Triggering processes and star formation in AGN: Multi-wavelength matters.

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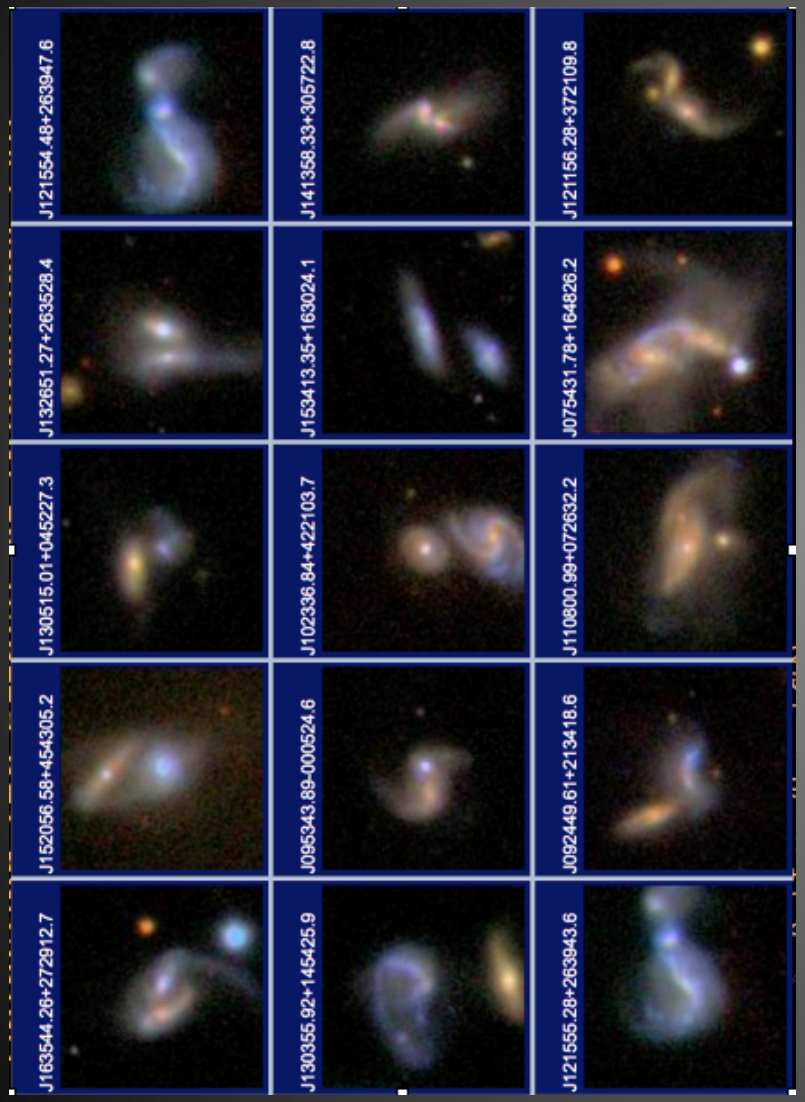
Galaxy pairs in the SDSS

