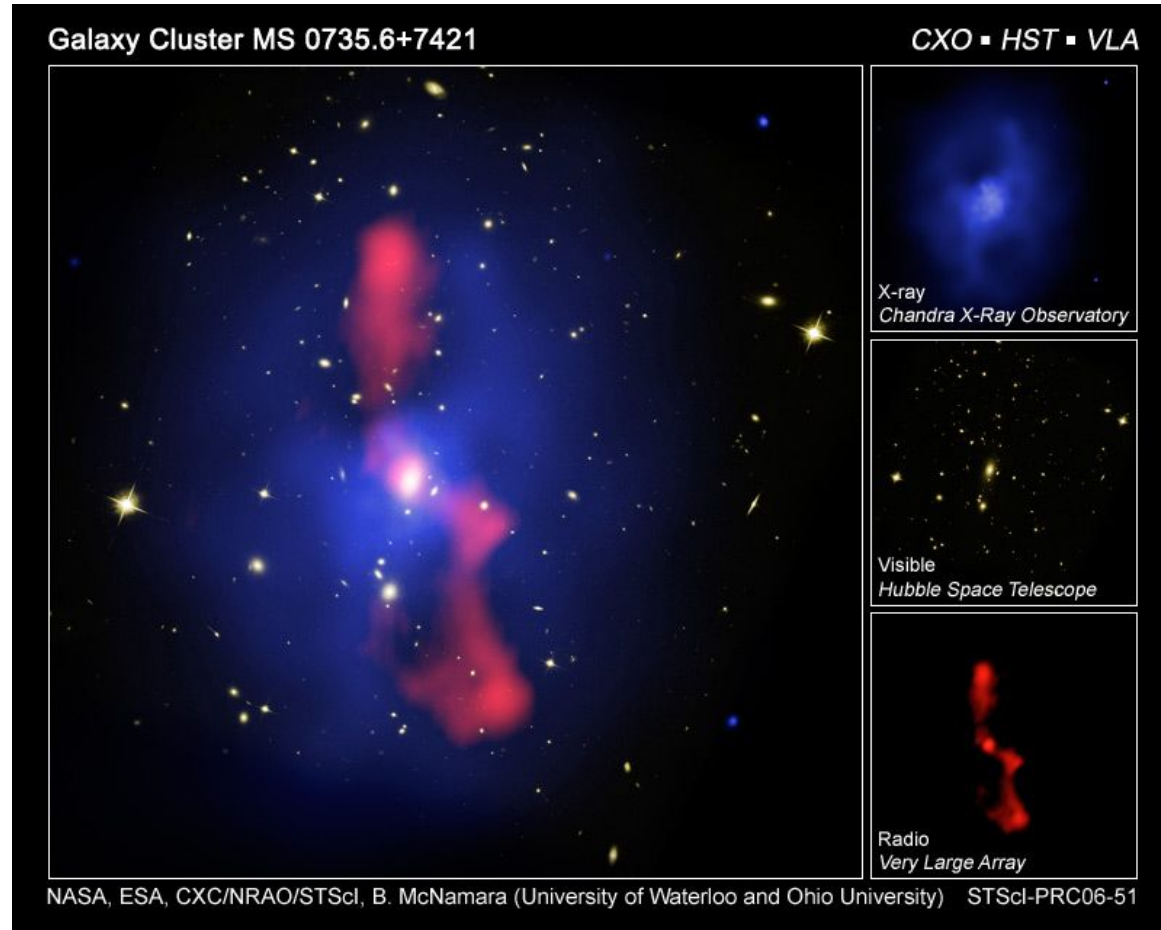


# Cosmic evolution of radio-AGN: insights on fuelling and feedback

Rohit Kondapally (he/him)

