# The MeerKAT Fornax Survey:
## Rapid HI removal in dwarf galaxies


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# The MeerKAT Fornax Survey (MFS)

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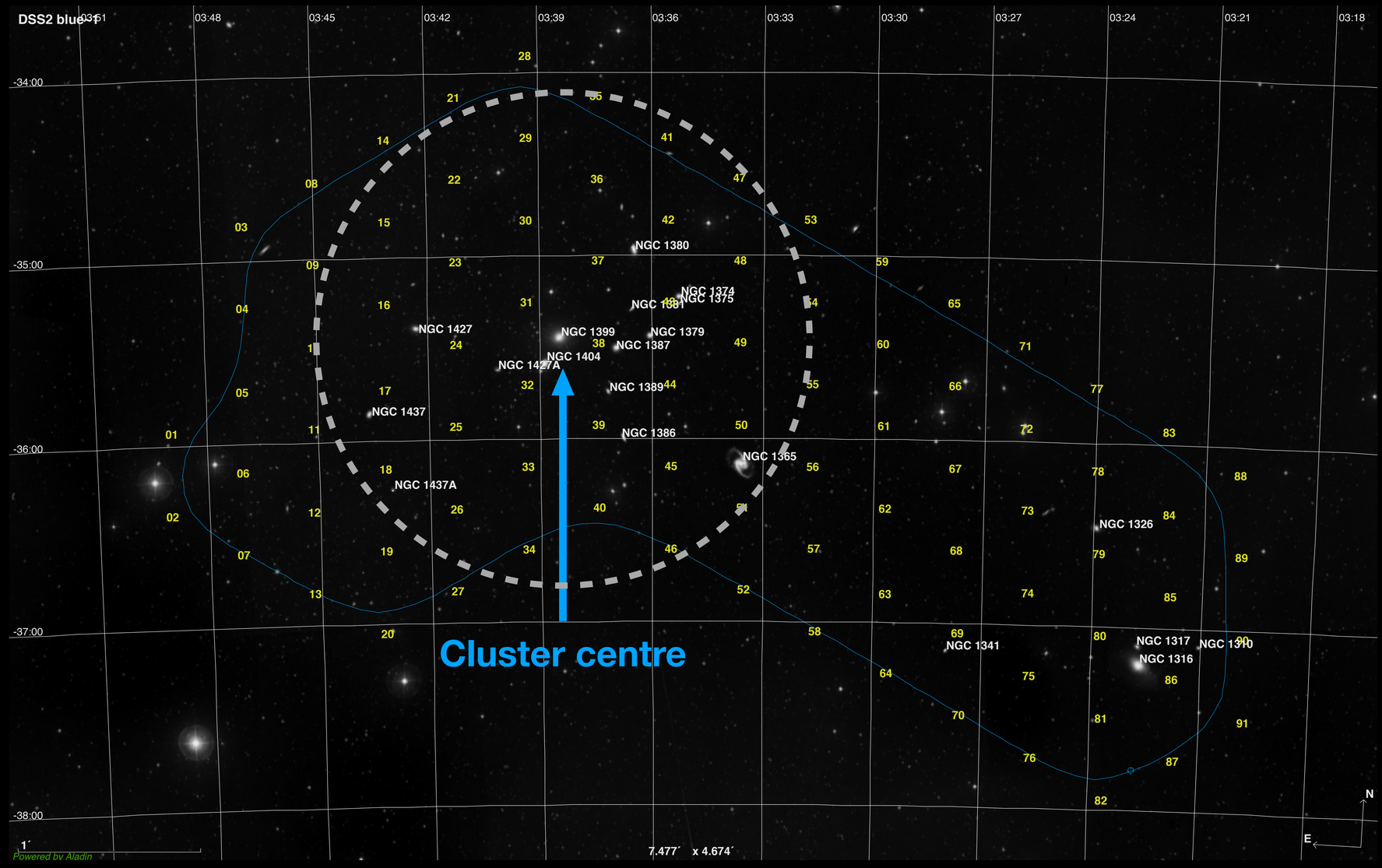
- We have a website! https://sites.google.com/inaf.it/meerkatfornaxsurvey
- PI: Paolo Serra.
- One on the top ranked Large Survey Projects (LSP) for MeerKAT.
- 91 pointings:
  - Equivalent to 25 hours per field.
  - Broadband continuum and HI spectral line.



# What can MeerKAT reveal?

## Broadband radio emission

- Black hole (AGN) emission and activity.
- Star formation.
- Magnetic fields.

## HI special line emission

- HI is the lightest and loosest bound gas.
- Fuel for star formation.
- Resolved @ kpc scales 3 orders of magnitude below SF:
    - Kinematics, Dynamical history.
- Dark Matter.

**Gas is fundamental to galaxy evolution.**


de Blok et al. (2018)

# MFS goals

Fornax is a nearby, low mass, low density cluster:

$M_{vir} \sim 5 \times 10^{13}\ M_{\odot}$

$R_{vir} \sim 700$ kpc

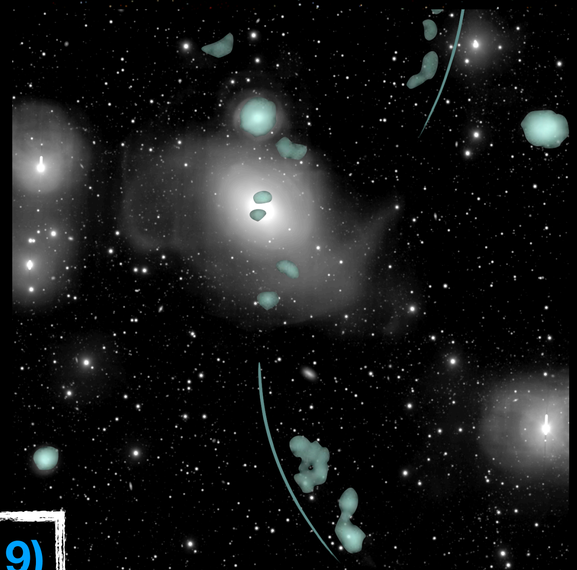
distance ~ 20 Mpc

- Can we find direct evidence of galaxy transformation in a small cluster?
- What physical processes are driving this transformation?