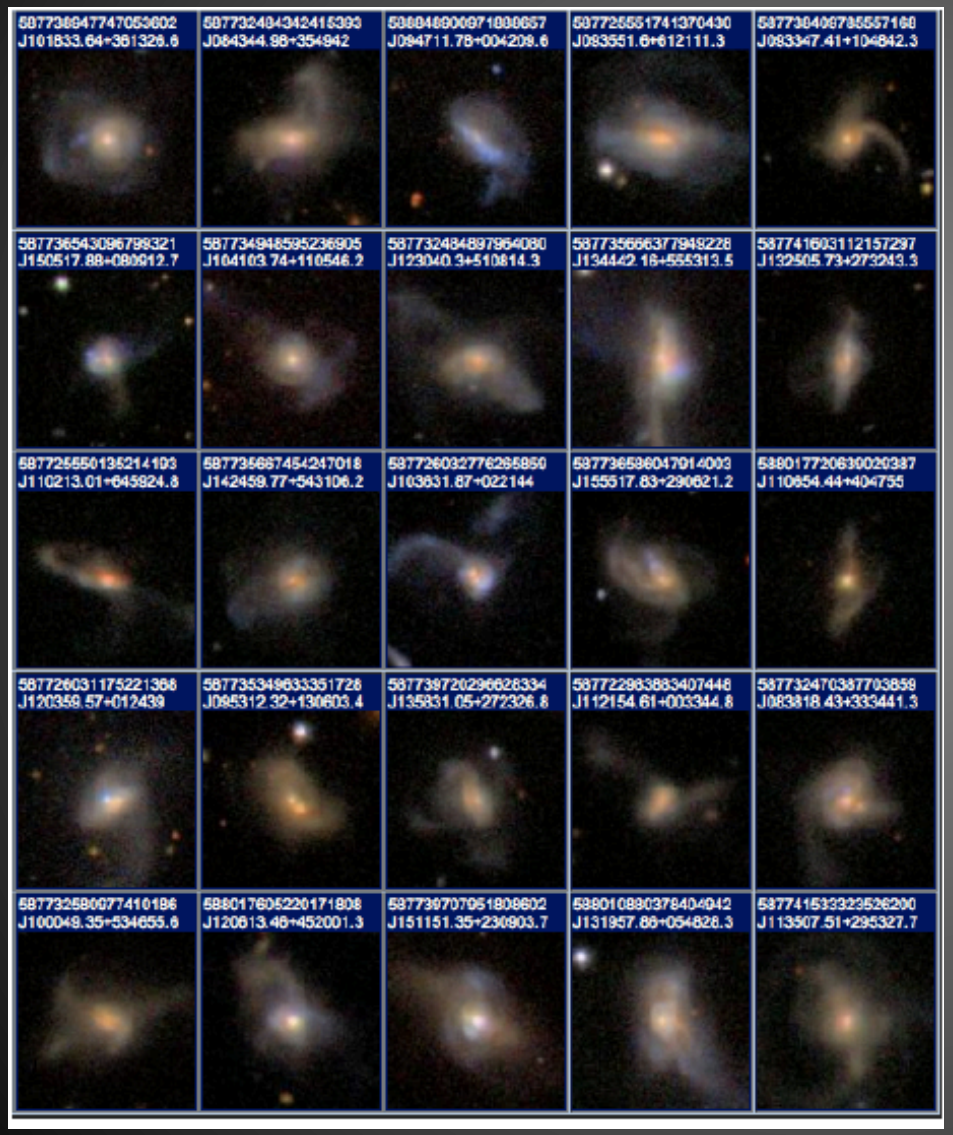


DR7 pairs sample:
Projected separation <80 kpc
ΔV <300 km/s
Mass ratio 0.1 - 10

Yields: ~14,000 galaxies in pairs.

Construct control samples that are matched in mass, redshift and environment: typically 100s control galaxies per pair.

