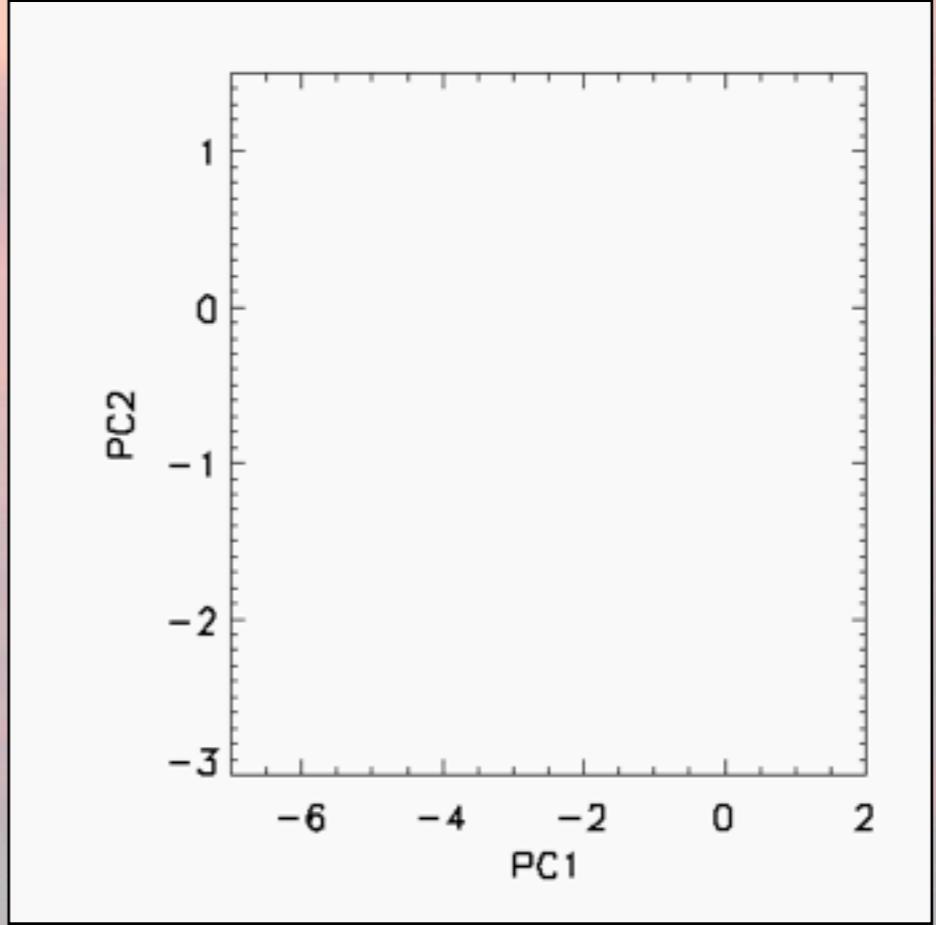
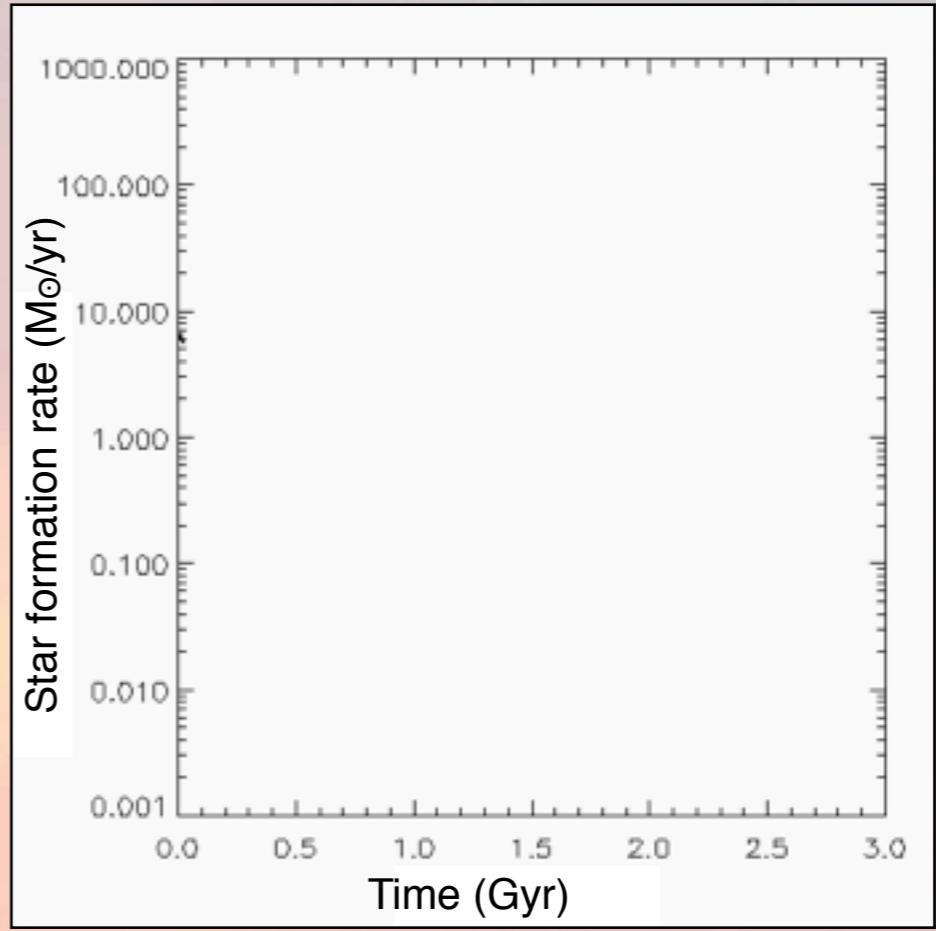
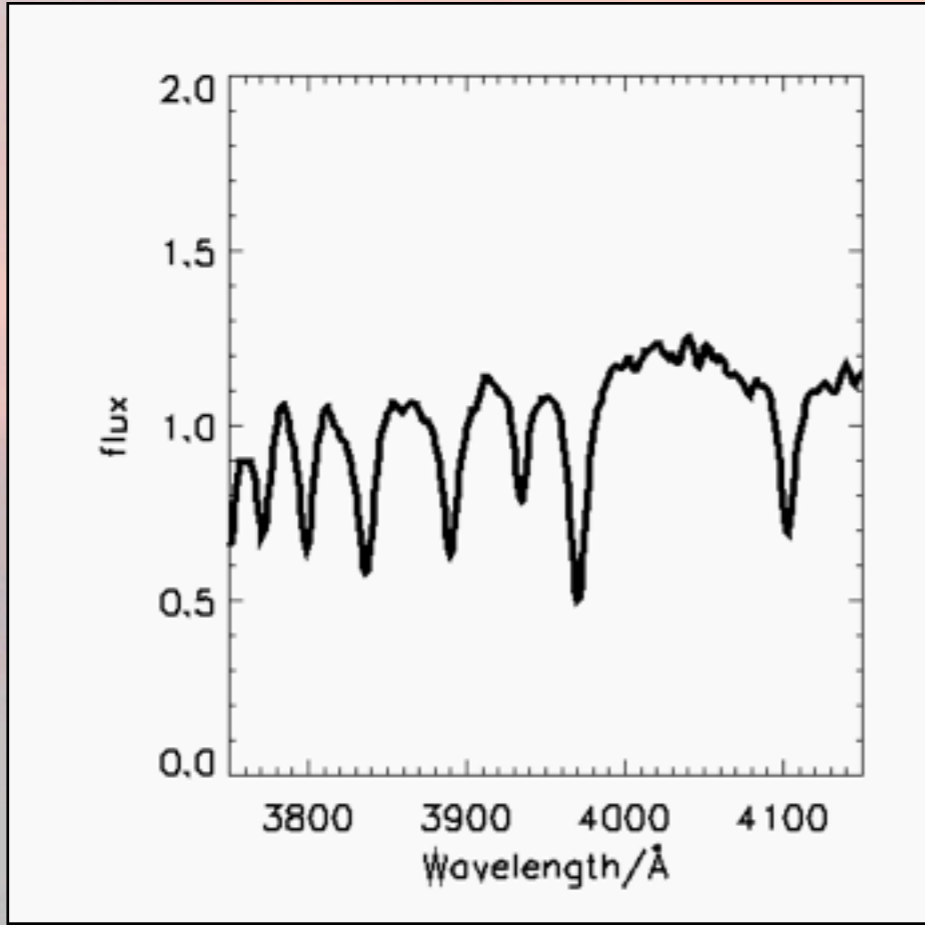
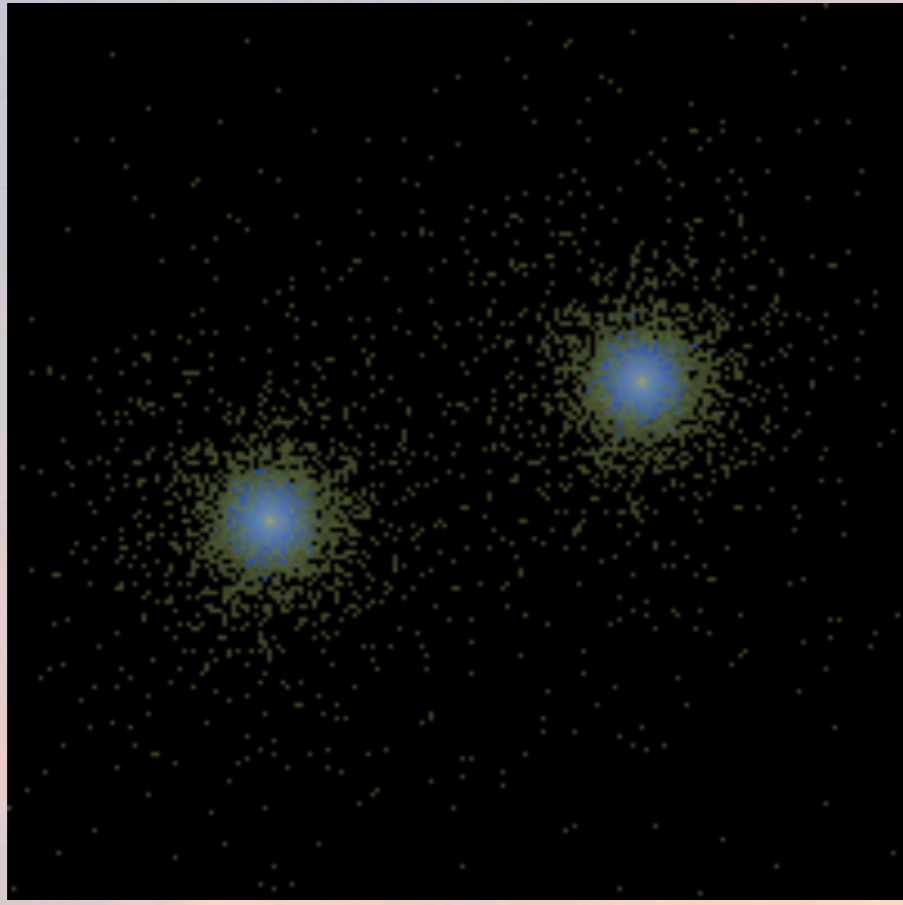
Collateral Information

