FINDING GALAXIES WITH UNUSUAL HI CONTENT

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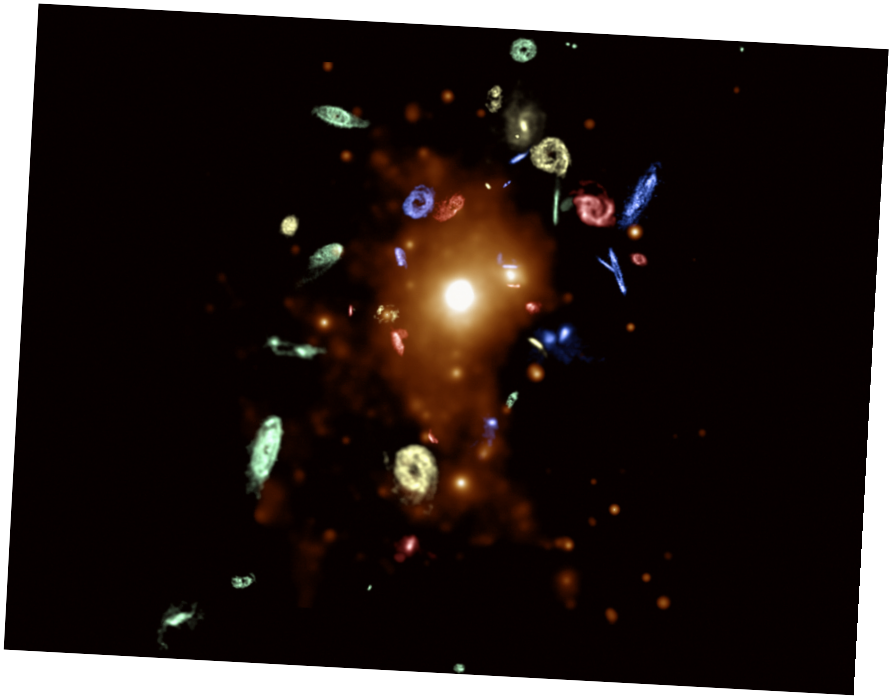
HI IN GALAXIES

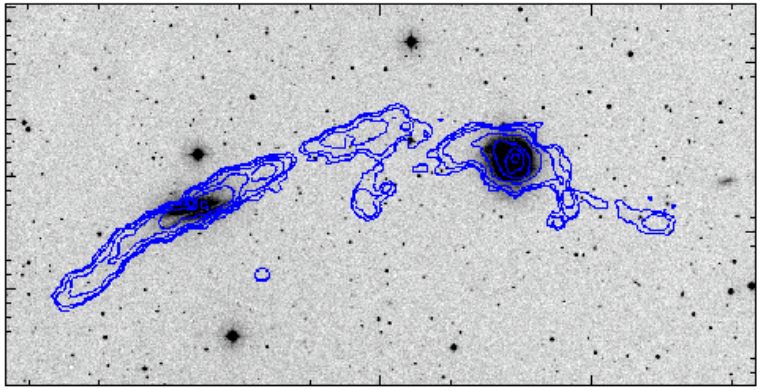
- HI is the fuel for potential star formation
- HI is a good **tracer of recent galaxy evolution**
- Galaxies in dense environment have less HI than galaxies in the field



Virgo galaxies (X-Ray and HI composite)
Chung et al., 2009

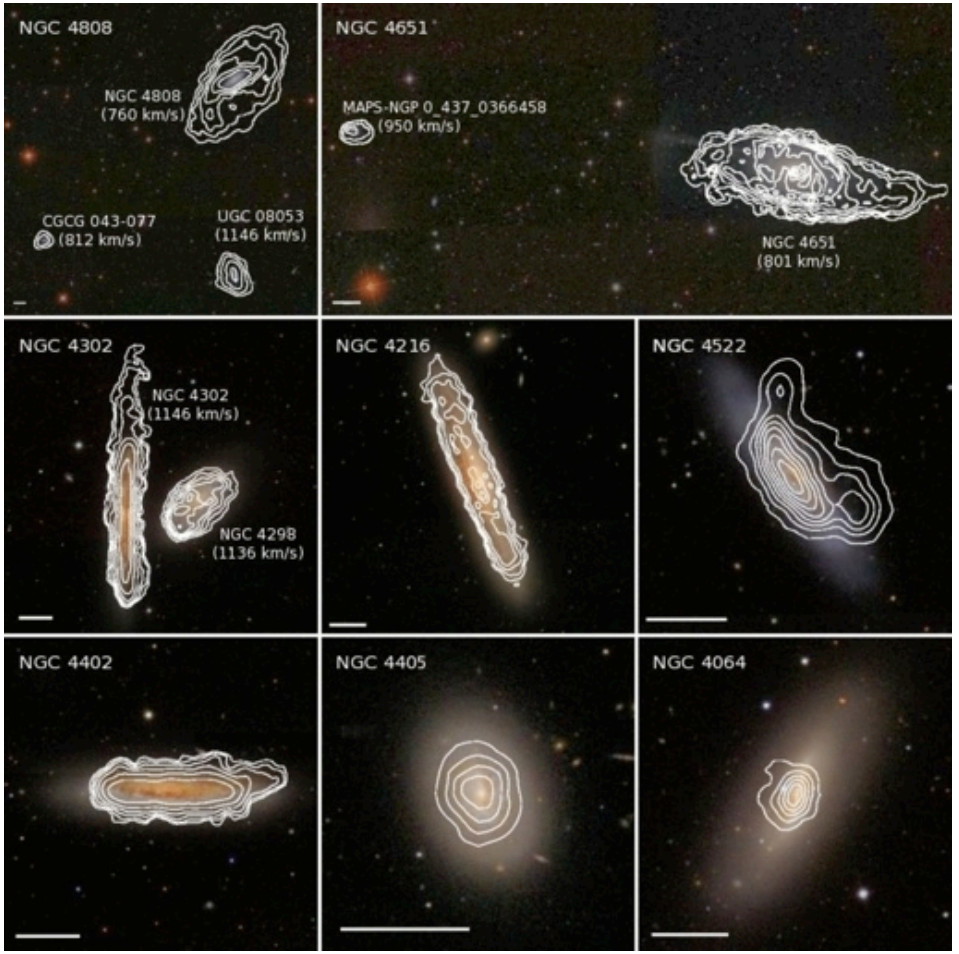
ENVIRONMENT

stuff happens ...



NGC 5713/5719
Langston & Teuben, ASP Conf. Ser. 240, Gas & Galaxy Evolution, p. 861.

- ✧ tidal interactions
- ✧ mergers
- ✧ ram pressure stripping
- ✧ thermal evaporation
- ✧ starvation



Virgo galaxies (SDSS images overlaid with VLA contours)
Chung et al., 2009

THE QUESTION IS?

How **the neutral hydrogen (HI)** content relates to other physical properties of galaxies and what external processes are influencing this relation.

Which **gas stripping mechanisms** work in low density environments?

DATA

- **The HI Parkes All Sky Survey (HIPASS)** (Barnes et al., 2001)
  - 64 m Parkes telescope (1997-2002)
  - Velocity range: -1280 to 12700 km/s
  - Declination range: -90˚ to +25˚
  - 5317 sources

- blind HI survey, HI flux limited sample
- only using the best identified optical counterparts (~2000 galaxies)

- **Optical/infrared data**
  - Magnitudes:
    - SuperCOSMOS (Doyle et. al., 2005)
    - 2MASS (Jarett et al., 2000)
  - Diameters:
    - Denis (Paturel et al., 2000, 2005)
    - UGC (Nilson et al., 1973, 1974)
    - 2MASS (Jarett et al., 2000)

SCALING RELATIONS

Correlation between the HI content of a galaxy and it's optical/infrared diameter and flux.

