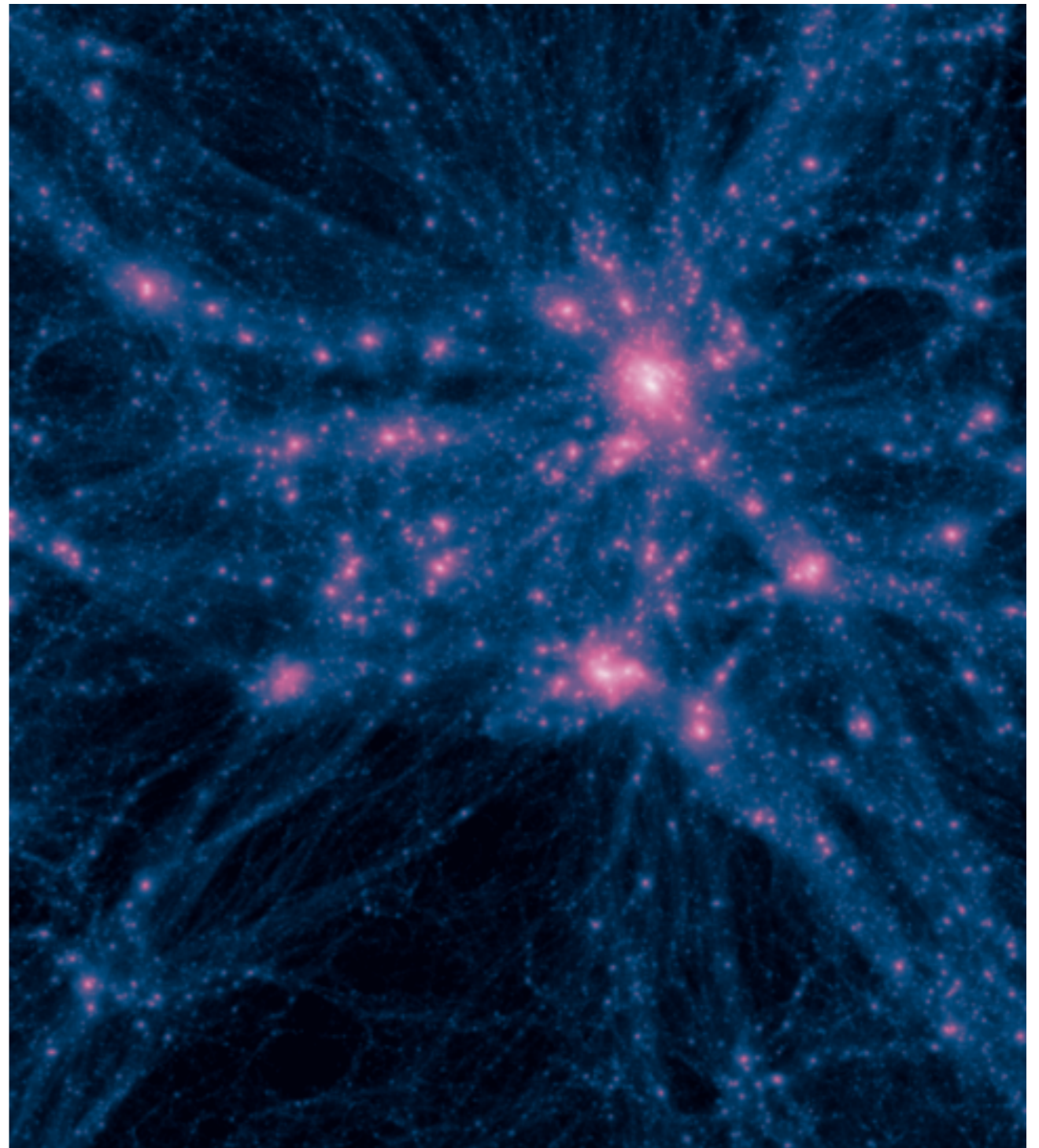# Does black-hole growth depend on the cosmic environment?