Post-merger sample

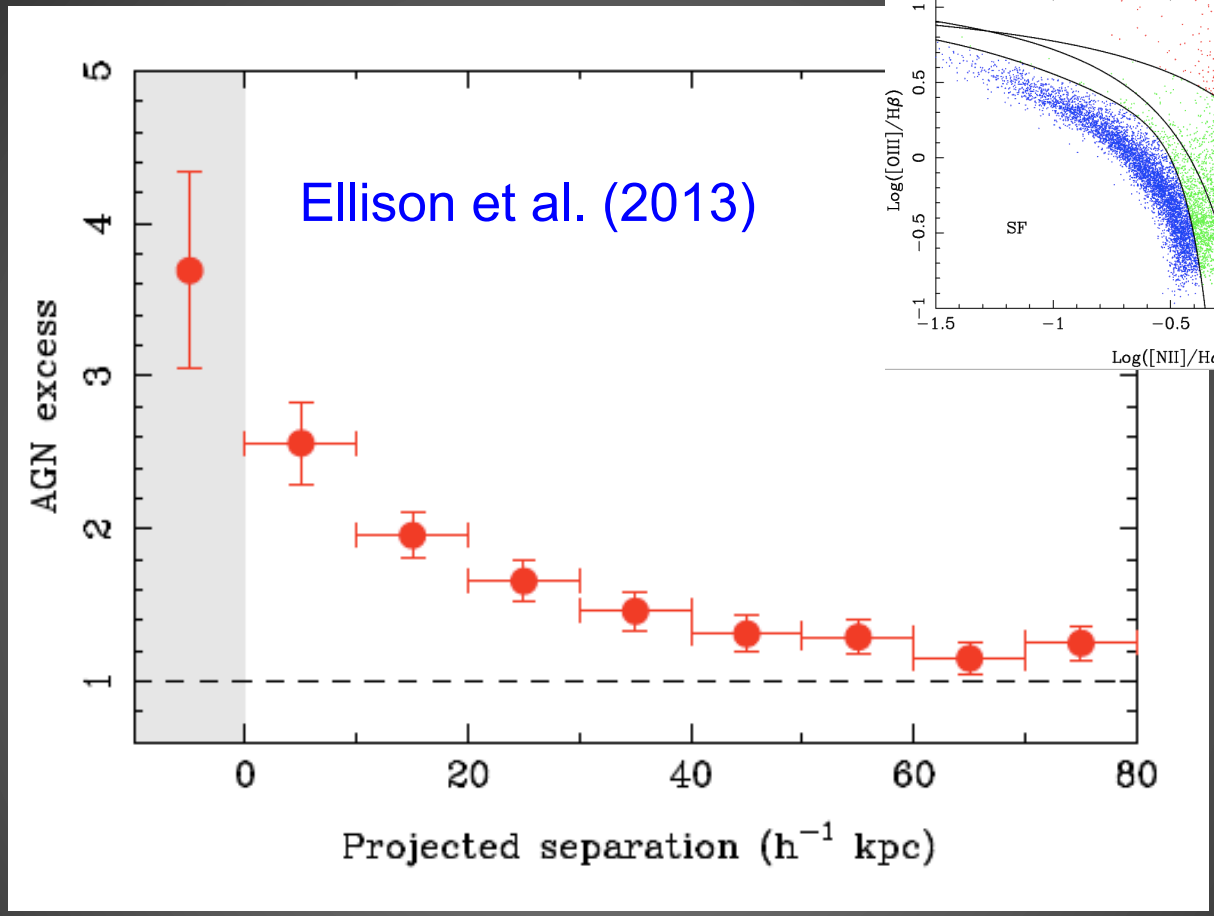


97 visually selected post-mergers from Galaxy Zoo.

Control matching and analysis done exactly same as for pairs.

AGN frequency: from optical emission lines

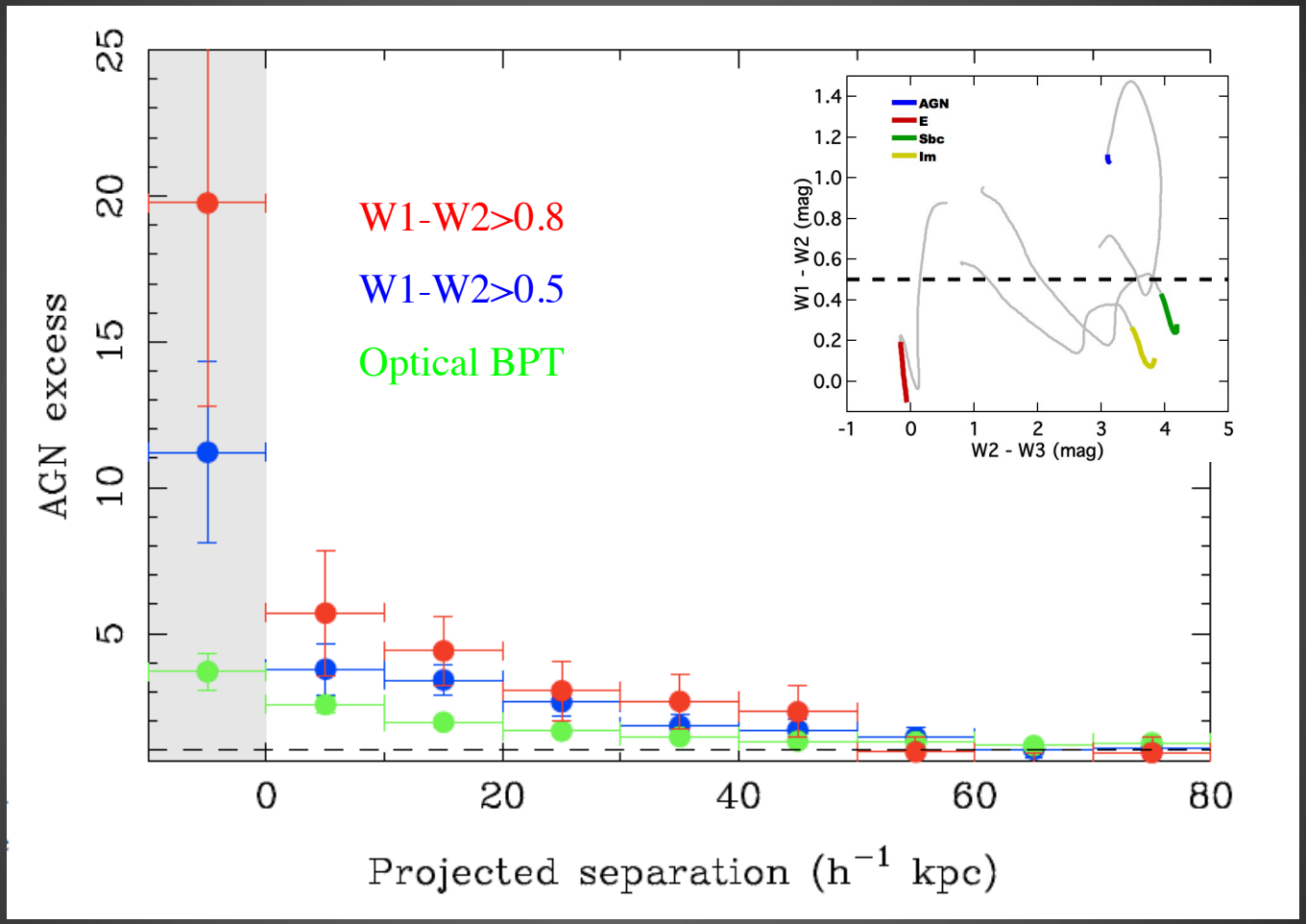
Merger AGN fraction/control AGN fraction