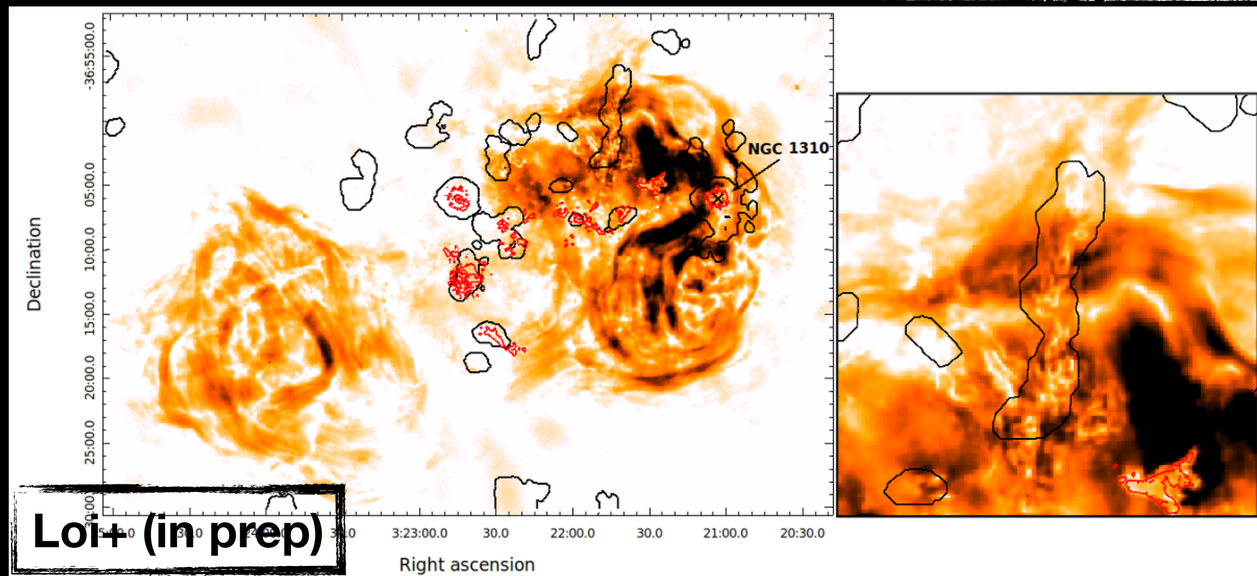
# MFS commissioning results

Maccagni+ (2020, 2021)

Kleiner+ (2021)

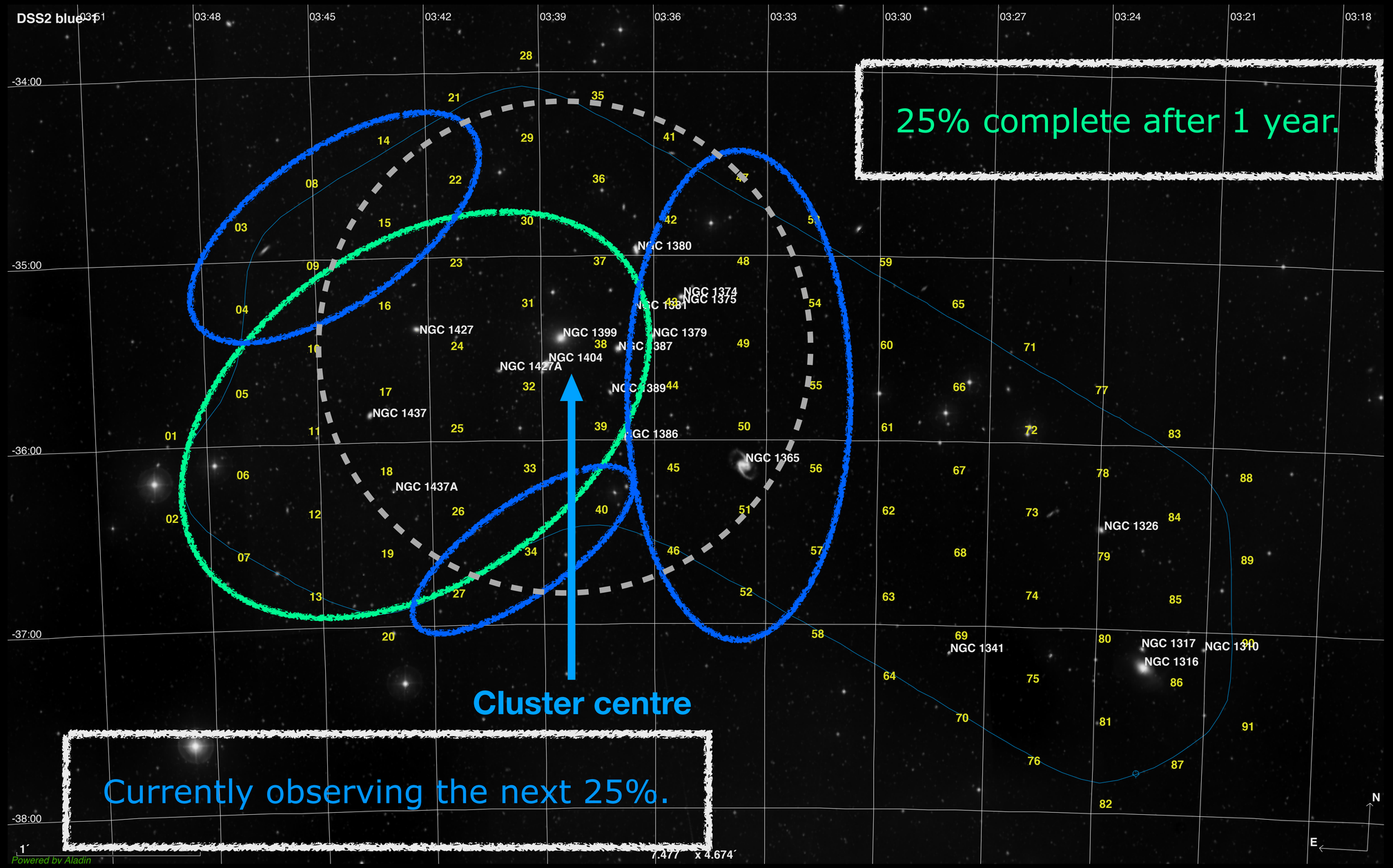


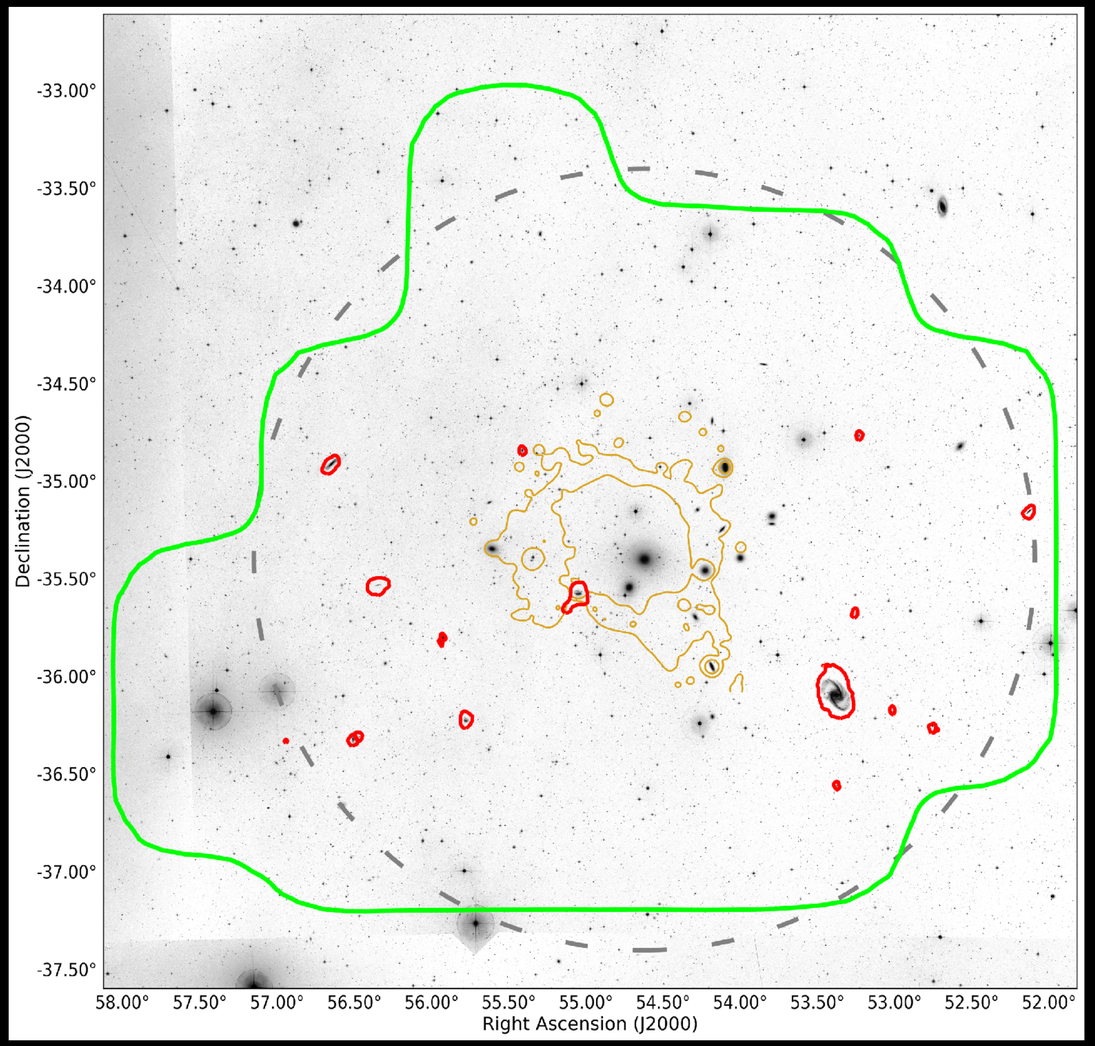
Serra+ (2019)




