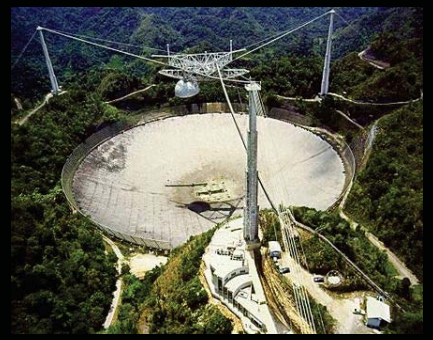
HI in low-z galaxies

How to observe?

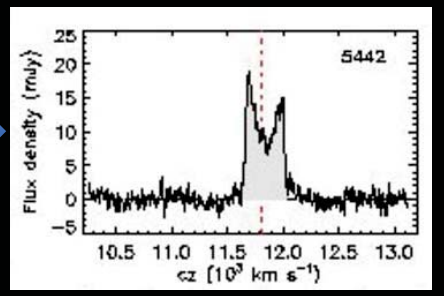
HI observation

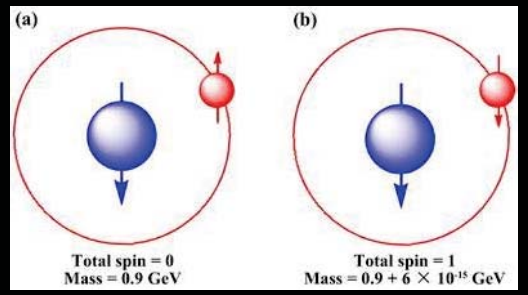


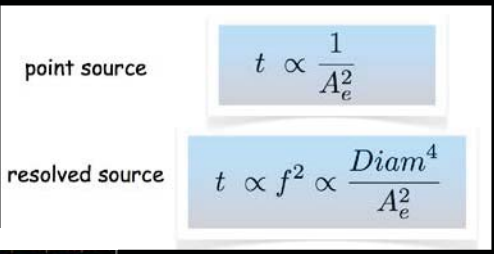
Arecibo

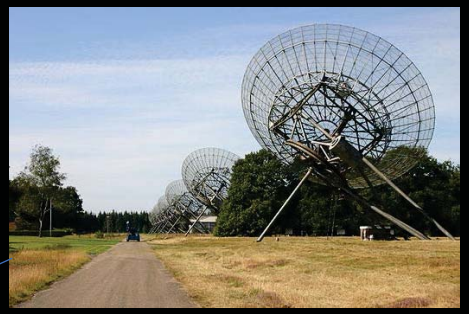
Spatial resolution 3’

$10^{19.5}$ cm^{-2} -> 0.2s

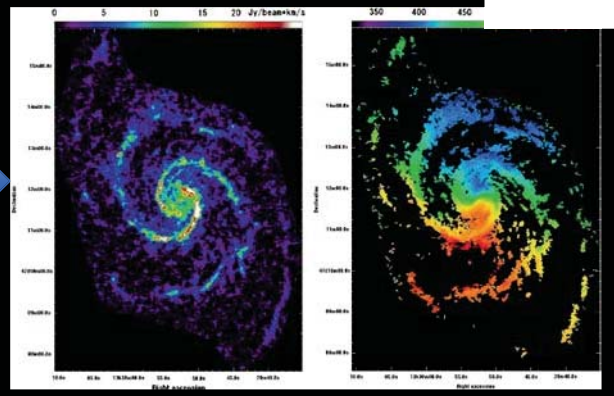








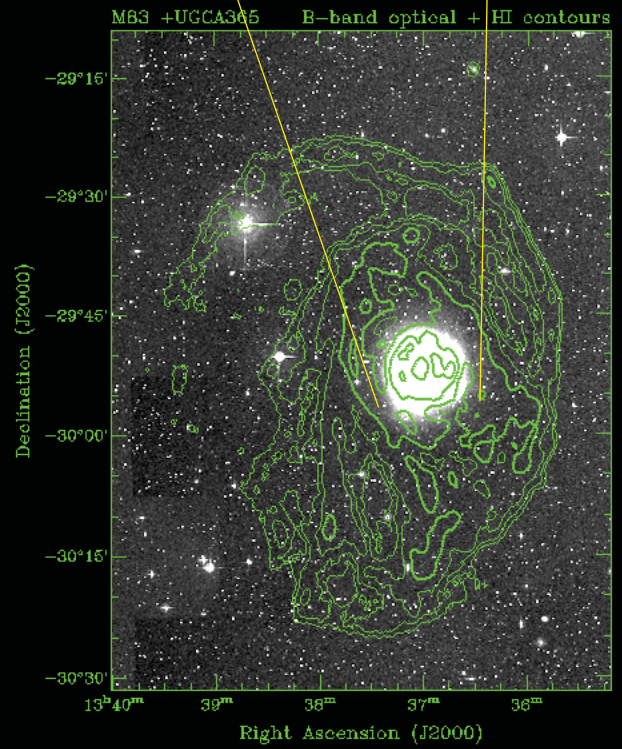
WSRT

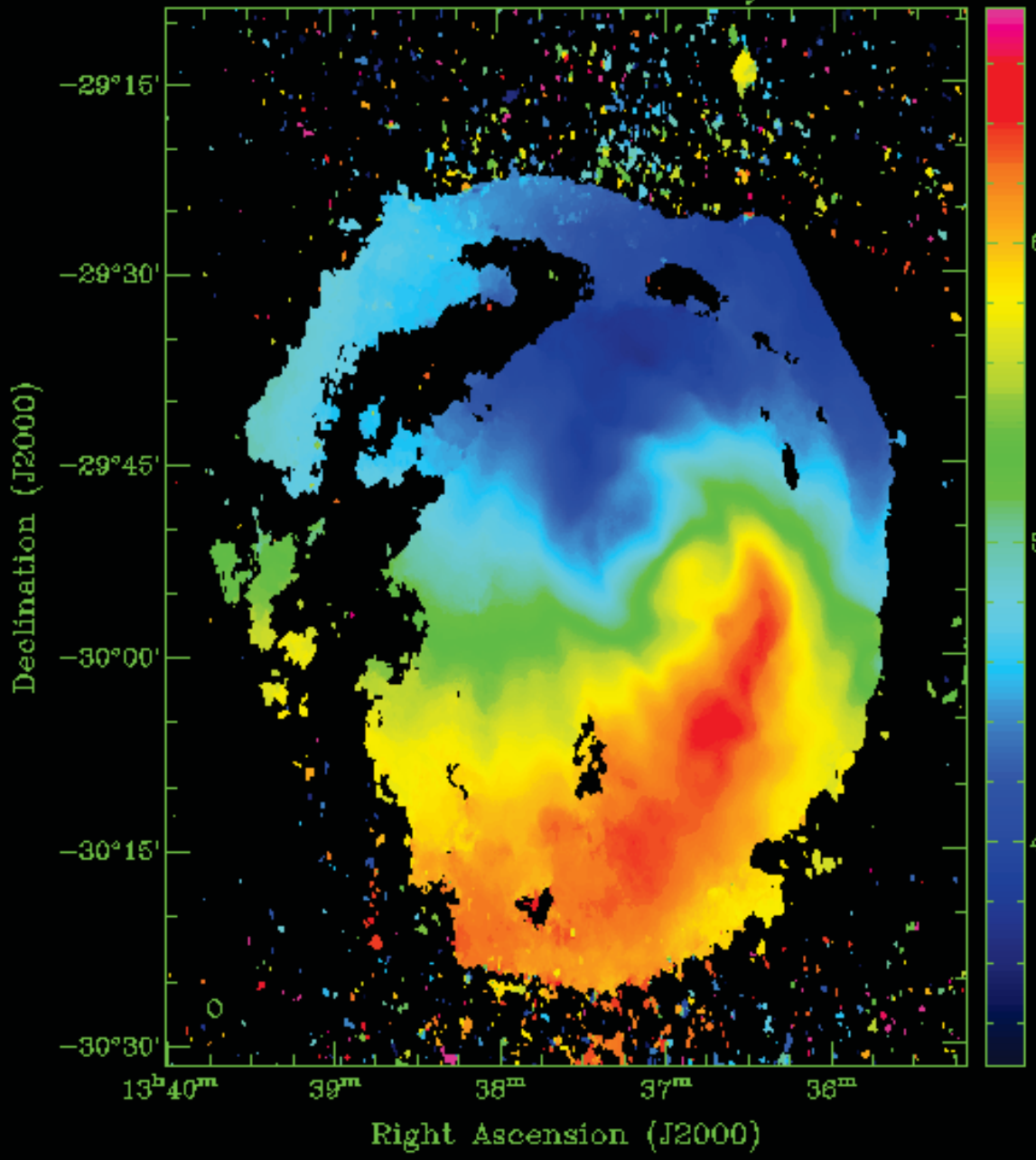


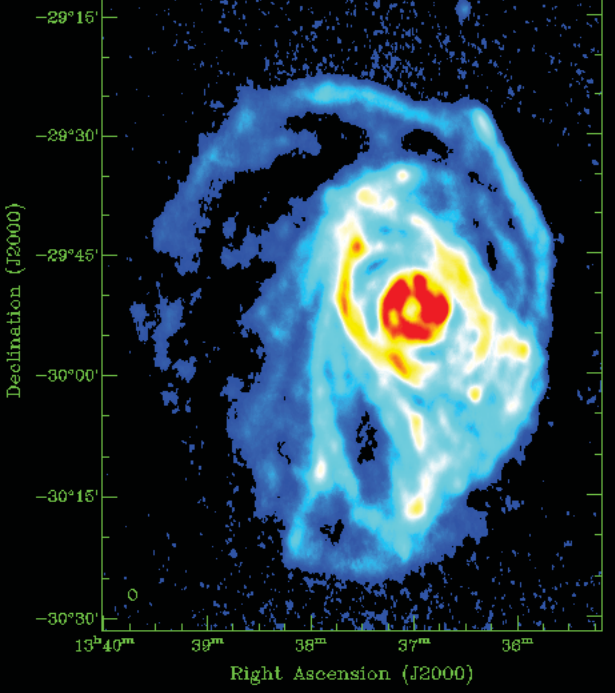
Spatial resolution 20’’

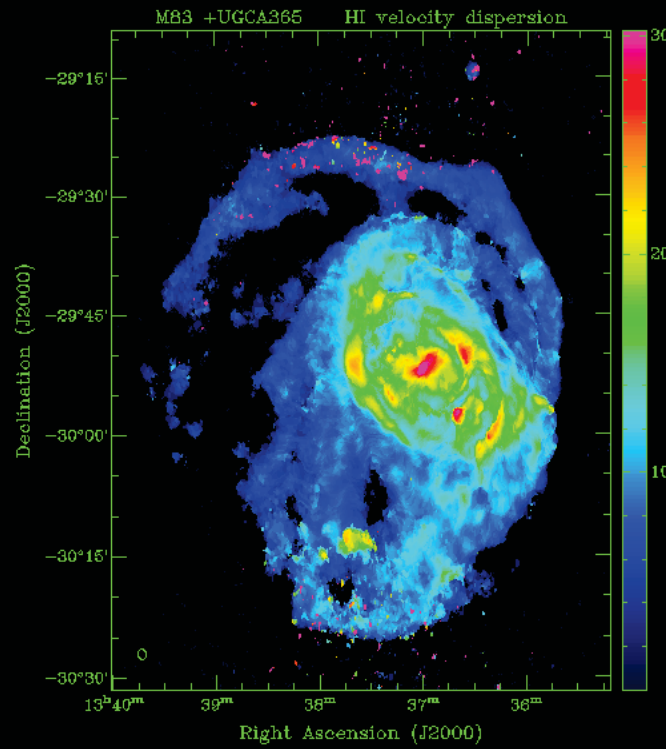
$10^{19.5}$ cm^{-2} ->12h

HI data cube of M83
(LVHIS)


M83 +UGCA365 B-band optical + HI contours
Declination (J2000)
Right Ascension (J2000)

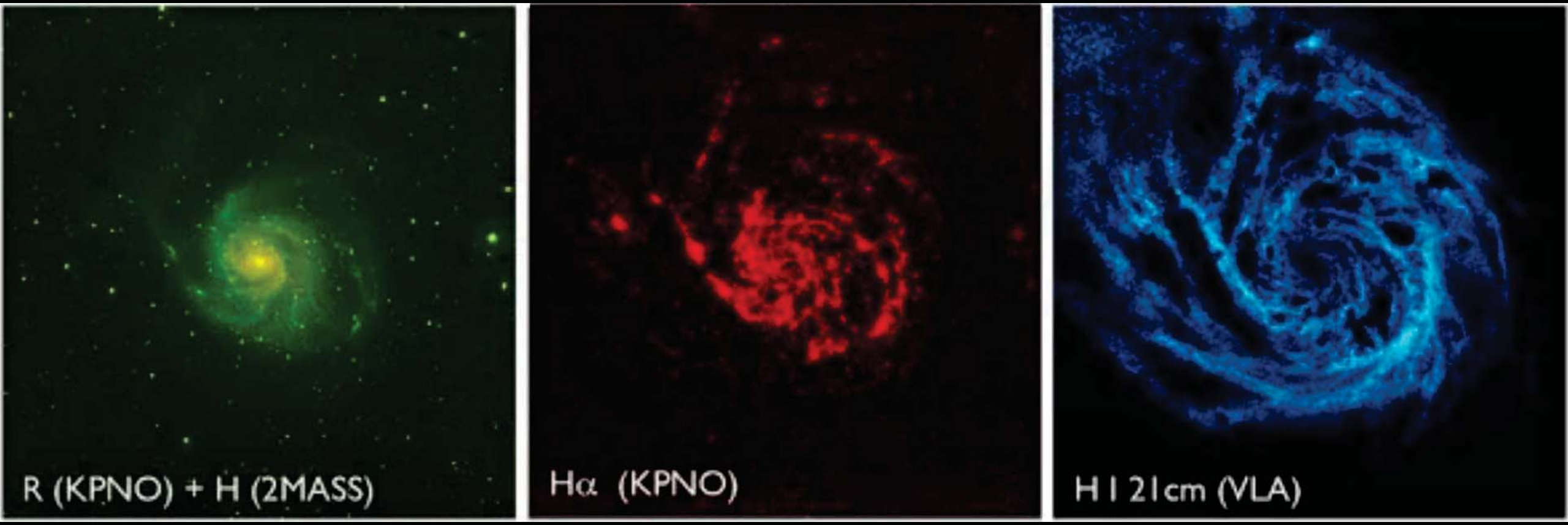

M83 +UGCA365 HI velocity field
Declination (J2000)
Right Ascension (J2000)
600
500
400
KM/S


Declination (J2000)
Right Ascension (J2000)


M83 +UGCA365 HI velocity dispersion
Declination (J2000)
Right Ascension (J2000)

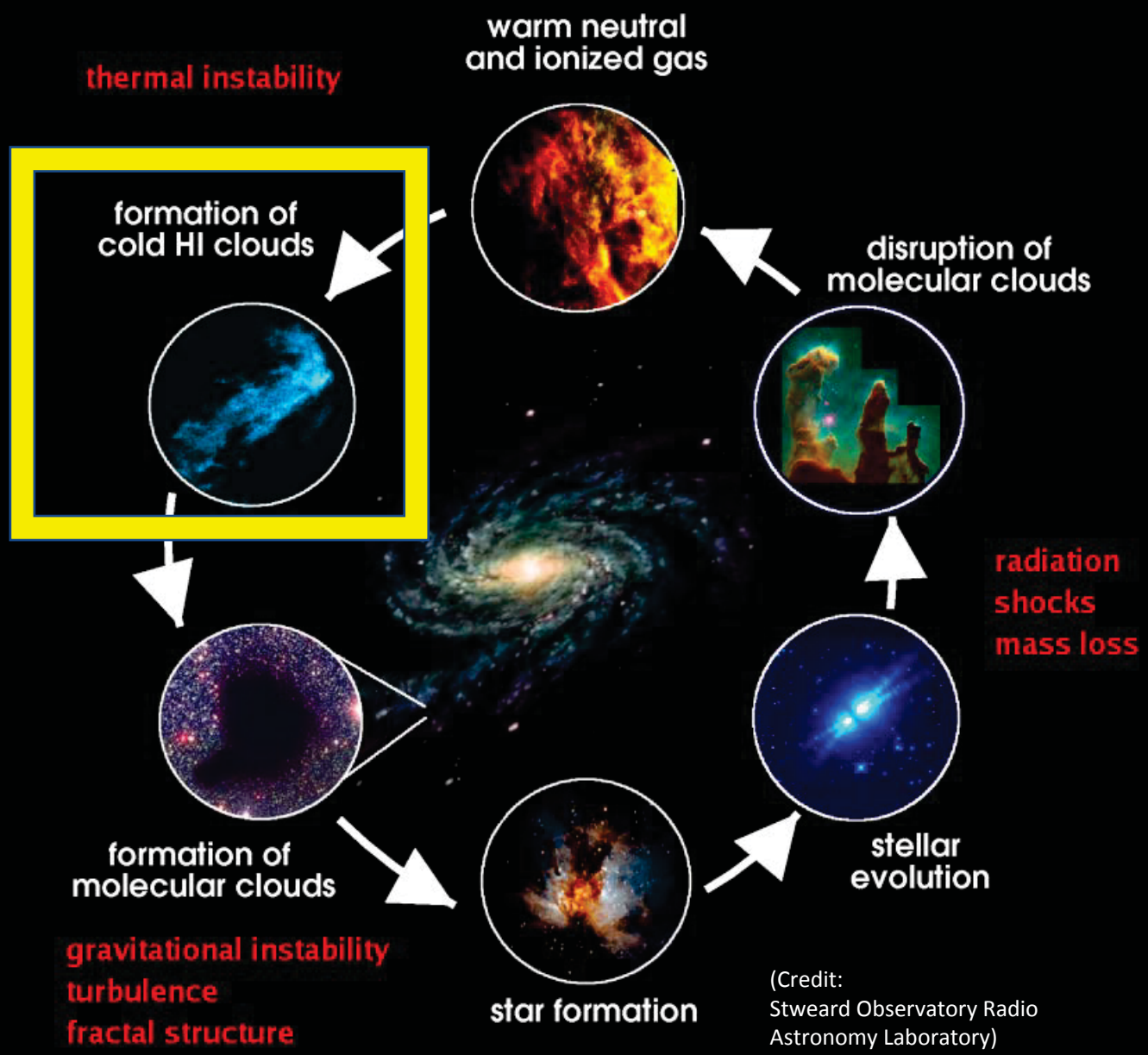
Why HI?