Although AGN *may* be triggered by first pass, fraction increases most strongly after coalescence

See also Ellison et al. (2011), Khabiboulline et al. (2014)

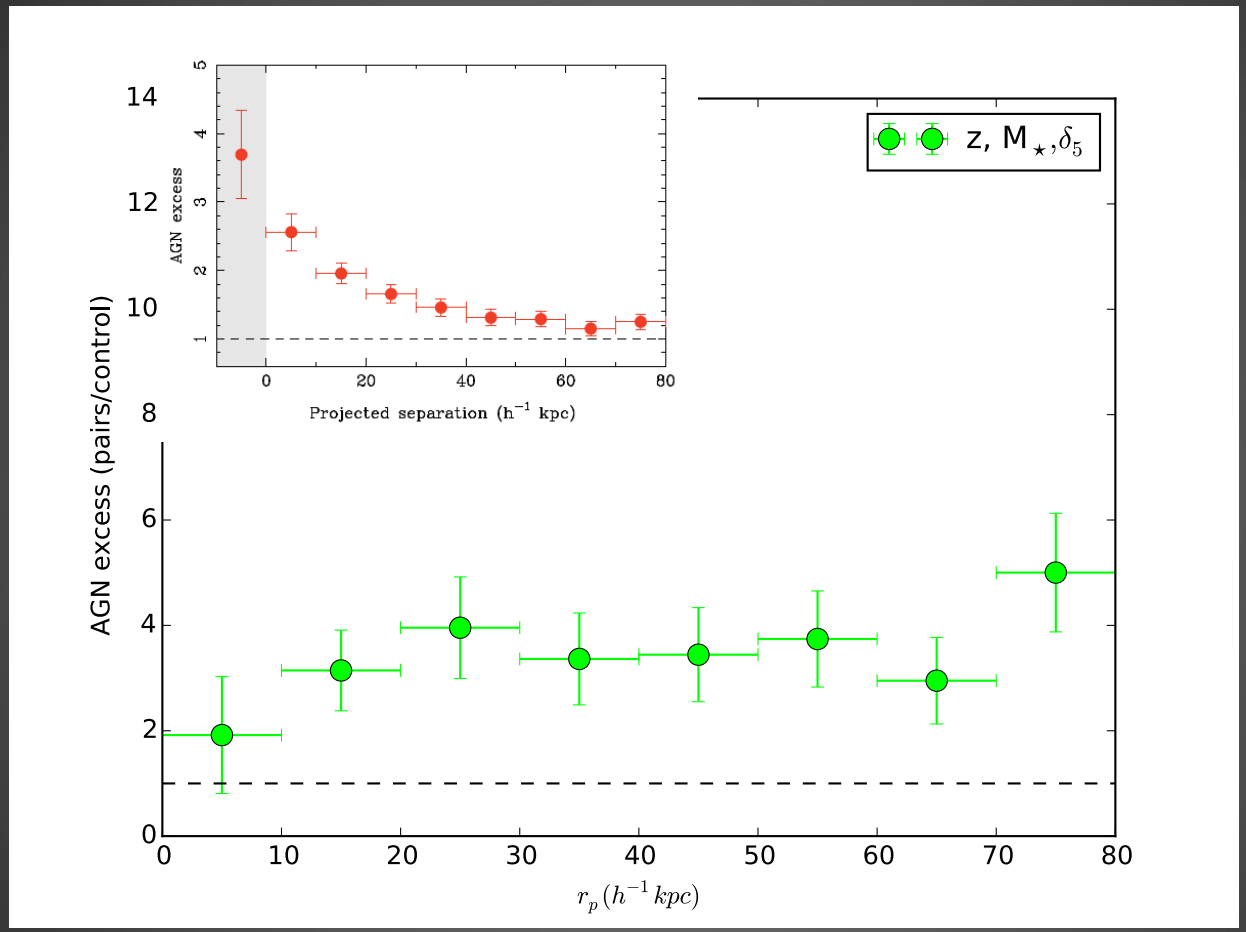
AGN frequency: from mid-IR colours



Significant fraction of merger triggered AGN are dust obscured and not seen as AGN in optical.

