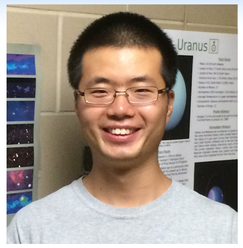
Linking Black-Hole Growth with Host Galaxies

G. Yang, W. N. Brandt, F. Vito, C.-T. J. Chen, J. R. Trump, et al.

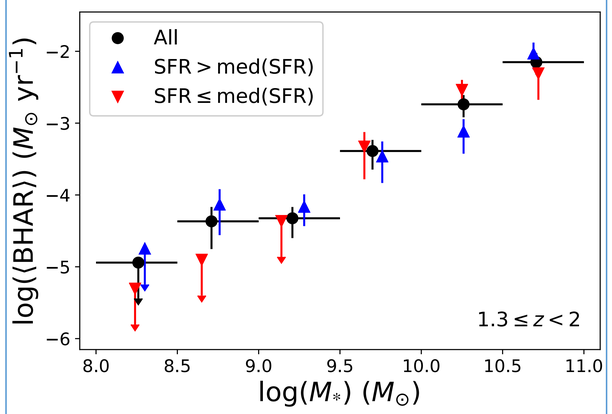


Abstract

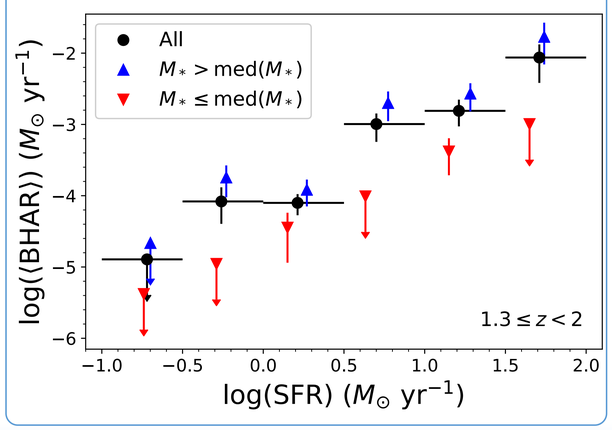
- In Yang et al. (2017), we proved that the black hole accretion rate (BHAR) may be fundamentally related to host-galaxy stellar mass ($M_\star$) rather than star formation rate (SFR).
- In Yang et al. (submitted), we further derived the BHAR-$M_\star$ relation and its redshift evolution at $z = 0$–4. We discussed this relation in the context of black hole-galaxy coevolution.

BHAR-SFR vs. BHAR-$M_\star$

In $M_\star$ controlled samples, high-SFR and low-SFR galaxies have similar BHAR.

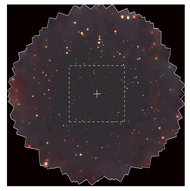


In SFR controlled samples, high-$M_\star$ galaxies have significantly higher BHAR than low-$M_\star$ galaxies.

