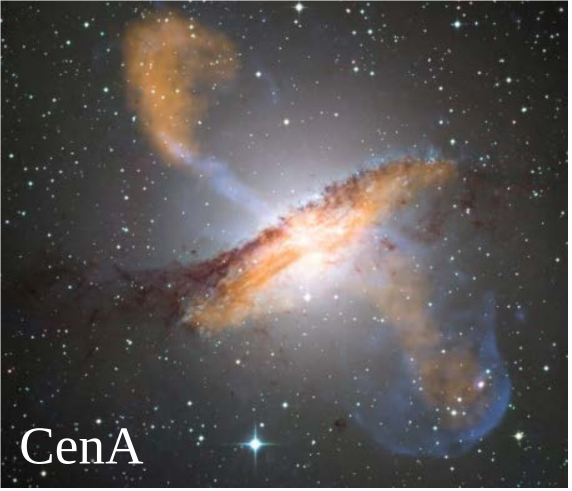
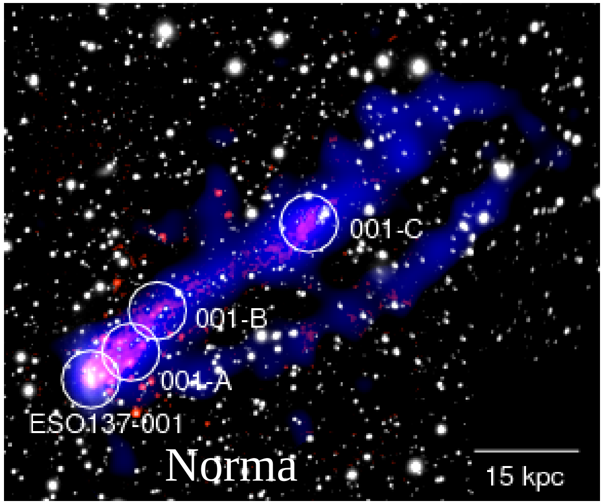
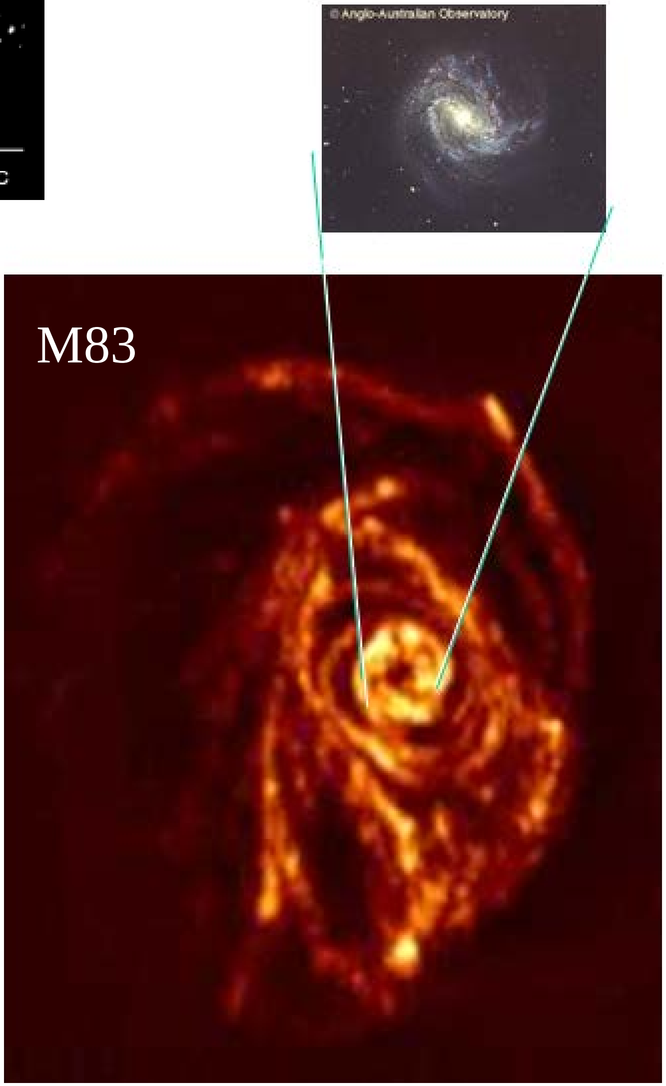
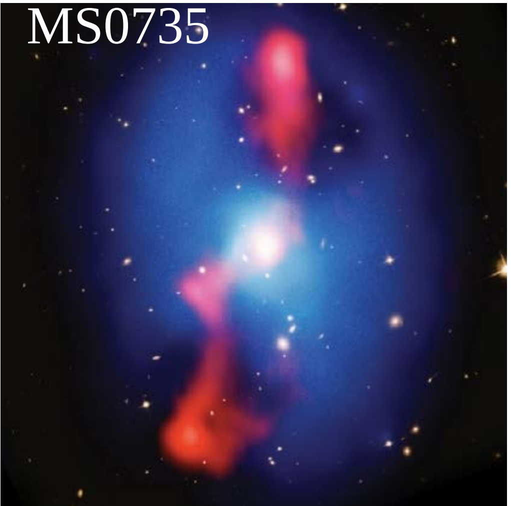




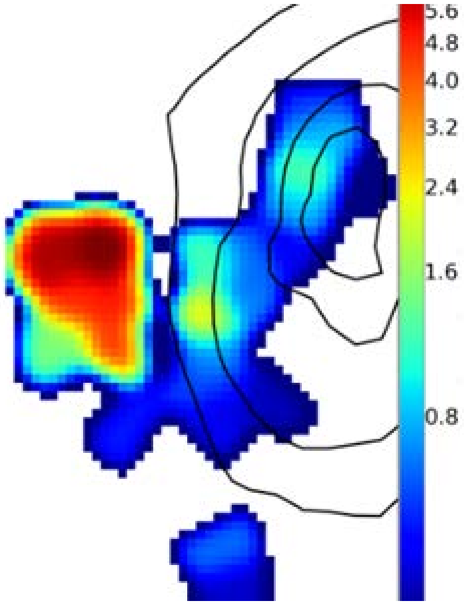
SFE in LSB regions



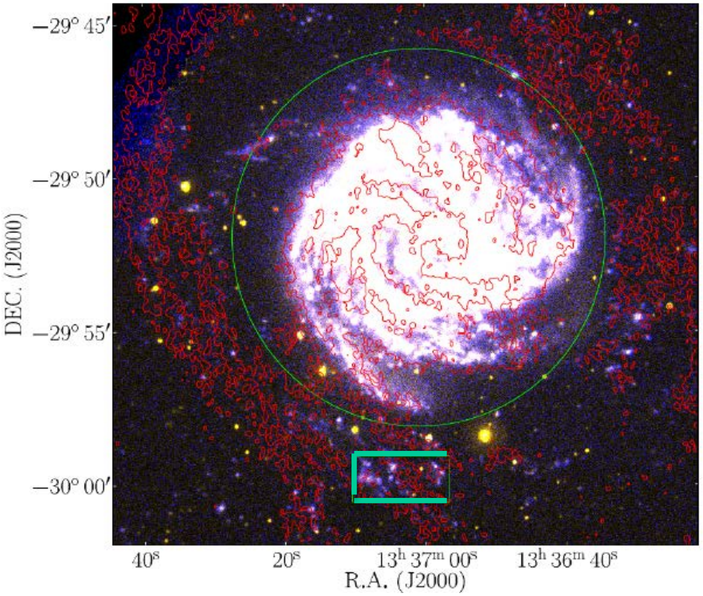


15 May 2019

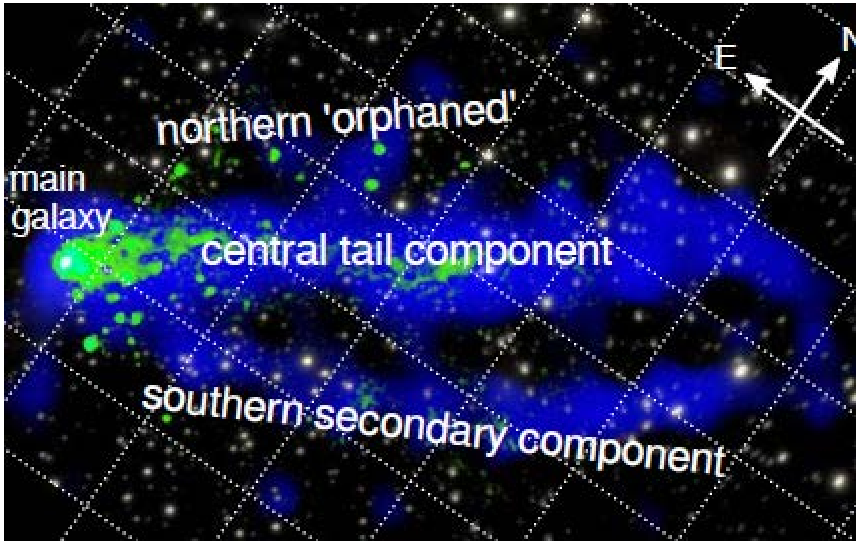
Françoise Combes
Observatoire de Paris



Outline



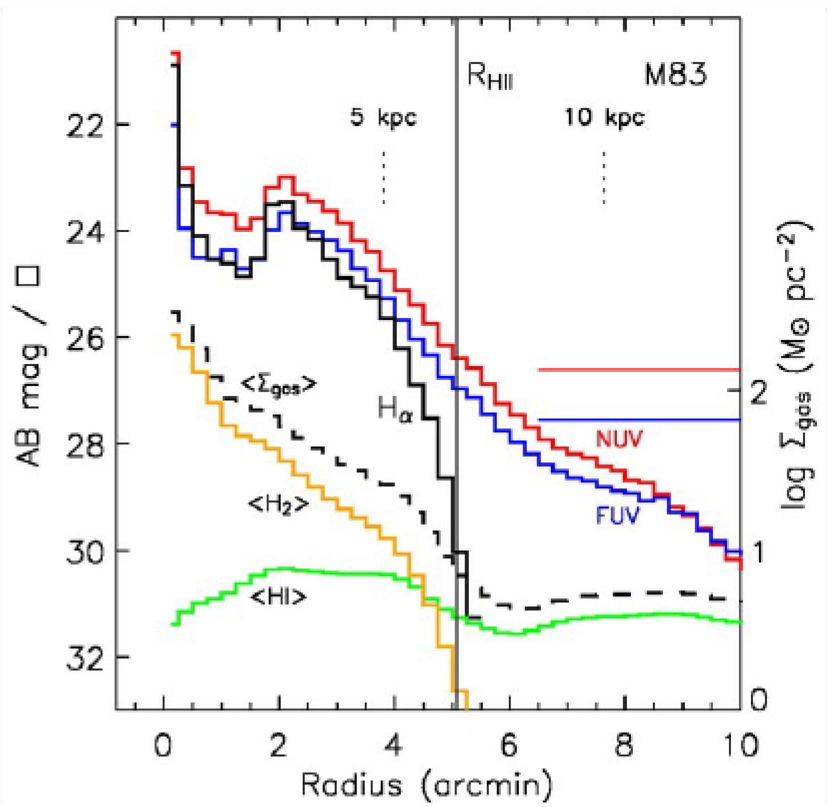
- **Star formation in XUV disks**
- **AGN in cool cores: moderation**
- **Environmental effects, RPS**
- **AGN positive feedback?**

