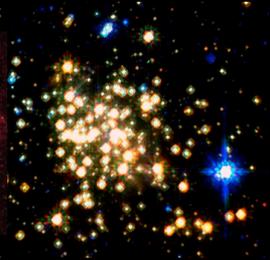
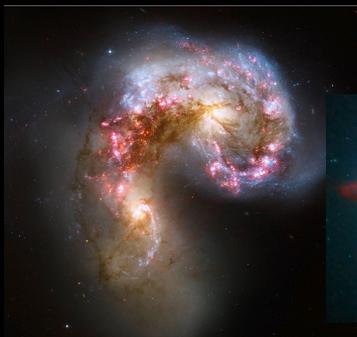
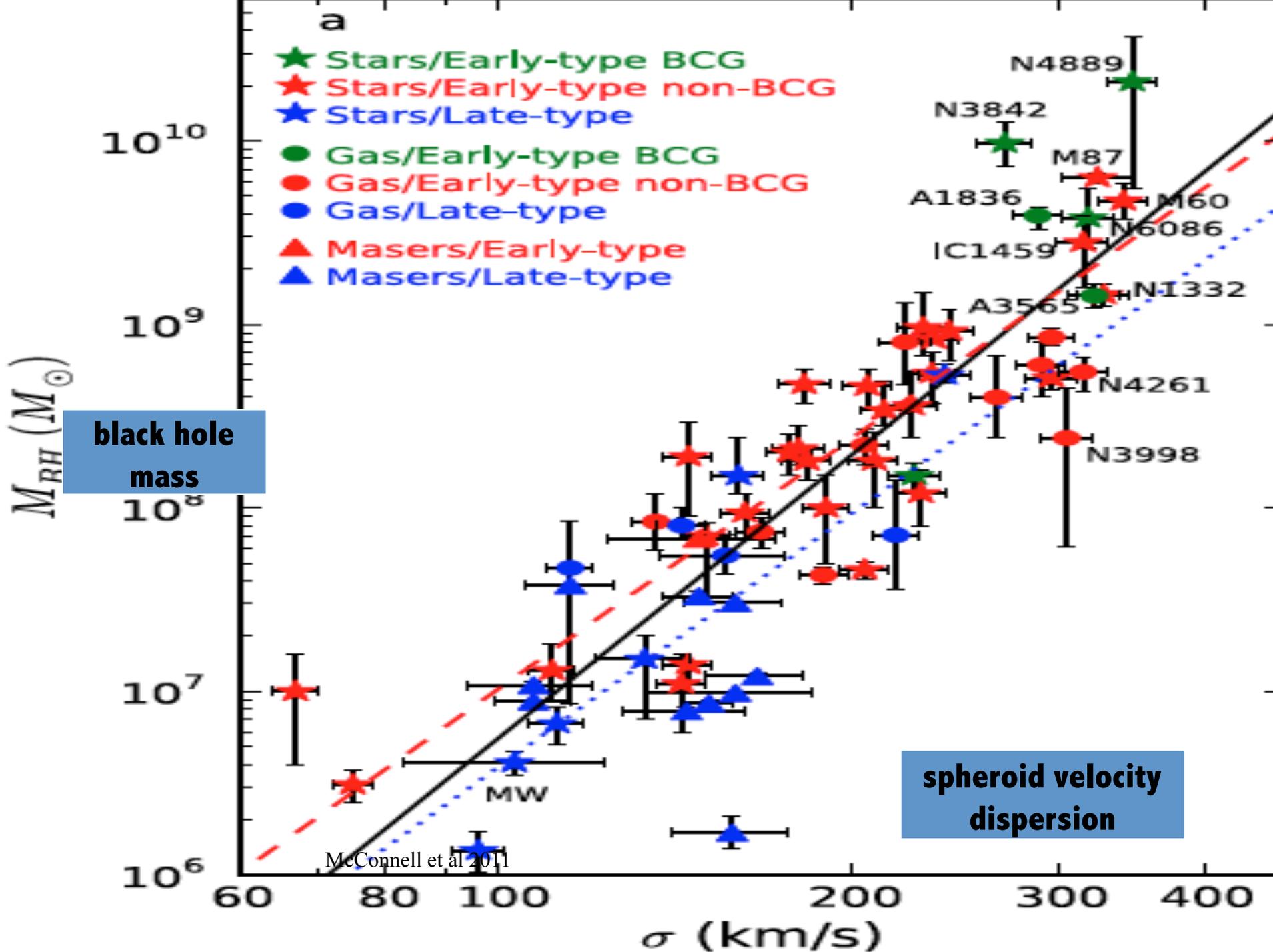


