Insights on the AGN-Galaxy Connection from CANDELS and X-UDS

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with

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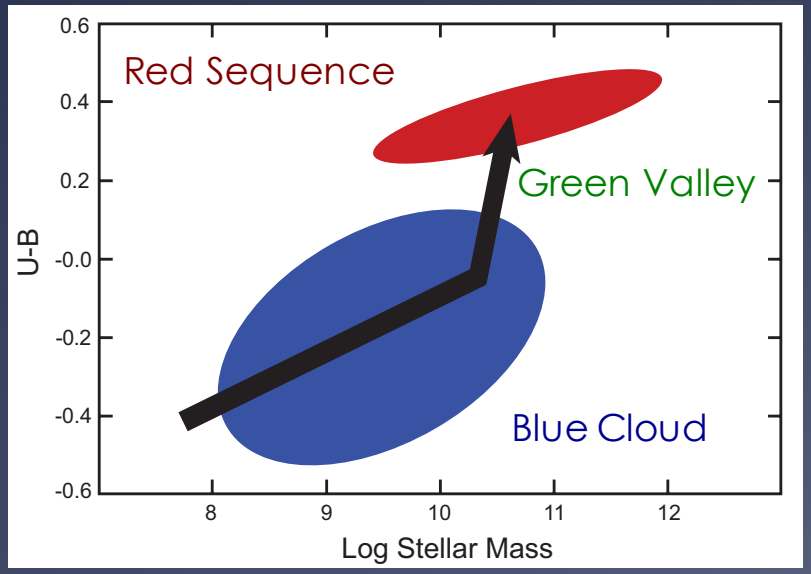
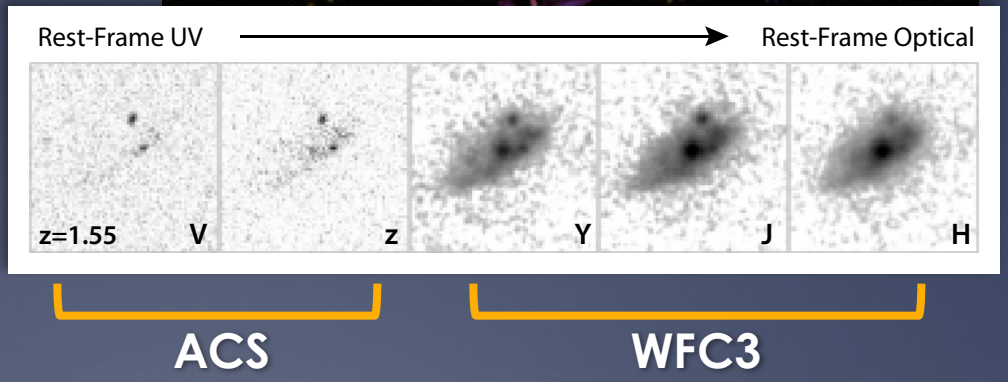
and the CANDELS Collaboration

The AGN-Galaxy Connection

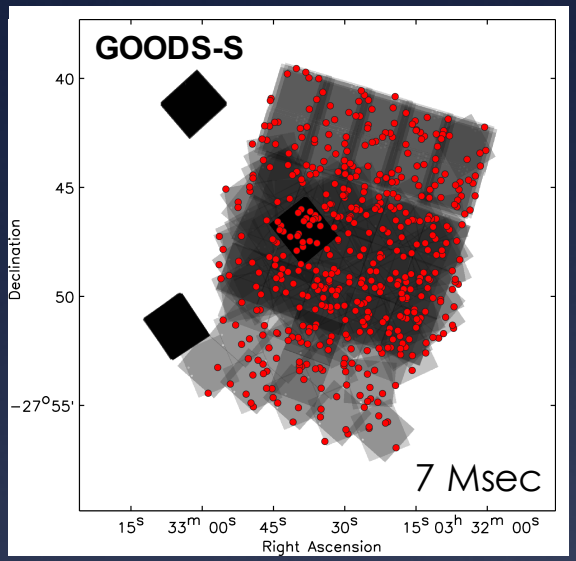
* What triggers AGN activity at z~2?
  Using host morphologies to determine mechanisms that fuel BH growth.

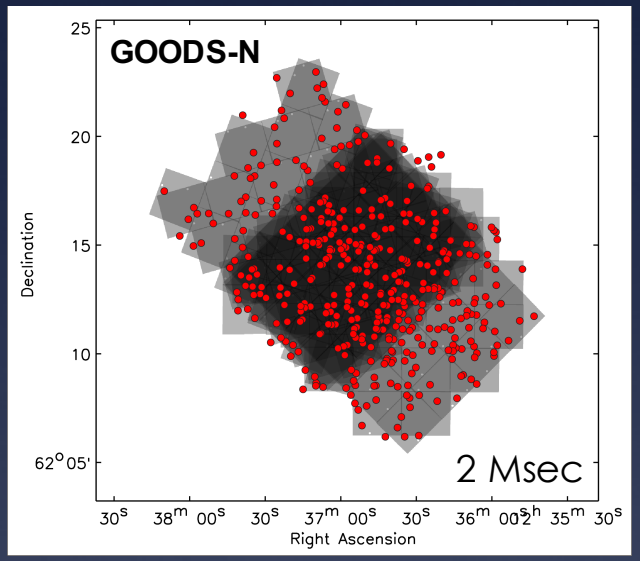
* What role do AGN play in quenching first generation of passive galaxies?
  Using host stellar populations to study SF shutdown in AGN hosts at z~2-3.