Vivienne Wild*, Michele Cirasuolo, Jim Dunlop
(and the CANDELS team)

* SUPA Advanced Fellow, University of St Andrews

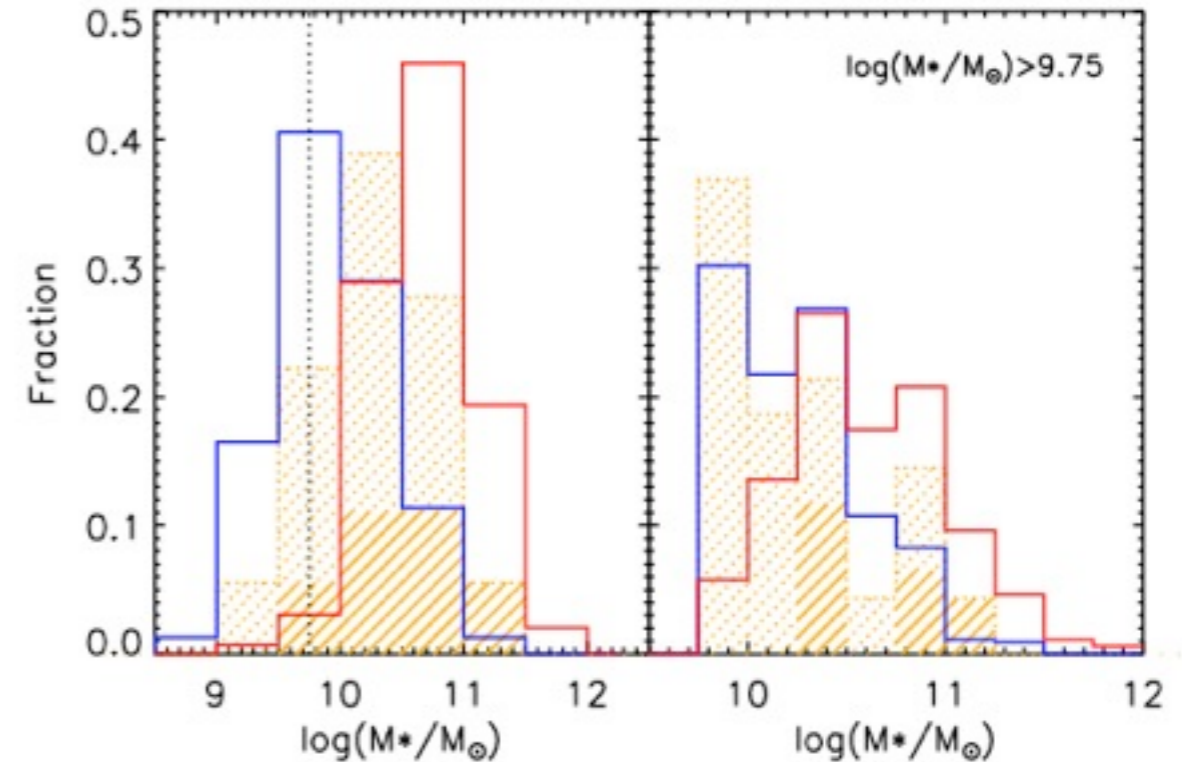
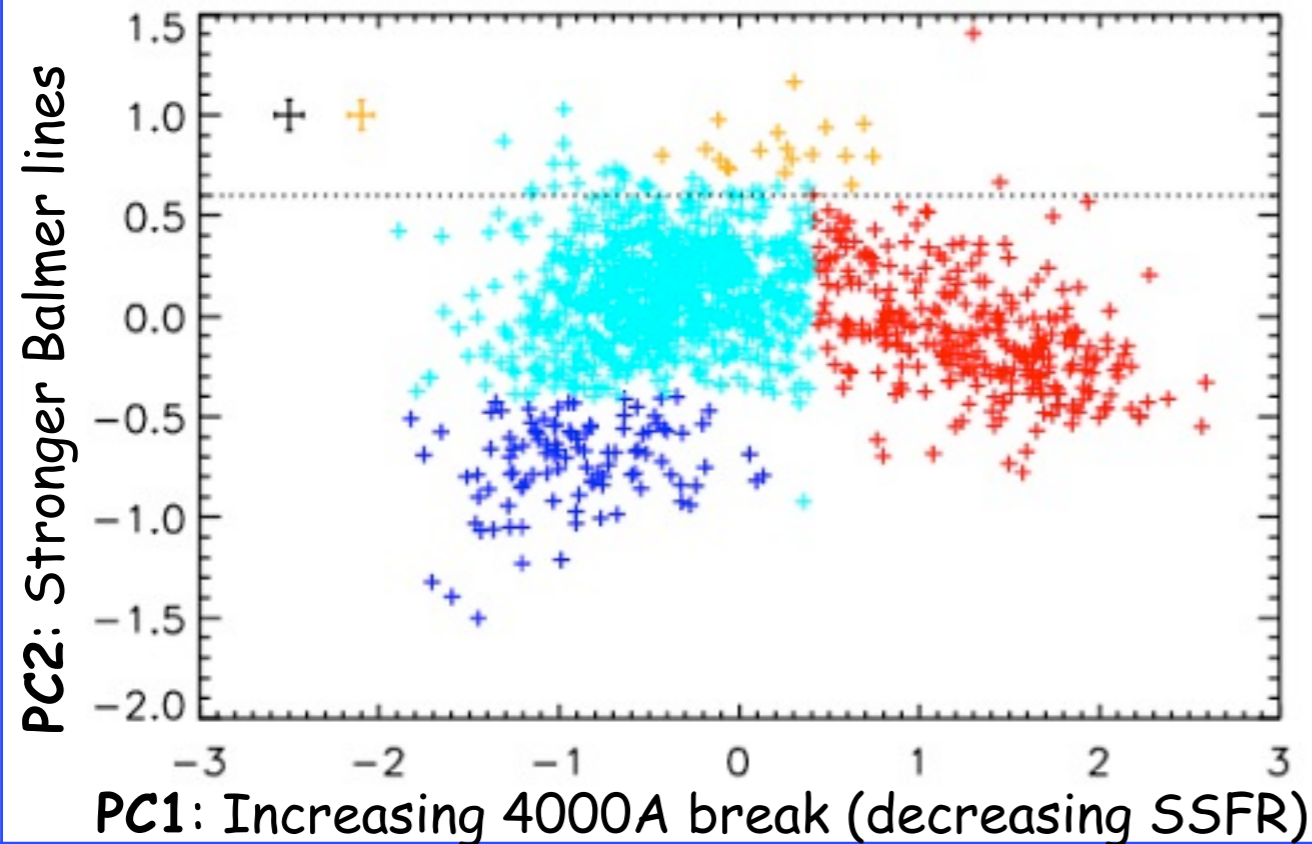
Motivation

◆ Spectra are expensive



Build-up of the red-sequence

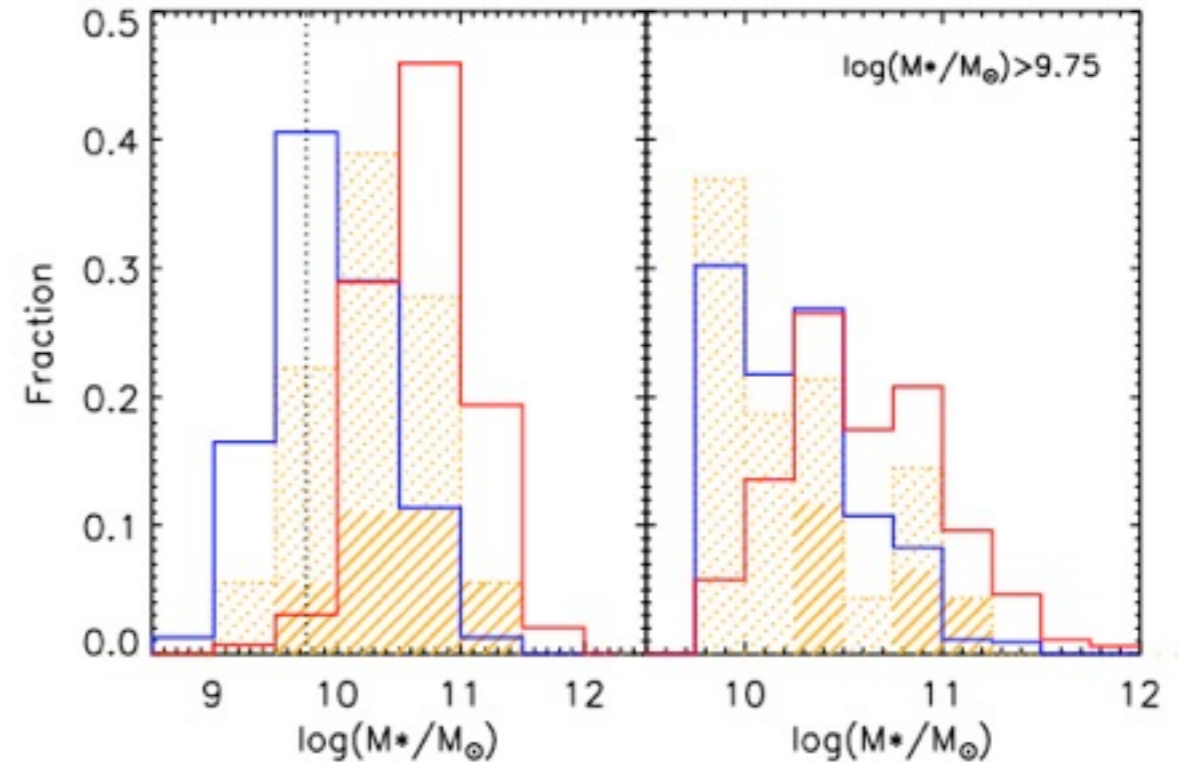
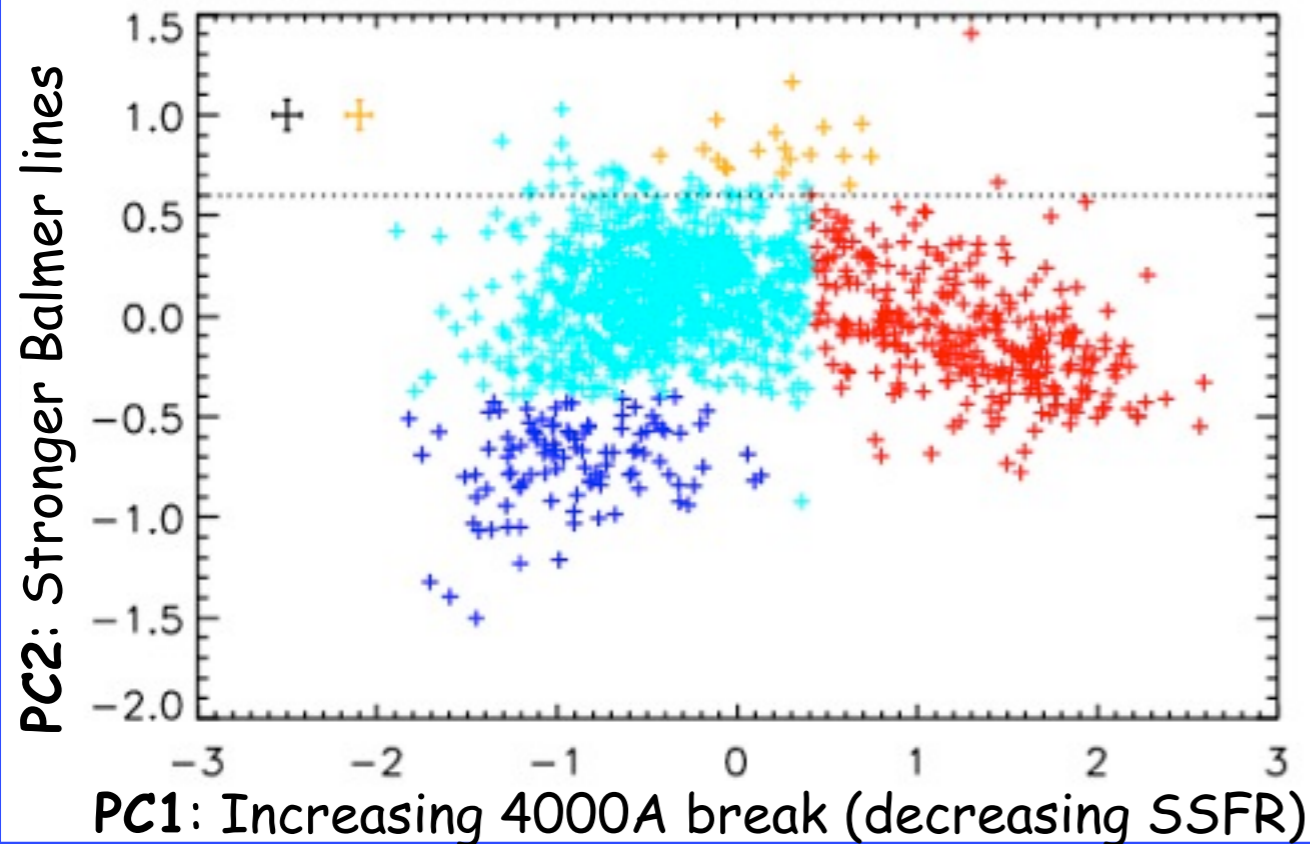
At $z \sim 0.7$ with VVDS ($R \sim 230$ spectra)



