Decomposing the Morphologies of AGN Hosts

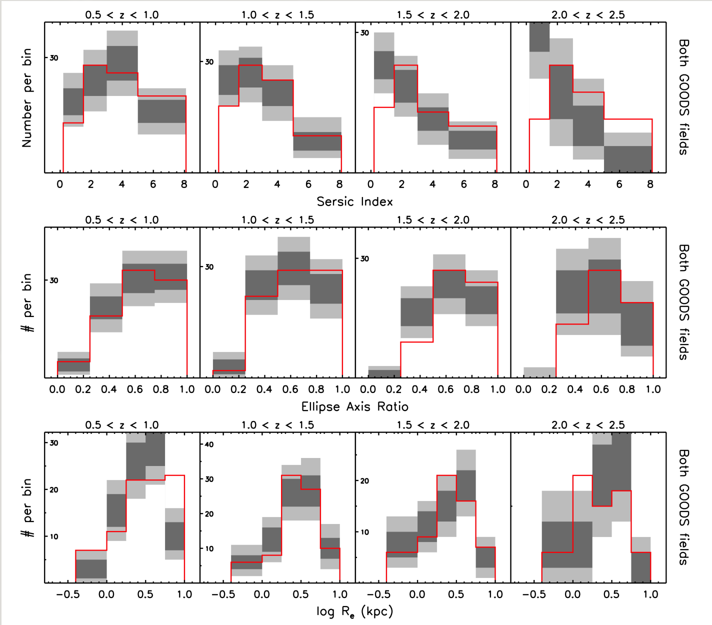
Victoria Bruce

University of Edinburgh

Collaborators: Jim Dunlop, Alice Mortlock, Dale Kocevski, Elizabeth McGrath & David Rosario

arXiv:1510.03870

AGN Host Morphology Study



Rosario et al. 2015

Are AGN hosts better modeled with an additional central point source component ?

- Sample: Full CANDELS-GOODSS area with $M_* > 10^{10} M_\odot$ at $0.5 < z_{phot} < 3$
- Near-IR and optical data for morphological decompositions: CANDELS-GOODSS in WFC3+ACS and accompanying ground U_{CTIO} to $K_{s\ ISAAC}$ with IRAC 3.6 to 8µm.
- AGN catalogue : 4Ms Chandra Hsu et al. 2014

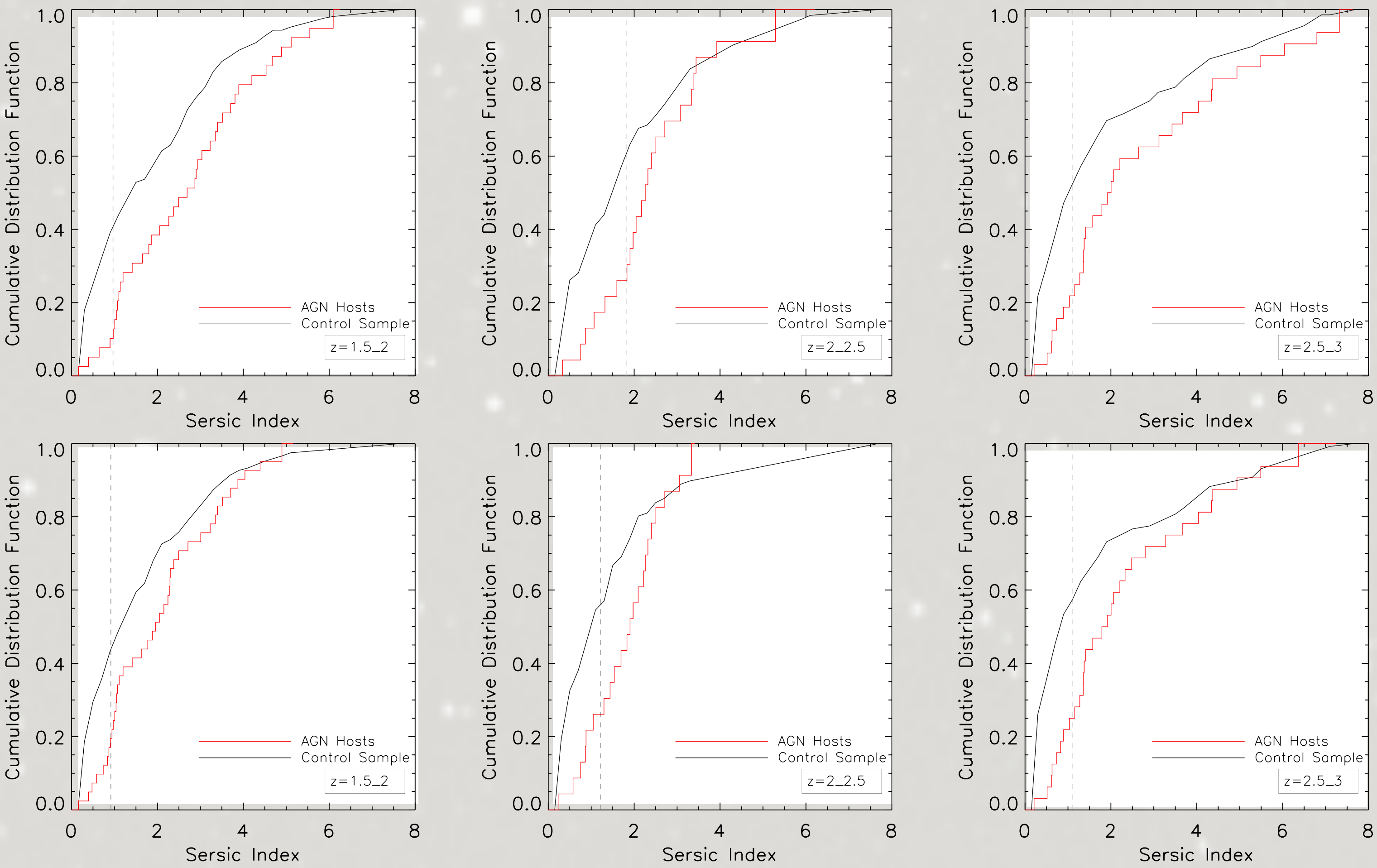
Mass Matching:

- Binned in 0.5 redshift bins
- 1000 bootstrap samples
- Median of samples within each property bin

Single Sérsic Fits

single Sérsic only

single Sérsic + point source

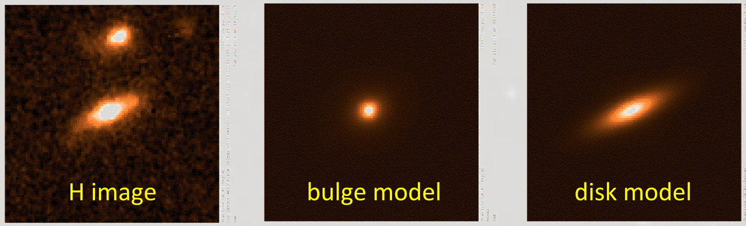


KS tests of the distributions show AGN hosts have fewer low Sérsic index fits in the highest z bins.

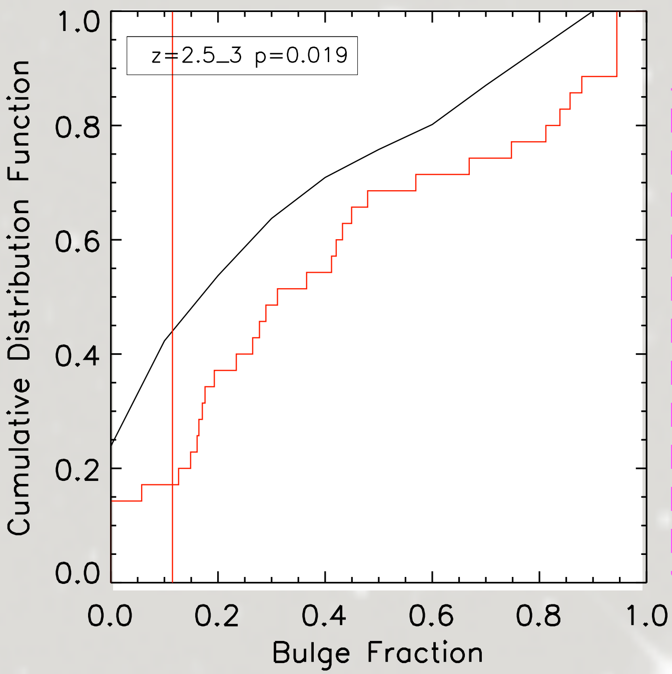
Multiple Sérsic Fits

Morphological Decompositions:

- Follows Bruce et al. 2012 & 2014a

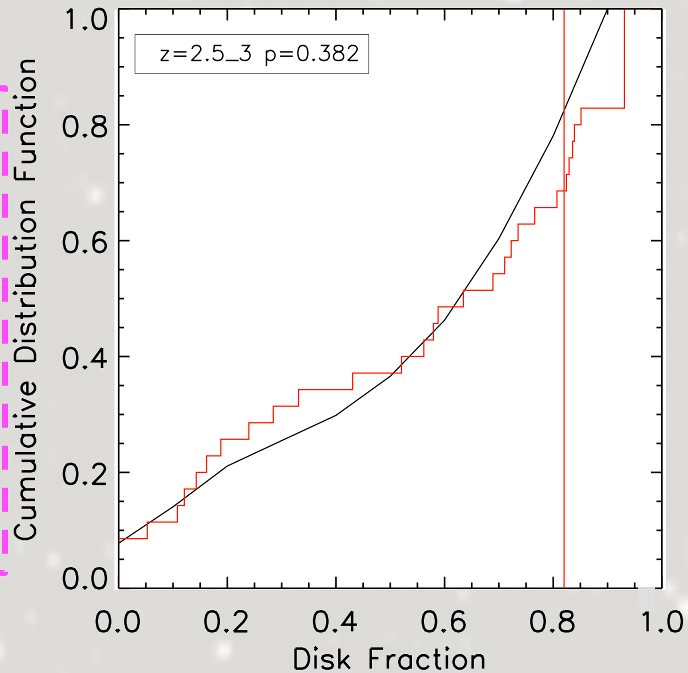


- Combinations of models with : bulge n=4 disk n=1 PSF
- Uncertainties: light fractions 10%, sizes 20%



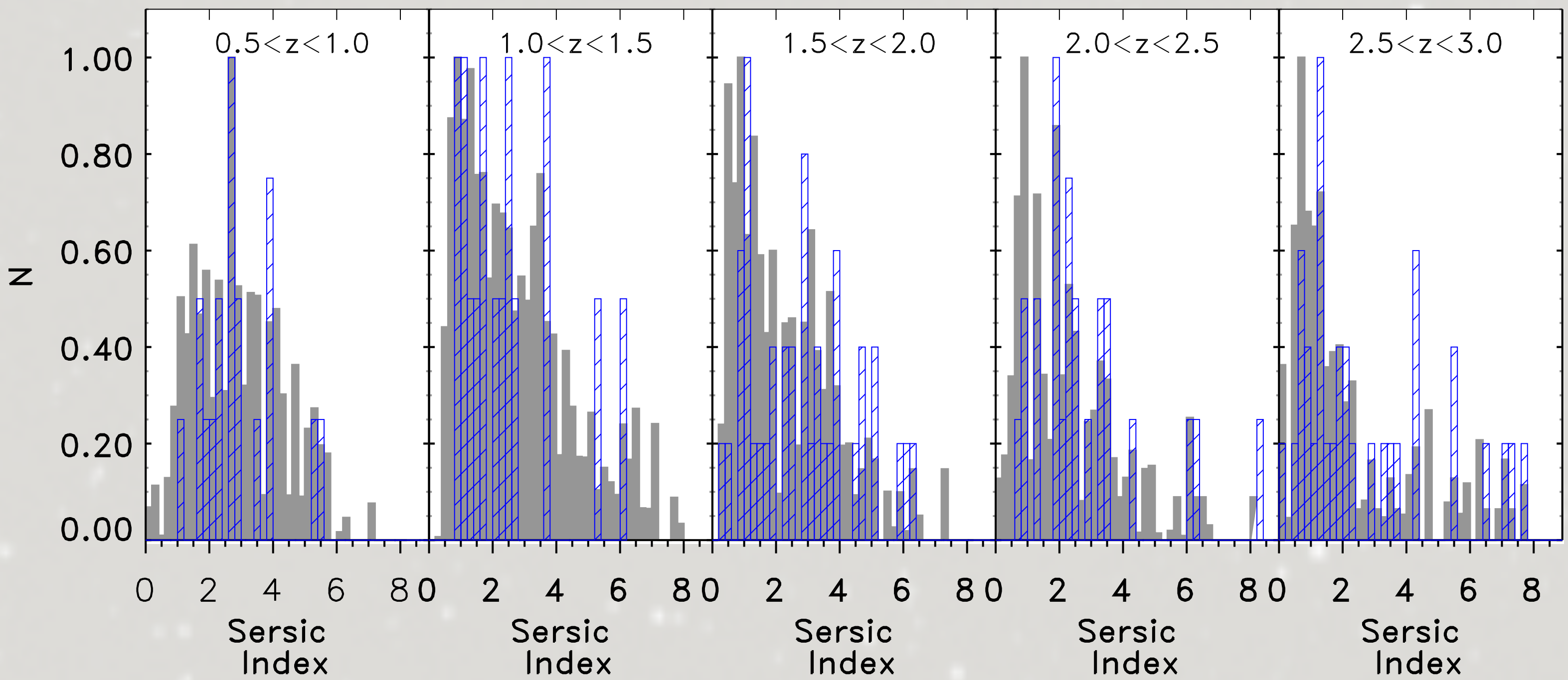
AGN have:
- fewer low bulge fractions
- more low disk fractions
- more pure bulges