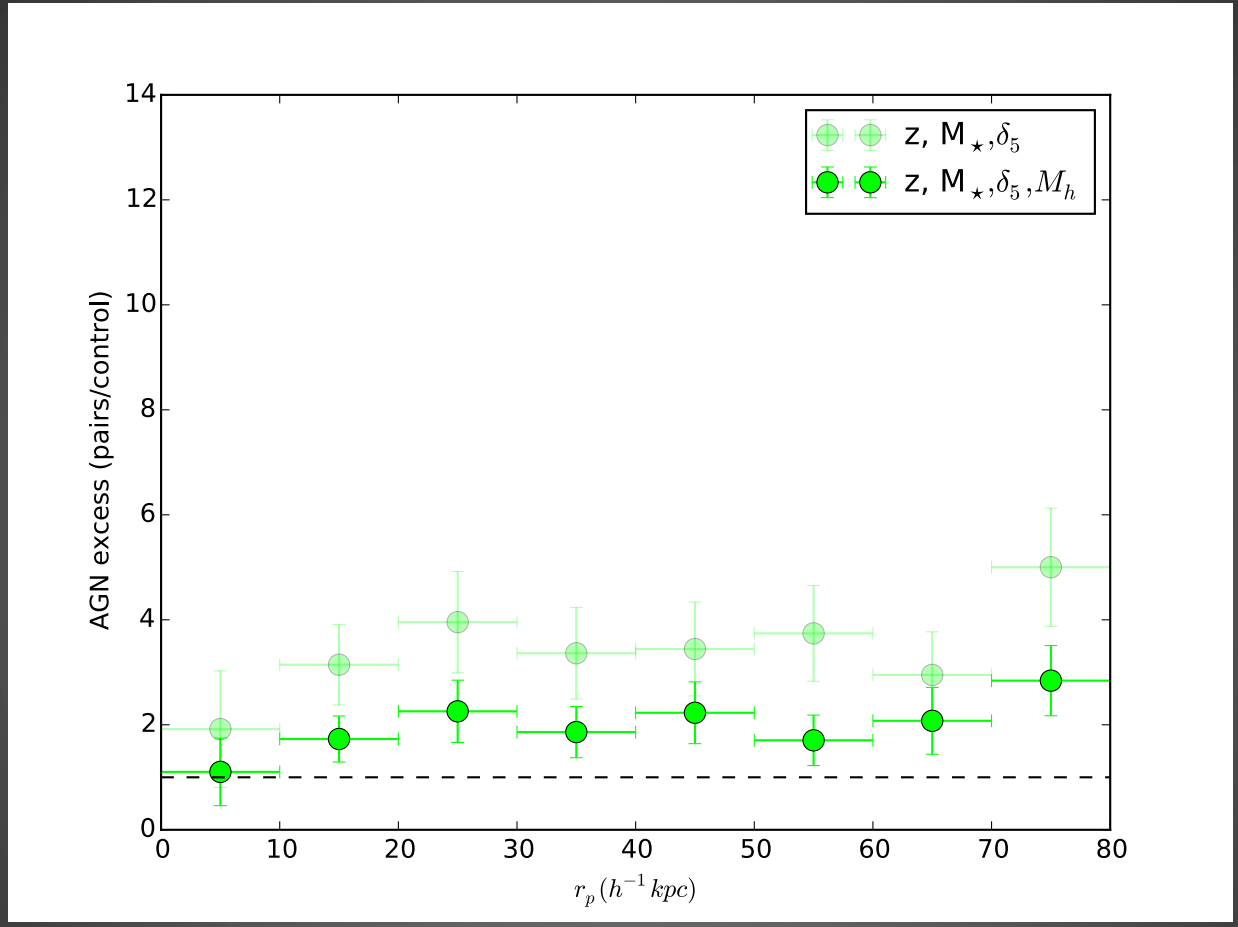
Satyapal et al. (2014)

Radio-selected AGN (LERGs = radiatively inefficient/radio mode) Selected from Best & Heckman (2012)