Philip Best + LOFAR SKSP team

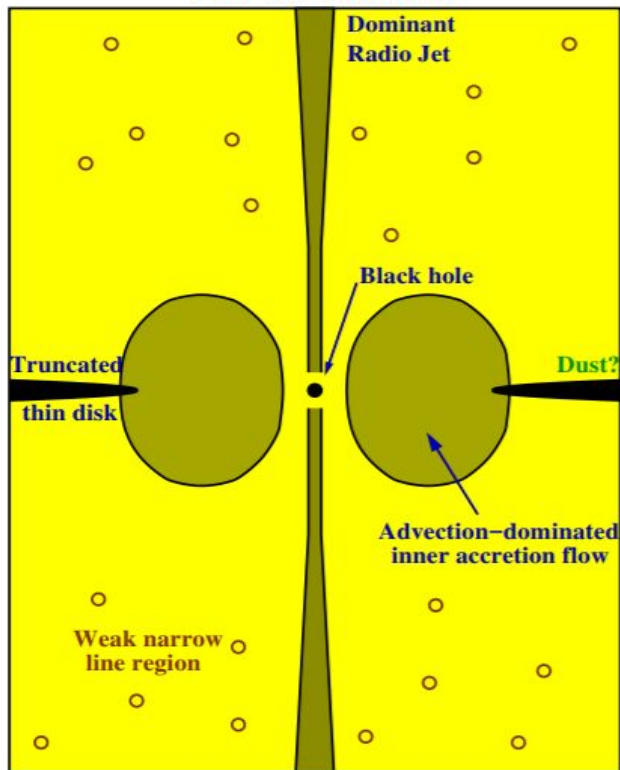
# AGN Feedback in Action



# Low-excitation radio galaxies (LERGs)

Powerful bi-polar radio  
jets

Radiatively-inefficient  
accretion



Massive galaxies

Red/quiescent  
population

Rich group/cluster  
environments



# How do LERGs evolve across cosmic time?

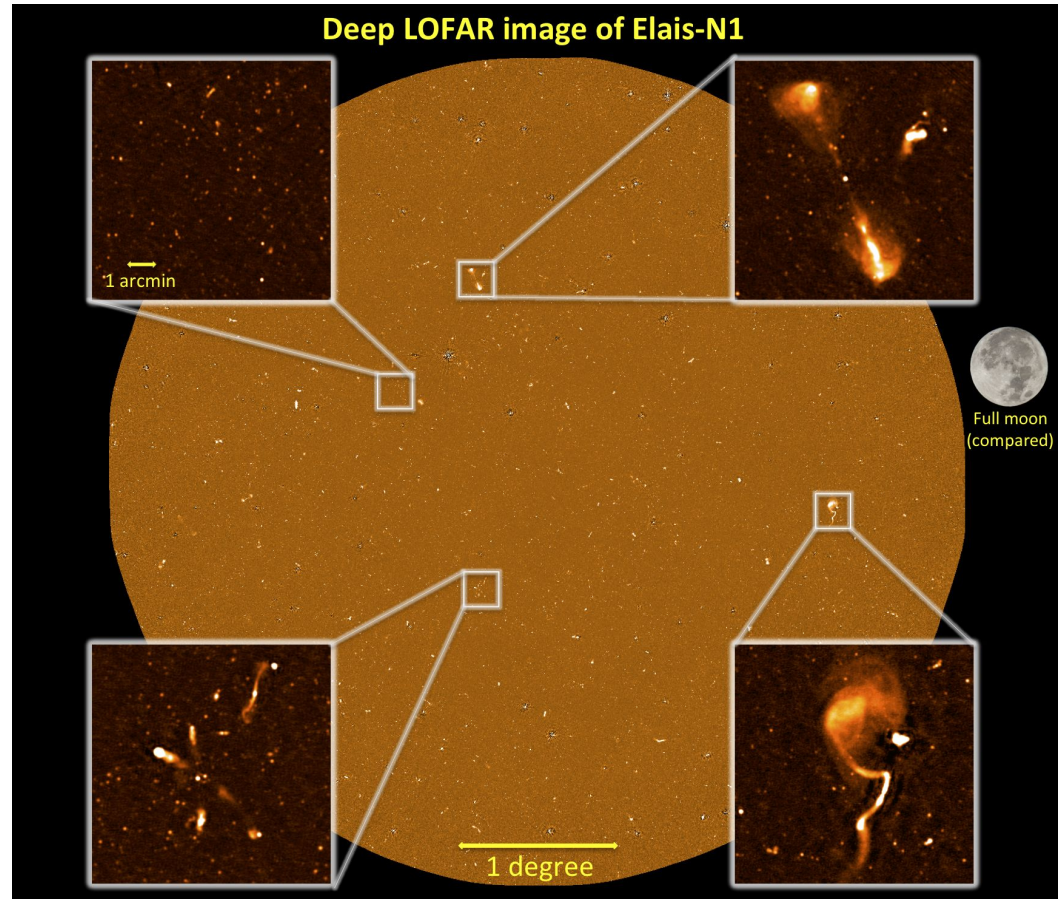
→ Deep, wide-area radio continuum surveys crucial