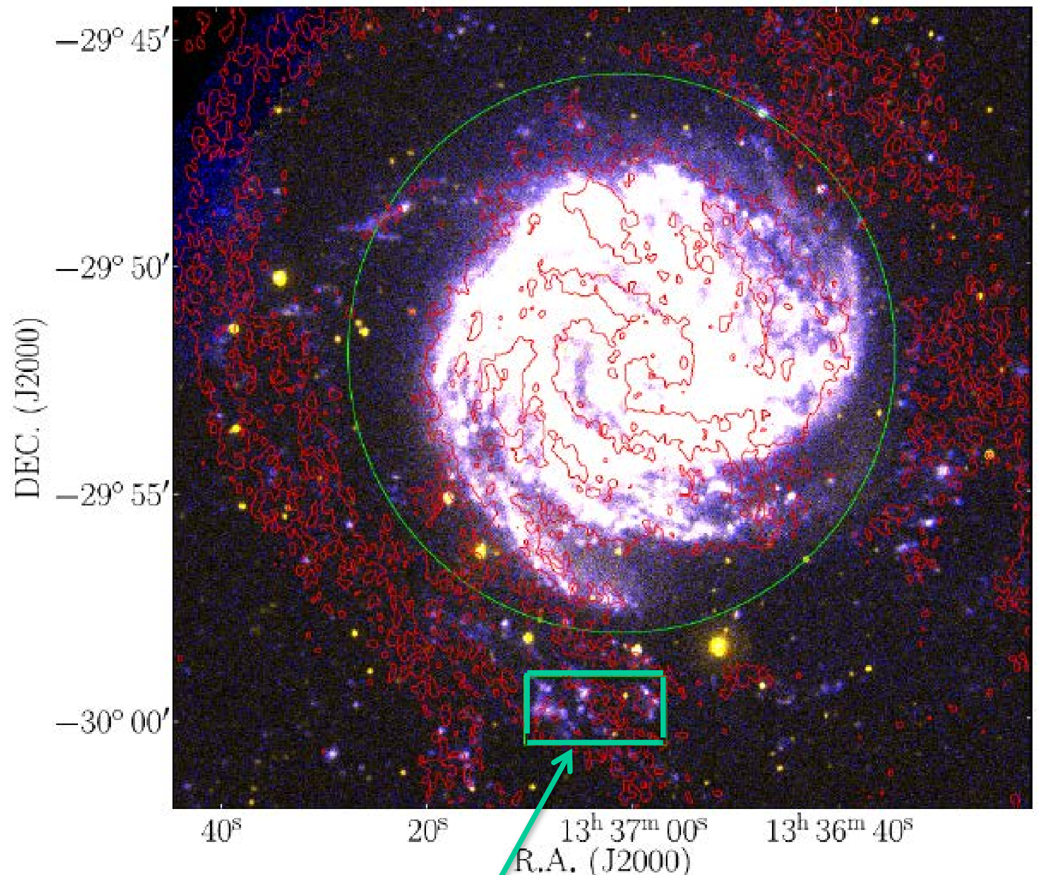


ALMA observation of the XUV disk

M83: Thilker et al 2005

R25=6.1’ = 8.64kpc

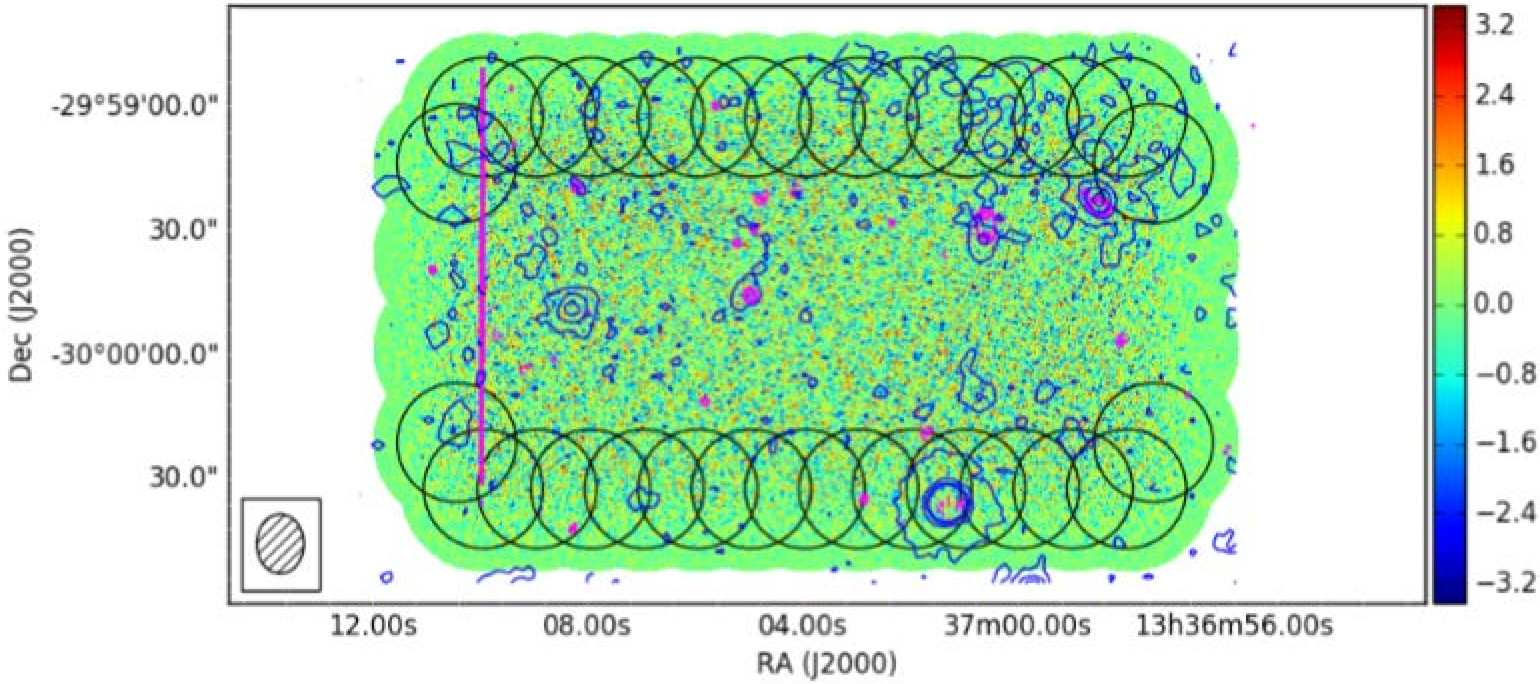




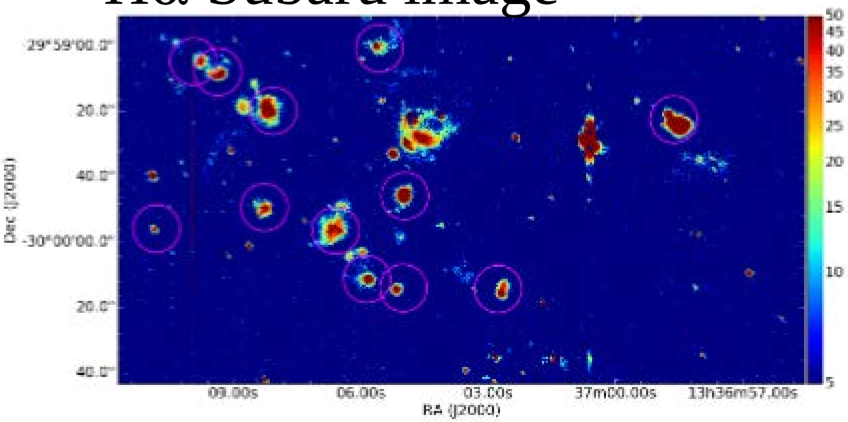
No CO detection

Hα(magenta) and FIR 24μm (black)

