Global HI properties of galaxies in the Southern Sky

Helga Dénes

Coordinating Supervisor: Virginia Kilborn
Associate Supervisor: Bärbel Koribalski

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Outline

- Introduction
  - About the HI content of galaxies

- Calculating the expected HI mass of galaxies
  - Looking into predicting the HI content of galaxies
  - First sample of HI deficient galaxies

- Future aspects
  - Wallaby applications

About the HI content in galaxies

- As a tracer of potential star formation, the neutral hydrogen (HI) content can be used to track evolutionary processes within a galaxy.

- The HI content of a galaxy can also be used as a tracer for environmental effects ⟶ HI is the most easily disturbed ⟶ helping us to understand the effects of environment on the evolution of spiral galaxies.

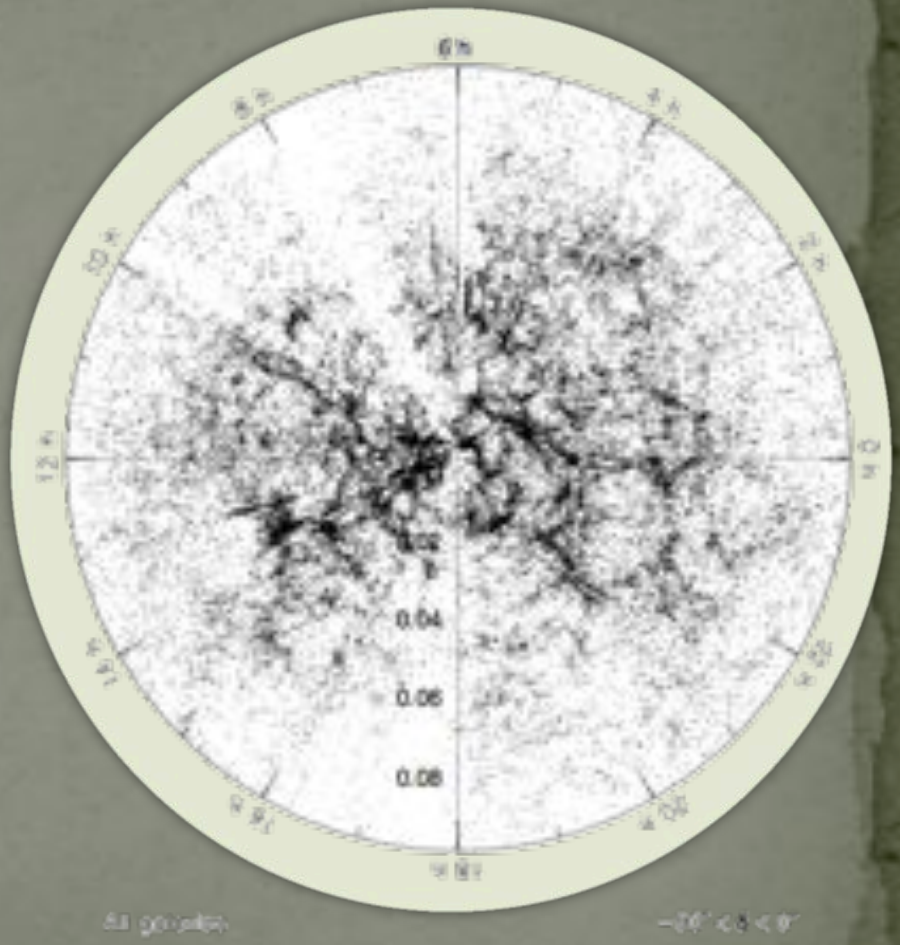
- Early type galaxies usually don't have much HI
- Usually we can only detect HI in late type galaxies

Environment

Half of the galaxies is in clusters or groups *(Eke et al. 2004)*

- Galaxy **clusters**:
  - More early type galaxies
  - HI deficiency first discovered in clusters
  - Late type galaxies in clusters tend to have less HI
  - Filled with hot intergalactic gas

- Some galaxies in **groups** also have less HI
  - mainly tidal interactions
  - but also ram pressure stripping possible *(candidates: NGC 300 in the Sculptor group, NGC 2276 in the NGC 2300 group)*



6dF – *Jones et al., 2004*

Calculating the expected HI mass

- Calculating the HI mass: $M(HI) = 2.36 \cdot 10^5 D^2 \int S\Delta V$

- Correlation between the HI content of a galaxy and it's optical/infrared diameter and flux.
  (depending on available data)
- Calculating the expected HI mass:

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

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

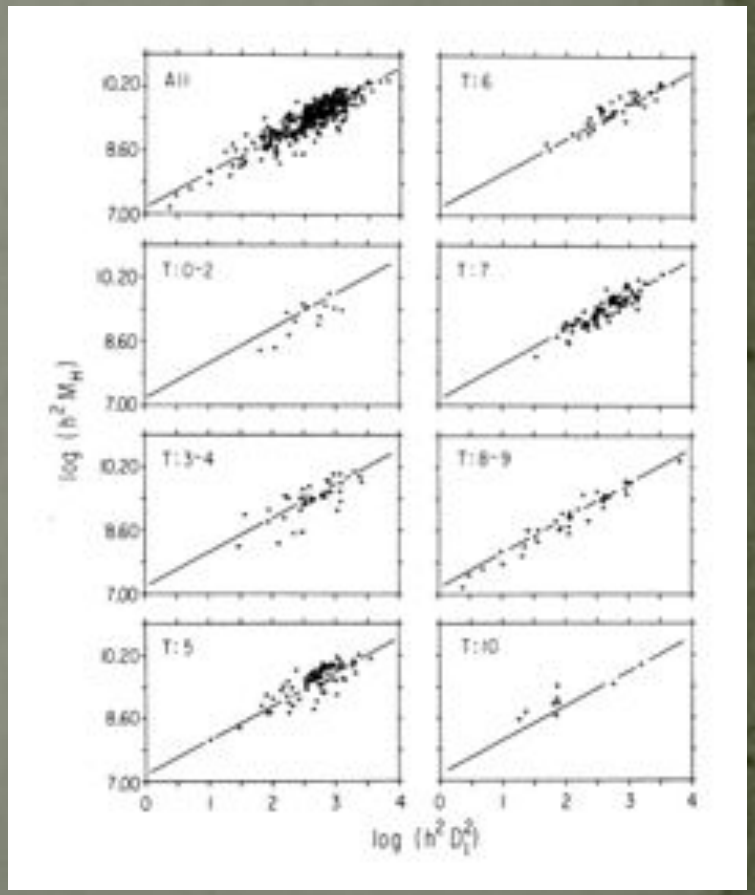
Haynes and Giovanelli (1984), Chamaraux et al., (1986)
Solanes et al. (1996), Kilborn et al. (2005)
Toribio et al. (2011)