THE AGN-OUTFLOW-STARBURST CONNECTION



Joe Silk



WHICH CAME FIRST ?

galaxy

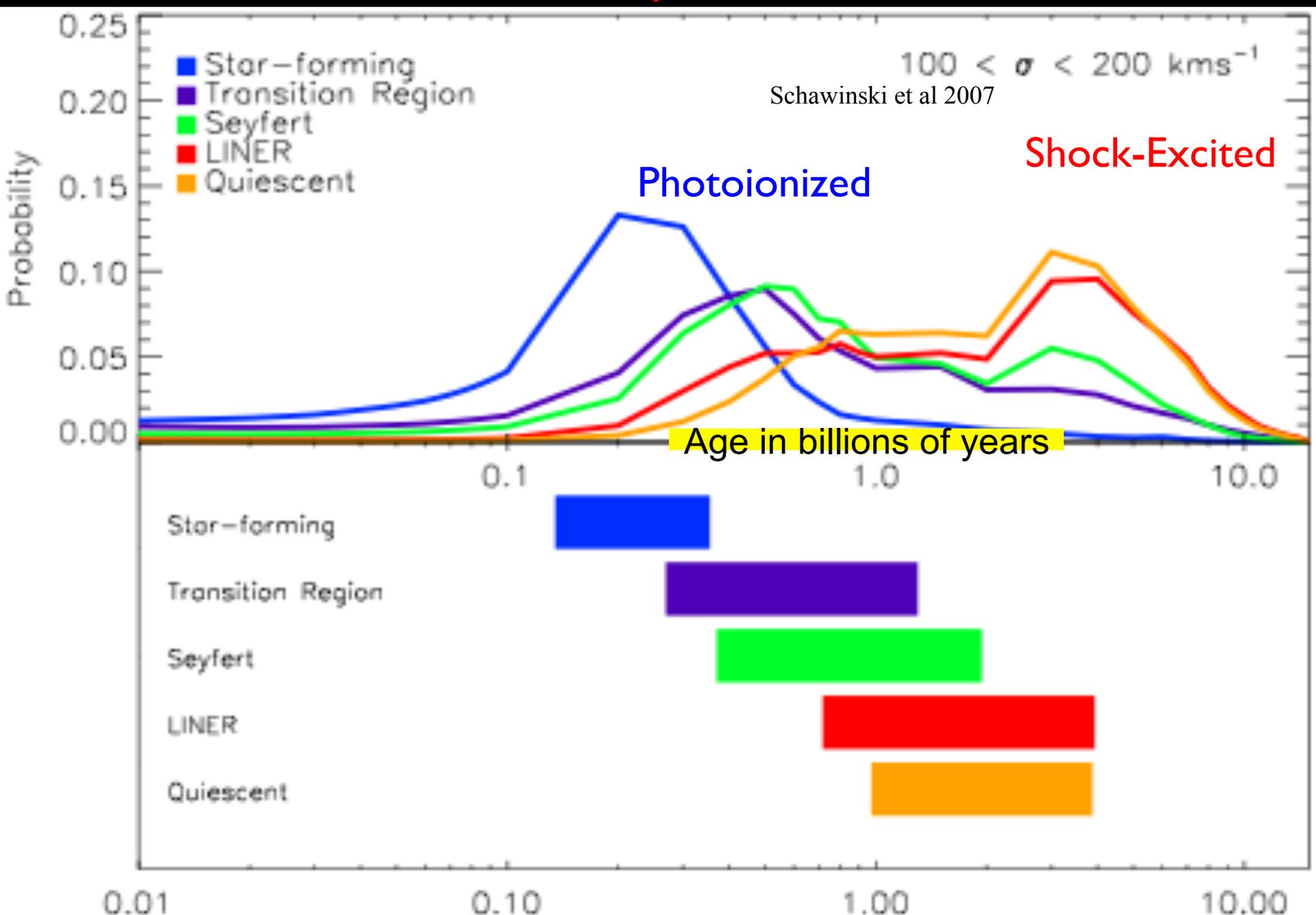
AGN



***NEGATIVE
FEEDBACK :***