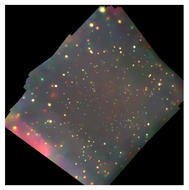


Survey data

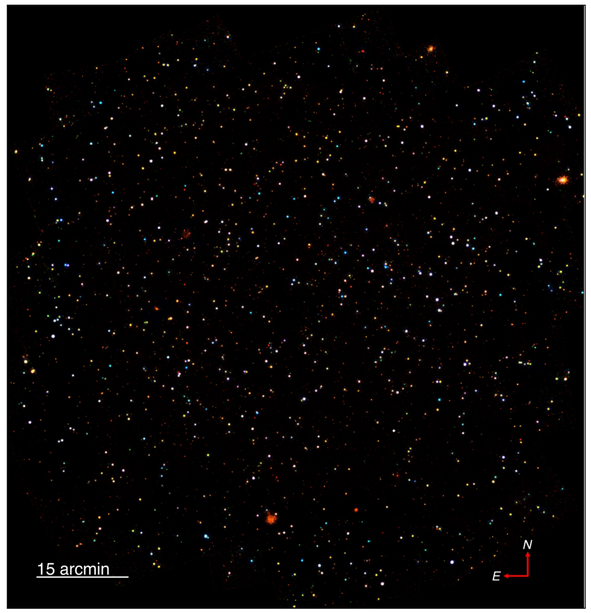
CDF-S
7 Ms
0.1 deg^2



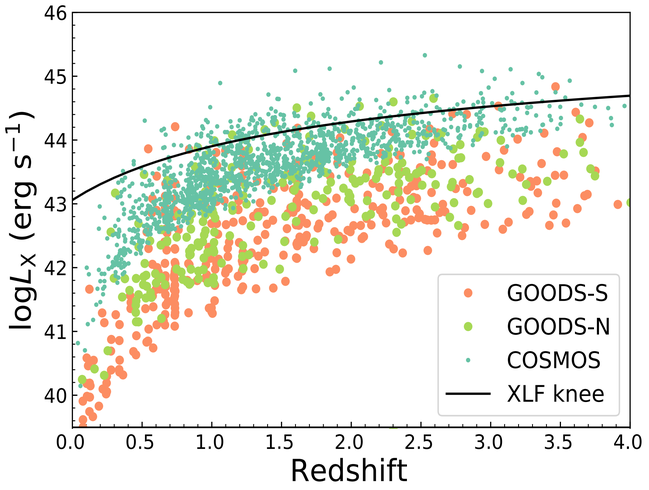
CDF-N
2 Ms
0.1 deg^2



COSMOS 160 ks, 2 deg^2



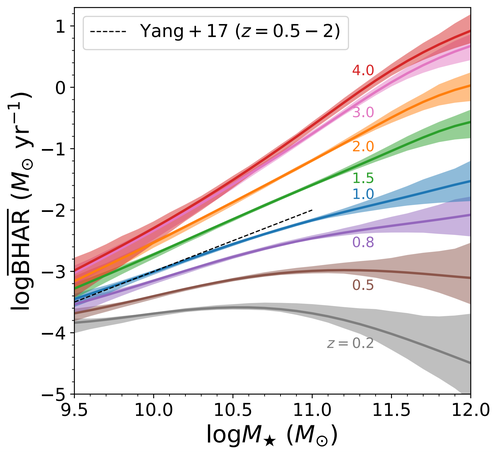
Our survey data sample most of cosmos accretion power.



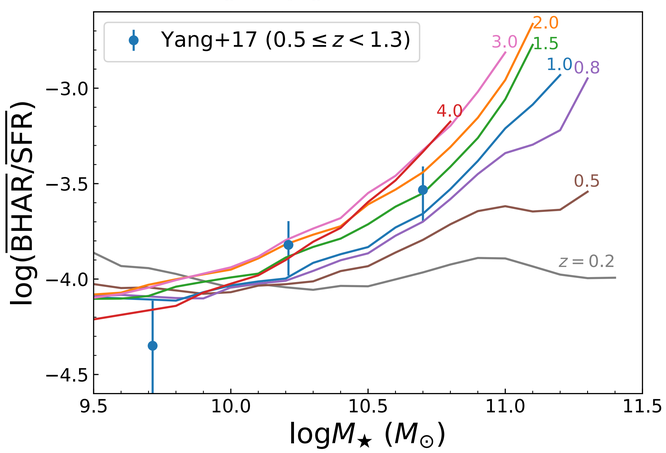
- CDF-S and CDF-N are the deepest X-ray surveys. COSMOS is shallower but covers much larger area.
- We also use stellar mass function and X-ray luminosity function to include accretion power from rare luminous quasars

Results: BHAR-$M_\star$ relation

BHAR drops steeply toward low redshifts in massive galaxies. AGN feedback!?

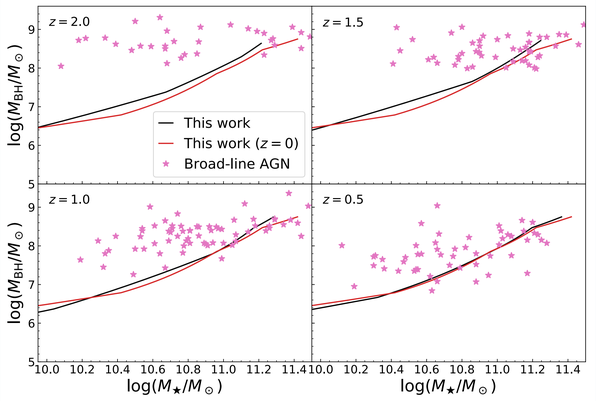


BHAR/SFR depends on both $M_\star$ and redshift → black hole and galaxy growth are not in lockstep



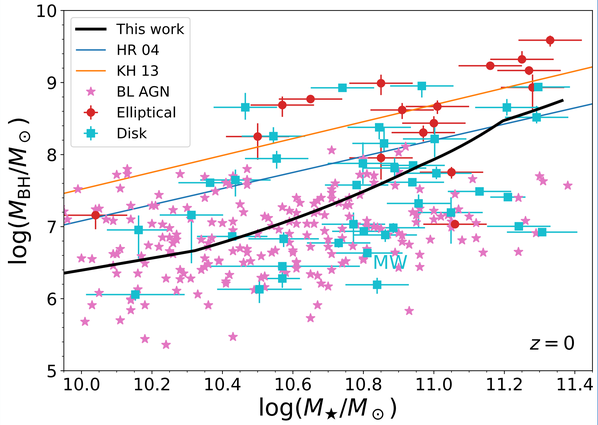
Black hole-galaxy coevolution

- The M_{BH}-$M_\star$ relation has little cosmic evolution since z~2.
- The M_{BH} for high-z BL AGNs are higher than our predictions, caused by selection biases?



The M_{BH}-$M_\star$ relation at z=0

- The $M_{BH}/M_\star$ ratio rises from ≈ 1/5000 at log$M_\star$ ≲ 10.5 to ≈ 1/500 at log$M_\star$ ≳11.2.
- At high $M_\star$, our $M_{BH}/M_\star$ is similar to the observed values for normal galaxies → accretion growth ≳ black-hole mergers
- At low $M_\star$, our $M_{BH}/M_\star$ is consistent observations for normal galaxies and BL AGNs.



Contact: gxy909@psu.edu (G. Y.)