# LOFAR Two-meter Sky Survey: Deep Fields

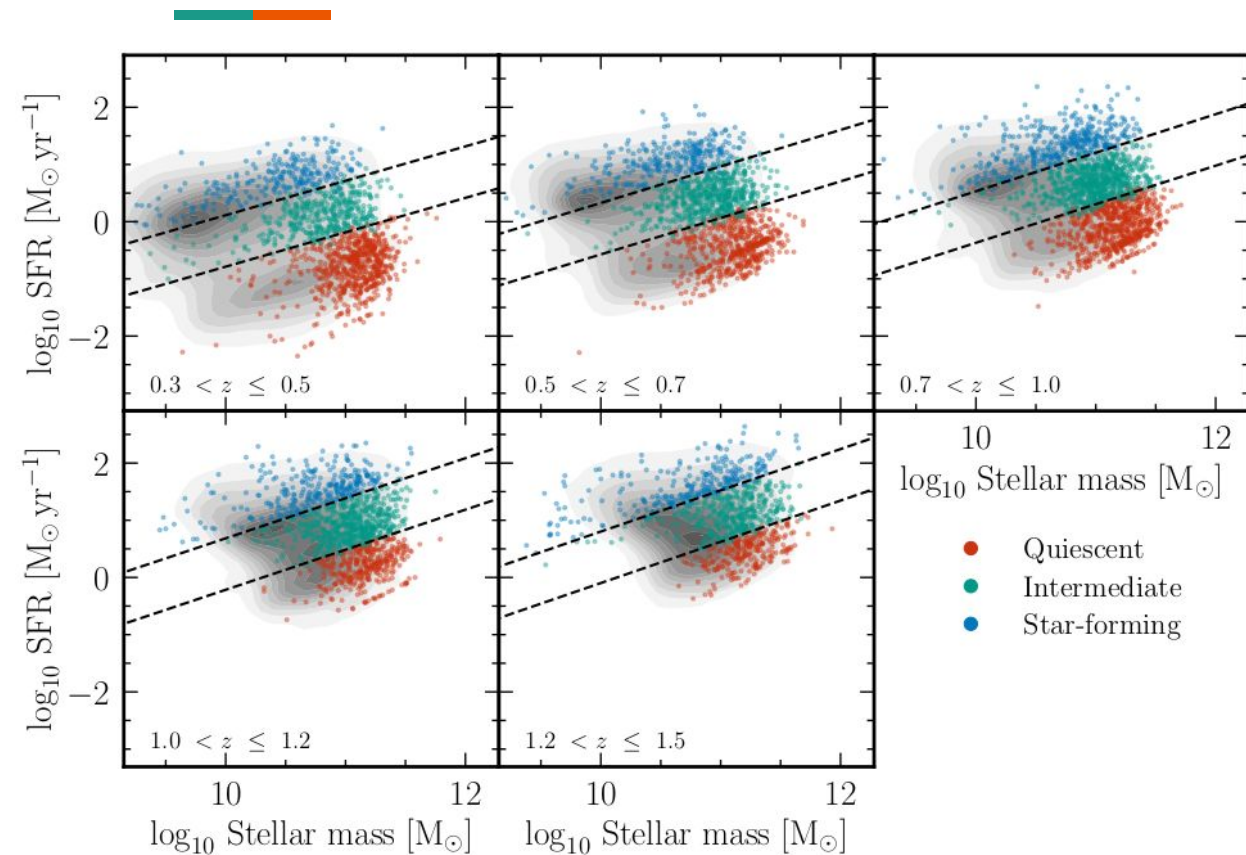
Deepest wide-field radio continuum survey to date at low frequencies

100s hrs of radio imaging over 25 sq. deg.

