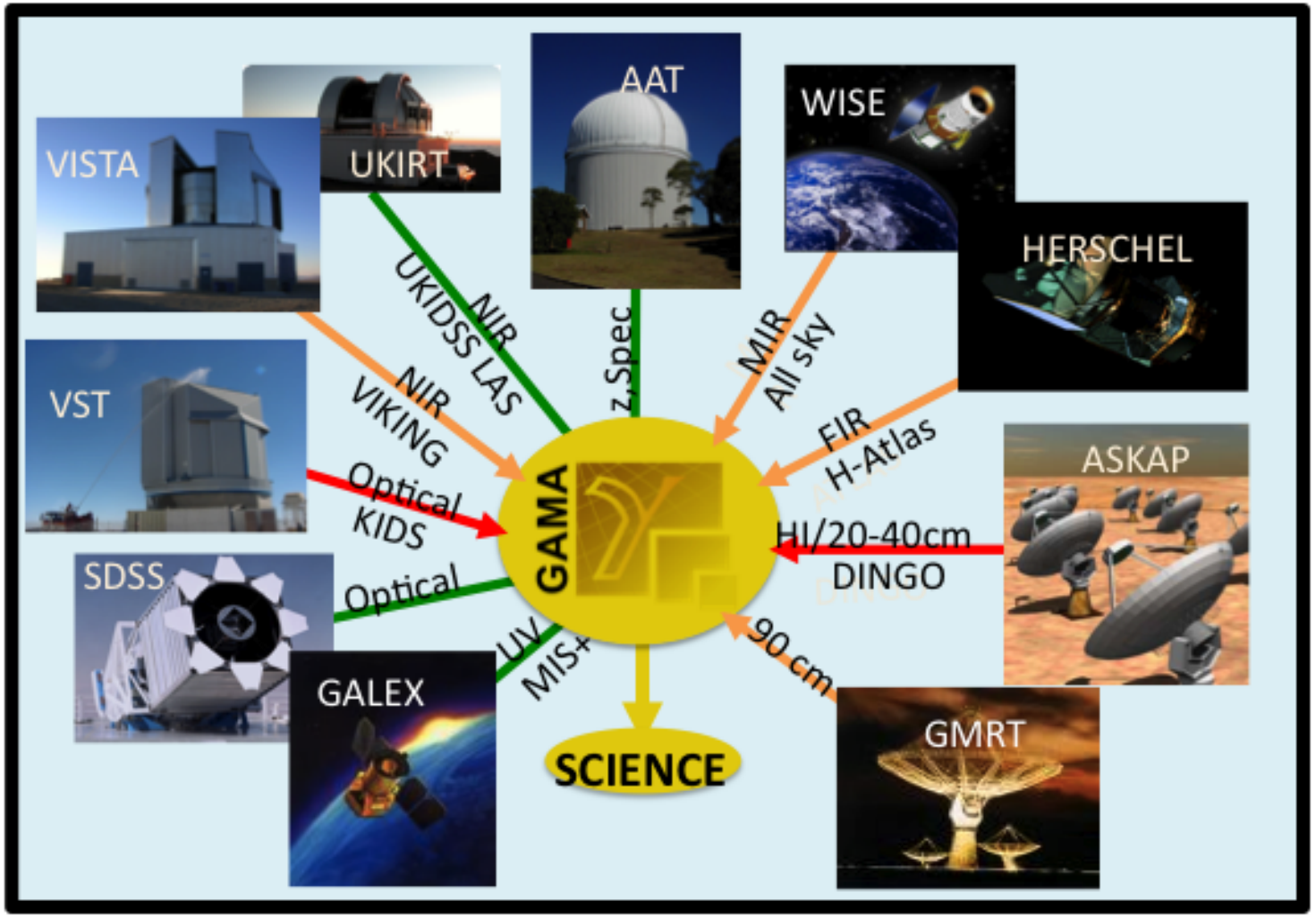
Large scale structure and galaxy formation studies with the Galaxy And Mass Assembly survey



Peder Norberg

Institute for Computational Cosmology, Durham University

Talk Overview

- Introduction to GAMA
- LSS with GAMA:
  - Angular clustering with GAMA calibrated z_{ph}
    → sensitivity to data systematics (in SDSS)
  - Redshift space clustering as f(z,M_*,colour)
    → test for systematics in f_g modelling
  - [Galaxy groups with spatially complete GAMA
    → test of ΛCDM and the halo model]
- Beyond LSS with GAMA:
  - why GAMA is “the” galaxy formation survey

GAMA Team/Collaboration

Galaxy And Mass Assembly Survey:
the redshift survey in a nutshell (2008-201?)