➡ still bulgier



Implications for Evolutionary Paths

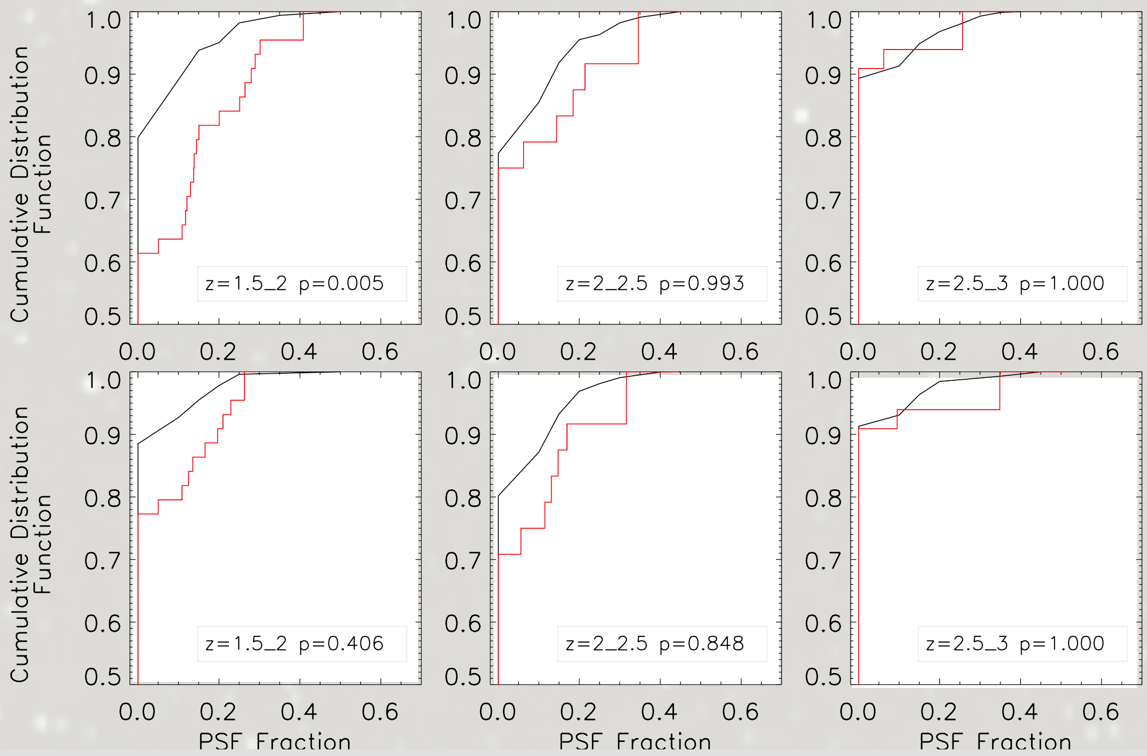
- Figure below shows the morphological evolution of the AGN and mass-matched control sample across the full 0.5<z<3 redshift range



- The evolution from disk to bulge-dominated morphologies of both populations, with an accelerated evolution for the AGN hosts, suggests the two populations are undergoing the same transformation processes capable of retaining massive disks
  ➡ evidence in favour of secular evolution

