Probing the massive and superdense galaxy population with KiDS

Co-funded by the European Union
PEOPLE

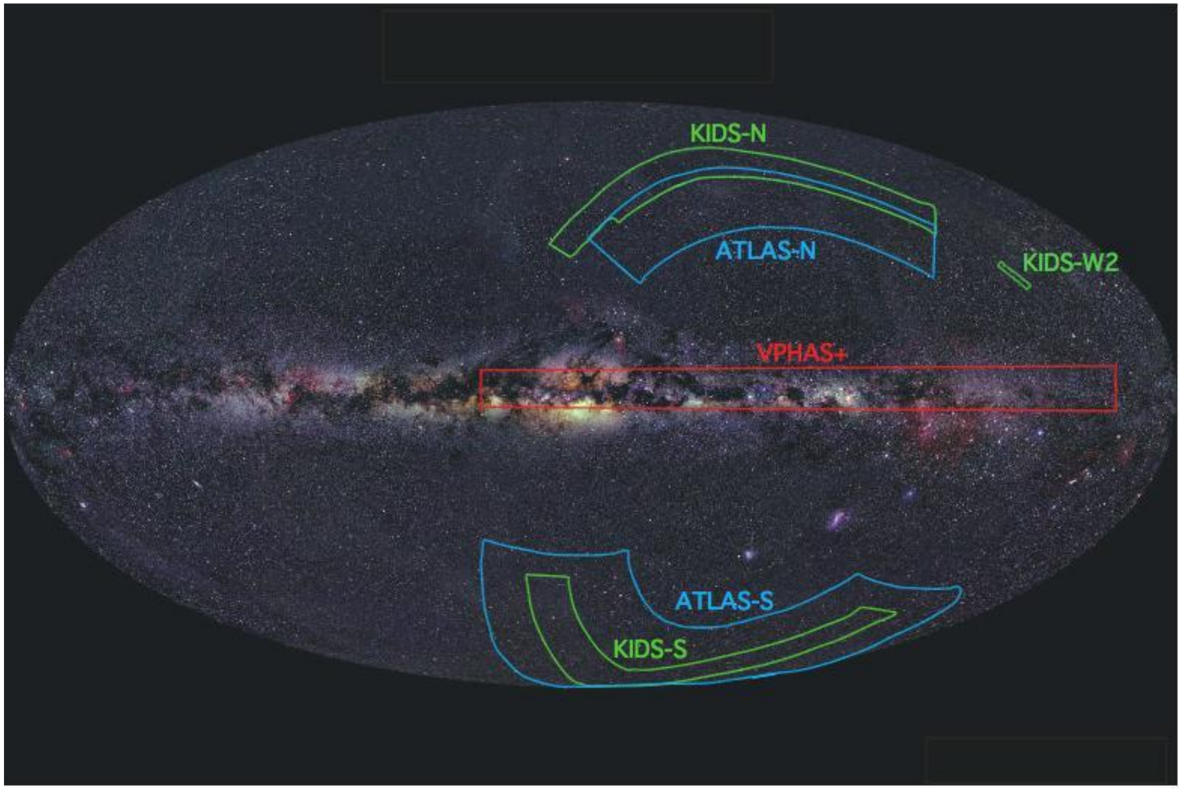
Crescenzo Tortora

INAF- Osservatorio di Capodimonte

and the KiDS collaboration

KIDS@VST

KiDS@VST aims to image 1500 square degrees in 4 bands (complemented in the NIR with VIKING@VISTA). Deeper and with better quality and higher spatial resolution than previous surveys.