Different appearance from other bands



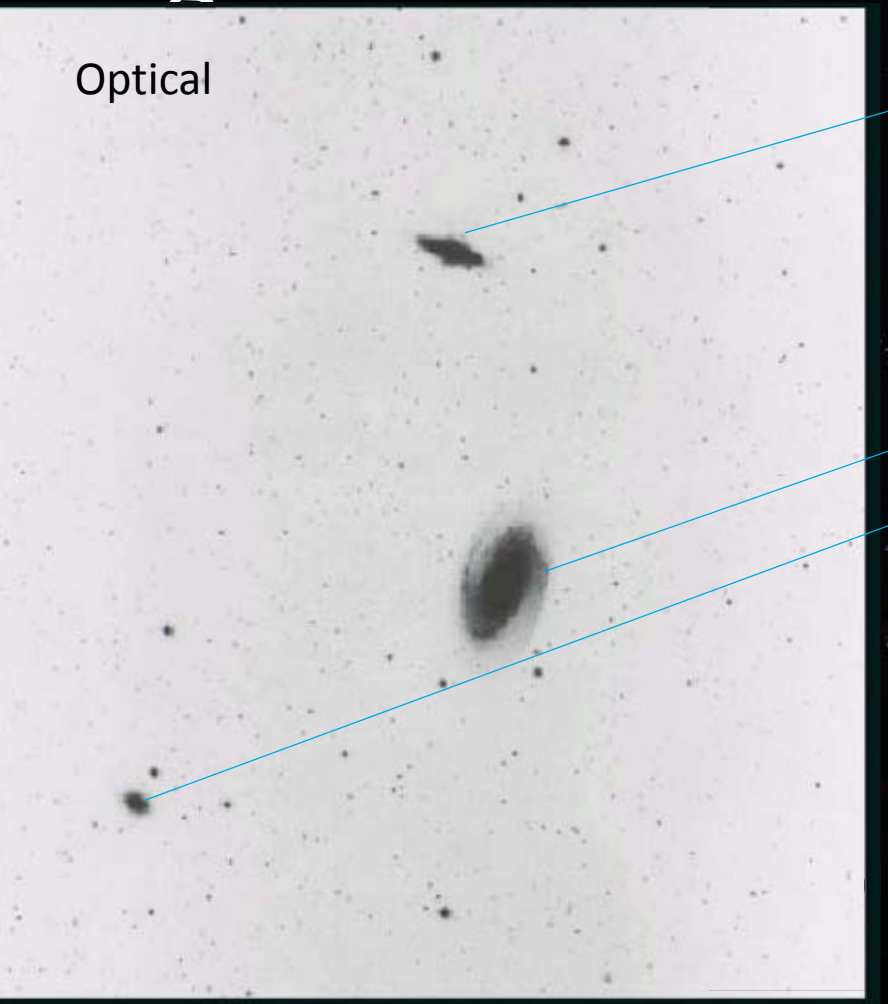
Credit: A. Lopez-Sanchez

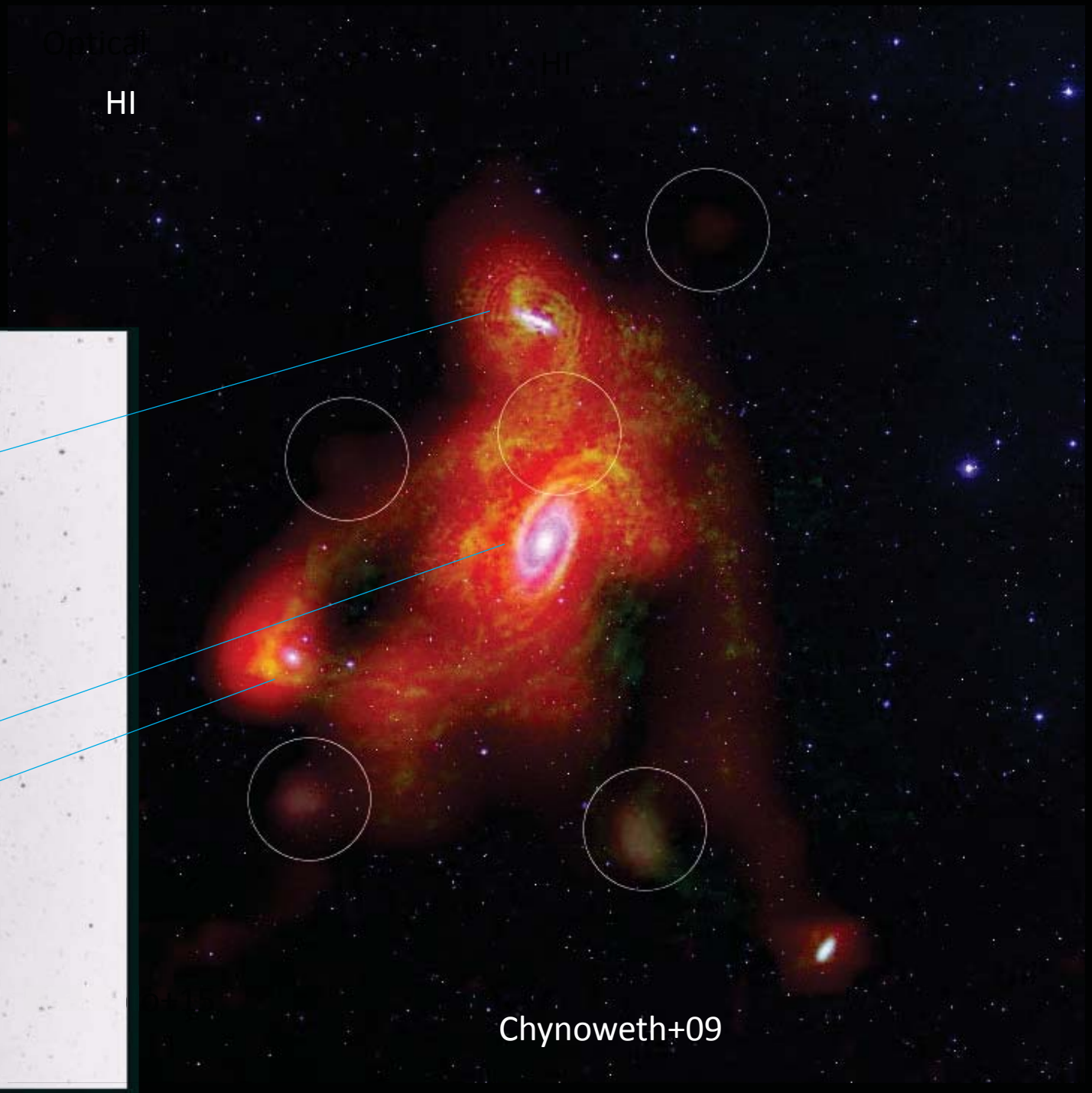
The life cycle of gas on stellar scales



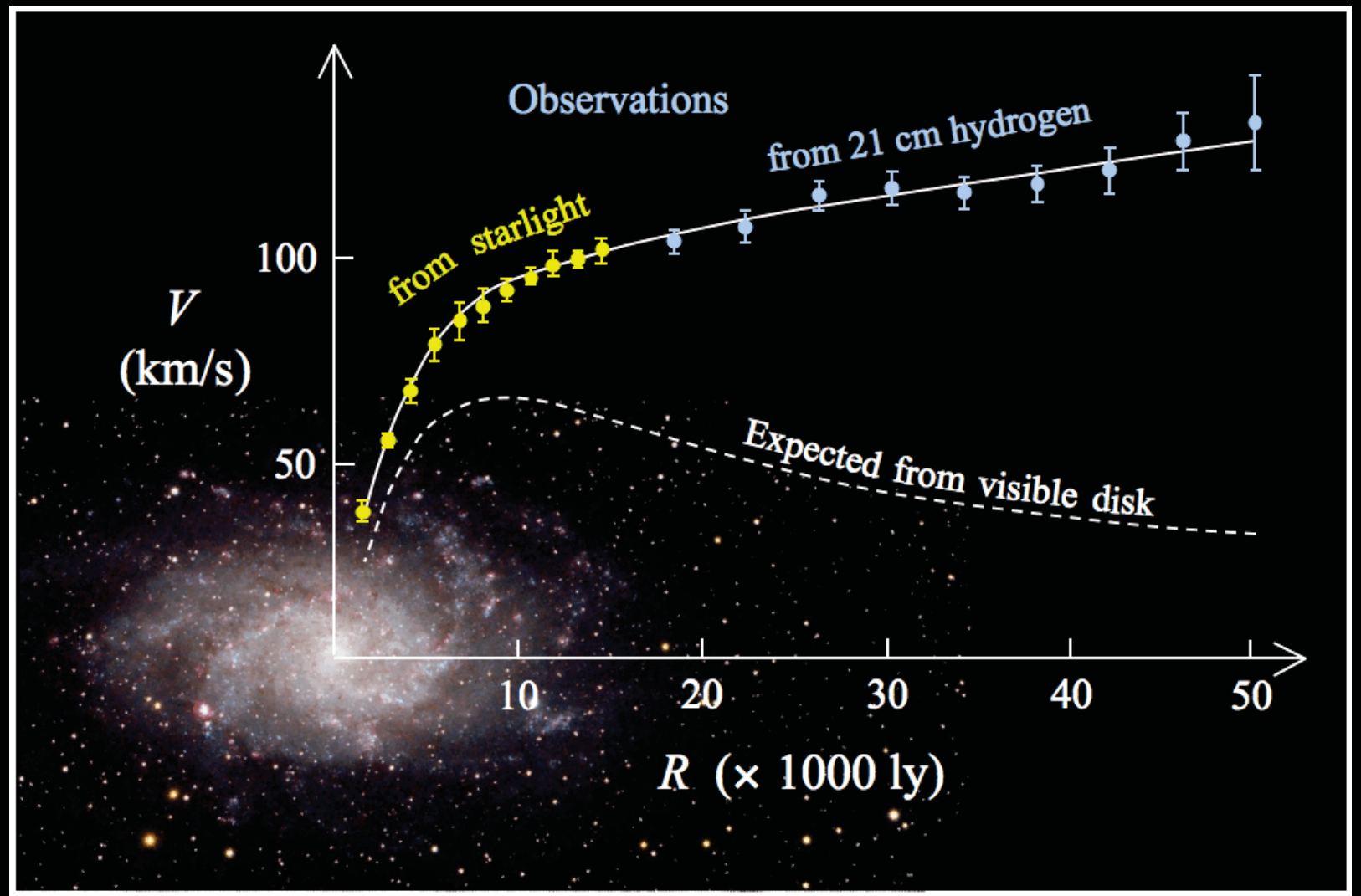
(Credit:
Steward Observatory Radio
Astronomy Laboratory)