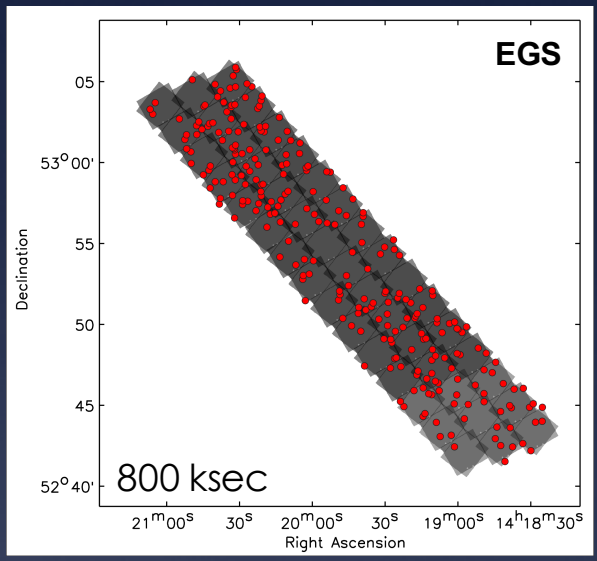


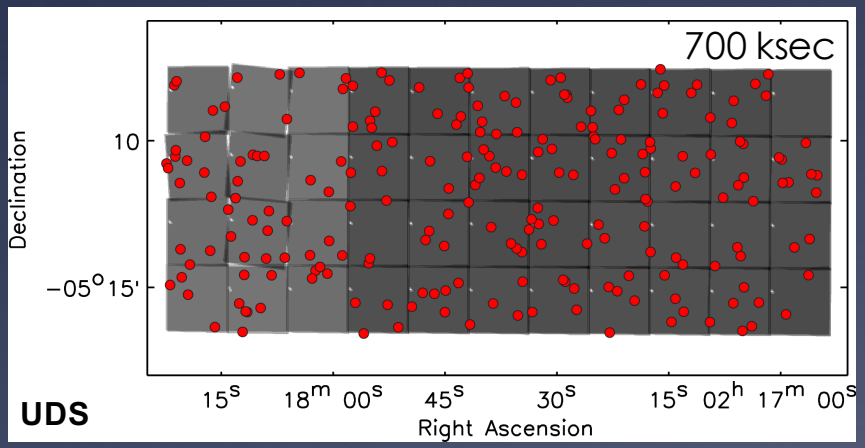


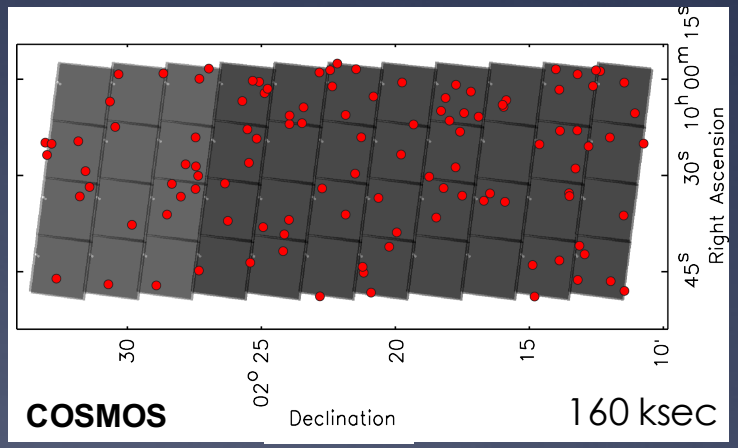
AGN in the CANDELS Fields







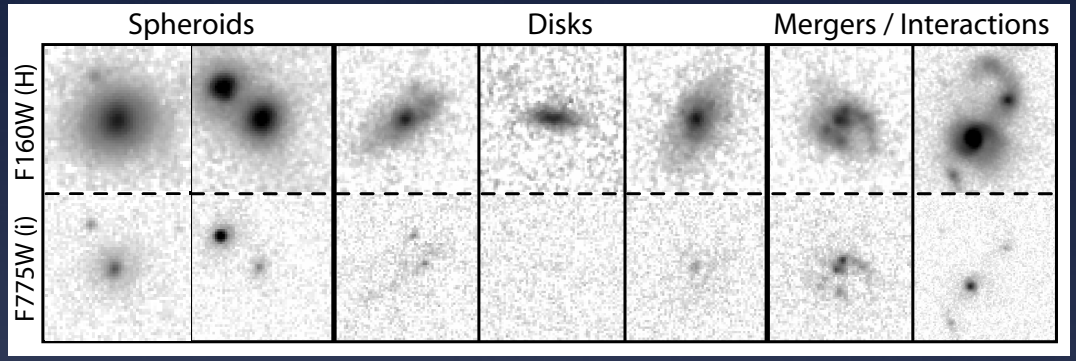


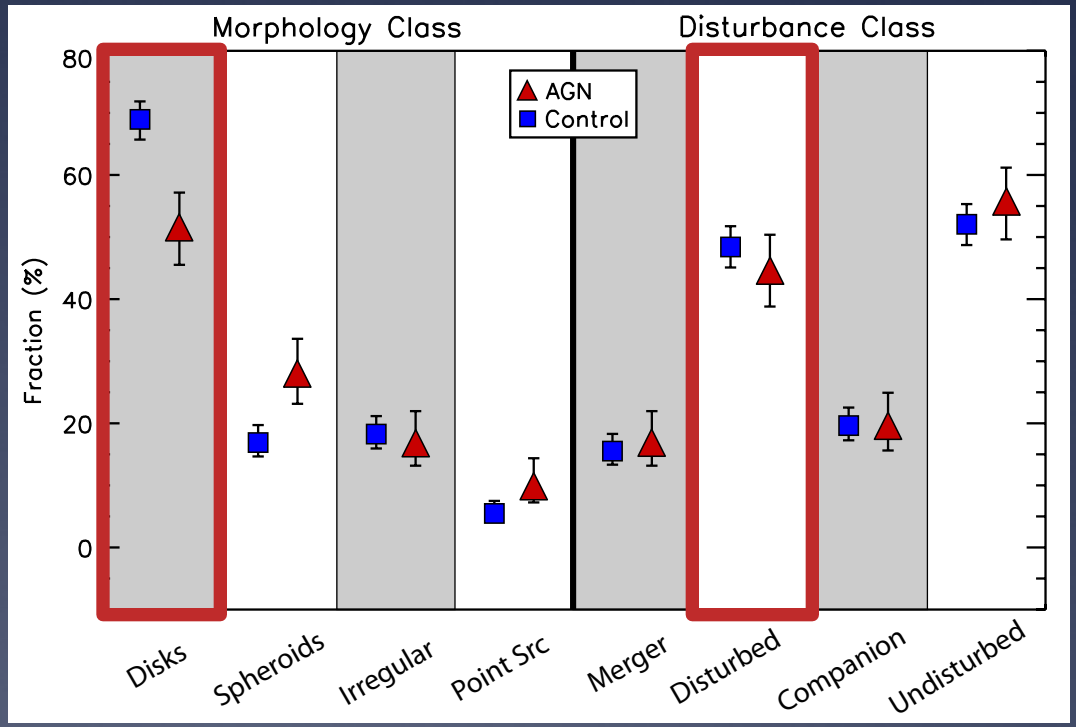


* ~1500 AGN detected in all five CANDELS fields

AGN Host Morphologies at z~2

* Most X-ray selected AGN at z~2 are not found in interacting galaxies.
* High disk fraction suggests stochastic fueling more important than predicted by fueling models.
* In agreement with previous results:
  * Grogin et al. (2005)
  * Cisternas et al. (2011)
  * Schawinski et al. (2011)





Kocevski et al. (2012)

New Constraints for AGN Fueling Models

Do We Expect Most AGN to Live in Disks?

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[2]*University of California Observatories/Lick Observatory, and Department of Astronomy and Astrophysics, University of California, Santa Cruz, CA 95064 USA*
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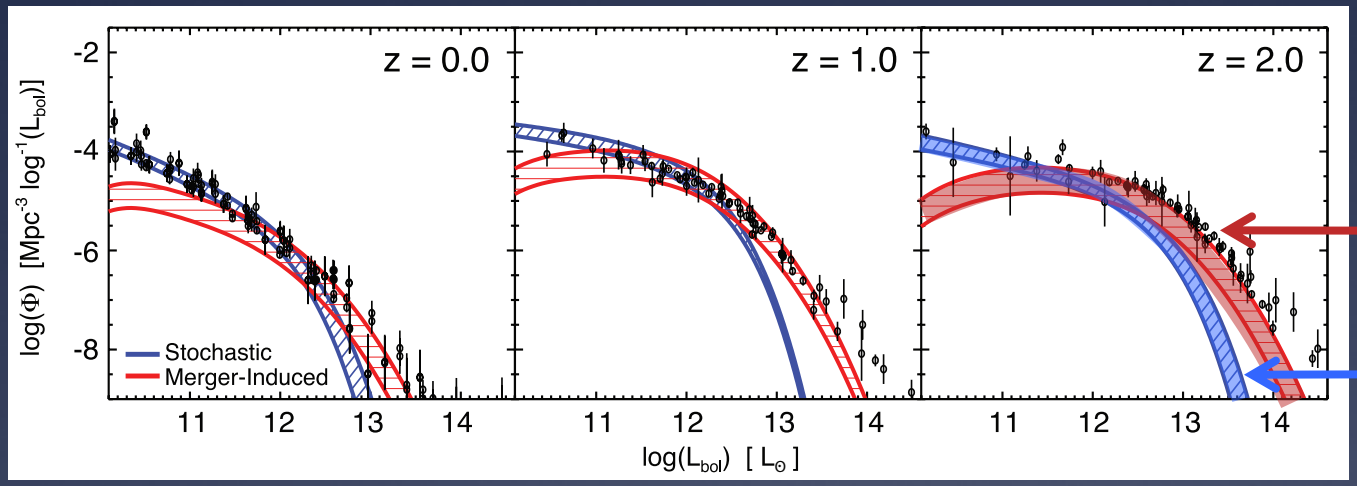
ABSTRACT

Recent observations have indicated that a large fraction of the low to intermediate luminosity AGN population lives in disk-dominated hosts, while the more luminous quasars live in bulge-dominated hosts (that may or may not be major merger remnants), in conflict with some previous model predictions. We there-

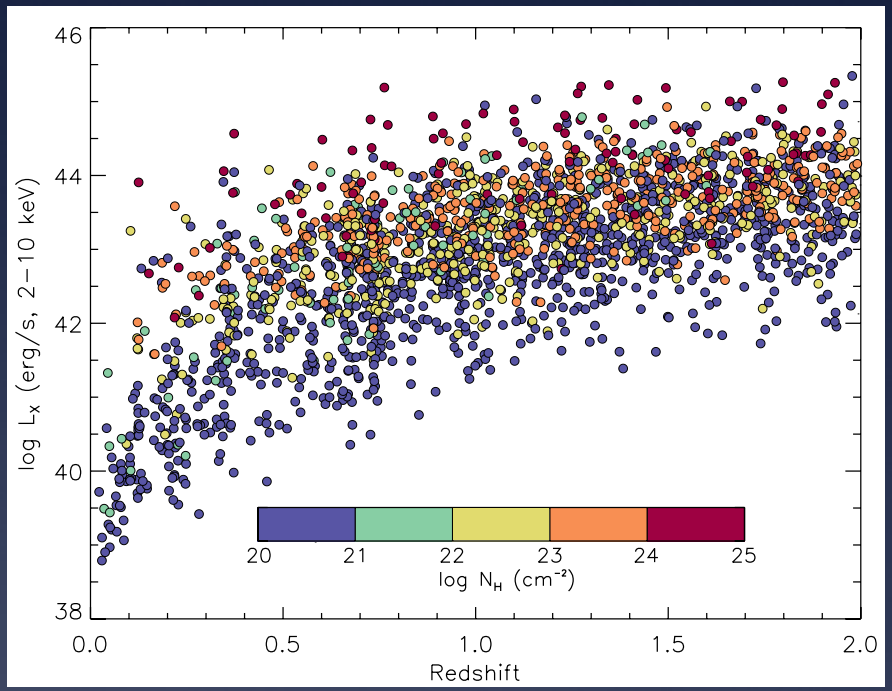


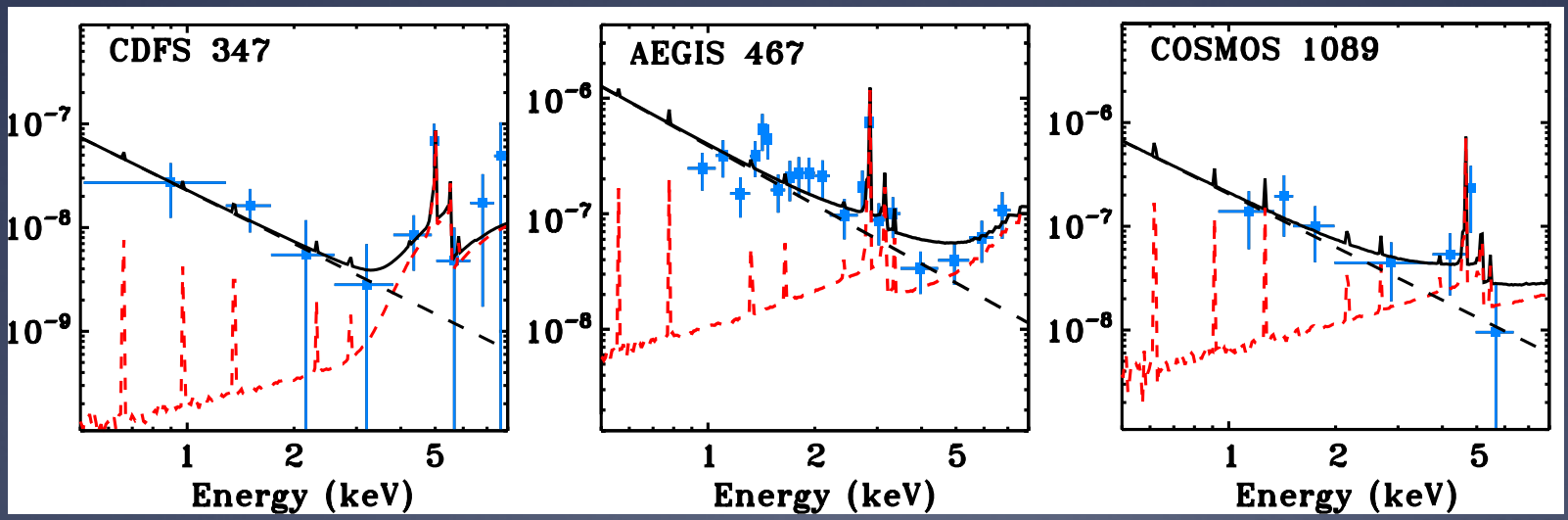
Hopkins et al. (2014)

- High gas fractions at z~2 results in ubiquitous AGN activity in undisturbed disk galaxies.
- However, majority of Black Hole growth still predicted to be driven by mergers!