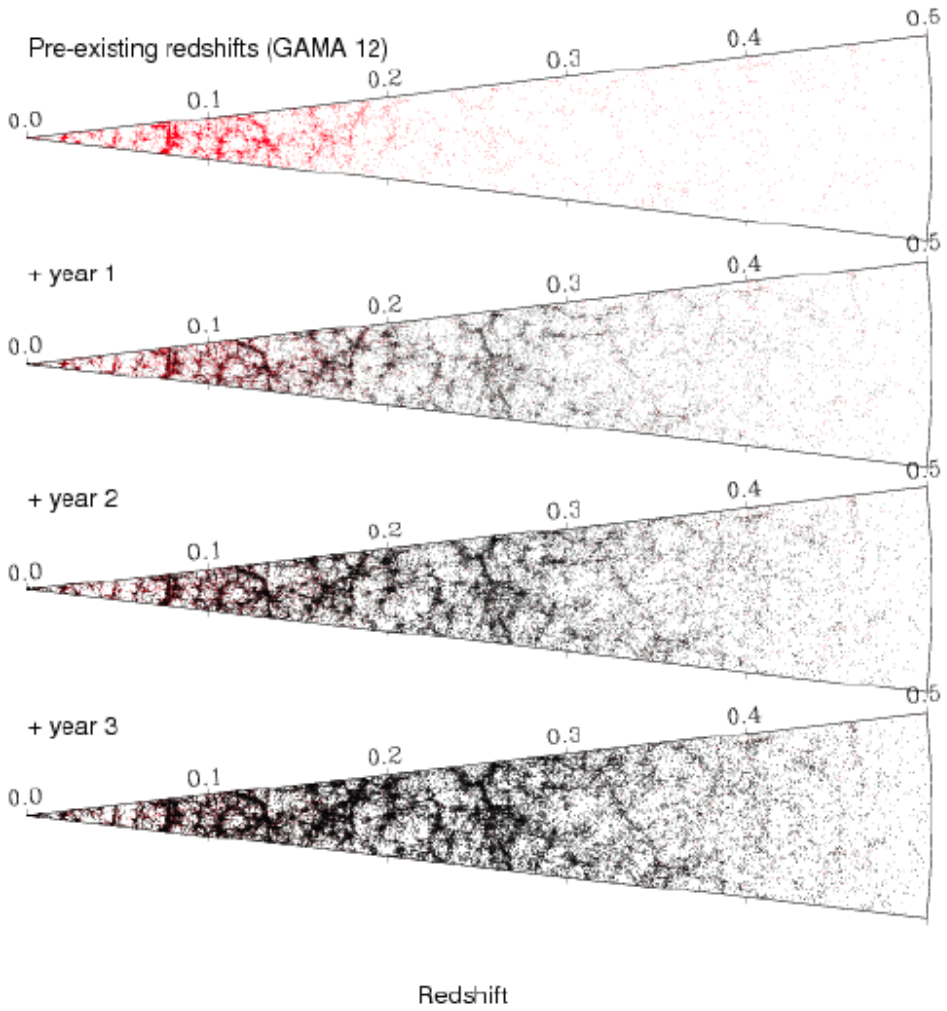
z-survey 2mags deeper than SDSS

5/6 regions all RA

350,000 galaxies

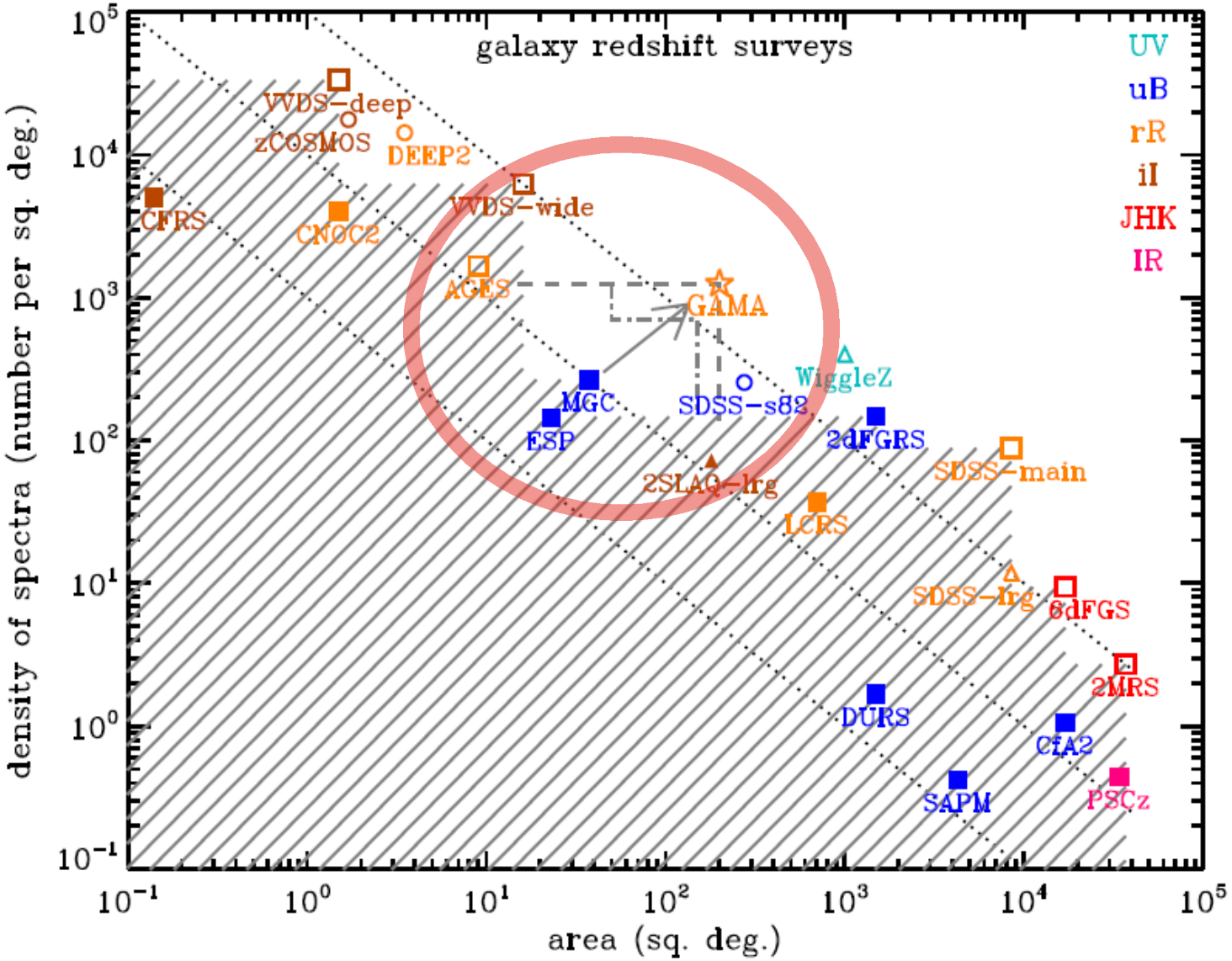
z<0.5

Giants to LMC range

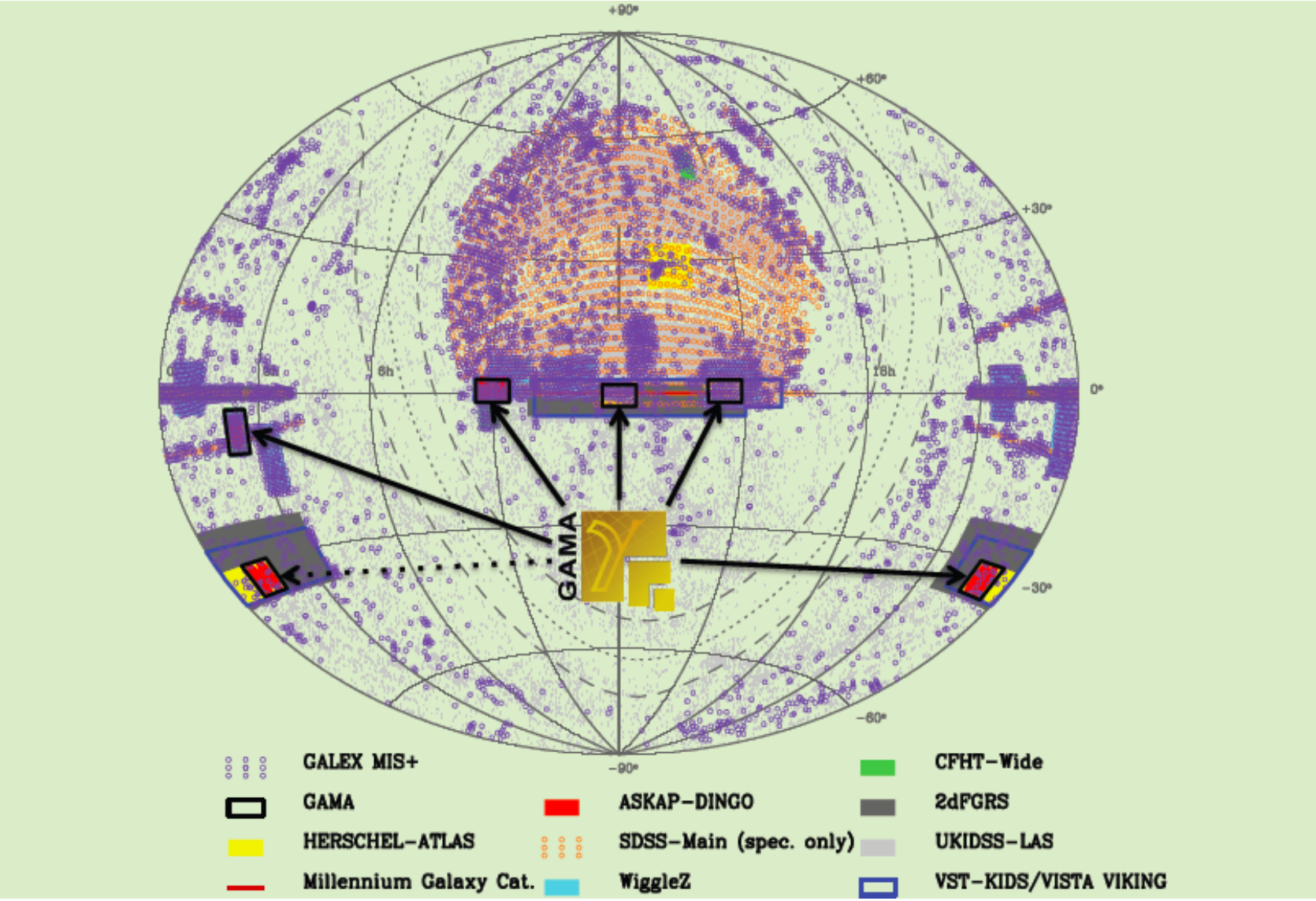


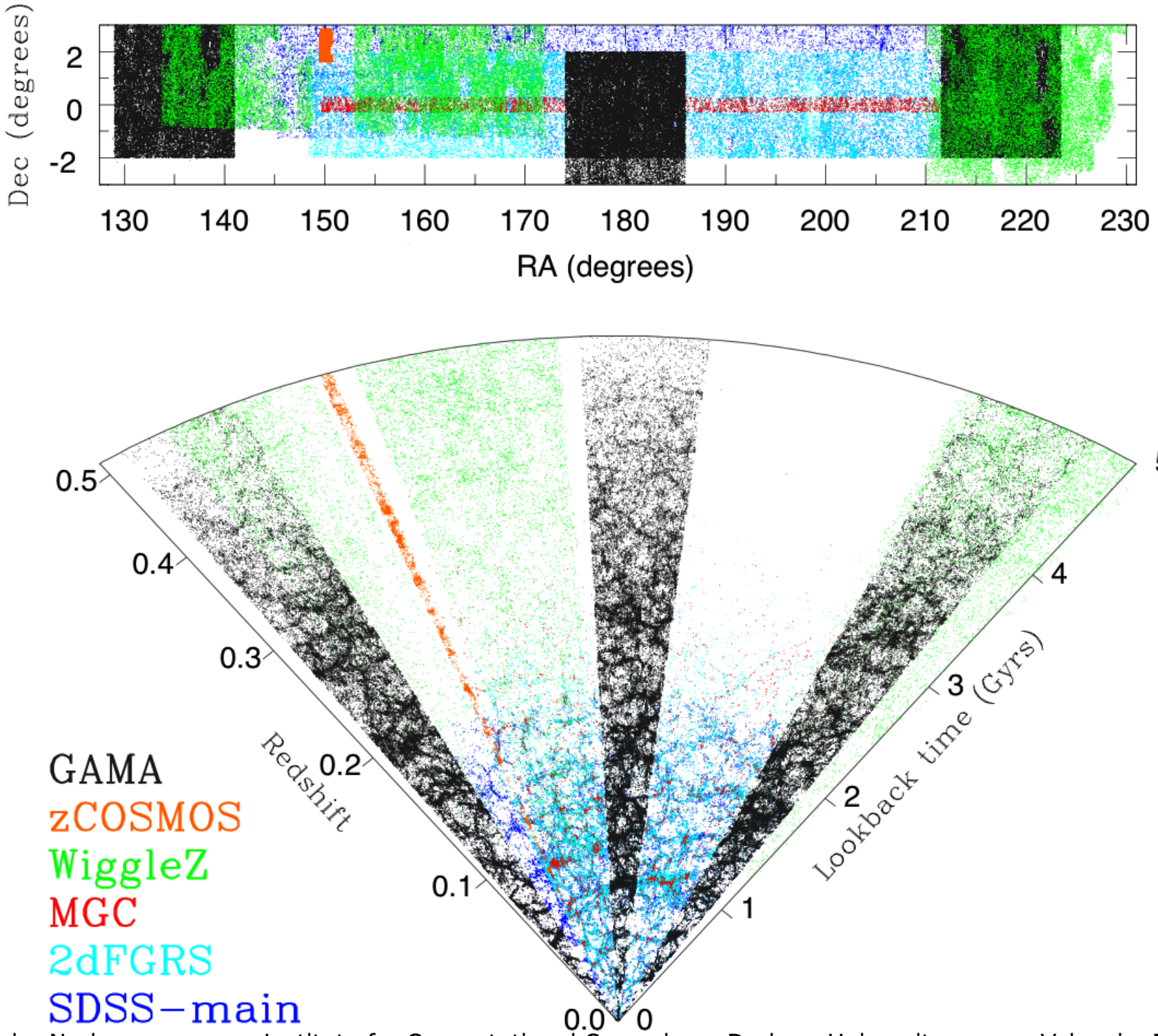
Galaxy And Mass Assembly Survey:

germane connection between shallow-wide & deep-narrow



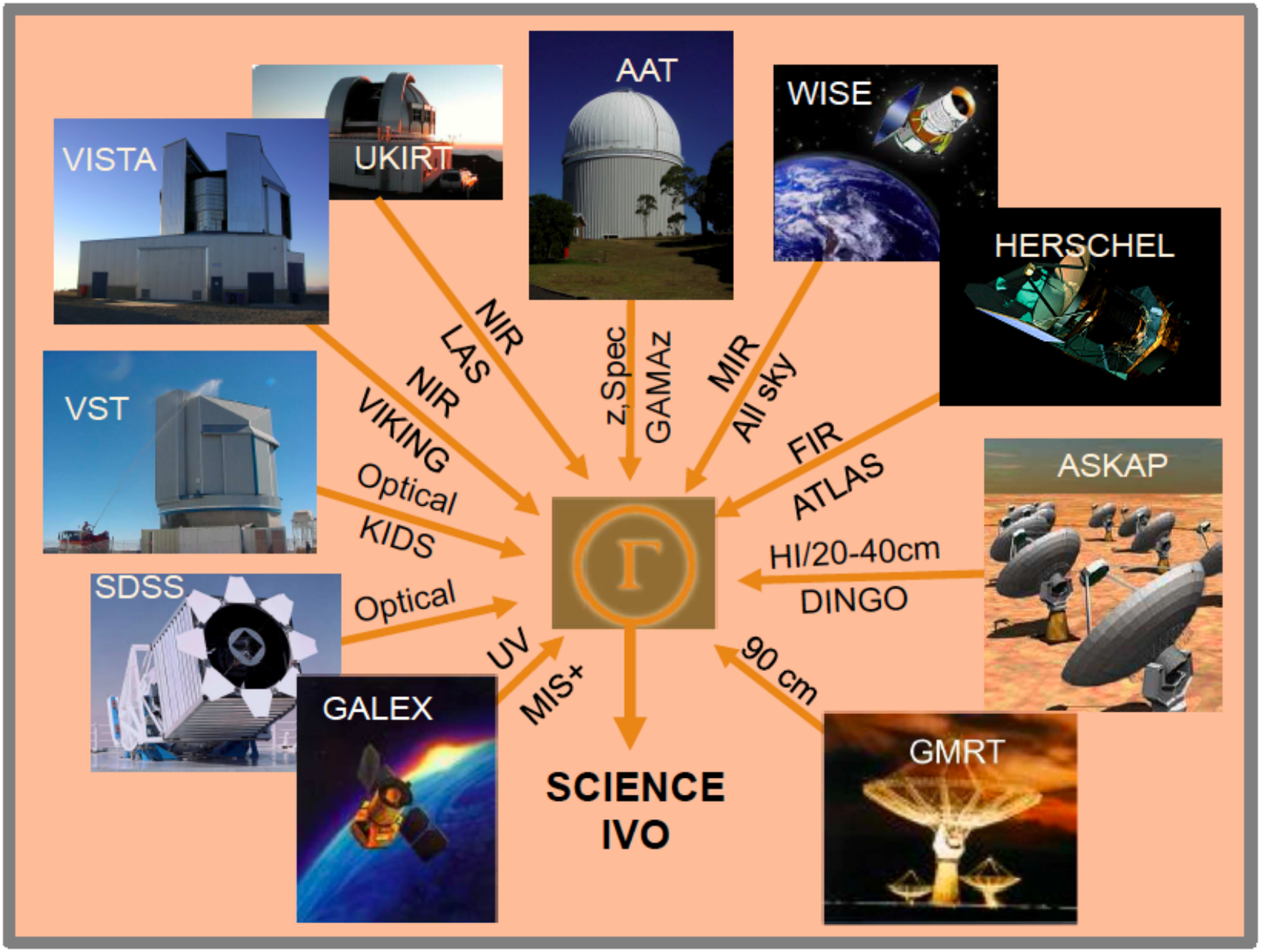
Galaxy And Mass Assembly Survey: where are the fields?




Dec (degrees)
2
0
-2
130
140
150
160
170
180
190
200
210
220
230
RA (degrees)
0.5
0.4
0.3
0.2
0.1
0.0
Redshift
0
1
2
3
4
5
Lookback time (Gyrs)
GAMA
zCOSMOS
WiggleZ
MGC
2dFGRS
SDSS−main

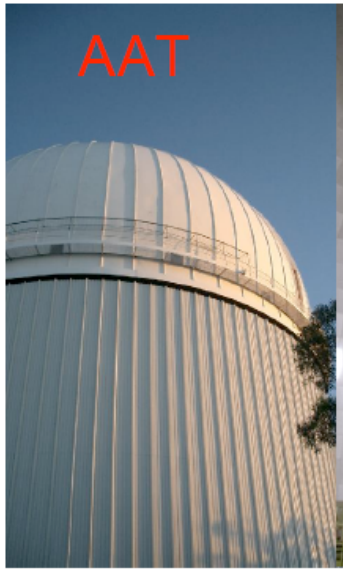
GAMA I

GAMA: Contributing Facilites

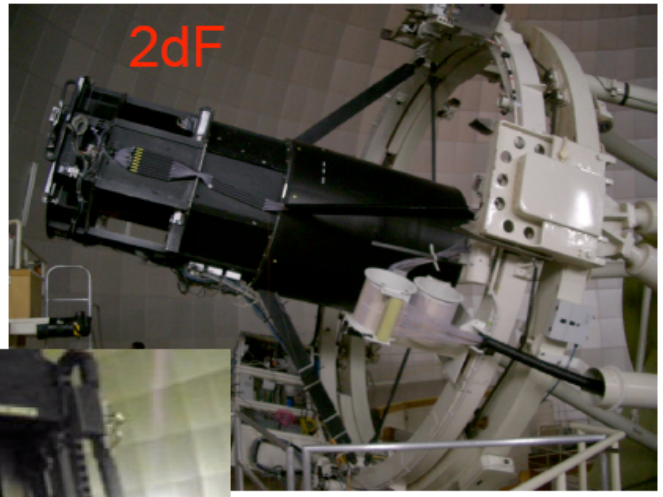


GAMA: Contributing Facilites

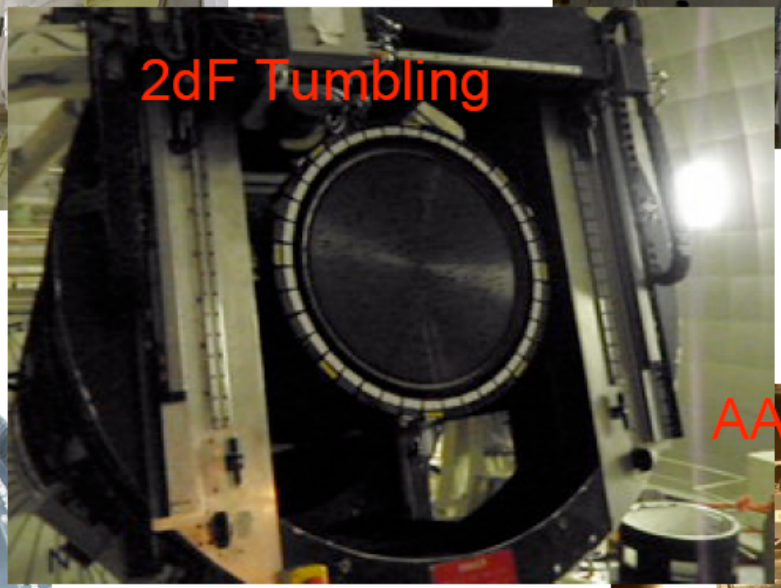
The Anglo-Australian Telescope (3.9m)