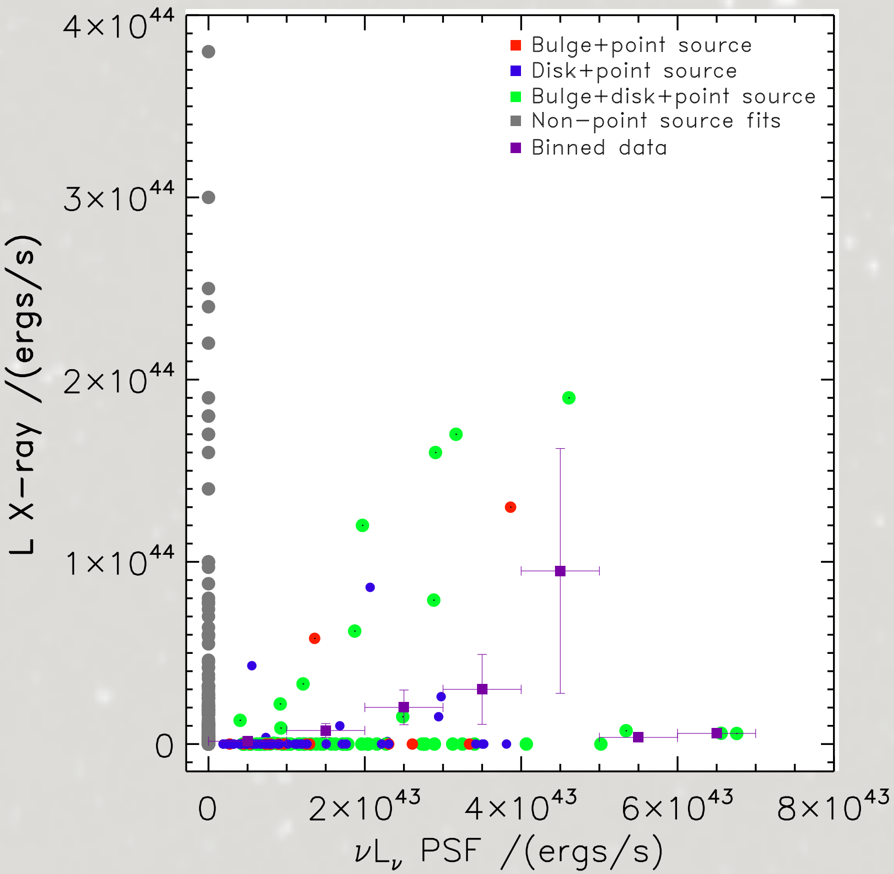
The Nature of the Point Source

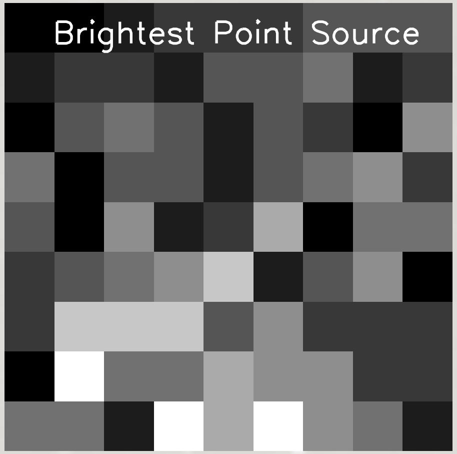
- PSF fraction difference between AGN hosts and control ? ✗
- PSF fraction difference between obscured and unobscured AGN ? ✗
- PSF fraction difference splitting above and below $L_X=10^{43.5}$ergs^{-1} ? ✓
    - higher luminosity AGN have higher PSF fraction