Haynes and Giovanelli (1984)
Chamaraux et al., (1986)
Solanes et al. (1996)
Kilborn et al. (2005)
Catinella et al., (2010)
Toribio et al., (2011)
etc.

Calculating the expected HI mass:

$$\log(M_{HI\,\mathrm{exp}}) = \alpha + \beta \log d$$

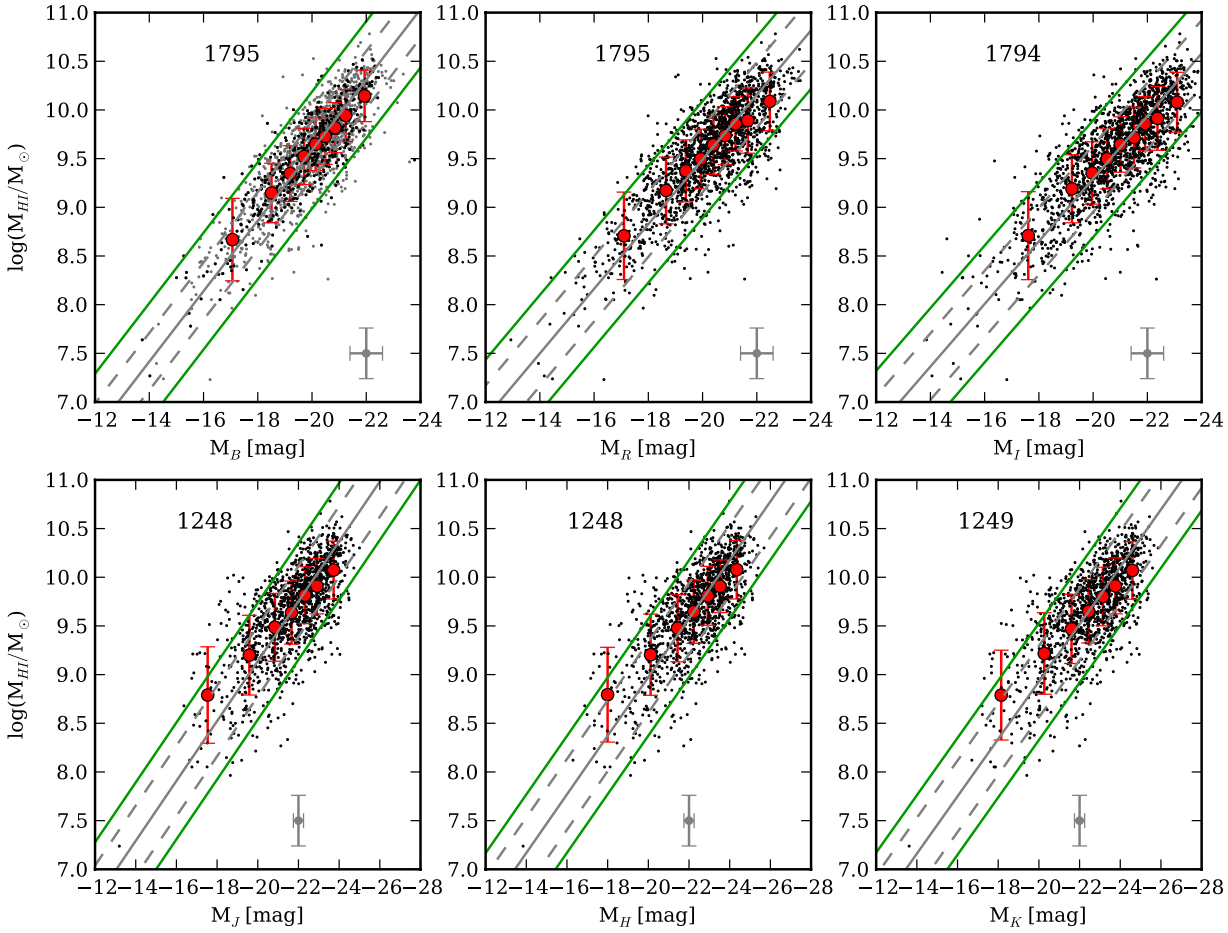
$$\log(M_{HI\,\mathrm{exp}}) = \alpha + \beta L$$

The HI "deficiency factor":

$$DEF_{HI} = \log[M(HI)_{\mathrm{exp}}] - \log[M(HI)_{obs}]$$

(Haynes & Giovanelli 1984)