Wild, Walcher, Johansson et al. 2009, MNRAS

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At $z \sim 0.7$ with VVDS ($R \sim 230$ spectra)

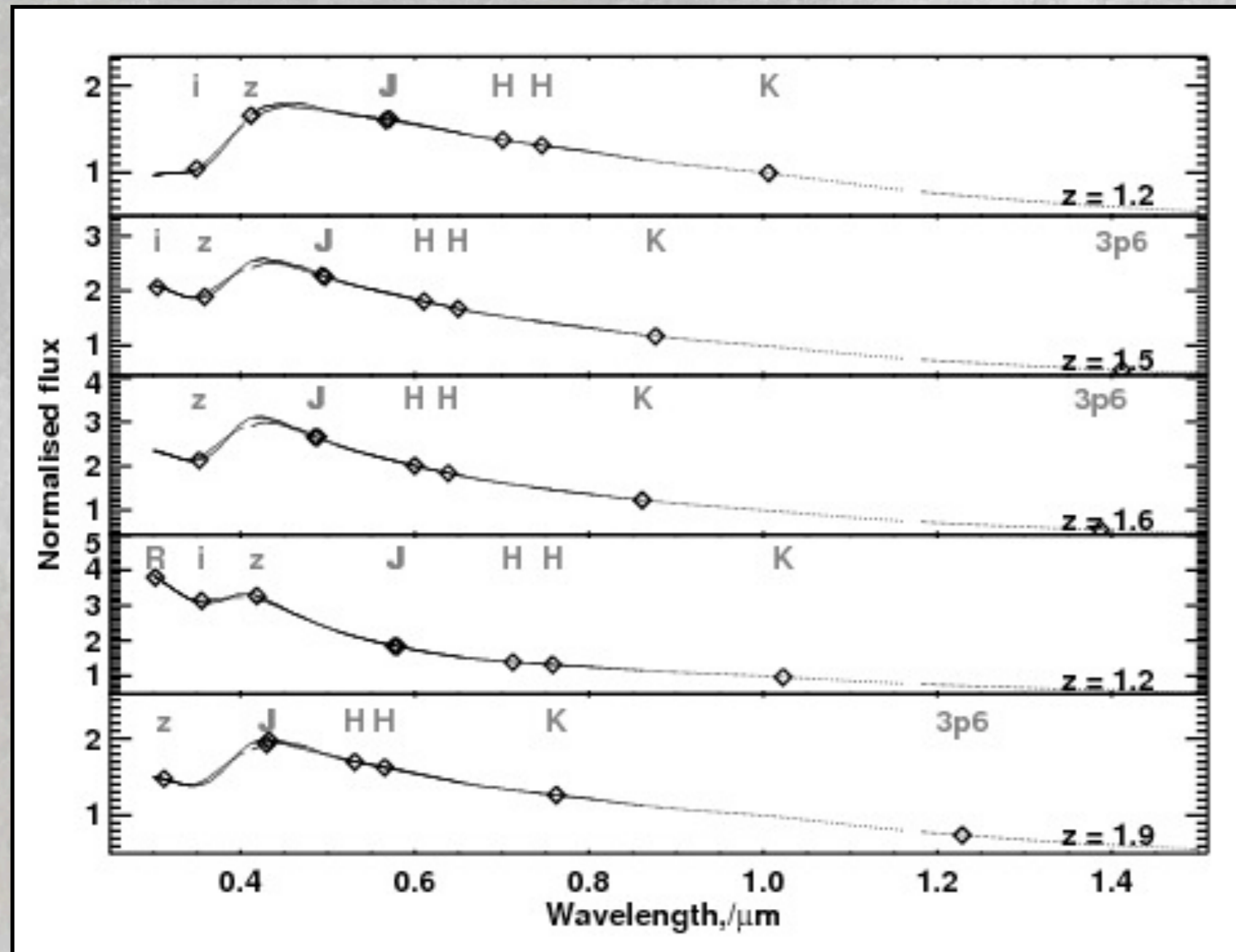


Fraction of red sequence accounted for by post-starburst galaxies (compared to Arnouts et al. 2007):

$$\frac{\dot{\rho}_{B \rightarrow R, \text{PSB}}}{\dot{\rho}_{B \rightarrow R}} = 38^{+4}_{-11}\%$$

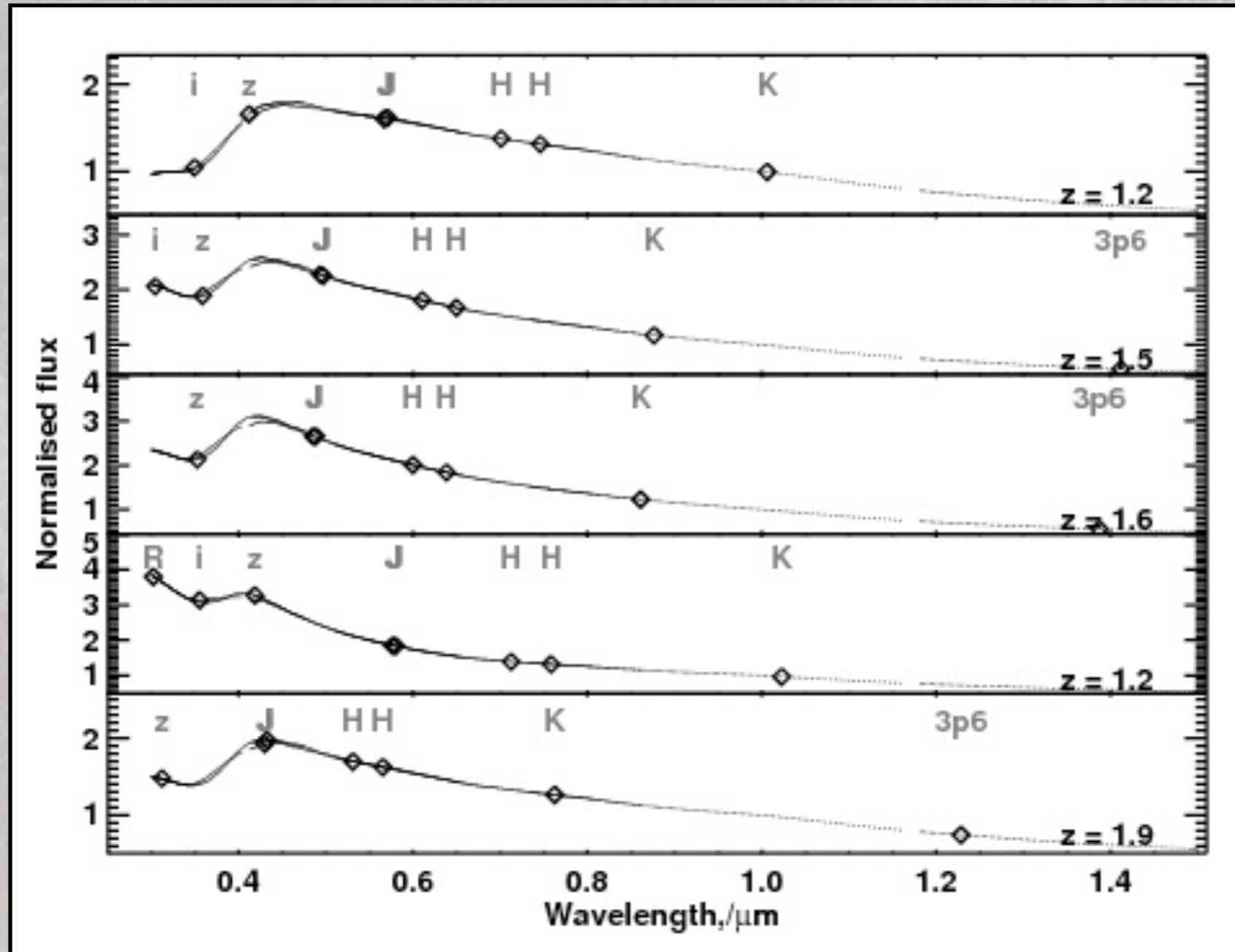
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The problem of K-correction