Loi+ (in prep)

# MFS status


DSS2 blue
03:51
03:48
03:45
03:42
03:39
03:36
03:33
03:30
03:27
03:24
03:21
03:18
-34:00
-35:00
-36:00
-37:00
-38:00
NGC 1380
NGC 1374
NGC 1375
NGC 1381
NGC 1427
NGC 1399
NGC 1379
NGC 1387
NGC 1404
NGC 1427A
NGC 1389
NGC 1437
NGC 1386
NGC 1365
NGC 1437A
NGC 1326
NGC 1341
NGC 1317
NGC 1310
NGC 1316
Cluster centre
25% complete after 1 year.
Currently observing the next 25%.
N
E
Powered by Aladin

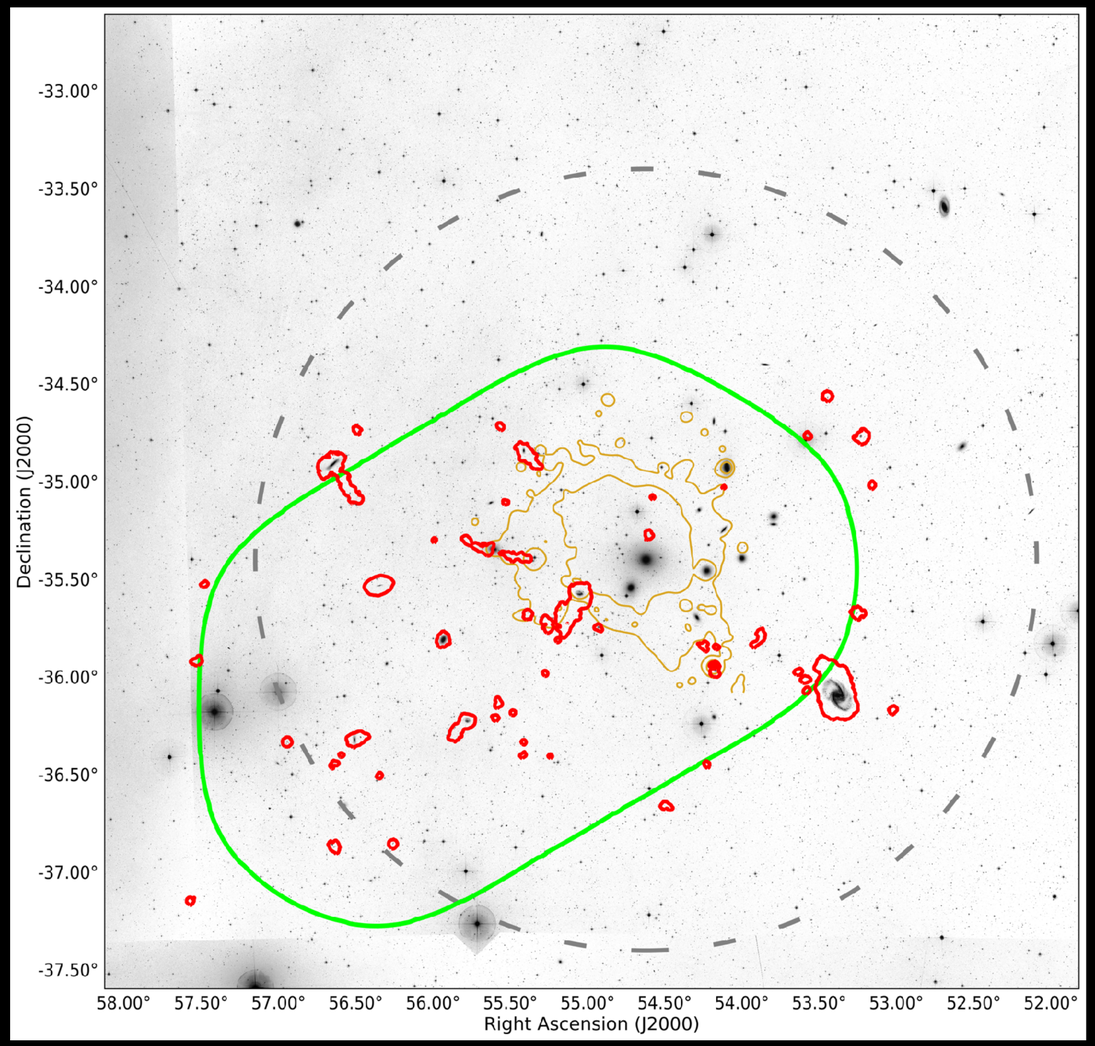



ATCA (Loni et al. 2021)