Cosmic environment

- **Dominated by dark-matter**

- **Cosmic web: cluster, filament, field**
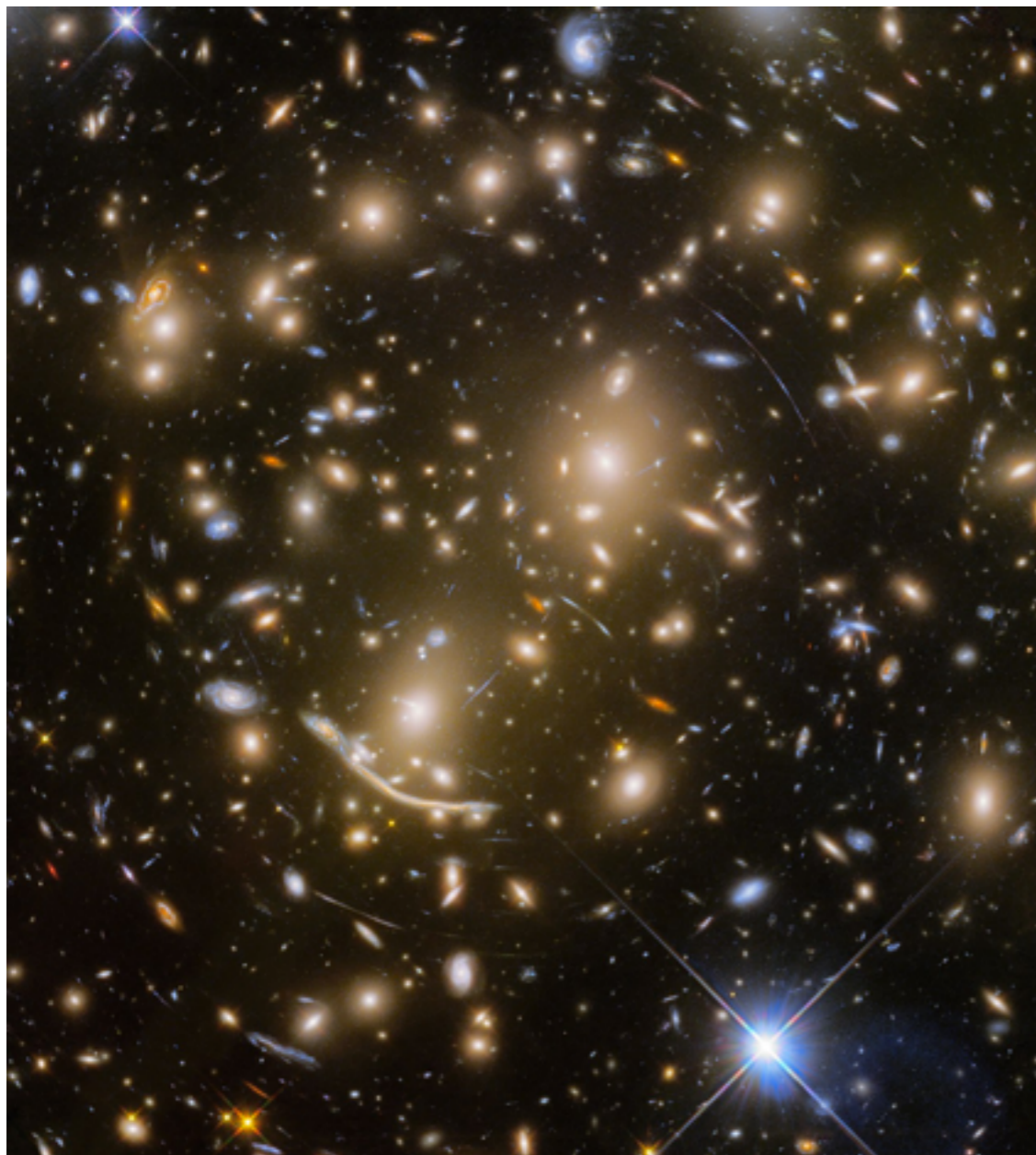
- **Galaxies are born in dark matter halos**