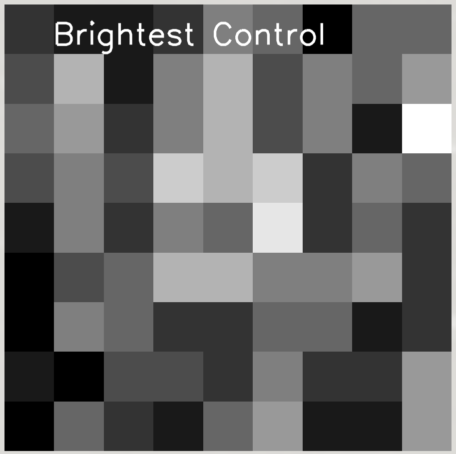


BUT The highest luminosity X-ray sources do not have the most PSF components

The Nature of the Point Source



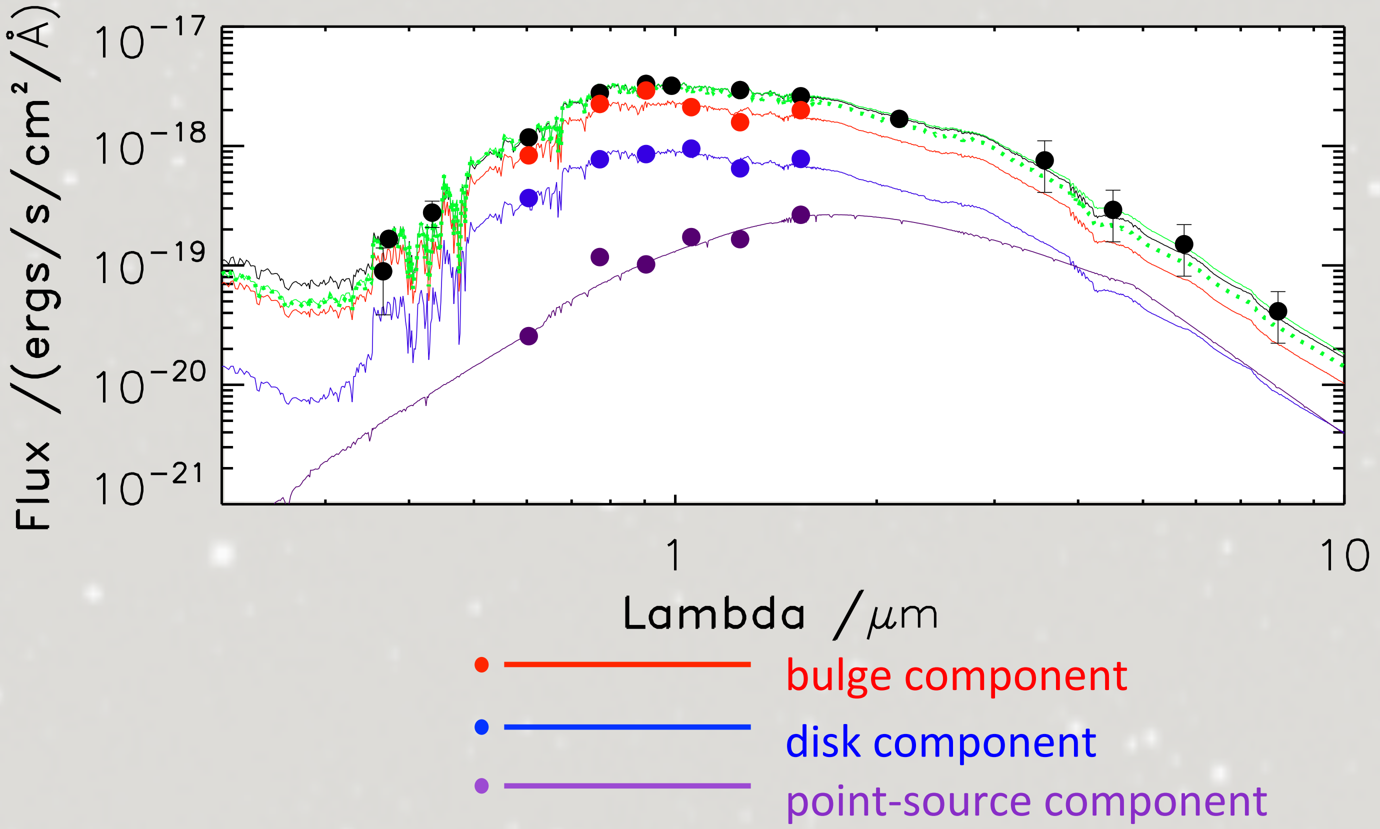




- PSF luminosity does positively correlate with AGN X-ray luminosity
- The highest luminosity PSF components have a higher fraction of X-ray counterparts

There is some indication selecting the brightest point-source components, preferentially selects AGN hosts

