Quasars do not live in merging systems:
no enhanced merger rate over non-quasars at $\log(M_*/M_\odot)<11.7$

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Galaxy-Black Hole Coevolution

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0 summary

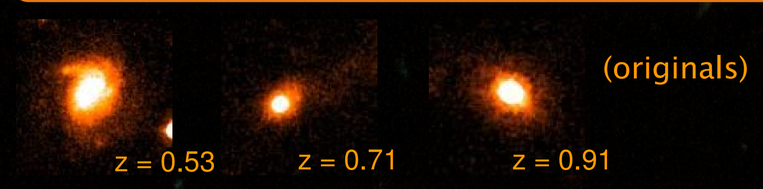
We are trying to solve the age-old question: what is the relevance of mergers and interactions as triggering mechanisms for AGN activity?
Visually, we compare the morphologies of a set of AGN host galaxies with a matched sample of inactive galaxies, both from the COSMOS survey (Scoville et al. 2007) using its high resolution imaging from HST. Specifically, we are looking for strong interaction signatures and ongoing mergers in order to determine and compare the merging fraction for both samples. We make this analysis strongly consistent by treating both samples in the same way, by making them indistinguishable between each other.
We find no enhanced merger rate for AGN hosts over inactive galaxies, up to $\log(M_*/M_\odot)=11.7$. We do not rule out that major mergers are one triggering factor for quasar activity, just suggest that it is either not the most significant one or that the time-lag between merging and AGN ignition is substantial.

1 data

Our main sample consists of 494 type-1 AGN observed with the HST/ACS in the F814W (broad I) band, detected by their X-Ray counterparts from the XMM campaign (Hasinger et al. 2007). For this first approach we are considering AGN with resolved host galaxies, over $z \sim 0.3$-1.0, which corresponds to 87 objects. This is the largest sample of AGN ever imaged at HST resolution.

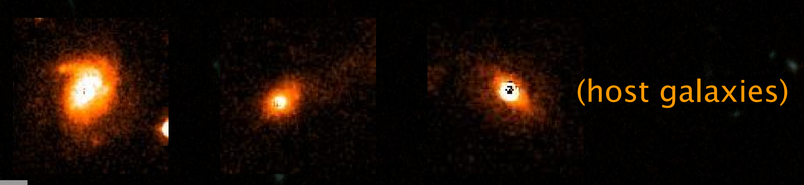
2 AGN-host galaxy decomposition

An essential part of our analysis consists of getting the best possible picture of the host galaxy. In order to do this, we remove the bright nucleus by modeling each AGN as a Sersic light profile plus a central point source. This is done through a 2-D parametric fitting with GALFIT (Peng et al. 2002). In a nutshell, the procedure looks as follows:



We start with the original ACS science images, for which we perform a 2 component fit.

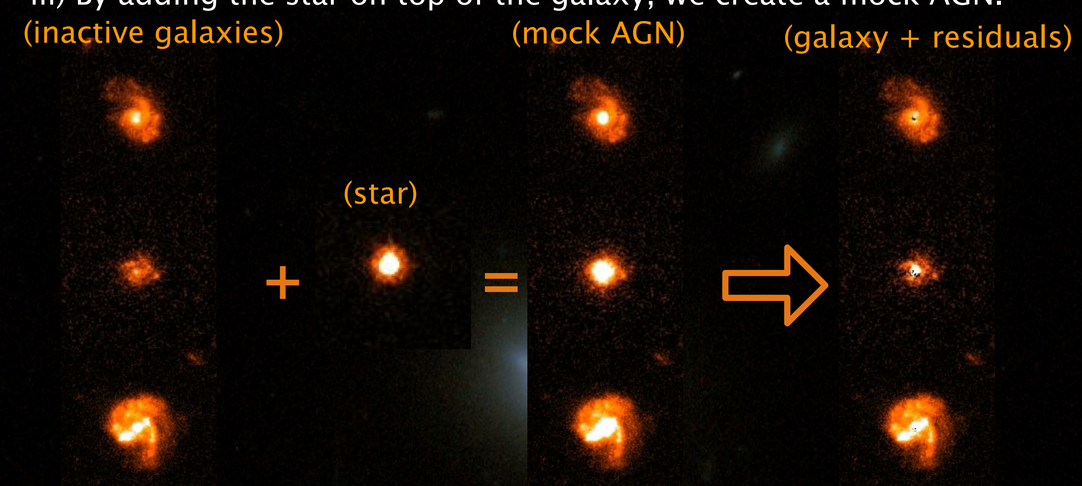
Then we subtract the PSF component, which removes the nuclear contribution to the overall light profile. This leads to the host galaxy, plus some residuals in the center.