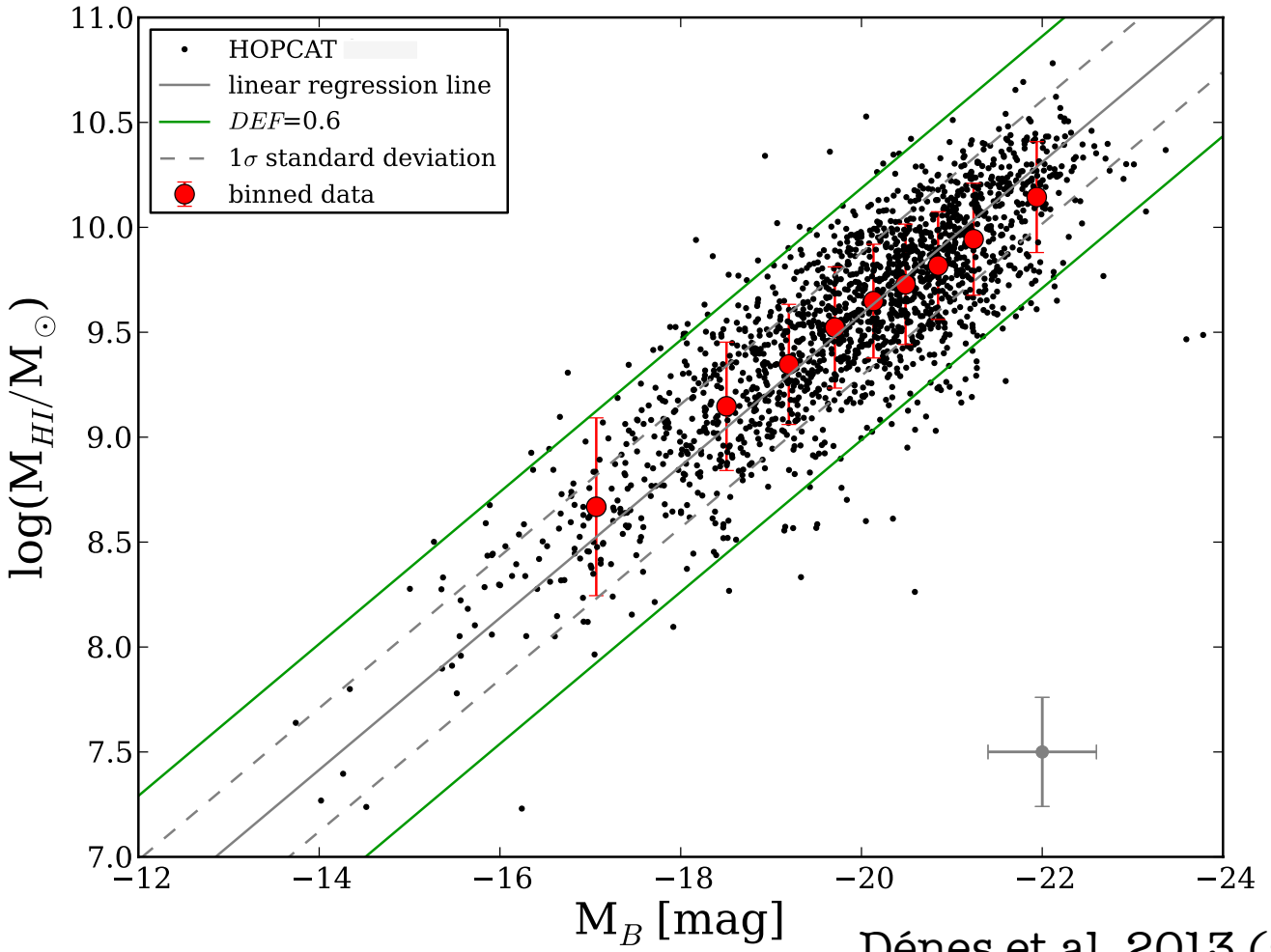
SCALING RELATIONS



Dénes et al. 2013 (submitted)

SCALING RELATIONS

HI mass - magnitudes



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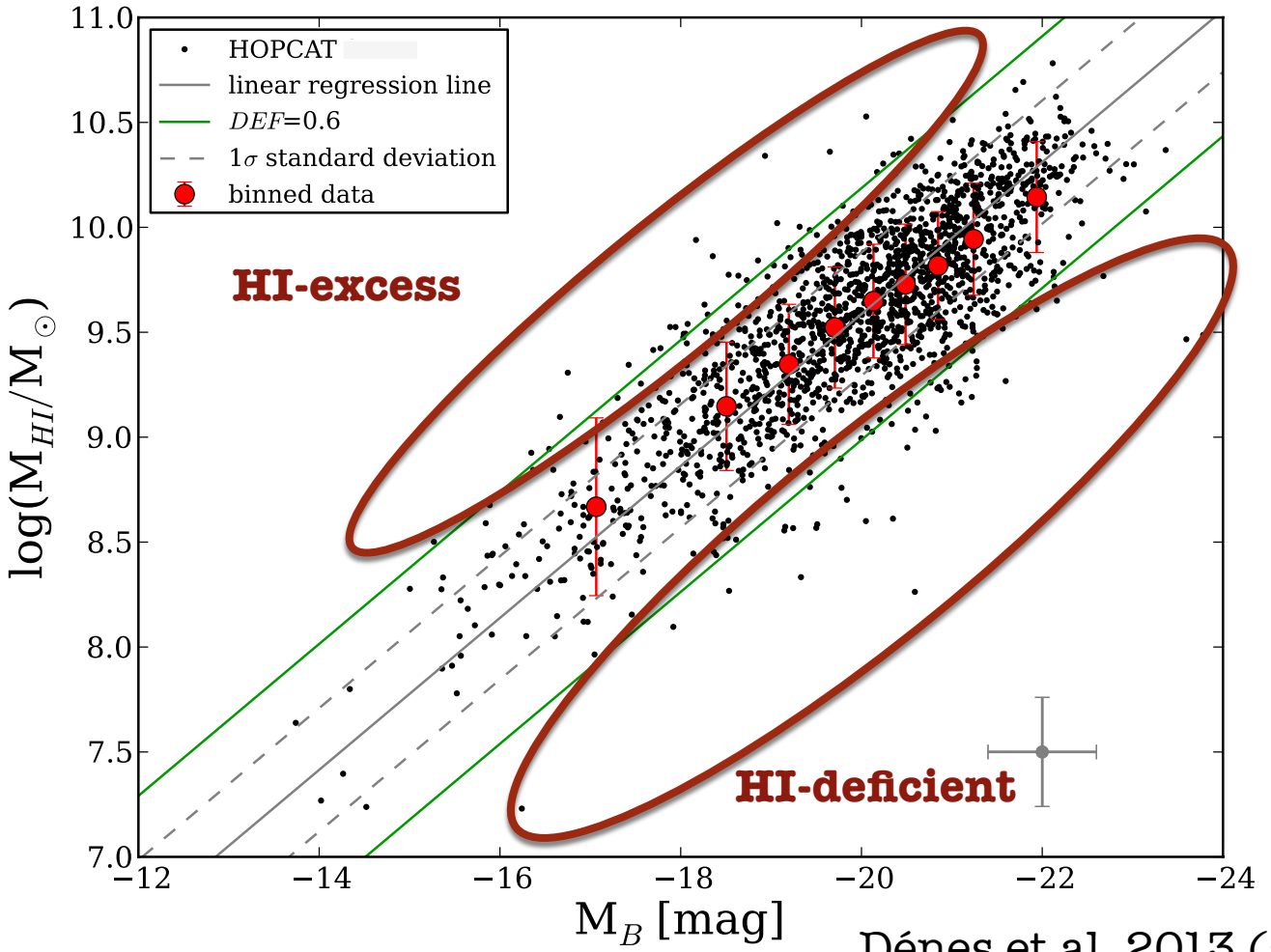


Dénes et al. 2013 (submitted)

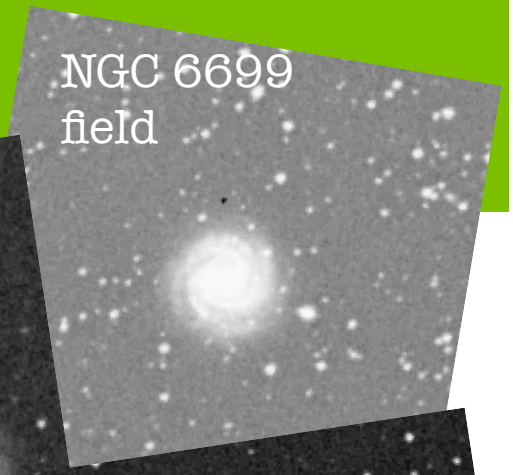
HI DEFICIENT GALAXIES

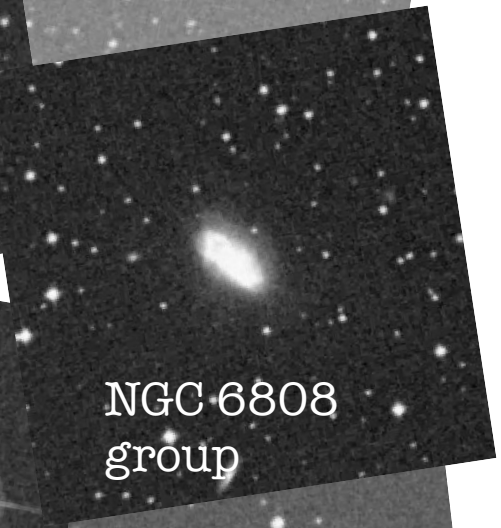
52 hours OBSERVED + 62 hours next semester with ATCA