Tidal stripping





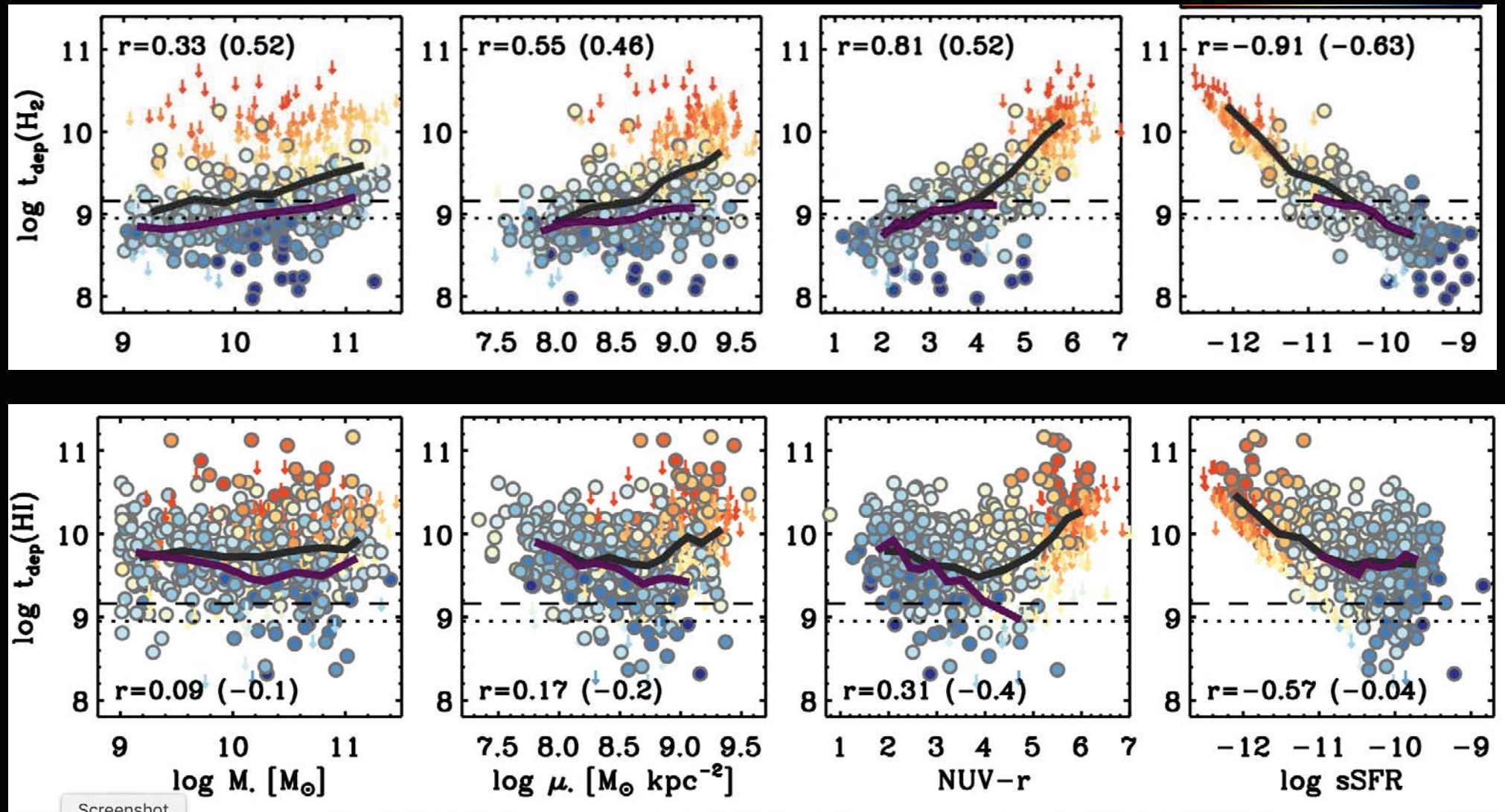
Probing the dark matter



The fueling of star formation

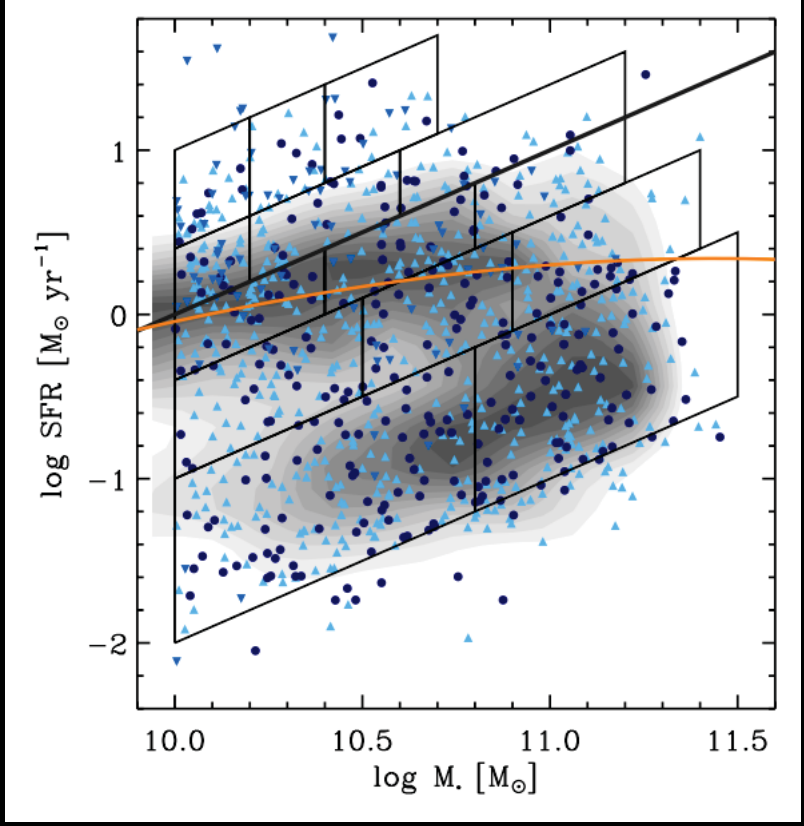
HI depletion time

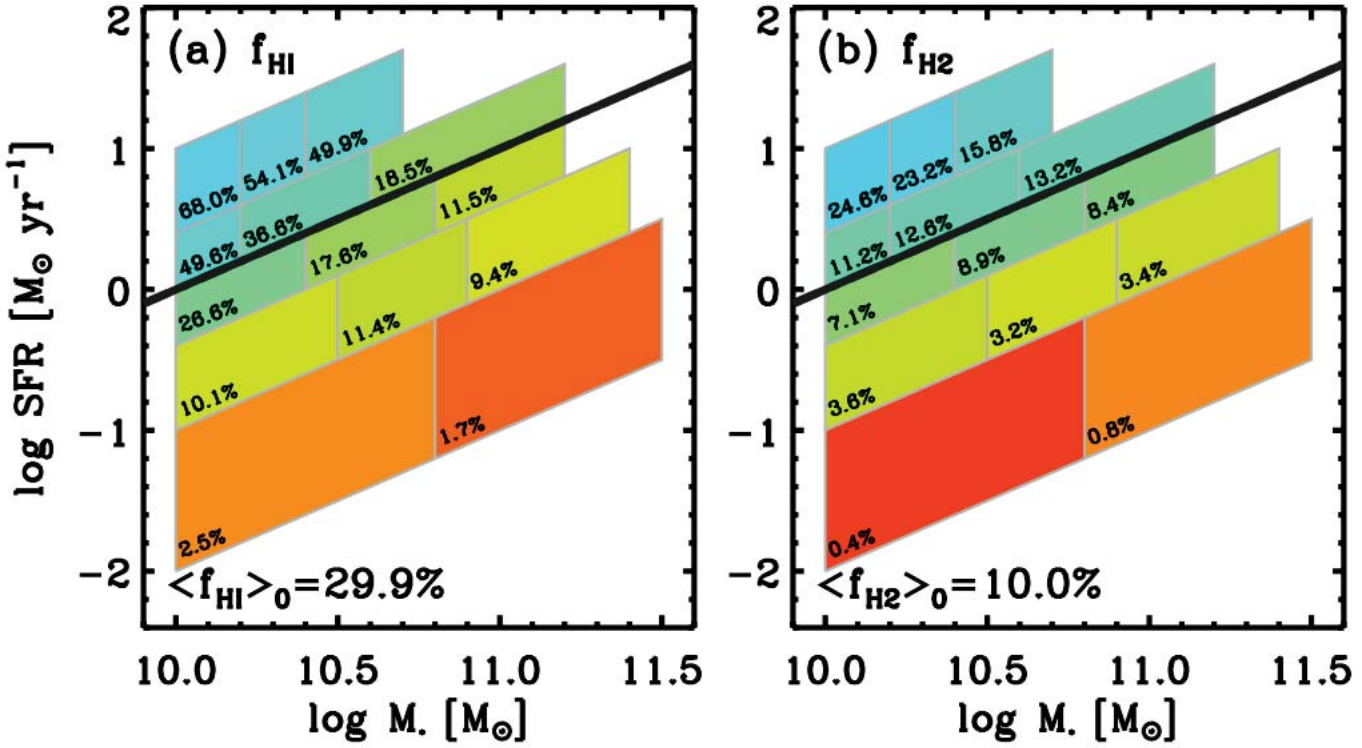
(Saintonge+18) $T_{dep} = M_{gas}/SFR$



HI and SFMS

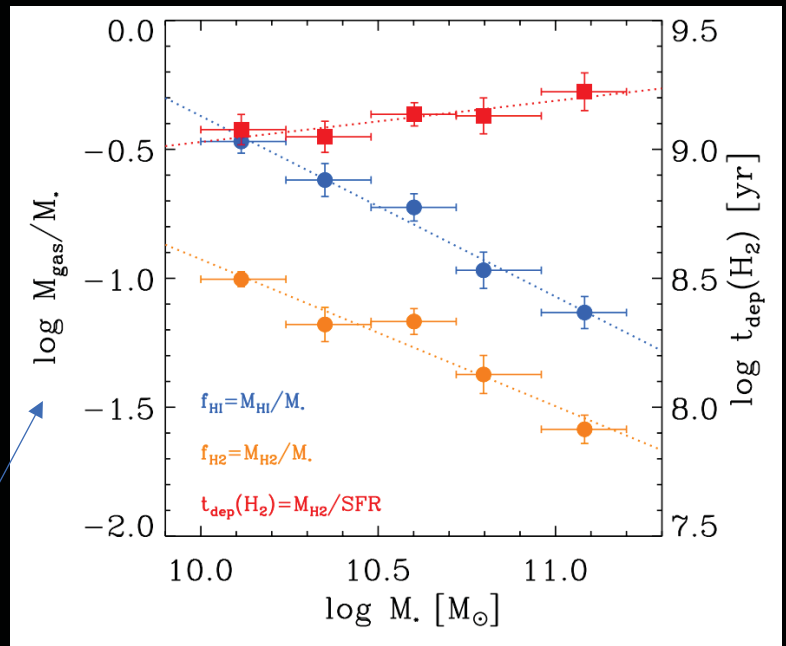
Saintonge+16



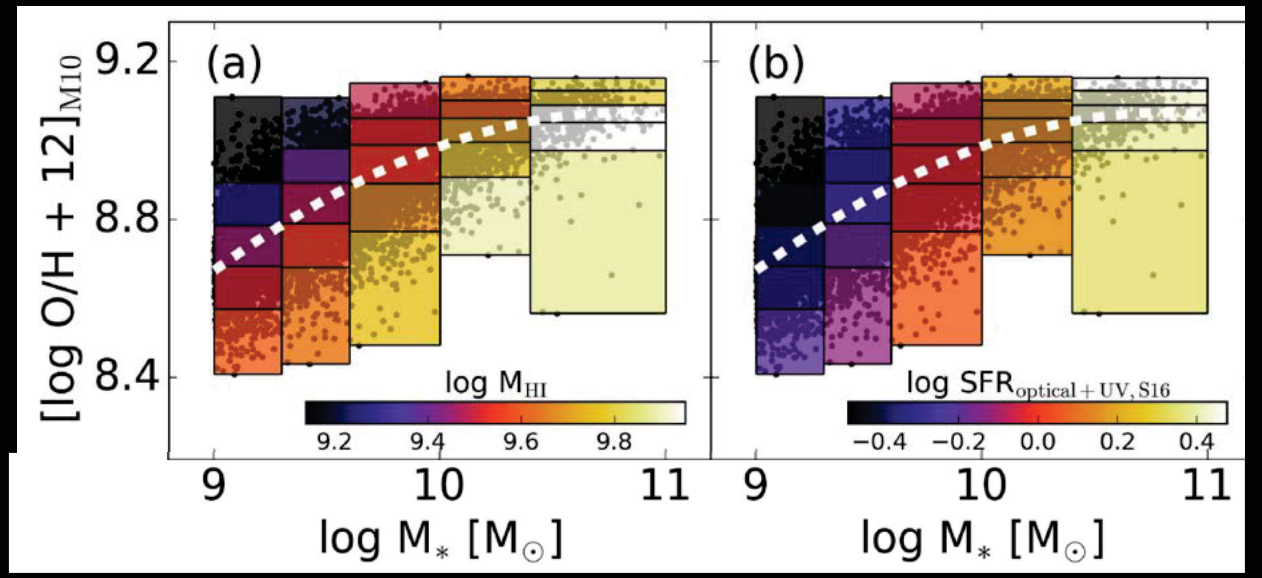


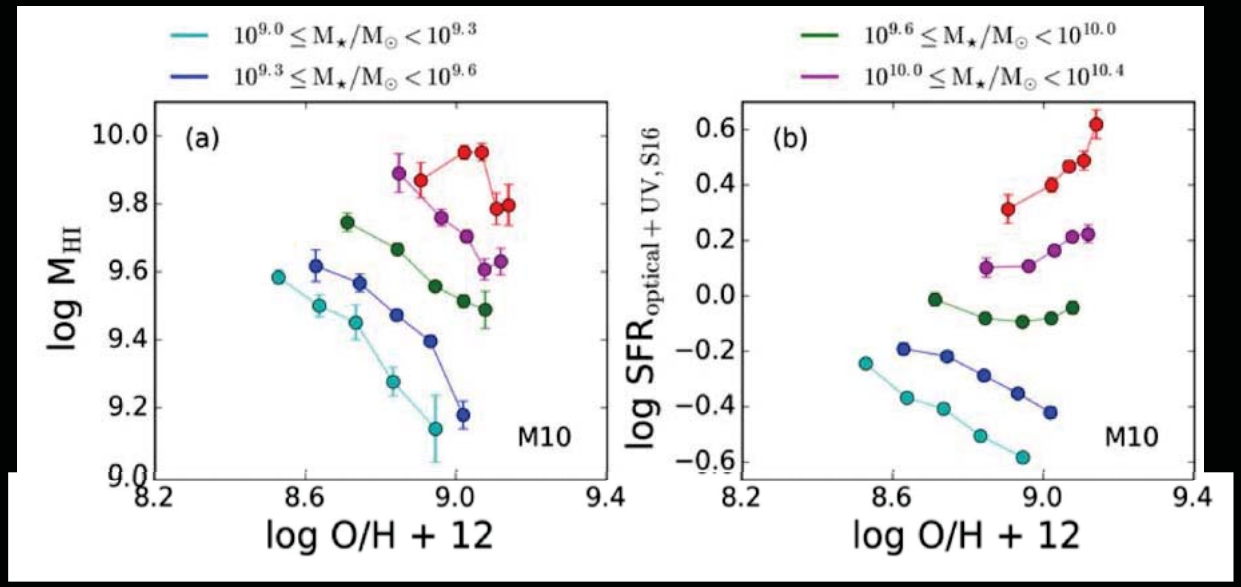
SFMS flattens due to a shrink of the gas reservoir rather than a bottle-neck in converting gas to stars