3 comparing apples with apples

To establish whether the AGN hosts are more disturbed that their inactive counterparts, we build a unique control sample that will allow us to compare them in a truly consistent way. We pick inactive galaxies, mock them up as AGN by adding a star as a fake active nucleus and then perform the same subtraction procedure as the original AGN:

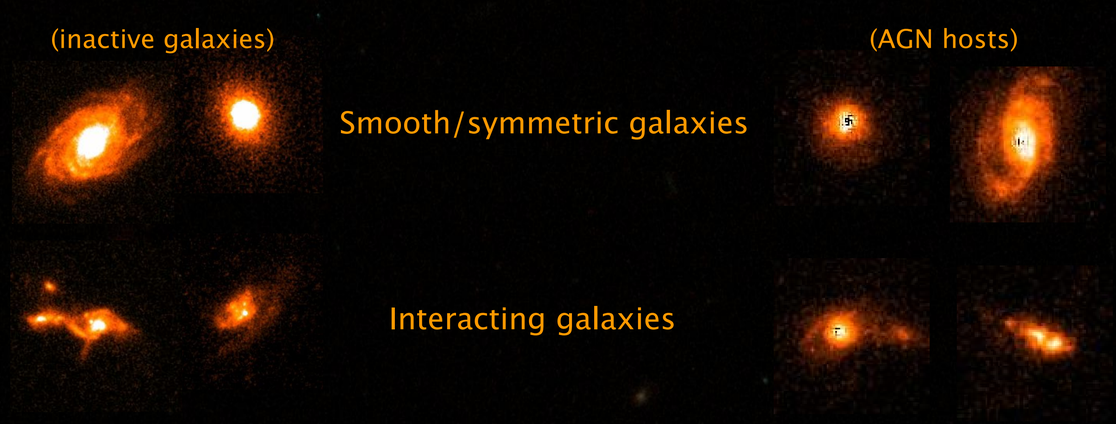
i) For each AGN, we select 10 control galaxies that match in redshift and host magnitude.
ii) From the Host/Nucleus flux relation for a given AGN, we search for a star that fits that ratio against the inactive galaxy
iii) By adding the star on top of the galaxy, we create a mock AGN.



iv) We treat our mock AGN exactly the same way as the original ones, which creates a set of galaxies with the same conditions in redshift, magnitude and residuals from nucleus removal as our hosts.

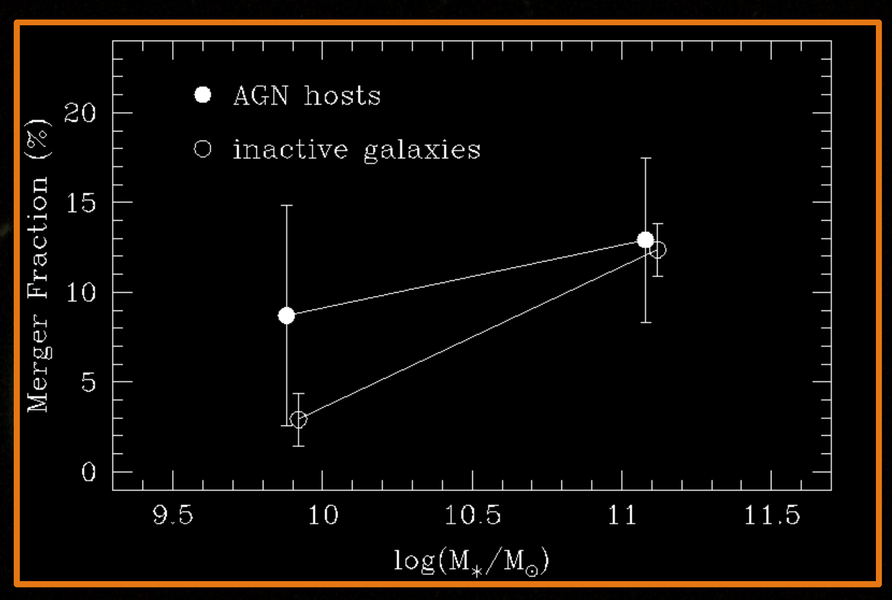
4 what are we looking for?

To perform the visual classification in an unbiased way, we blindly mix the AGN hosts with the inactive galaxies after PSF subtraction, and proceed to classify accordingly to their morphologies. We classify both samples into classes of smooth and undisturbed, mildly disturbed, and showing evidence of a recent (or ongoing) strong interaction:



5 results

From our visual morphological analysis, we find the fraction of strong interactions for the AGN host galaxies and inactive galaxies to be 11.6% ± 3.9% and 10.6% ± 1.2% respectively. These numbers are in rough agreement with inactive galaxy merger fractions at similar redshifts from Jogee et al. (2009; also HST imaging) but do not point towards an enhanced frequency of merger signatures for the AGN hosts.
We compute stellar masses (observed I-band magnitude plus assumed intermediate age stellar population) to check whether there is a trend towards an increasing difference between the merger fractions of the active and inactive galaxies at the higher mass end ($\sim 10^{10.5}$ to $10^{11.7} M_\odot$), where major mergers could potentially play a larger role. We find no evidence for an excess in the merging fractions of the AGN hosts even at this massive end, as shown in the plot below.



references

- Hasinger et al. 2007, ApJS, 172, 29
- Jogee et al. 2009, ApJ, 697, 1971
- Peng et al. 2002, AJ 124, 266
- Scoville et al. ApJS, 172, 38
- Sersic, 1968, OAC

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