M(HI) > $10^7$ $M_\odot$

N(HI) > $2\times10^{19}$ cm$^{-2}$

res: 1 arcmin, 6.7 km/s

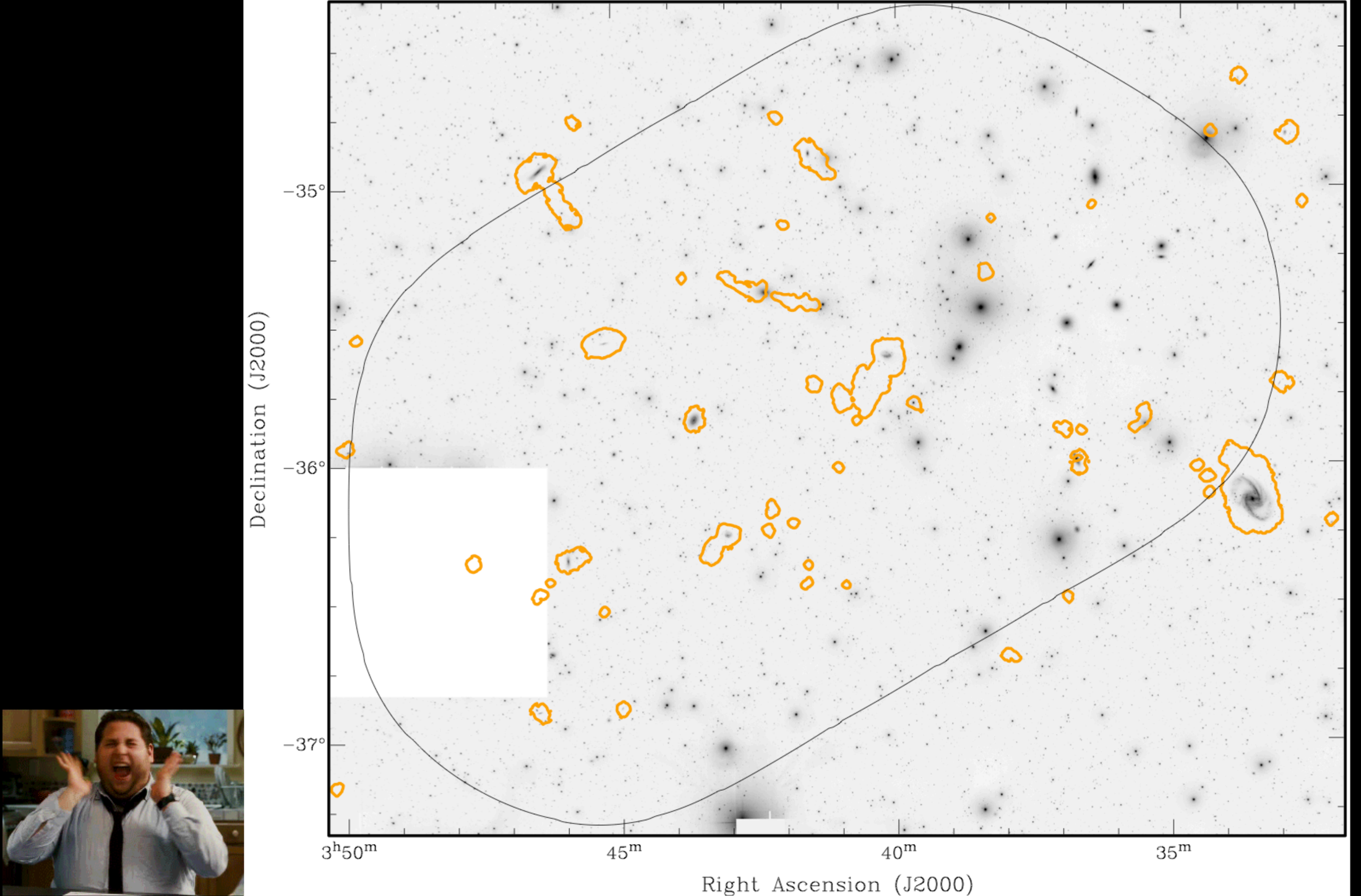


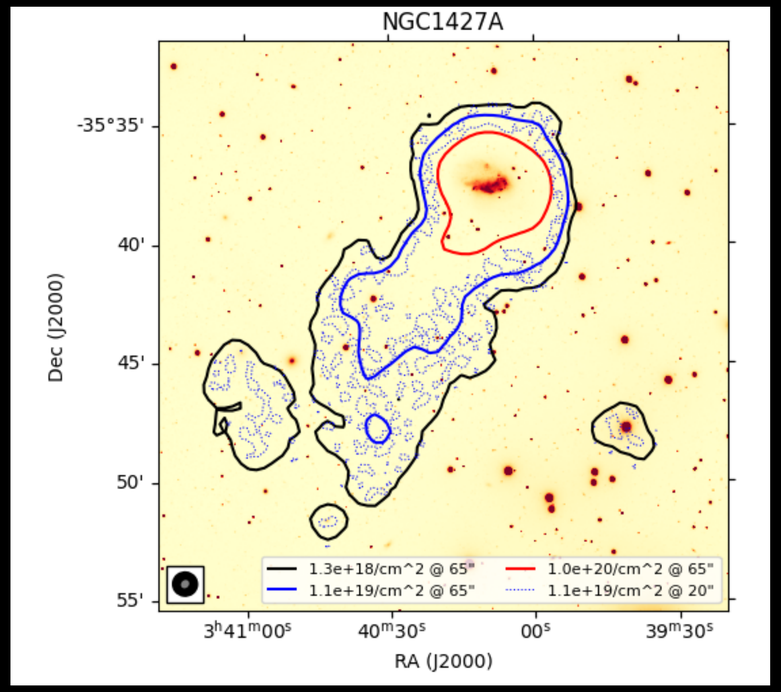

MeerKAT

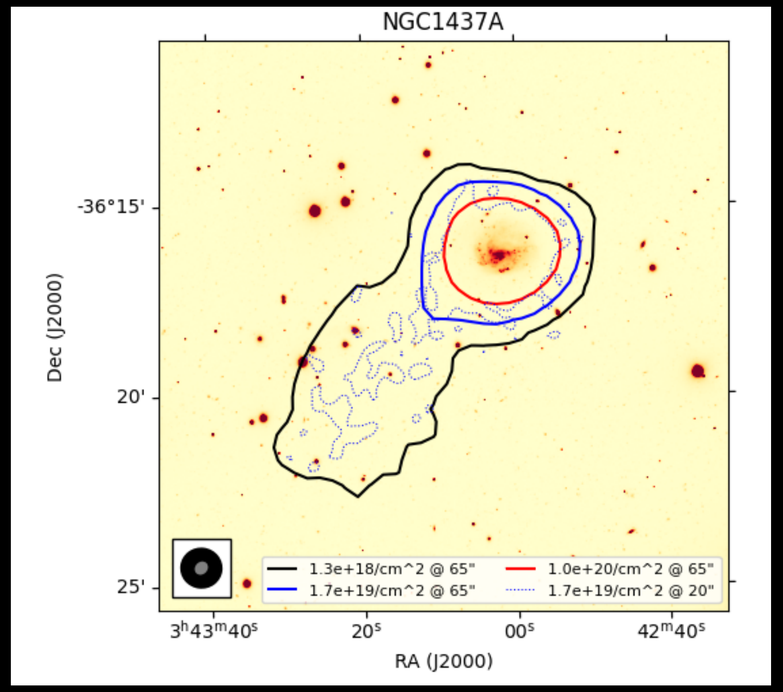
M(HI) > $10^6$ $M_\odot$

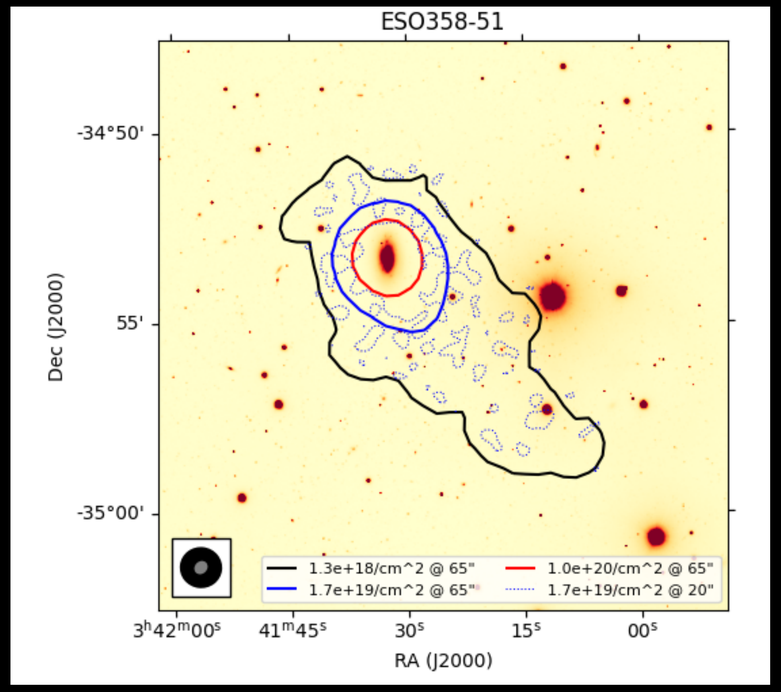
N(HI) > $1\times10^{18}$ cm$^{-2}$

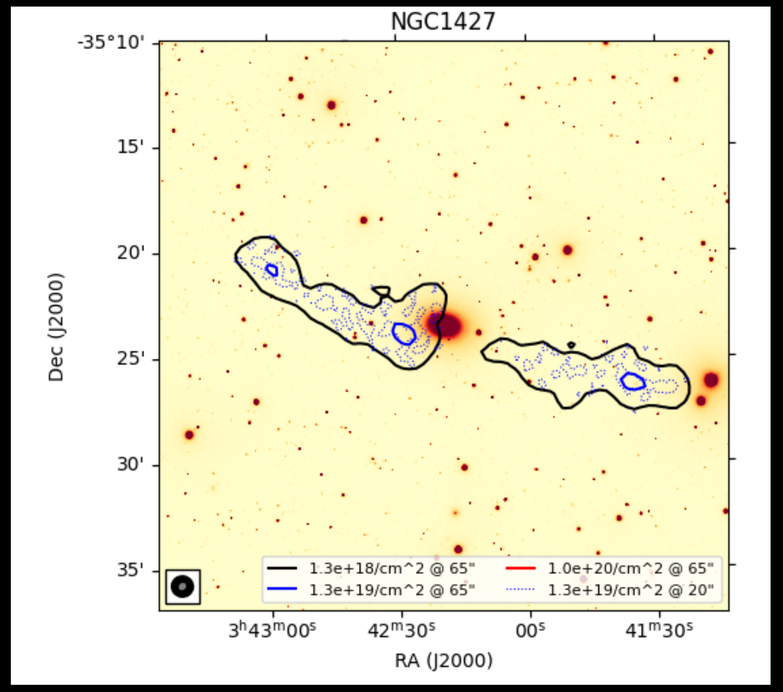
res: 1 arcmin, 1.4 km/s


−35°
−36°
−37°
Declination (J2000)
3h50m
45m
40m
35m
Right Ascension (J2000)