121 point mosaic

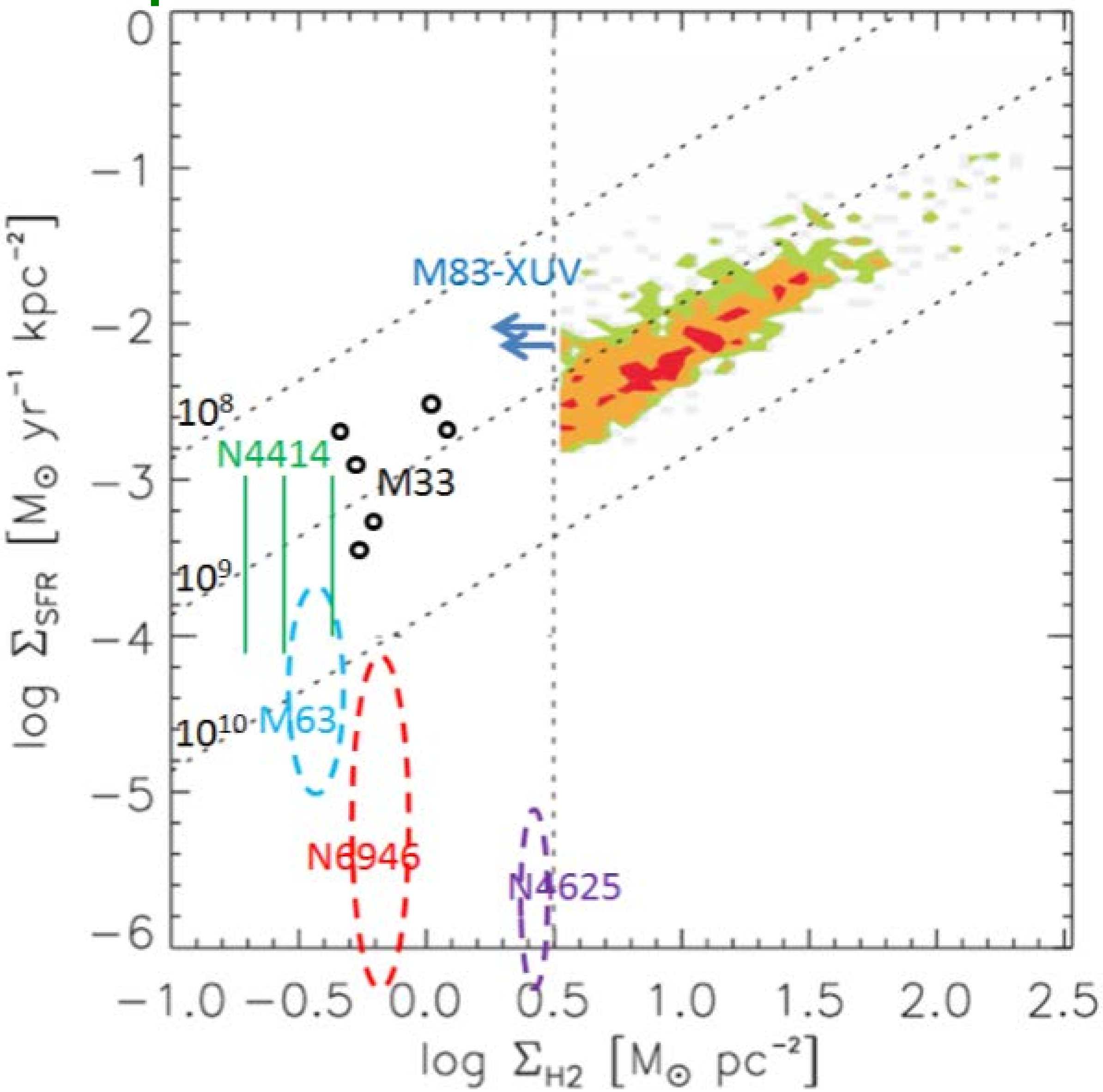


Hα Subaru image



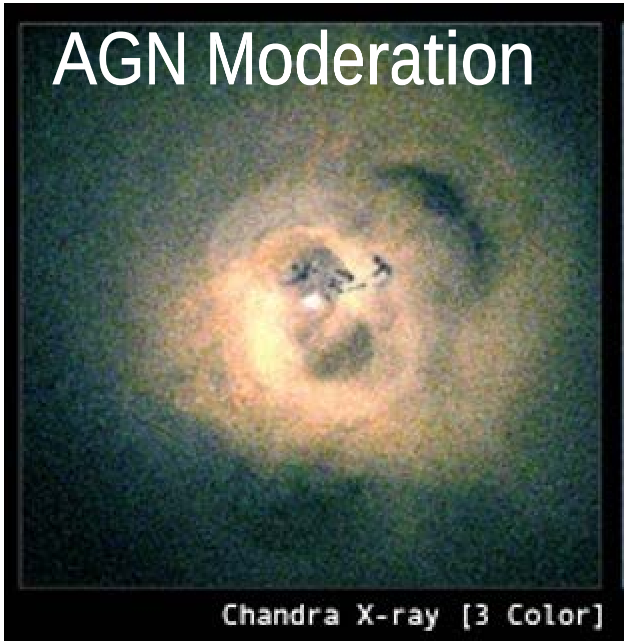
Bicalho et al 2019

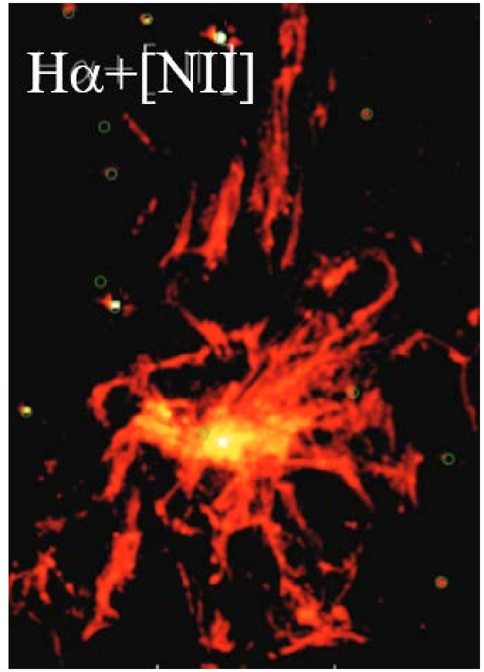
Very high depletion times



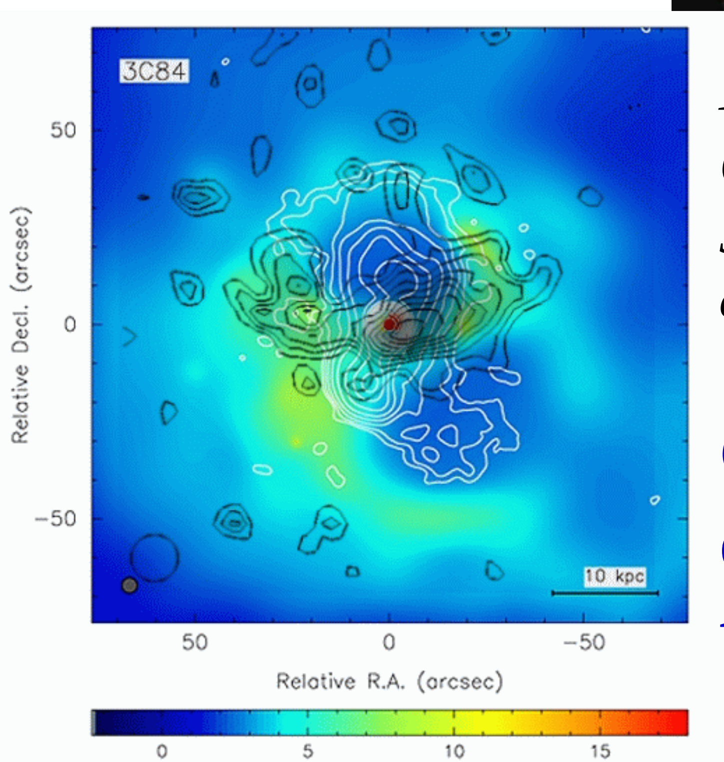
Bicalho et al 2019

Gas flow in cool core clusters



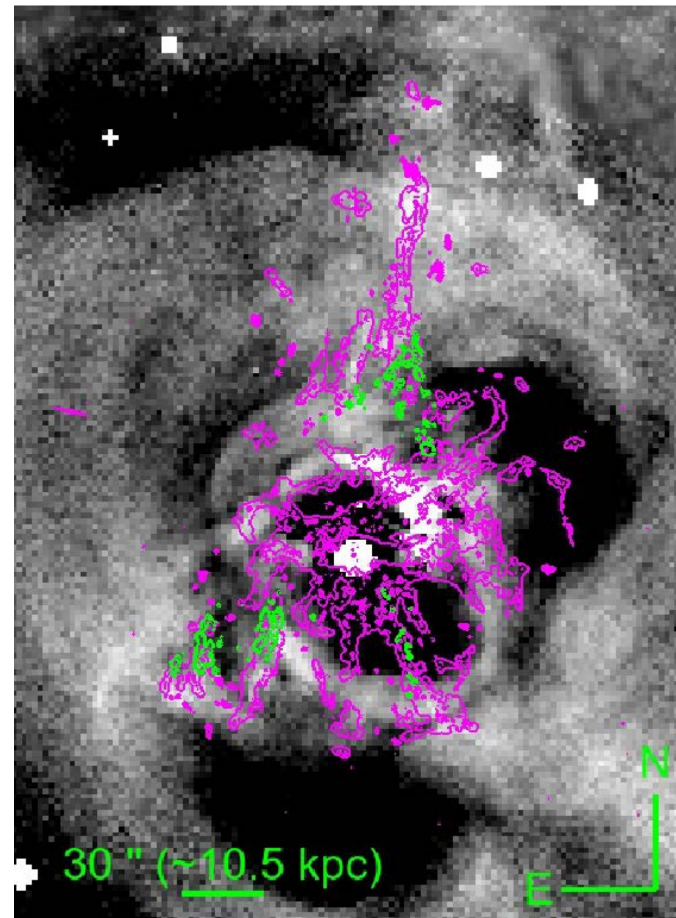


Star formation (green)
Canning et al 2014

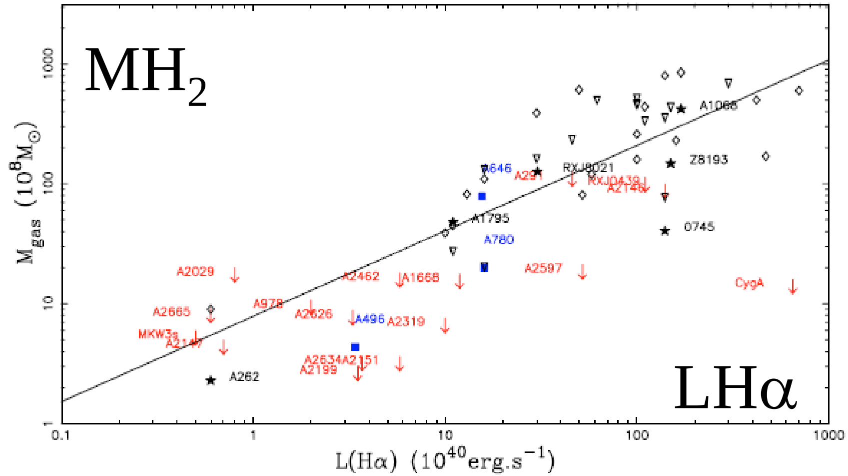


Molecular Gas
Salomé et al 2006

Gas raining down towards the AGN