Host Morphology vs Obscuration

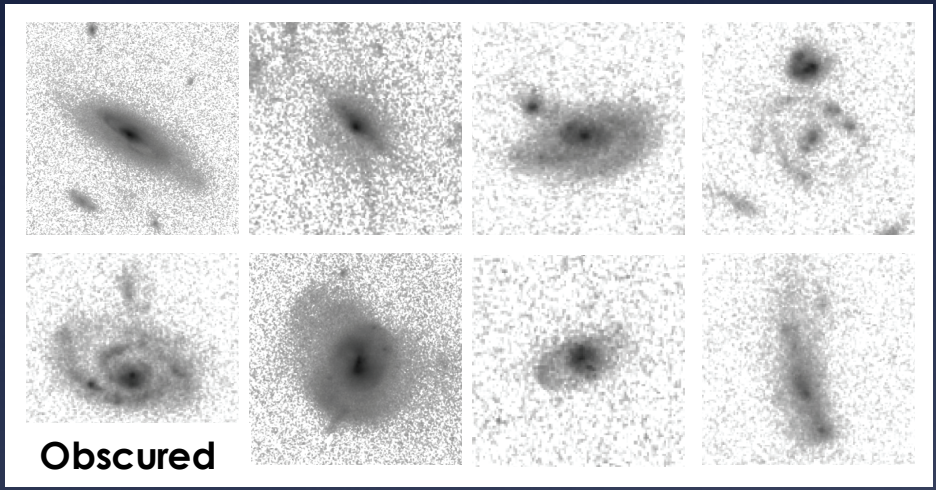
- Host Morphology Comparison:
  - 121 Heavily Obscured AGN with $N_H > 10^{23.5}$ cm^{-2}
  - 279 Moderately Obscured AGN with $N_H = 10^{22-23.5}$ cm^{-2}
  - 281 Unobscured AGN with $N_H < 10^{22}$ cm^{-2}
- Subsamples matched in redshift and X-ray luminosity.

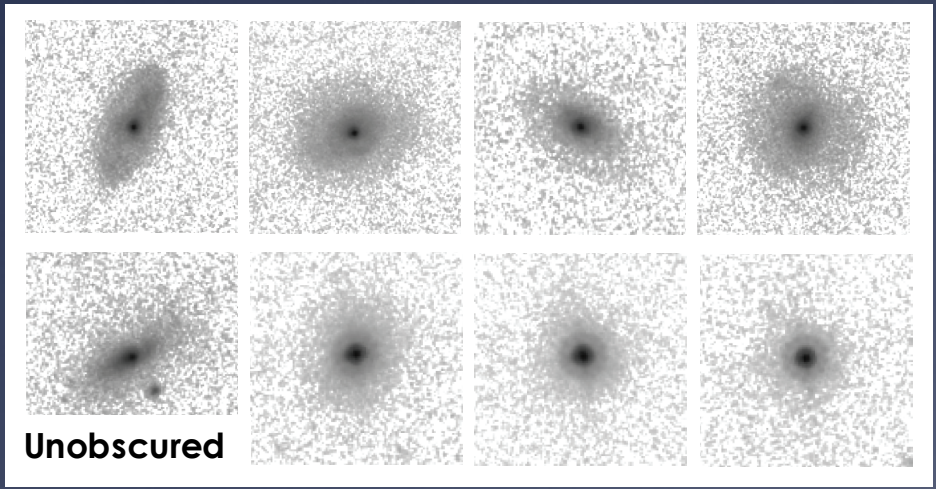


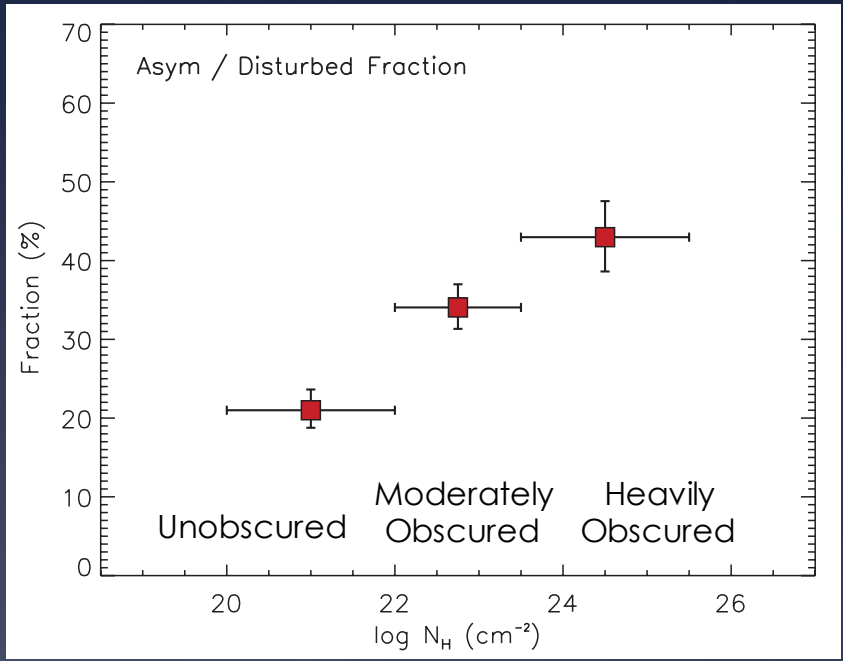


Brightman et al. (2012)

Mergers Hidden by Obscuration?



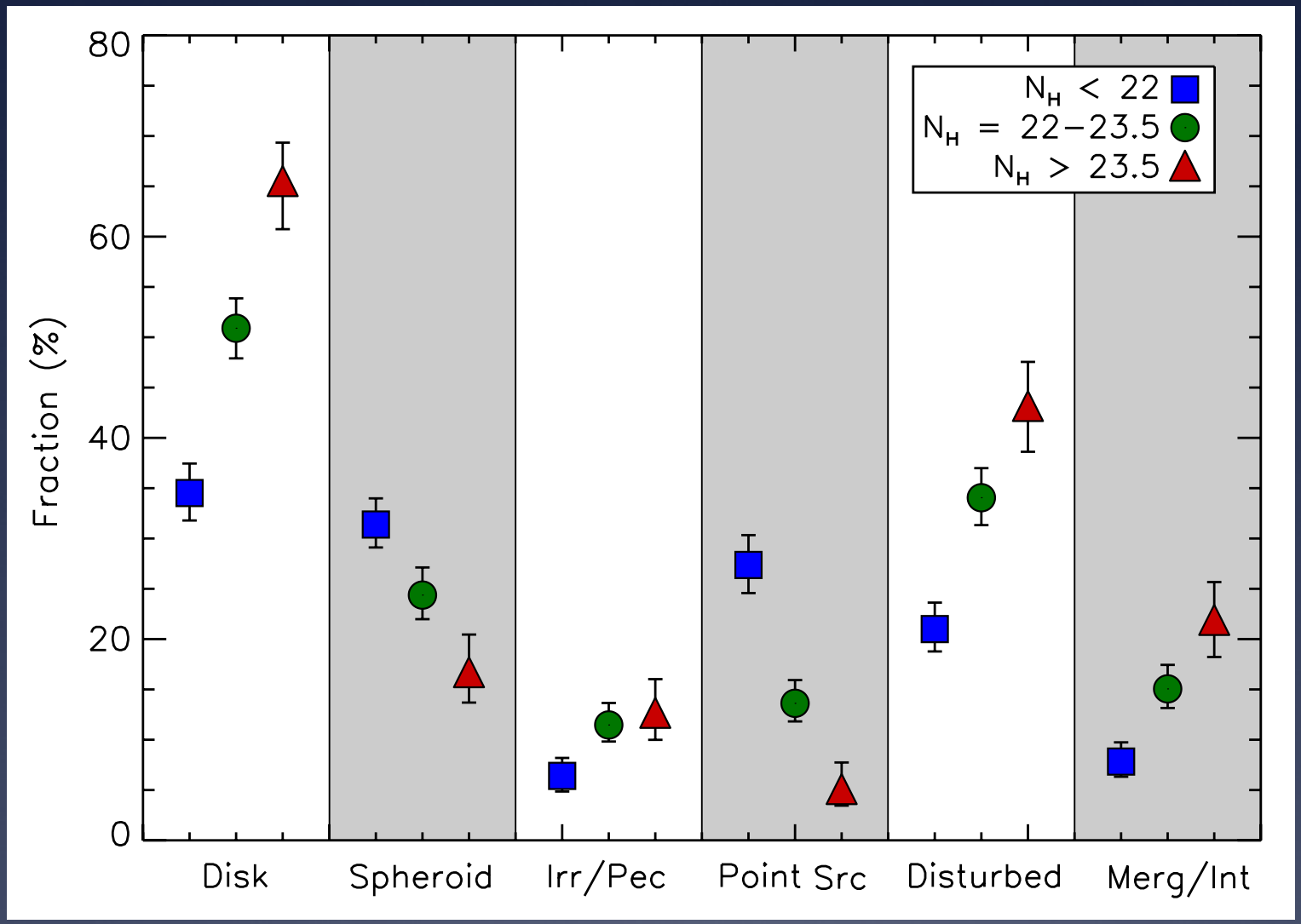




Kocevski et al. (2015)