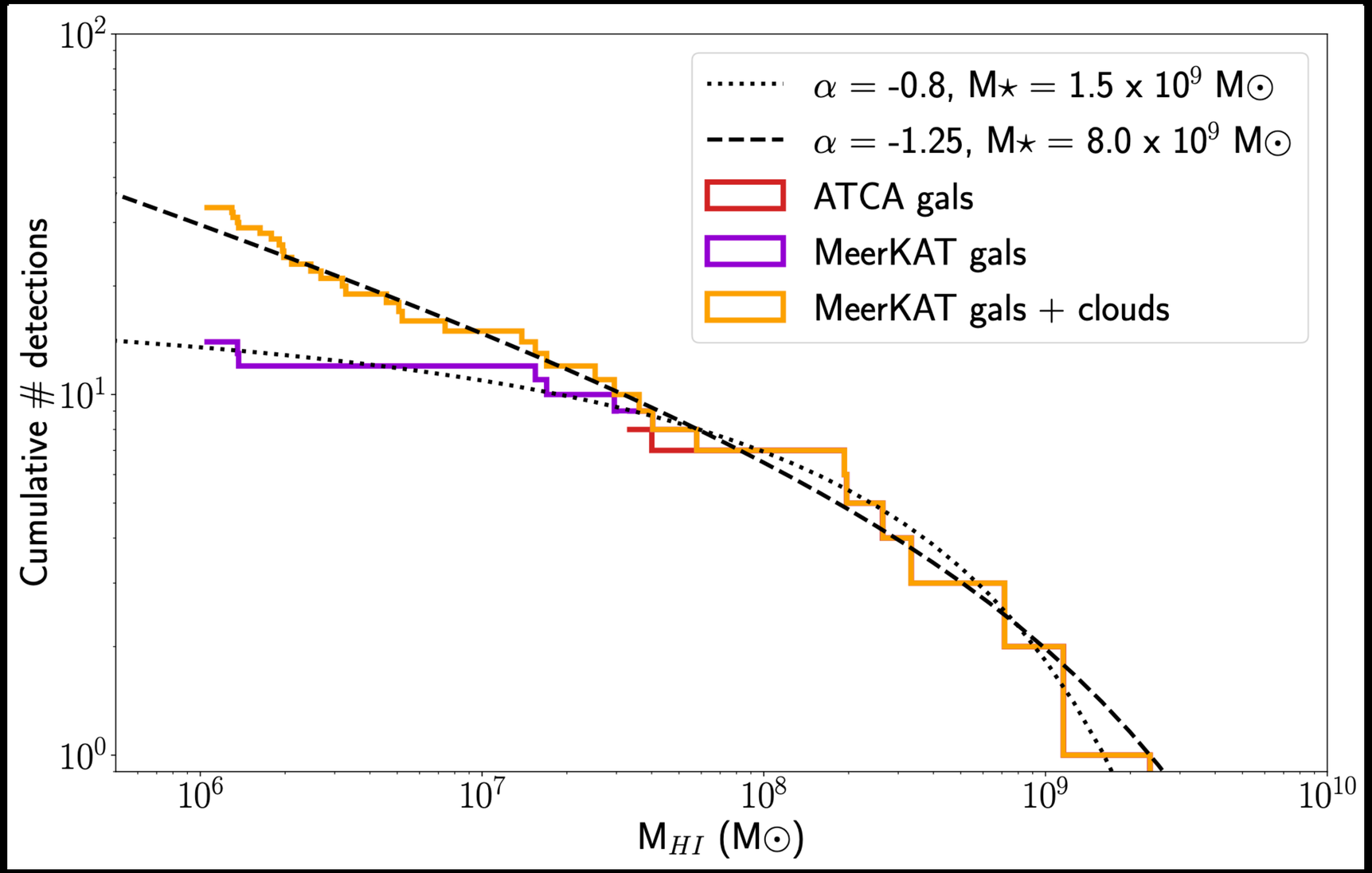




Ram pressure doesn't appear to be the only mechanism producing HI tails

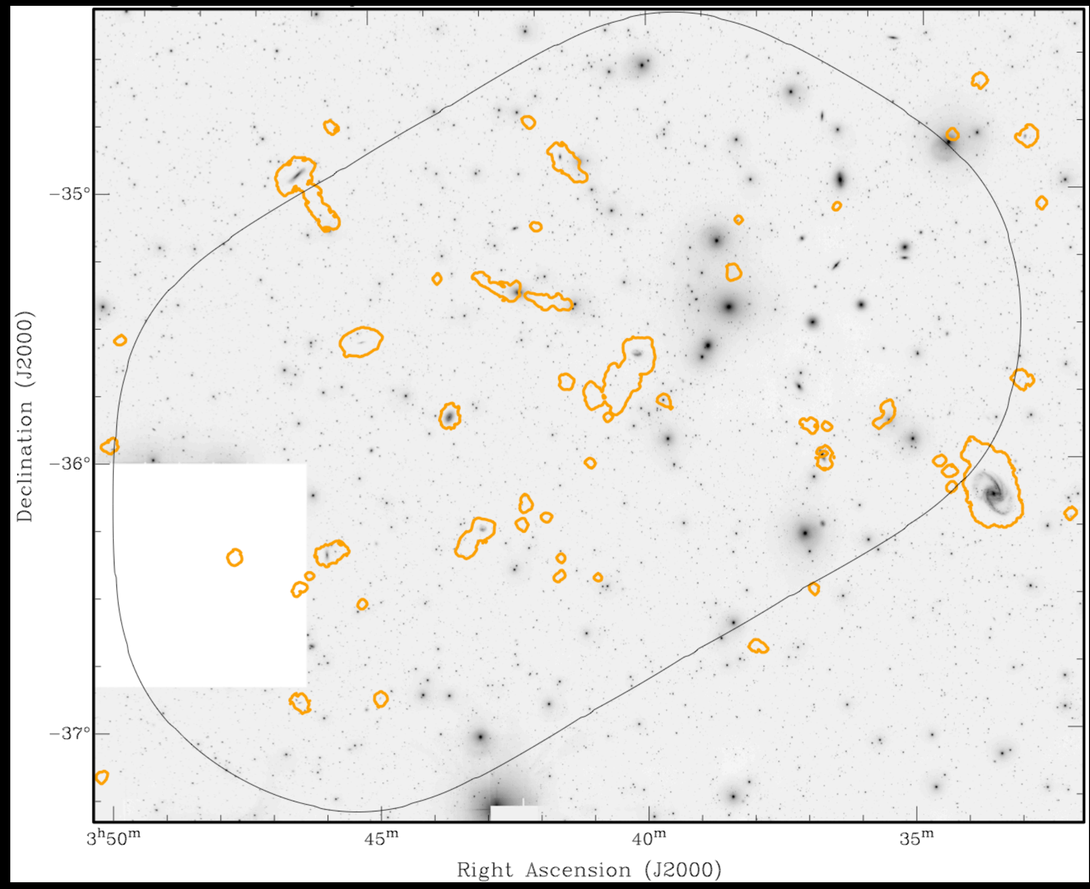
# The MFS HIMF



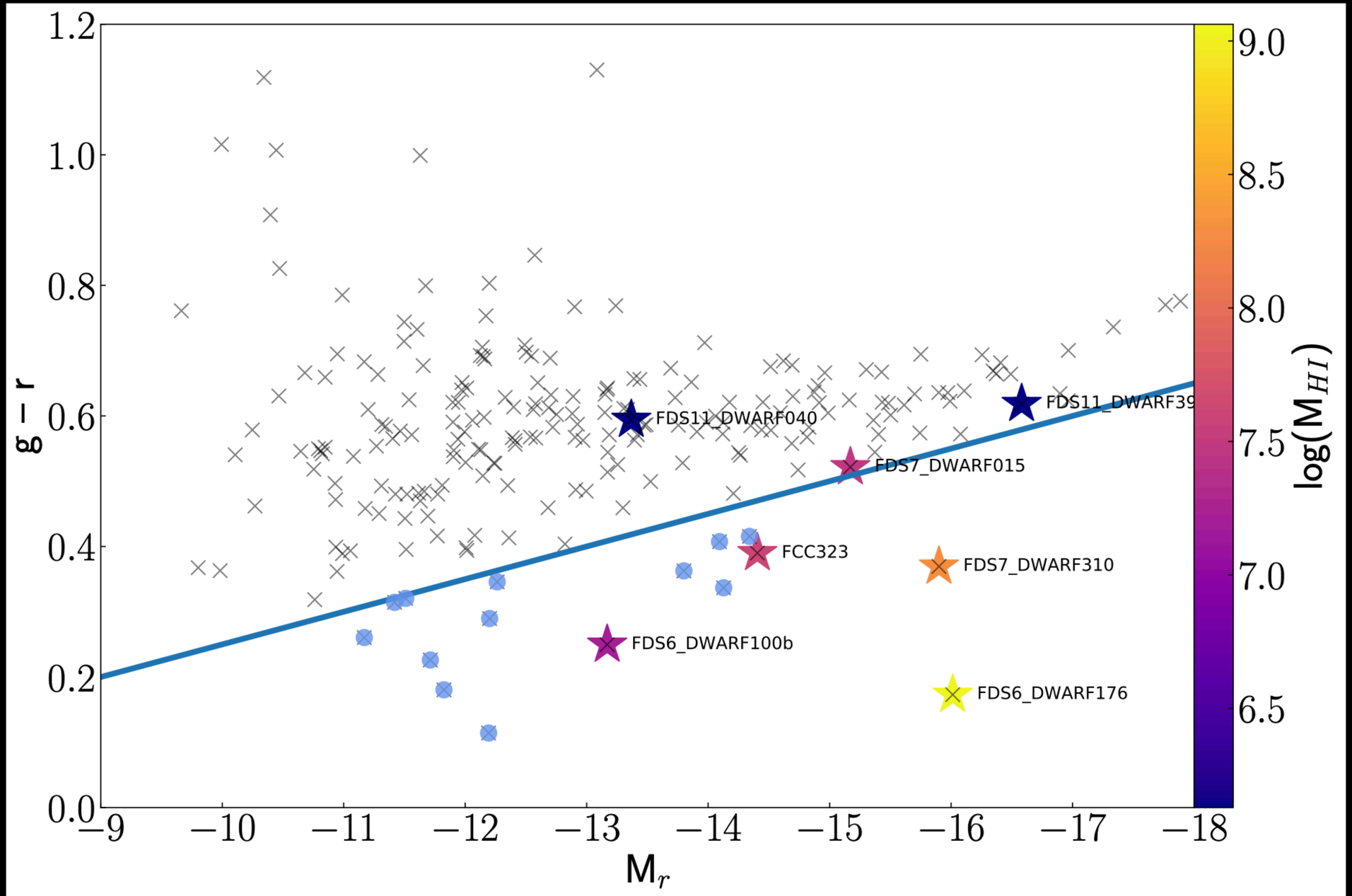

- HI Mass Function (HIMF) - The number density of galaxies(?) in the Universe as a function of their HI mass.
- Fitted by a Schecter function, described by alpha, Mstar.