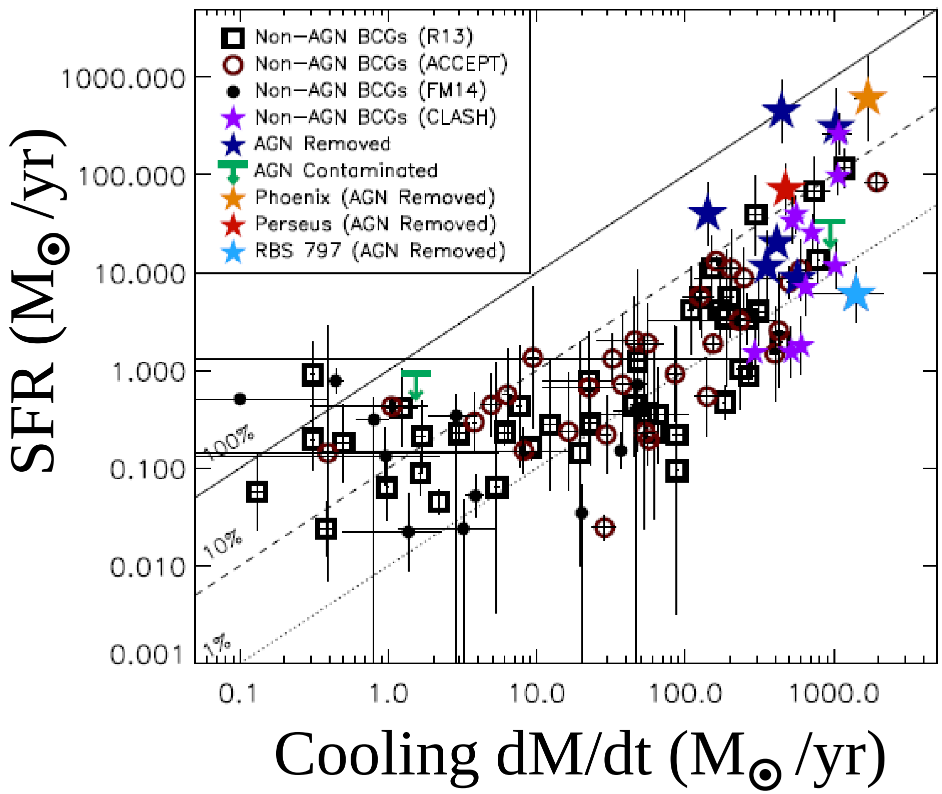


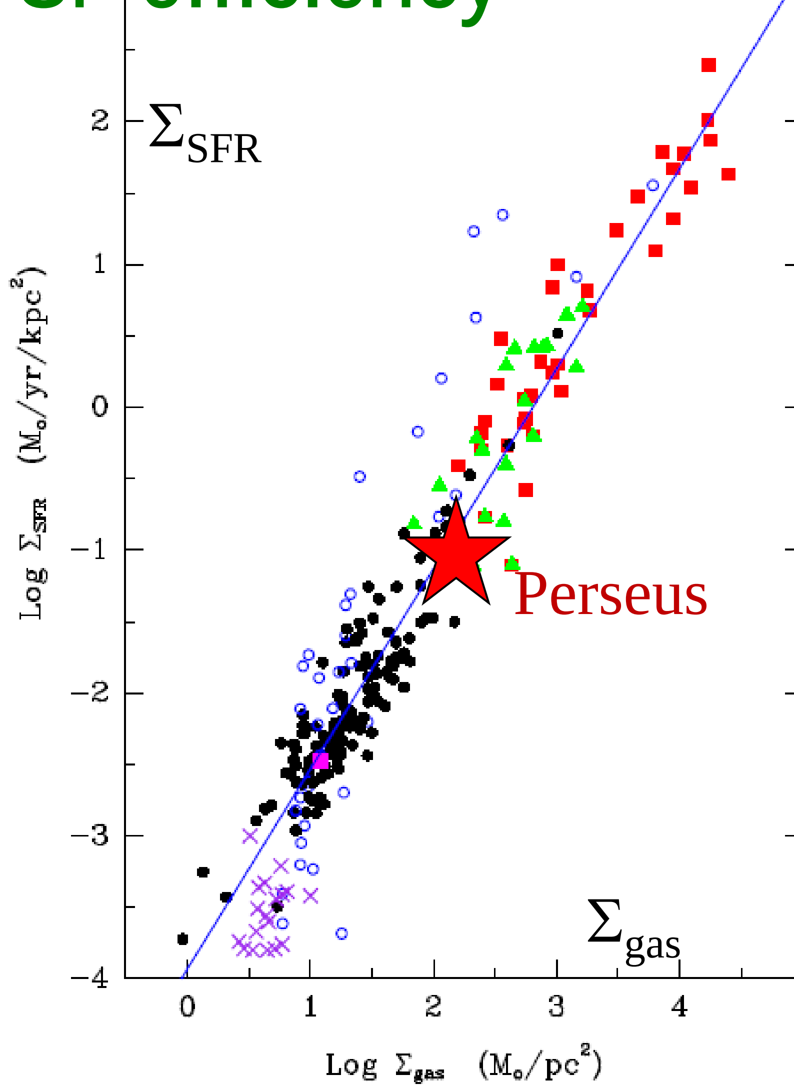
SF efficiency



CO and Hα emissions are well correlated

Salome & Combes 2003



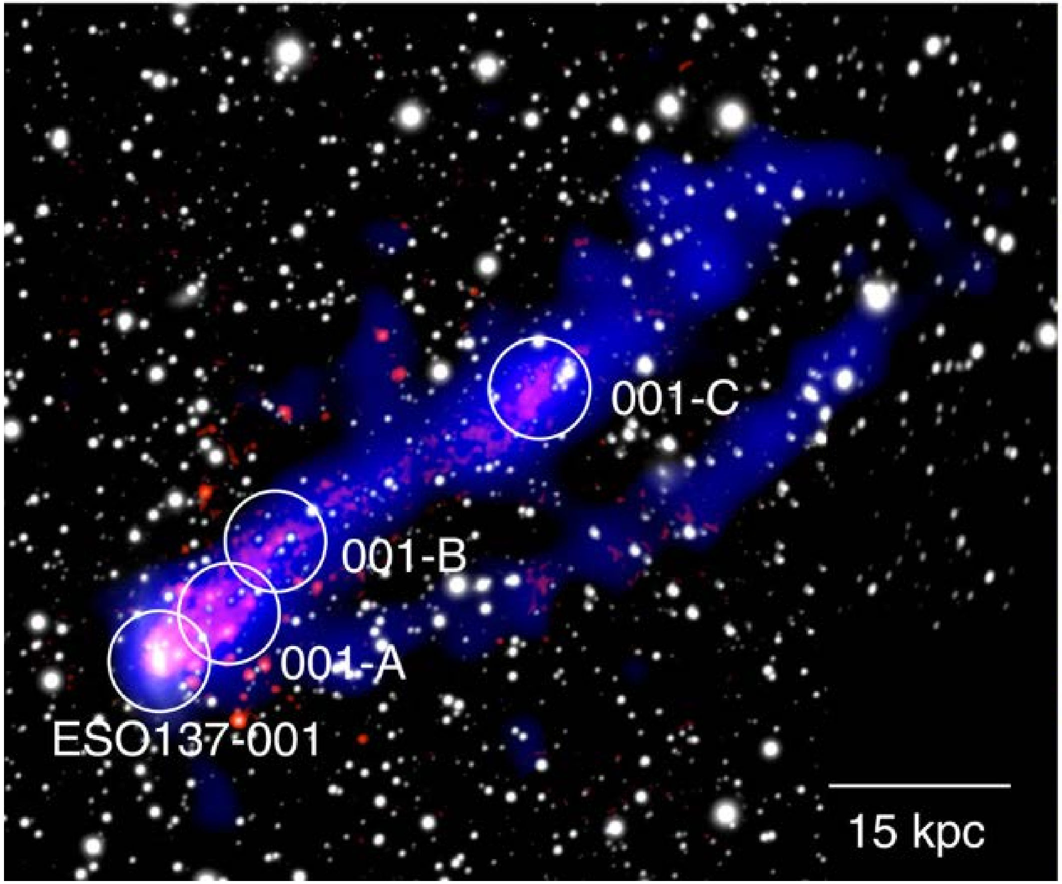


Kennicutt & Evans 2012

McDonald et al 2018

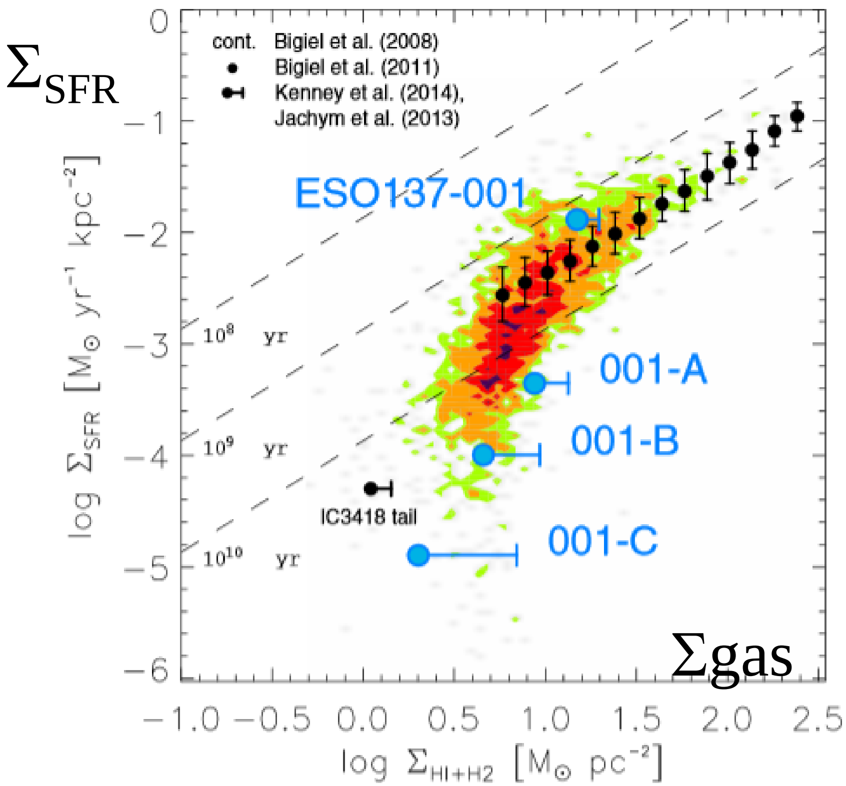
Environmental quenching

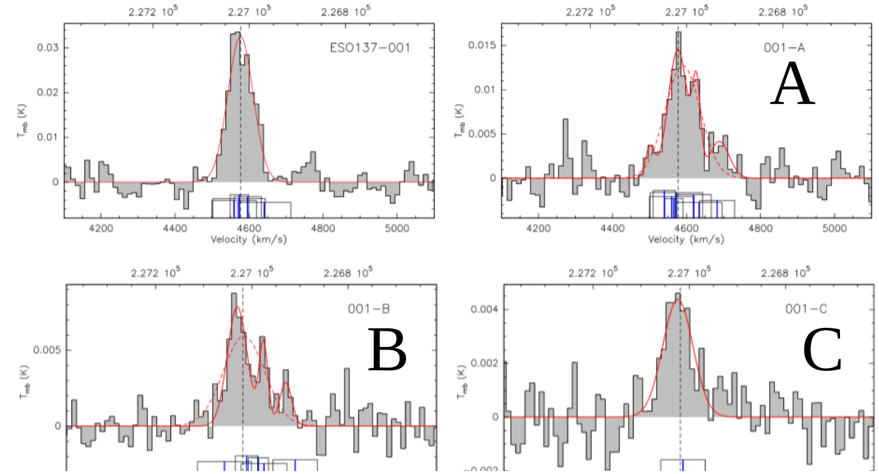
Ram pressure in clusters: **in general slow**:
In Virgo, HI deficient, but not H_2 (Kenney & Young 1989)
but **can be fast** in exceptional cases: ESO137-001