Tasse et al. 2021; Sabater et al. 2021  
Kondapally et al. 2021; Duncan et al. 2021  
Best et al. 2023, Shimwell et al. 2025



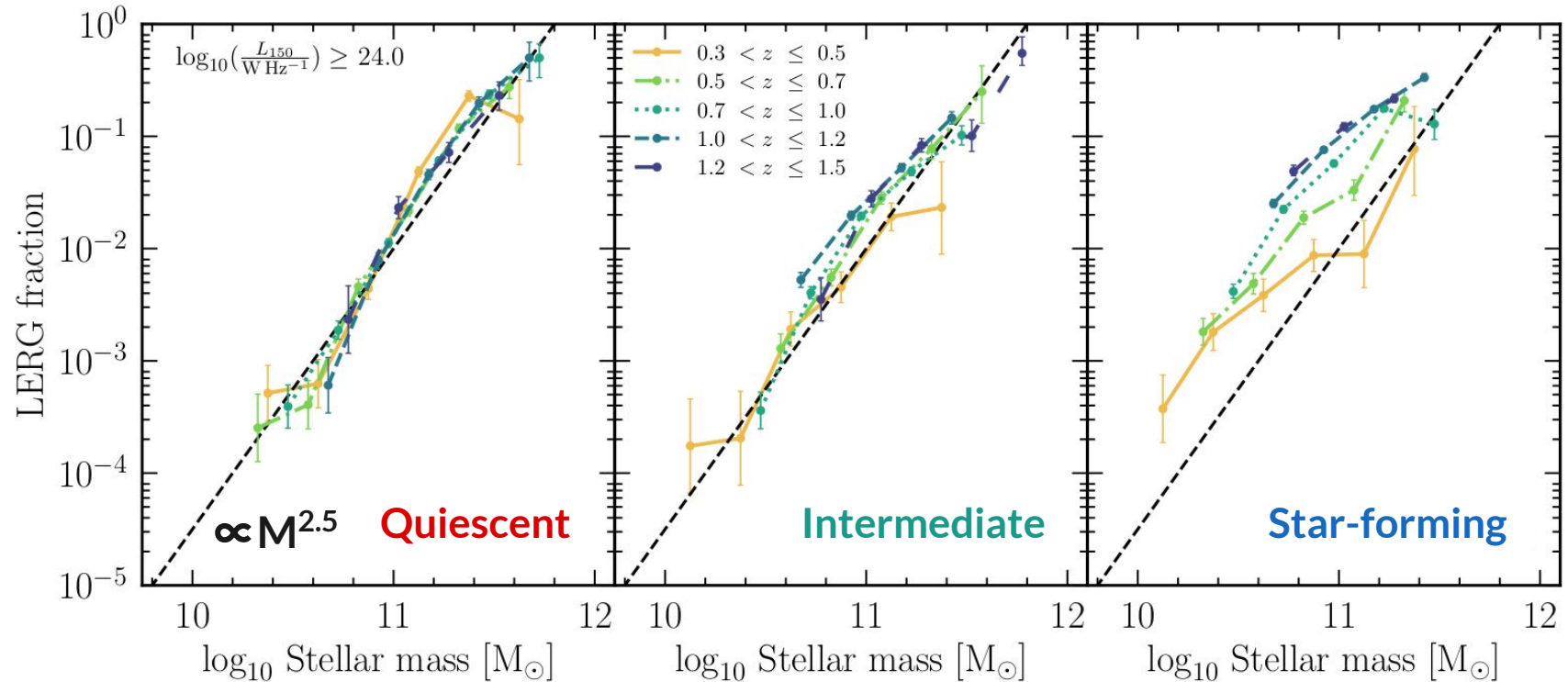
# LERGs found across the galaxy population



Using the LOFAR-Deep survey

Find **significant** population of **LERGs** within star-forming galaxies at earlier times

# Incidence of LERGs across the main sequence



**Q-LERGs: LERG fraction  $\sim M^{2.5}$**   
→ Fuelling from hot gas since  $z \sim 1.5$ ;  
consistent with local Universe

**SF-LERGs: Flatter mass dependence**  
→ Additional fuelling mechanism, cold gas?

See also: Williams & Rottgering (2015);  
Whittam et al. (2022)

# Conclusions

Deep, wide-area radio continuum surveys are opening up a new parameter space for galaxies and AGN studies

Considerable population of LERGs hosted by star-forming galaxies in the early Universe

→ These may be fuelled differently (via cold gas) compared to LERGs in quiescent galaxies

→ Characterise molecular gas properties to understand how these LERGs are fuelled/triggered

