

The Many Lives of Active Galactic Nuclei: Cooling Flows, Black Holes and the Luminosities and Colours of Galaxies

Croton et al. MNRAS 365, 11-28 (2006)



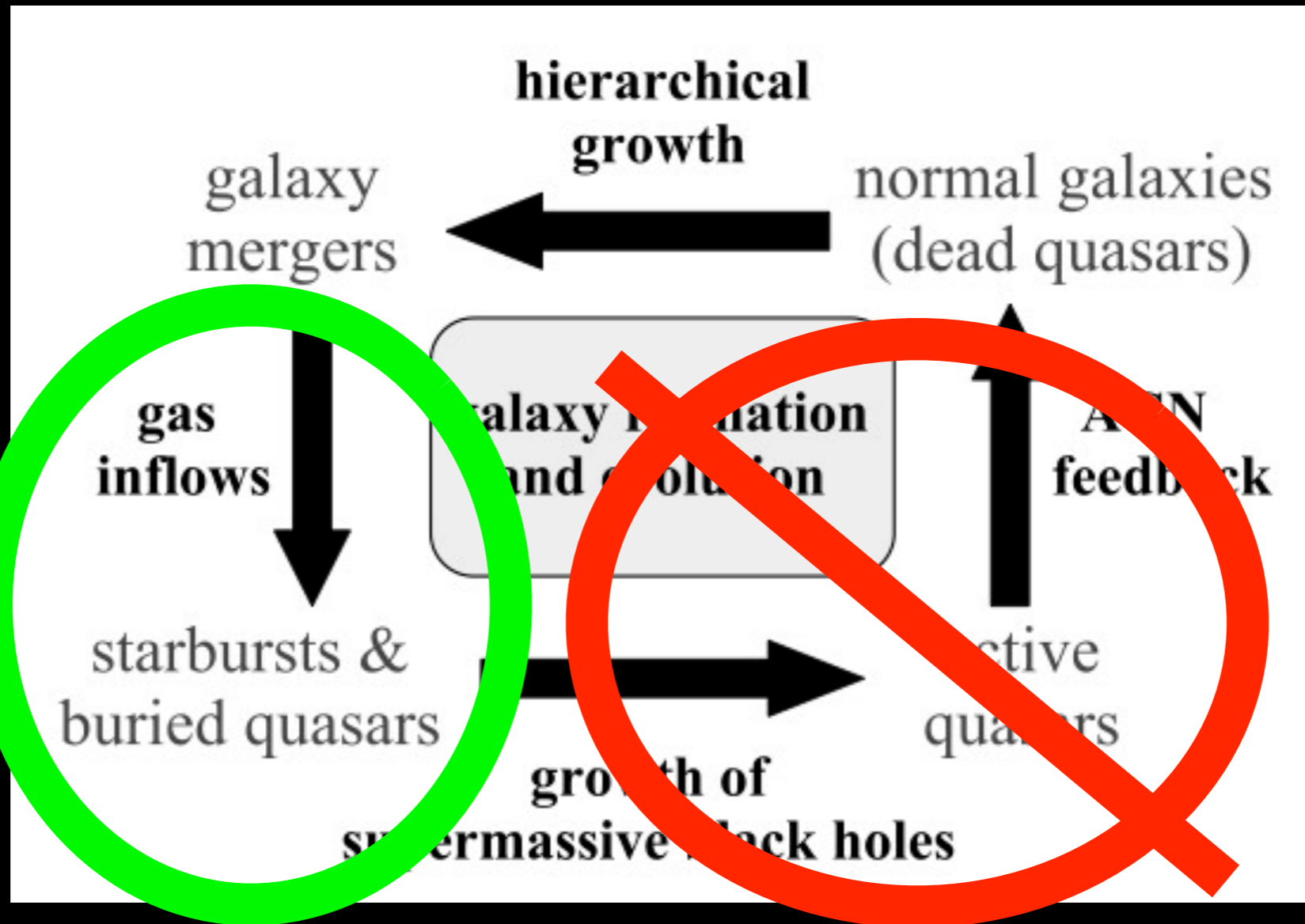
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Ph 689- Nov. 12 2009

Outline

- Tracing semi-analytic models around the “cosmic cycle” of galaxy formation and evolution
- Briefly, how well these models match observations
- Physical models that might cause “radio” feedback