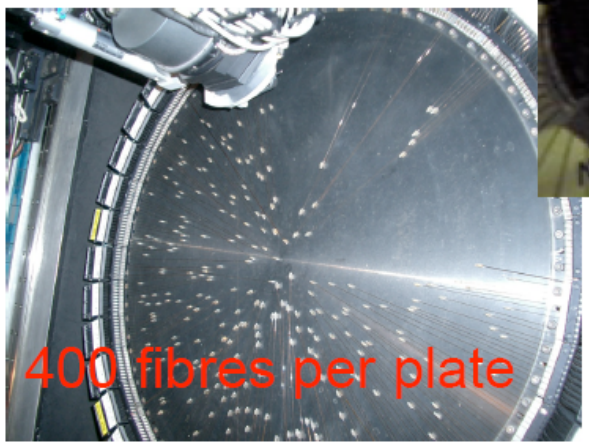


Robotic positioner

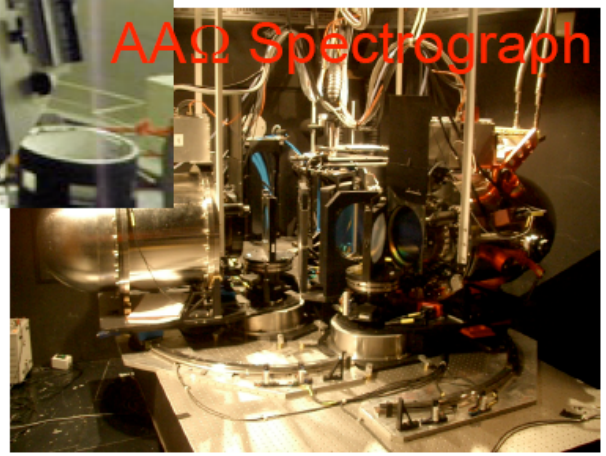


Double-beam spectrograph

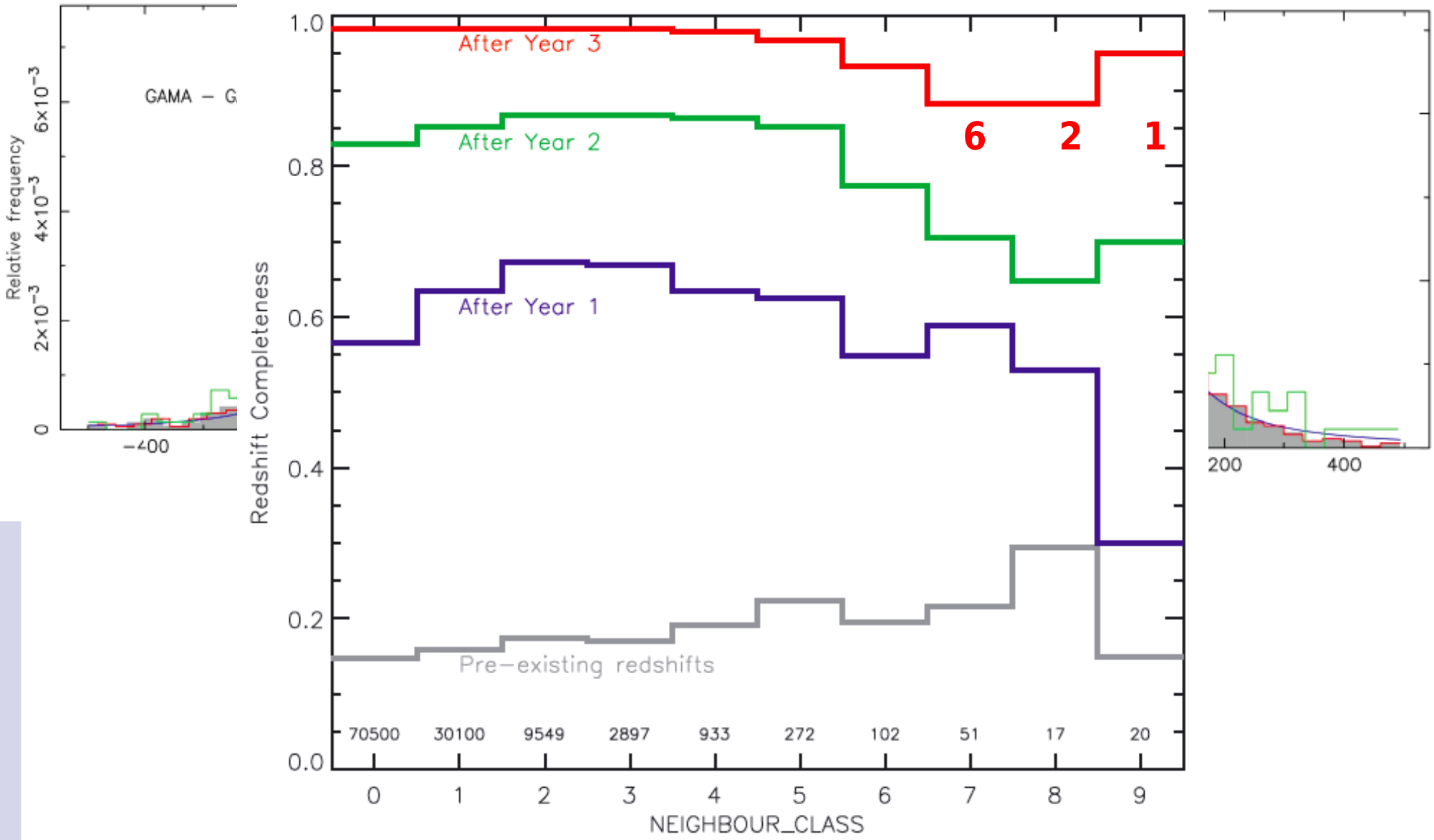




2.5k redshifts per night via two 400 fibre plates ….!

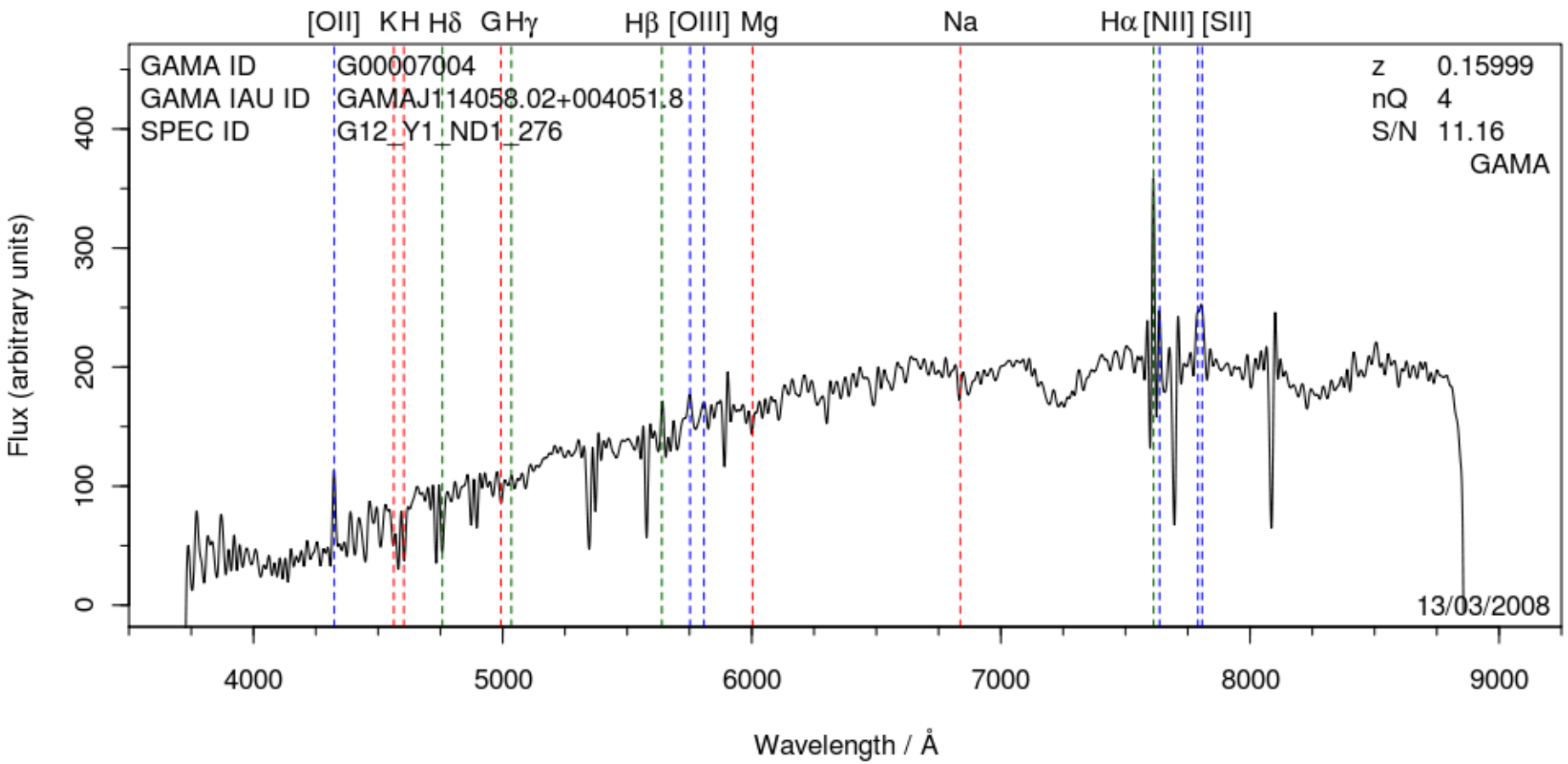


GAMA: redshift accuracy, quality & completeness



Driver et al. (2011)

GAMA: example spectra
(improved with PCA sky-subtraction)



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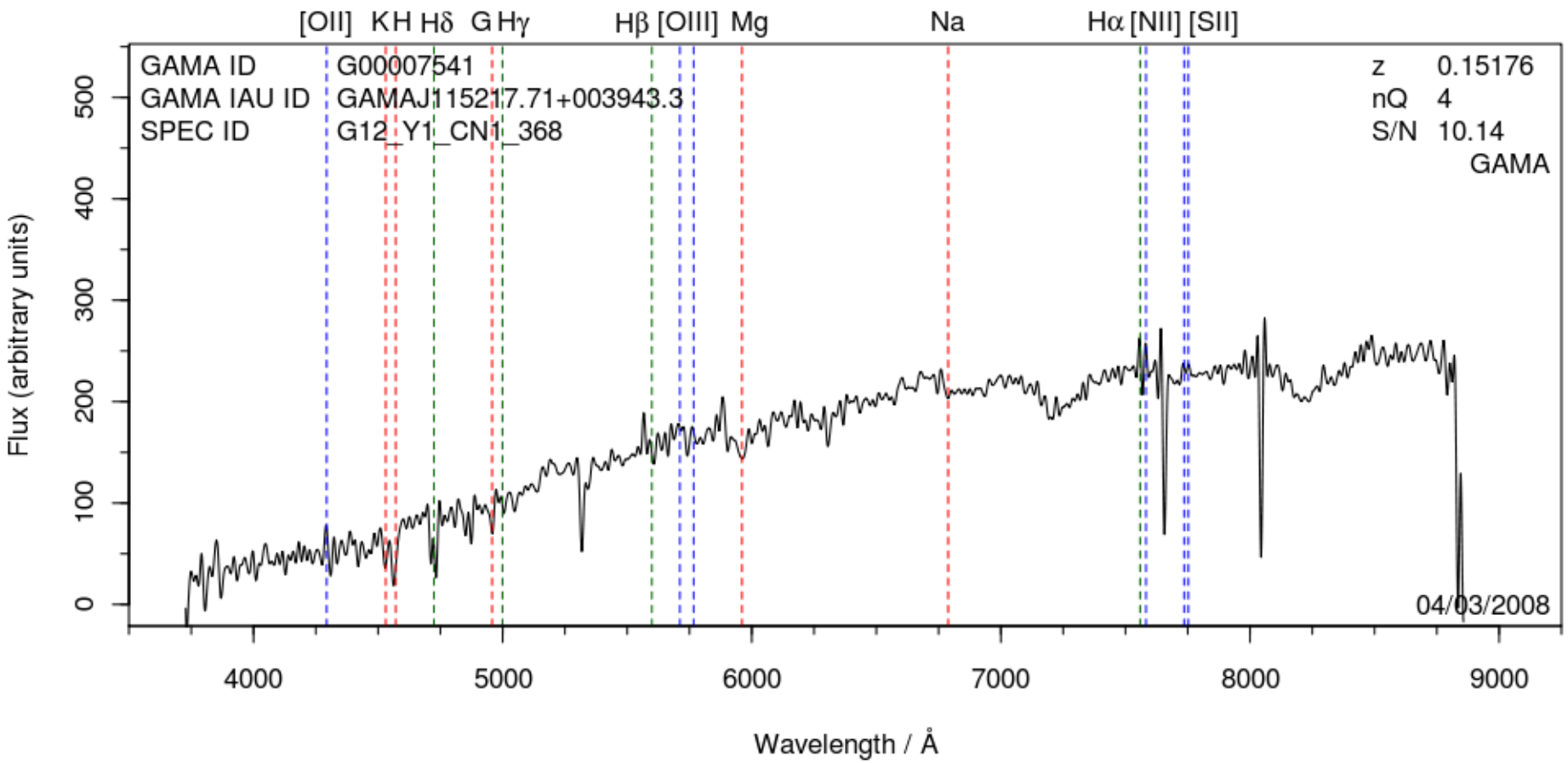
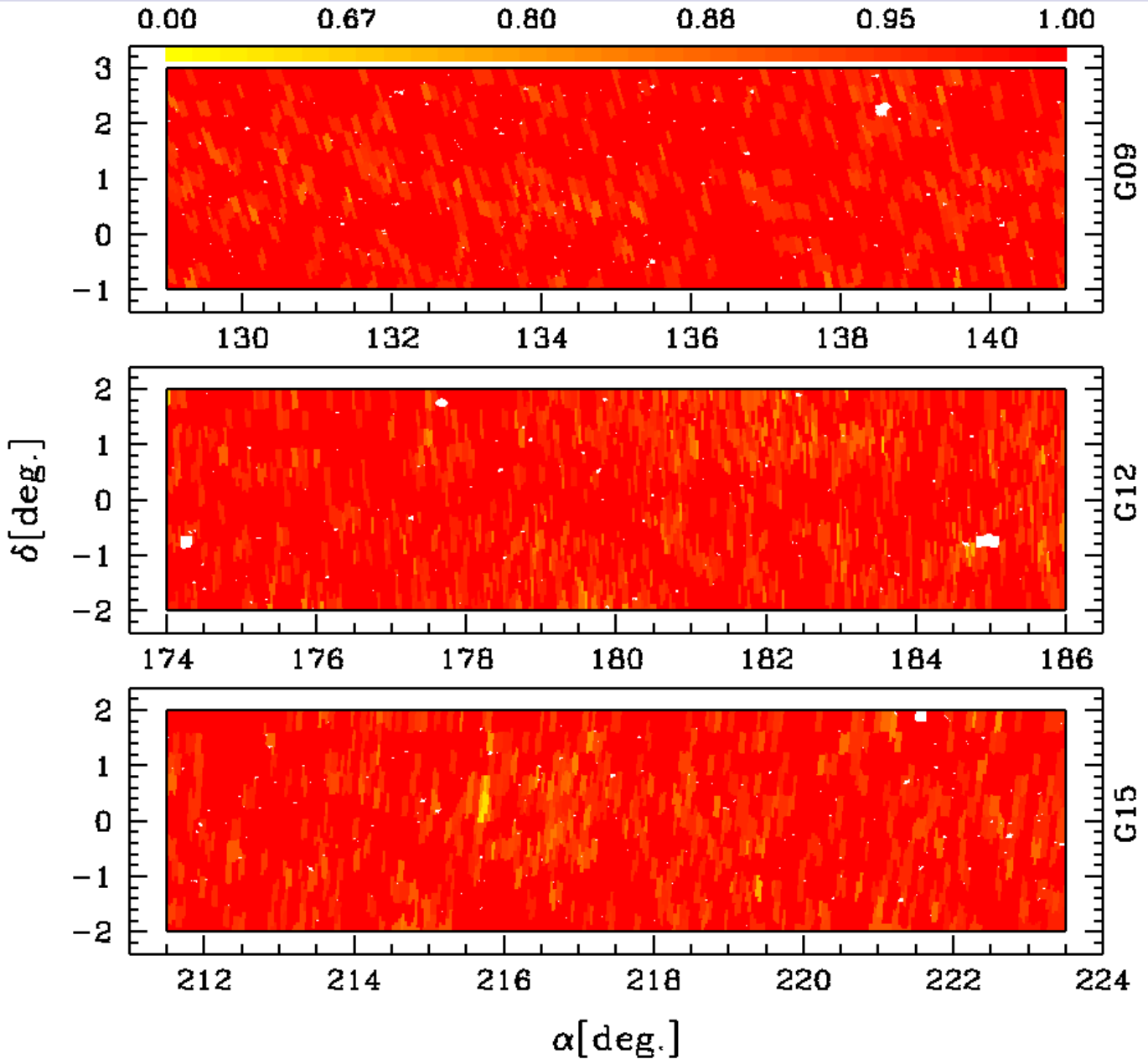