Catinella et al. (2010)

- The HI "deficiency factor":

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

(Haynes et al., 1984)

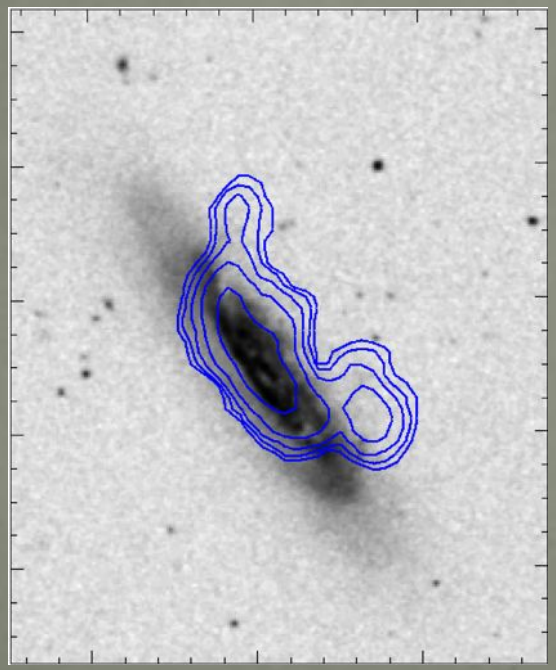


(Haynes et al., 1984)

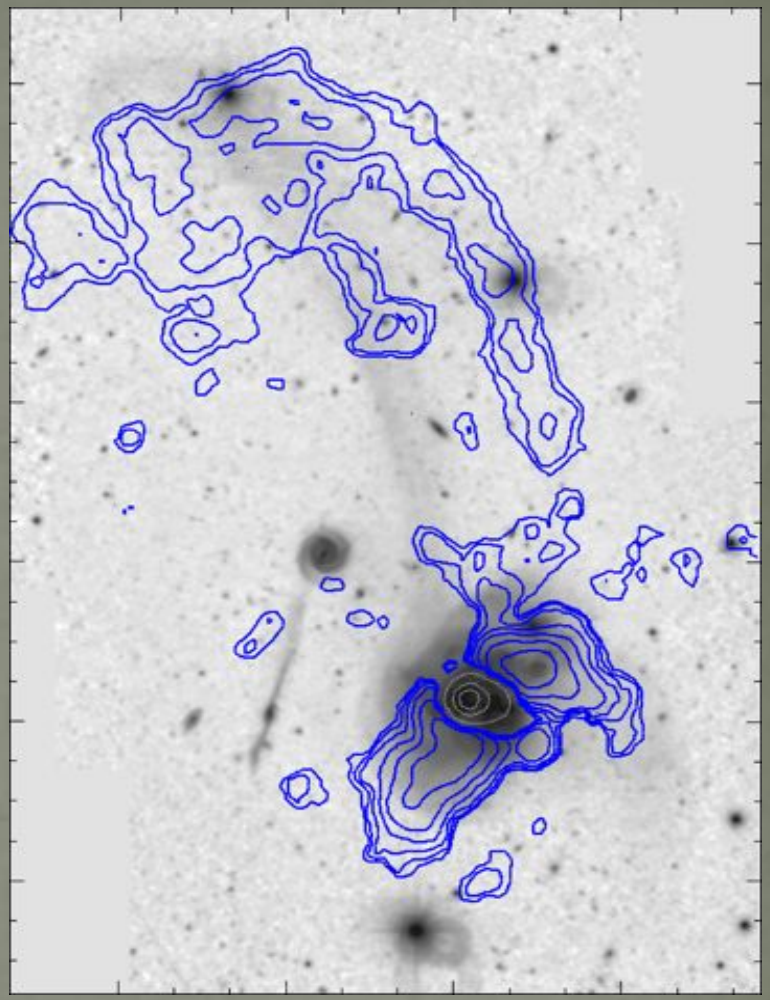
HI deficient galaxies

Possible HI stripping mechanisms:

- ✧ galaxy-galaxy collision
- ✧ tidal interactions
- ✧ ram pressure stripping
- ✧ evaporation
- ✧ gas removal from within the disc



NGC 4522
Ram pressure stripping
Kenney et al. 2004



Arp 299
Interacting galaxies
Hibbard & Yun, 1999

My project

- I'm working on a way estimate the HI content of galaxies from their optical and infrared properties.
- Aiming for a morphology independent, reliable method to estimate the expected HI content of galaxies in the southern sky.

- I will calculate the expected HI content of all the galaxies in the 6dF galaxy catalogue (Jones at el., 2009) in the velocity range of the HI Parkes All-Sky Survey (HIPASS), -1280 to 12700 km s–1 (Barnes et al. 2001).

- I will define a sample of interesting galaxies (HI deficient, HI excess) and investigate them in more detail to learn more abut these curios objects.

- Investigate the environmental effects on the HI content of galaxies.

- Making predictions for Wallaby, what we expect to detect.

The HI Parkes All-Sky Survey (HIPASS)