# Dwarf galaxies in the Fornax Cluster

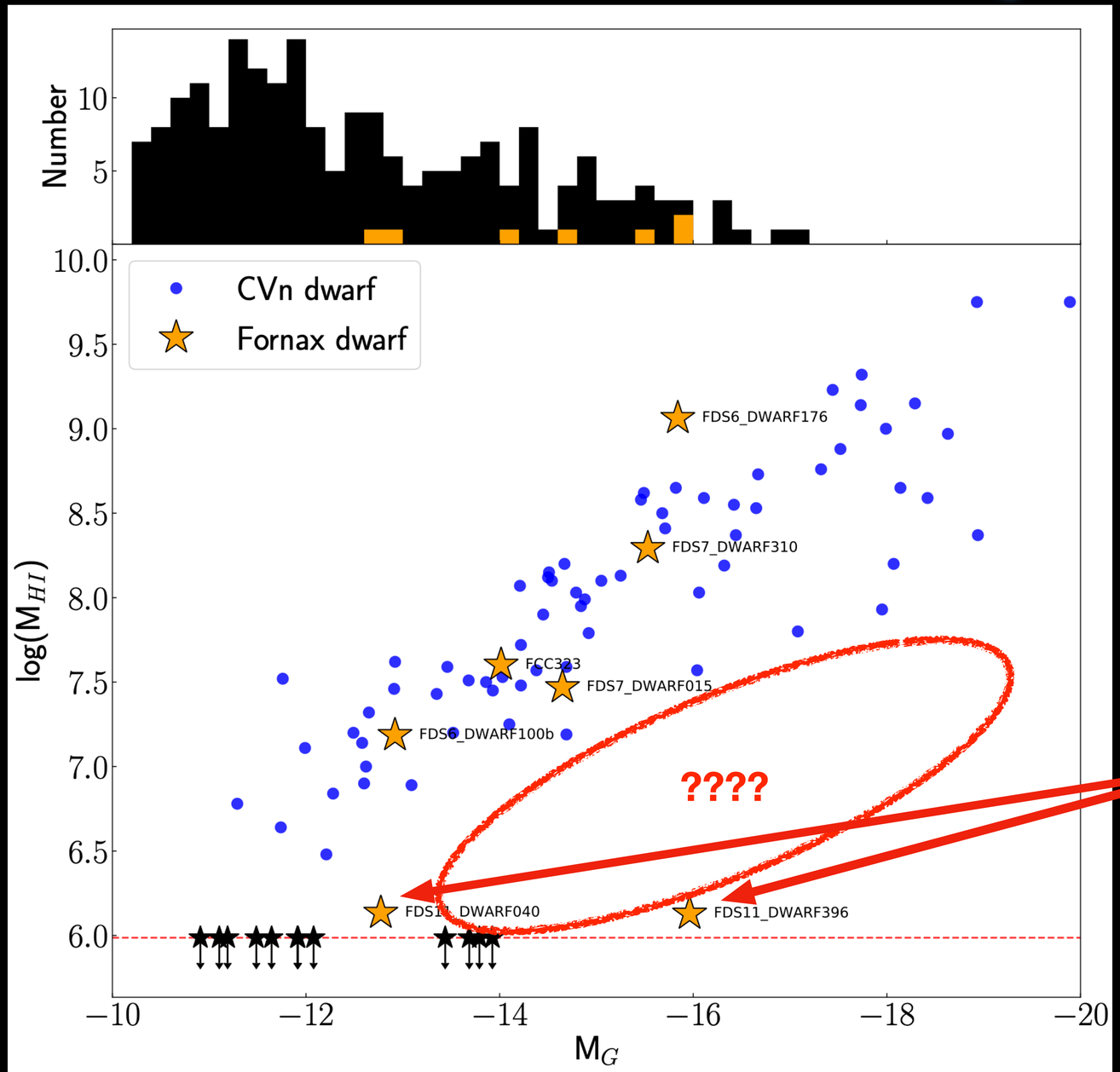
- Dwarfs are more sensitive to galaxy transformations.
    - New parameter space - do any cluster dwarfs have HI?
- Venhola+ (2018) dwarf catalog (Mr > -18.5)…
    - Dwarfs (Mr > -18.0).
    - Intermediate (-19.0 < Mr < -18.0).
    - Bright (Mr < -19.0).
- 300 dwarfs in the footprint (<10% contamination):
    - 12 have HI.
    - 7 of those are within 3sigma sensitivity.