- ◆ Broad-band data = a massively sparse sampled data array
- ◆ Observed frame colour-colour diagrams have very limited use
 - Have to use SED+SFH+ZH models to K-correct... very model dependent
 - Unlike spectral indices

The problem of K-correction

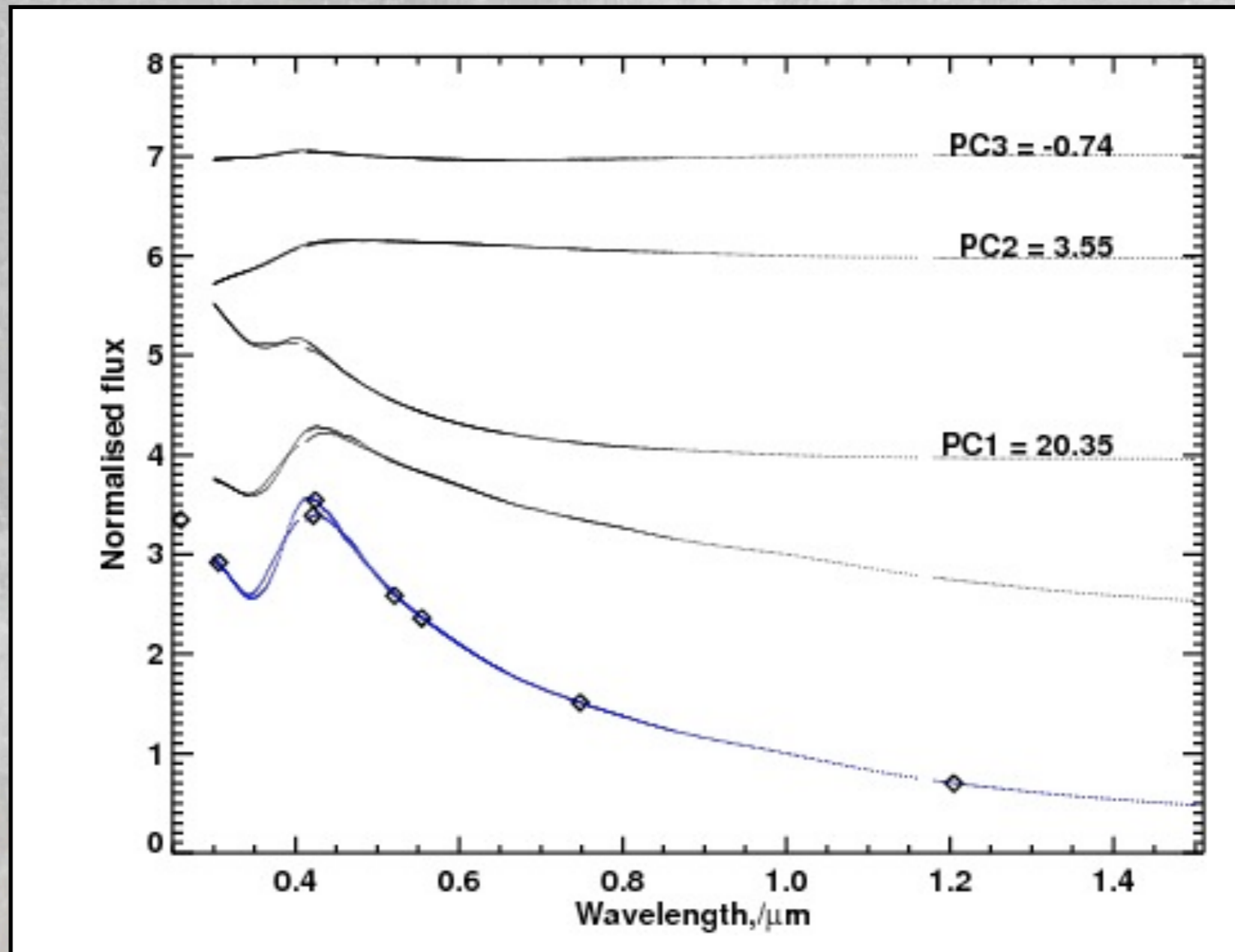


Most of wavelength space is covered by some galaxy at some redshift

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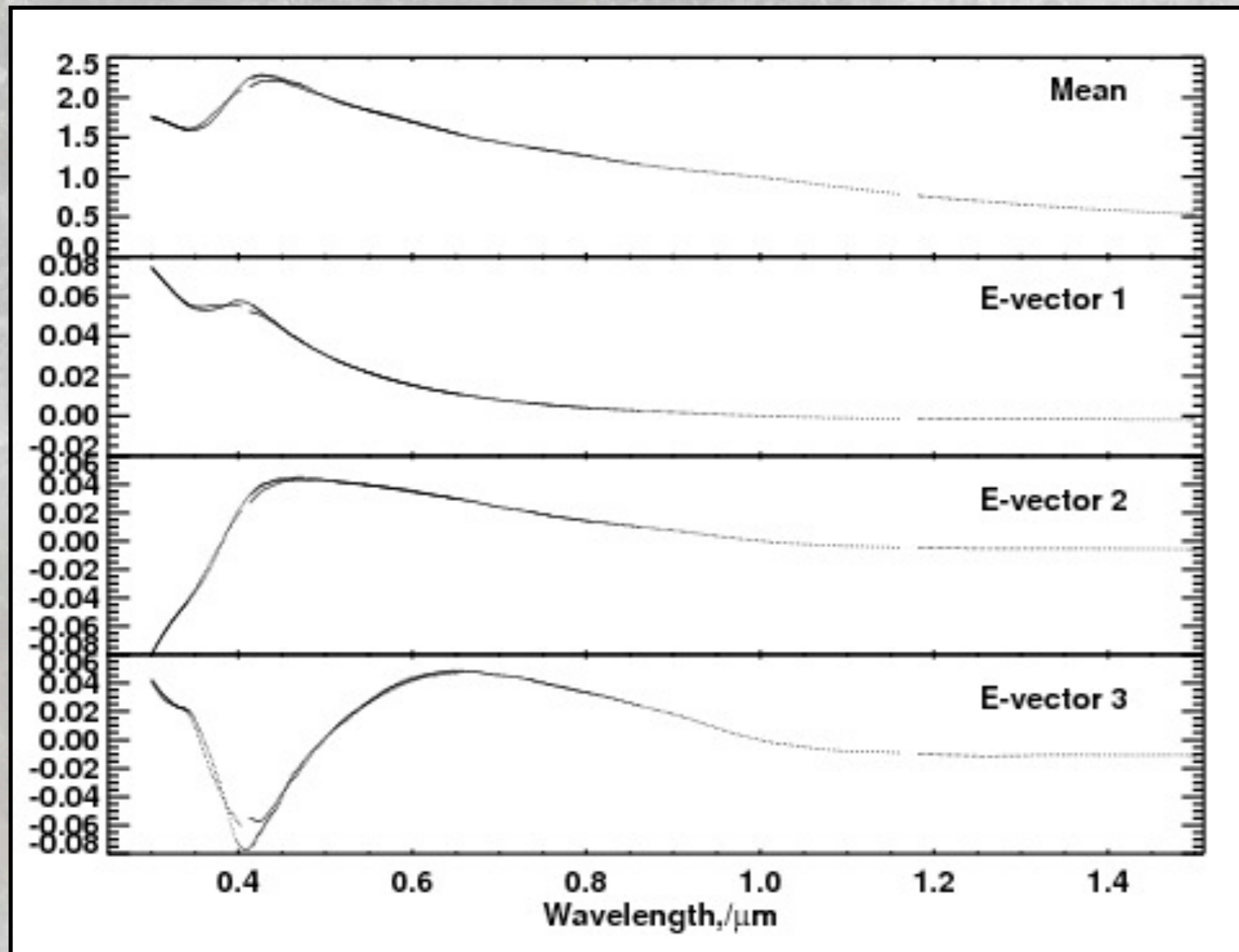
Stellar populations with PCA

Espec 3 →
+
Espec 2 →
+
Espec 1 →
+
Mean →
=
Galaxy →
PCA
reconstruction



- ◆ A (mock) $z = 1.92$ galaxy, observed in the UDS field
- ◆ Subaru BVRiz, CANDELS JH, UKIRT JHK, SEDS 3.6 and 4.5 μm