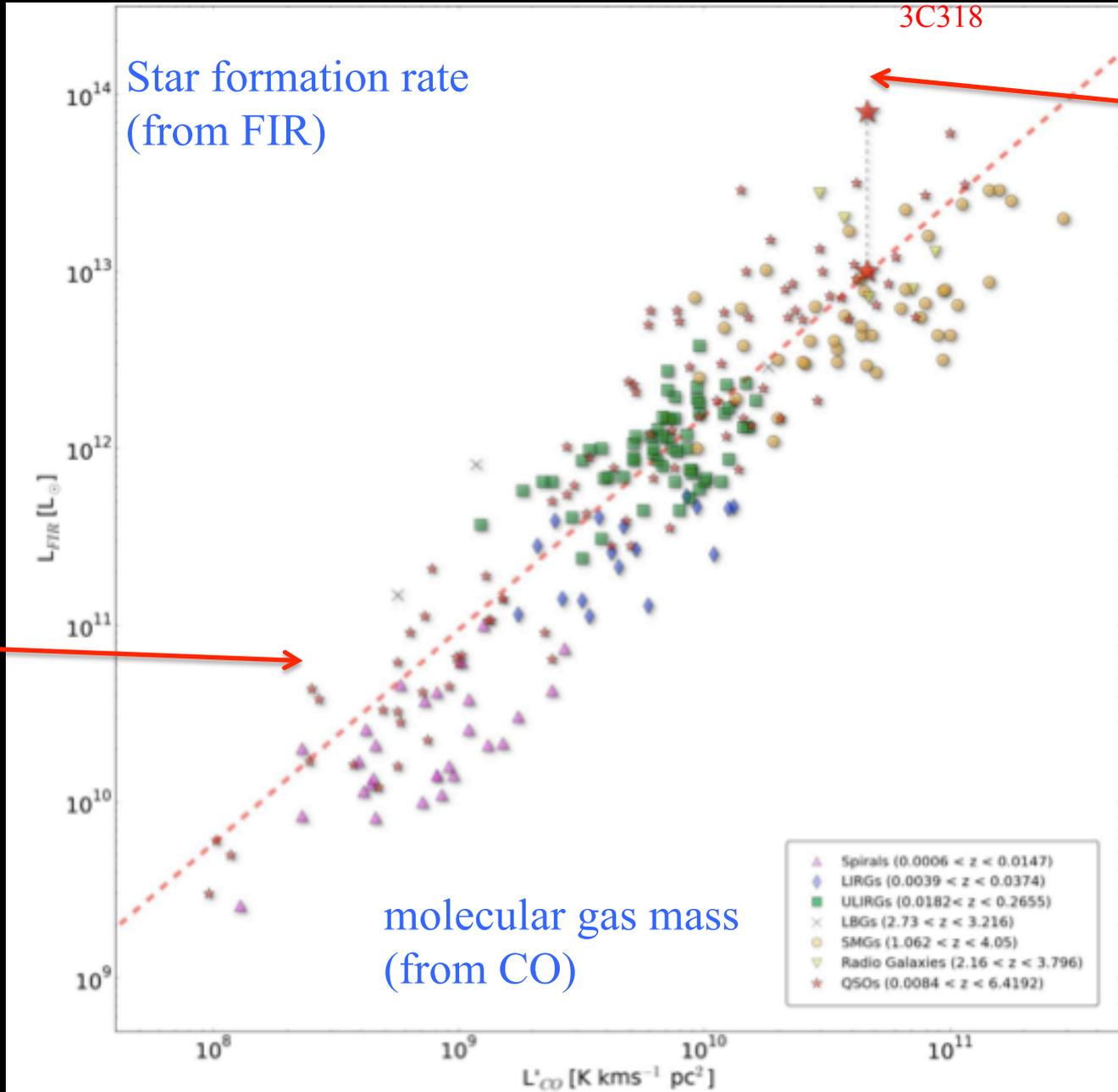
quenching

AGN are observed to quench star formation....



Short gas depletion times with luminous AGN?