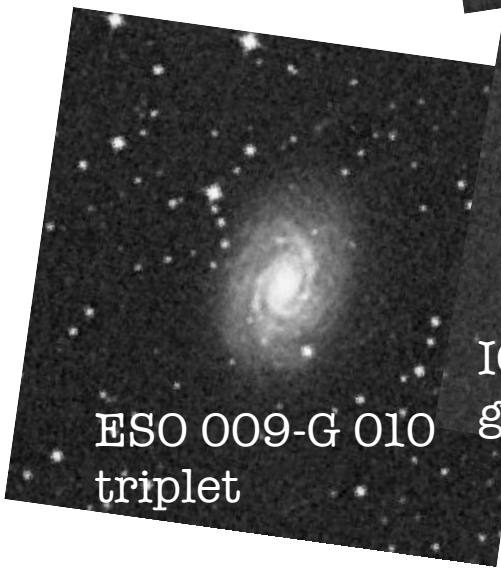
In groups:
- NGC 1473
- NGC 1515
- NGC 6808
- IC 1993

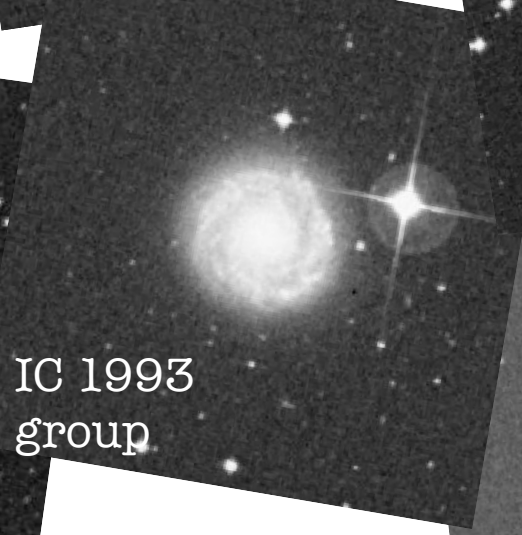
In a triplet:
- ESO 009-G 010

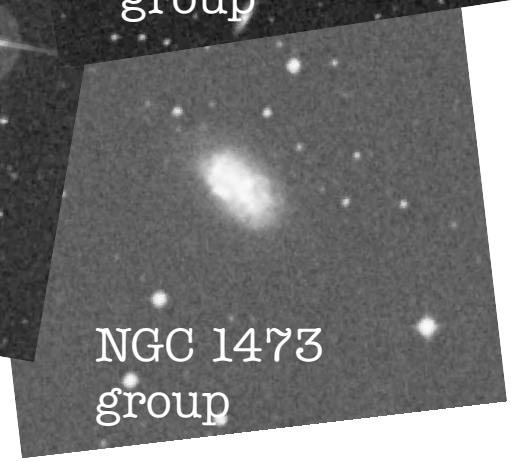
In the field:
- NGC 6699











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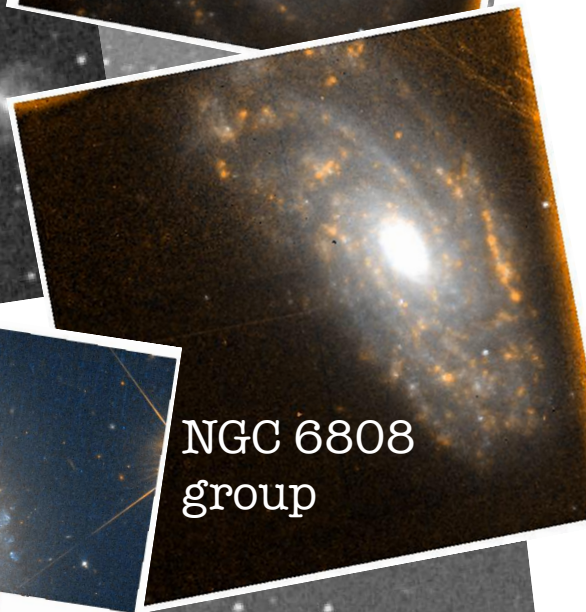
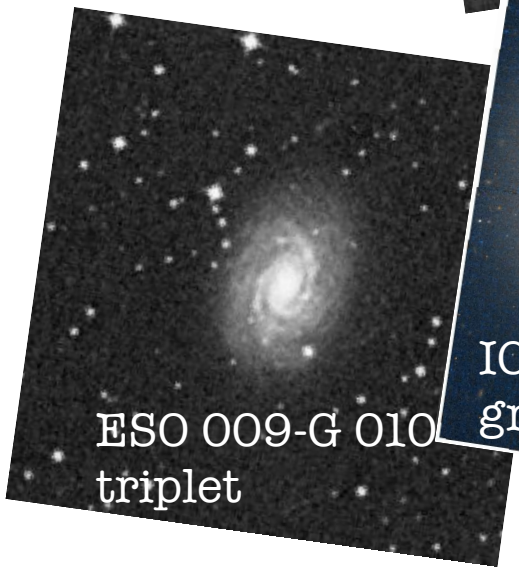
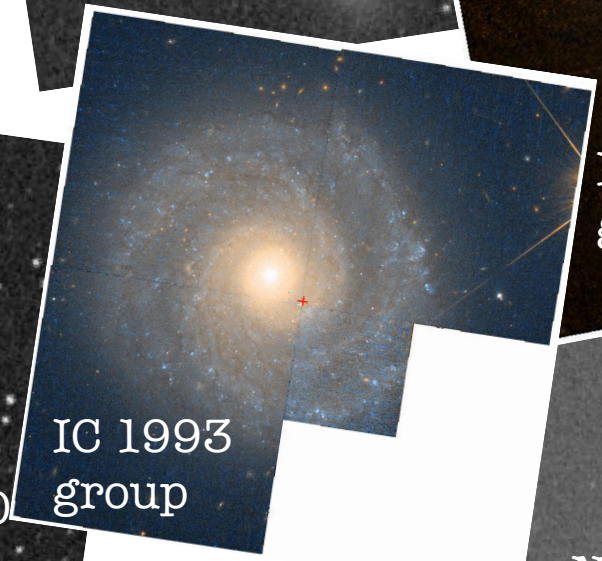
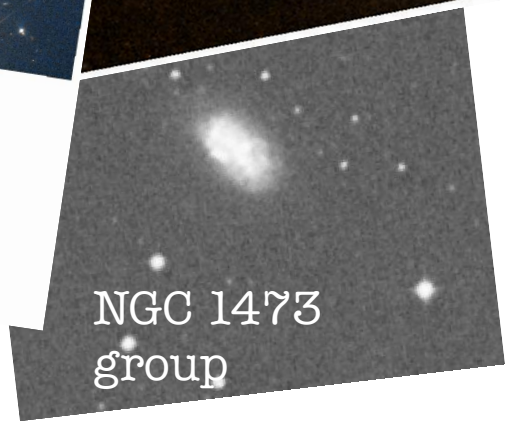








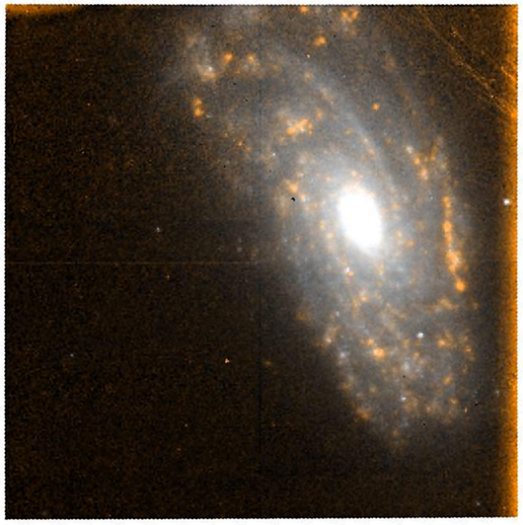
OBSERVING IS FUN!