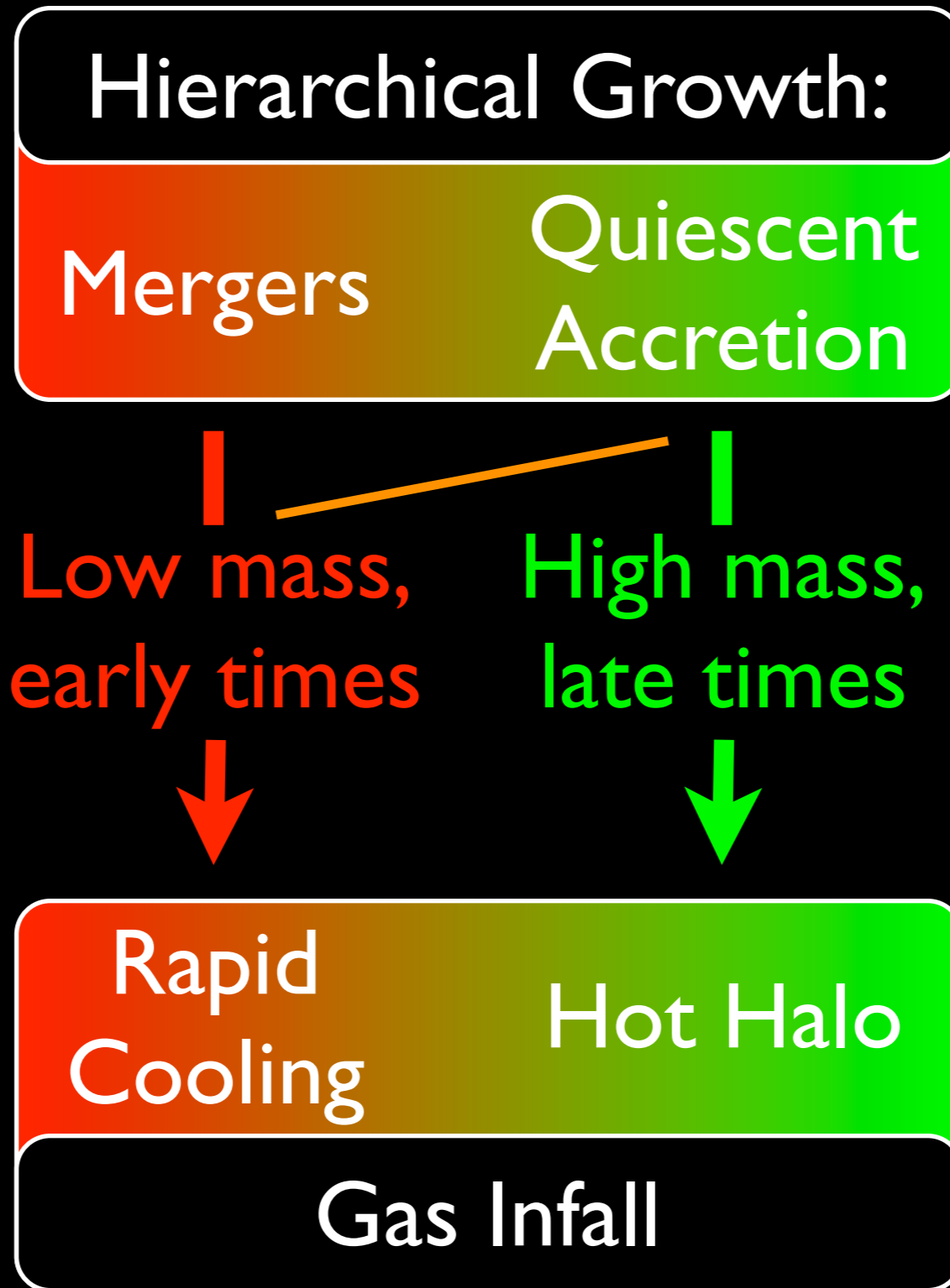
Cosmic Cycle

Hopkins et al. 2006



**Not in
this paper!**

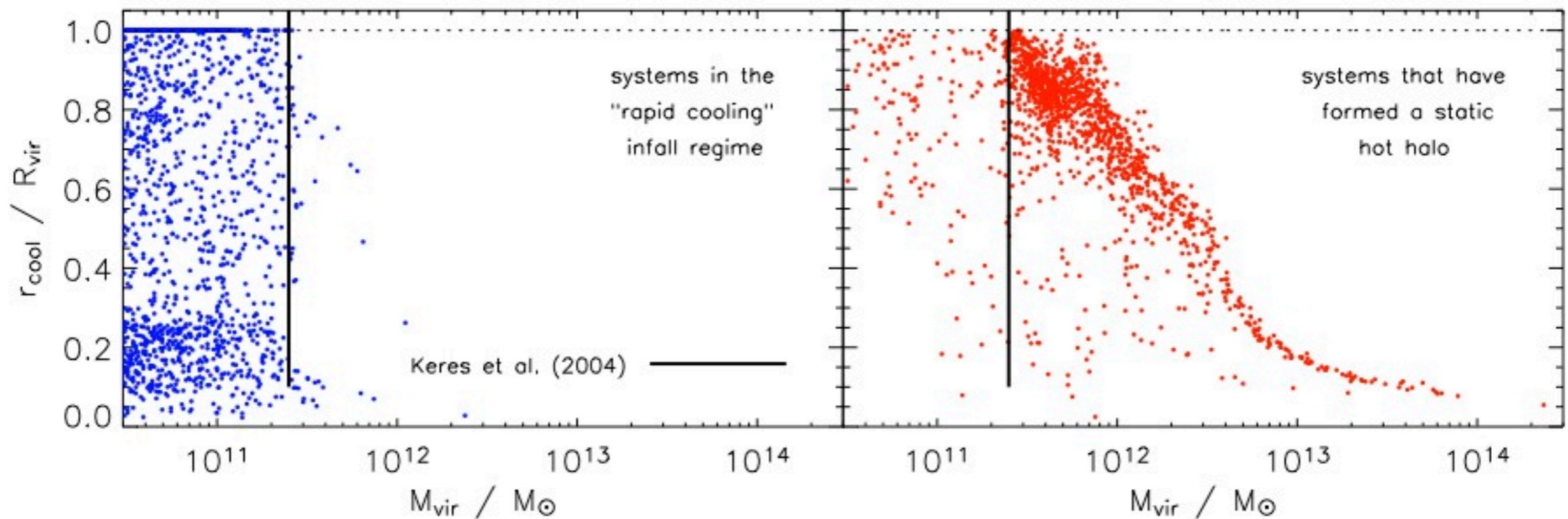
A Different Cosmic Cycle



A Different Cosmic Cycle

Hierarchical Growth:

Quiescent

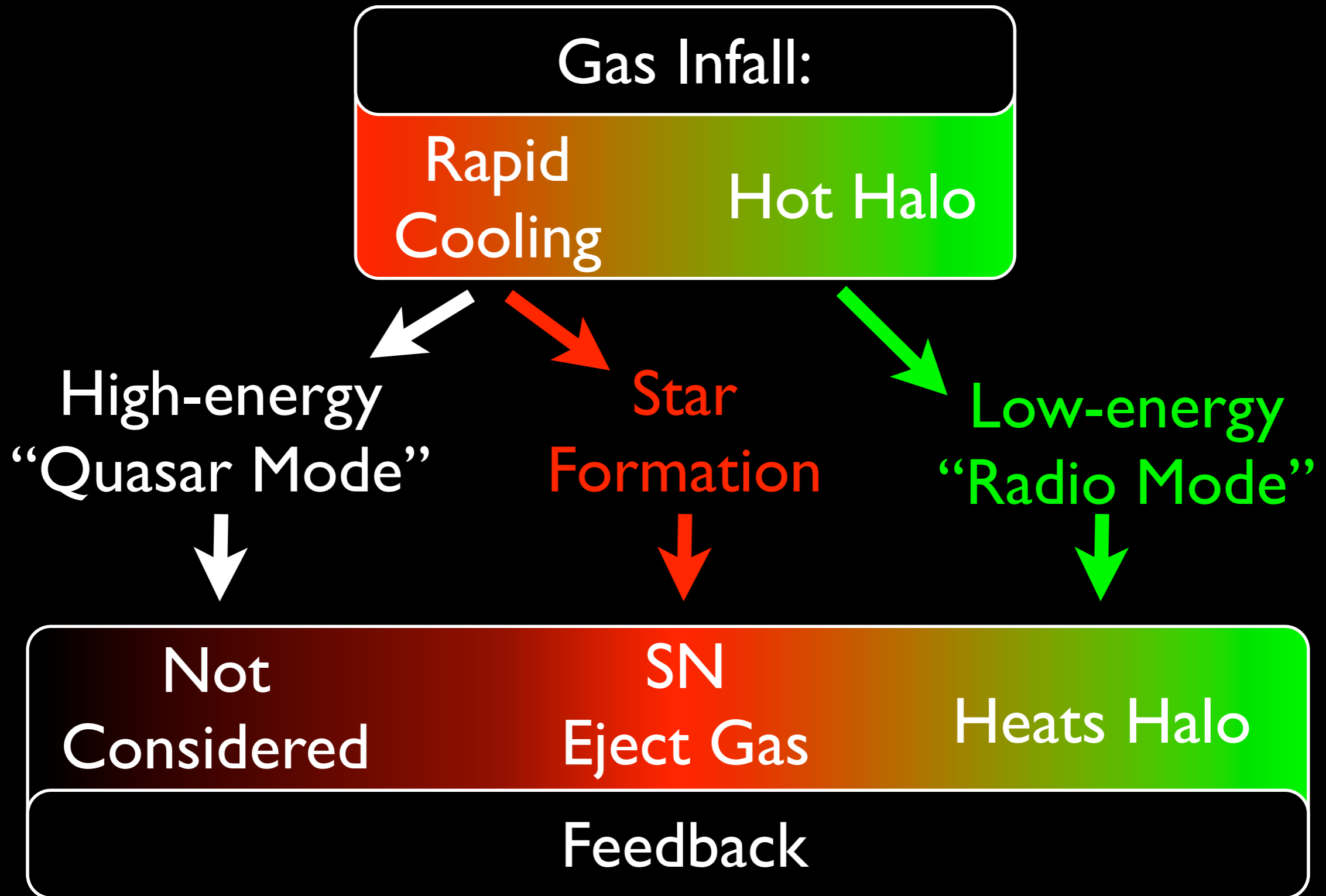


Cooling

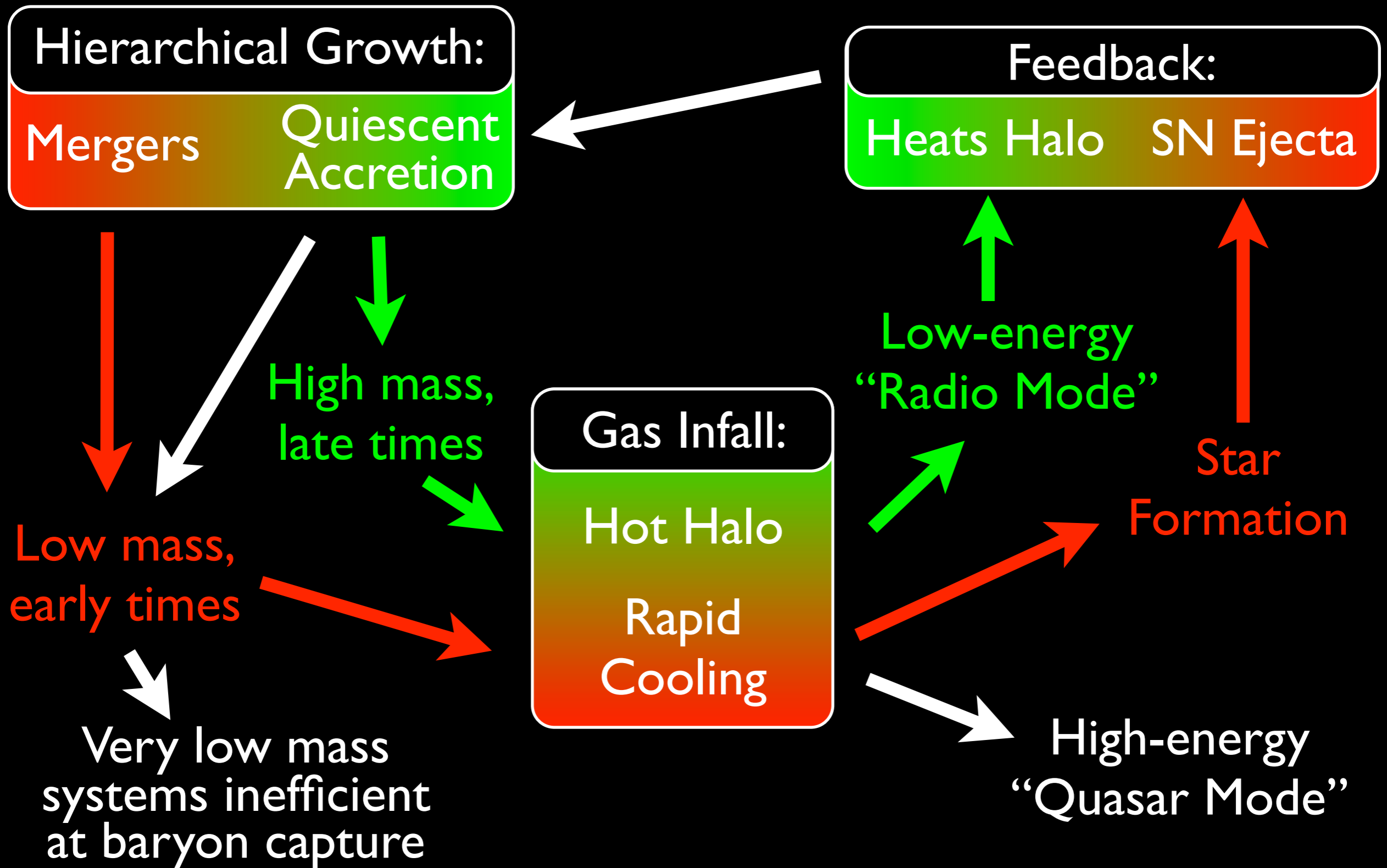