Credit: Illustris simulation

Environment shapes galaxy

Clusters: early-type galaxy

Field: late-type galaxy

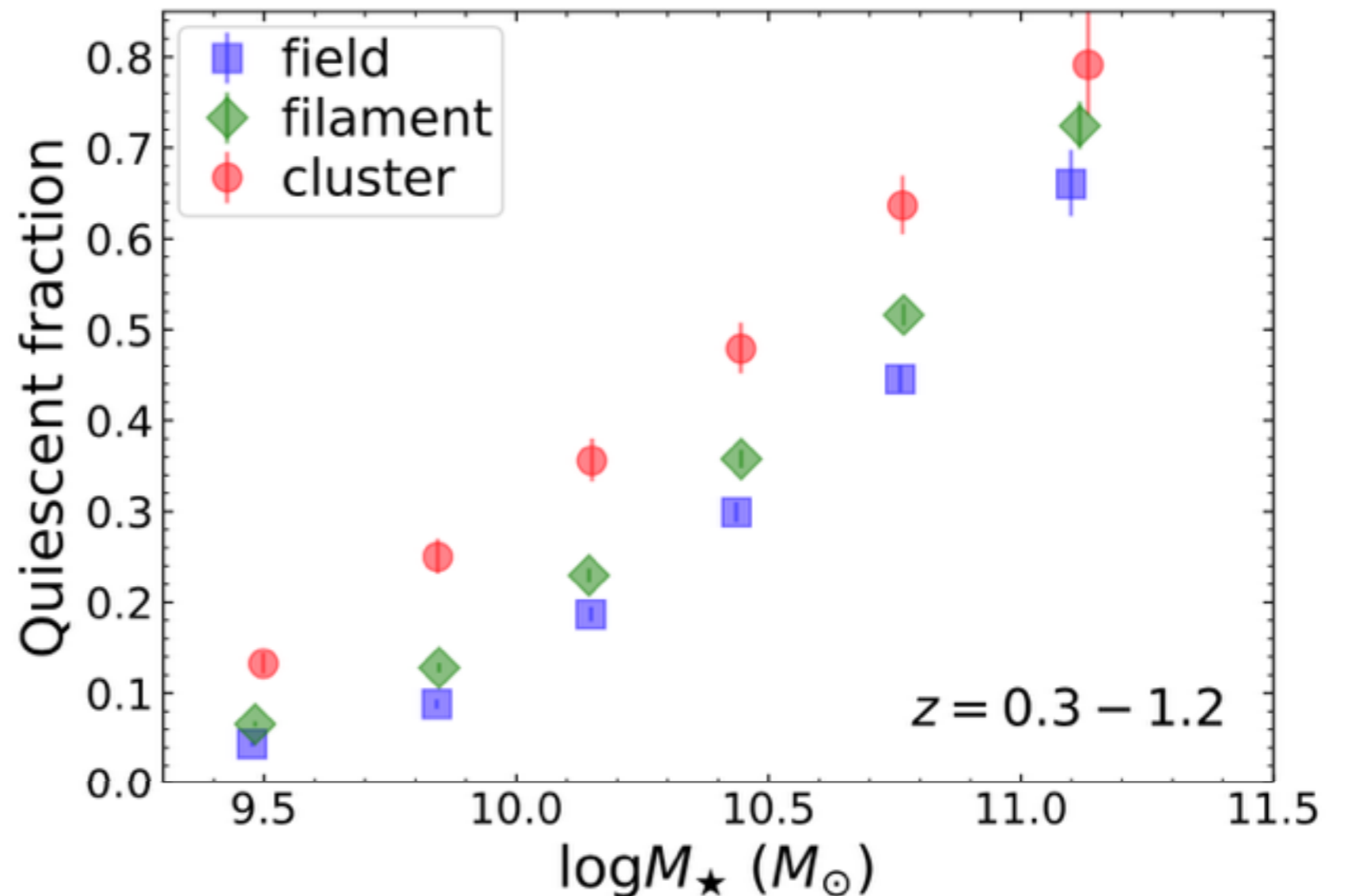Abell 370, credit: NASA, ESA, Jennifer Lotz and the HFF Team