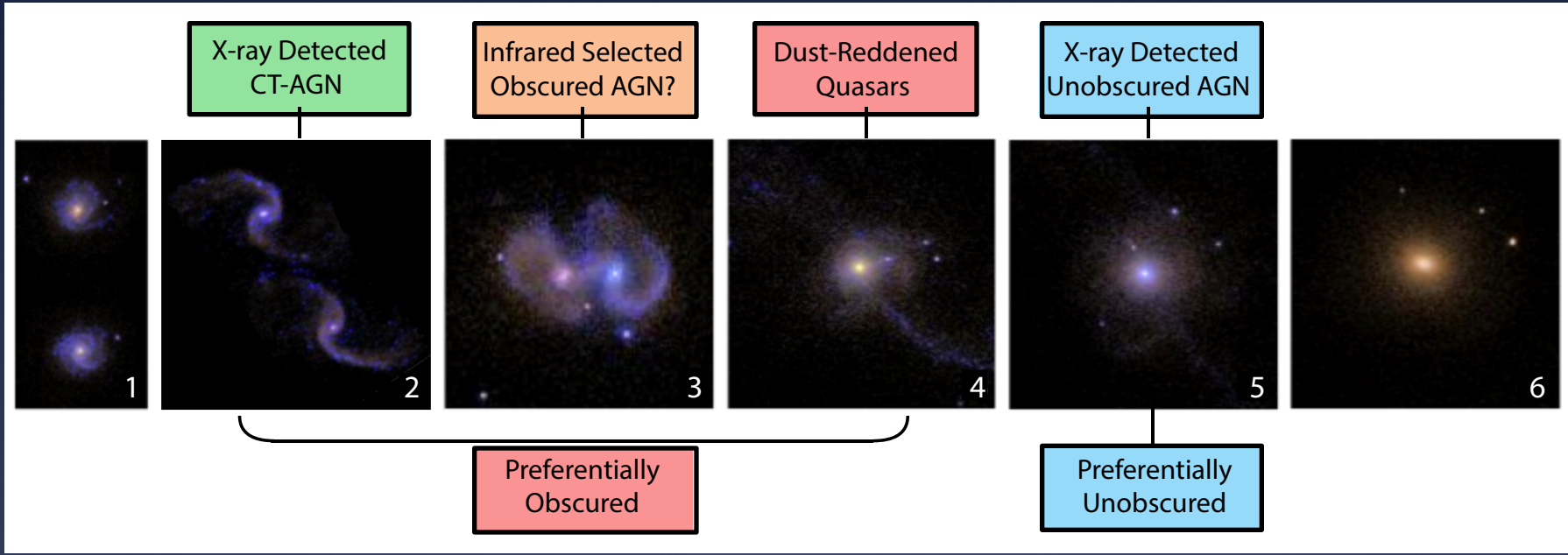
* Heavily obscured AGN are more disturbed than their unobscured counterparts *at fixed luminosity*.

Host Morphology vs Obscuration



Kocevski et al. (2015)

What Triggers AGN Activity at z~2?



* Excess of disturbed morphs vs obscuration consistent with evolutionary sequence.
* Increased secular fueling + incompleteness at high obscuration may explain lack of convincing AGN-merger connection at z~2.

CANDELS and the AGN-Galaxy Connection

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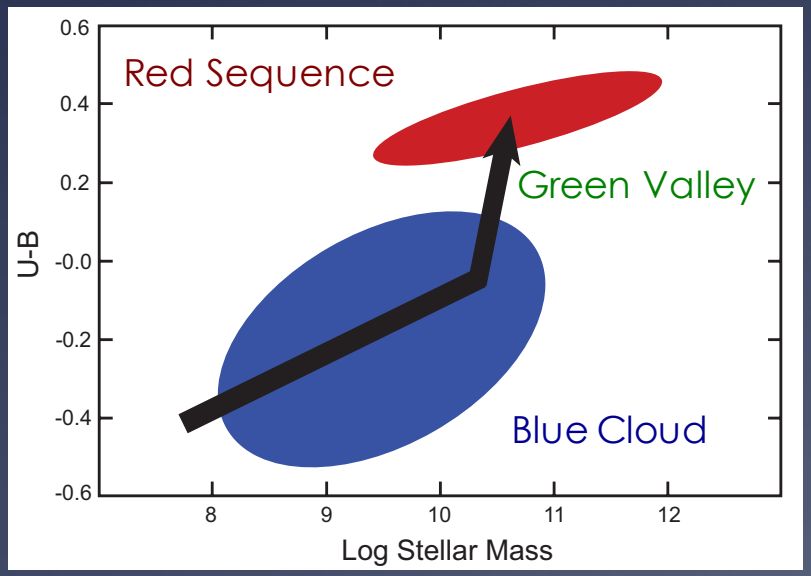
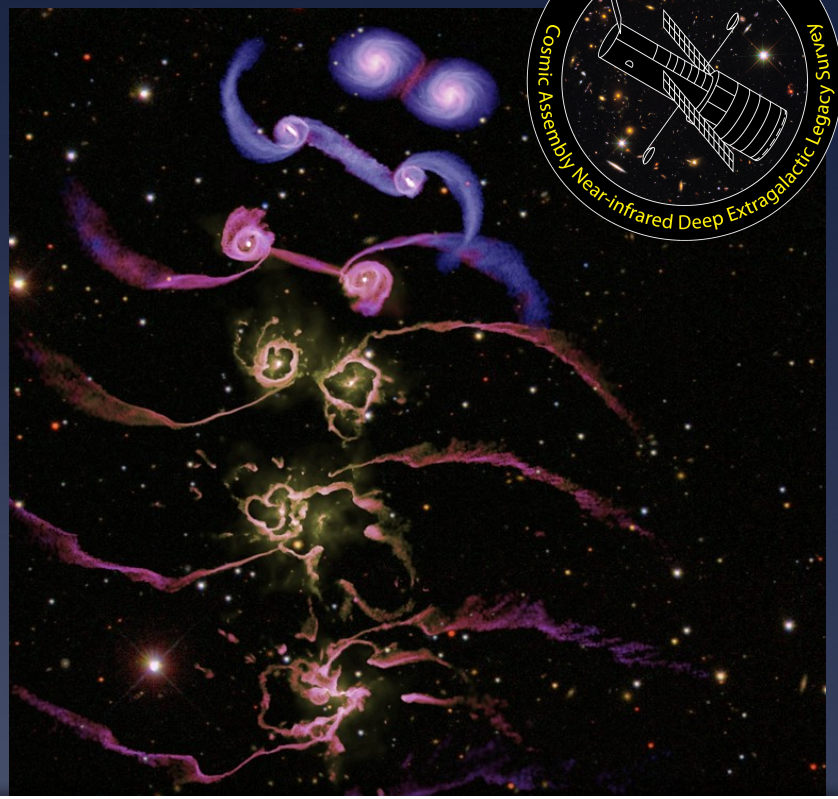
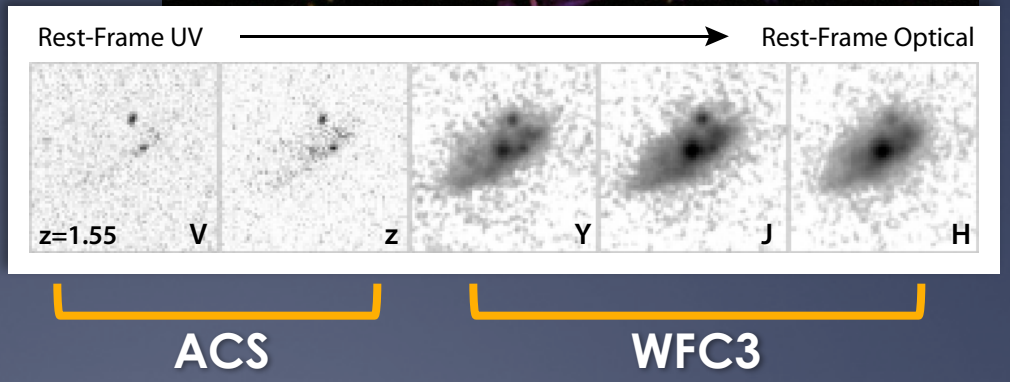
  Using host morphologies to determine mechanisms that fuel BH growth.

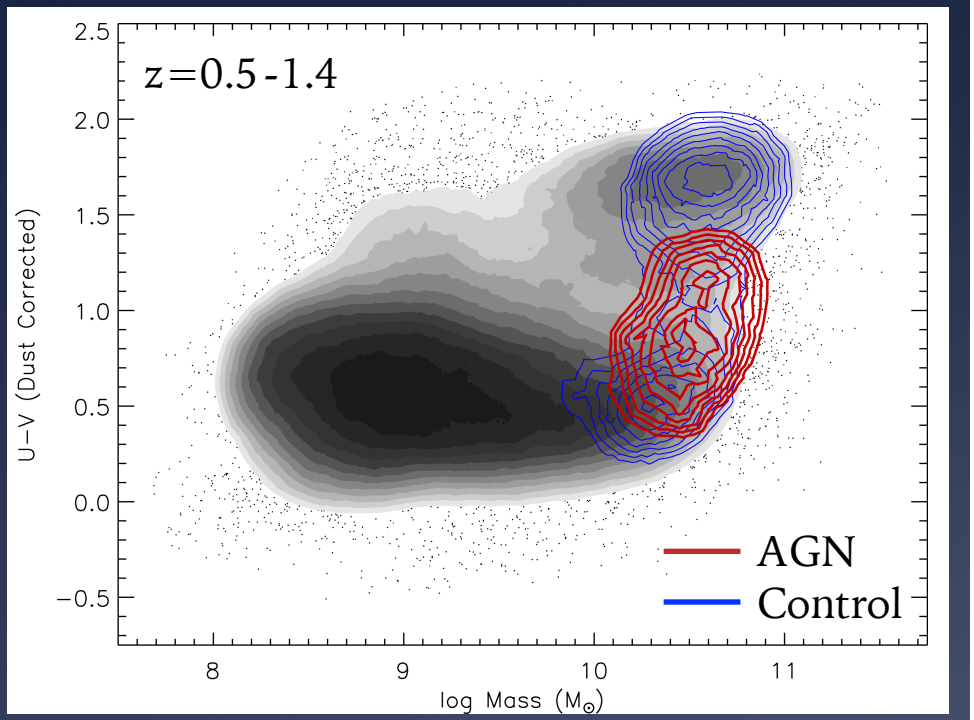
* What role do AGN play in quenching first generation of passive galaxies?
  Using host stellar populations to study SF shutdown in AGN hosts at z~2-3.