Hot Halo

Gas Infall

A Different Cosmic Cycle cont'd



A Different Cosmic Cycle cont'd



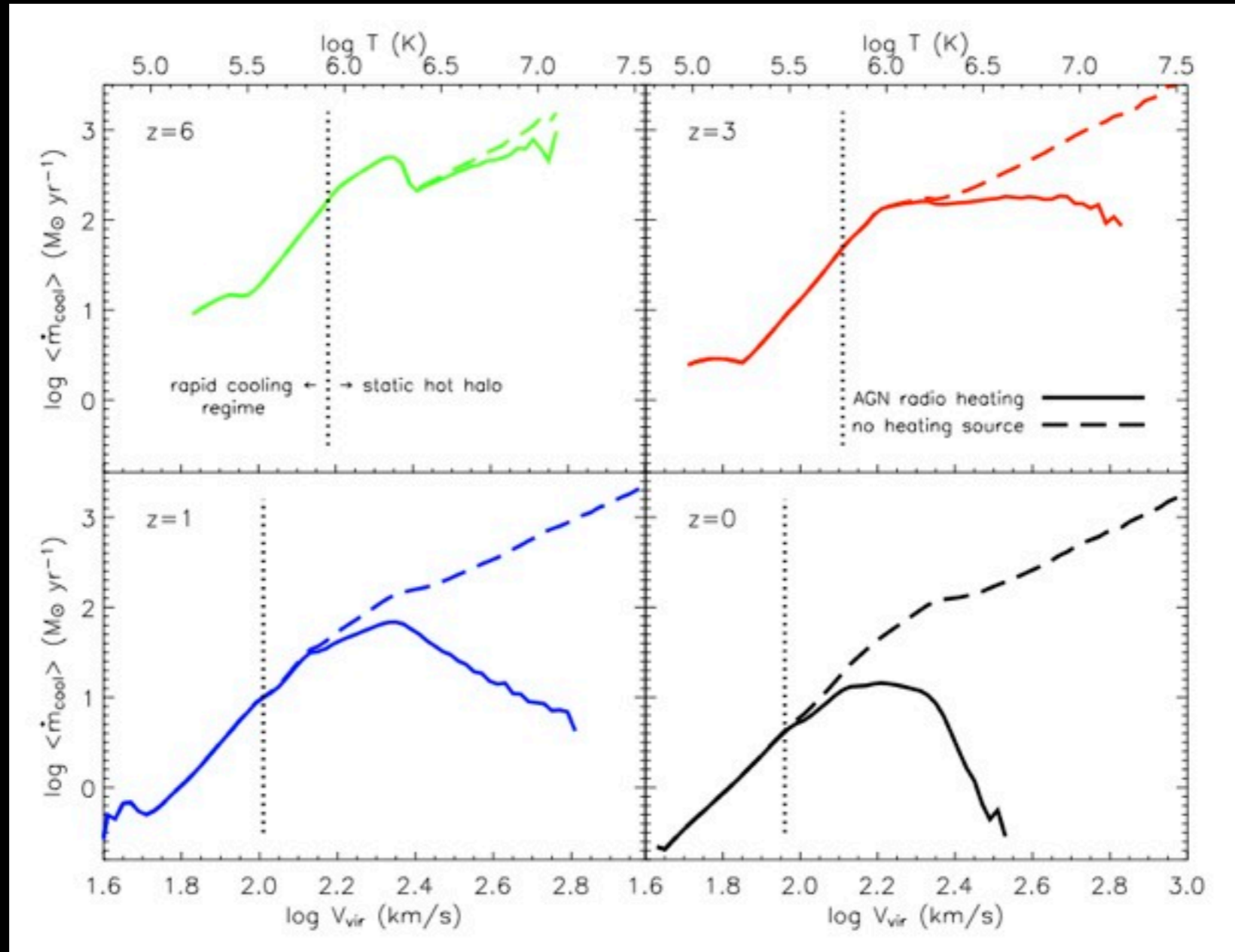
How well do they do?