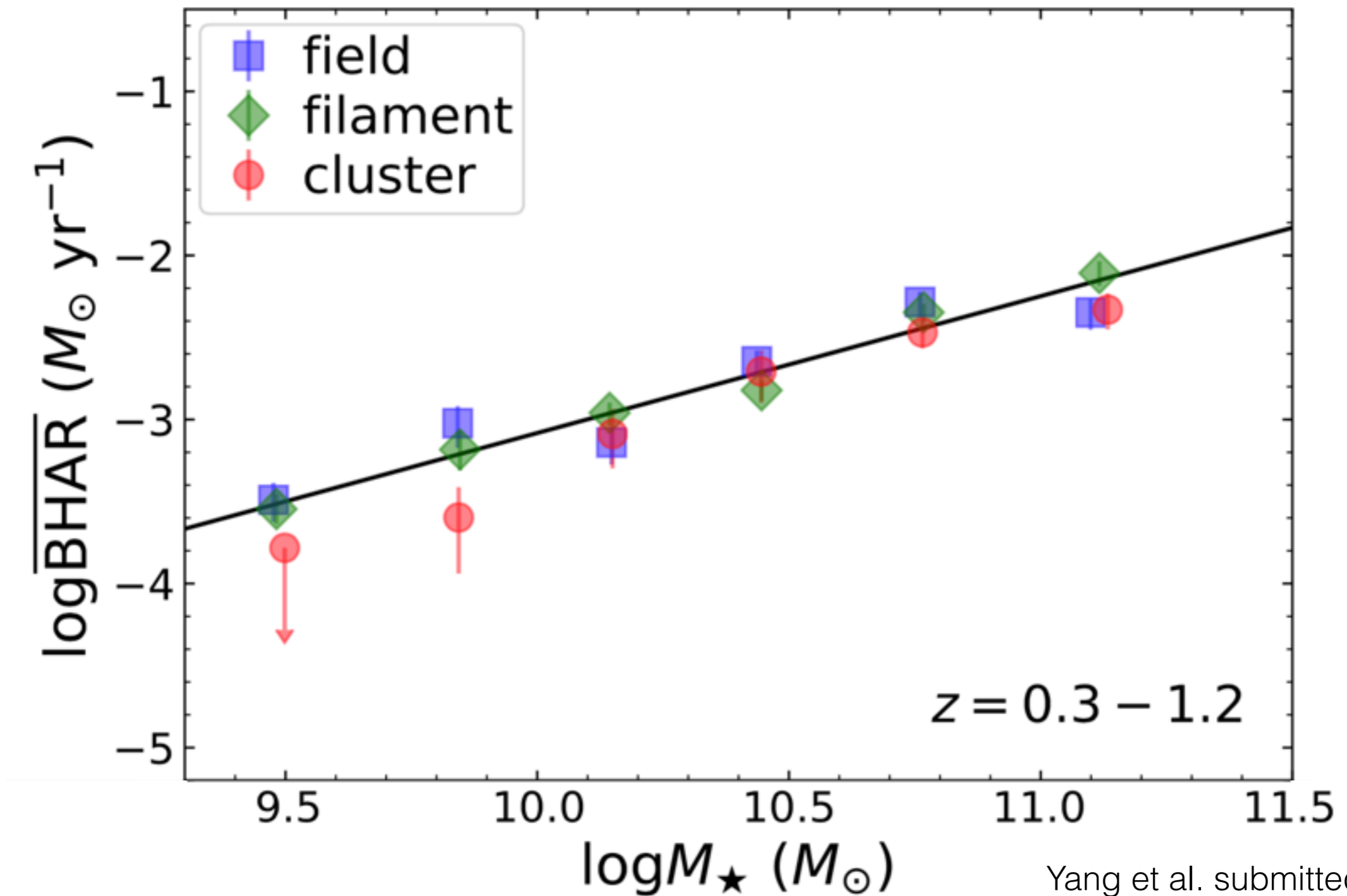M101, Credit: Bob Franke

Why? ram-pressure stripping and etc.

Credit: ESO

Observations: environmental quenching

At z<~1, quiescent-galaxy fraction is higher from field to cluster

Yang et al. submitted

BHAR: NOT affected by environment

Yang et al. submitted

Summary

- **BHAR is mainly related to $M_\star$ rather than environment**