GAMA-I: redshift completeness...~98%!

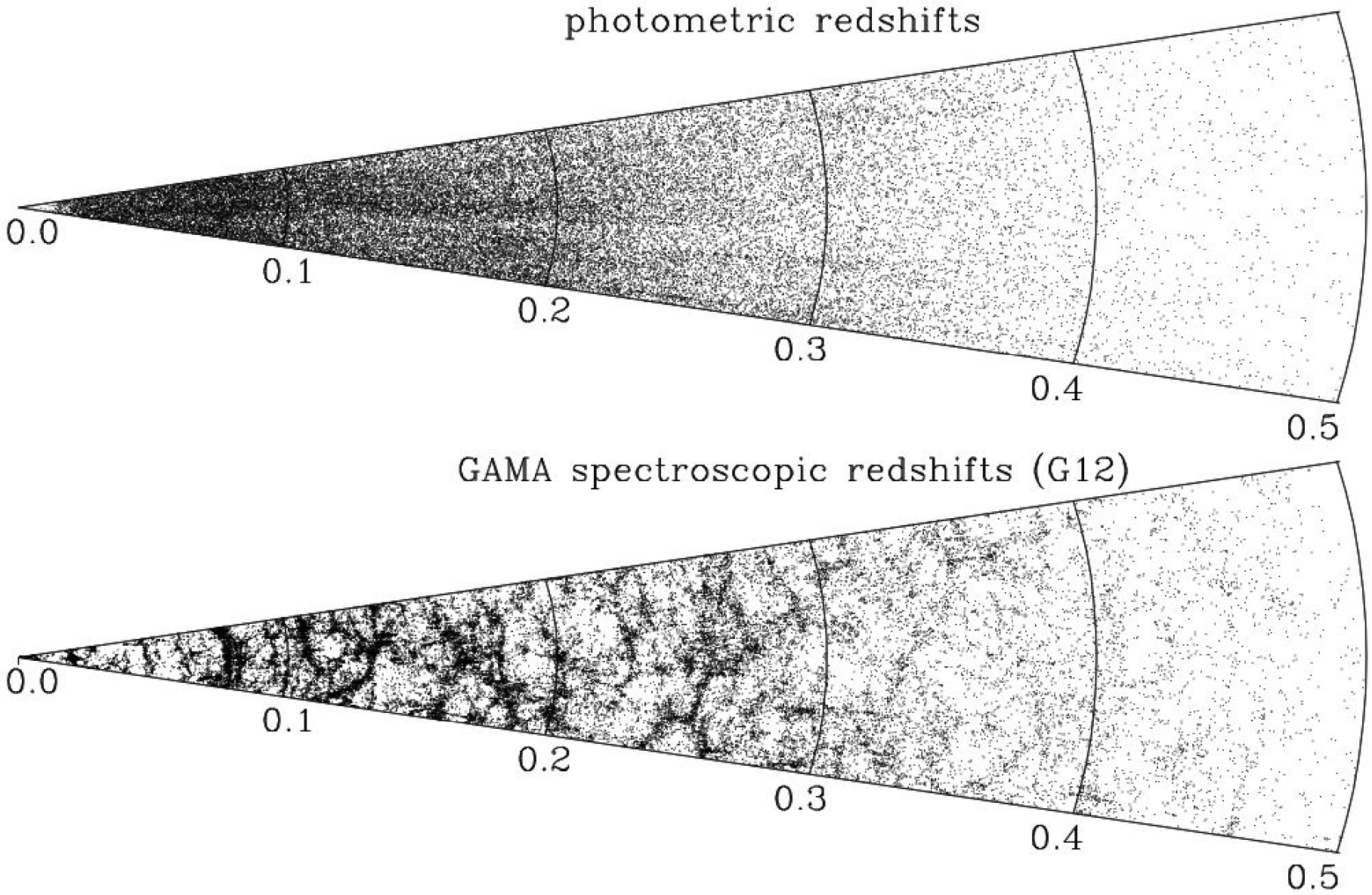


$r_{AB}<19.4$

$r_{AB}<19.8$

$r_{AB}<19.4$

GAMA: improved photometric redshifts (r<19.8)



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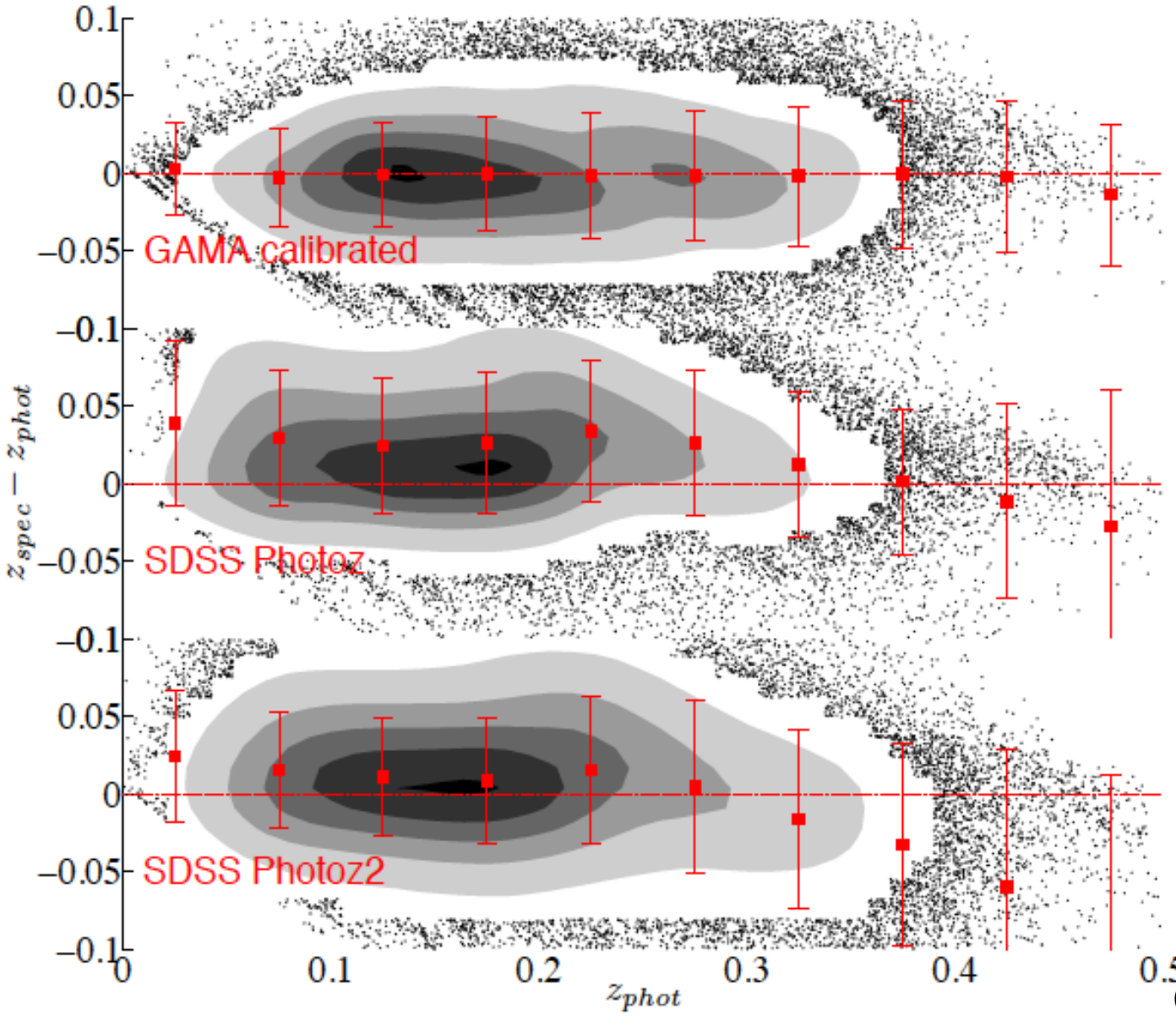