Important disclaimer:
model parameters are specifically tuned
to best match observations!

- Black hole mass to bulge mass relation
- Star formation rate density
- Tully-Fisher relation
- Gas fraction and B-band luminosity
- Metallicity and stellar mass relation

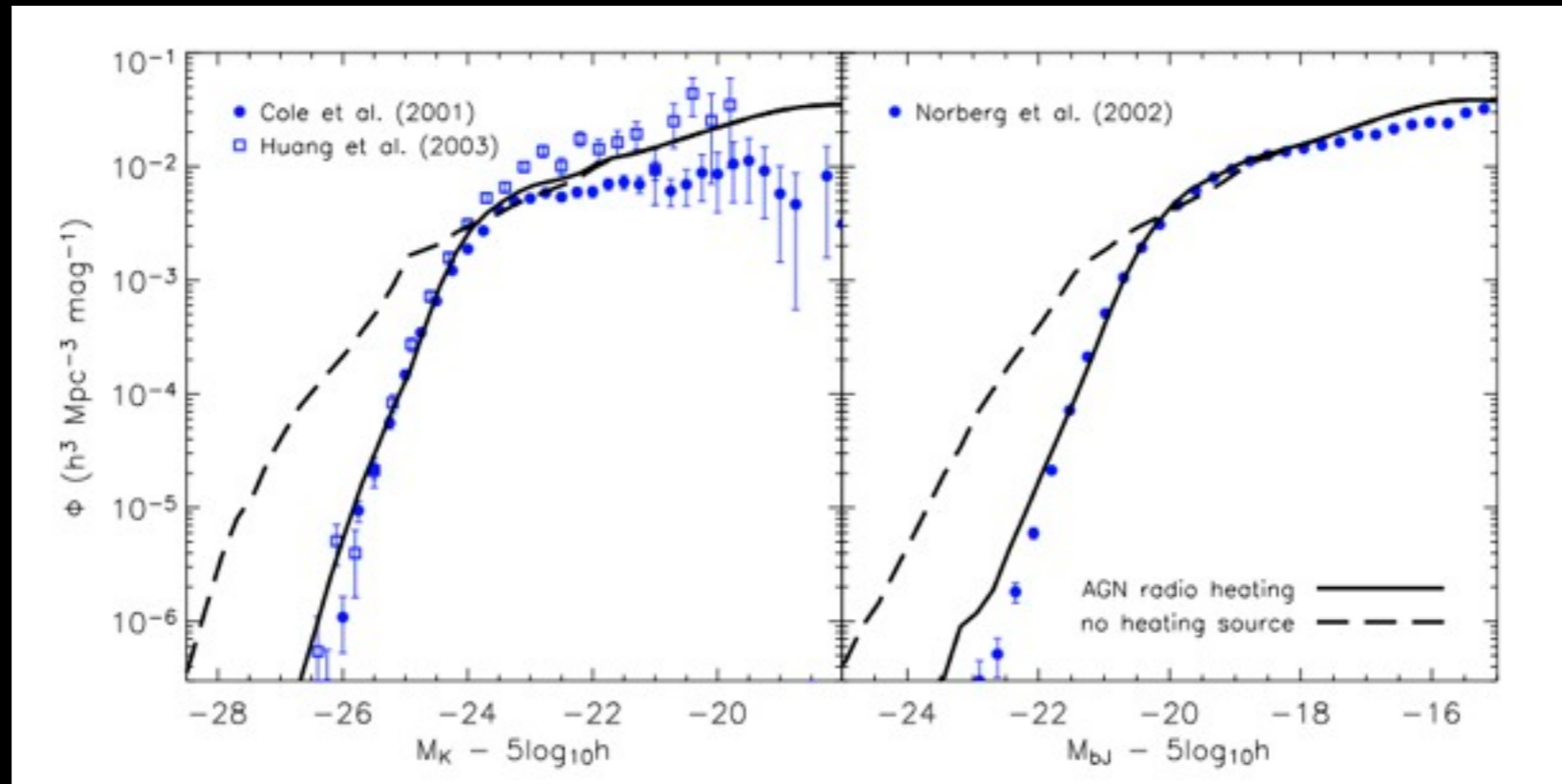
How well do they do? cont'd

The importance of the “Radio Mode”



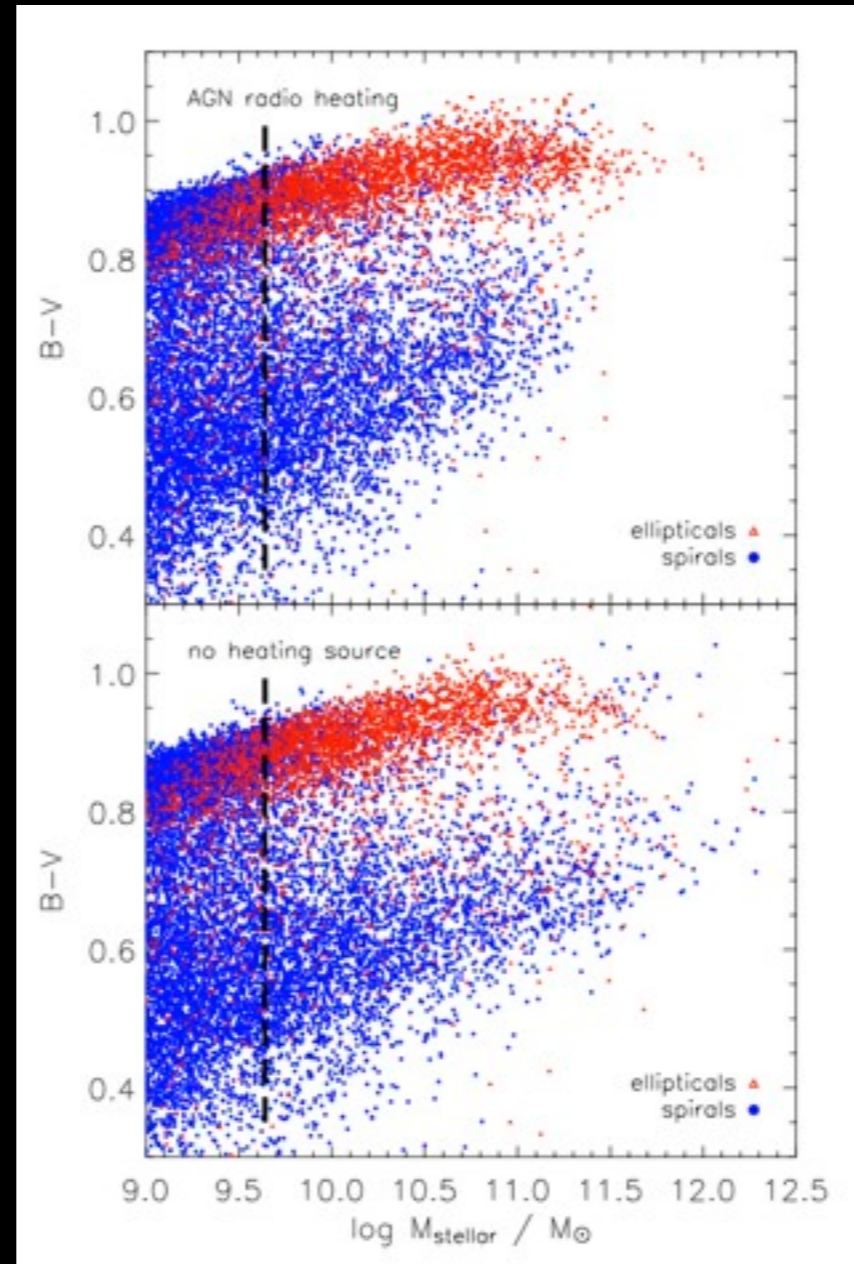
How well do they do? cont'd

The importance of the “Radio Mode”