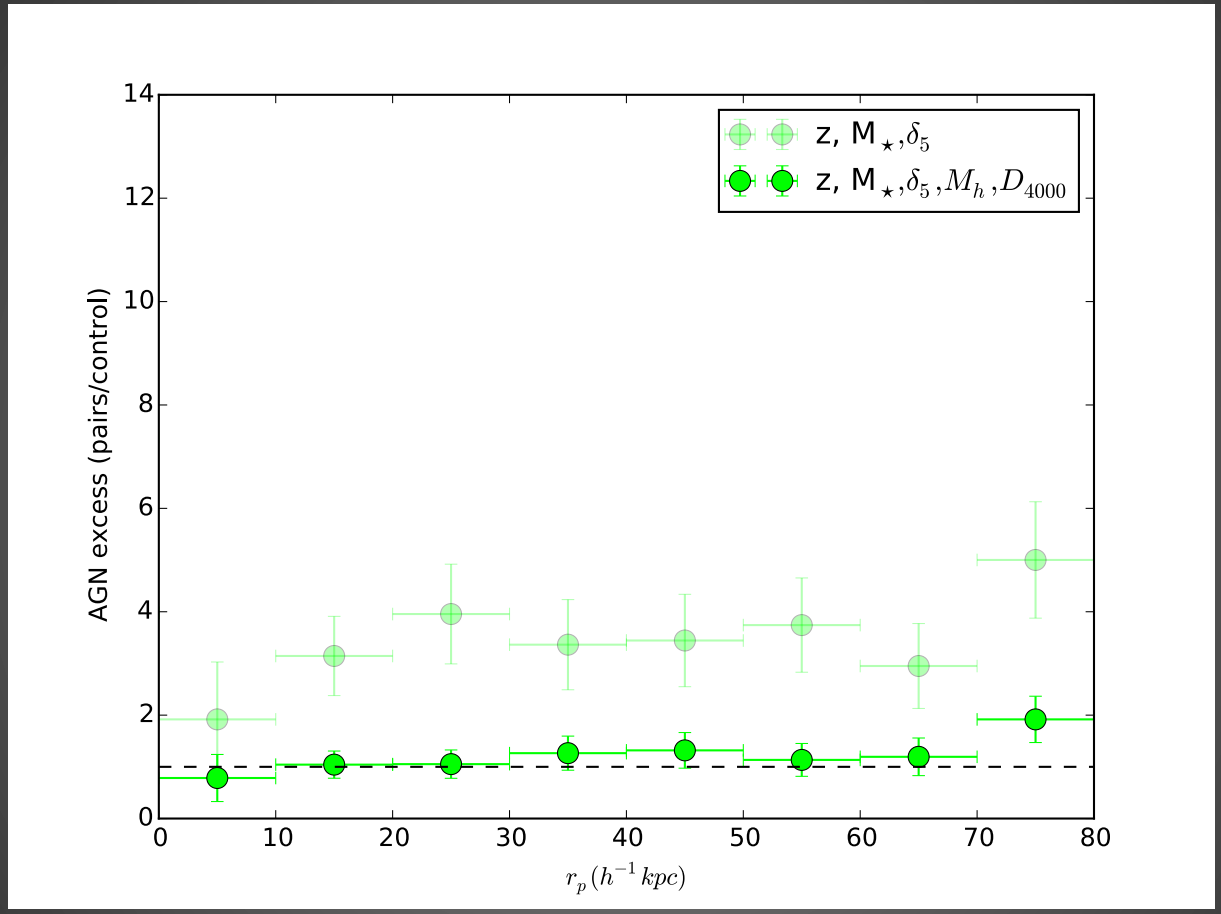
RL-AGN excess in pairs, but no trend with separation (and excess extends to 500 kpc). Non-merger origin?

Radio-selected AGN (LERGs)

