

The Spark for Star Formation Across Billions of Years

Michael Calzadilla

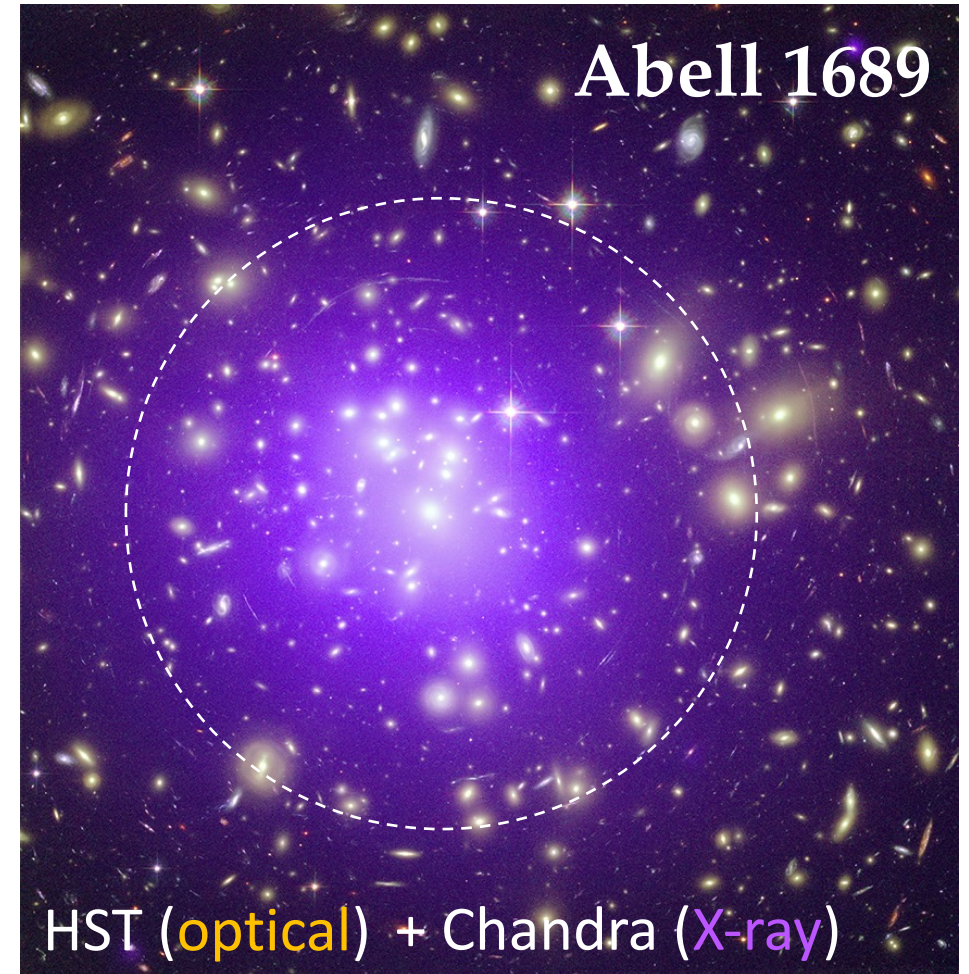