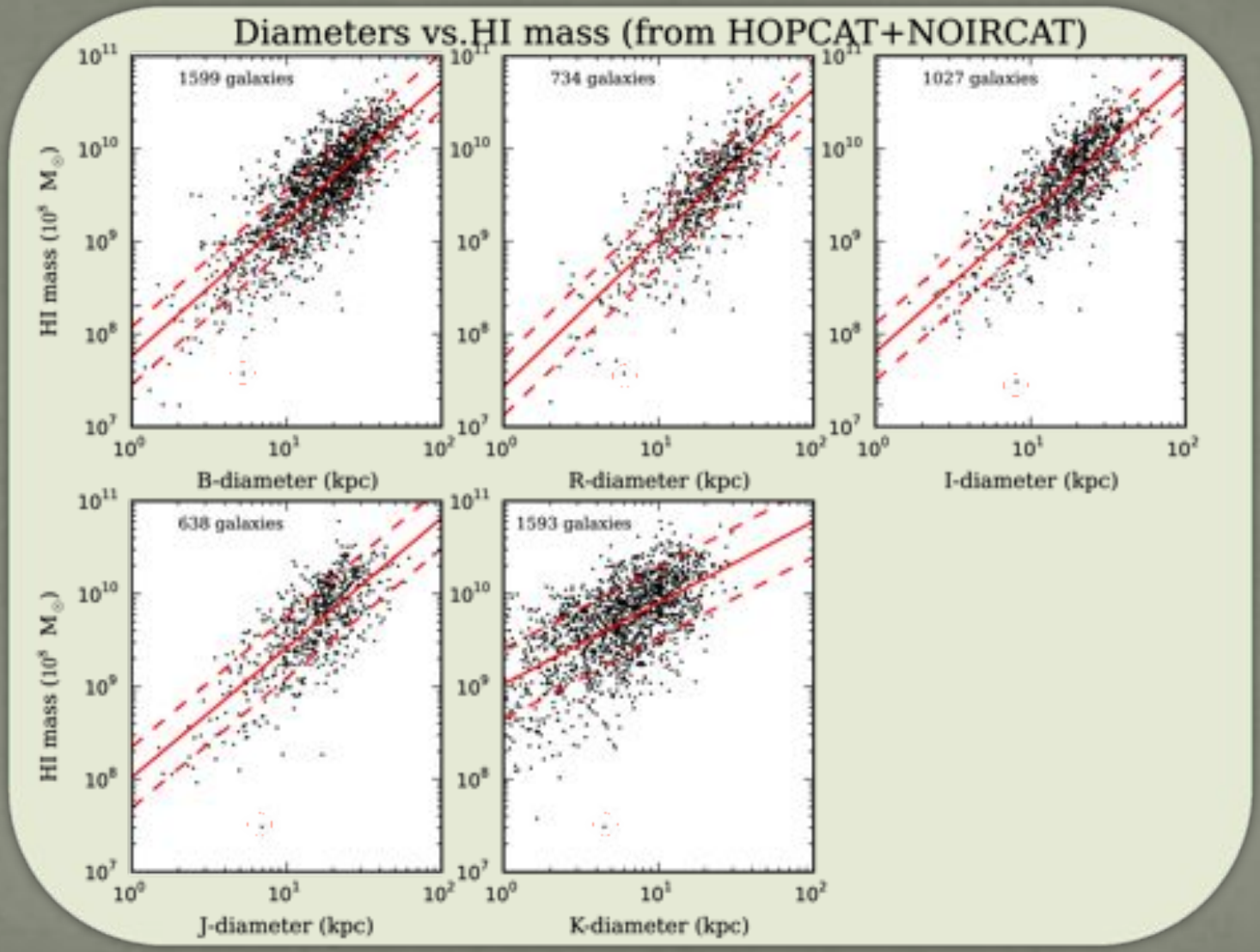
64 m Parkes telescope (1997-2002)
Velocity range: -1280 to 12700 km/s
Declination range: -90° to +25°
5317 sources
Beam size: 15.5 arcmin
Velocity resolution of 18 km/s

Available data

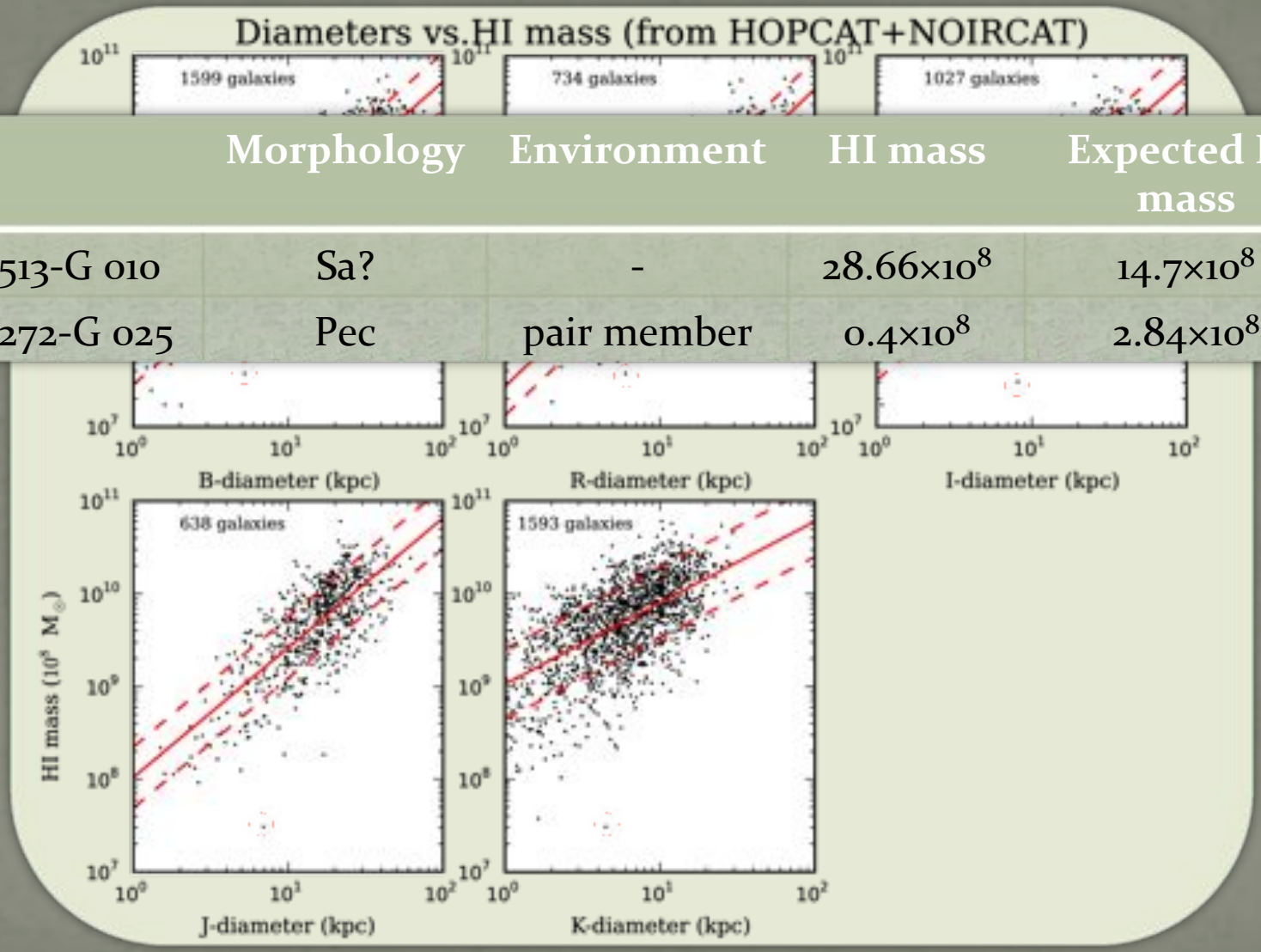
HICAT *(Meyer et al., 2004)*
– 4315 sources 1756 galaxies with reliable counterparts (*Doyle et al., 2005)*
B, R, I magnitudes from SuperCosmos
Diameters: B, R, I , J, 2MASS – K