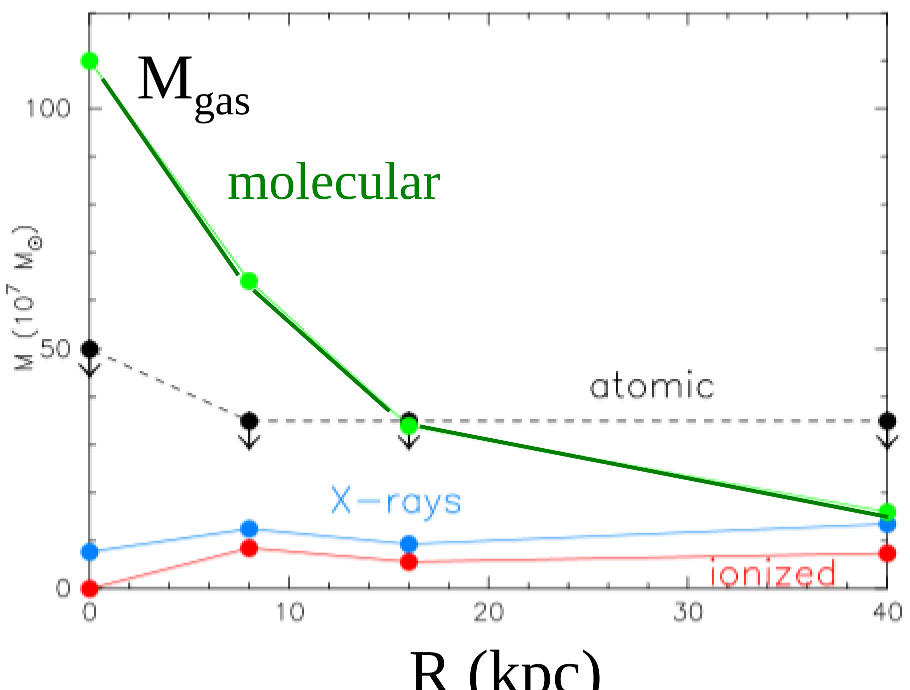


Jachym et al 2014

Ram-pressure quenching





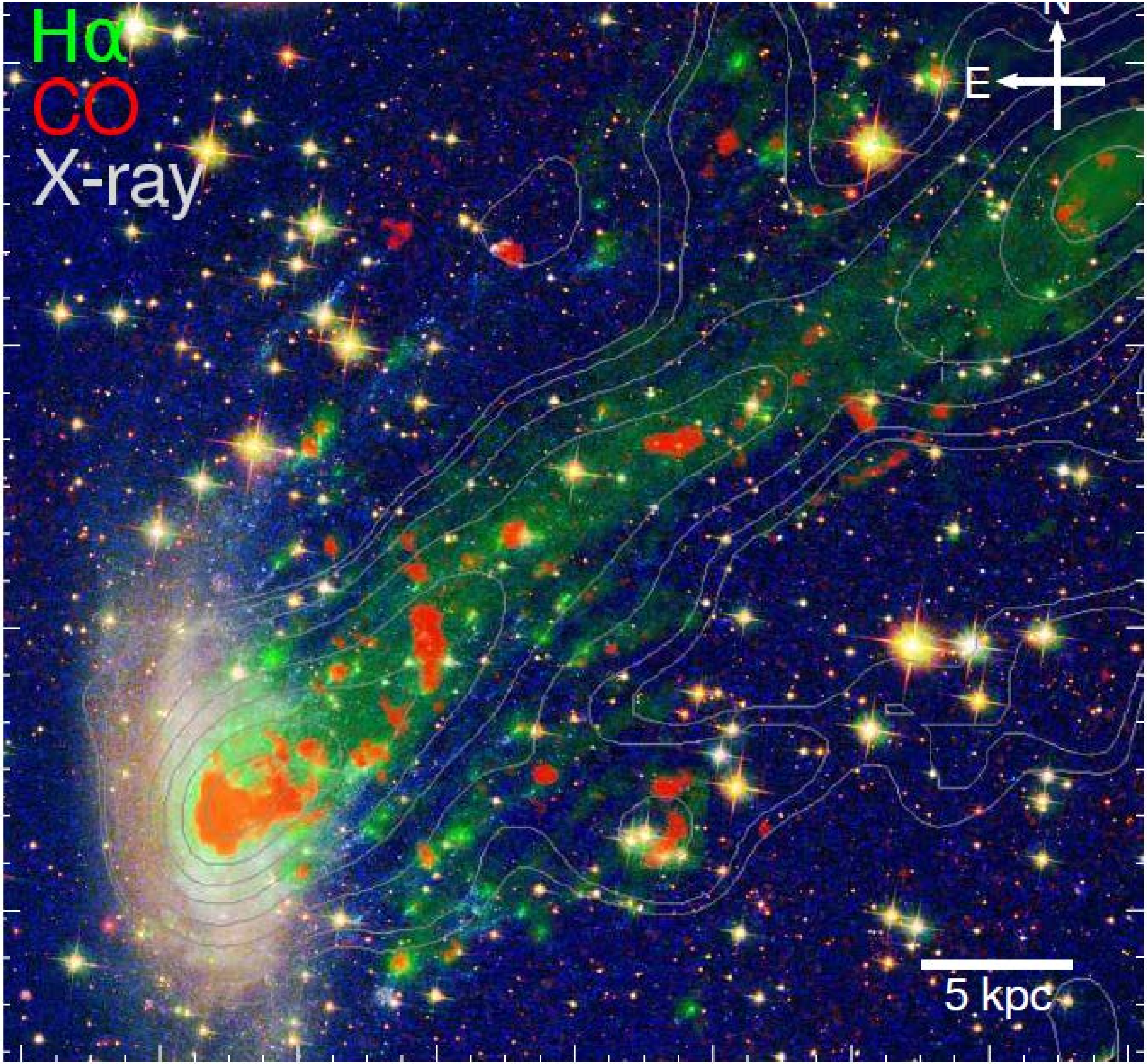


Tail of 80kpc in X-ray gas,
40kpc in CO
M(H_2) in C =1.5 $10^8 M_\odot$

Jachym et al 2014

ALMA CO more H_2 in the tail than in disk

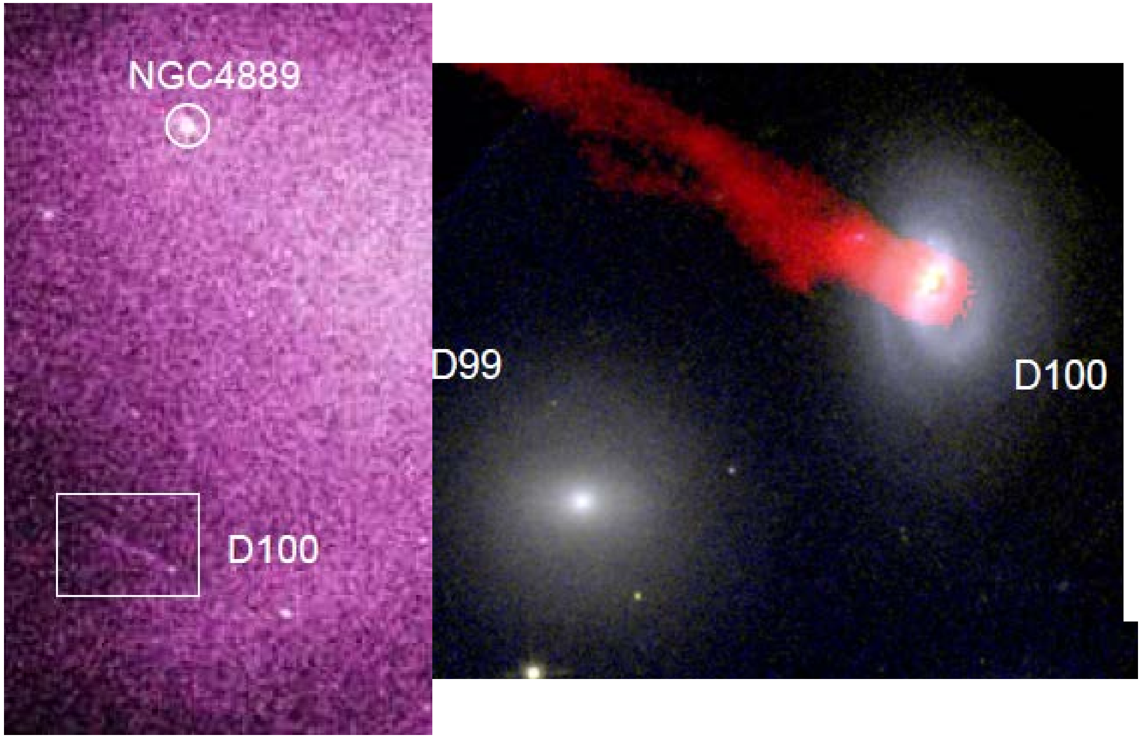
➔ in situ

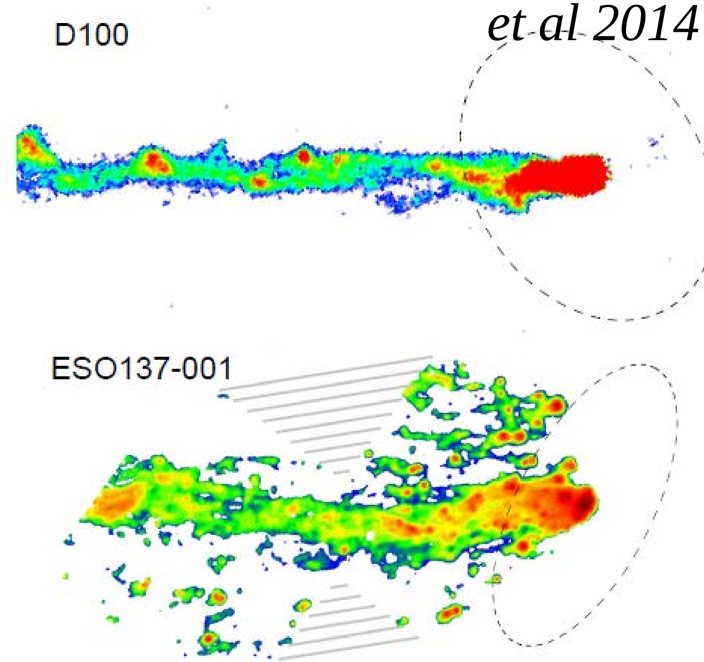


Jachym et al 2019