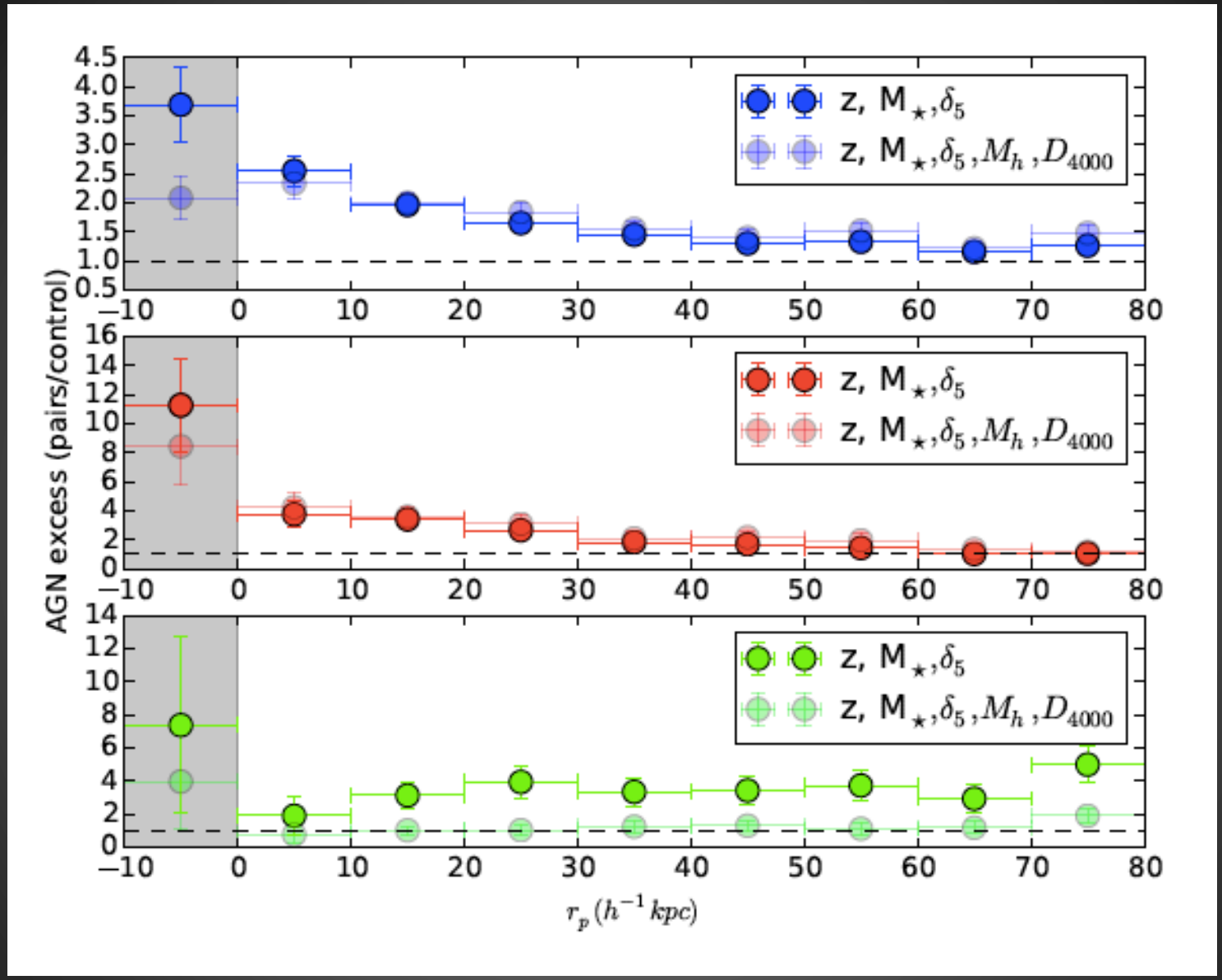


Matching in halo mass reduces the excess, but does not remove it: some dependence on external group gas, but not the whole story.

Radio-selected AGN (LERGs)

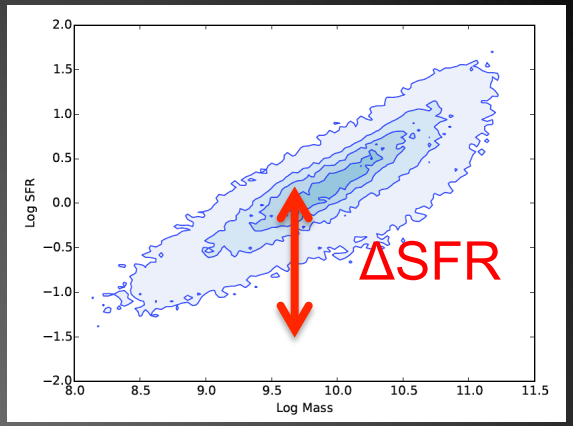


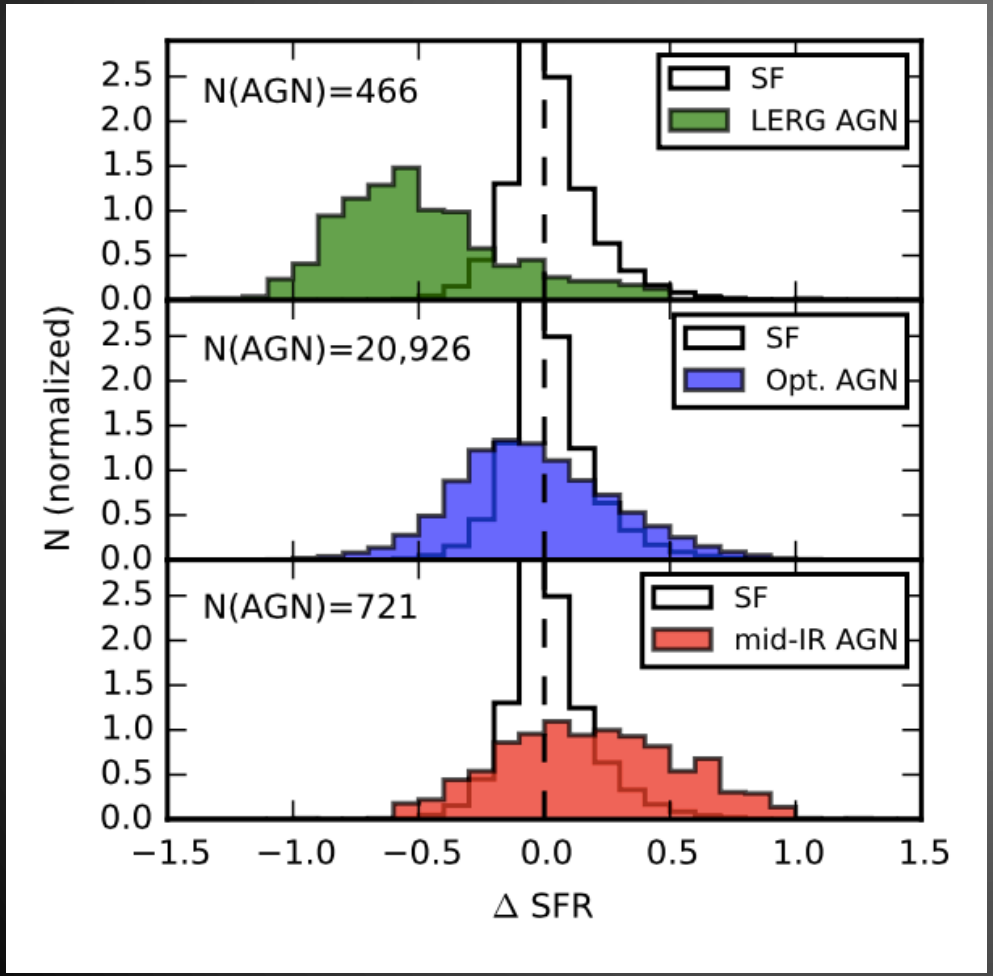
Matching in halo mass and D4000 removes the excess:
Fuelling linked to both environmental and internal stellar sources