NHICAT *(Wong et al., 2006)*
– 1001 extragalactic sources 530 galaxies with reliable counterparts *(Wong et al., 2009)*
from which 416 have 2MASS conterparts

Diameter – HI mass plots

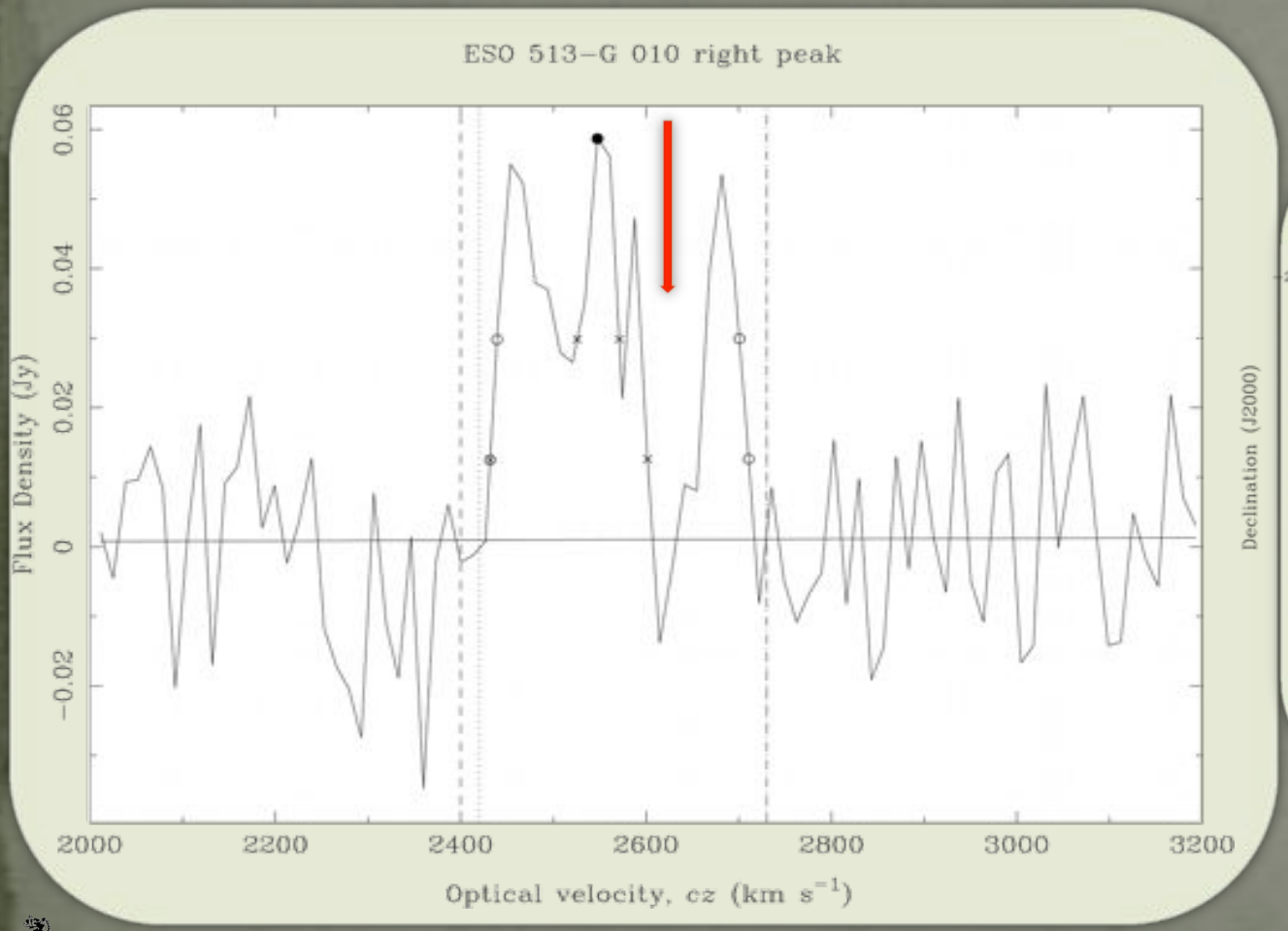


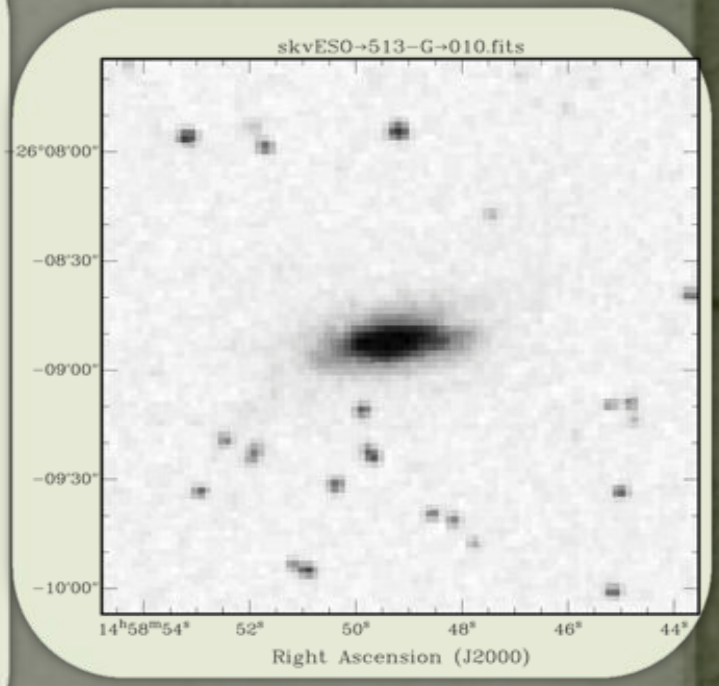
Diameter – HI mass plots



	Morphology	Environment	HI mass	Expected HI mass
ESO 513-G 010	Sa?	-	28.66×10^8	14.7×10^8
ESO 272-G 025	Pec	pair member	0.4×10^8	2.84×10^8