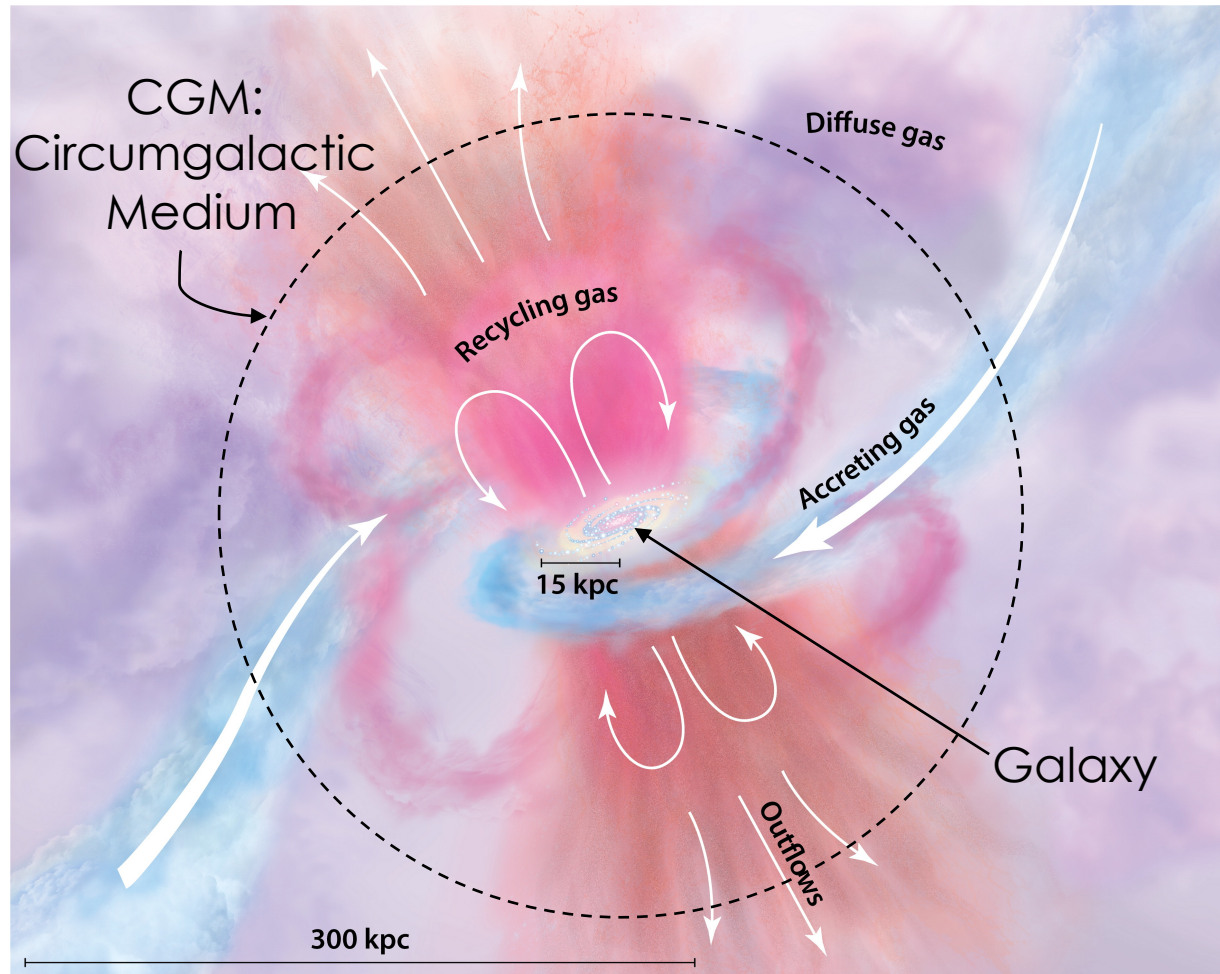
South Pole Telescope collaboration