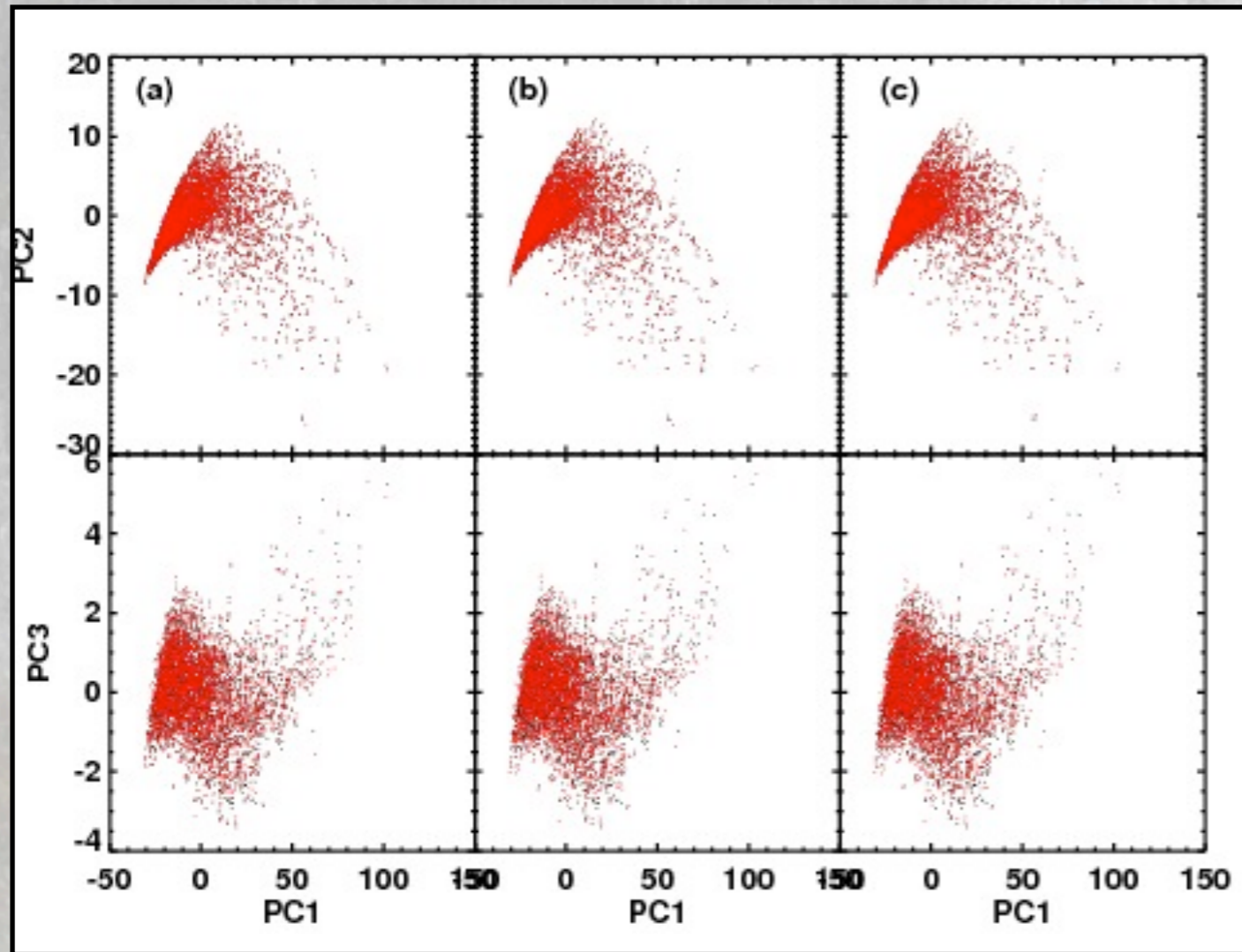
PCA on photometric datasets



These three supercolours account for 99.98% of the variance in the SED shapes

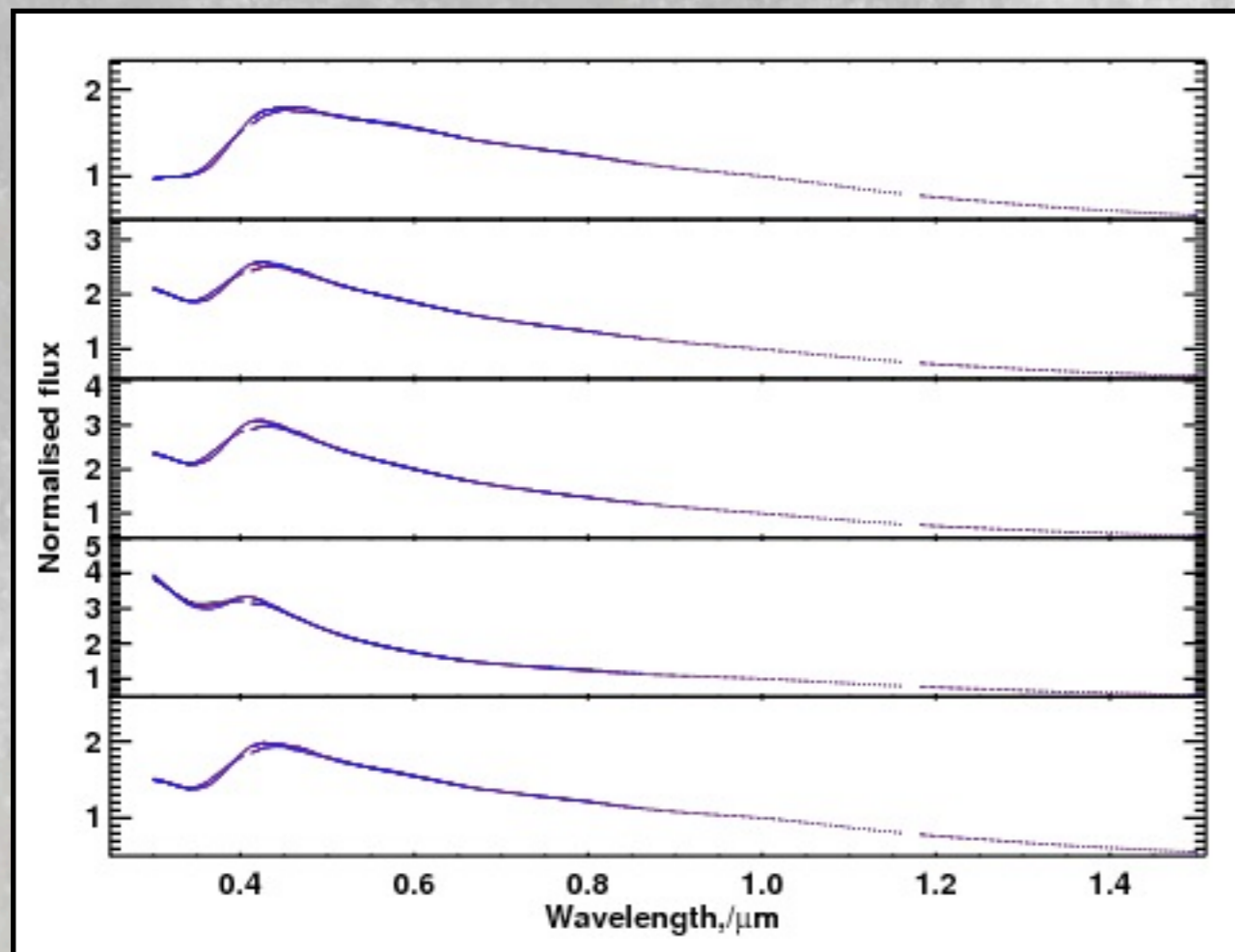
They are **redshift independent** "colours"

(lack of) information loss



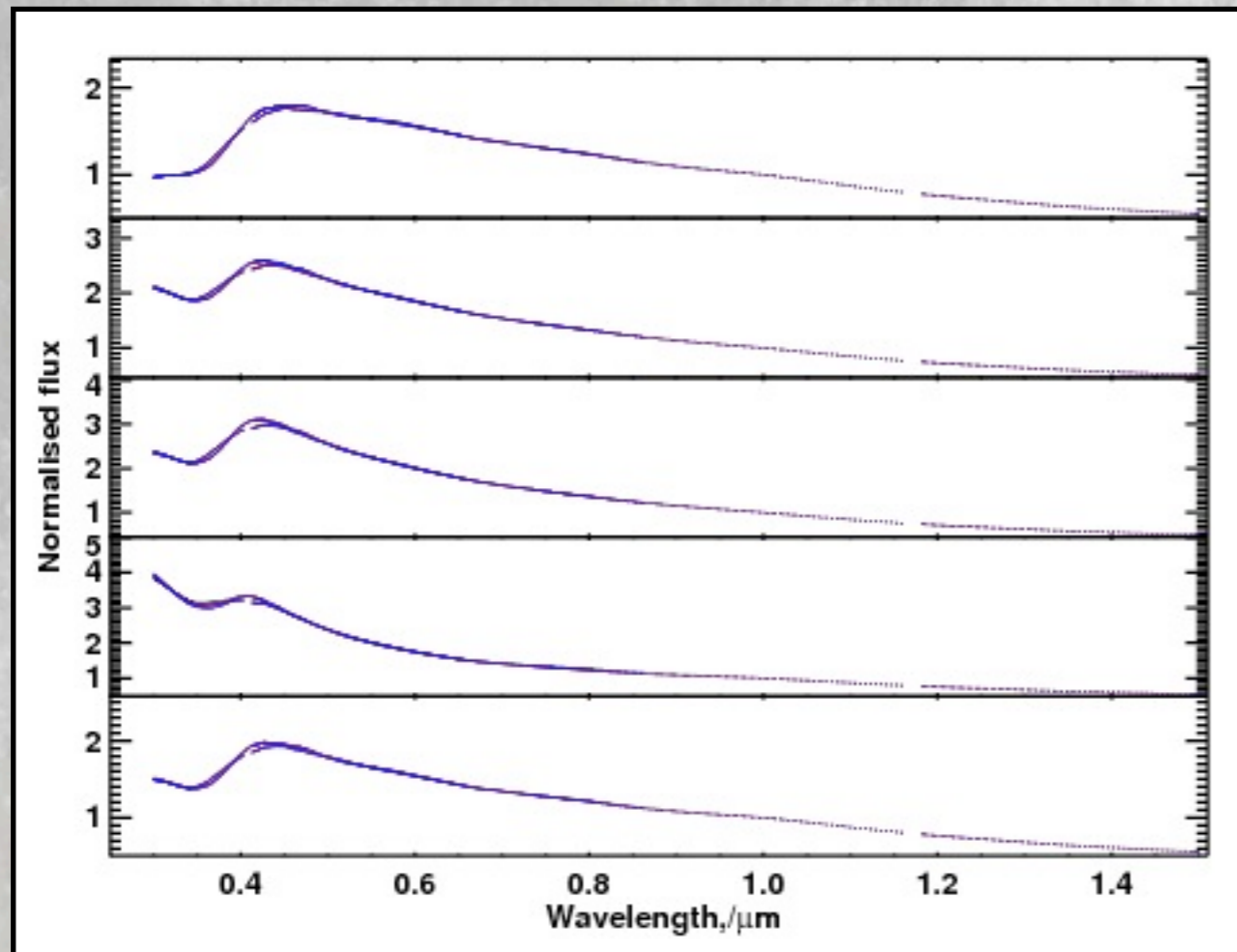
- ◆ black: complete array 0.3-1.5 μ m, sampled by 10 bands every $\delta z=0.01$
- ◆ red: incomplete data
 - a: using only 10 bands
 - b: unknown normalisation
 - c: with photo-z errors