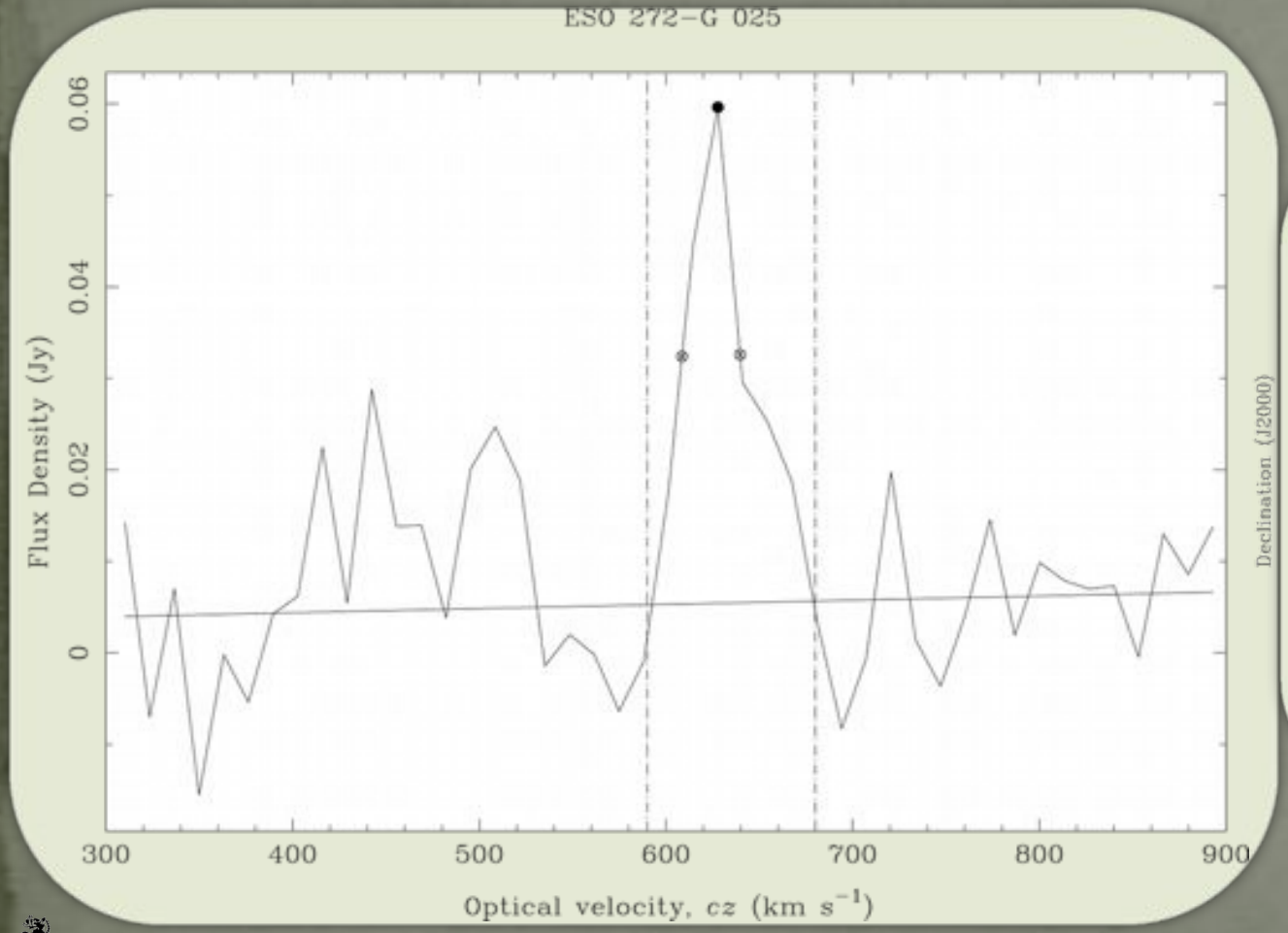
HI deficient candidate galaxies
ESO 513-G 010