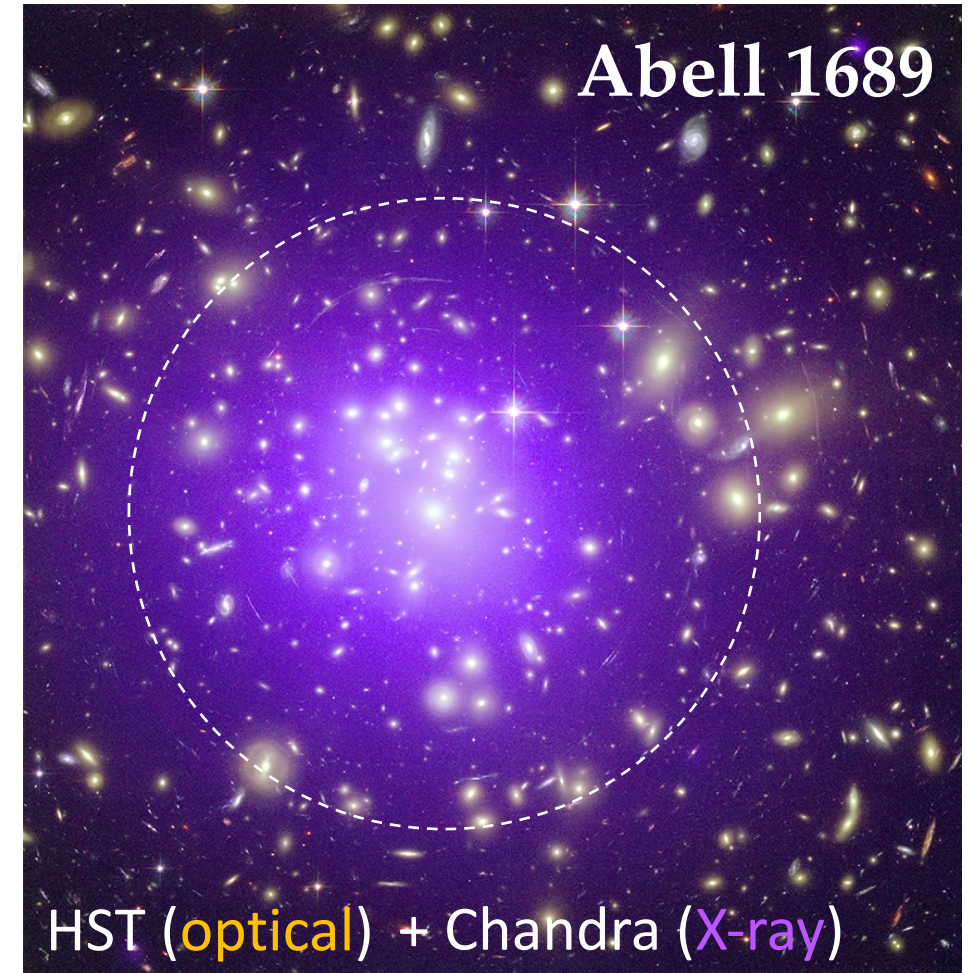
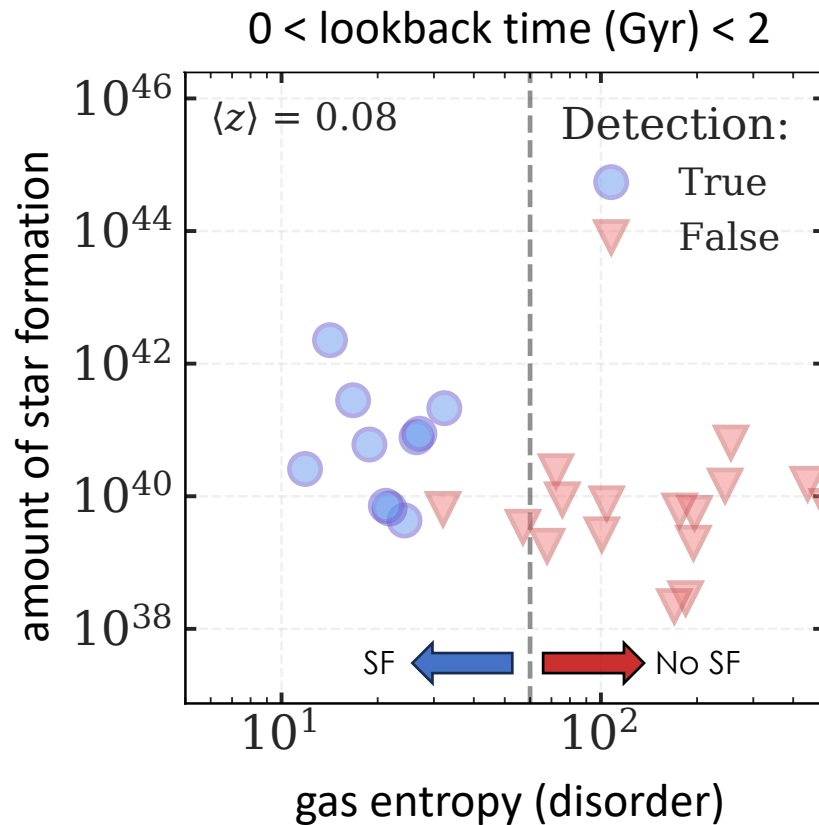