(lack of) information loss



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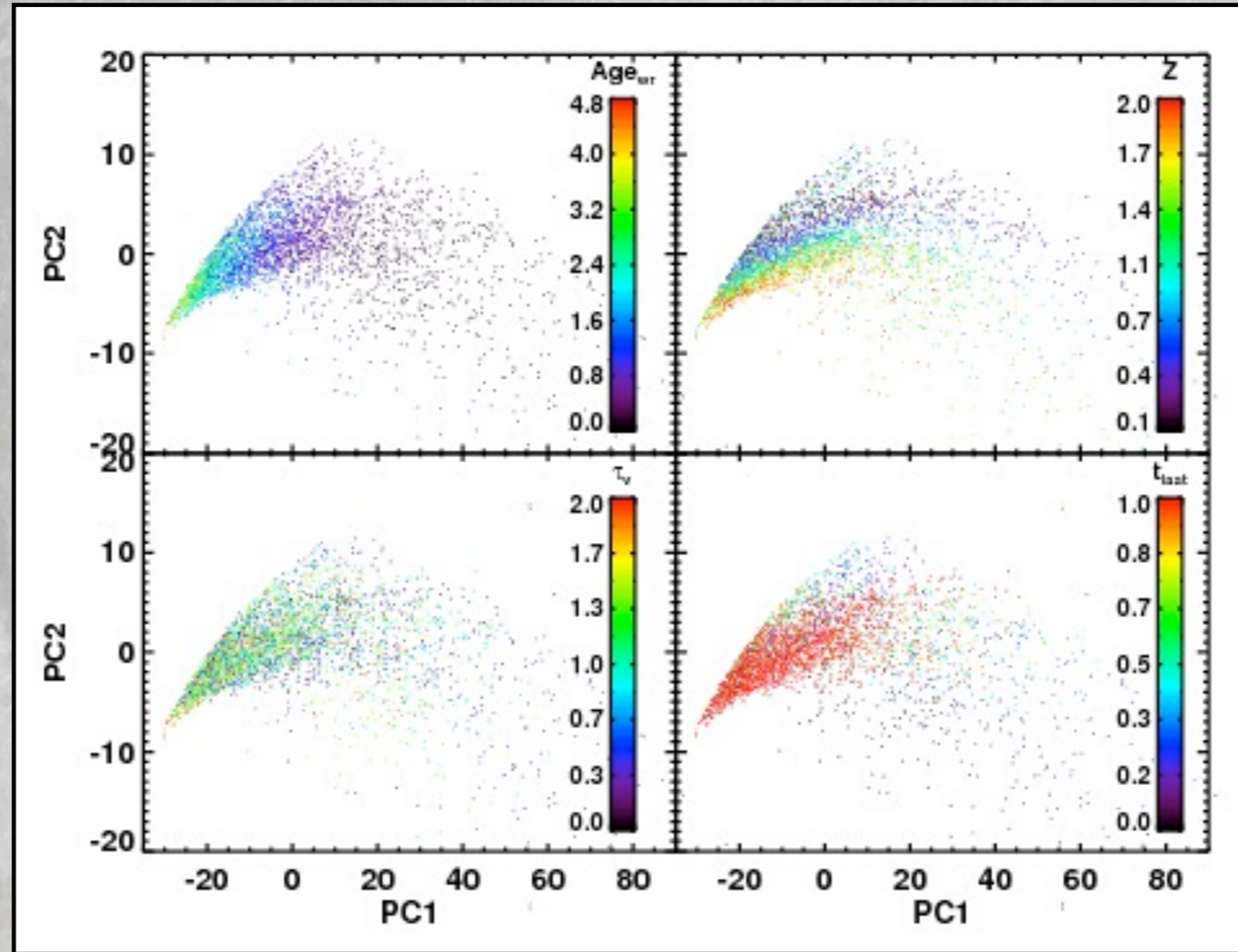
(lack of) information loss



Very little information is lost by the “gappy” nature of the dataset
(plenty is lost by the low resolution - but we’re stuck with that)

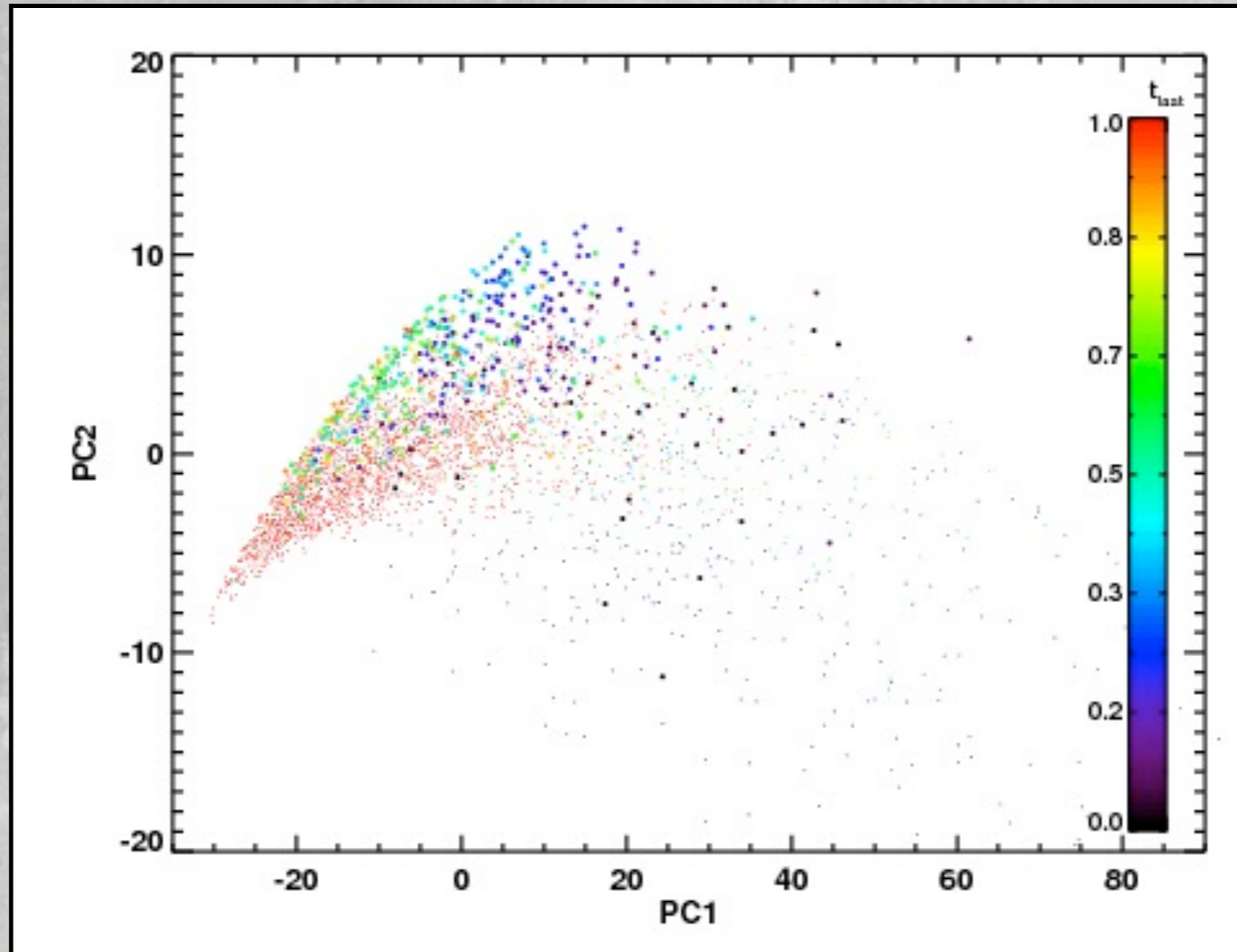
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Information content



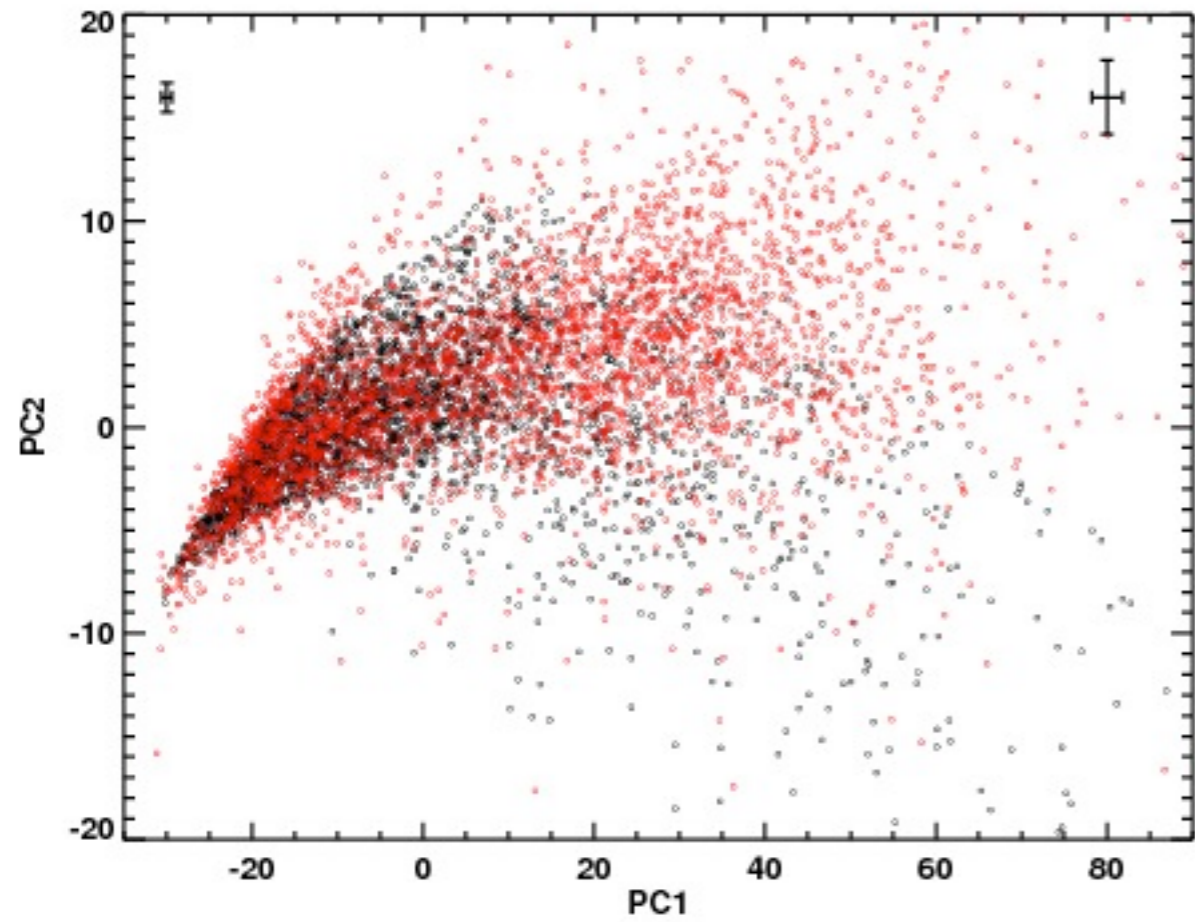
- ◆ Need models to link supercolours to physical parameters
- ◆ Can clearly identify a plume of post-starburst galaxies
 - Starburst $1e7 \rightarrow 1e9$ years ago
 - Burst mass fraction $\sim 30\%$