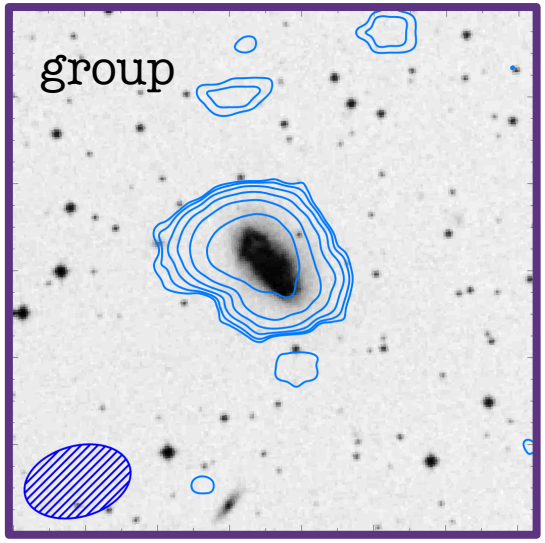
HI DEFICIENT GALAXIES

4-10 times less HI than expected

Signs of interaction:

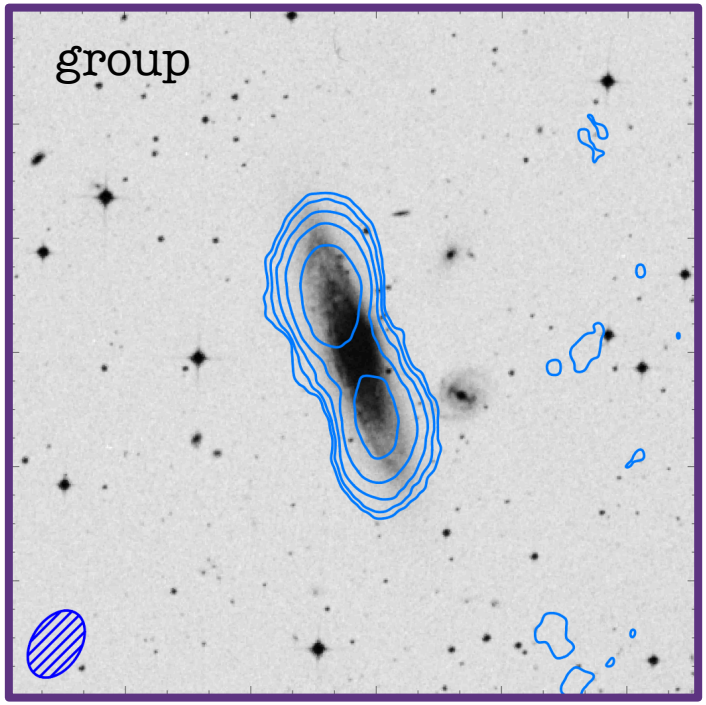
- ✧ Warp
- ✧ HI extension





NGC 6808 – HST image

NGC 1515



ATCA HI contours overlaid on DSS2 Blue image

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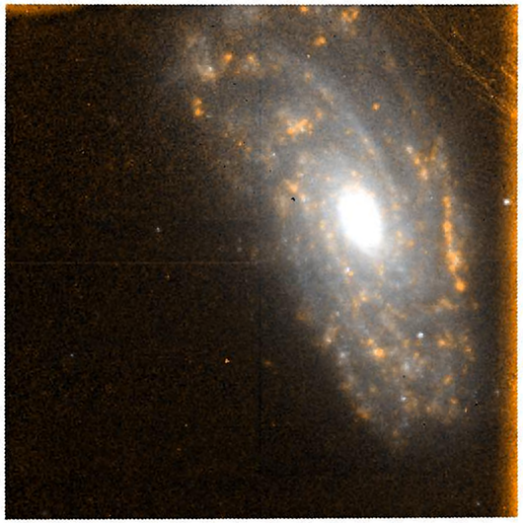

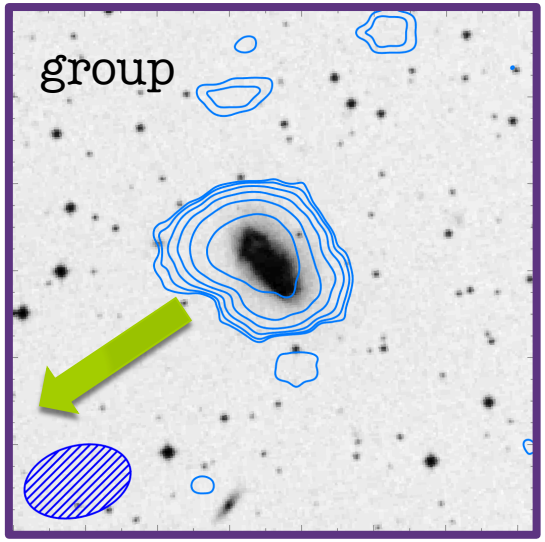

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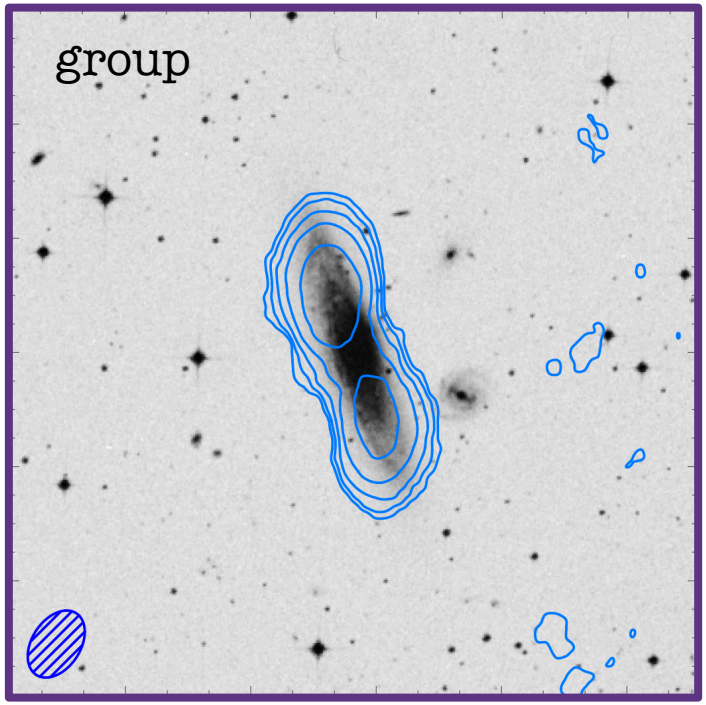
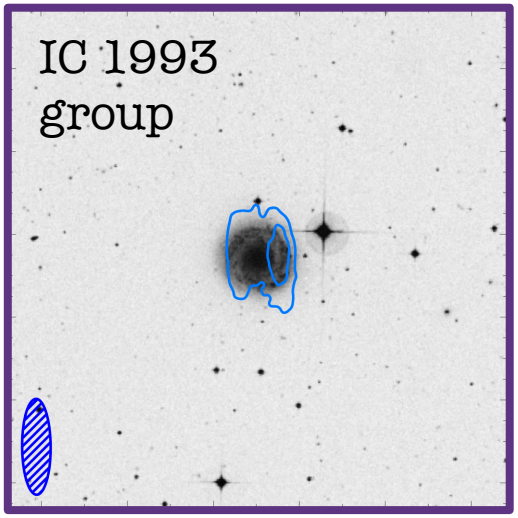
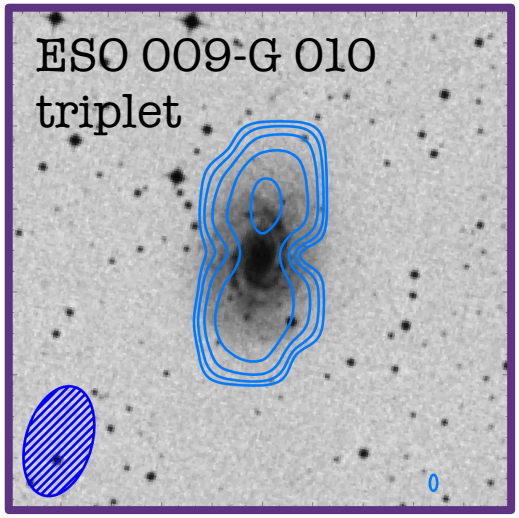
NGC 1515