GAMA
vs
SDSS DR7

Photoz
Table 1

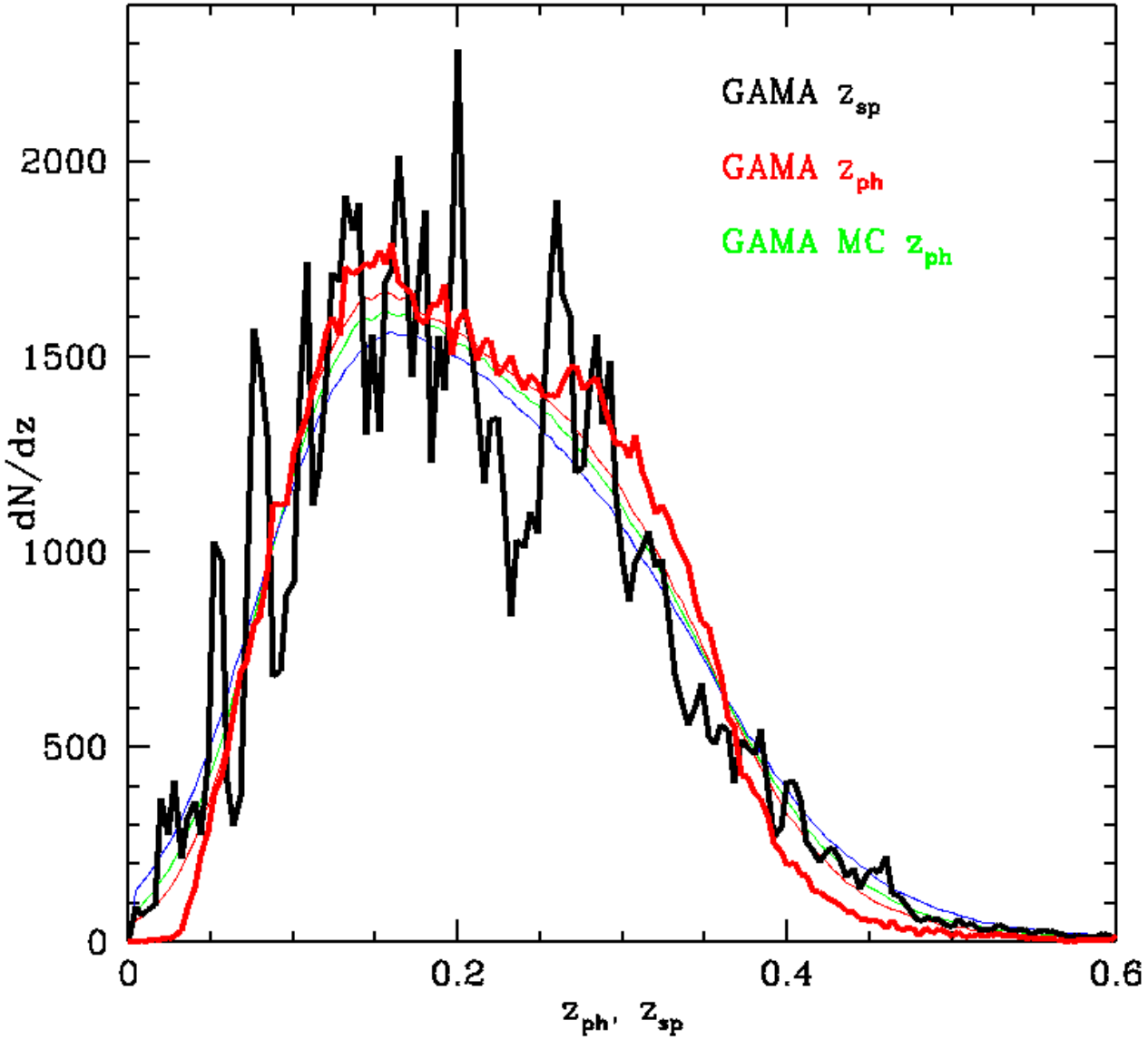
&

Photoz
Table 2

Parkinson (in prep)

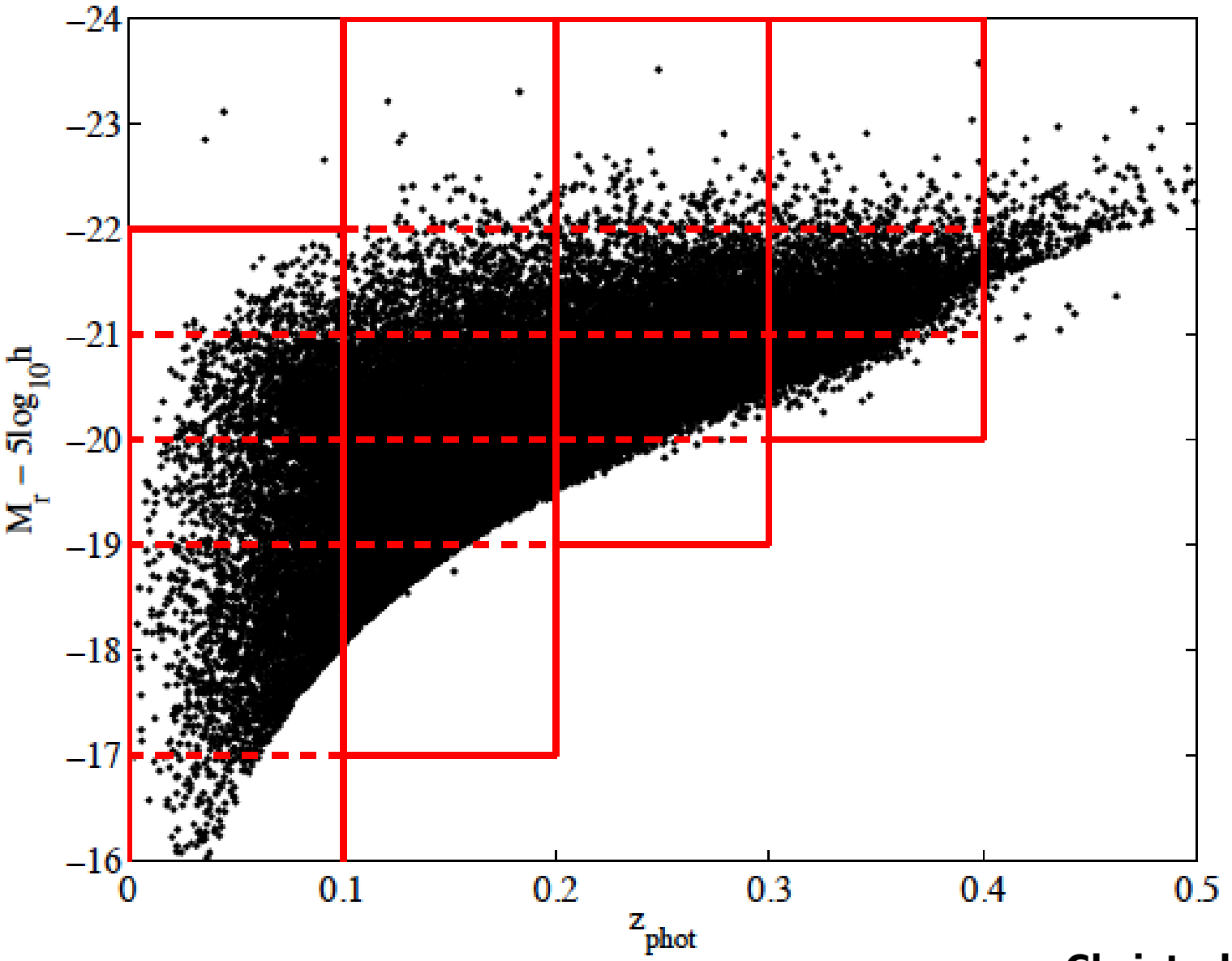
Christodoulou et al.