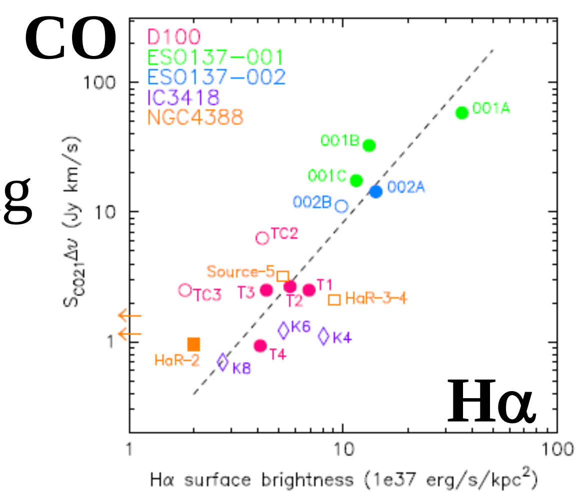
Ram-pressure in Coma

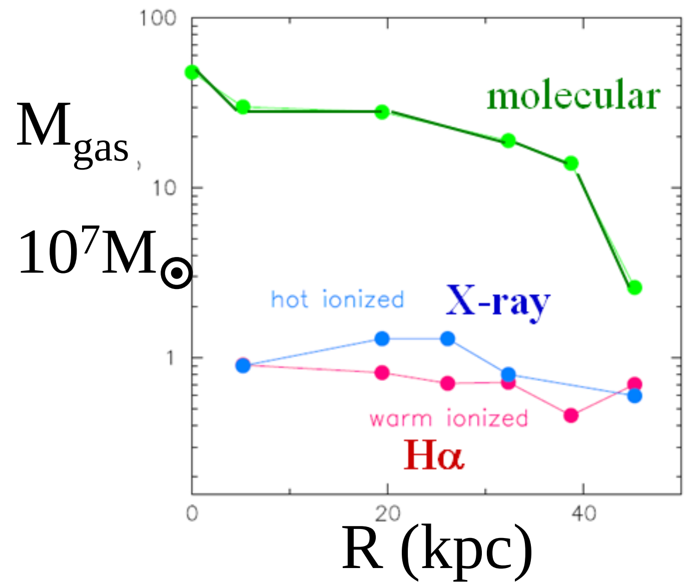
MUSE Fumagalli et al 2014





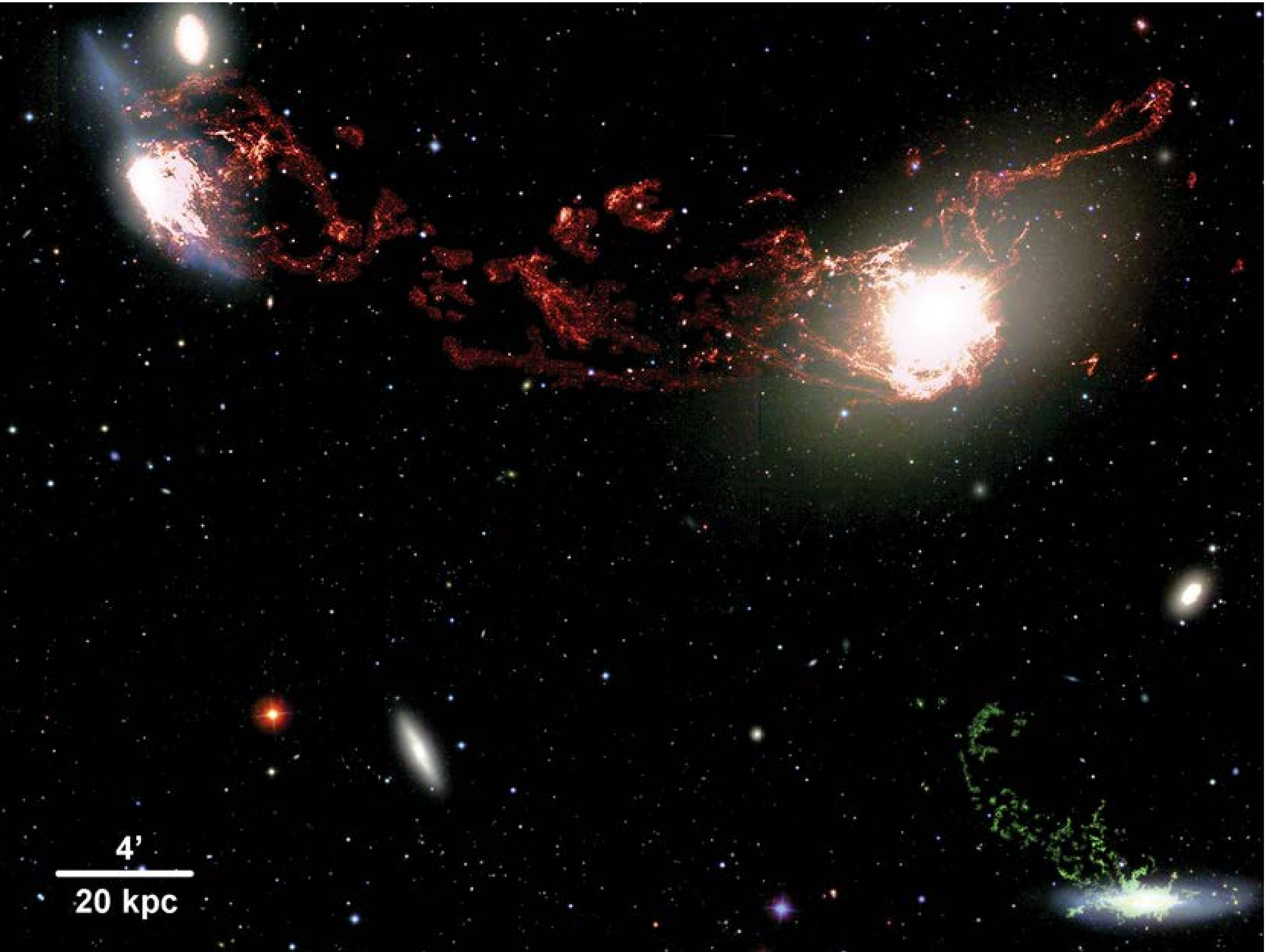
D100 tail: thinner
Last stage of stripping





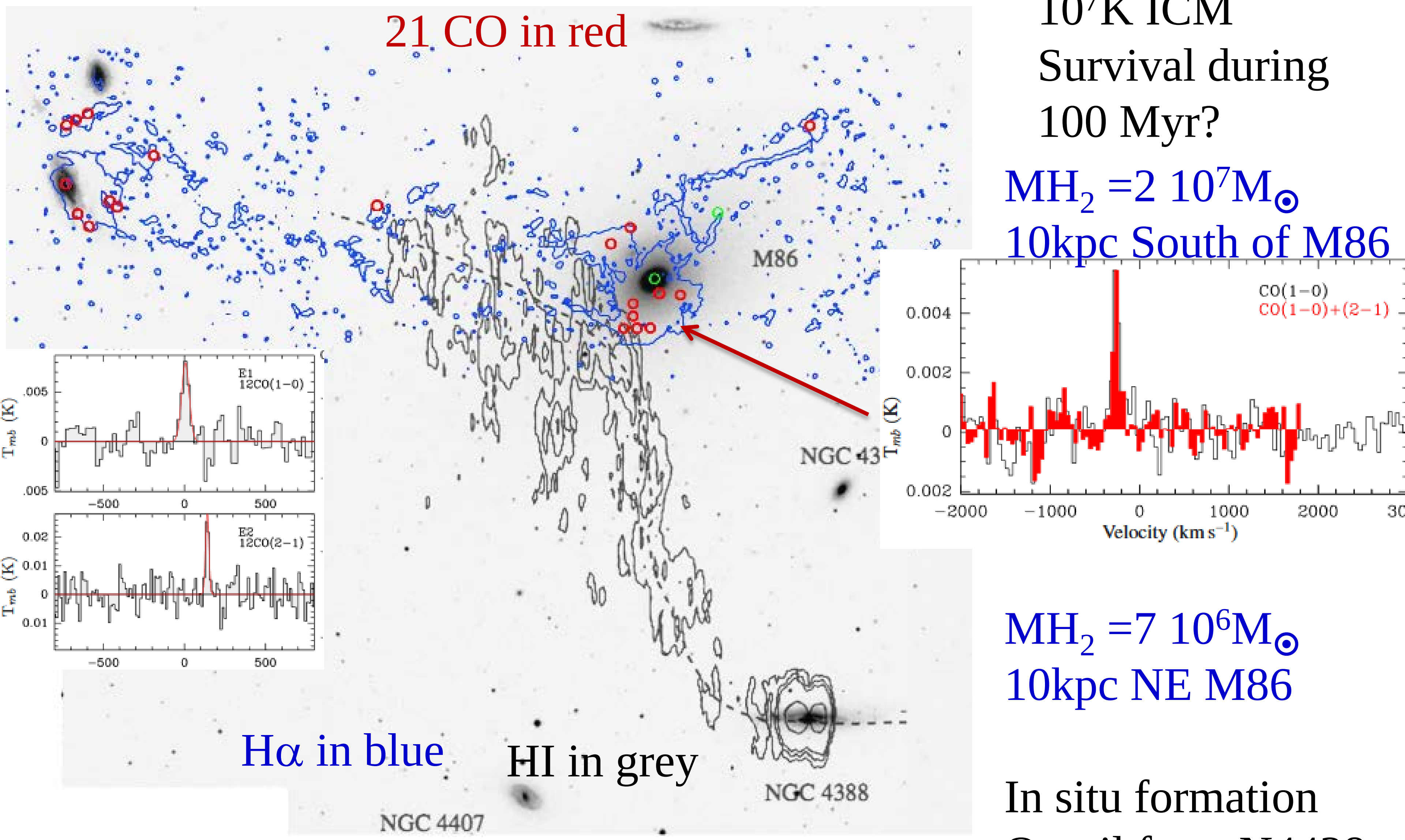
Jachym et al 2017

Giant Hα tail in Virgo



Kenney+
2008

Tail around M86 : H2 gas in hostile environment



10^7K ICM
Survival during
100 Myr?

