Structural transformation and quenching in massive post-starburst galaxies

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Summary

- Identifying PSBs in deep photometric surveys (Wild et al. 2014)
- Spectroscopic confirmation (Maltby et al. 2016)
- PSB mass functions at z>1 (Wild et al. 2016)
- PSB structural parameters (Almaini et al. 2016)
- Conclusions





Hubble Heritage

The UKIDSS Ultra-Deep Survey Deepest NIR survey over ~1 sq deg



New depths: J=25.6, H=25.1, K=25.3 (AB, 5σ, 2" apertures) www.nottingham.ac.uk/astronomy/UDS

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 (VISTA + UKIRT): Y=24.4, J=25.6, H=25.1, K=25.3 (AB)

Near-IR (Spitzer IRAC): SPUDS: ~24 (AB) 3.6, 4.5μm SEDS: ~26 (AB) at 3.6, 4.5μm

Mid-IR (Spitzer IRAC) ~80µJy 24µm (SPUDS)

X-ray: XMM-Newton 100ks + 6x50ks Chandra (1.25 Ms)

Radio: VLA 12 μJy rms 1.4Ghz



Hartley et al. (2013)

Identifying post-starburst galaxies

Classifying galaxies with PCA "super-colours"



Wild et al. 2014

Identifying post-starburst galaxies with deep UDS photometry



Wild et al. (2014)

Spectroscopic confirmation of PSBs

Majority of PSB candidates show clear PSB/E+A signatures

→ 19/24 (~80%) strong Hδ absorption (W_{Hδ} > 5 Å)
→ 14/24 (~60%) strong Hδ (W_{Hδ} > 5 Å) & weak [OII] (W_[OII] > -5 Å)



Maltby et al. (2016)

Comparison of PCA and UVJ selection 1<z<2



Almaini et al. (2016), c.f. Whitaker et al. (2012)

Massive post-starbursts more common at z>1 SF, passive, PSB



Mass function evolution: Massive post-starbursts more common at z>1



Wild et al. (2016)

Quenching timescales (assuming all quiescent galaxies were PSBs)



Structural Transformation

Measuring galaxy sizes – ground vs space SF, passive, PSB $(M_* > 10^{10} M_{\odot})$



High-z post-starburst galaxies are ultra-compact 1<z<2



Almaini et al. (submitted)

High-z post-starburst galaxies are ultra-compact Confirmation with CANDELS



Almaini et al. (submitted)

High-z post-starburst galaxies are ultra-compact Splitting by redshift



Almaini et al. (submitted)

Measuring Sérsic Indices – ground vs space

SF, passive, PSB ($M_* > 10^{10} M_{\odot}$)



Sérsic index distributions (SF, passive, PSB) z>1 M_{*} >10¹⁰ M_☉



Almaini et al. (submitted)

Summary and conclusions

- New PCA technique for classifying galaxy SEDs
- Identified ~500 post-starburst candidates at z>1
- PSBs account for large fraction of red sequence build-up
- PSBs are highly compact, with high Sérsic indices

Morphological transformation occurs before (or during) quenching event

Gas richer merger (disk instability?) => Dissipational collapse ("compactification") => Quenched "red nugget" [AGN, SF winds?] => Gradual growth through minor mergers