Information content

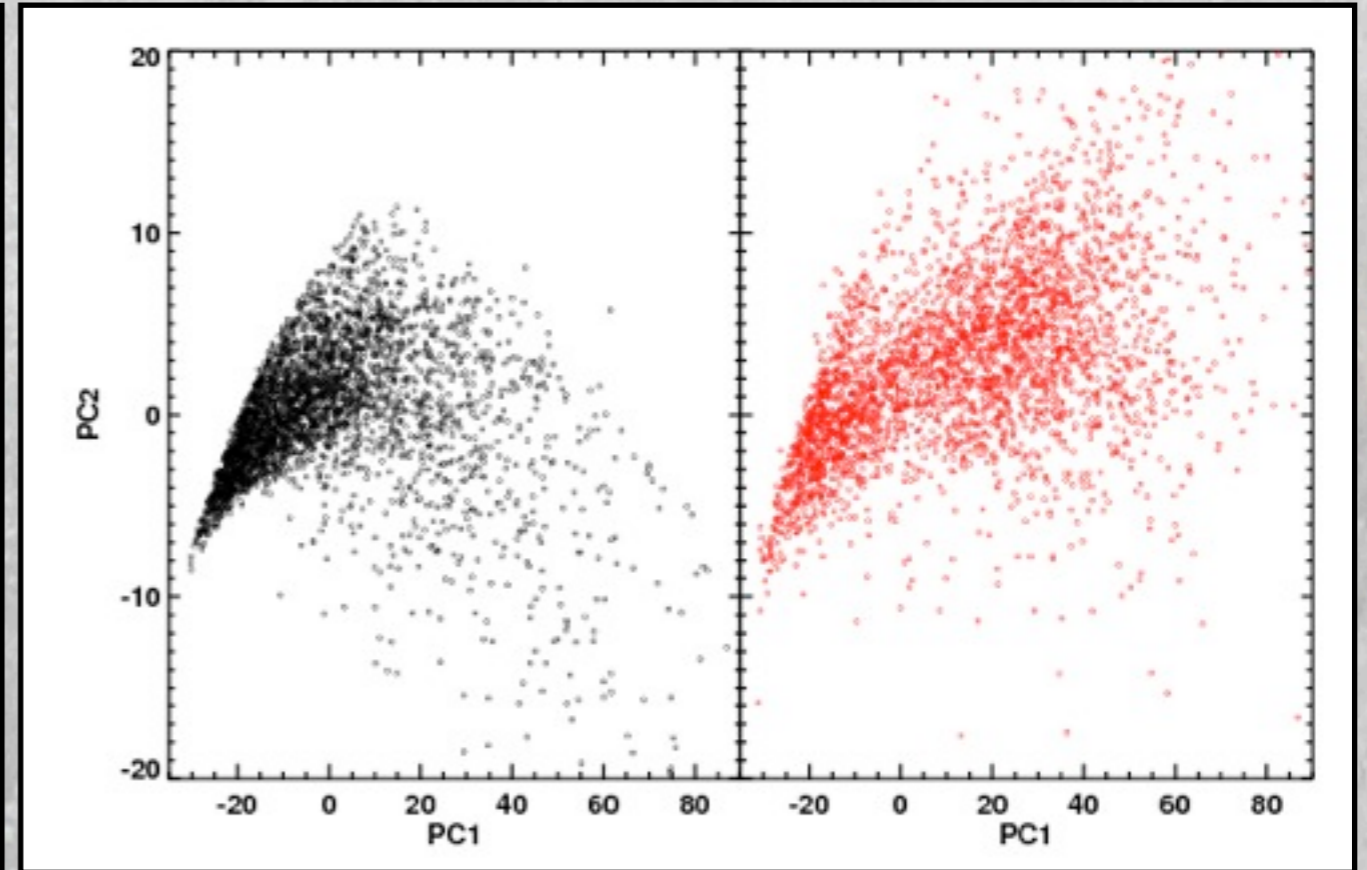
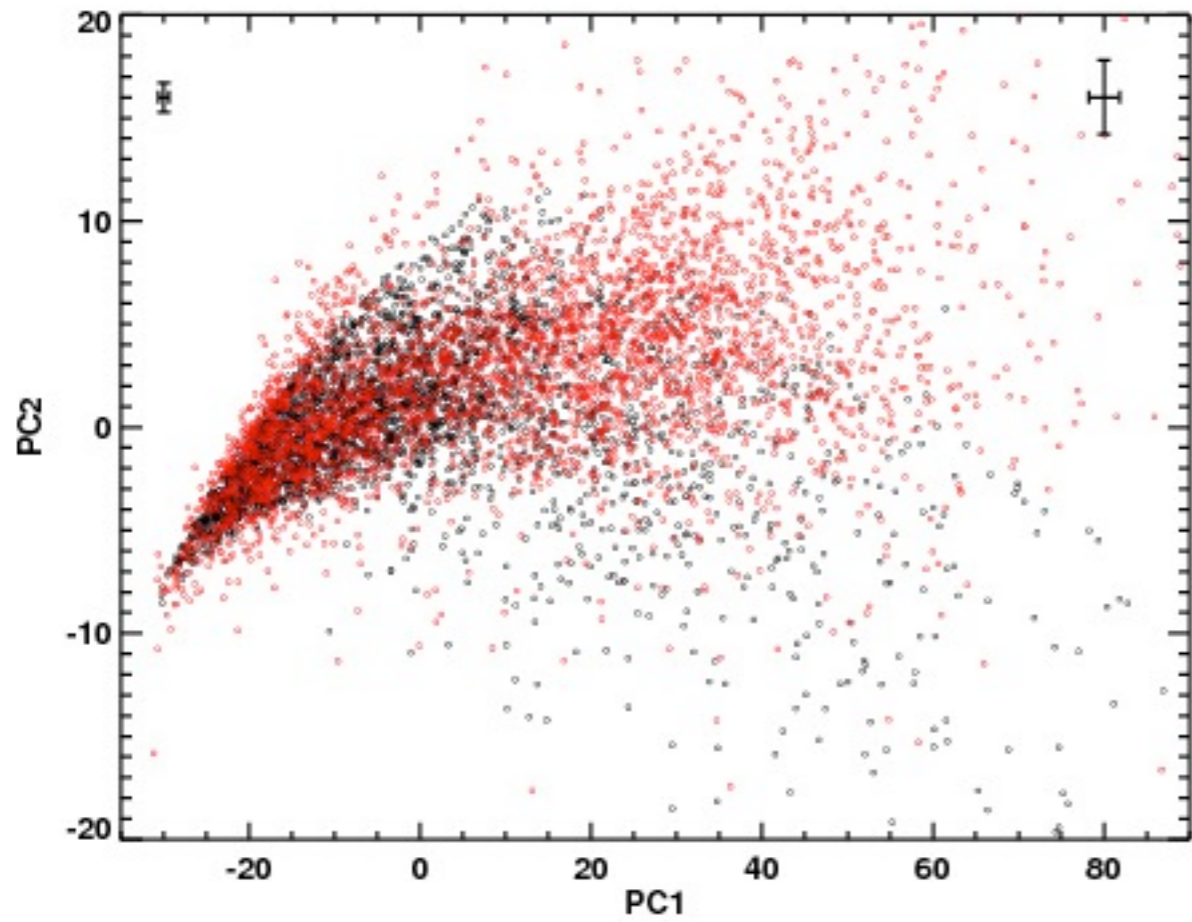