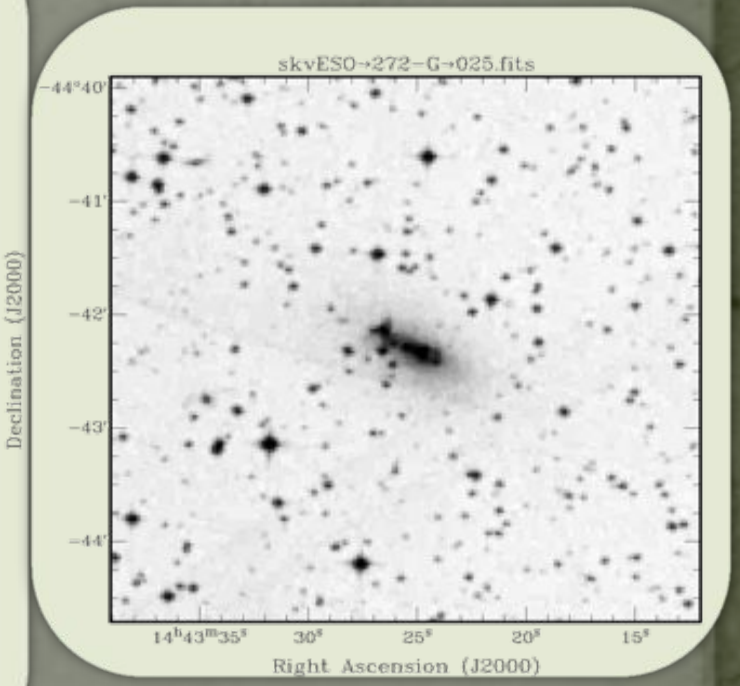




DSS2 - blue

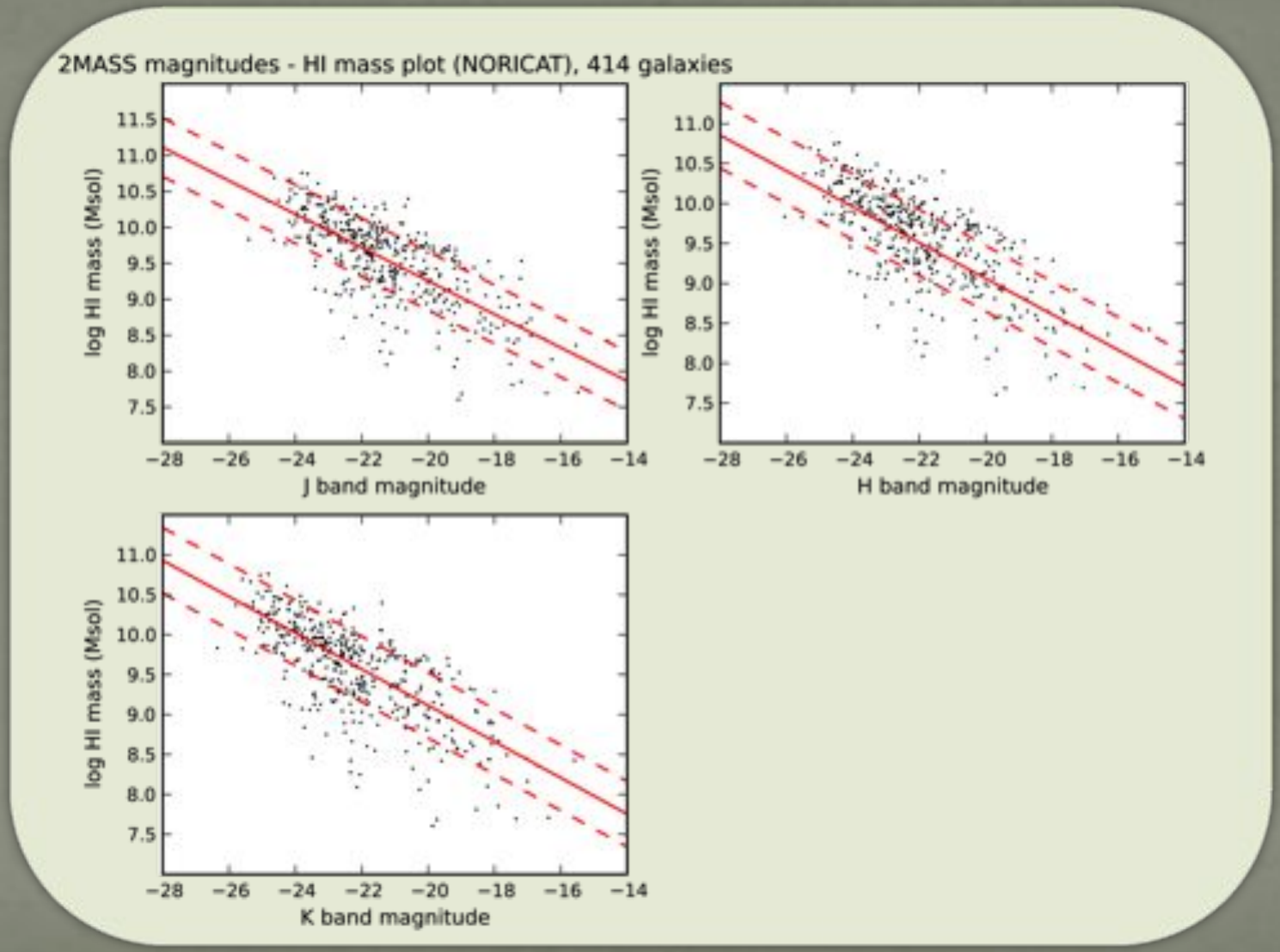
HI deficient candidate galaxies
ESO 272-G 025



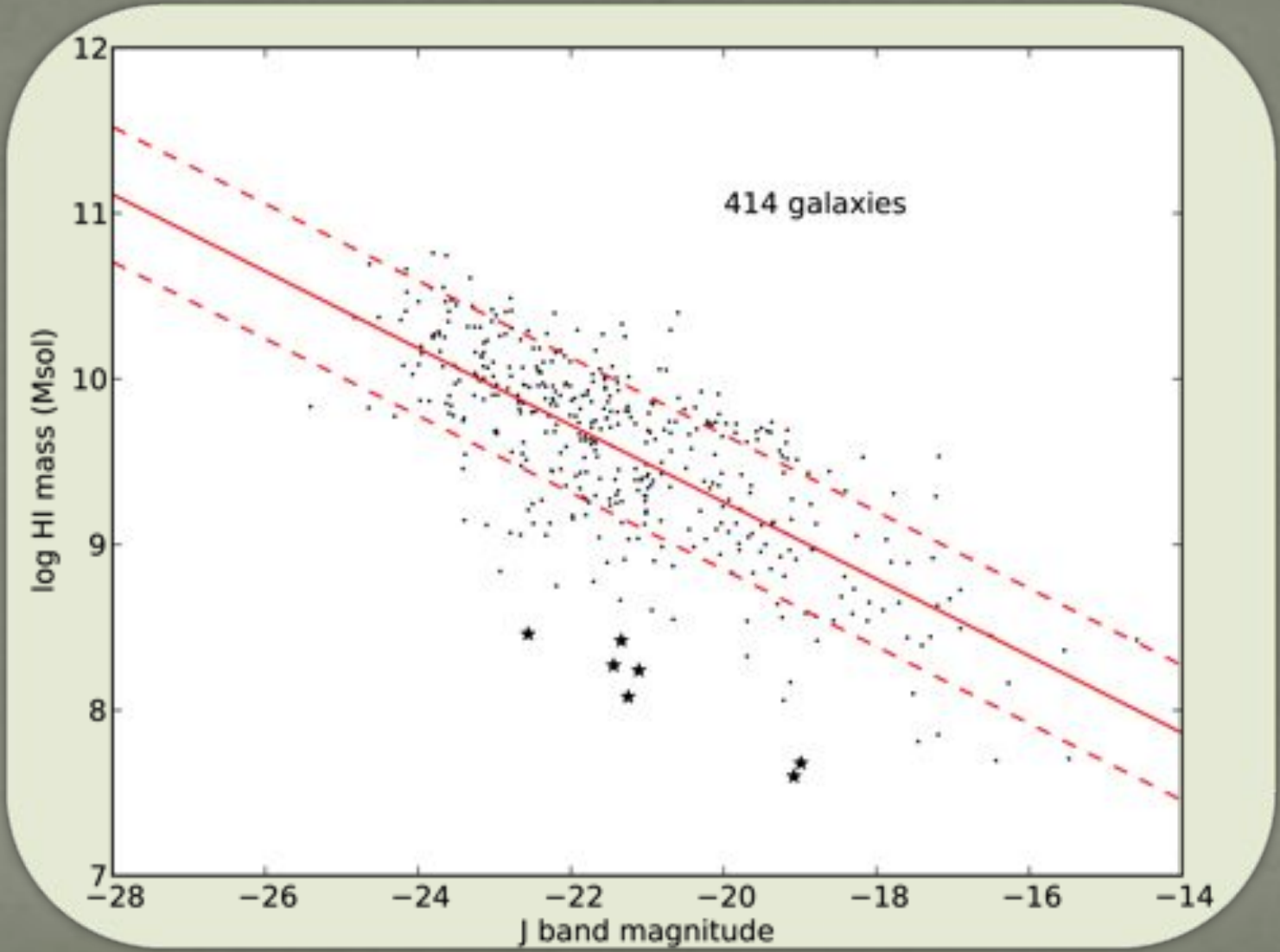


DSS2 - blue

2MASS magnitudes – HI mass plot (NHICAT)