How well do they do? cont'd

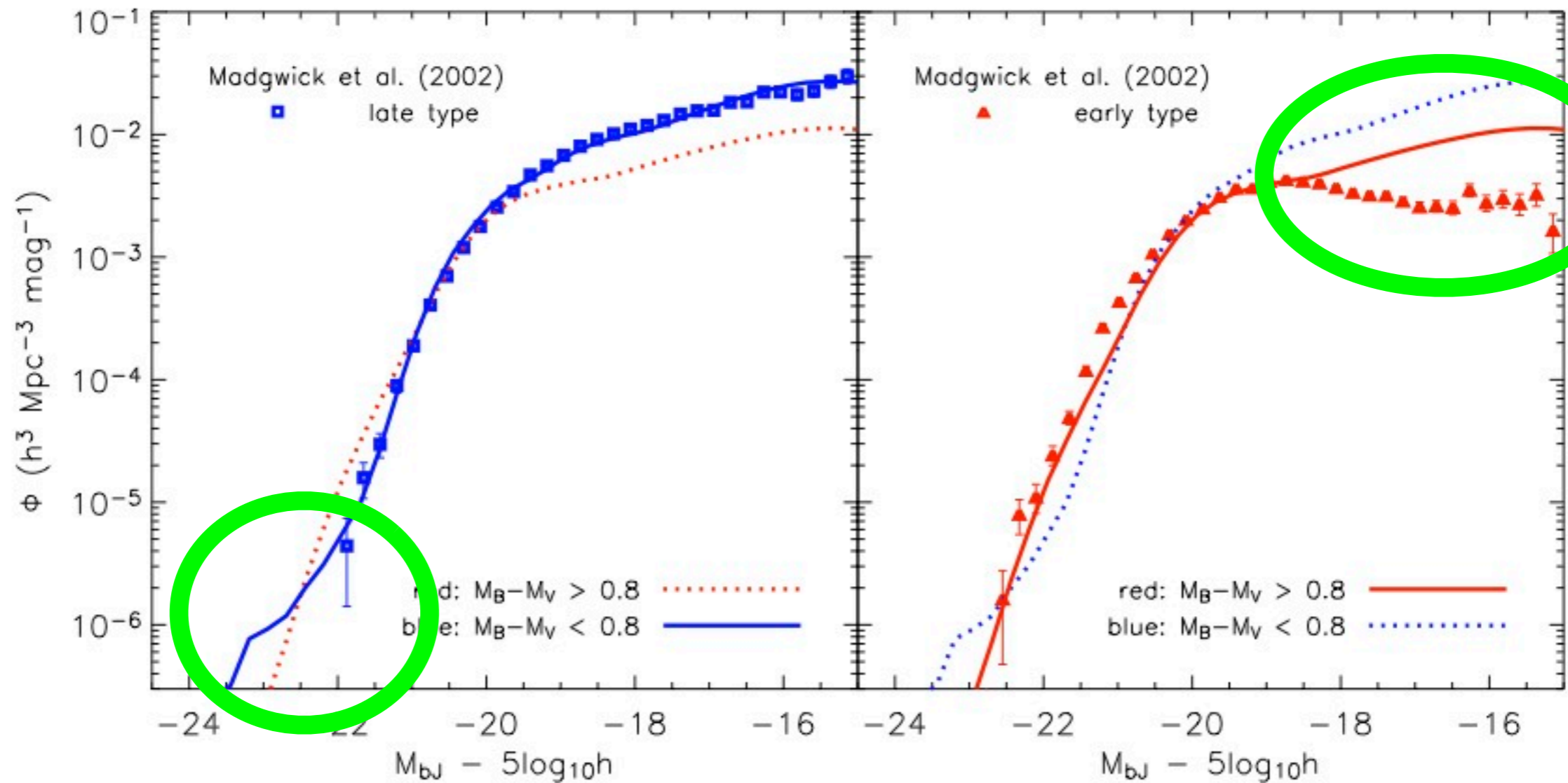
The importance of the “Radio Mode”



How well do they do? cont'd

Where they fall short

???



Merging starbursts

Physical Models of the “Radio Mode”

- Cold cloud accretion: as gas cools, it heats and accelerates, eventually fragmenting into clouds that are accreted
- Bondi-Hoyle accretion: the cold clouds end up in the disk, and the residual hot gas is accreted onto the black hole

Conclusion

A low-energy “radio mode” caused by quiescent black hole accretion is a plausible cause of the observed cut-off in star formation for later time and high mass systems.