Along the SFMS



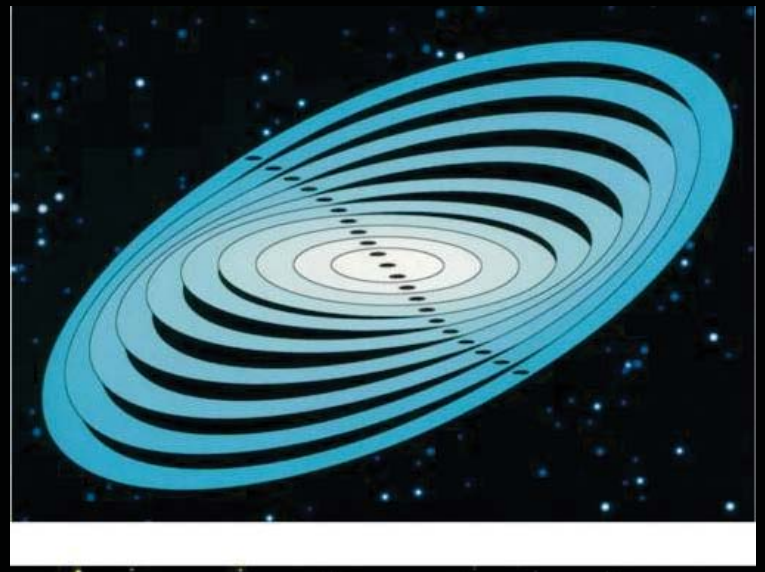
Scatter of the M*-Metalicity relation

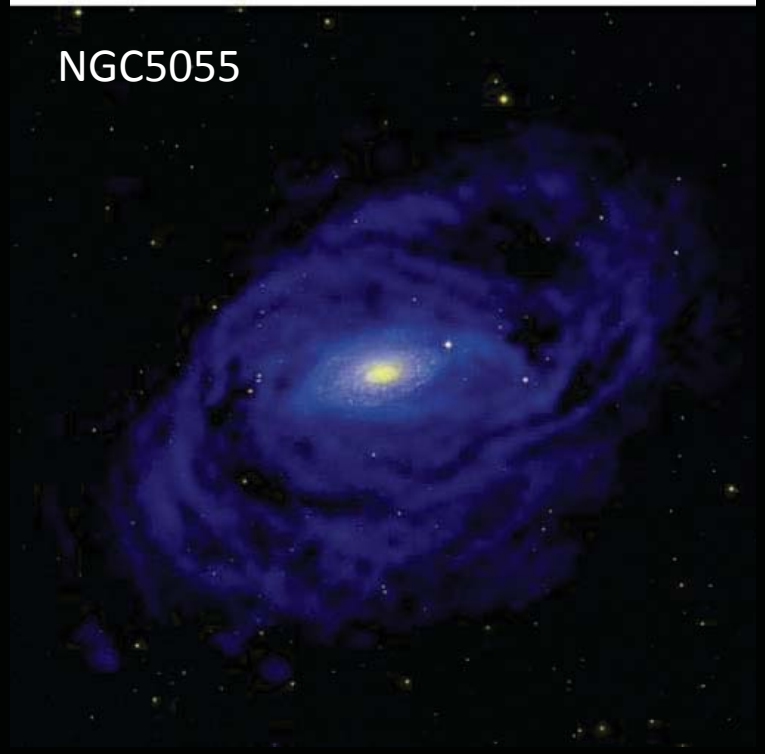




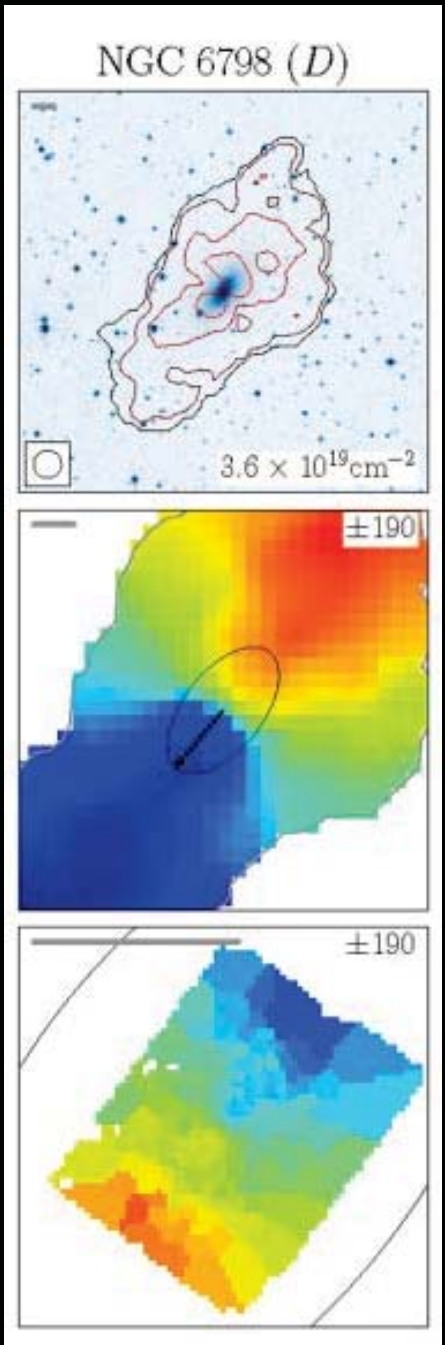
Brown+16

Kinematical features that indicates external origin



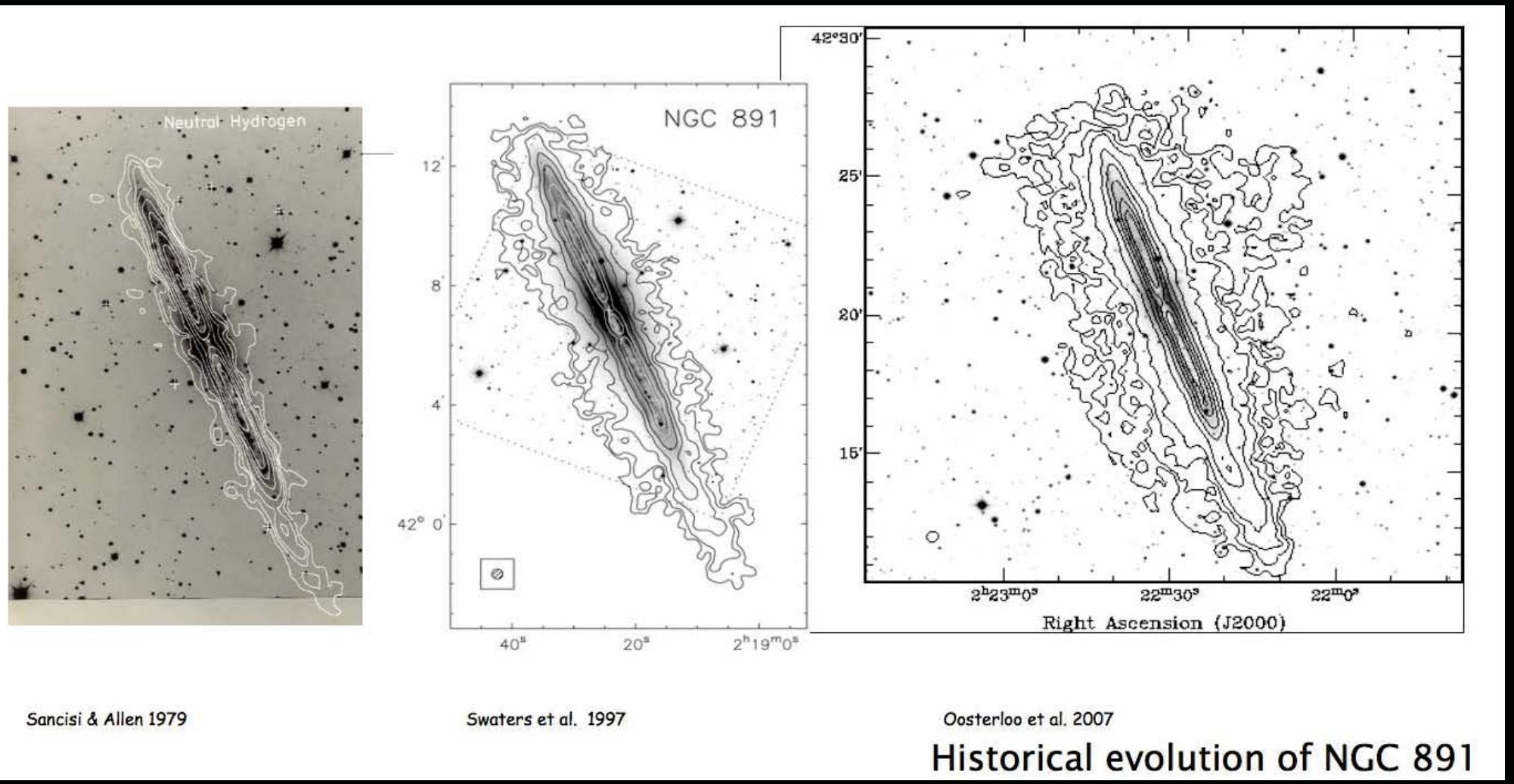


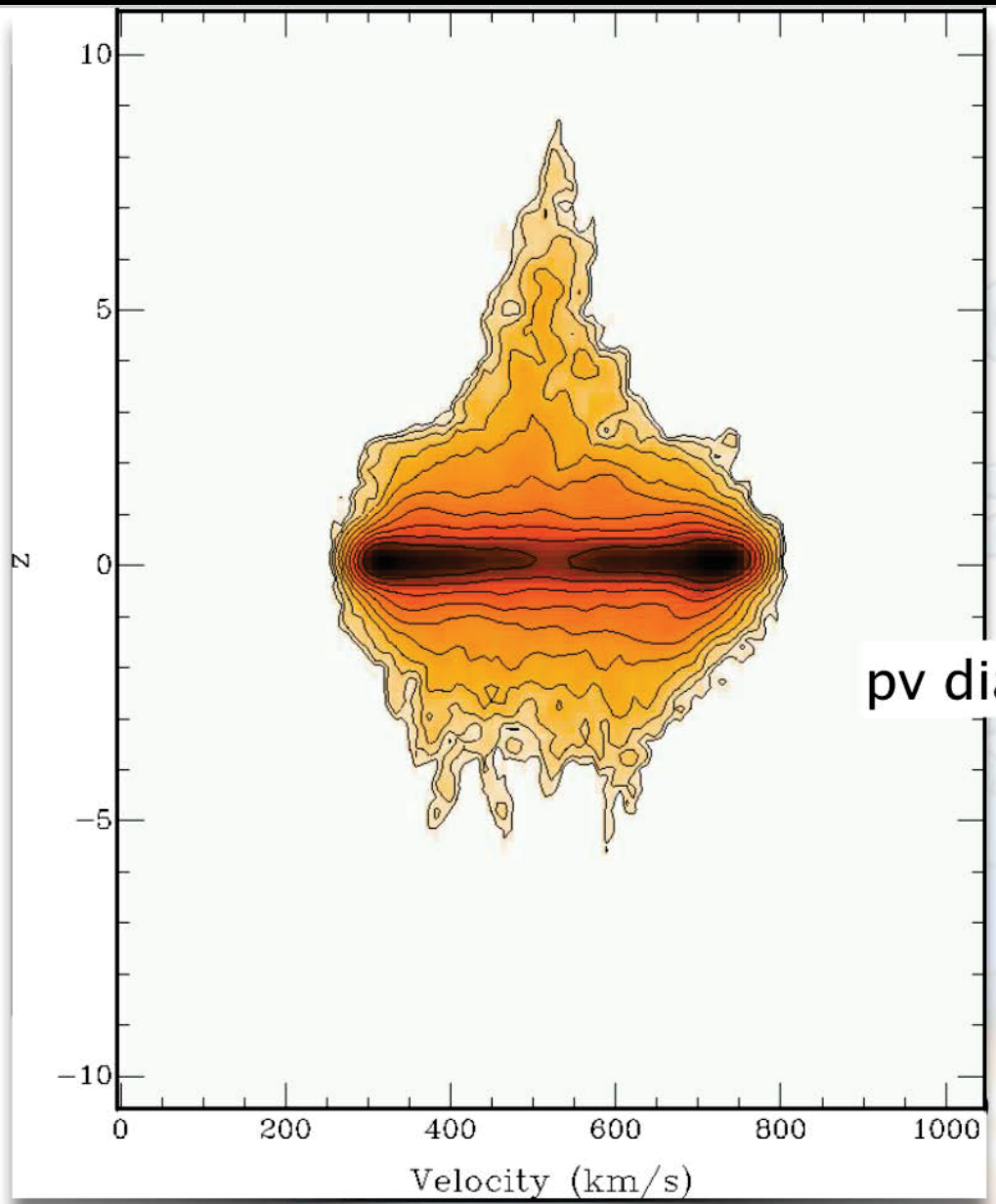
NGC5055



Thick HI discs

(Credit: Oosterloo)

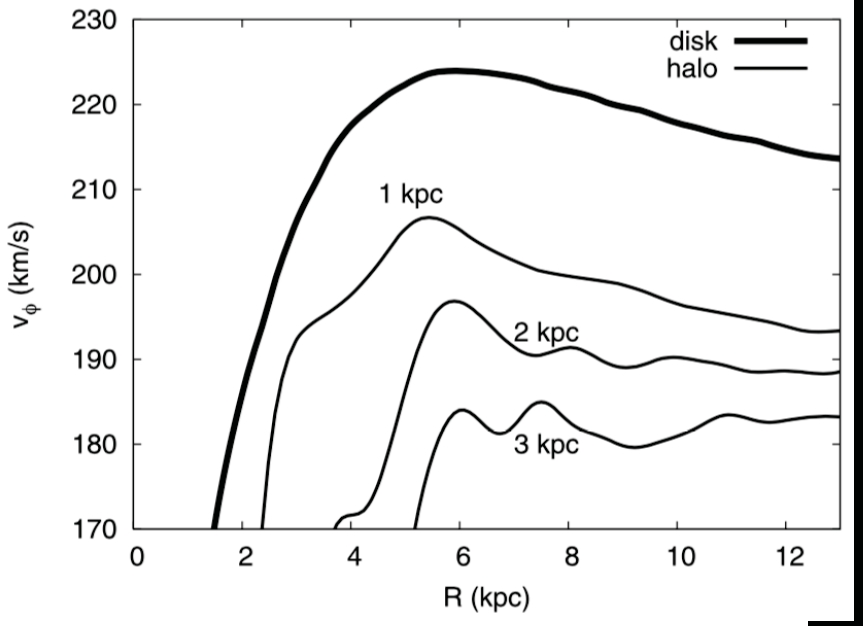




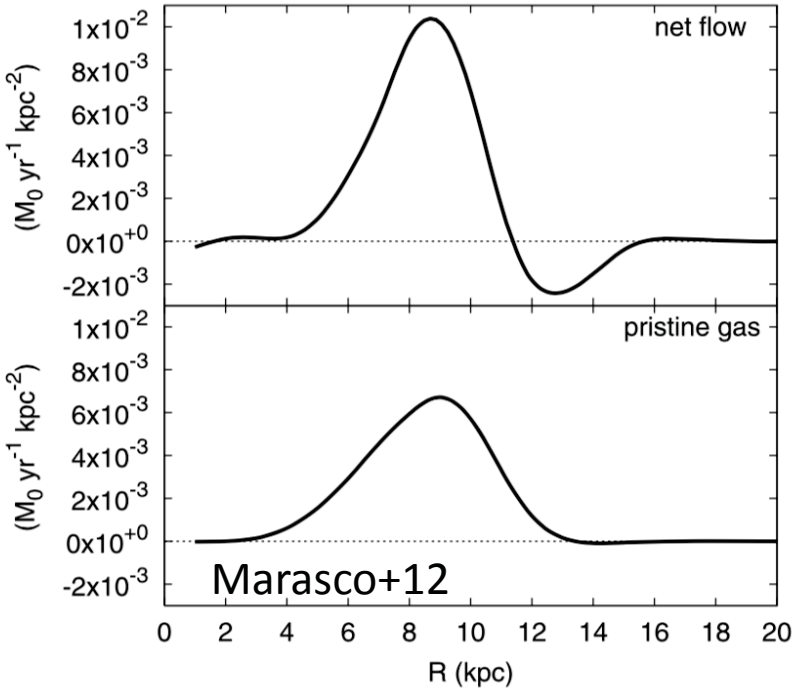
pv dia

Vertical gradient of rotation

Oosterloo+2007

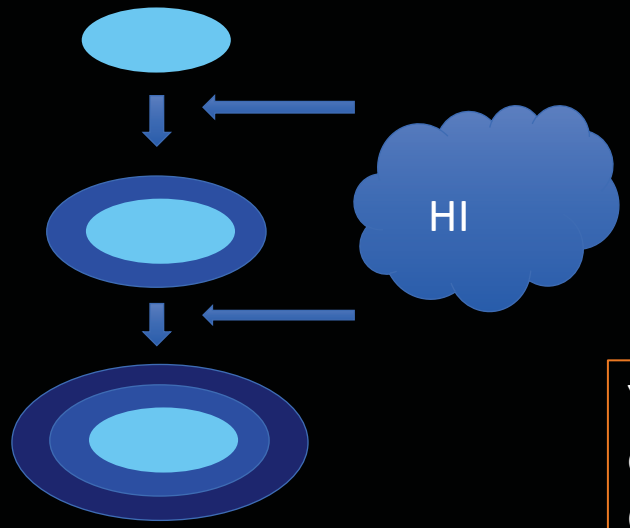


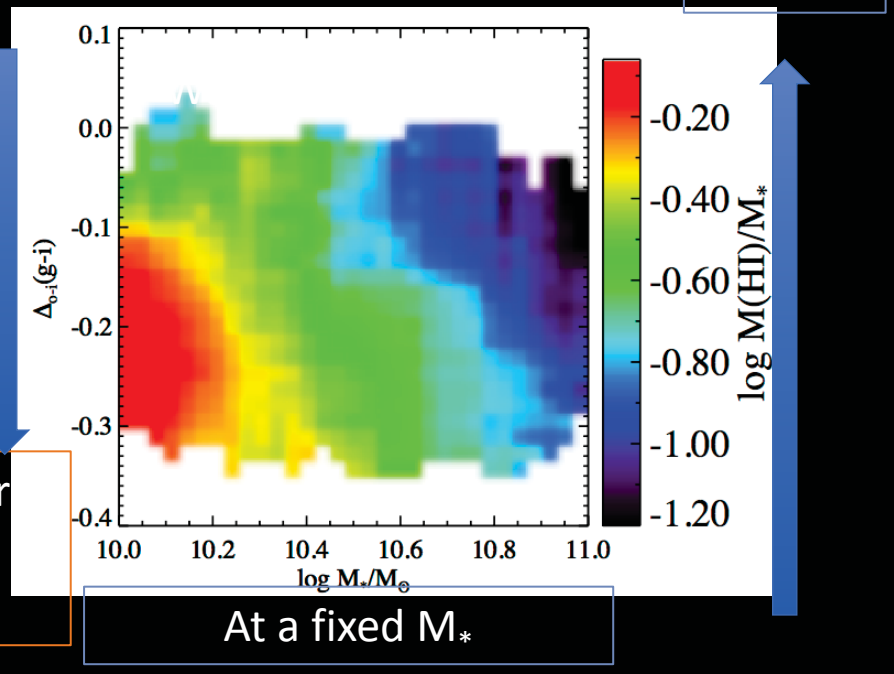
Gas flow in our model



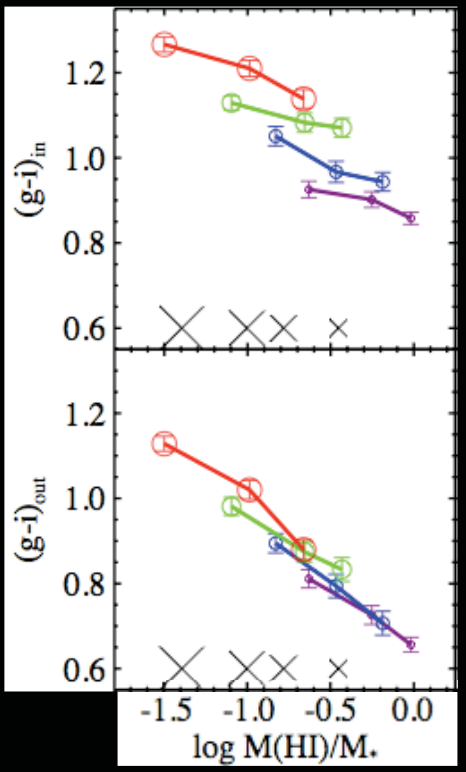
HI and the inside-out disc formation

ΛCDM galactic disc formation:



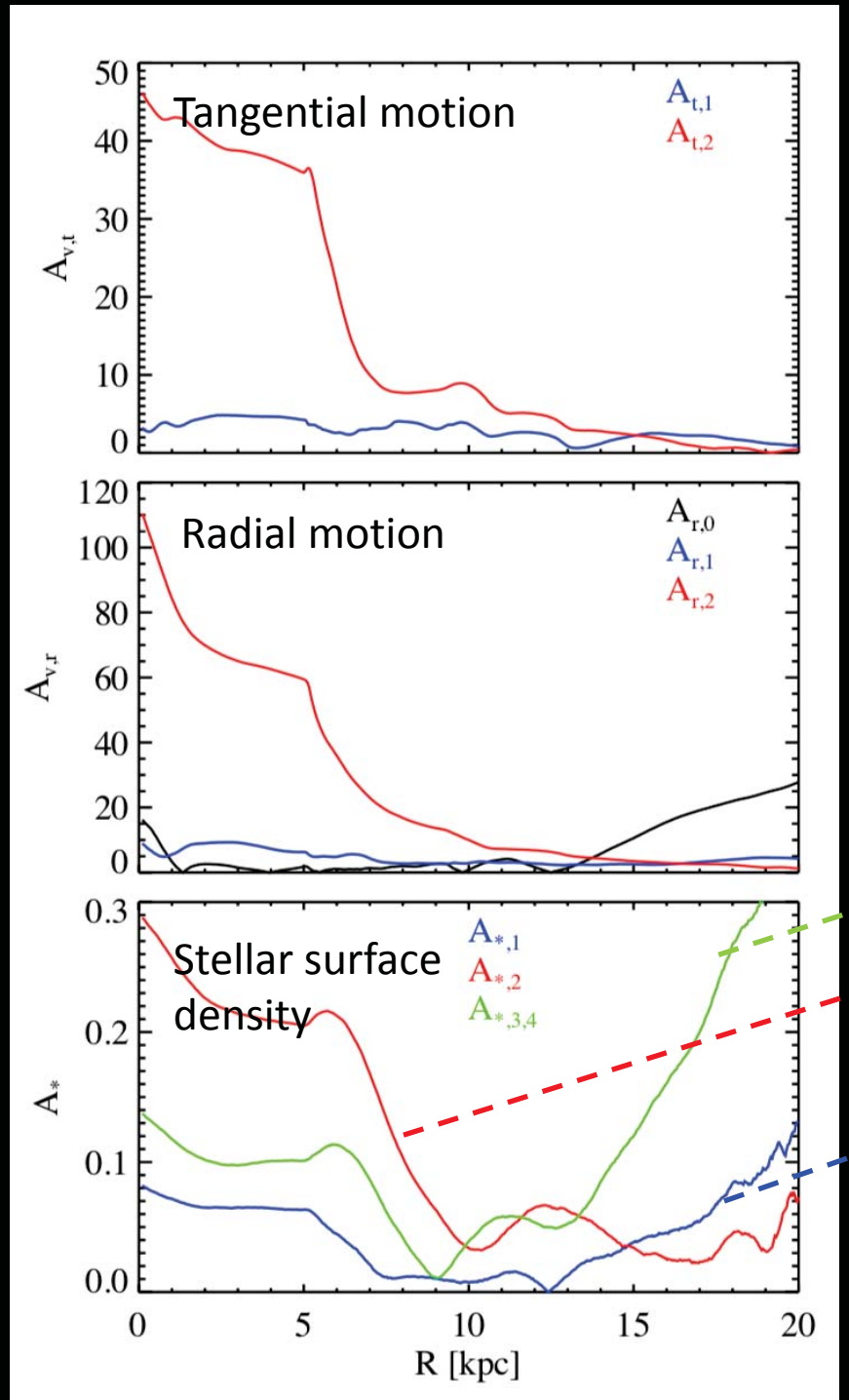


circle size –> mass bins



(Wang+11)