How did we arrive at the galaxies we see today?

How do galaxies acquire the gas needed for star formation?



A trigger for star forming material to condense out of hot atmospheres



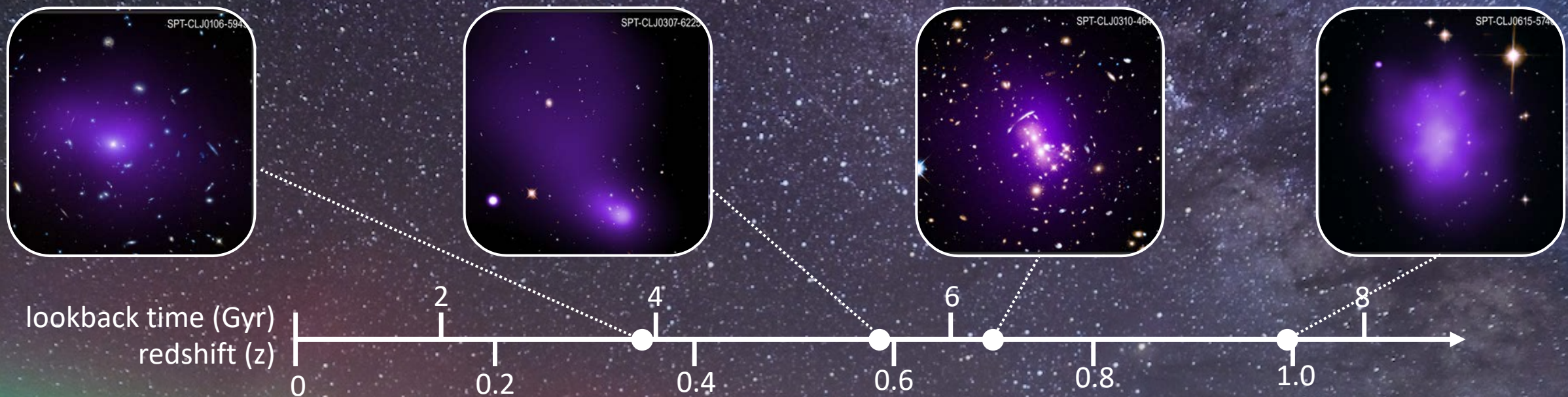
Was atmospheric cooling just as important in the past?

Cosmic star formation, mergers, black hole accretion peaked between 7-11 Gyr ago

Challenges:

- finding distant clusters
- multiwavelength followup





SPT-Chandra sample:

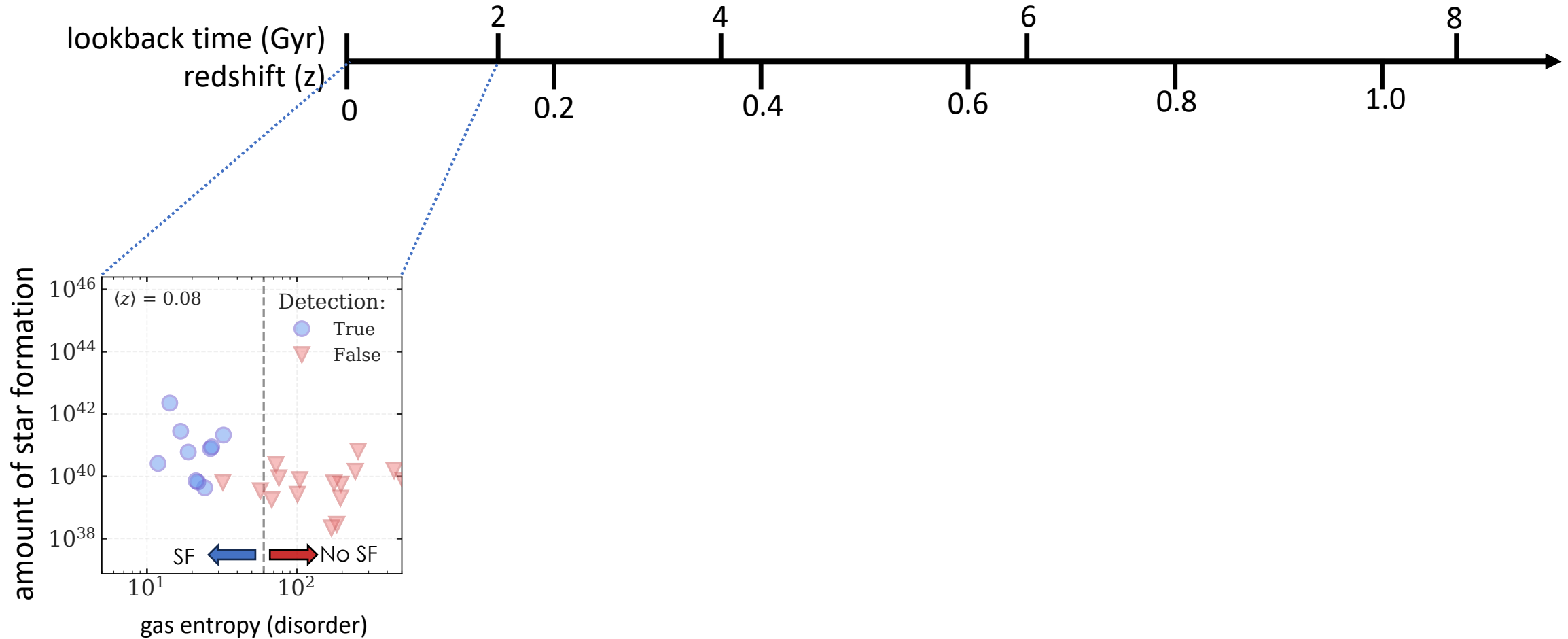
Unbiased sample of 95 clusters
spanning 10 Gyr in evolution

Multiwavelength followup:

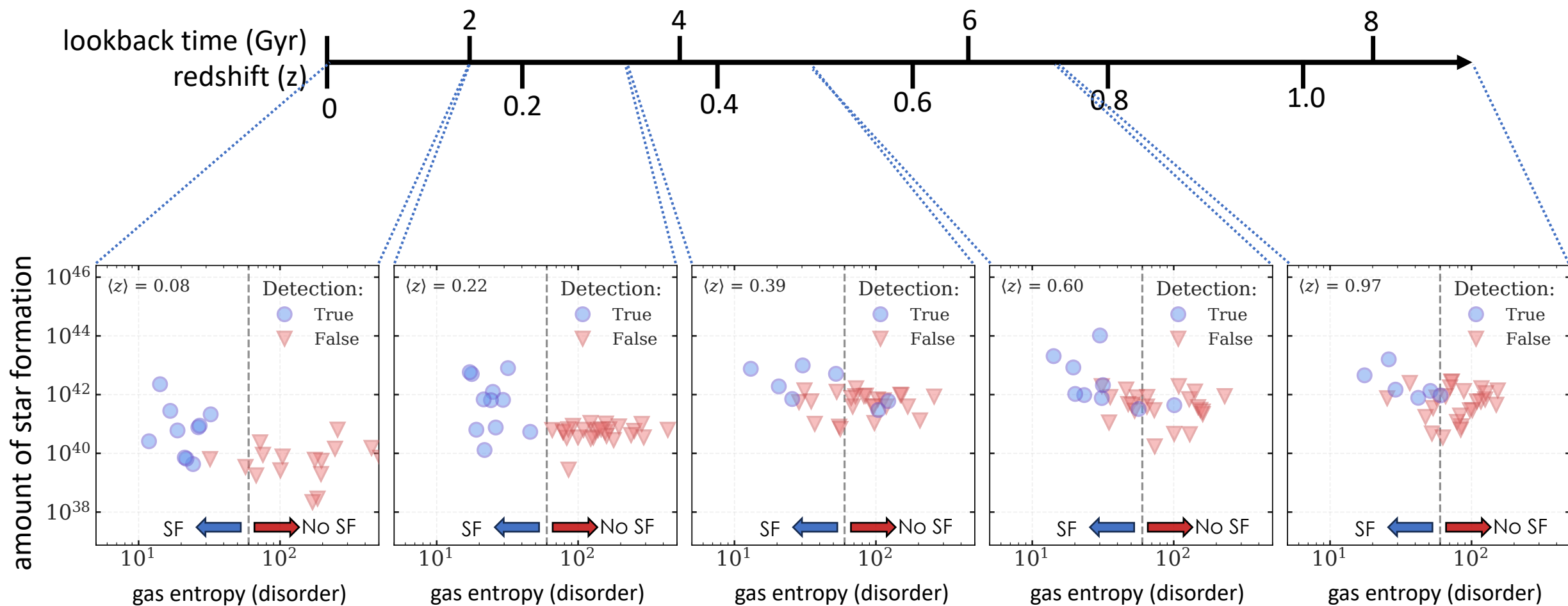
~4 Ms Chandra (X-ray)