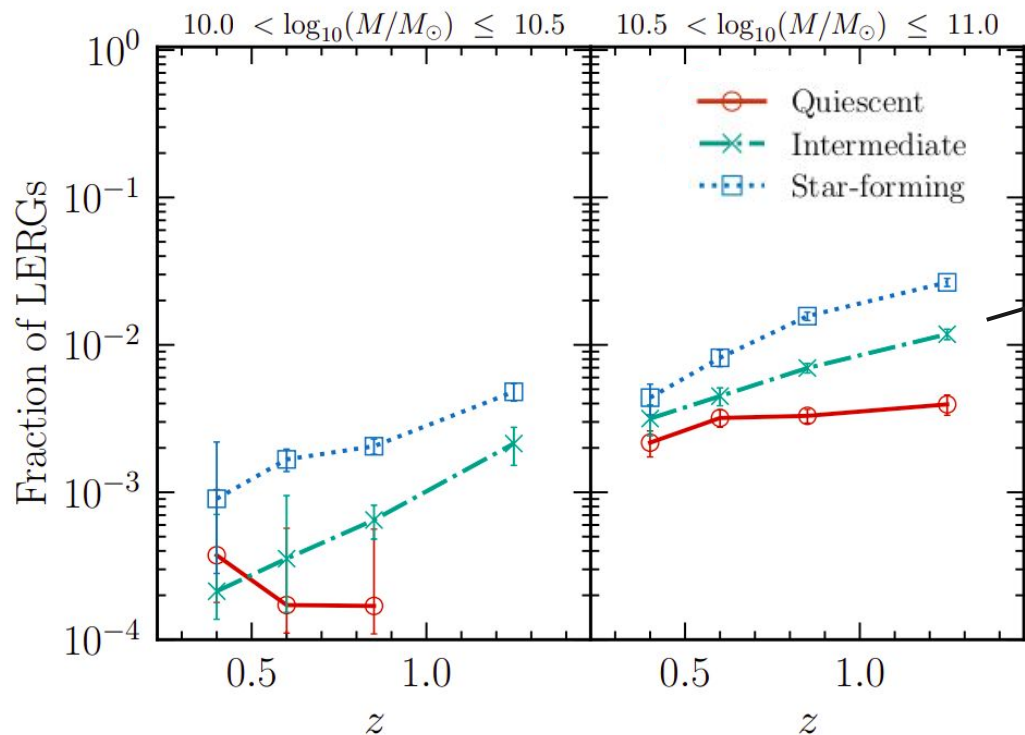






# Incidence of LERGs across SFR and Mass

At low(er) stellar masses



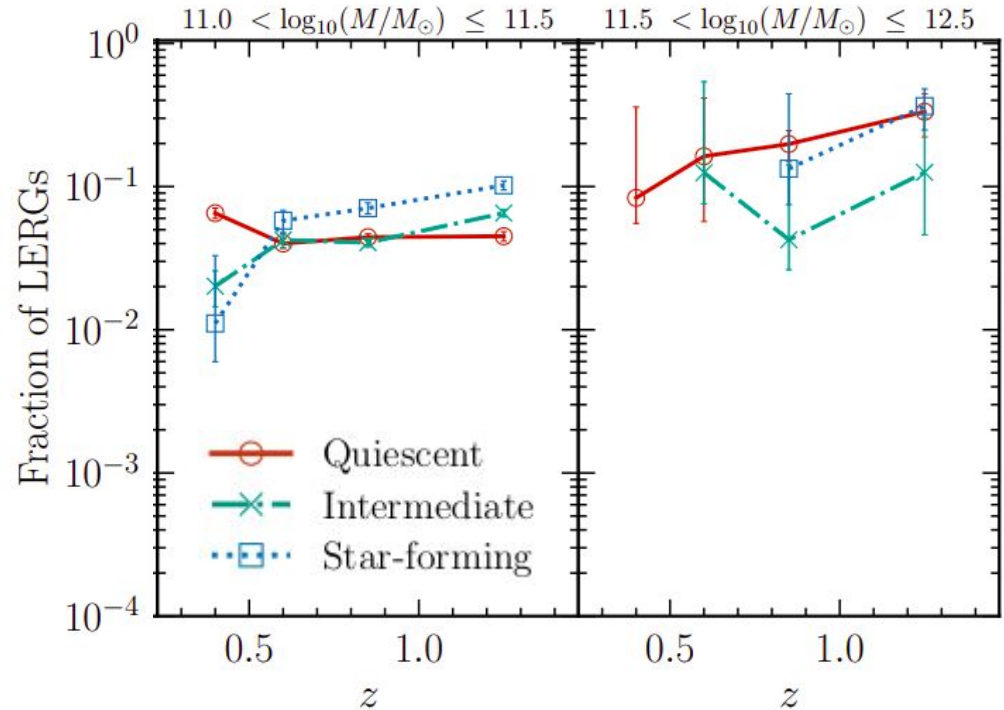
Higher incidence of LERGs with increasing star-formation of host (relative to MS)