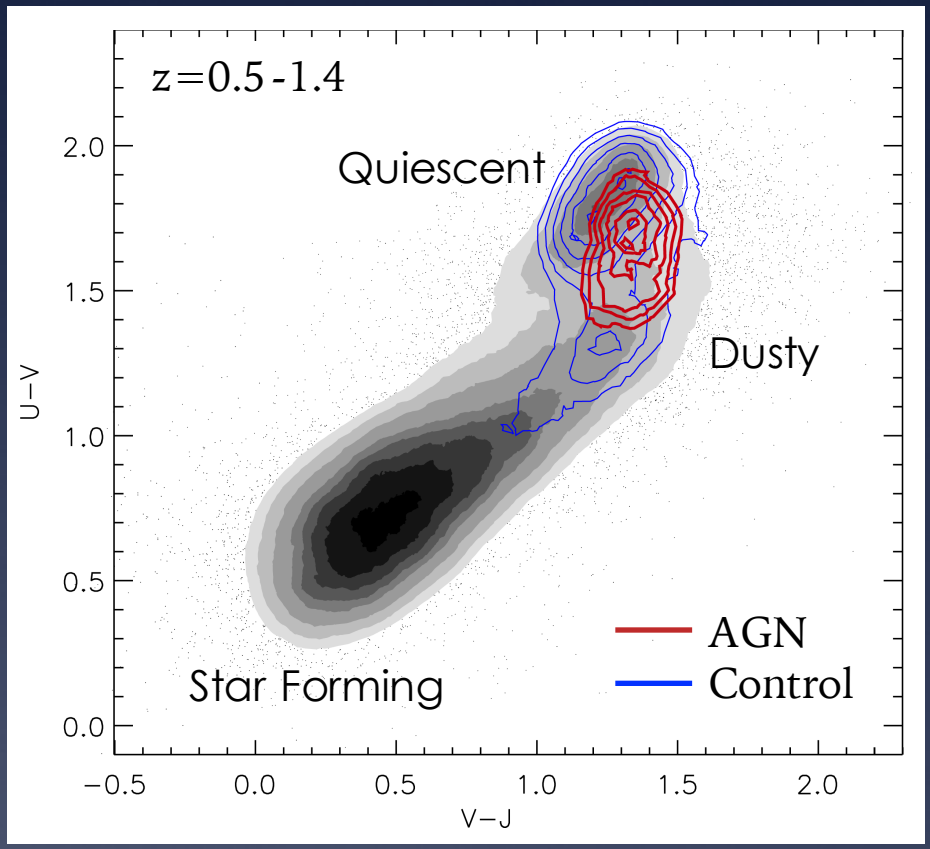






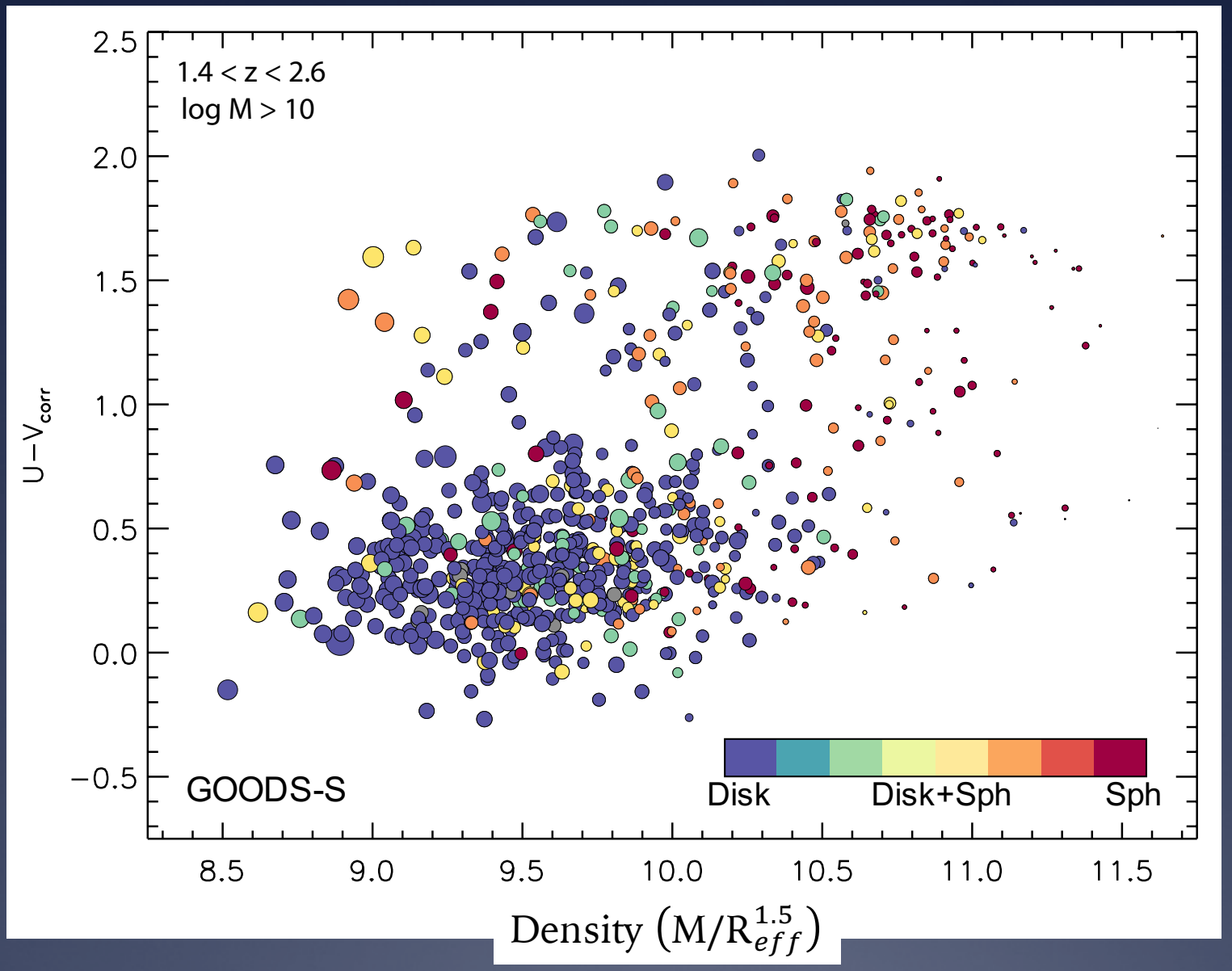
AGN Host Rest-Frame Colors





- AGN hosts have intermediate colors relative to mass-matched control sample at all redshifts (z=0.5-2.6).
- Consistent with previous results that AGN live in the Green Valley.