~30 nights optical spectroscopy

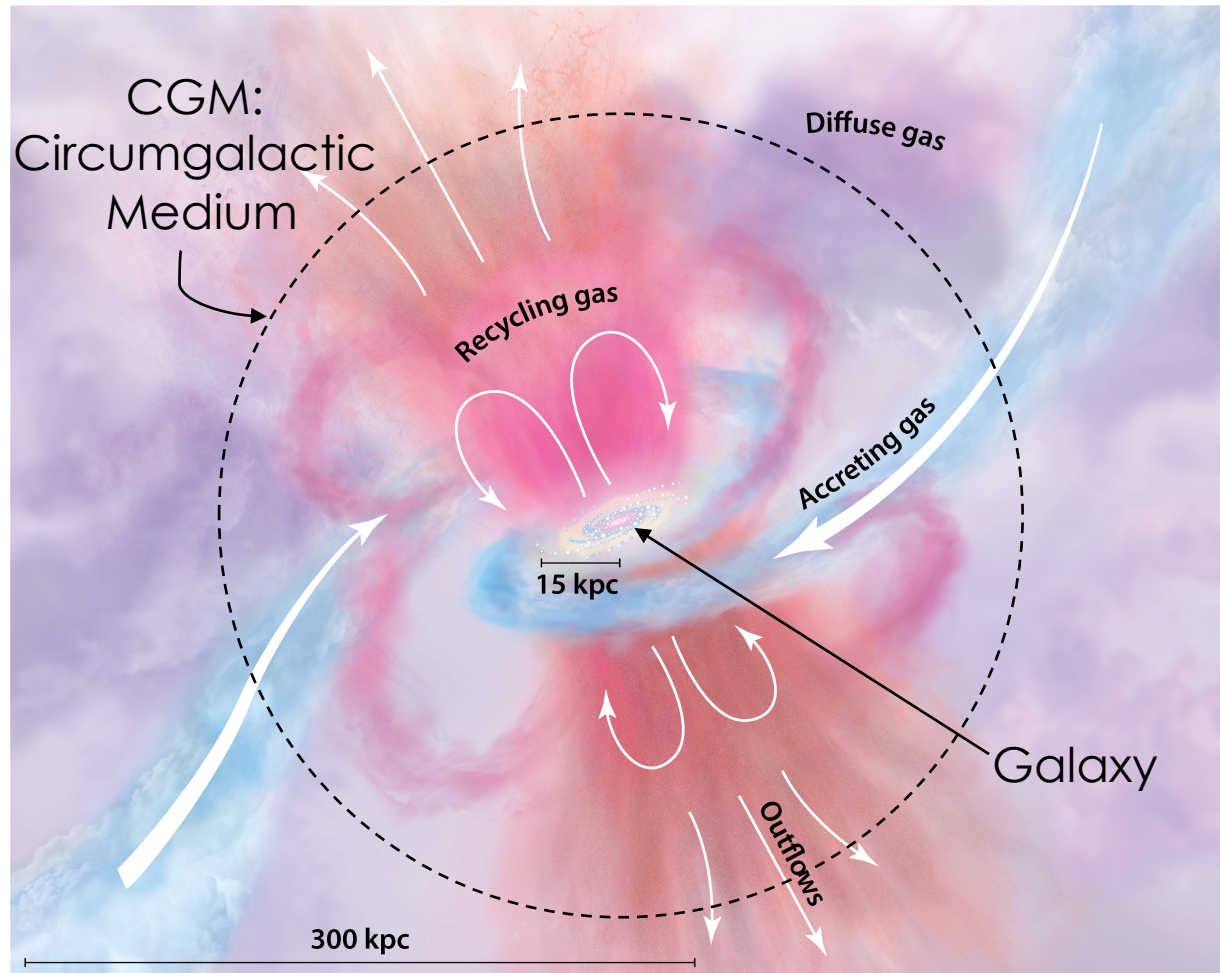
Trigger for star formation persists for 10 Gyr