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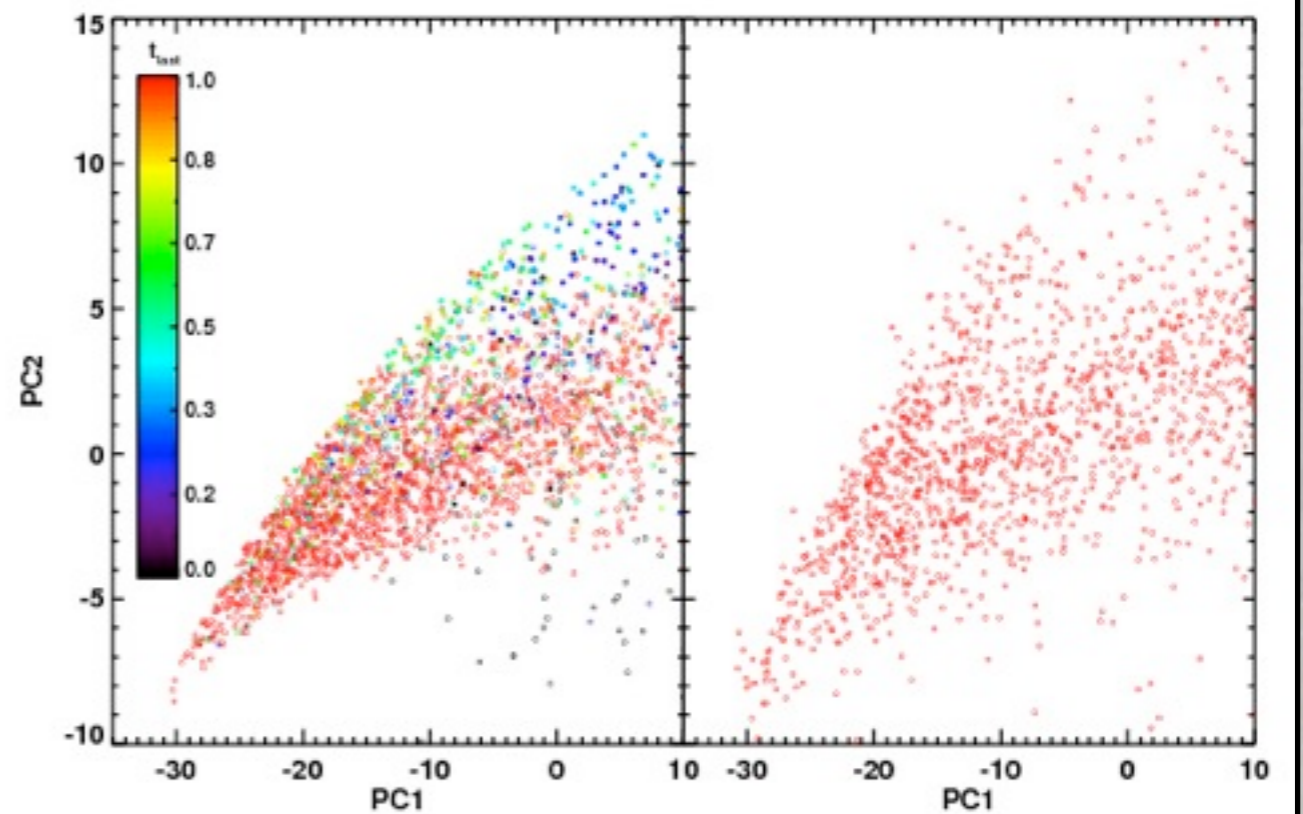
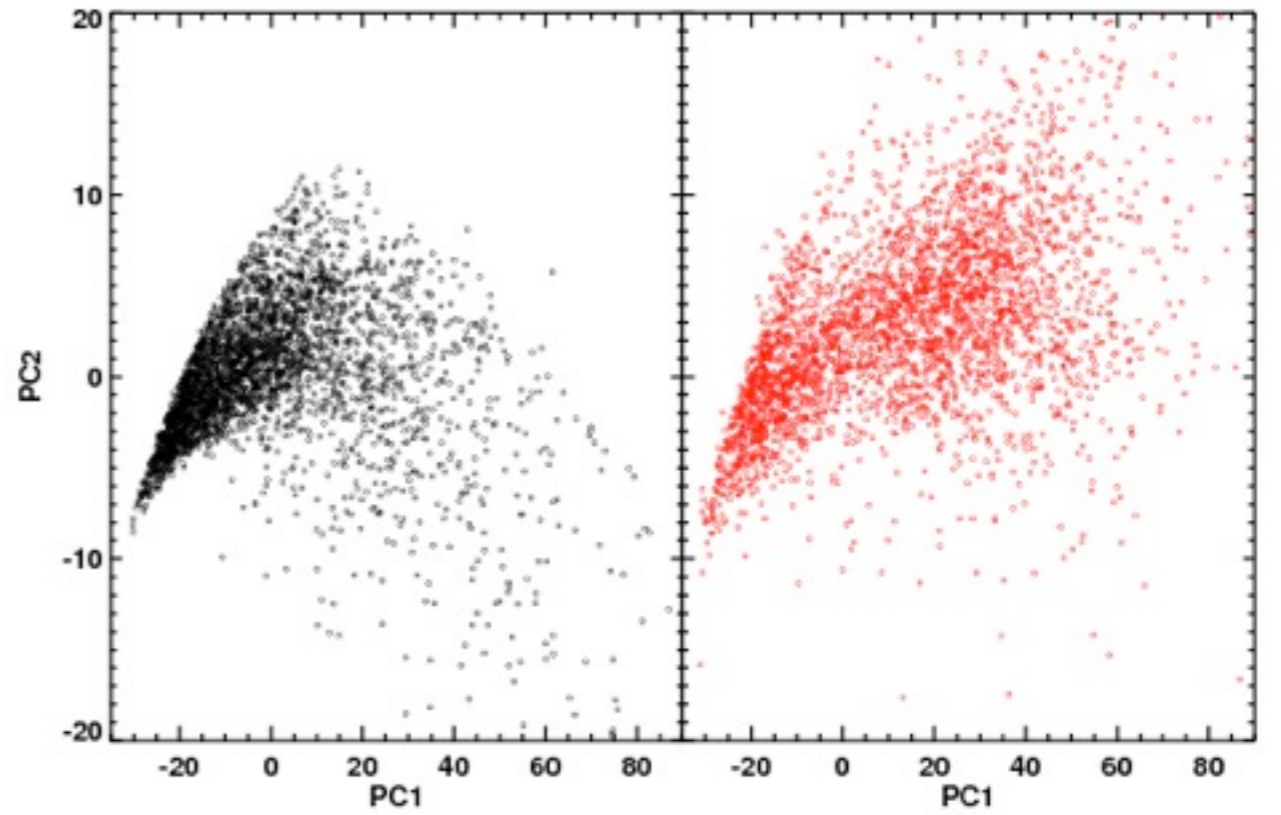
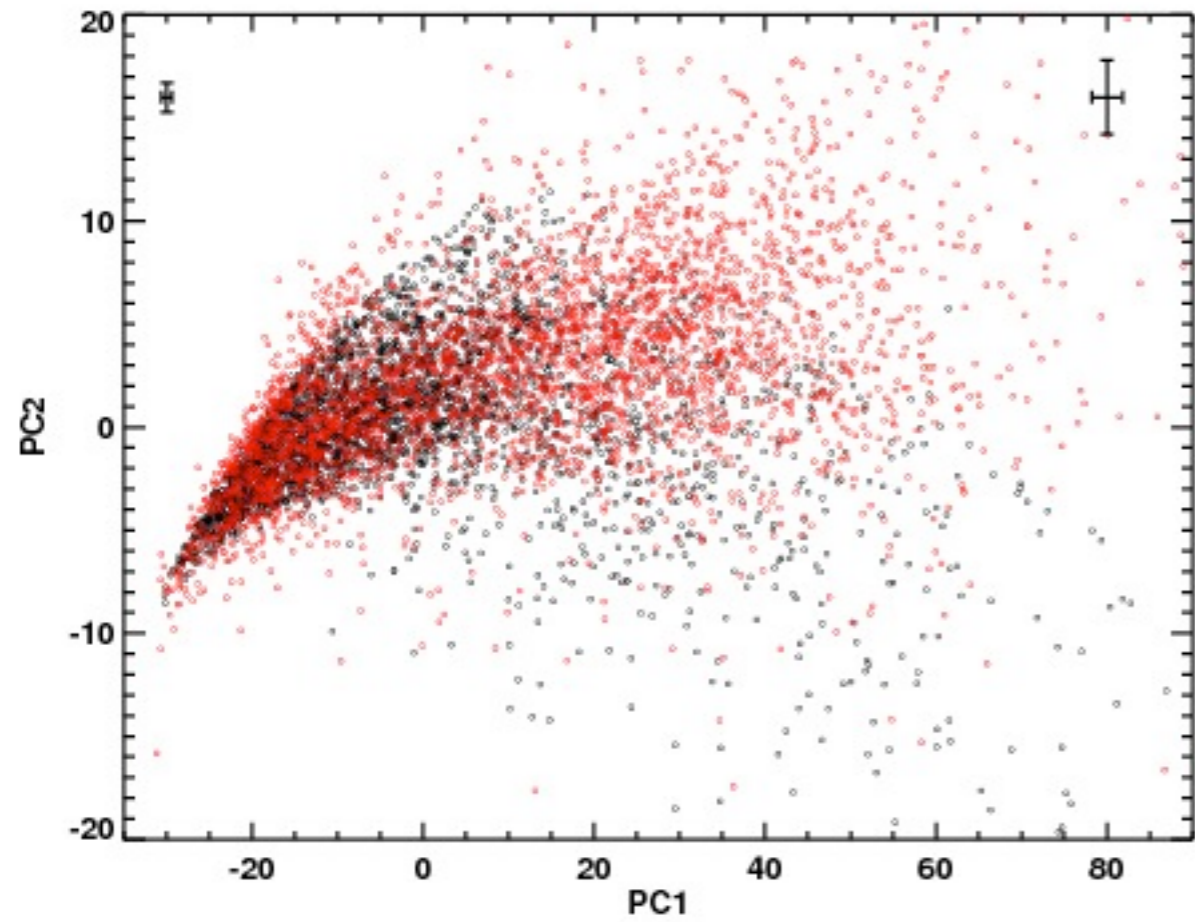
Data vs. models



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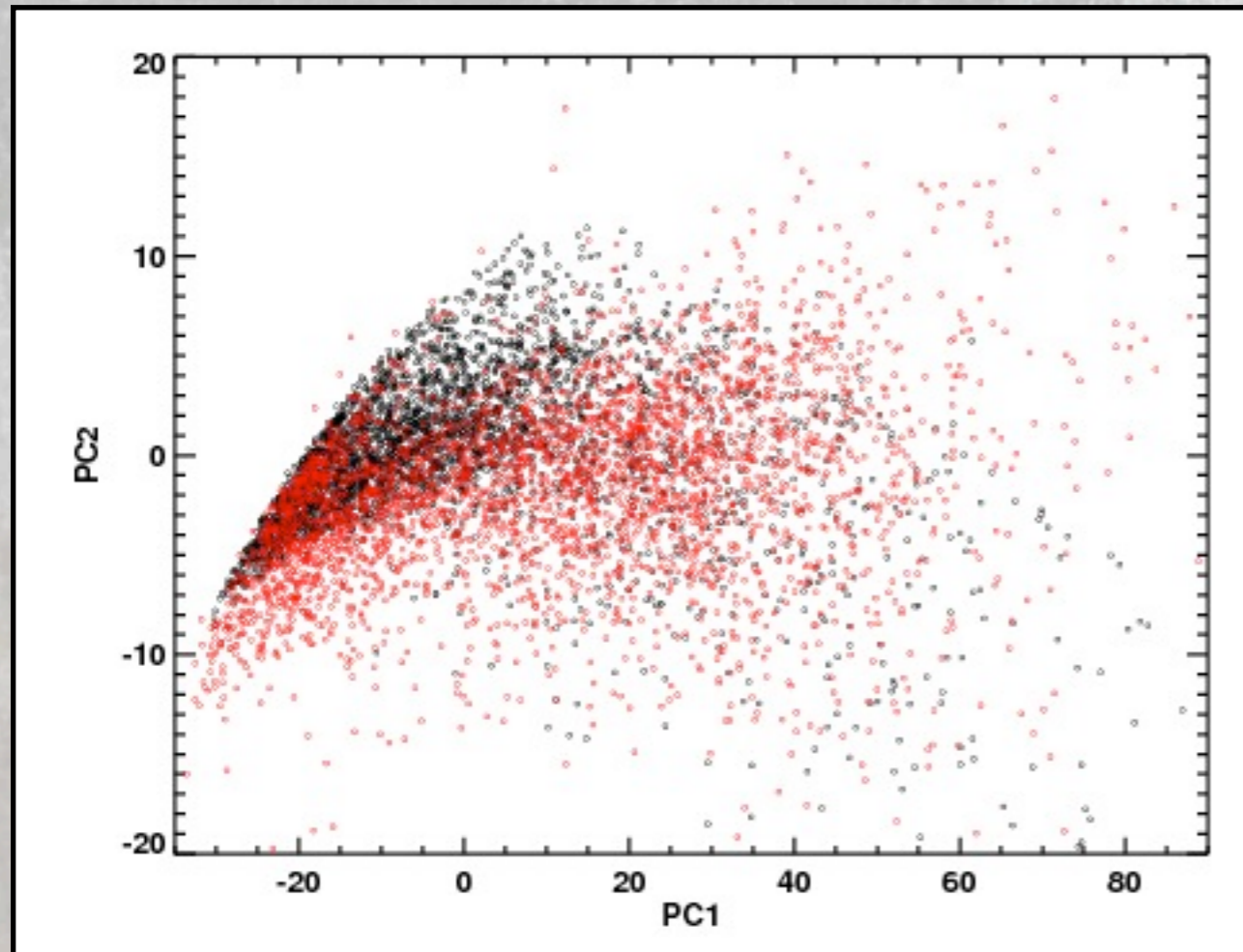


Data vs. models



Beware the data/models

Zero-point offsets / total photometry errors First order error analyses (σ_z) mask problems



◆ Data:

- Zero-point offsets / total photometry errors
- photo-z's

◆ Models

- Wrong SFHs, dust, spec. synth. methods, emission lines

Conclusions

◆ Super-colours

- Redshift independent measure of SED shape
- Visualise entire dataset (e.g. mass limited galaxy population)
- Spot problems (photo-z, photometry, spec.synth., model SFH)
- Identify interesting sub-populations with limited model reliance

◆ Post-starbursts

- Starburst -> post-starburst -> quiescent
 - A potentially important channel for building the red sequence
- Can measure a mass flux (RS build-up rate), fairly directly
- Will be able to track the morphology over ~1 Gyr