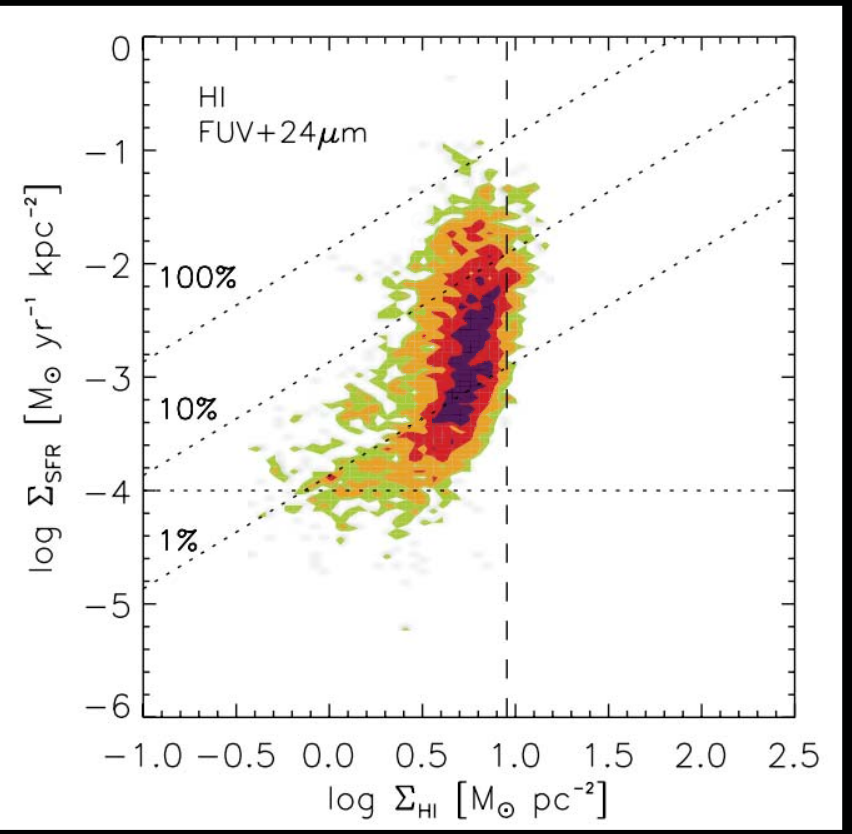
Non-circular non-thermal motion



Wang+

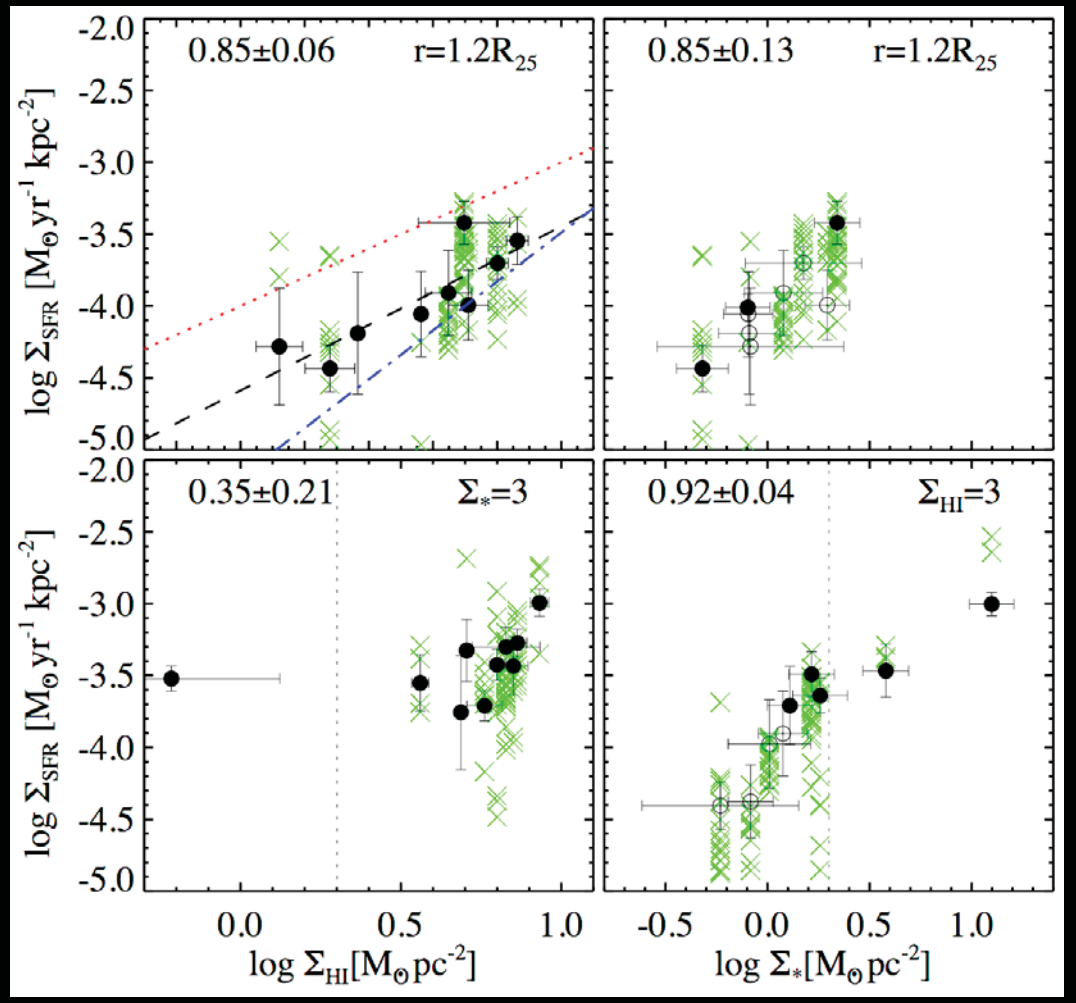
The resolved HI-SFR relation

(Bigiel+08)
H_2 dominated region



No intrinsic relation between Σ_{SFR} and Σ_{HI}

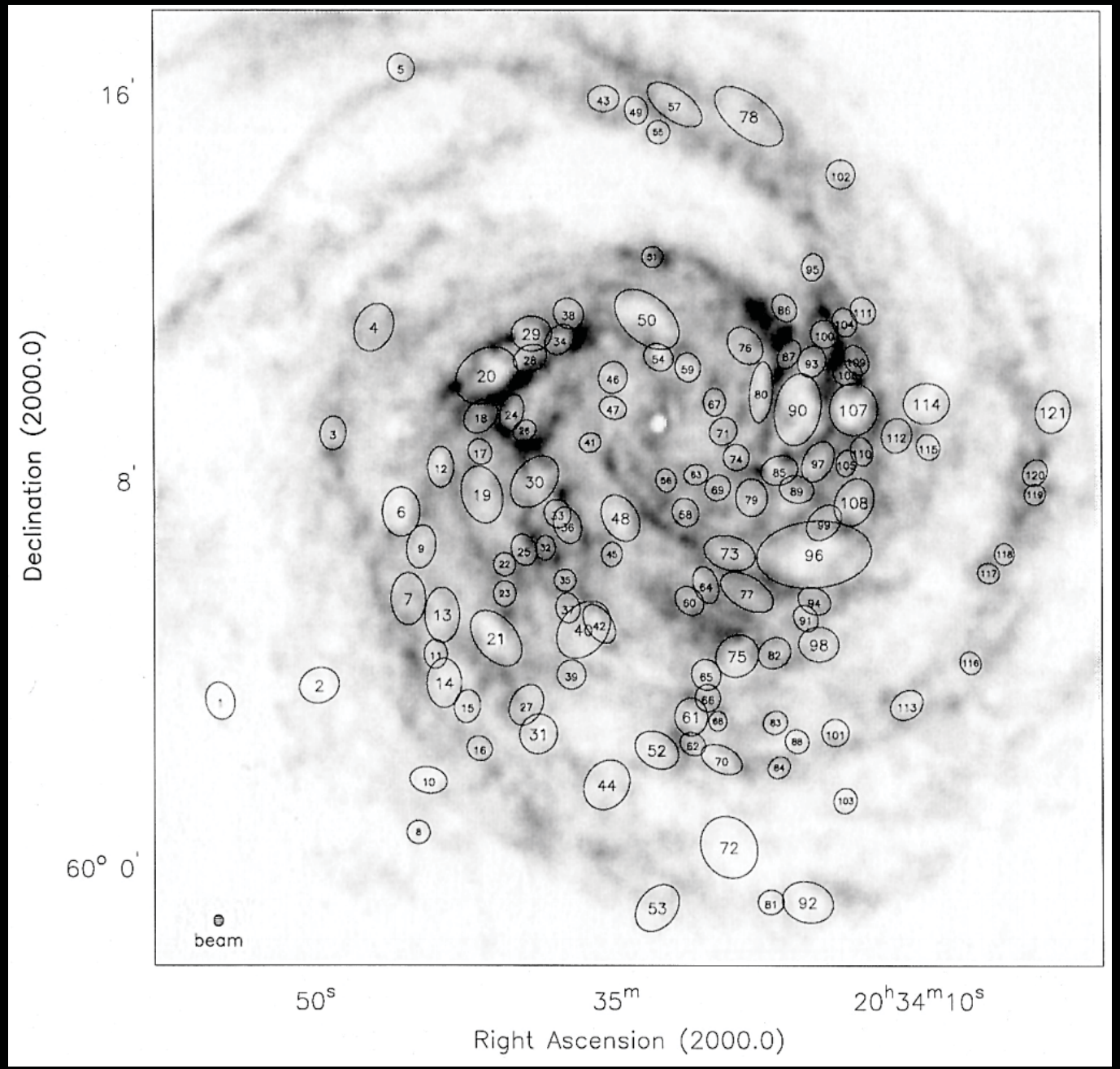
(Wang+16) HI dominated region

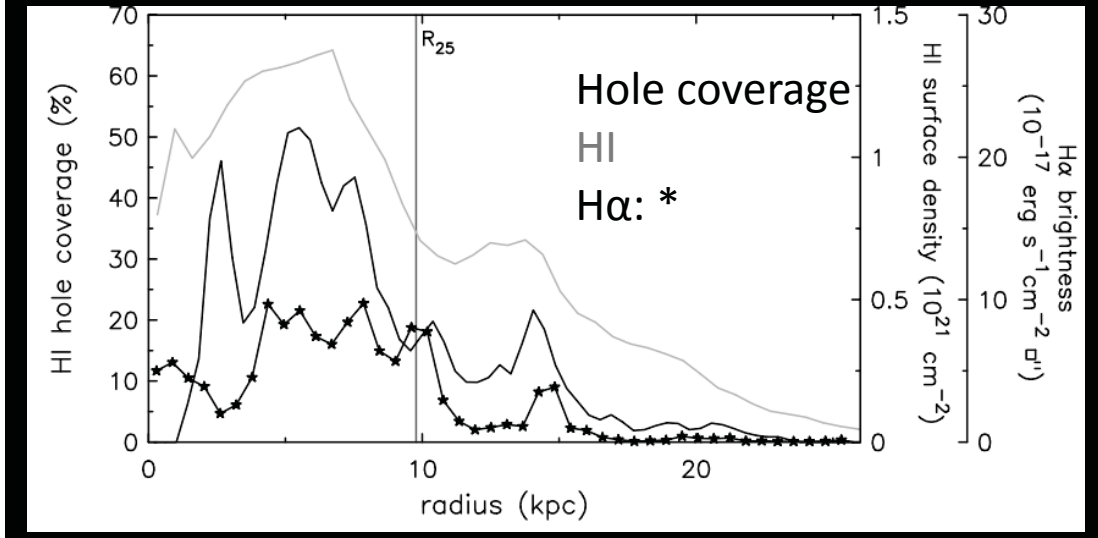


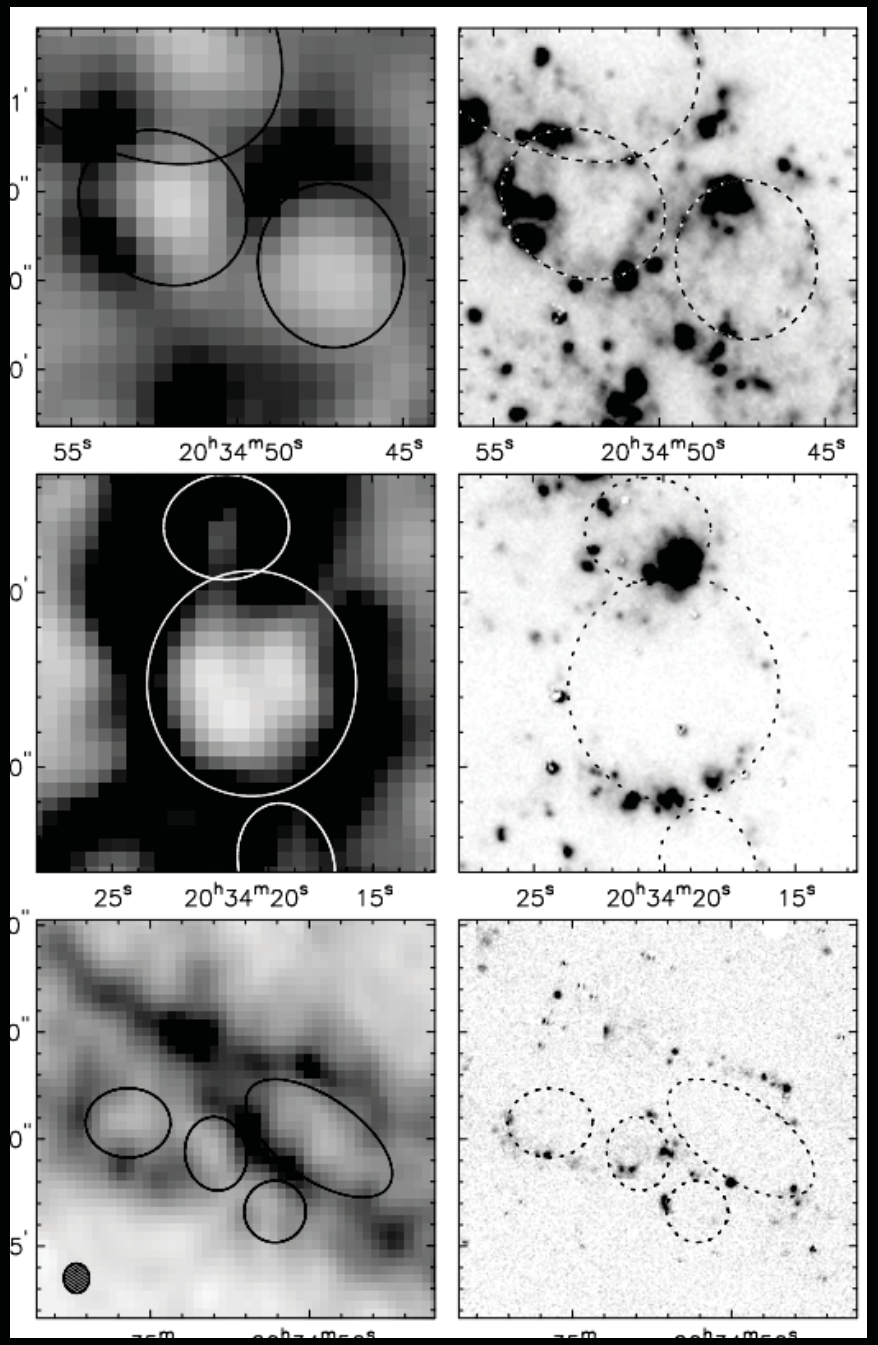
HI surface density

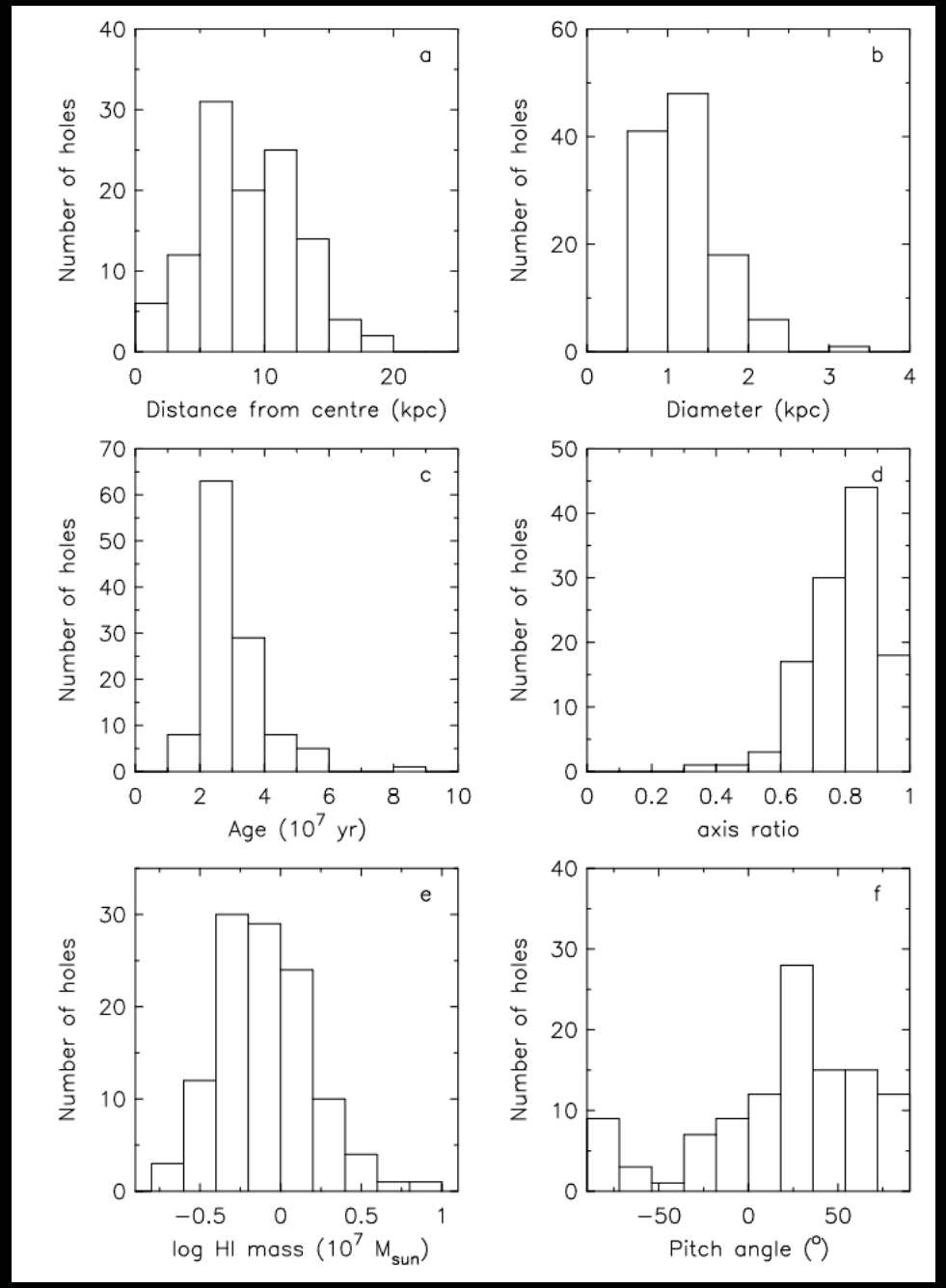
Stellar mass surface density

NGC6946 (Boomsma+08)