GAMA: N(z) for z_{spec} and z_{ph}



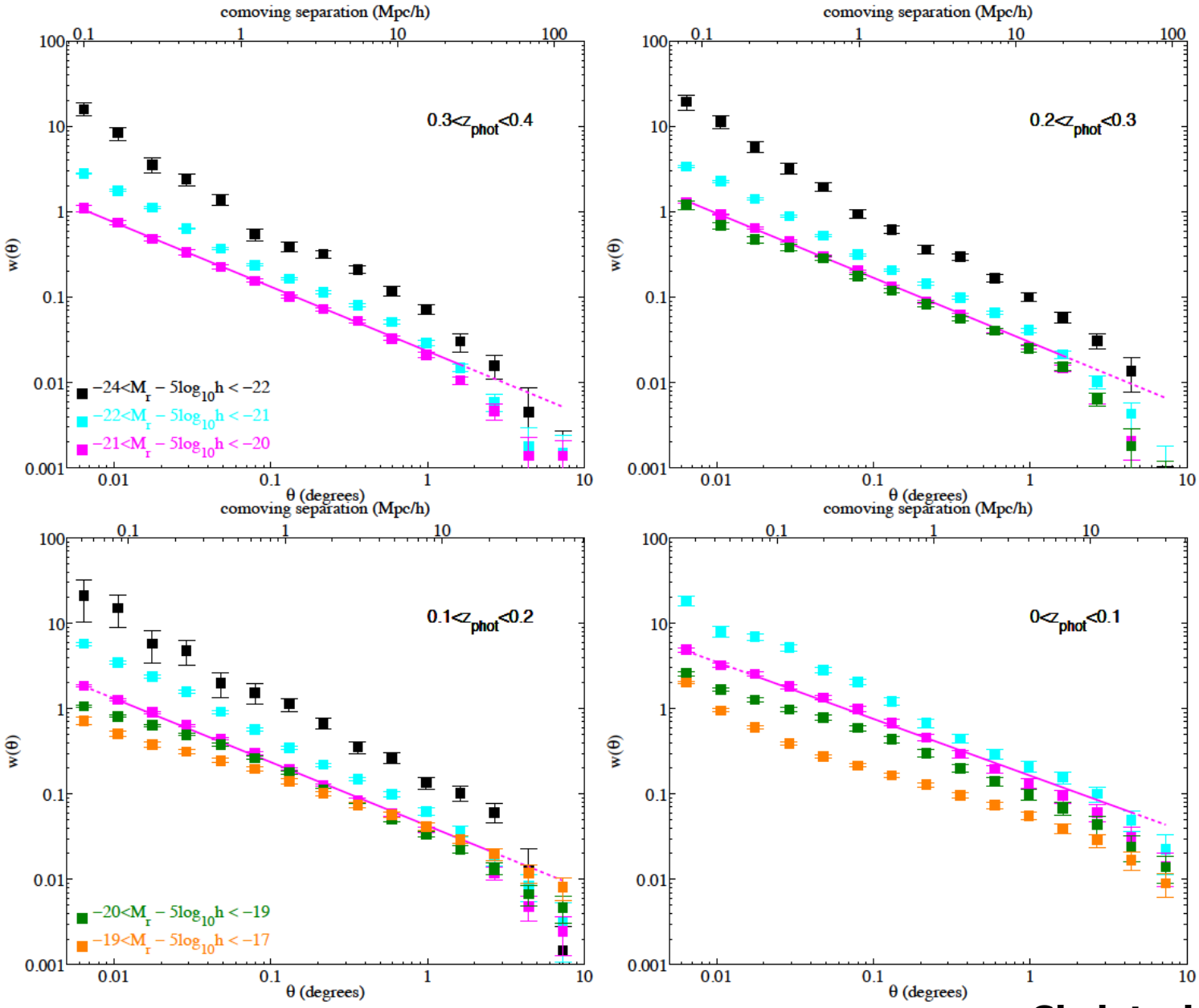
Driver et al. (2011)
Christodoulou et al.

SDSS: clustering split by z_{ph} & $M_r(z_{ph})$



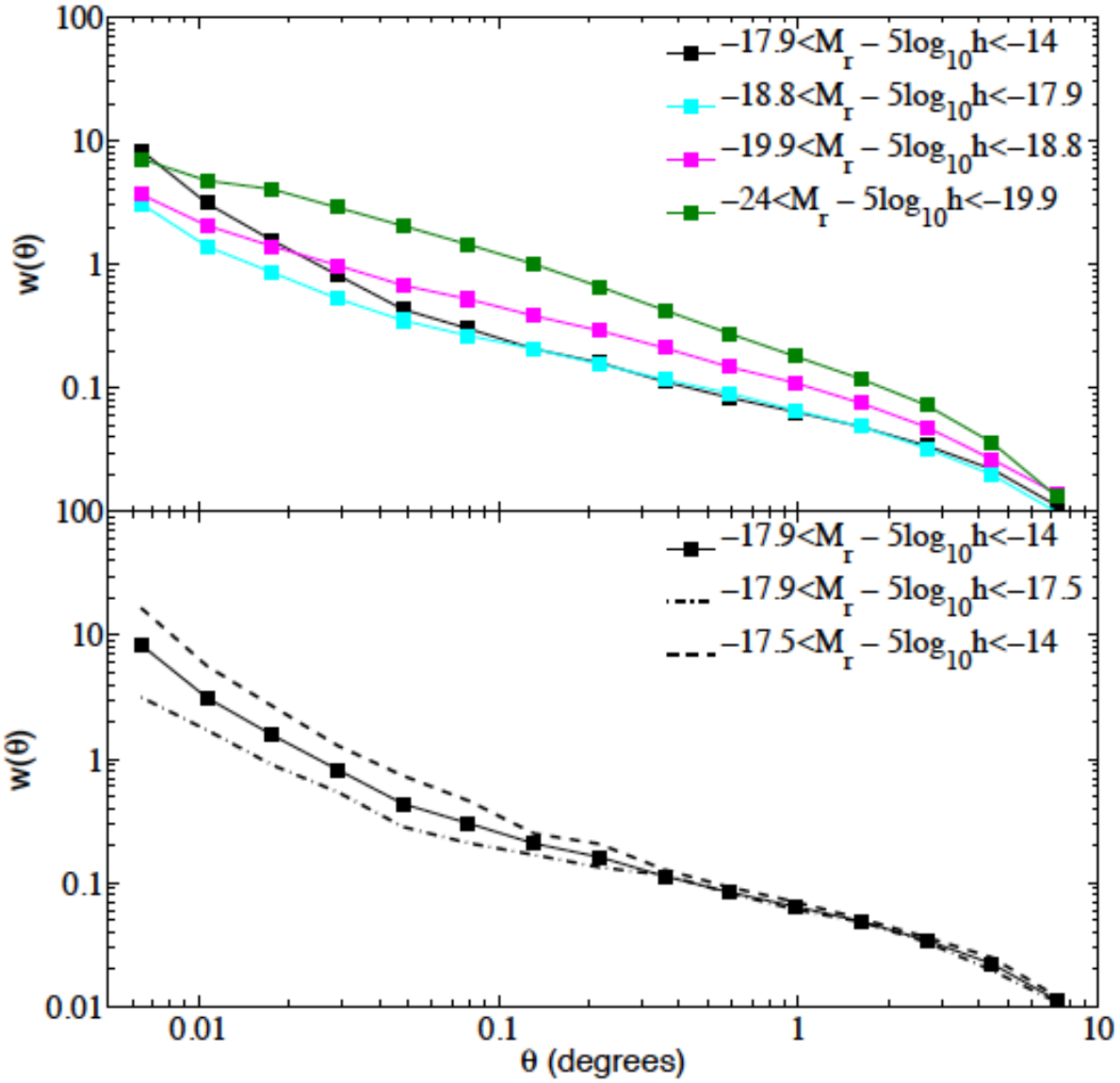
Christodoulou et al.

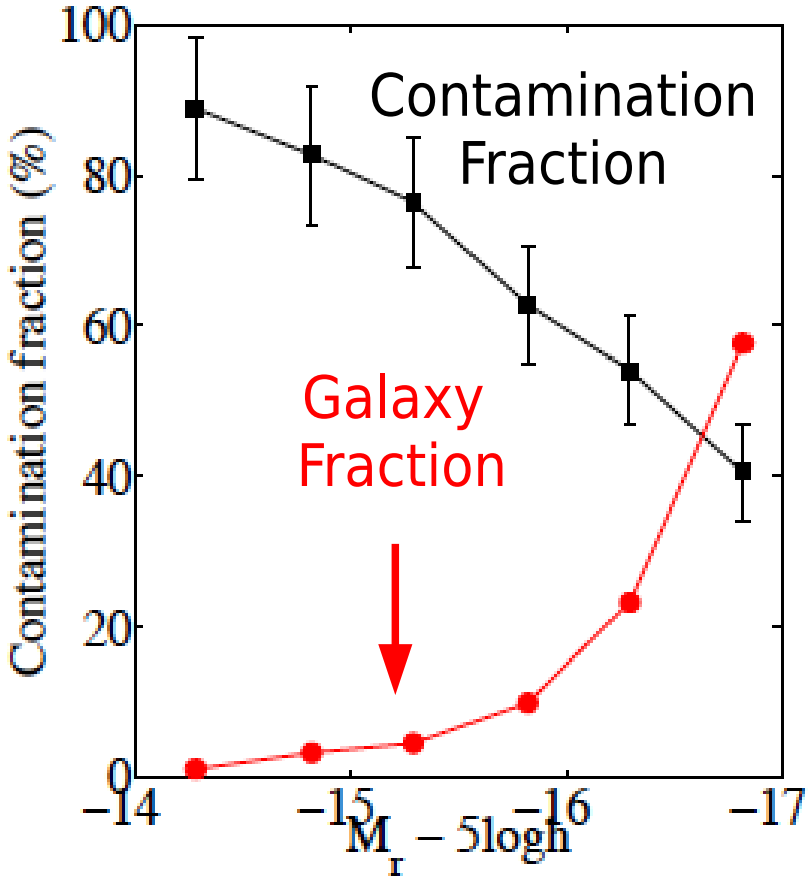
SDSS: w(θ) split by z_{ph} & $M_r(z_{ph})$



Christodoulou et al.

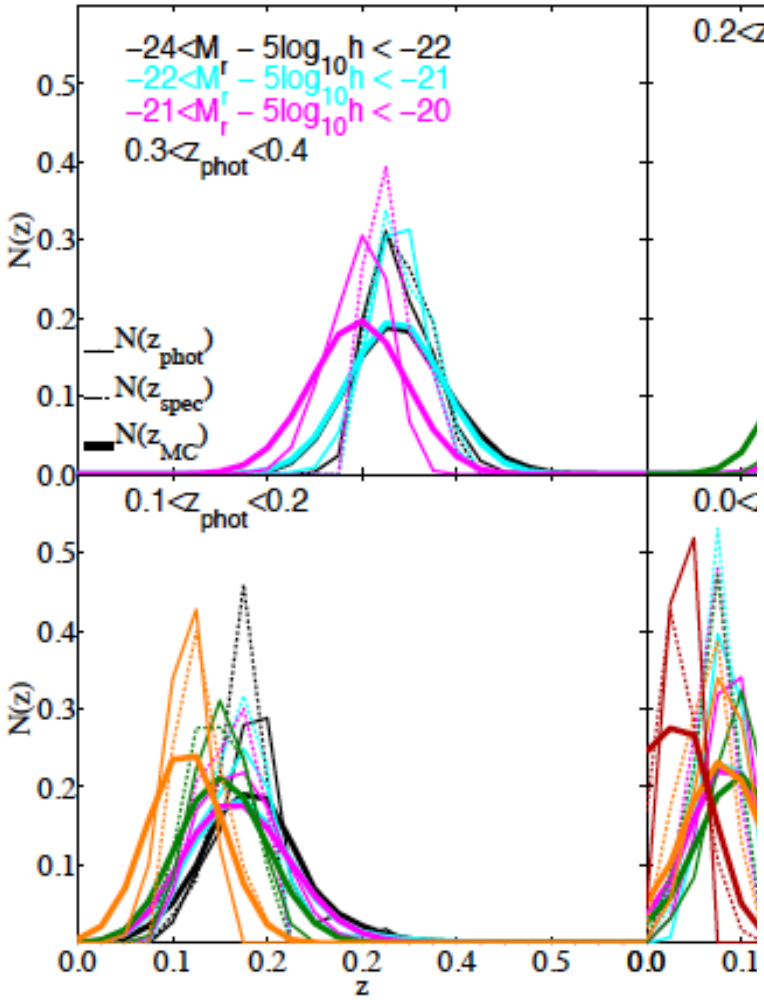
SDSS: w(θ) for faint galaxies, split by $M_r(z_{ph})$