Trigger for star formation persists for 10 Gyr



Black hole feedback regulates gas supply



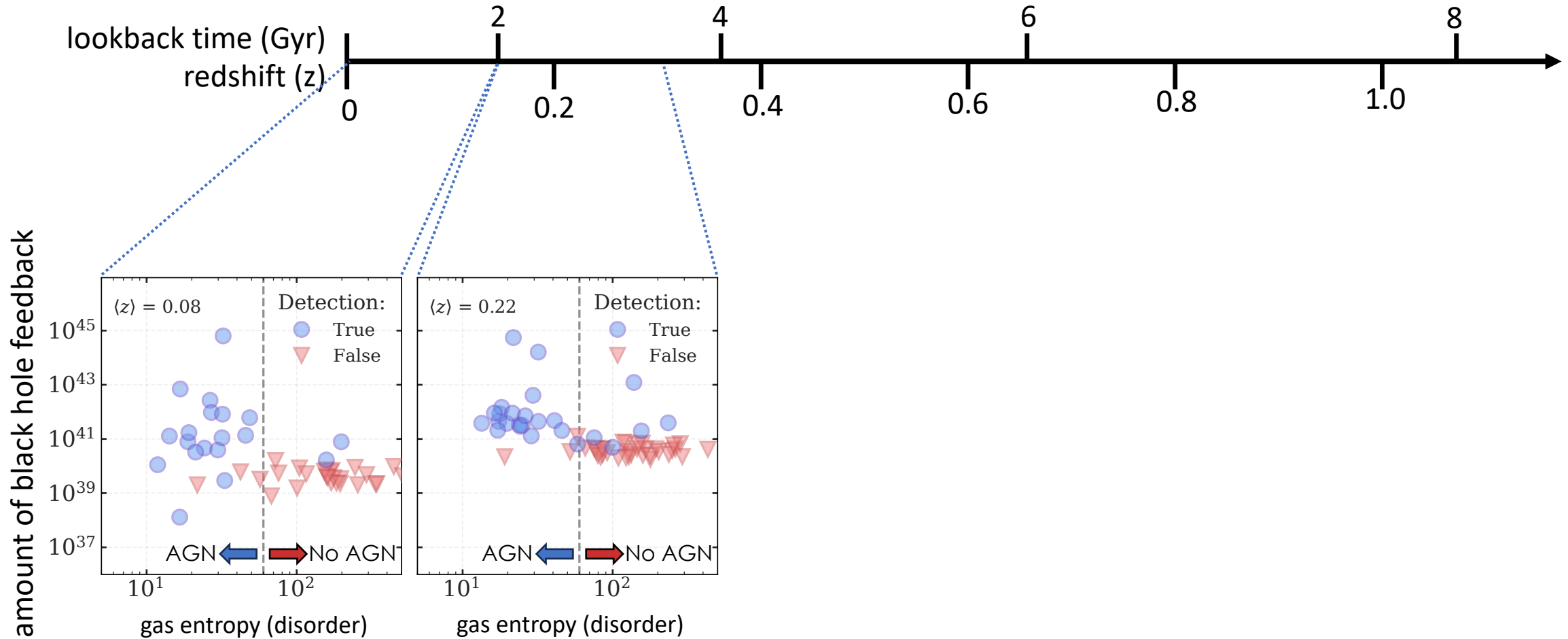
Black hole outflows suppress cooling and star formation