Quenching Pathways at z~2



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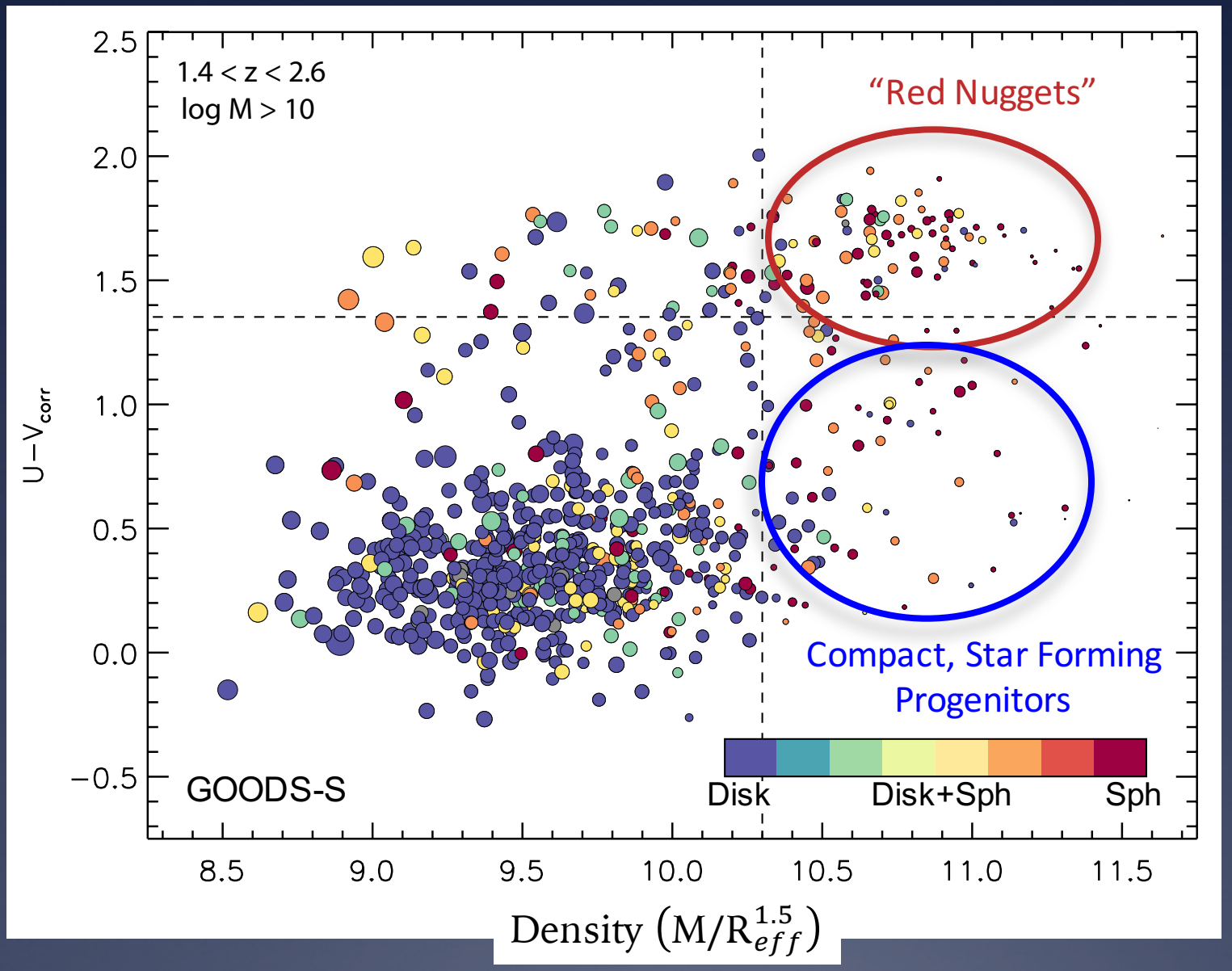
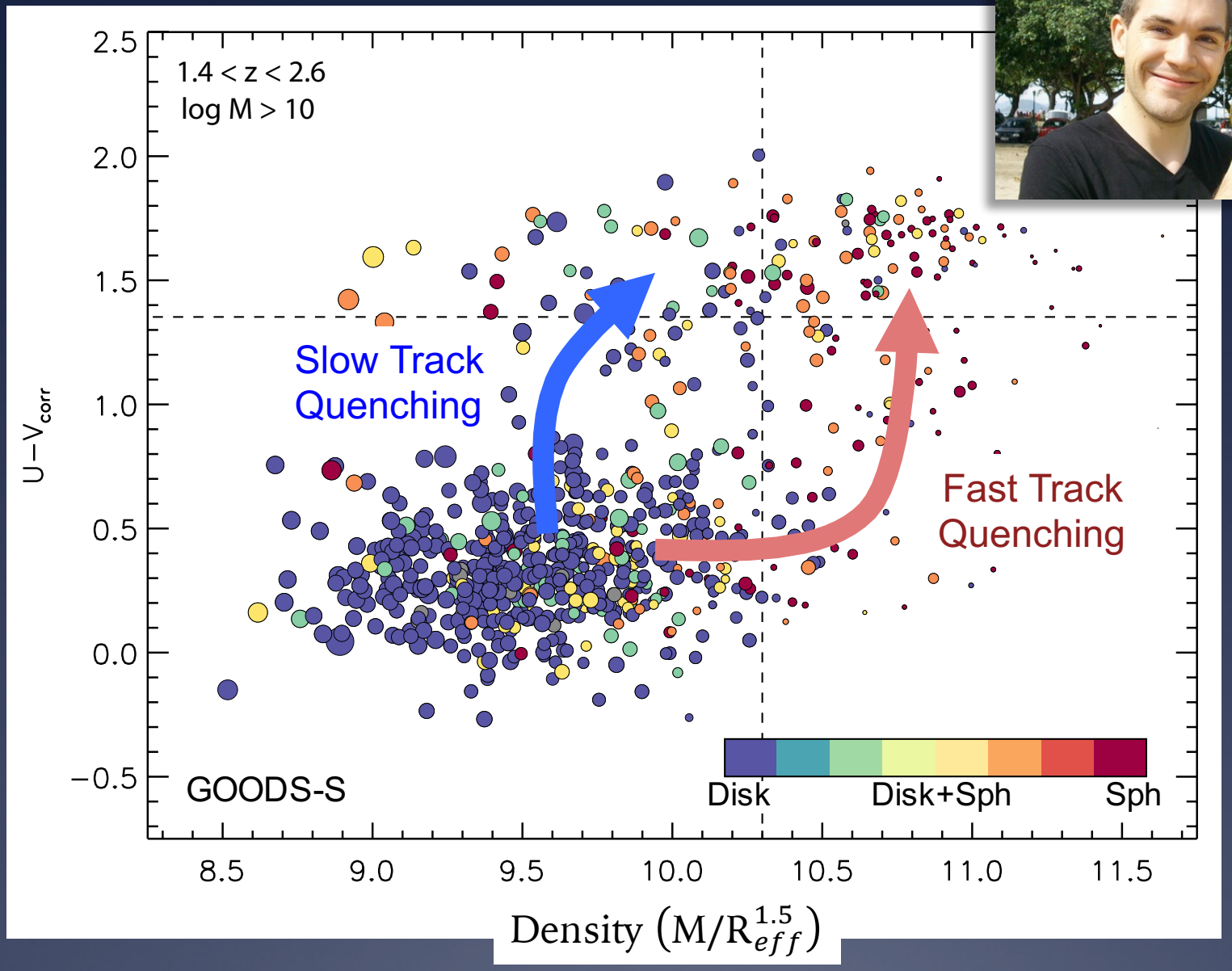
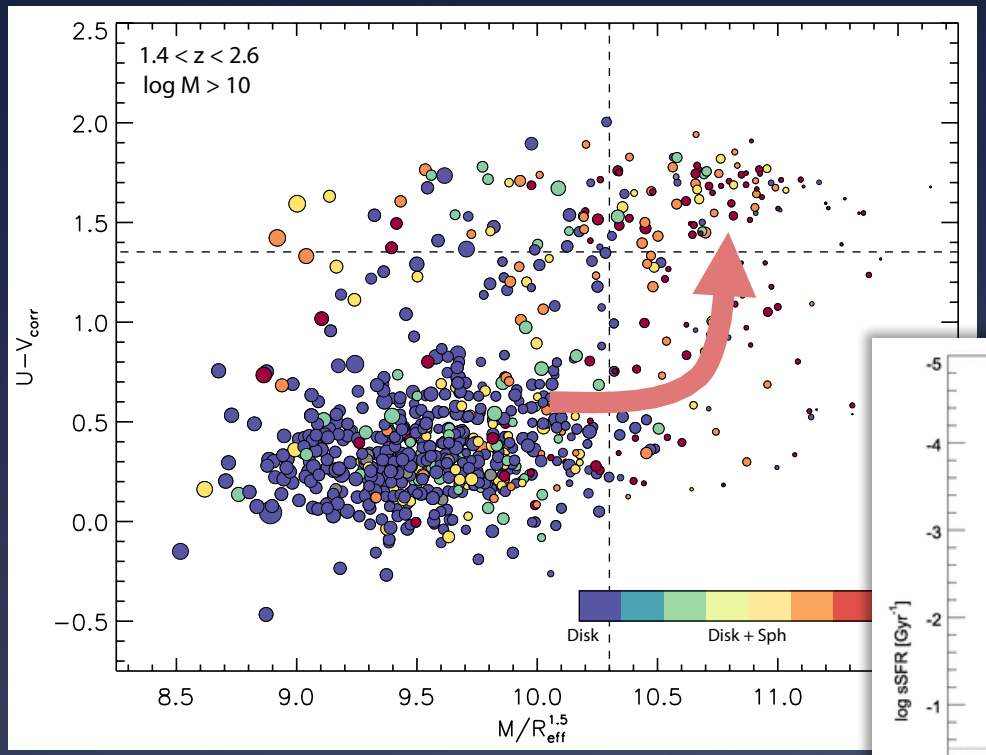
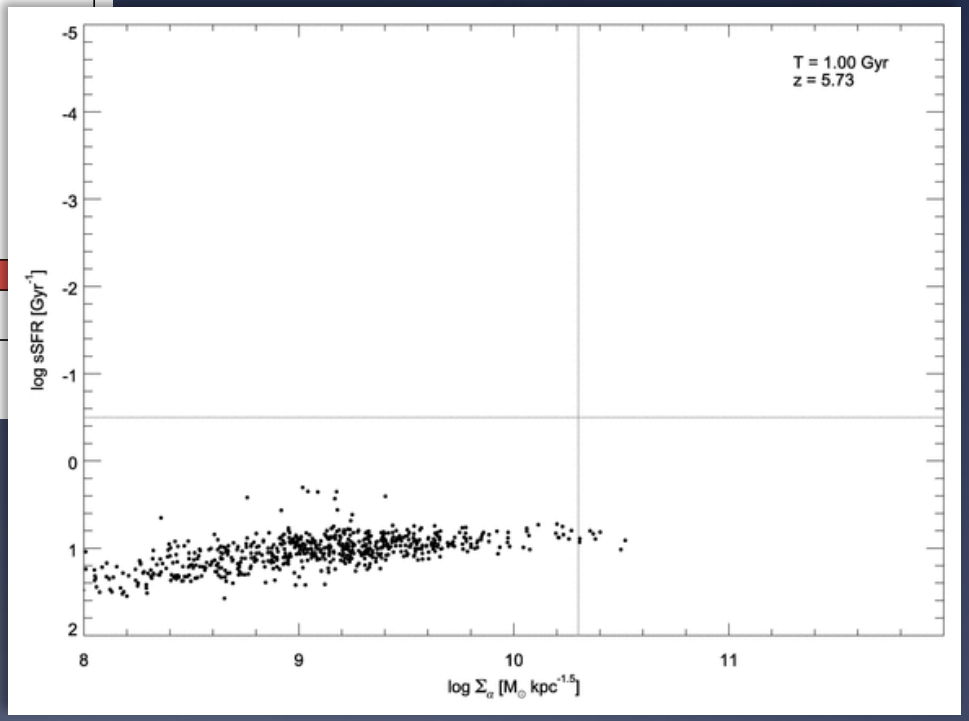