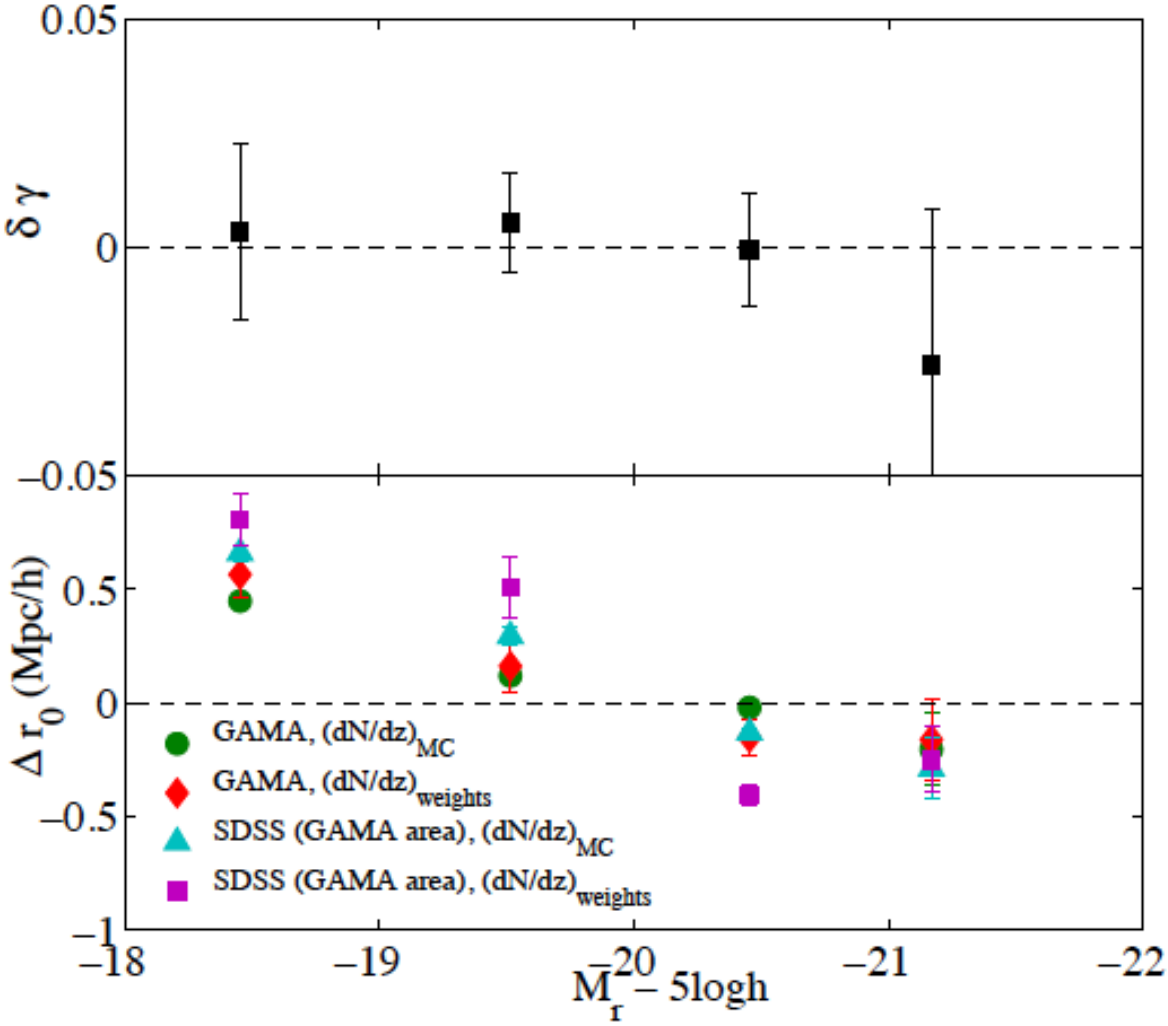


Christodoulou et al.

GAMA: more systematics with data split by z_{ph}

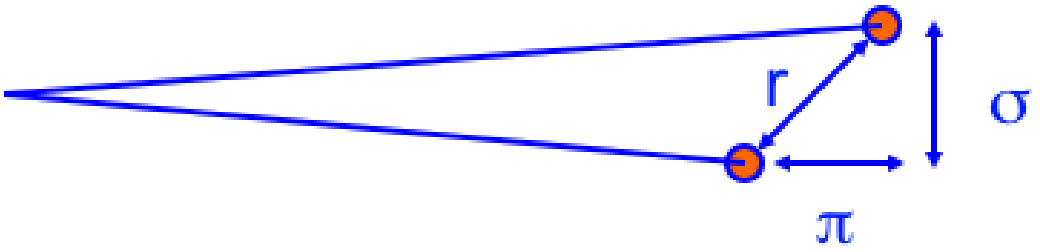


N(z) reconstruction

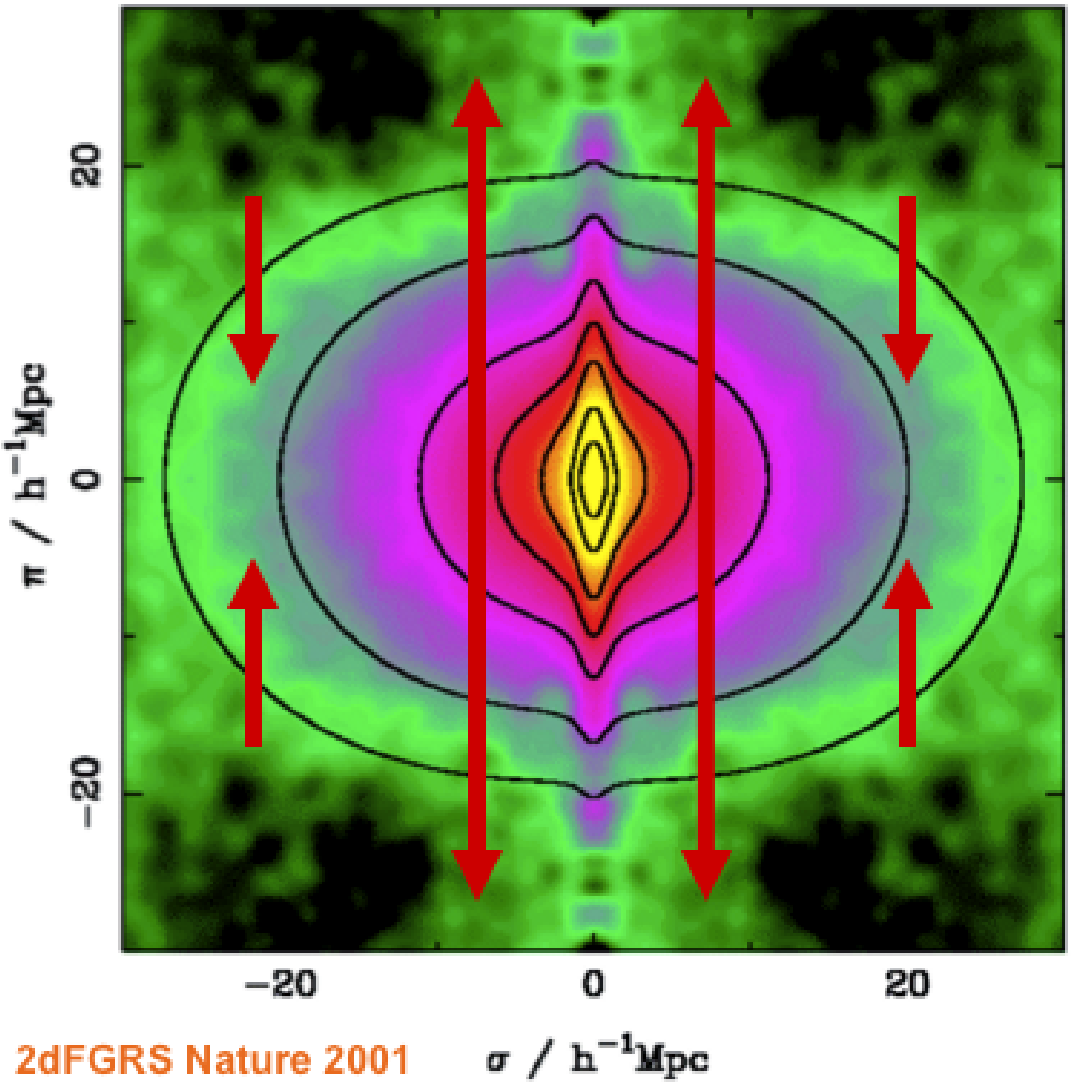


Christodoulou et al.

Redshift-Space Distortions



- RSD due to peculiar velocities are quantified by correlation fn $\xi(\sigma,\pi)$.
- Two effects visible:
  - Small separations on sky: 'Finger-of-God';
  - Large separations on sky: flattening along line of sight.



2dFGRS Nature 2001

Conclusions

- GAMA is a unique multi-wavelength survey:
  - 200k redshifts so far (aim: 350k)
  - Very high completeness (~98% to r<19.8)
  - 21 bands (far-UV to far-IR + X-ray + Radio)
- GAMA LSS is ideal to test for systematics:
  - via improved photo-z (unbiased)
  - by identifying catalogue contaminations
  - in theoretical clustering models
- Main GAMA strength:
  - Test galaxy formation models (far-UV to far-IR)