ATCA HI contours overlaid on DSS2 Blue image

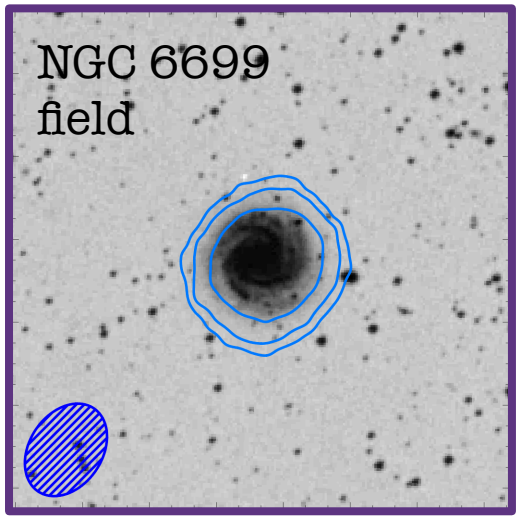
HI DEFICIENT GALAXIES

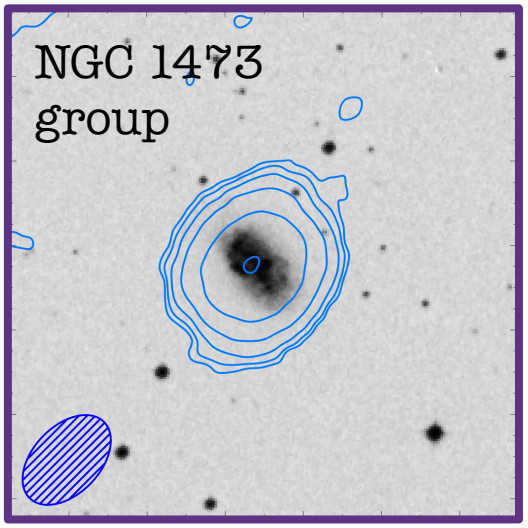




ATCA HI contours overlaid on DSS2 Blue image

- need higher resolution observations
- 62 hours observing in next semester





HI EXCESS GALAXIES

Observing the **20 most HI rich galaxies**

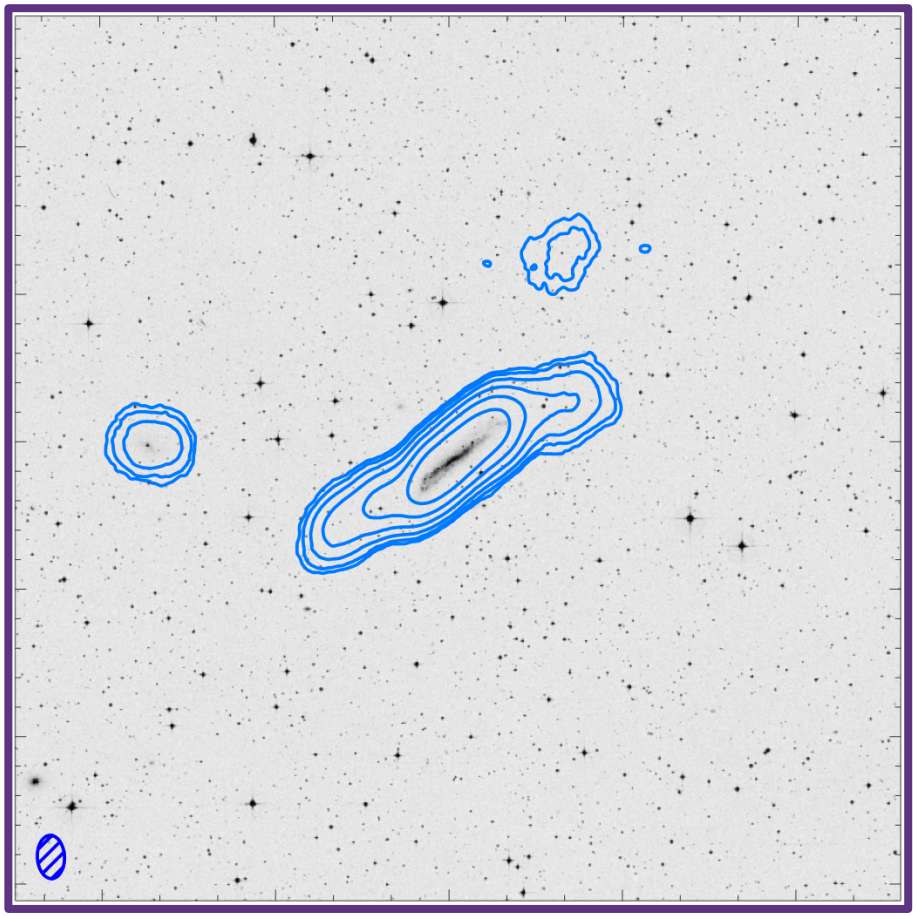
169.5 hours OBSERVED
With ATCA

A big galaxy, a smaller galaxy and an HI cloud:

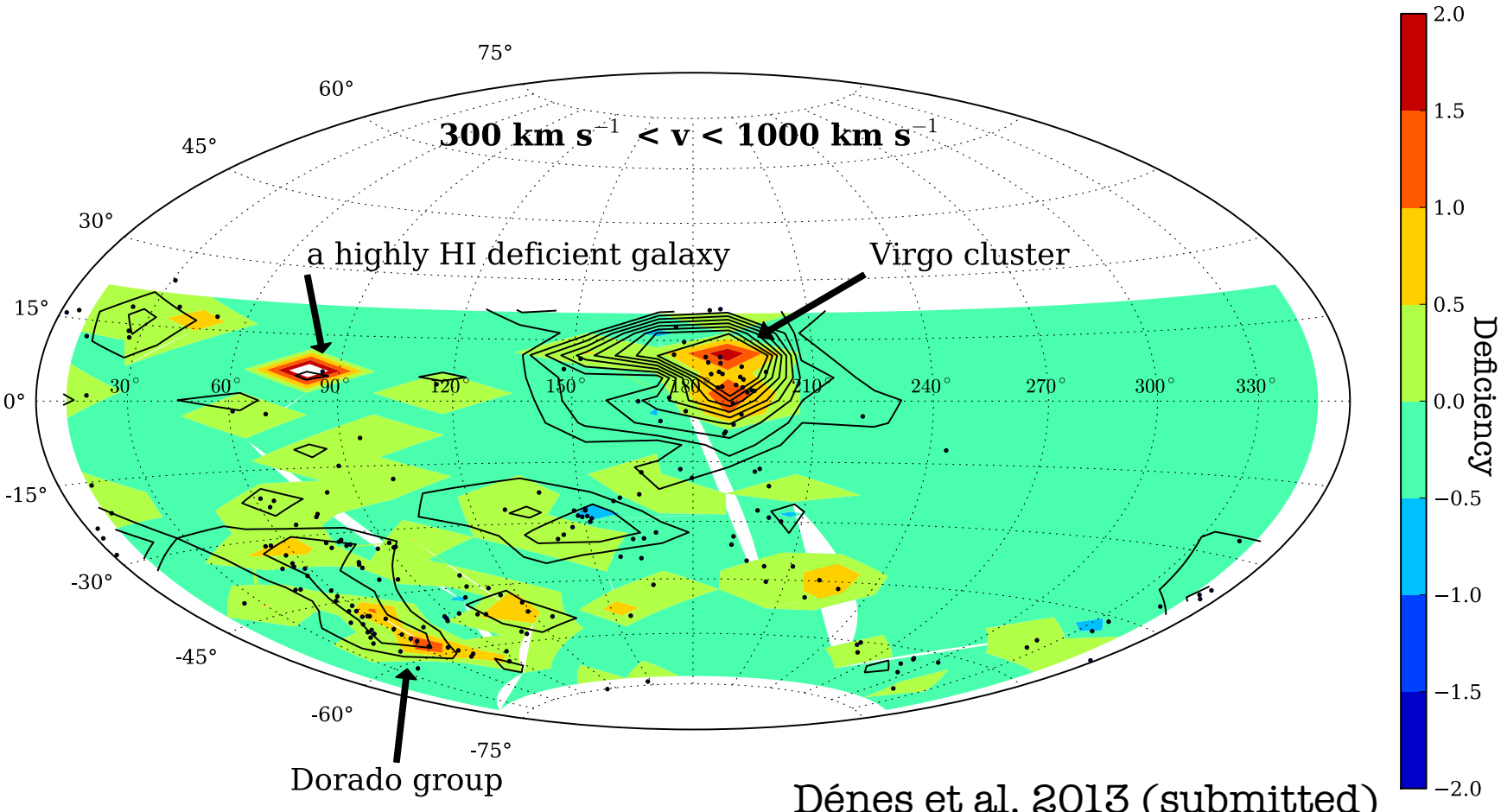
- 2-4 times more HI than expected
- HI mass: 4.06 x 10^9 $M_\odot$
- Warped HI disk
- In a galaxy group

- Small galaxy:
  - 47 kpc (projected) distance
  - HI mass: 1.96 x 10^8 $M_\odot$

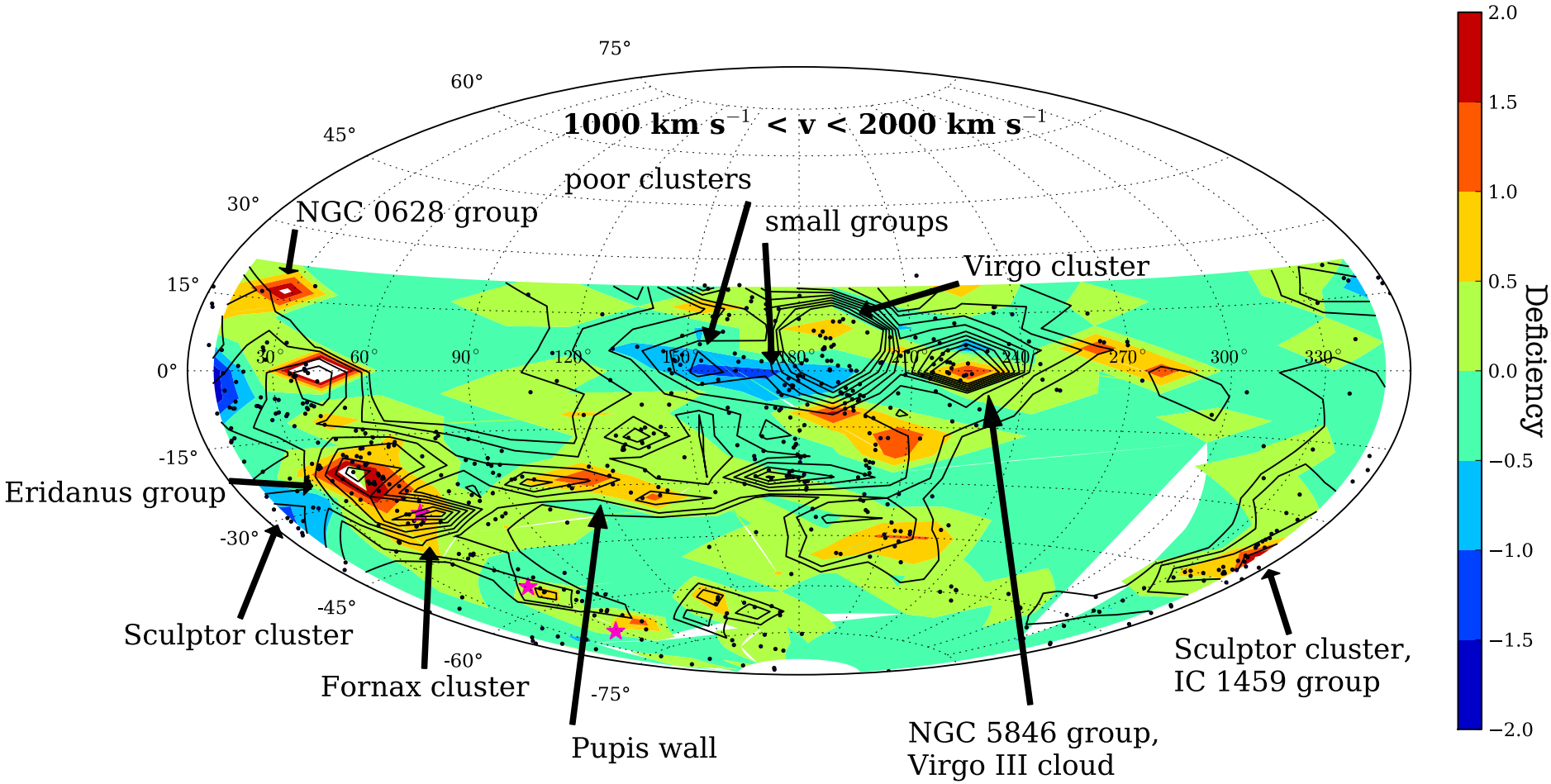
- HI cloud:
  - 46.83 kpc (projected) distance
  - HI mass: 2.3 x 10^8 $M_\odot$



WHERE DOES IT HAPPEN?