At low masses: star-formation drives the incidence of LERGs across redshift

# Incidence of LERGs across SFR and Mass

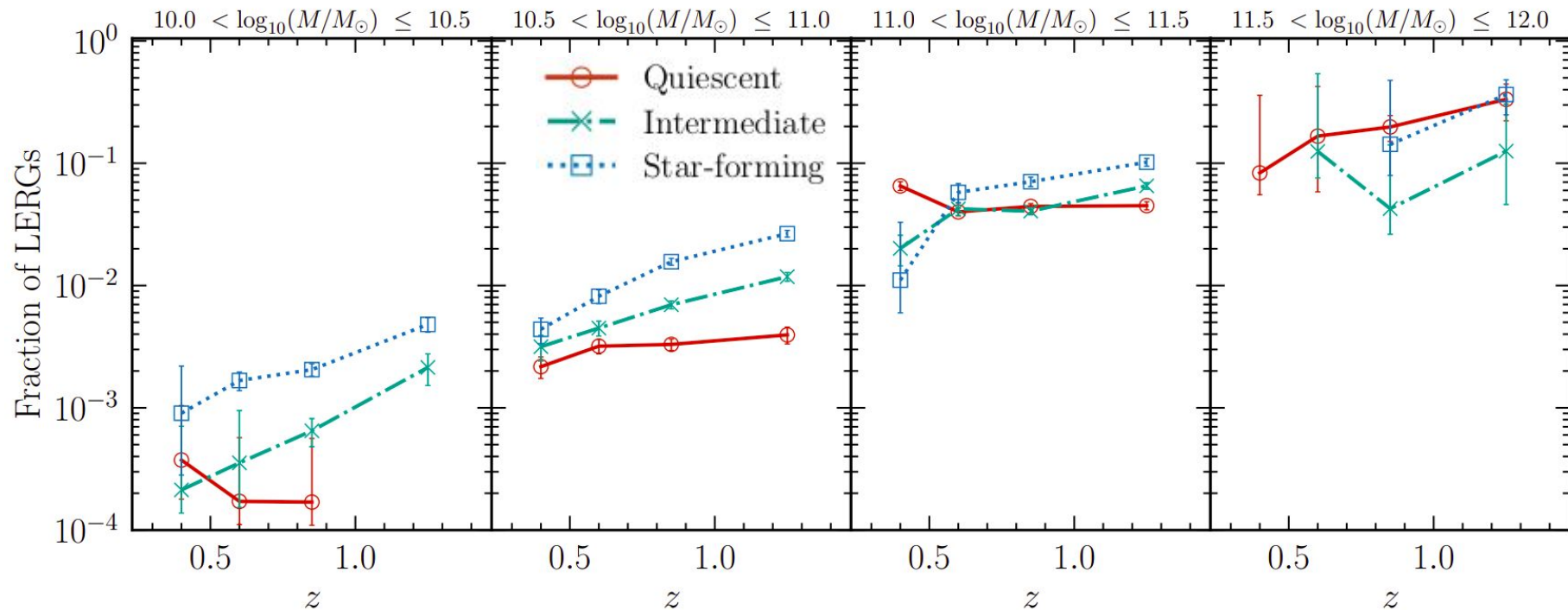
Stellar mass drives the LERG activity (rather than SFR)

At high stellar masses



# Incidence of LERGs across SFR and Mass

Increasing stellar mass →



# Low-excitation radio galaxies (LERGs)



Powerful bi-polar radio  
jets

Radiatively-inefficient  
accretion

How do the  
LERGs evolve at  
higher redshifts?

Massive galaxies

Red/quiescent  
population

Rich group/cluster  
environments