$MH_2 = 2\ 10^7 M_\odot$
10kpc South of M86

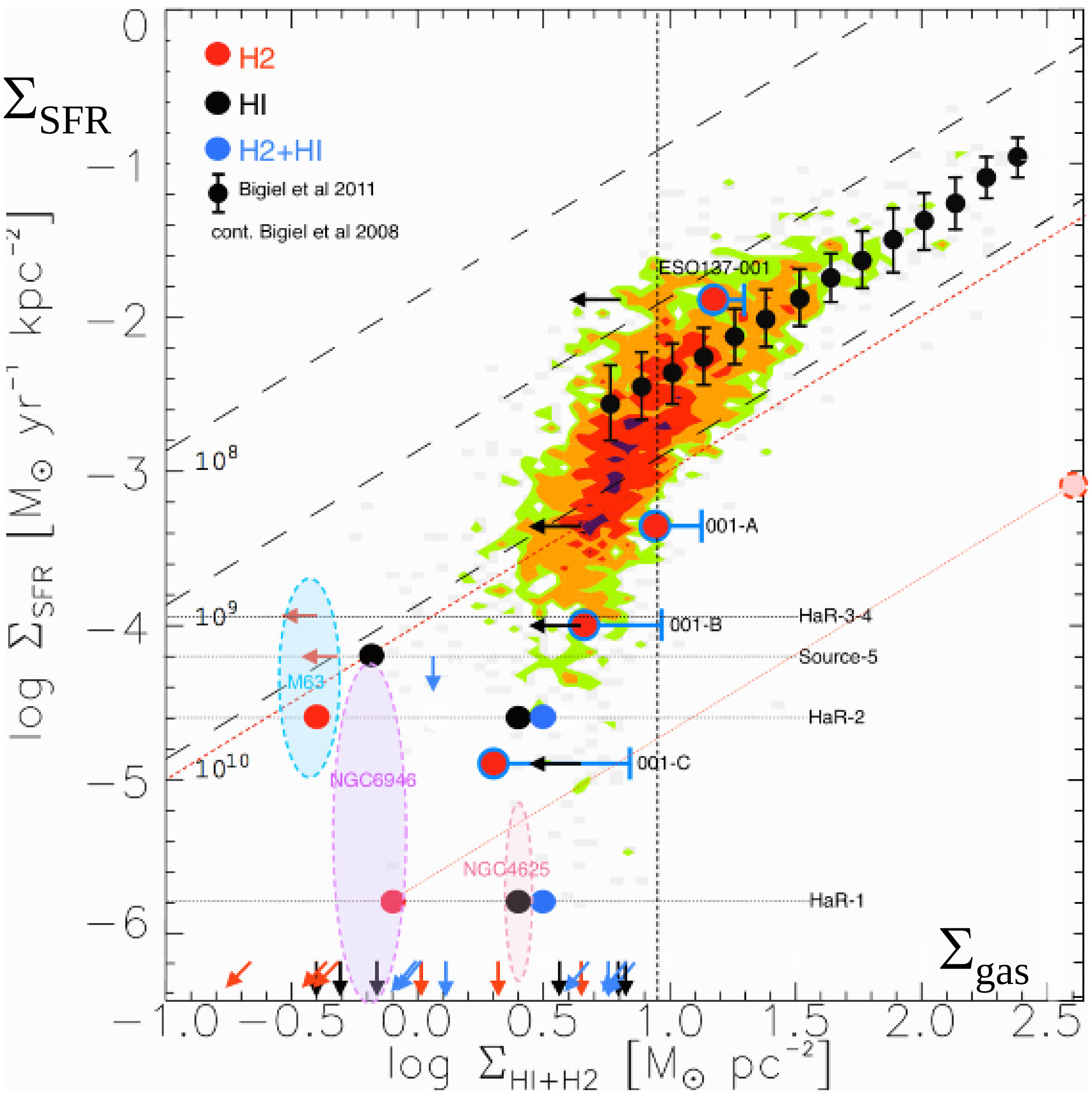
$MH_2 = 7\ 10^6 M_\odot$
10kpc NE M86

In situ formation
Or tail from N4438

Dasyra et al 2012

Star formation efficiency

Comparison with XUV disks



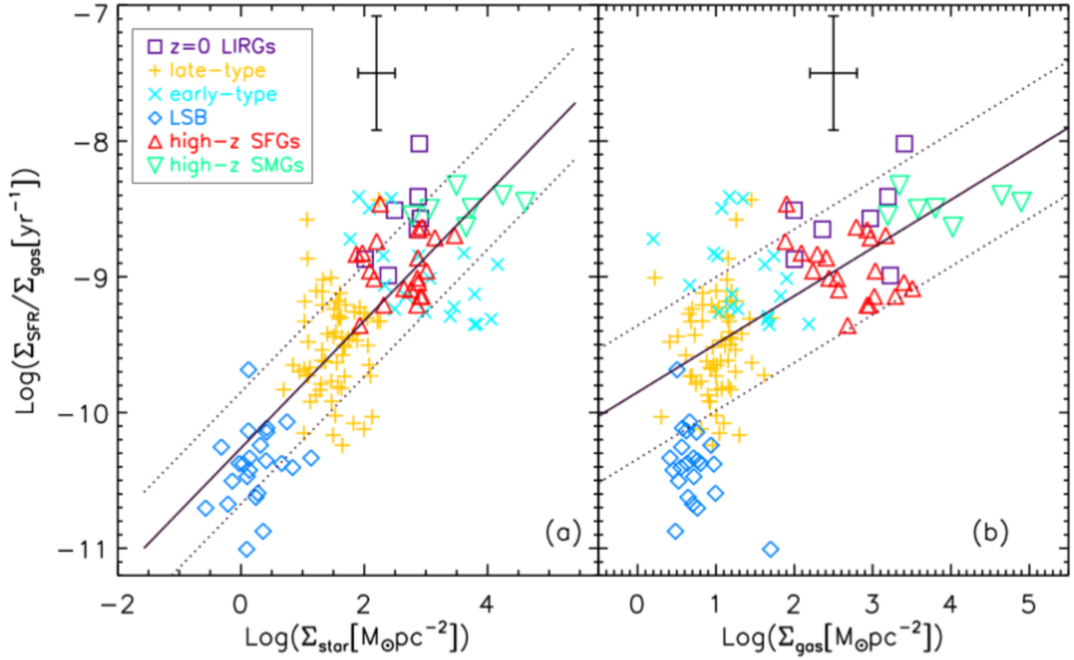
Gas in tails, and far from disks have not enough pressure from stars