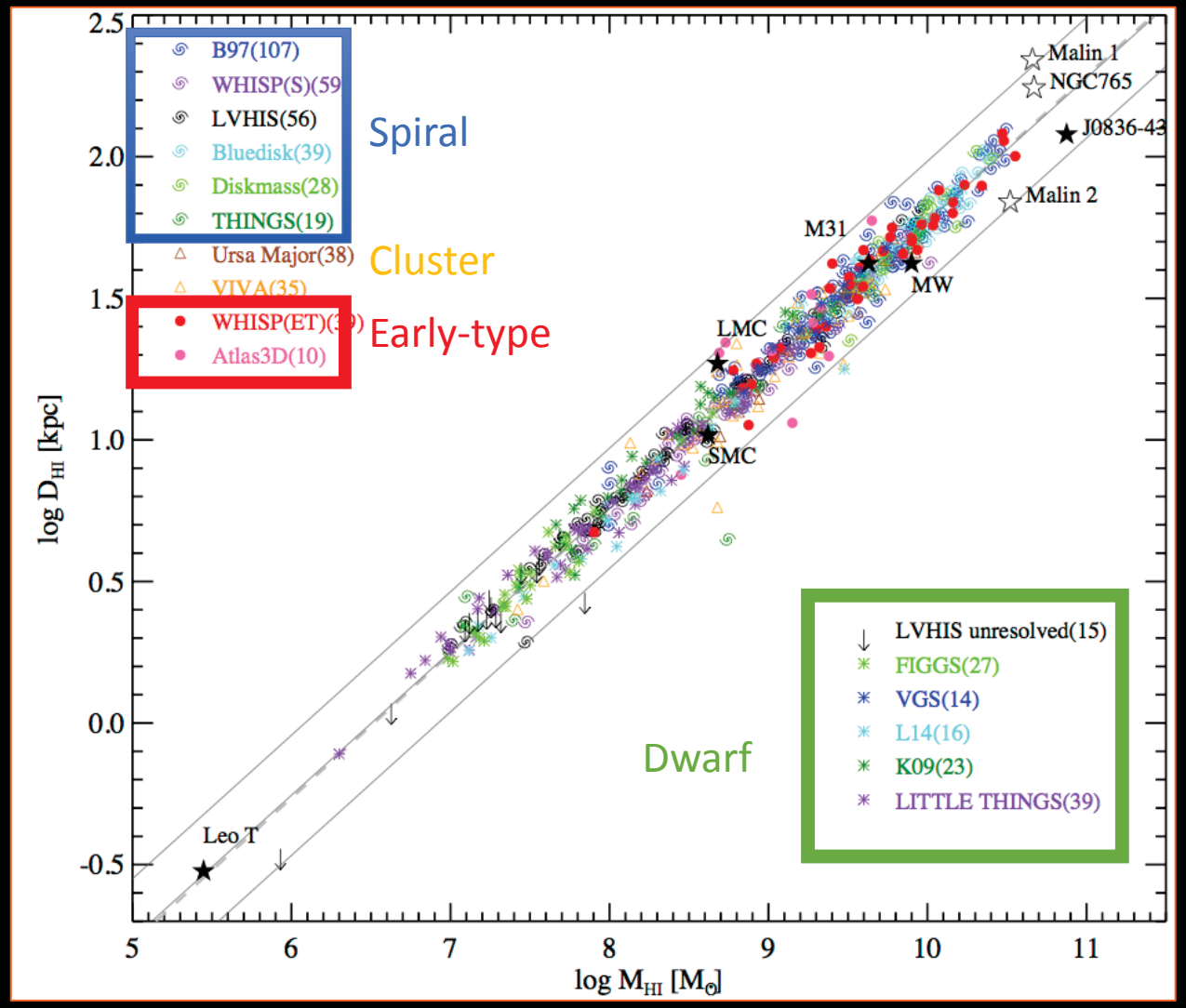






Simulations predict that an OB association giving an energy input of 10^{53} erg, creates a superbubble with a diameter of about 1.3 kpc and a shell mass of 0.6×10^7 Msun in 30 Myr.