Ellison, Patton & Hickox 2015

SFRs of AGN hosts obtained from far-IR luminosities (catalog of SFRs from far-IR luminosities for SDSS galaxies: Ellison et al. 2016a).





Radio-selected AGN (LERGs) are strongly UNDER star forming

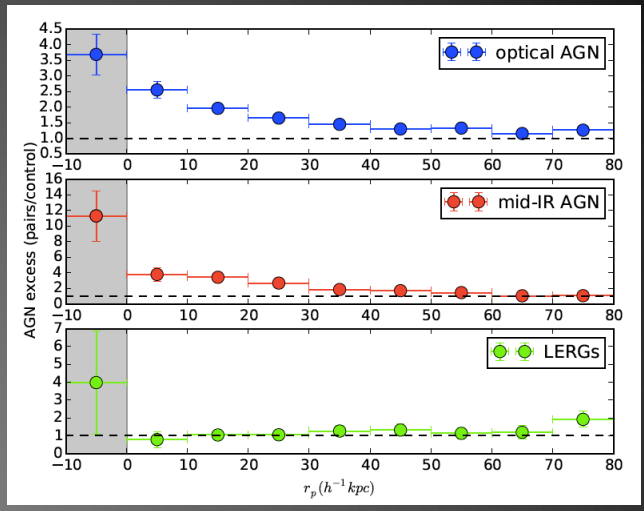
Optically-selected AGN are slightly UNDER star forming

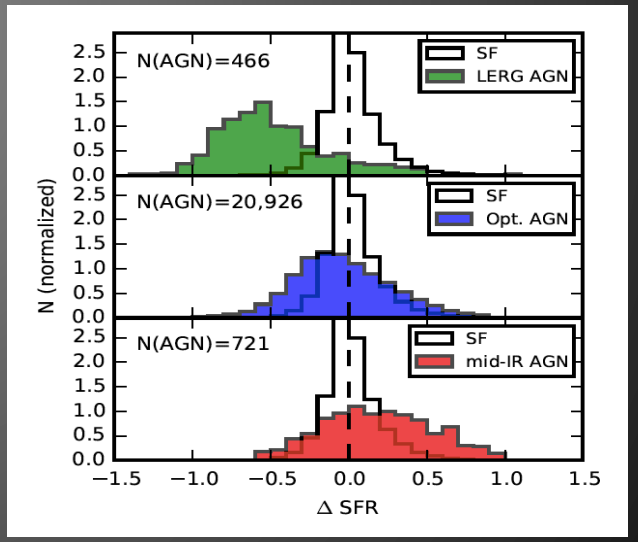
mid-IR-selected AGN are OVER star forming

Ellison et al. (2016b)

Summary

- Mergers can trigger AGN, and enhance their accretion rate. Ellison et al. (2011, 2013).
- IR selected AGN more prevalent in mergers than optically selected AGN – mergers more frequently to lead to obscured AGN. Satyapal et al. (2014)
- Low excitation radio galaxy (LERG) AGN are not fuelled by mergers Ellison, Patton & Hickox (2015).
- SFRs of AGN depend on how AGN is selected. Ellison et al. (2016b).





Not all AGN are equal! Selection matters.