# Dwarf CMR


g − r
M_r
log(M_HI)
FDS11_DWARF040
FDS11_DWARF39
FDS7_DWARF015
FCC323
FDS7_DWARF310
FDS6_DWARF100b
FDS6_DWARF176

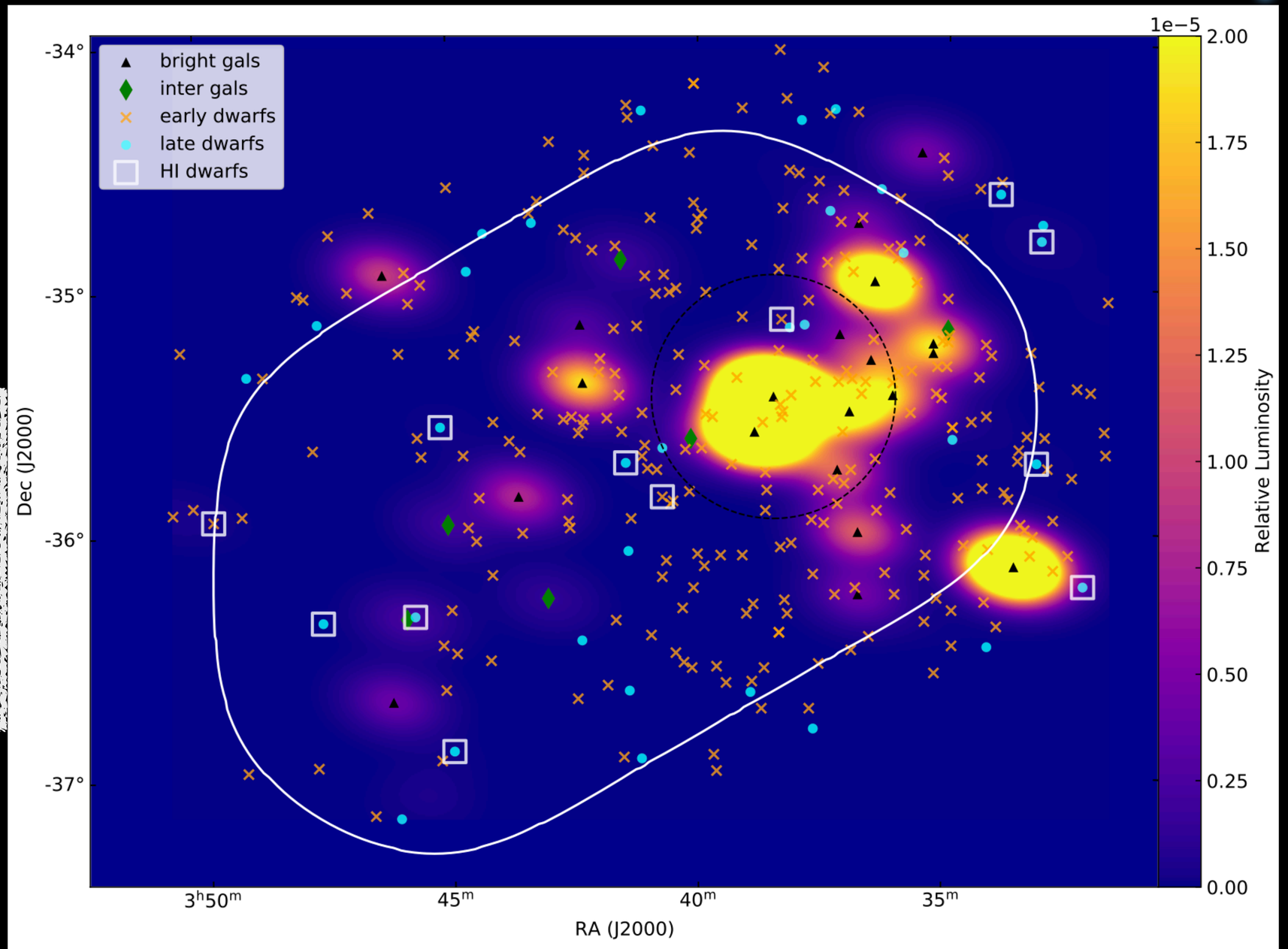
# Dwarf HI - luminosity



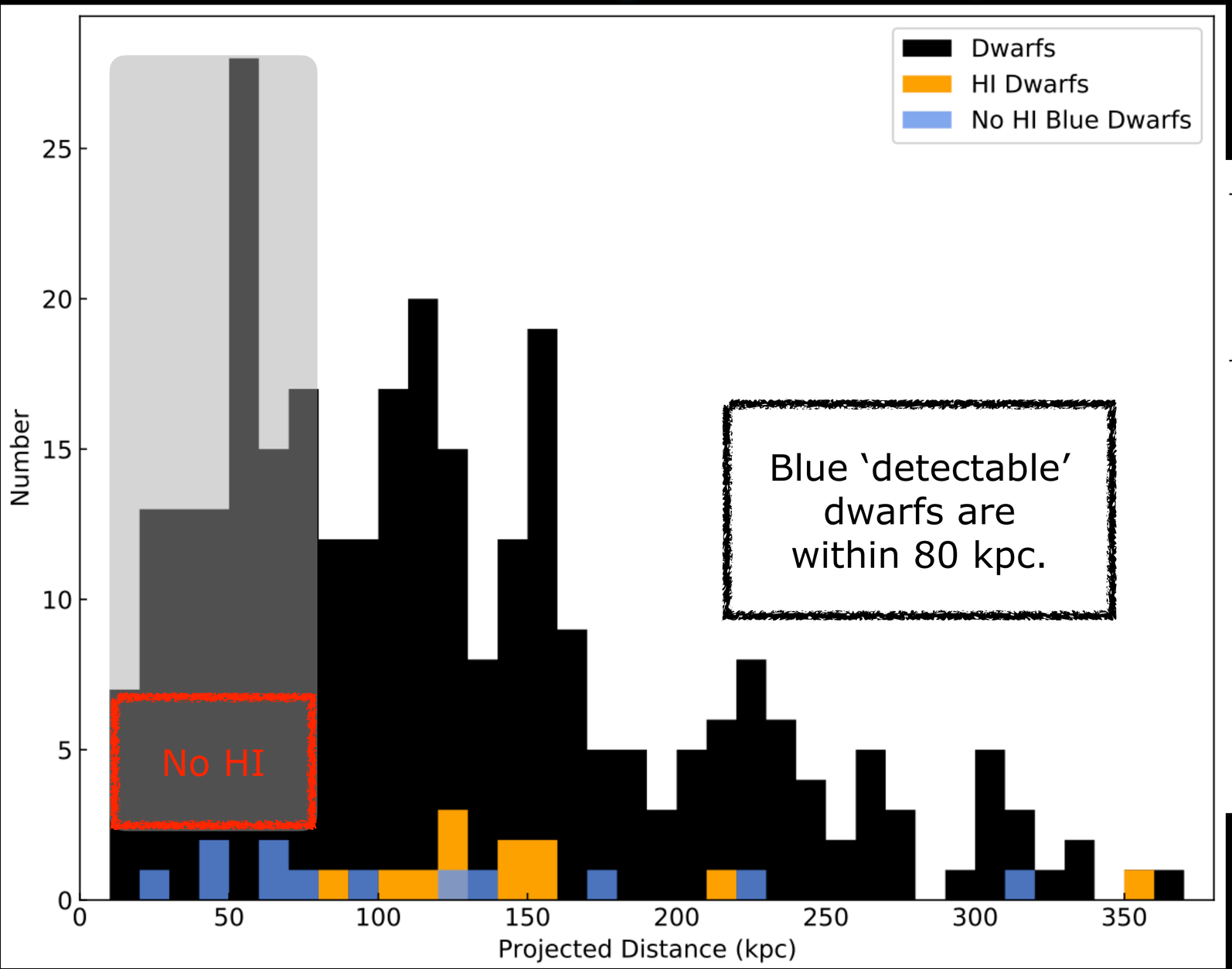

Red, early types

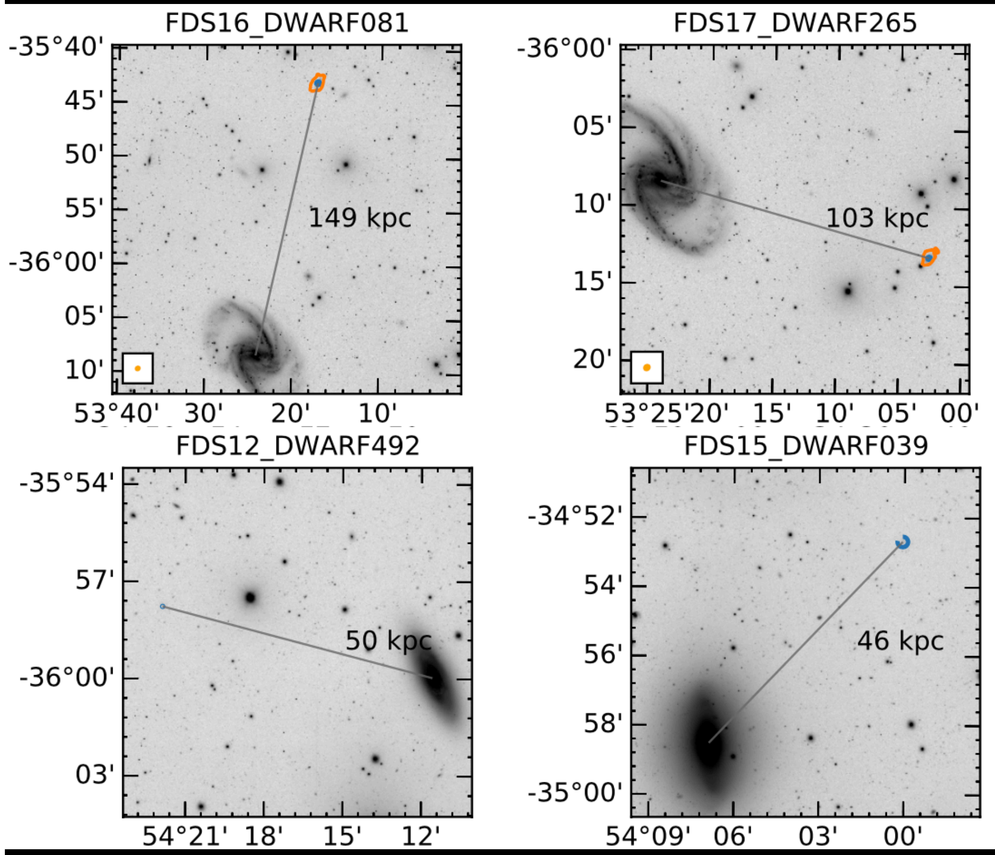
# Dwarf location & number density

Dwarfs with HI appear to avoid dense substructure and bright galaxies



# Dwarf proximity to bright galaxy



# Fornax Cluster and the 7 dwarfs

- The story so far:
  - The HI in a dwarf can't survive 1 pericentric passage.
    - 95% of dwarfs have no HI detected.
  - If a dwarf has HI, it has a normal amount until it rapidly looses it.
    - i.e. We don't observe a population of transitioning dwarfs.
  - No dwarf with HI is closer than 80 kpc to a bright galaxy.
    - Suggests that massive galaxies (tidal, hot halo?) and pre-processing play an important role.
    - Supported a population of blue dwarfs with no HI and < 80 kpc to a bright galaxy.
- MFS is 25% complete and lots of exciting results already.
  - Currently observing the next 25%… stay tuned!

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