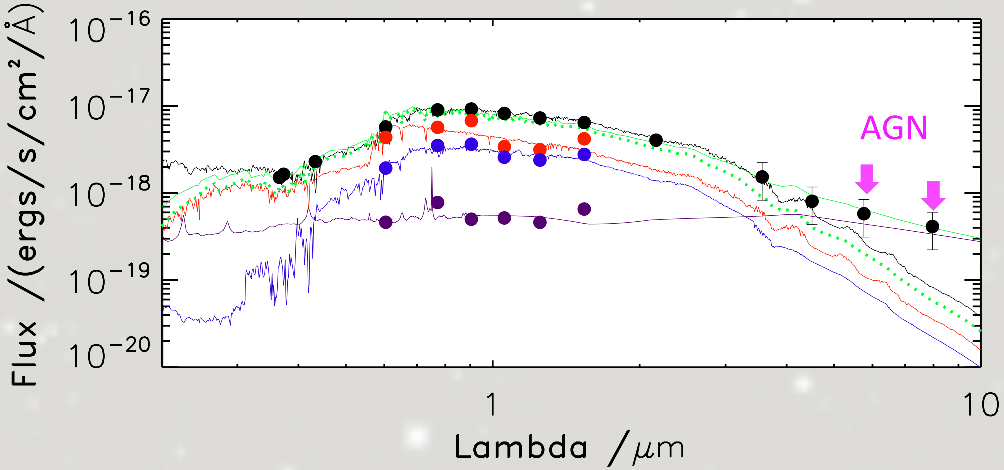
The Nature of the Point Source



- Extend H-band decompositions to bluer bands + ACS
- Adopt decompositions from F435W to F160W

- Simultaneously fit bulge+disk+point source, constrain sum of these models to total flux at extreme blue and red ends.

The Nature of the Point Source

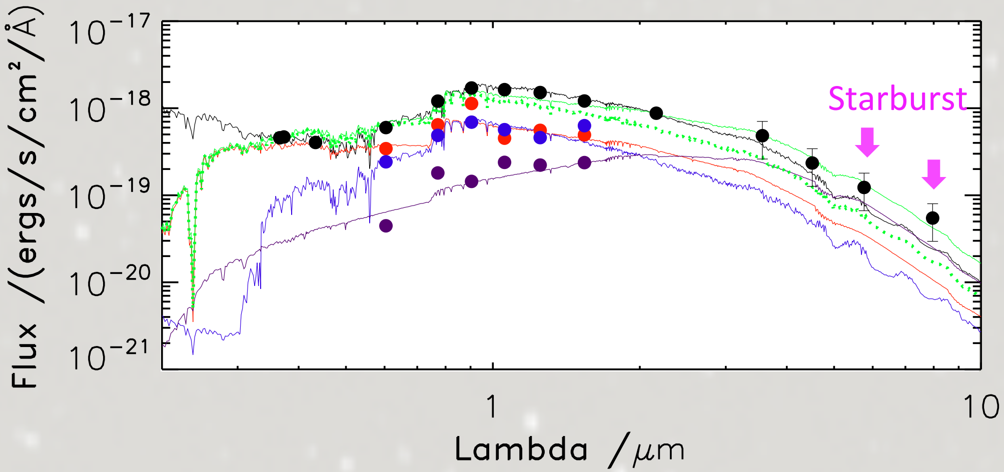


- Extend model fitting to the reddest IRAC 5.8 and 8μm bands.

- bulge and disk= stellar templates with range of SFH, ages and A_v
- point source =starburst with $0<A_v<8$ and age range between 10Myrs-1Gyr

<u>or</u>

Type I AGN with $0< A_v<8$



Breakdown of the Point Source Fits

1355
Galaxies with $M_* > 10^{10} M_\odot$ at $0.5 < z_{phot} < 3$

↓

132
PSF components

↓

9
AGN SED fits

↙ ↘

4
with X-Ray counterparts

5
without X-Ray counterparts

- Point source components are necessary to fully describe the stellar populations of these $M_* > 10^{10} M_\odot$ at $0.5 < z_{phot} < 3$ objects.

- 10% of all fits have a PSF component
- 15% of all fits have an X-ray counterpart
    - 20% of PSF fits have an X-ray counterpart
        - 45% of PSF+AGN SED fits have X-ray counterparts ➡ Type I AGN

Future Work

- Exploration of obscured and un-obscured fractions…..
- Trends with fitted A_v and ages and models for PSF components…..
- Connections with sub-mm galaxies…..

Summary:

- AGN hosts are more bulge dominated than a non-active control sample, but are otherwise similar.
- Similar evolution of the two samples and retention of massive disks indicates secular evolution also plays a role in AGN host galaxy evolution.
- Point source morphology fits are predominantly stellar in nature.
- However, selecting brightest PSF fits preferentially selects X-ray AGN.
- SED fitting of the PSF component can select non-X-ray AGN.

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 312725