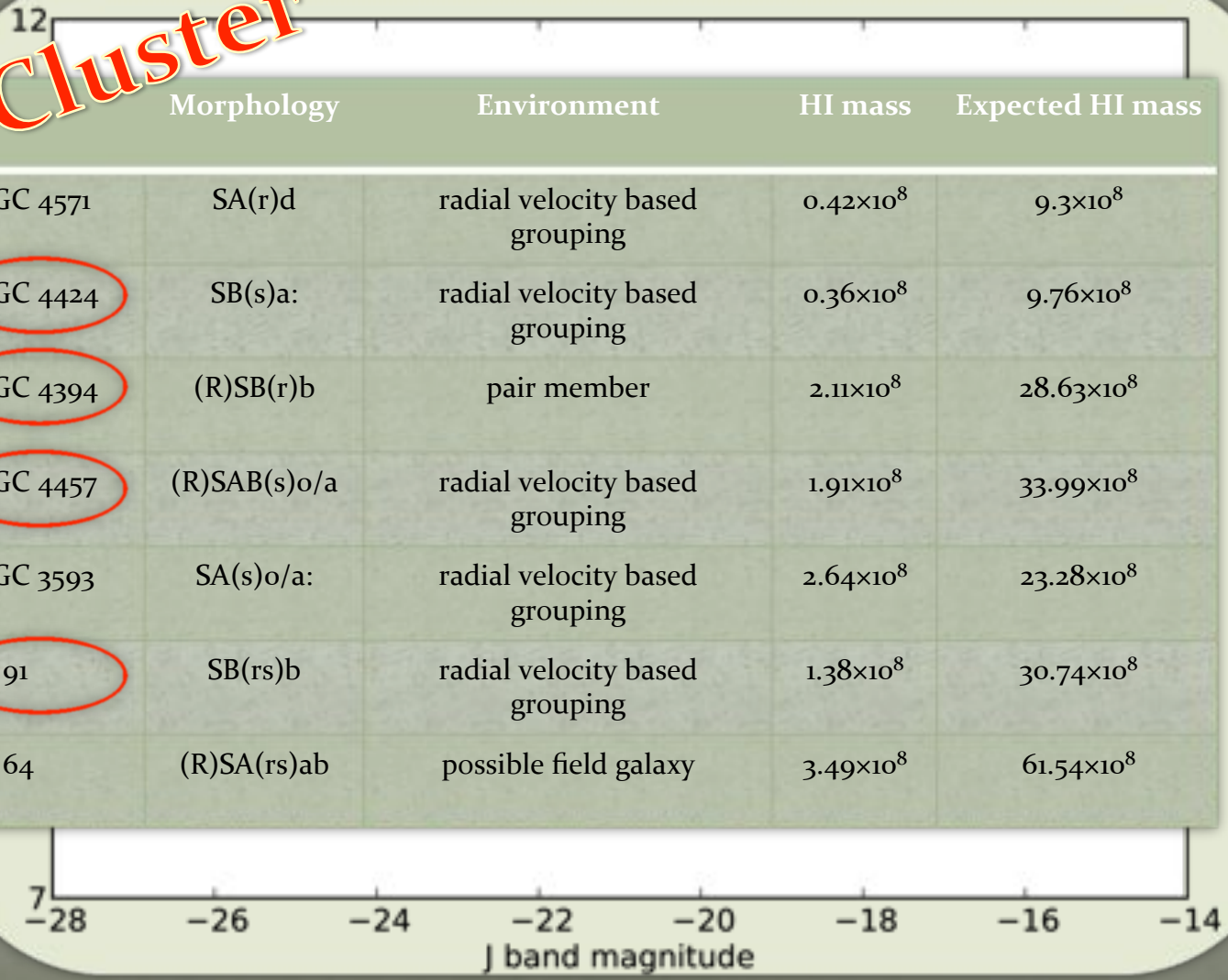
J-band magnitude – HI mass plot (NHICAT)



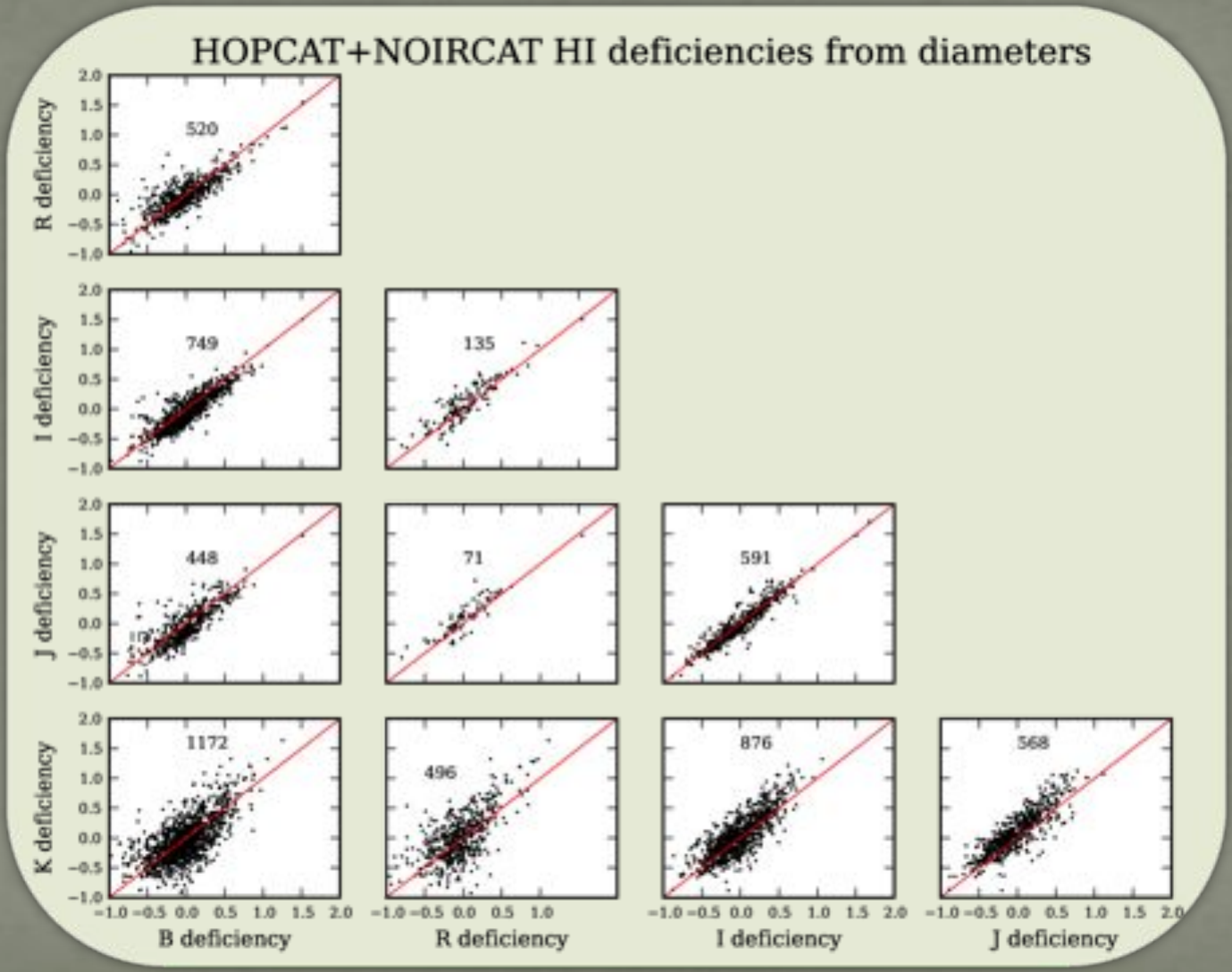
J-band magnitude – HI mass plot (NHICAT)