Quenching Pathways at z~2



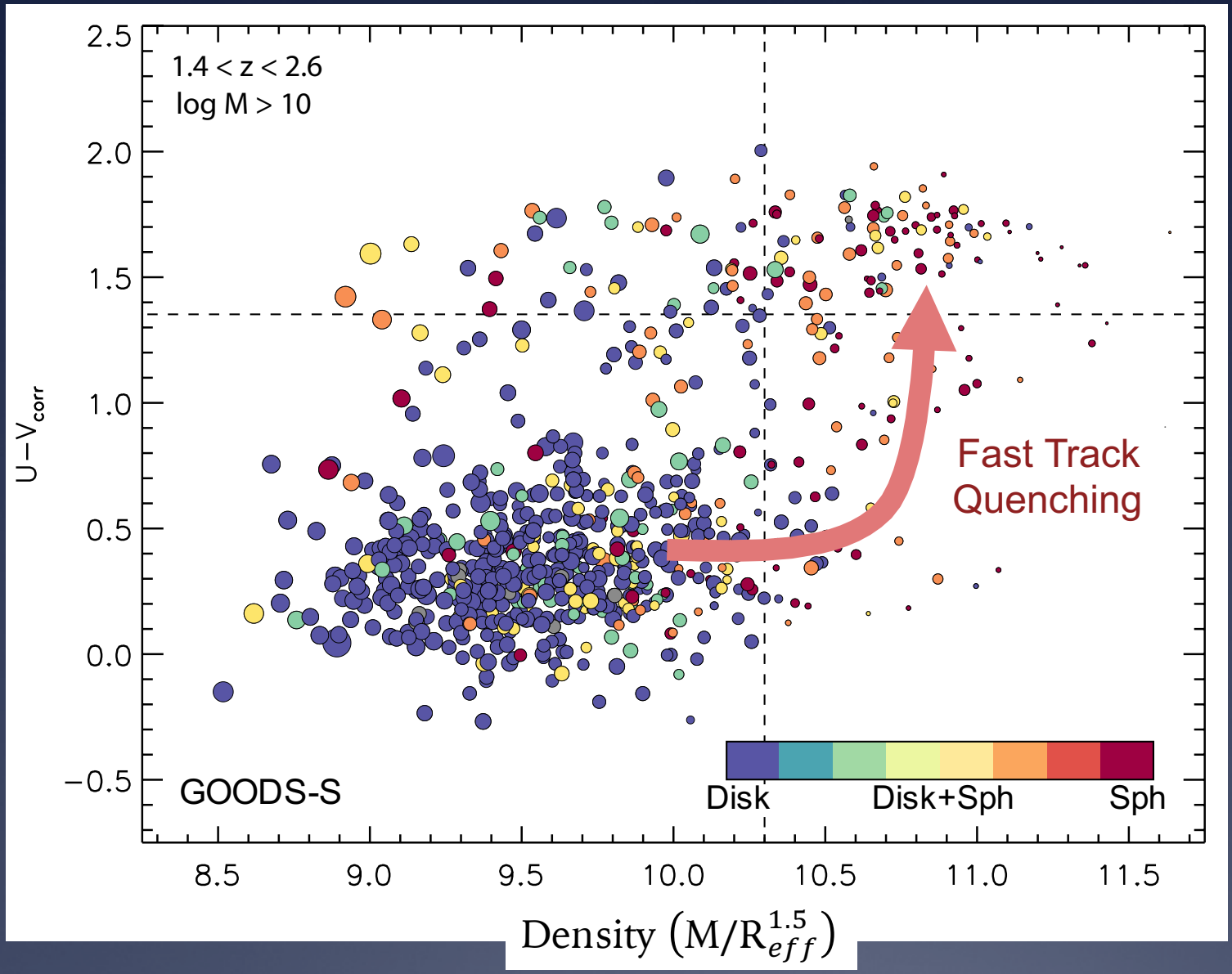
Fast-Track Quenching



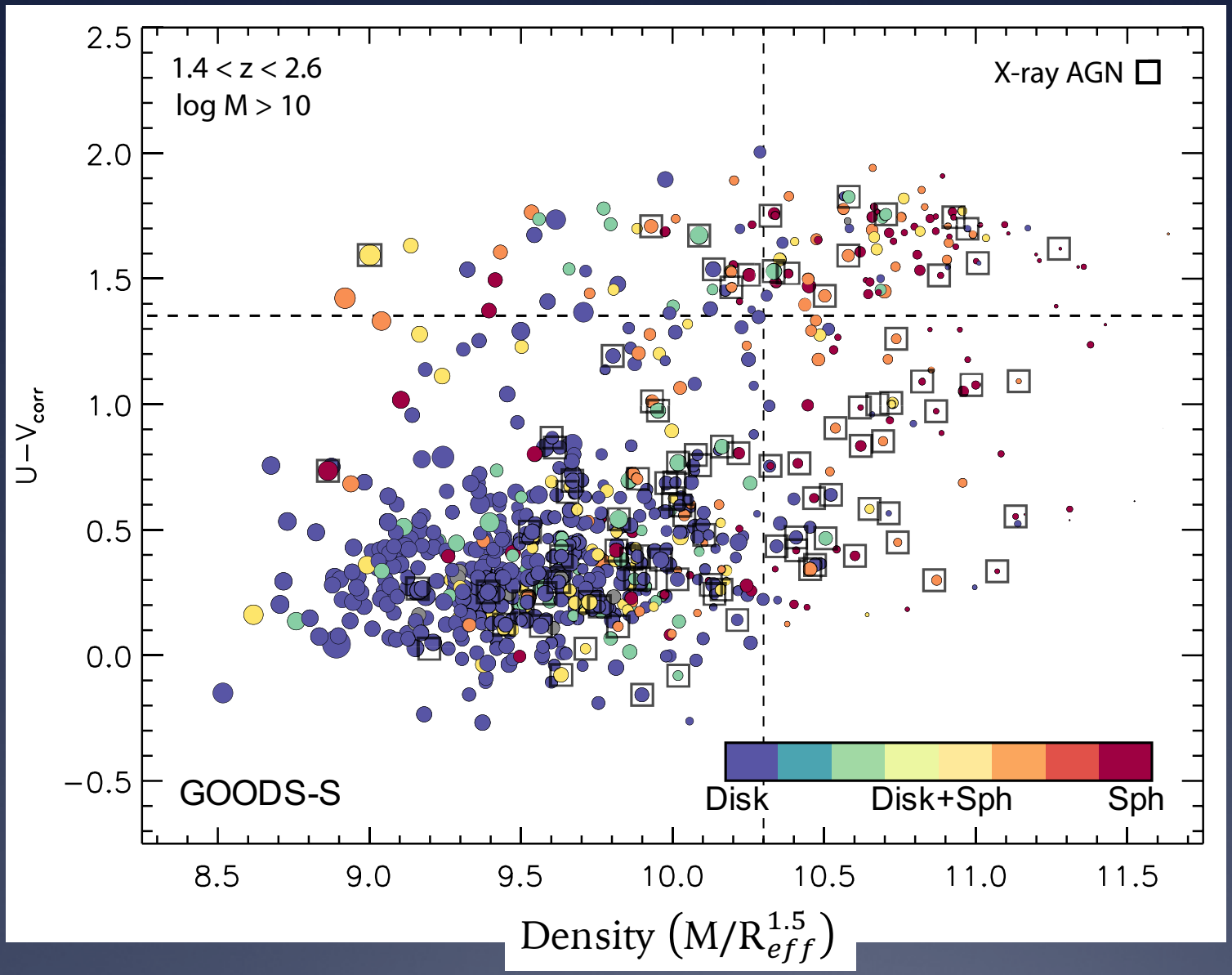


Courtesy Rachel Somerville & Joel Primack

Quenching Pathways at z~2



AGN at the Quenching Threshold



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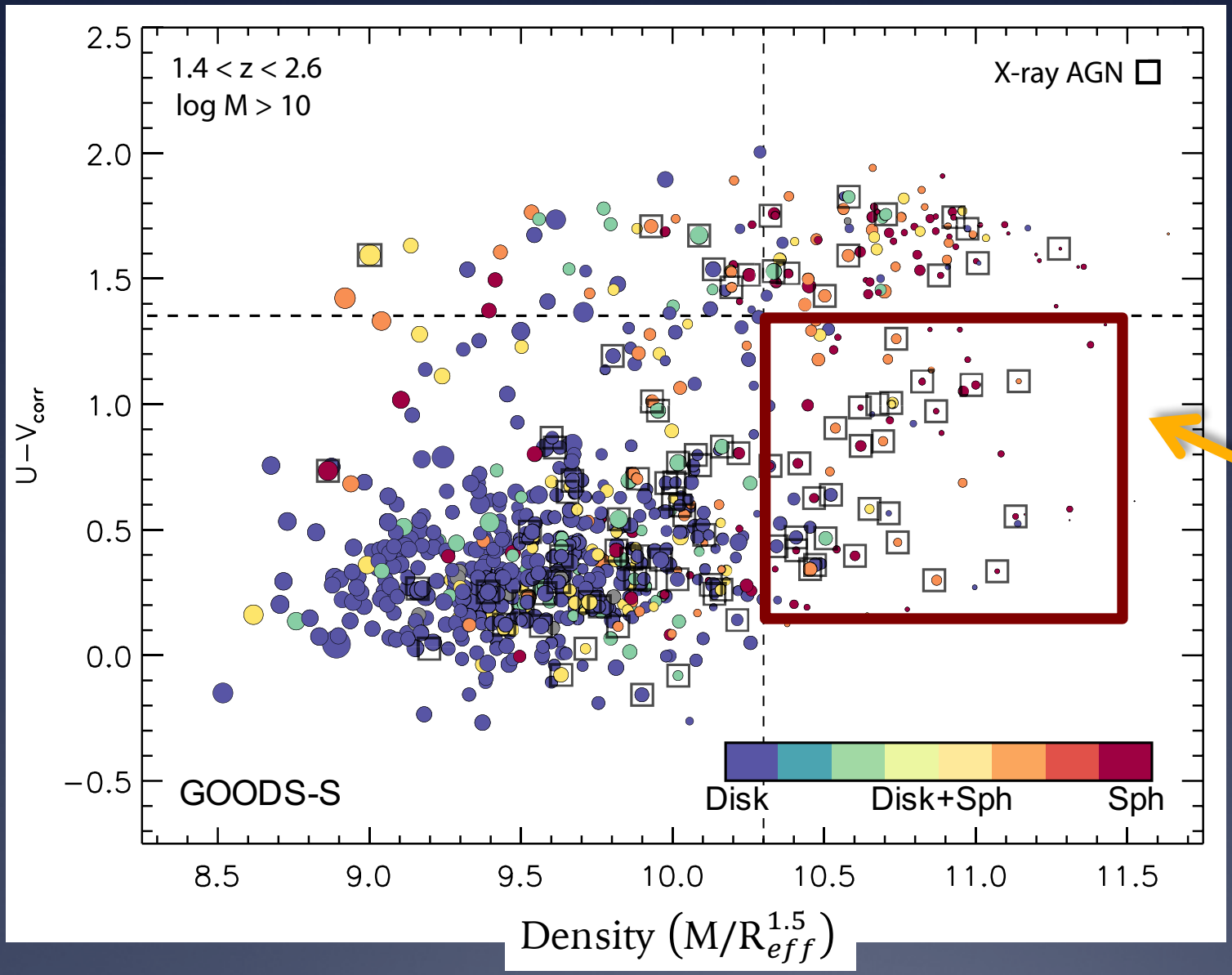
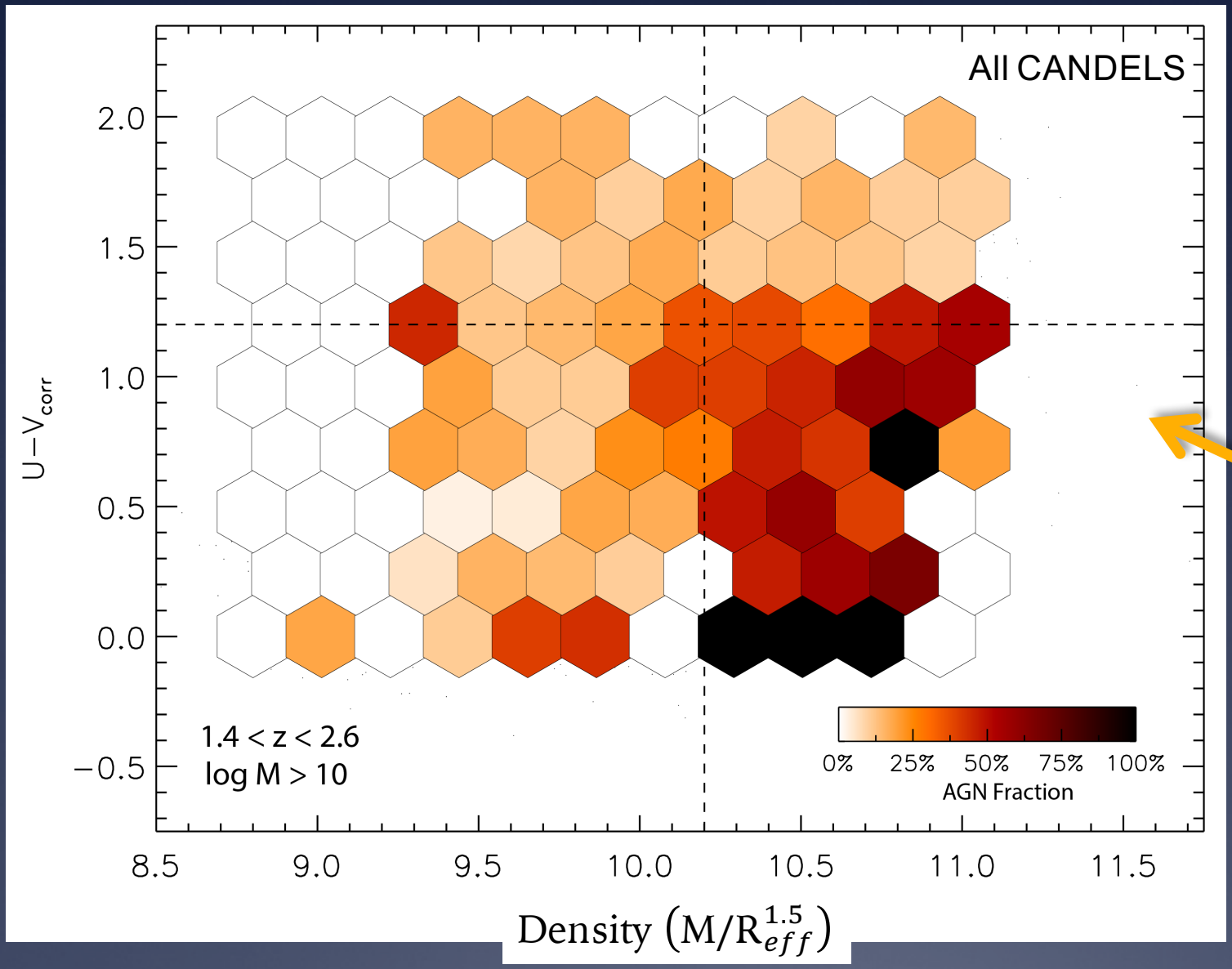


X-ray AGN Fraction: 48%

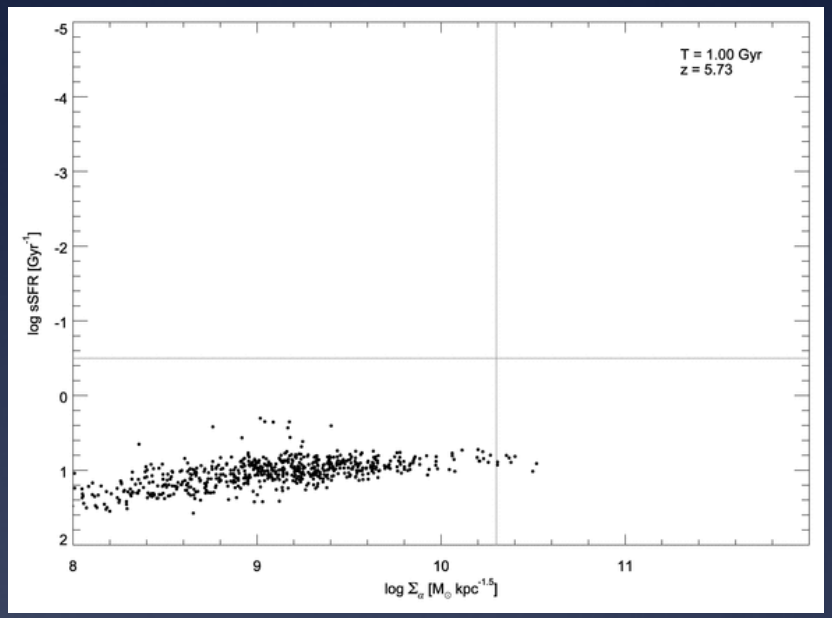
AGN at the Quenching Threshold

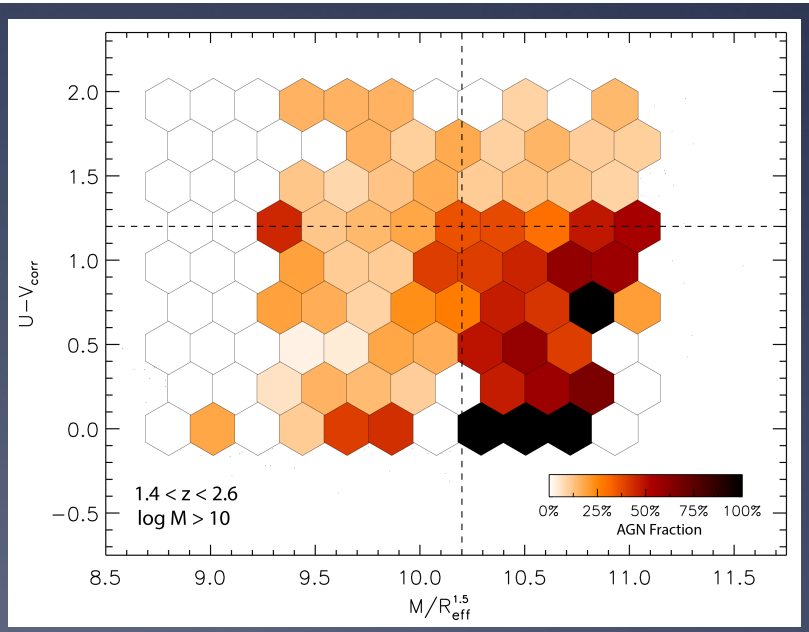


X-ray AGN Fraction: 48%

What Role Do AGN Play in Quenching?

* Large fraction (48%) of compact, star forming galaxies host an X-ray luminous AGN at z~2.
* First generation of quenched galaxies emerged directly following a phase of rapid Black Hole growth.
* Hints at possible role of AGN feedback in the quenching process.





Summary of Key Results

* Mergers not needed to fuel most AGN activity at z~2.
* Connection between mergers and obscured Black Hole growth.
* AGN-merger connection missed by previous studies due to obscuration.
* AGN appear ubiquitous in galaxies transitioning from blue cloud to the red sequence at z~2.
* First generation of quenched galaxies emerged directly following a phase of rapid Black Hole growth.