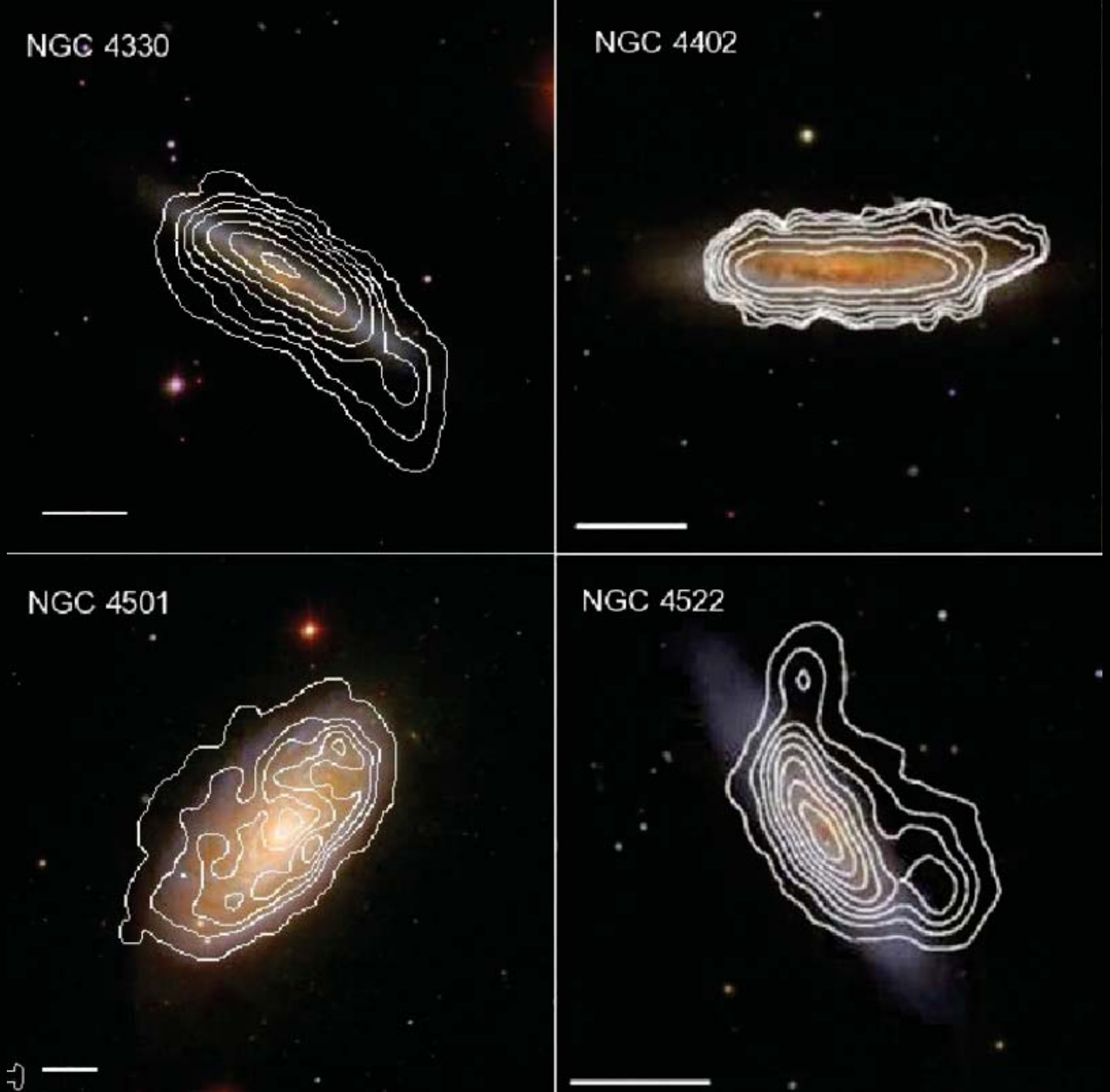
The HI size-mass relation



Wang+16

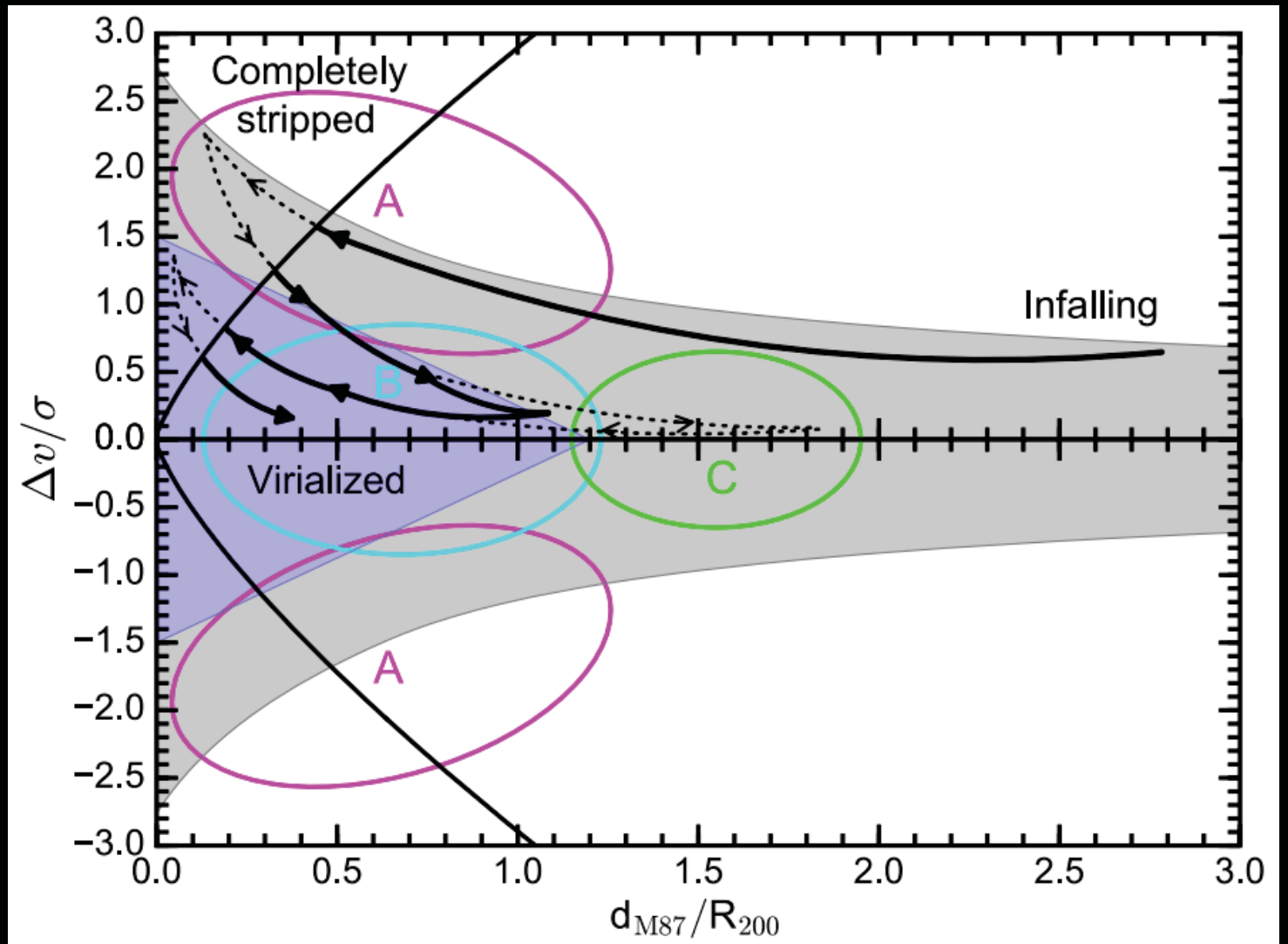
Environmental effects

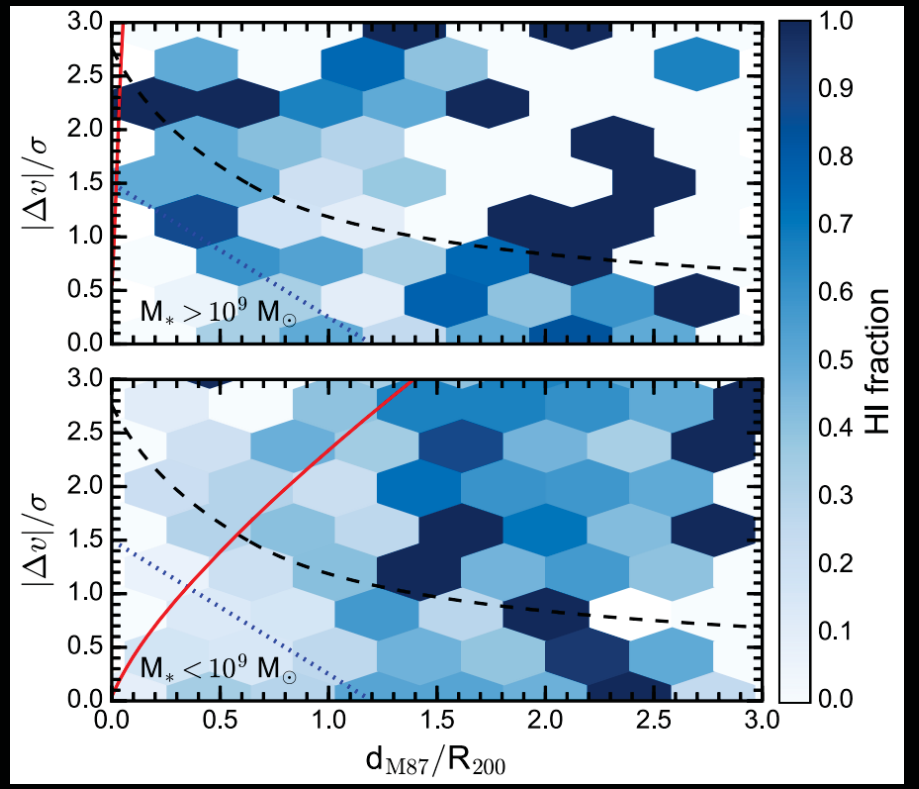
Ram-pressure stripping



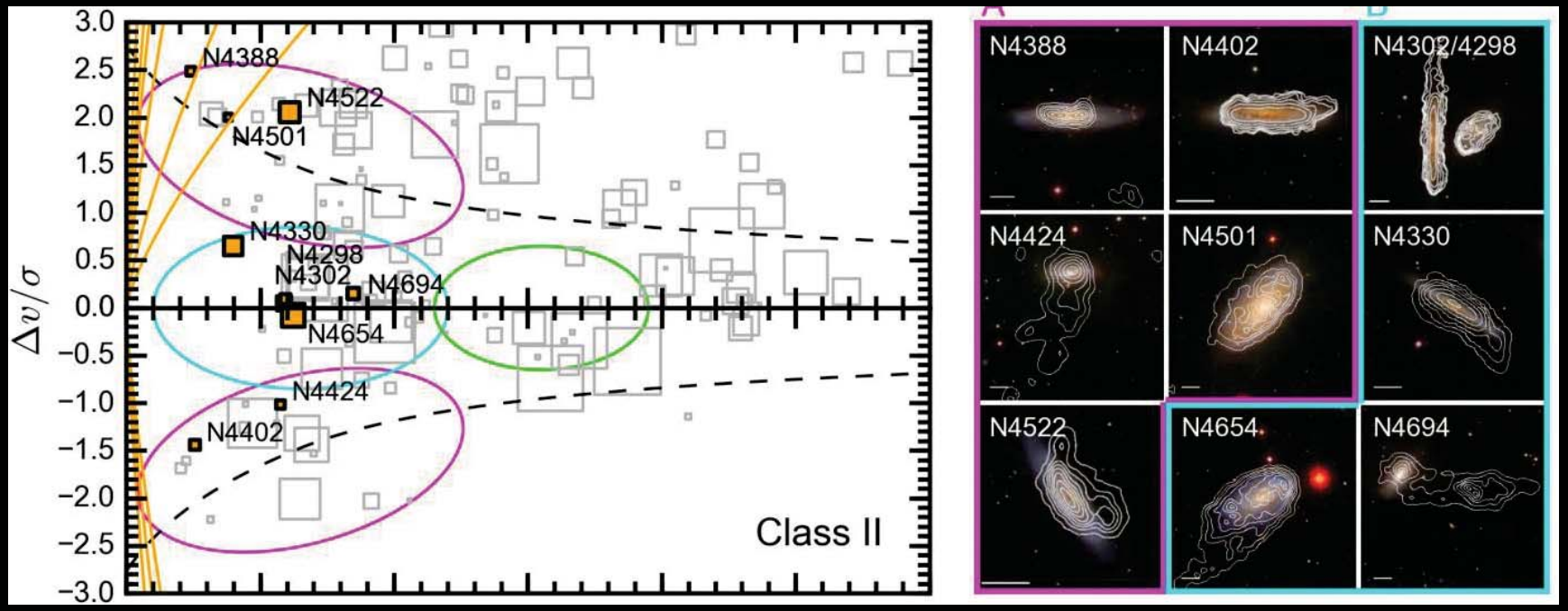
Chung+09

Phase-space diagram of clusters

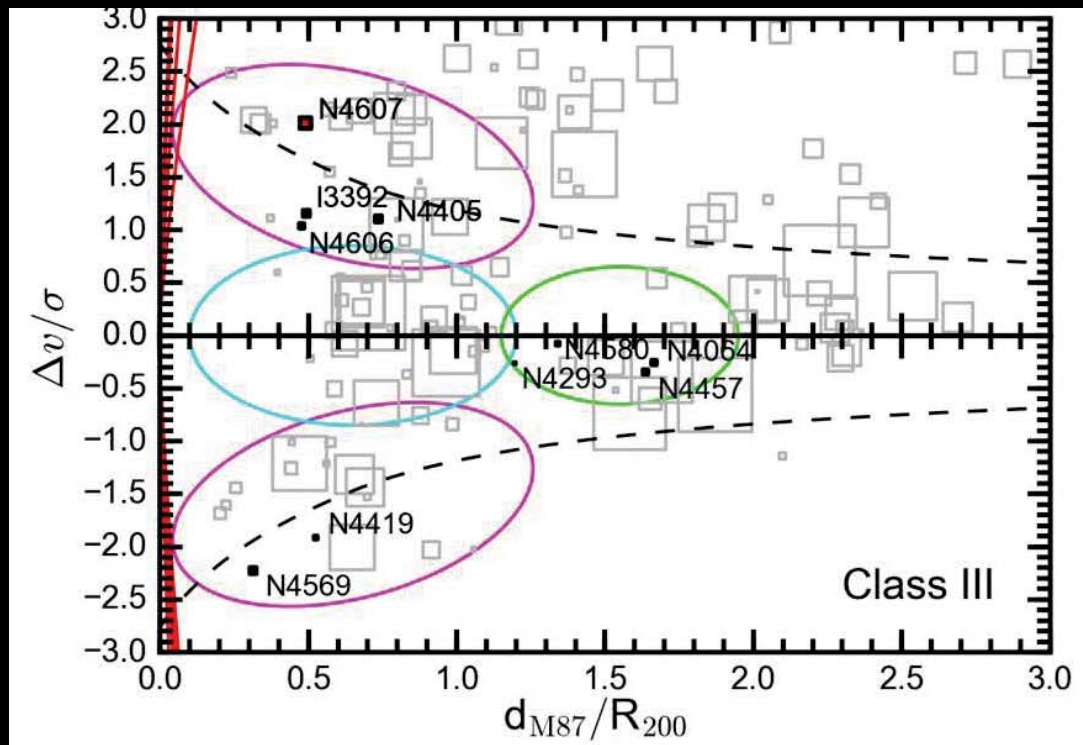


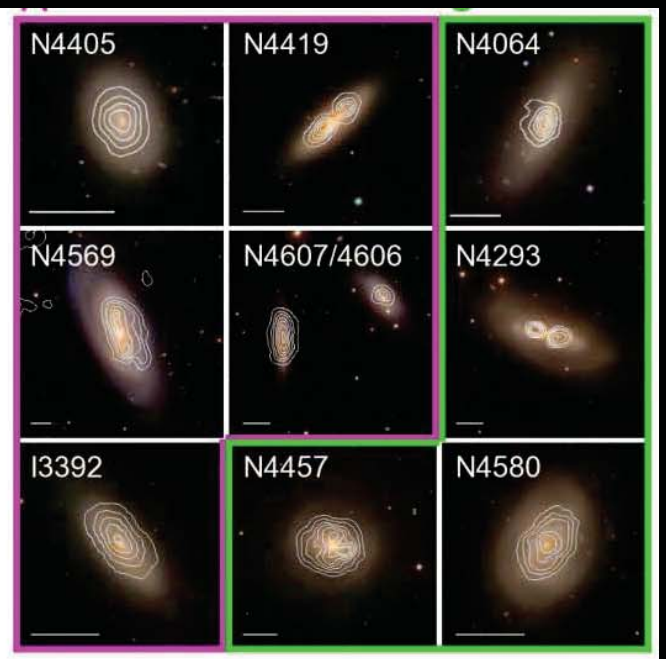


Virgo Cluster galaxies
(Yoon+17)



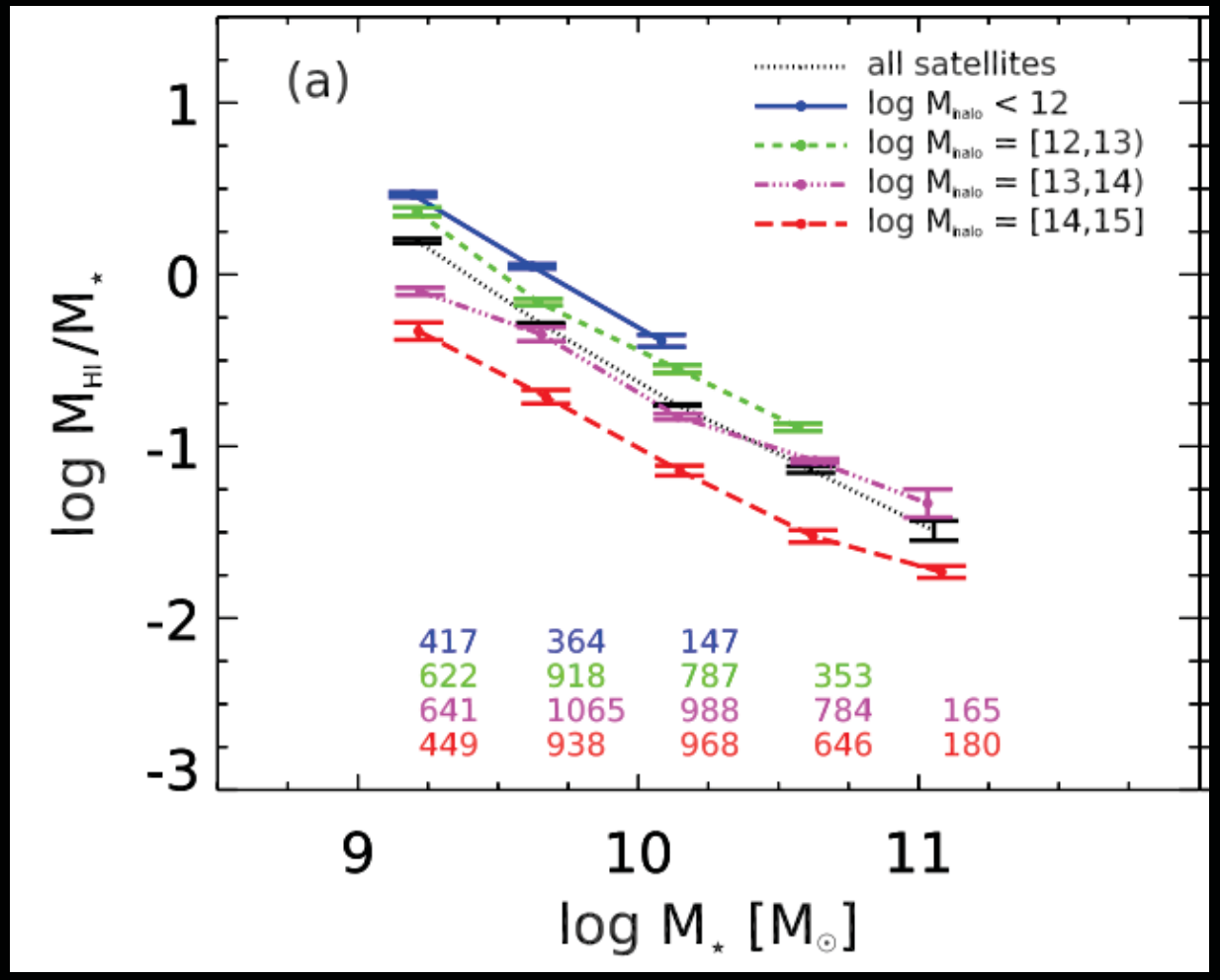
Virgo Cluster galaxies
(Yoon+17)

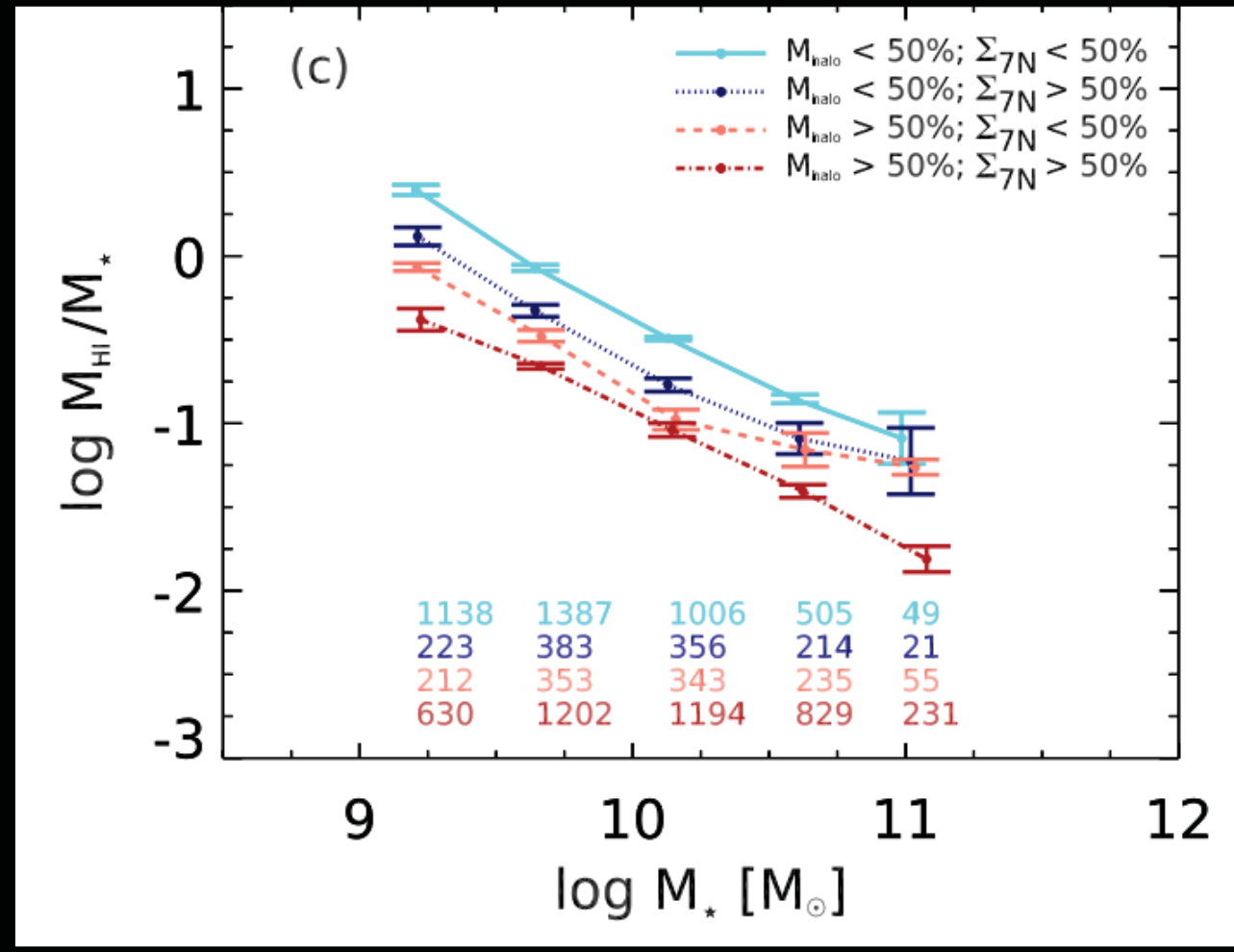




Satellites in groups (local density vs halo mass)

(Brown+16)