Virgo Cluster

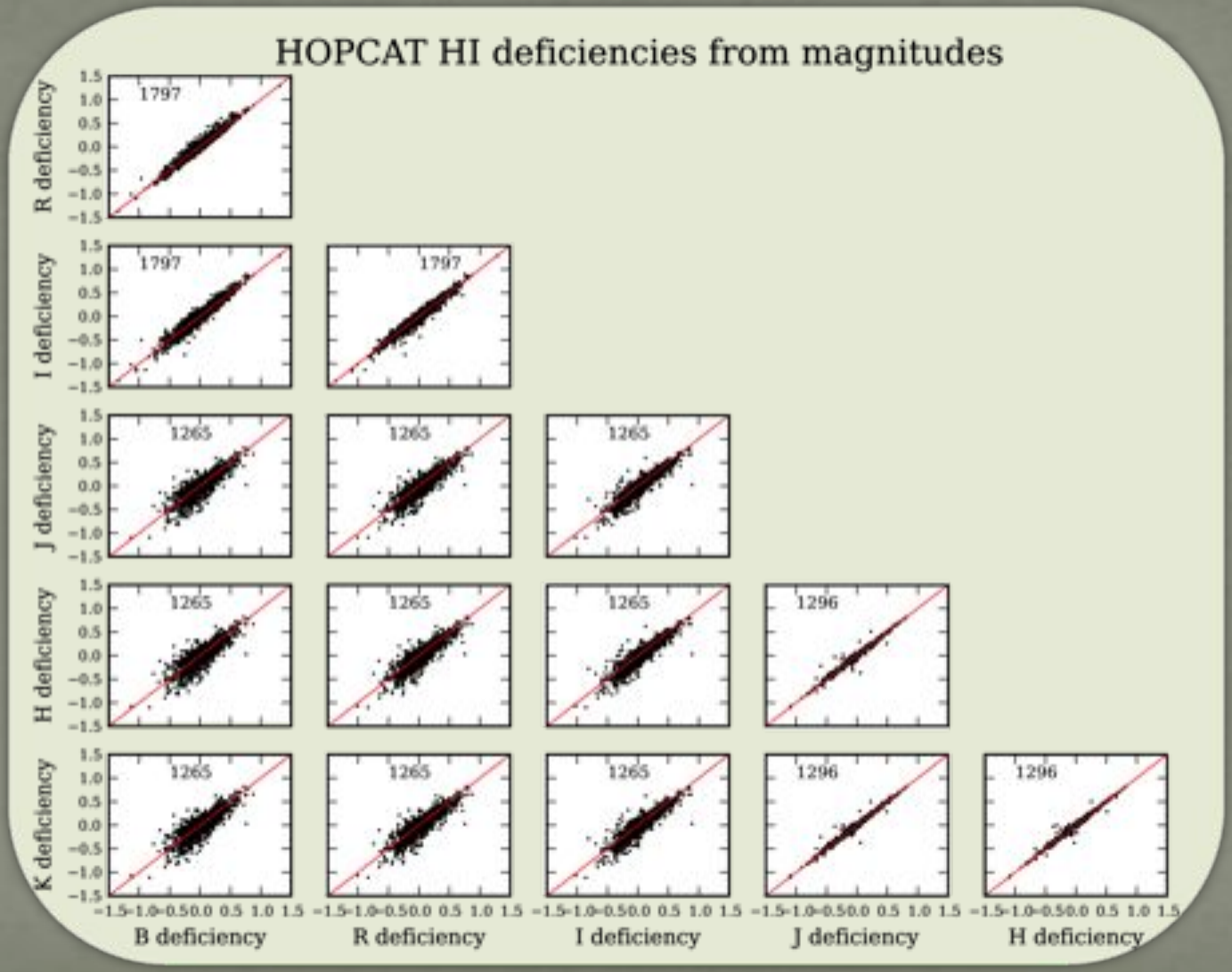
		Morphology	Environment	HI mass	Expected HI mass
	NGC 4571	SA(r)d	radial velocity based grouping	0.42×10^8	9.3×10^8
Trunctuated	NGC 4424	SB(s)a:	radial velocity based grouping	0.36×10^8	9.76×10^8
Anemic	NGC 4394	(R)SB(r)b	pair member	2.11×10^8	28.63×10^8
Trunctuated	NGC 4457	(R)SAB(s)0/a	radial velocity based grouping	1.91×10^8	33.99×10^8
	NGC 3593	SA(s)0/a:	radial velocity based grouping	2.64×10^8	23.28×10^8
Anemic	M 91	SB(rs)b	radial velocity based grouping	1.38×10^8	30.74×10^8
	M 64	(R)SA(rs)ab	possible field galaxy	3.49×10^8	61.54×10^8



HI Deficiencies



HI Deficiencies



Future aspects

- ★ Producing a catalogue of galaxies we expect to detect with Wallaby – based on 6dF (125 071 galaxies)
- ★ This will be a valuable comparison to the simulated galaxies, which we expect to detect.

Thank you for the attention!