Gas depletion
time
~200 Myr



Star formation rate
(from FIR)

molecular gas mass
(from CO)

Gas depletion
time ~20 Myr
SFR ~ $10^3 M_{\odot}/\text{yr}$
 $M_{H_2} \sim 4 \cdot 10^{10} M_{\odot}$

Heywood+ 2013

***POSITIVE
FEEDBACK :***

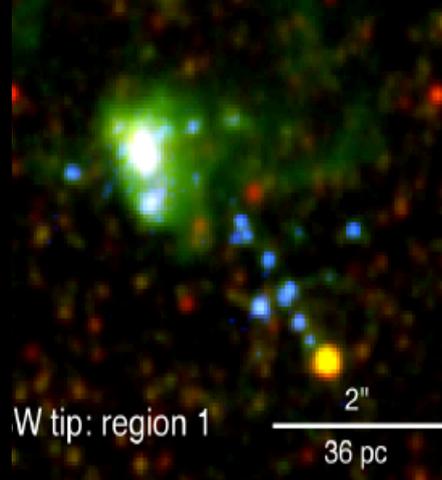
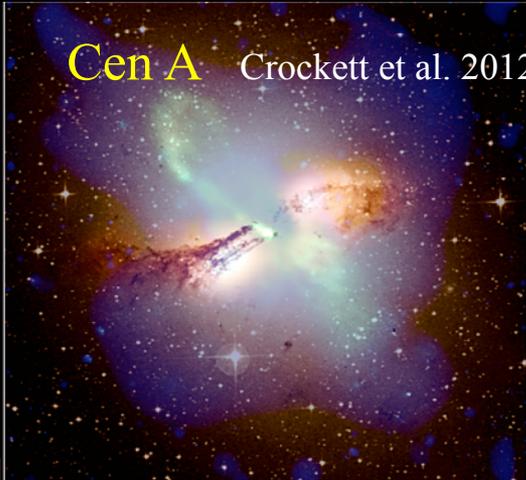
triggering

AGN TRIGGER STAR FORMATION

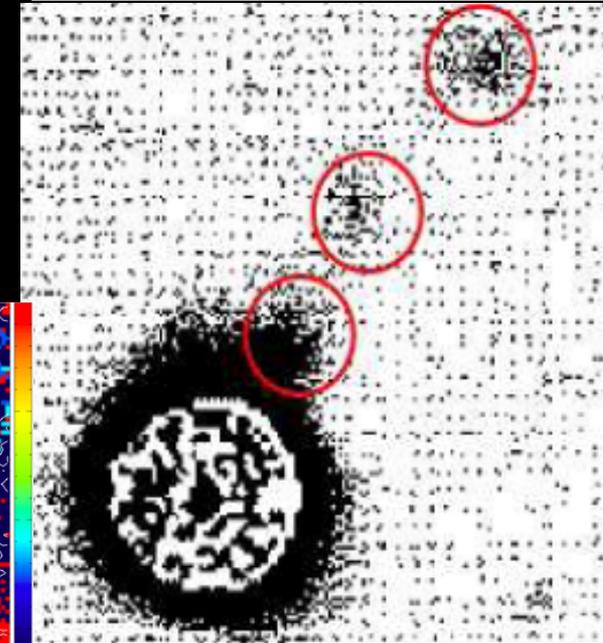
JS + C. Norman 2009

If AGN-driven outflows trigger star formation,

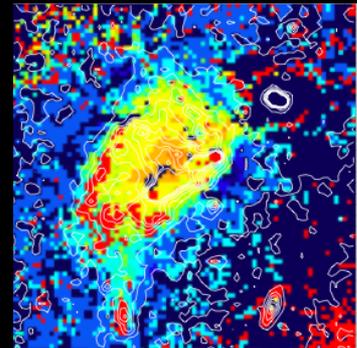
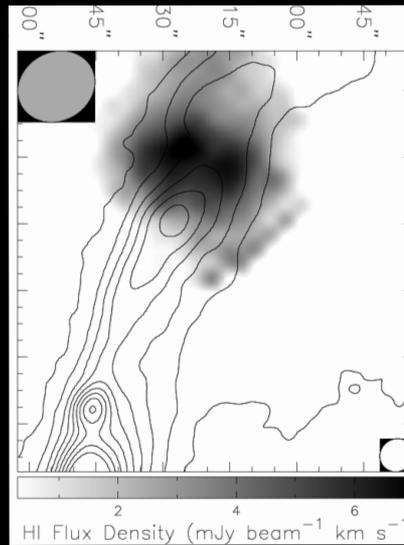
star formation rate boost factor $\sim v_{\text{cocoon}}/\sigma \sim 10-100$