And the gas surface density is not enough for fast HI to H_2 transition

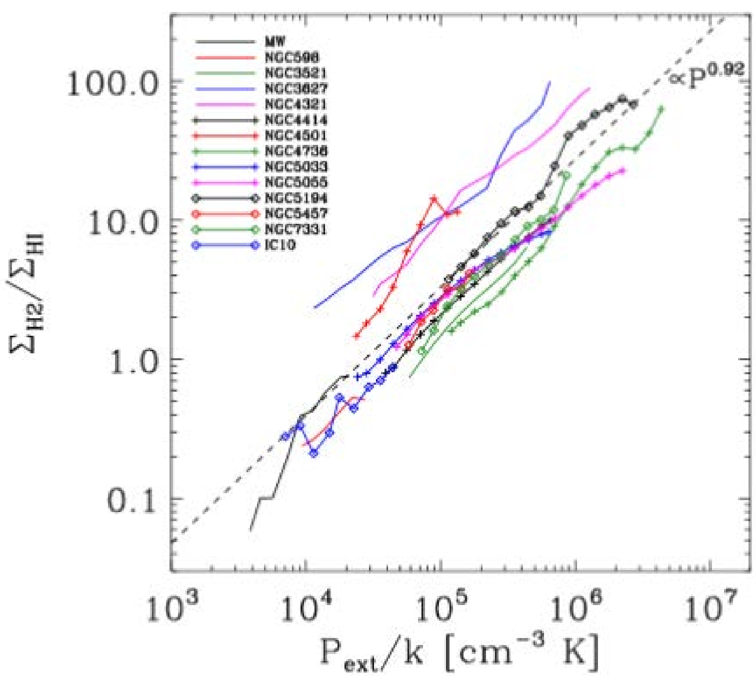
Verdugo et al 2015

Importance of pressure

The surface density of stars
is very important for
the SF effeiciency

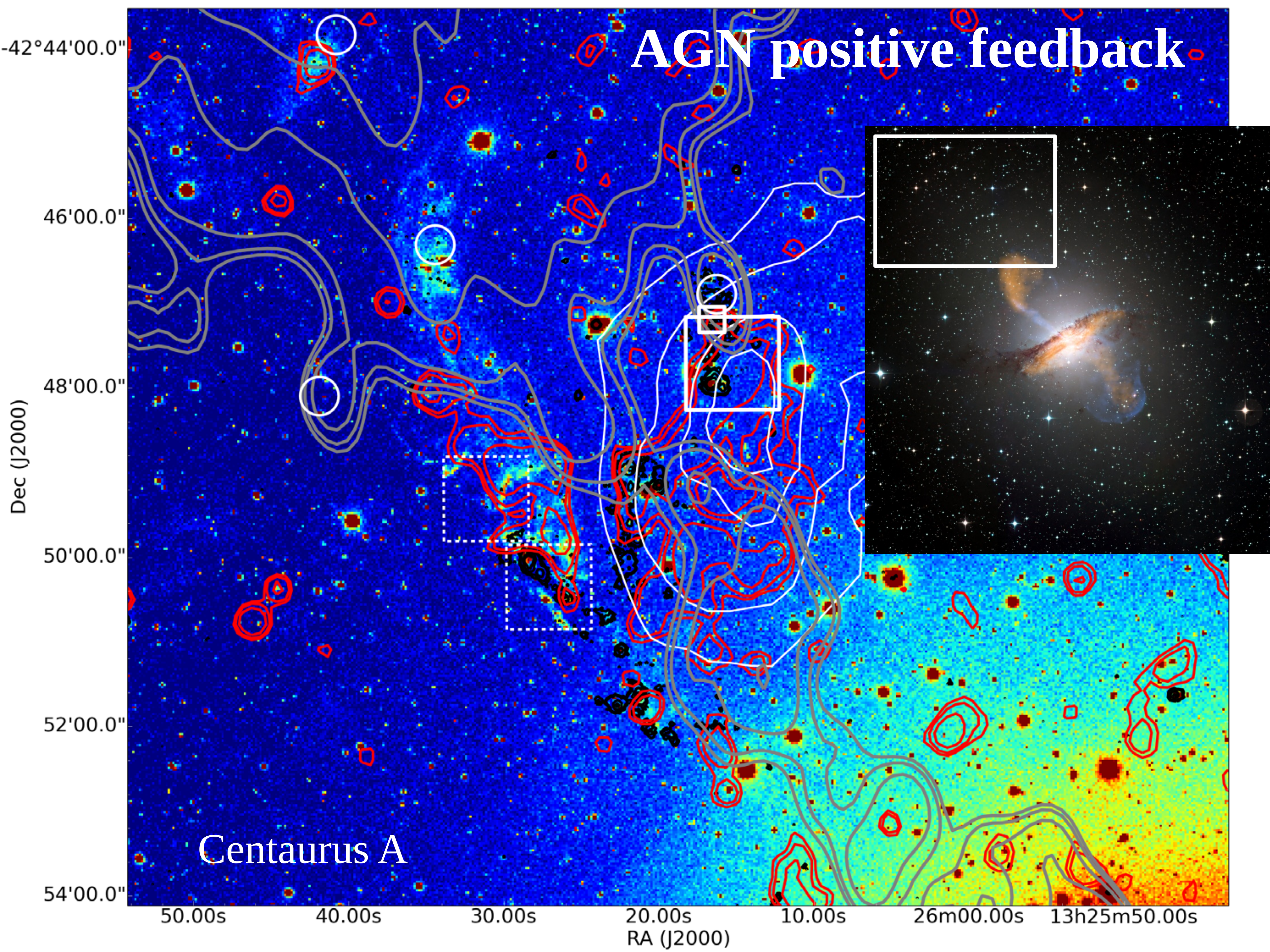


Shi, Helou et al 2011



The HI to H_2 transituon
is favored by external pressure

Blitz & Rosolowsky 2006

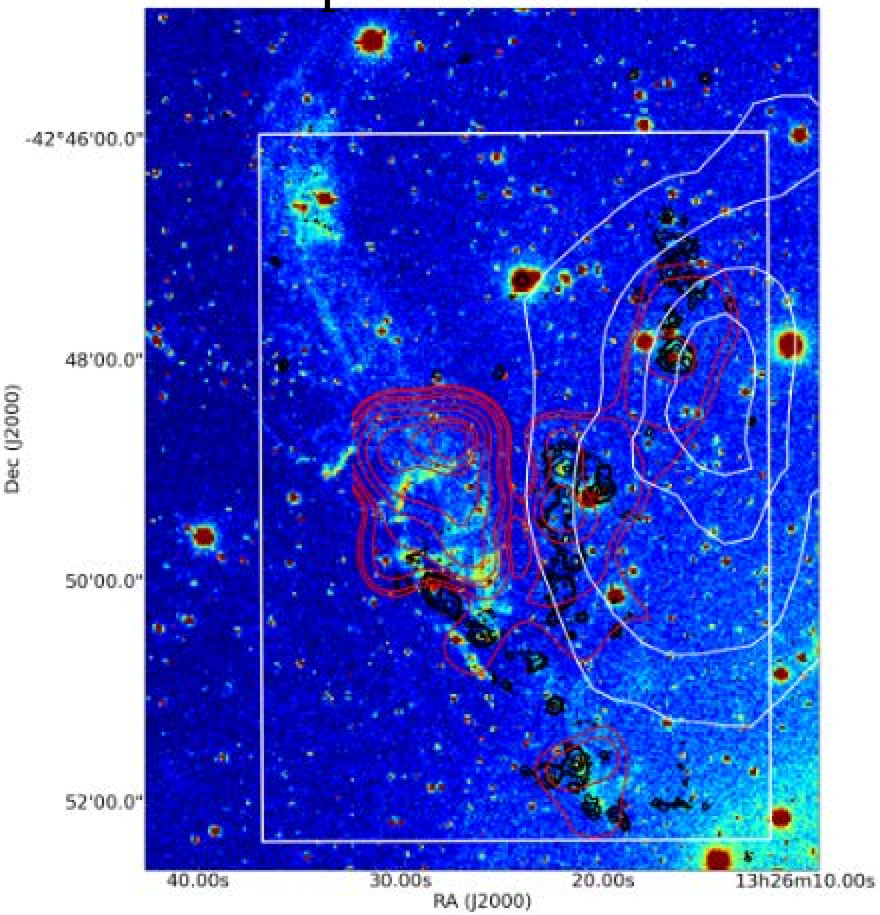


AGN positive feedback
Centaurus A
-42°44'00.0"
46'00.0"
48'00.0"
50'00.0"
52'00.0"
54'00.0"
Dec (J2000)
50.00s
40.00s
30.00s
20.00s
10.00s
26m00.00s
13h25m50.00s
RA (J2000)

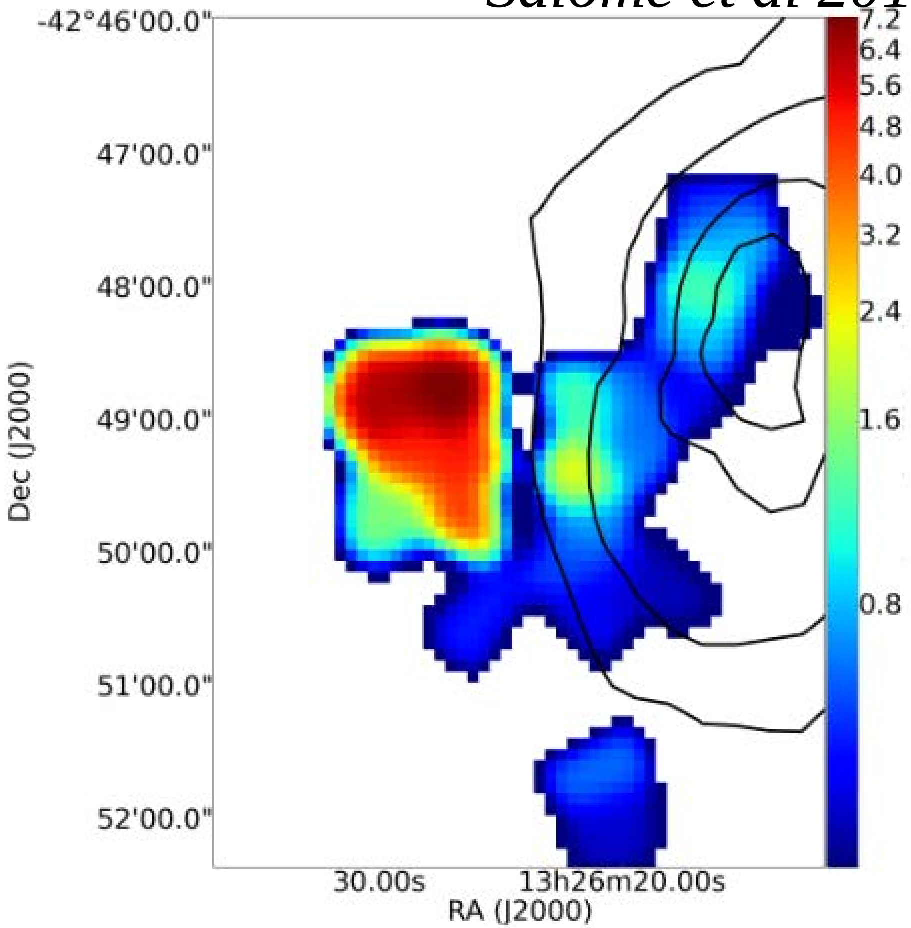
Molecular gas in the shell

H_2 dominant at E, HI at W, **tdep=7-16 Gyr**

Hα map



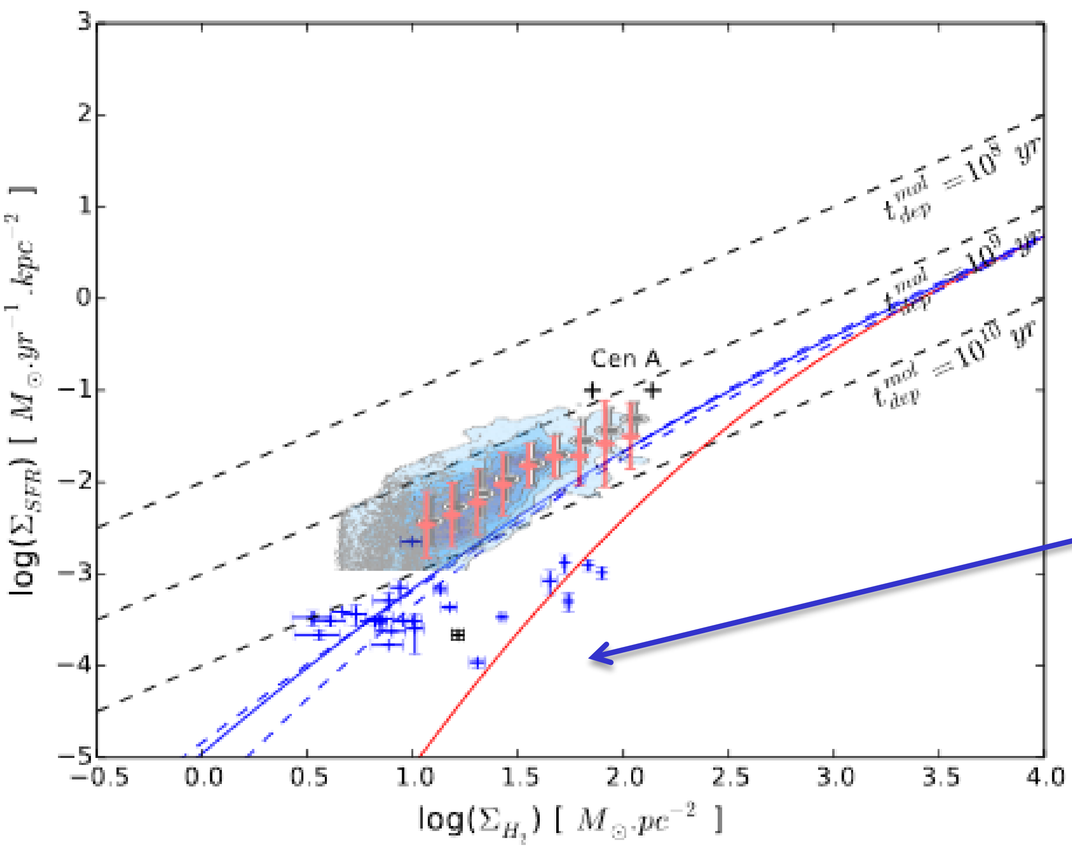
Salomé et al 2016



Red: CO, White: HI, **FUV-Galex: black** CO21, HI contours

Star formation triggering

The radio jet effectively triggers star formation in the shell along the jet ➔ positive AGN feedback



However, the SF efficiency is lower than in disks

➔Not enough pressure

➔Tdep larger than a Hubble time

Salome et al 2016

Conclusions

XUV disks: very low SF efficiency (disk flaring?)

AGN feedback: cool-core clusters, molecular gas outside disks
low efficiency

Environment processes: Tides, ram-pressure, starvation
Formation of molecular gas in situ, low SFE

AGN positive feedback: jet induced star formation
low SFE