X-ray:
Cooling
atmosphere

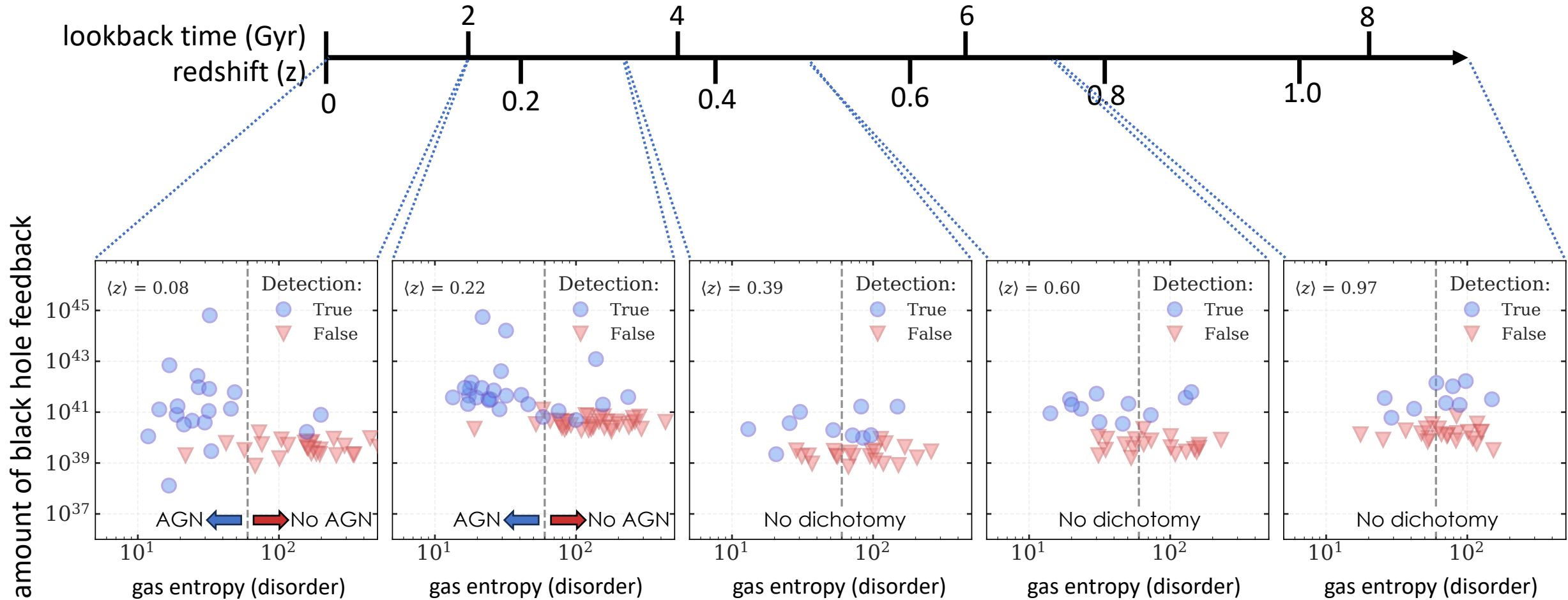
Optical:
Galaxies &
Star formation

Radio:
Black hole
feedback

Trigger for black hole feedback disappears



Trigger for black hole feedback disappears



Summary

Multiwavelength SPT sample of ~100 clusters spanning 10 Gyr

Trigger for star formation in BCGs persists out to $z > 1$

Beginnings of black hole feedback?

Come see more info today at:
Galaxy Clusters II session,
2:20pm Room 216



Michael Calzadilla
msc92@mit.edu