H₂ formation triggered by AGN

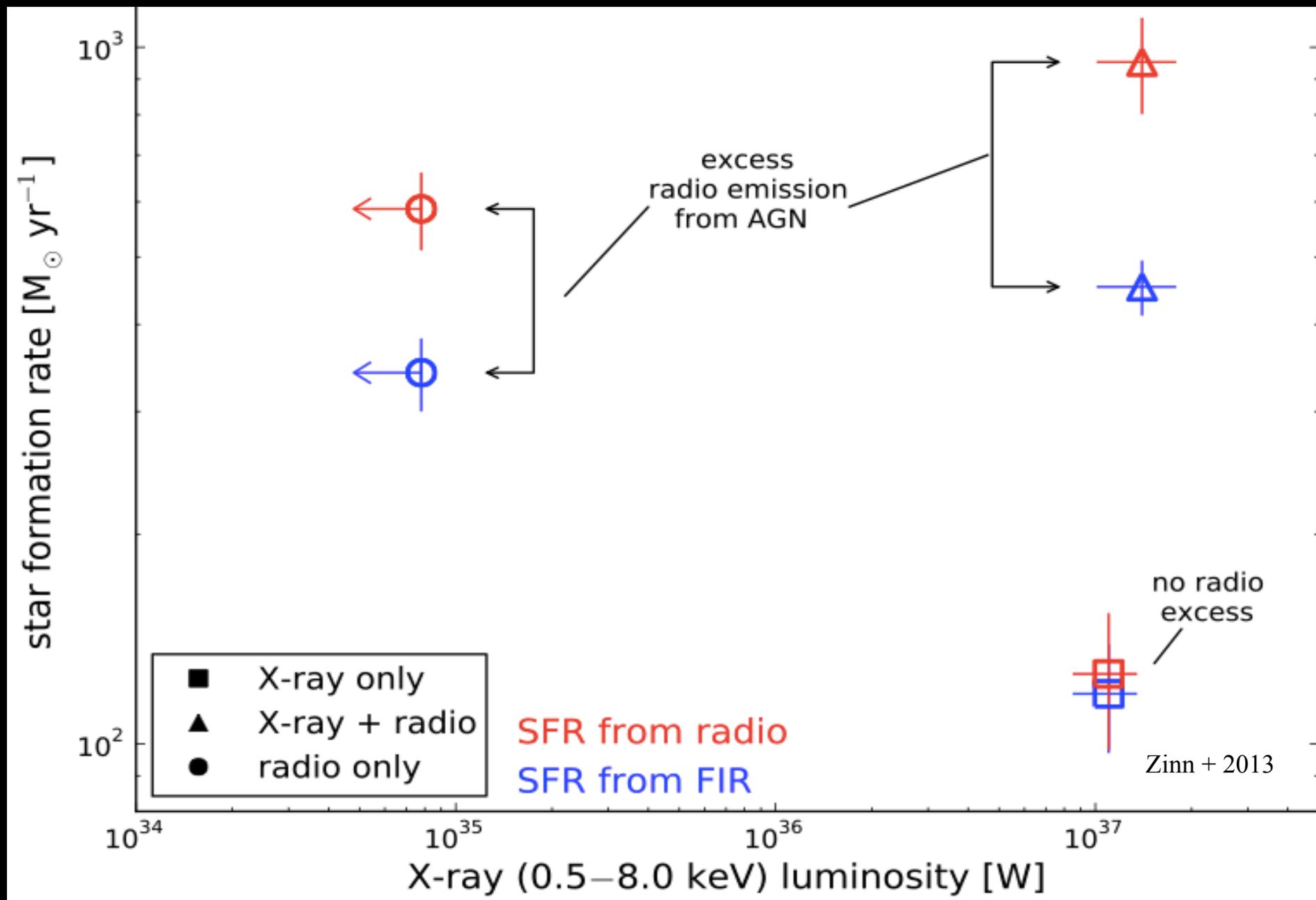


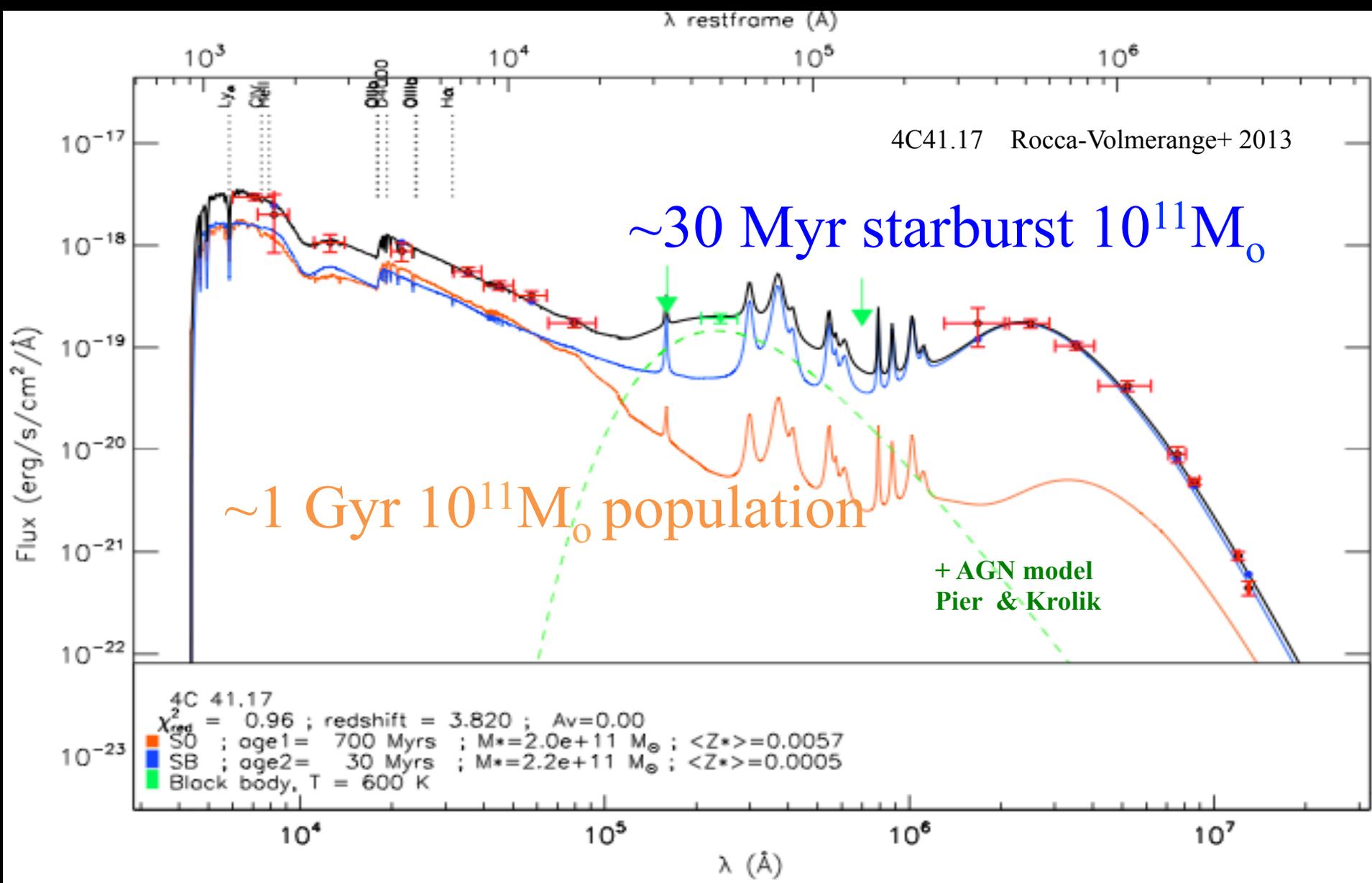
Minkowski's object
Croft et al. 2006



Klamer et al. 2006
z = 4.7 quasar + CO

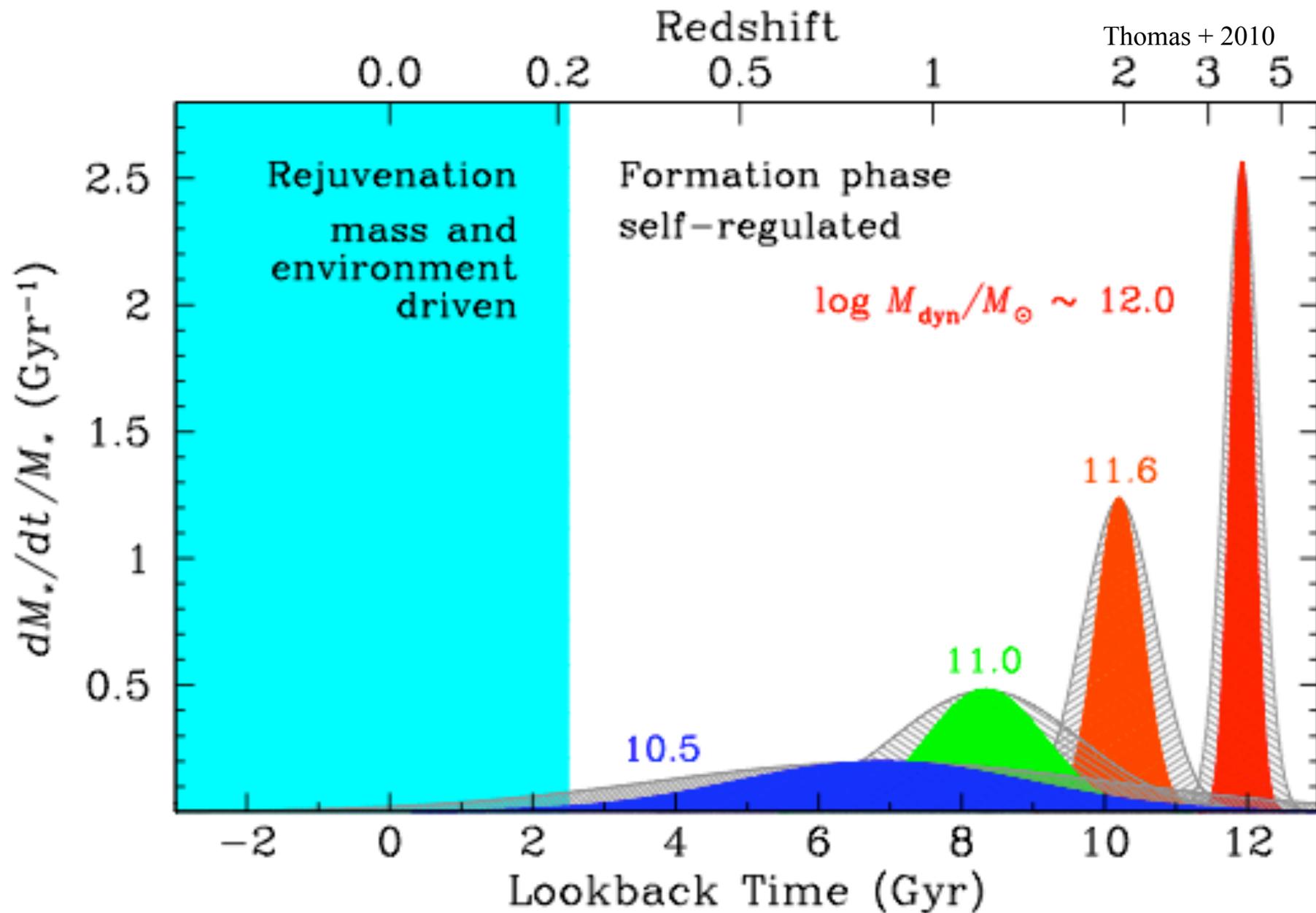
Radio jets induce excess star formation





***WHY IS FEEDBACK
SO IMPORTANT?***

The alpha element clock: $\ll 1$ Gyr for massive spheroid formation



THE AGN-OUTFLOW-STARBURST CONNECTION

If it looks like a duck...

walks like a duck,
talks like a duck,

it probably needs a bit
more time in the oven.

9:15-9:45 Tim Heckman

Outflows driven by starbursts

9:45-10:15 Volker Gaibler (Heidelberg)

Positive and negative feedback by AGN jets

coffee break

10:45-11:15 Nadia Zakamska

Observations of feedback in radio-quiet quasars

11:15-11:45 Alex Wagner (Tsukuba)

Galaxy-scale feedback by AGN jets and winds

11:45-12:15 Yohan Dubois (IAP)

Effects of AGN feedback on structure formation

12:15-12:45pm lunch break

12:45 -2:00pm Short talks / Discussion

Sanch Borthakur

Evidence of massive outflows and escaping Lyman continuum photons from low-z Lyman Break Analogs

Ai-Lei Sun (Princeton)

Observations of molecular gas in a radio-quiet quasar

Marcio Melendez (UMd)

Fast molecular outflows in luminous galaxy mergers: evidence for quasar feedback from Herschel

Gerard Kriss

Discovery of high velocity outflows in Seyfert 1 galaxies and in intermediate redshift quasars

Megan Gralla

The Sunyaev-Zel'dovich Effect Associated with Radio Galaxy Hosts