Dénes et al. 2013 (submitted)



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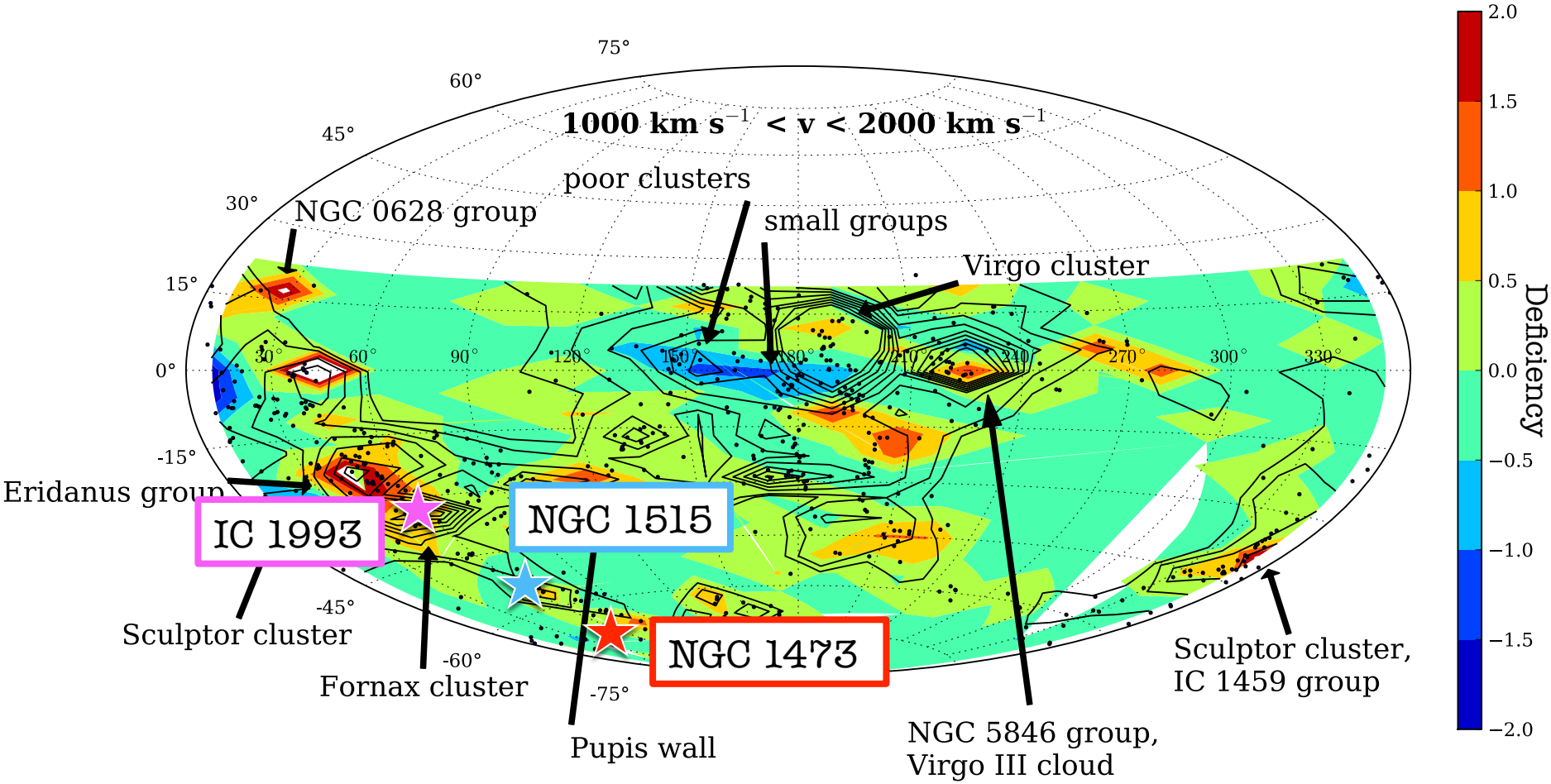
HI-deficient regions correlate with high density regions
HI-excess regions correlate with the edges of dense regions



Dénes et al. 2013 (submitted)

HI-deficient regions correlate with high density regions
HI-excess regions correlate with the edges of dense regions

CONCLUSIONS

- Scaling relations between the HI content of galaxies and their optical/infrared properties are useful tools to identify HI deficient and HI excess galaxies.

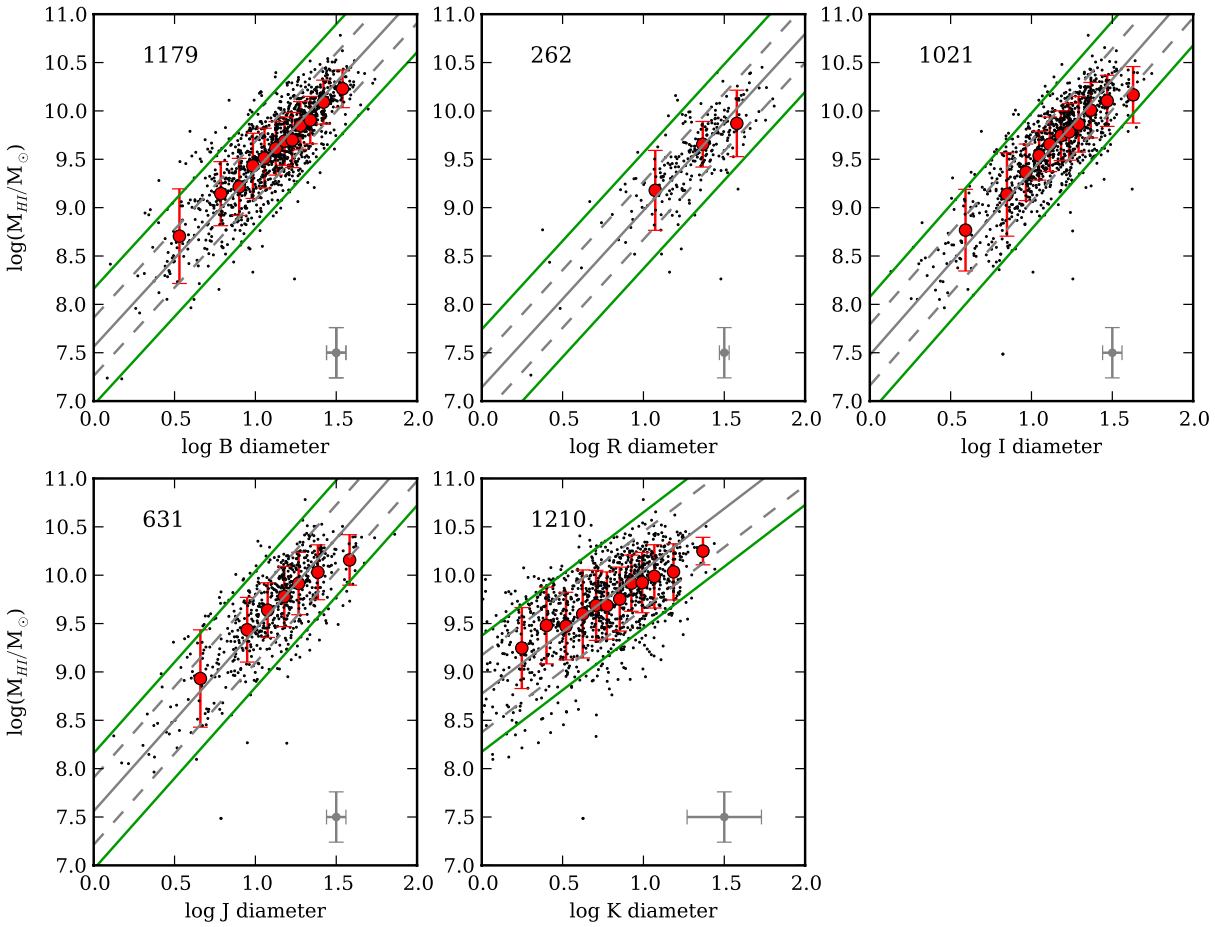
- HI deficient galaxies are not just found in dense clusters, but also in galaxy groups and in the field.

- We can map the global distribution of the HI-deficient and HI-excess galaxies. HI-deficient regions correlate with high density regions and HI-excess regions correlate with the edges of dense regions.

THANK YOU!

SCALING RELATIONS

HI mass – diameters (B-K bands)



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