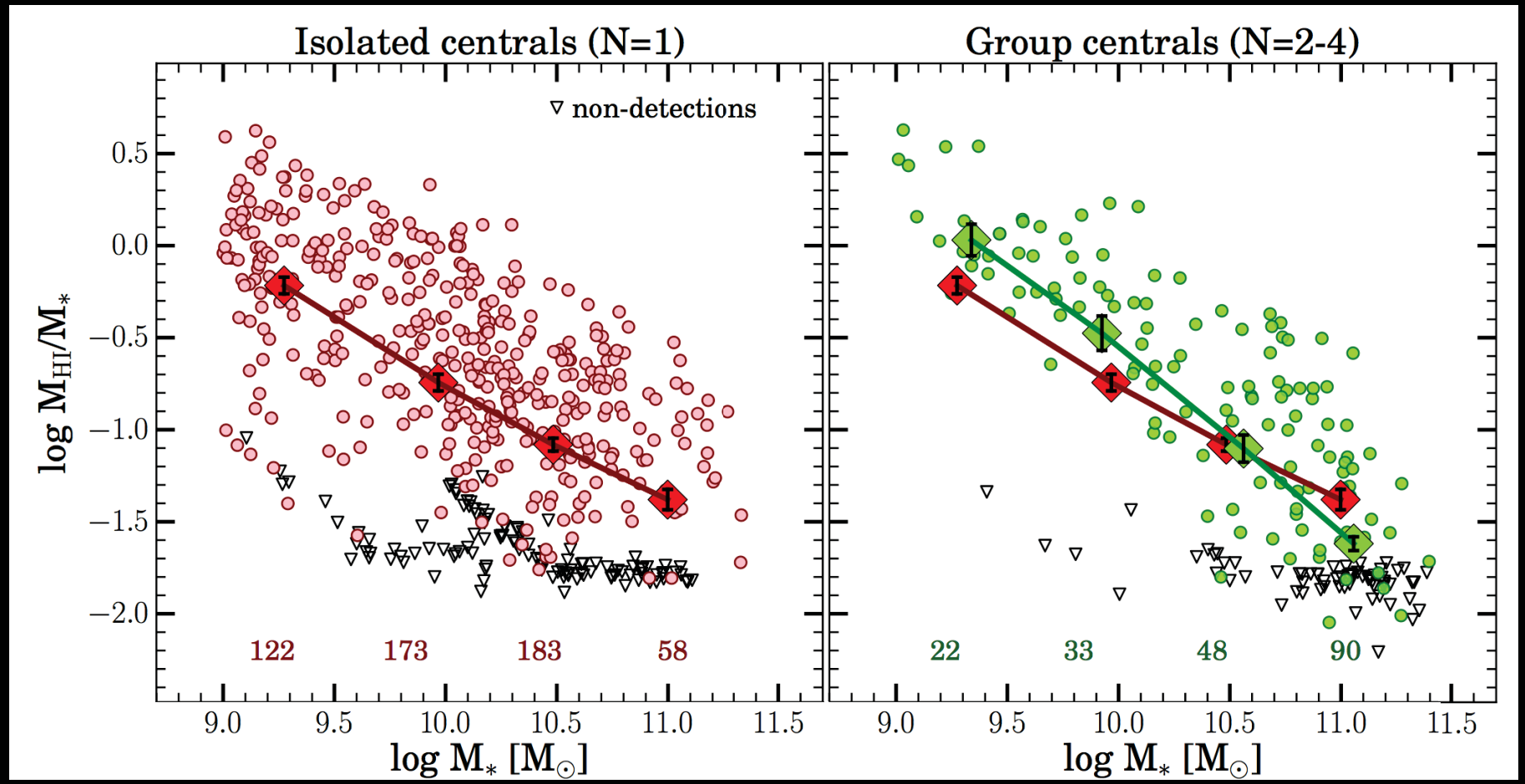




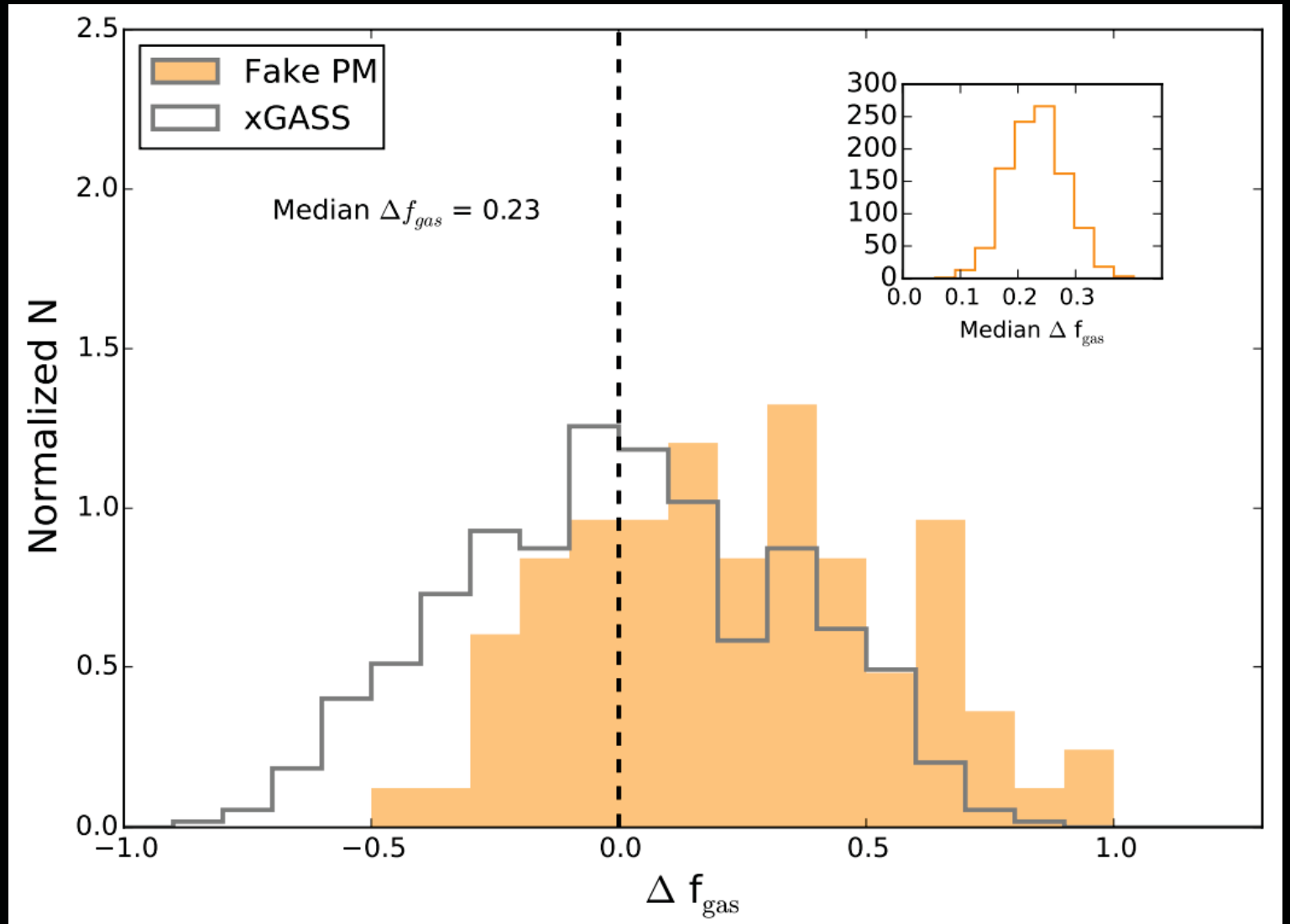
Centrals in groups

(Janowiecki+16)

Striping vs accretion



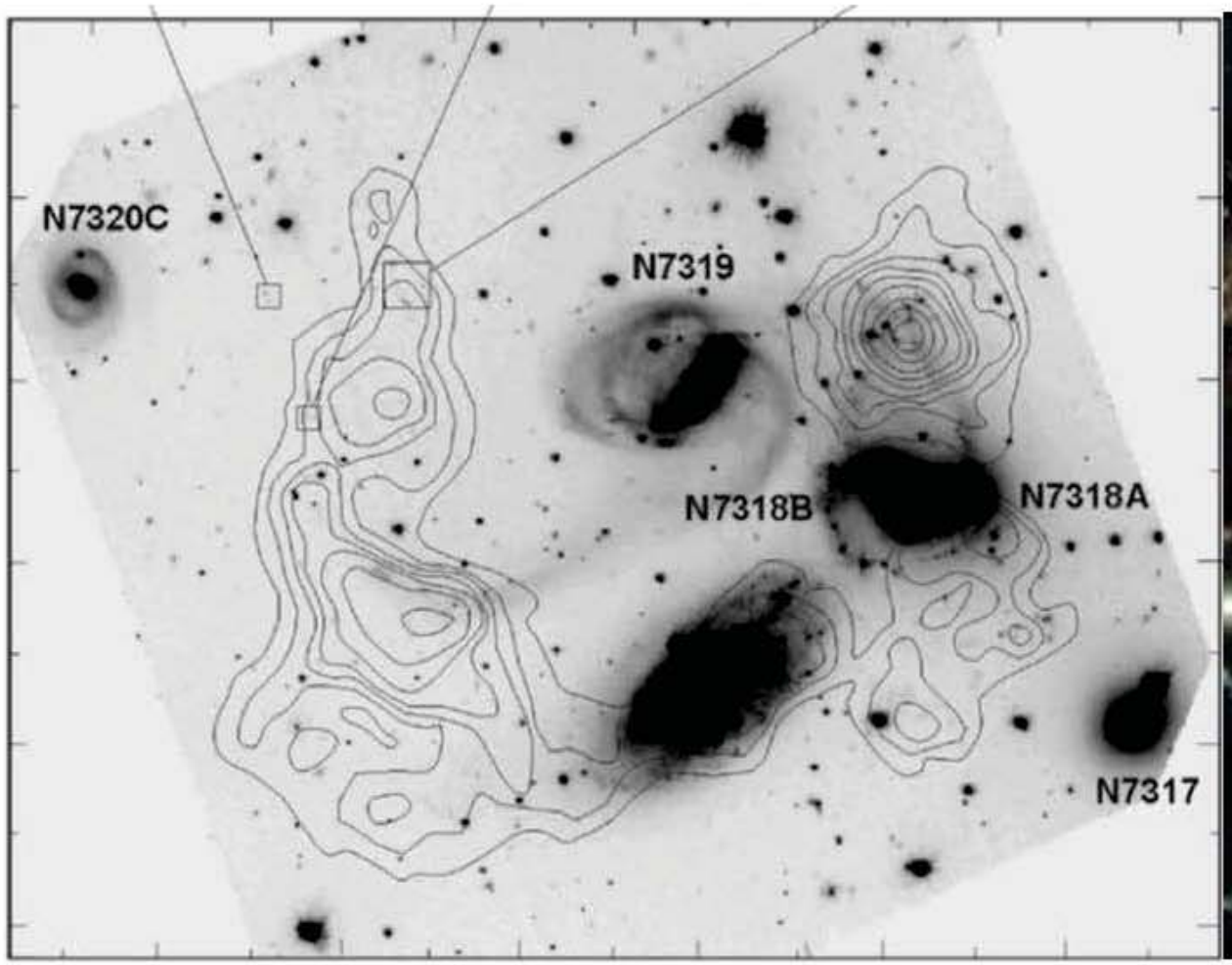
Enhanced HI mass fraction in post-mergers

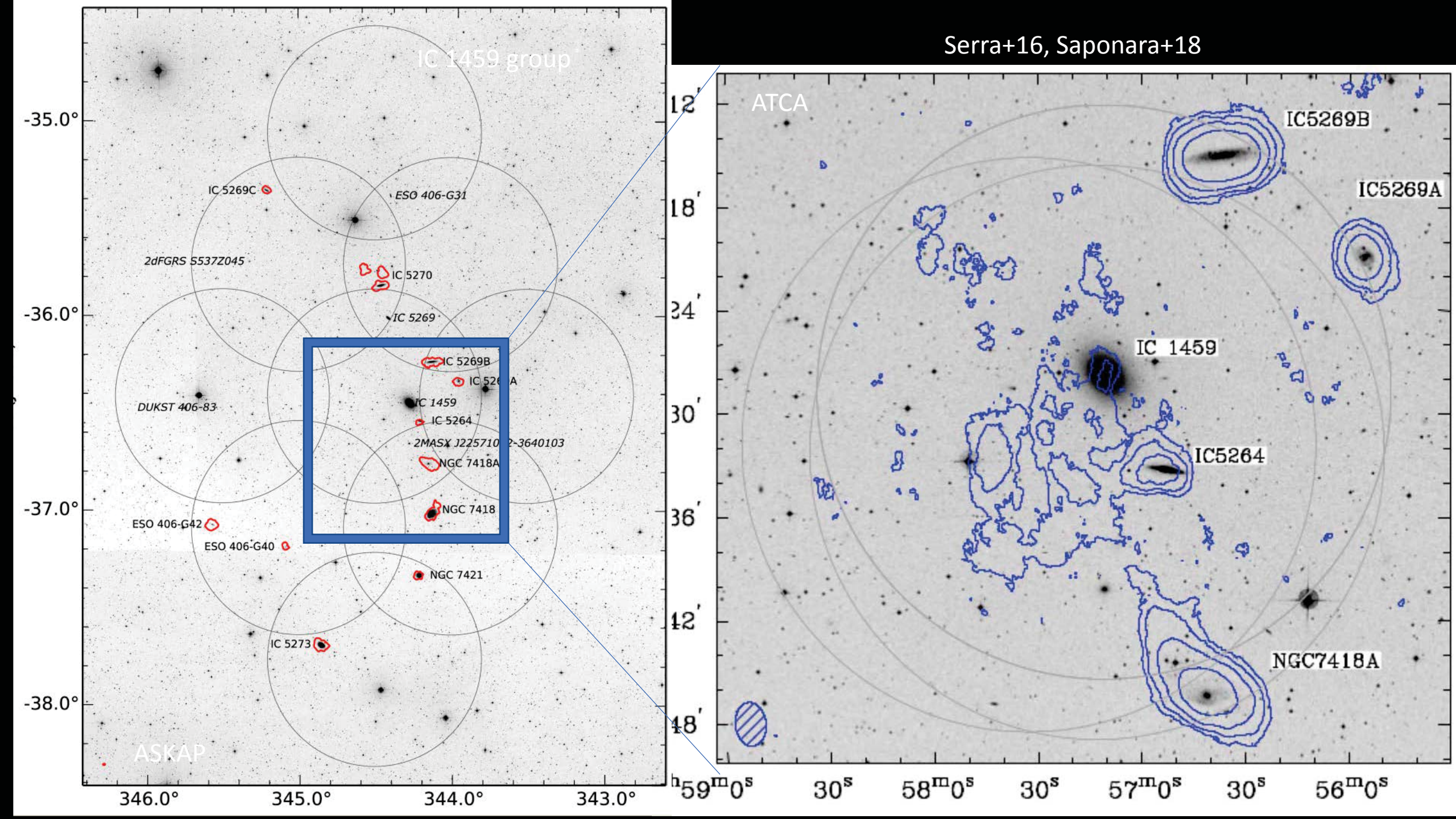


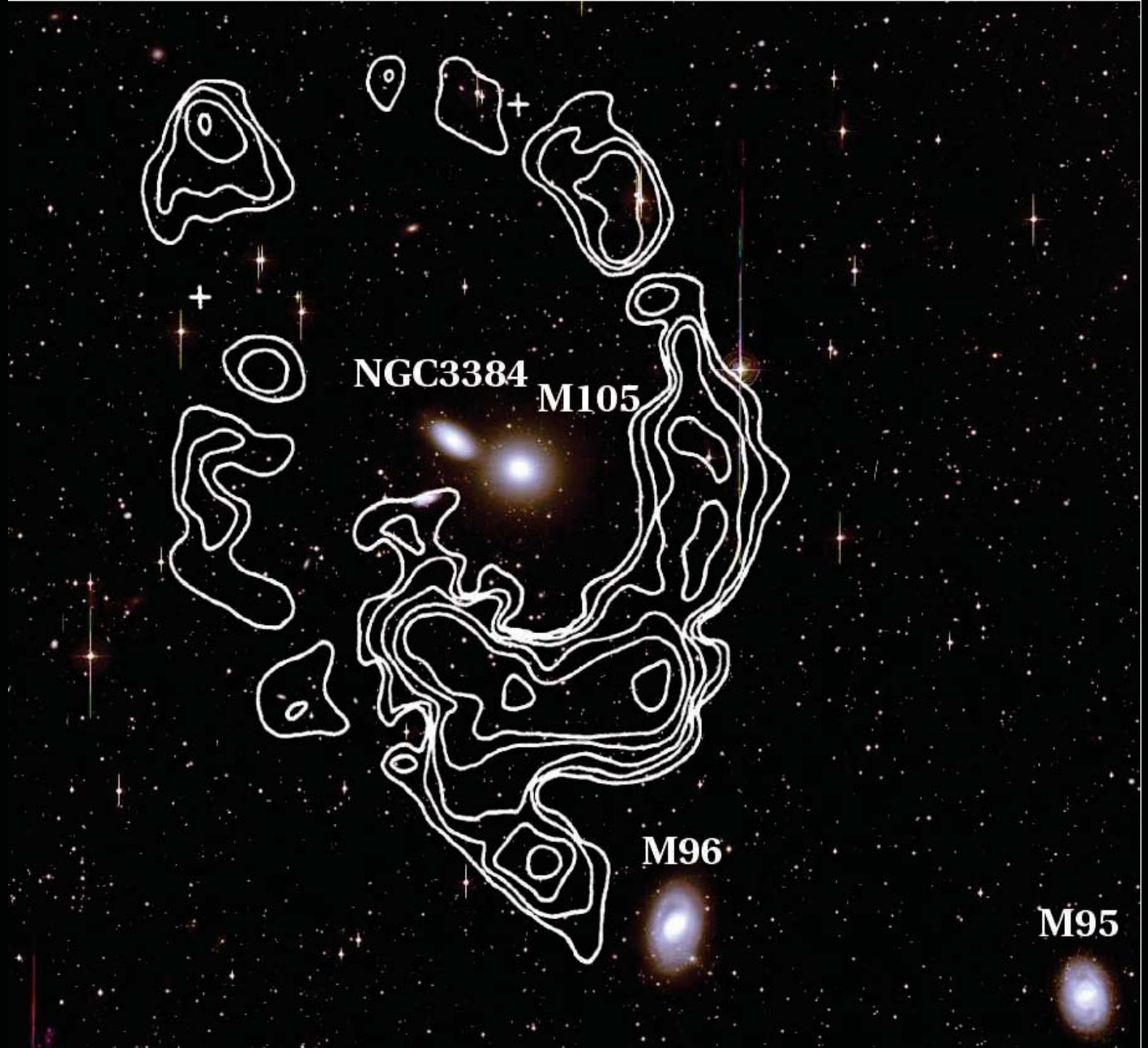
Ellison+18

Stephan's Quintet: hydrogen contours (left) & MegaCam optical (right)

References: Williams et al. 2002, Duc et al. 2018




IC 1459 group
Serra+16, Saponara+18
ATCA
ASKAP
IC 5269C
ESO 406-G31
2dFGRS S537Z045
IC 5270
IC 5269
IC 5269B
IC 5269A
DUKST 406-83
IC 1459
IC 5264
2MASX J225710 -3640103
NGC 7418A
NGC 7418
ESO 406-G42
ESO 406-G40
NGC 7421
IC 5273
-35.0°
-36.0°
-37.0°
-38.0°
346.0°
345.0°
344.0°
343.0°
12′
18′
24′
30′
36′
42′
48′
59m0s
30s
58m0s
30s
57m0s
30s
56m0s



1.8°×1.8°
(350×350 kpc²)

Watkins+16

Surveys

Existing data

SINGLE-dish:

- ALFALFA
- HIPASS
- (X-)GASS
- HRS
- Nançay catalog
- AGS
- GEMS

Interferometry:

- WHISP
- THINGS
- LVHIS
- VLA ANGST

- LITTLE THINGS
- FIGGS(2)
- SHIELD

- ATLAS3D
- Oosterloo ET

- VIVA

- Ursa-Major
- VGC

- HALOGAS
- Bluedisk
- HIGHMASS
- Lemonias+
- HIX
- IMAGING

- BUDHIES

Published
Not published

Data on the way:

- CHILIES
- CHILLING
- WALLABY

Future data:

- WALLABY
- Apertif

- MHONGOOSE
- Fornax
- MALS

- LADUMA
- DINGO

Distant future:

- SKA