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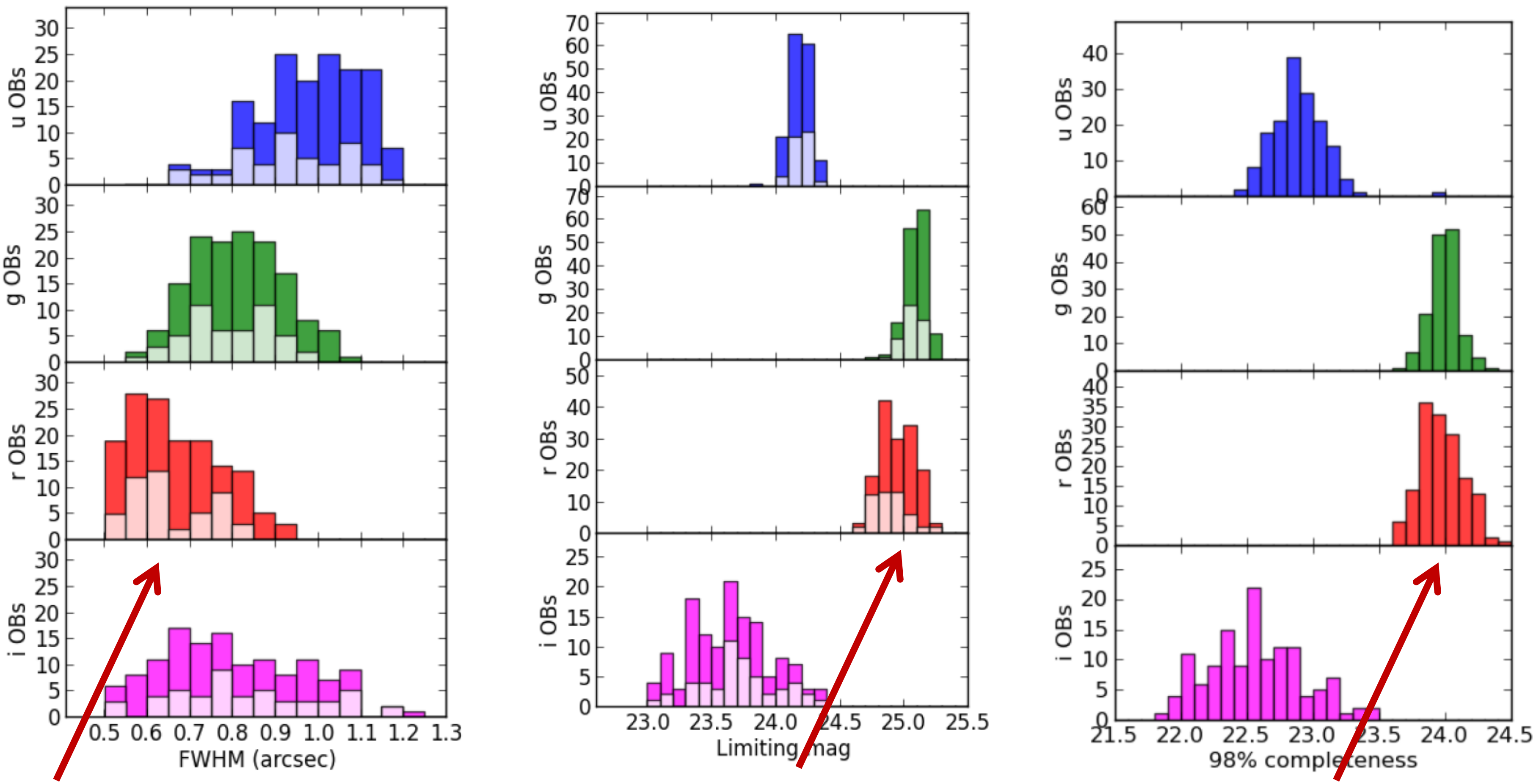
- VST/OmegaCAM: 1 sq.deg, 2.6m tel.
- 1500 sq.deg. of ugri
- pixel scale 0.21''/pxl (0.4''/pxl of BOSS/SDSS and 0.27''/pxl of DES)
- very good seeing, 0.65'' in r-band (>1'' for SDSS and DES)
- ~2.5m deeper than SDSS (1m shallower than CFHTLS)

KIDS@VST

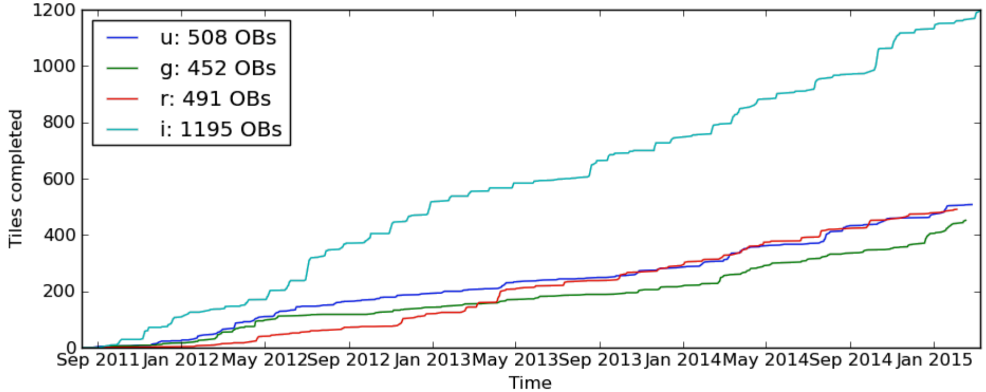
KiDS@VST aims to image 1500 square degrees in 4 bands (complemented in the NIR with VIKING@VISTA). Deeper and with better quality and higher spatial resolution than previous surveys.

- gravitational lensing
- dark matter and dark energy (via WL)
- **galaxy evolution**
- searching for galaxy clusters
- high redshift quasars.

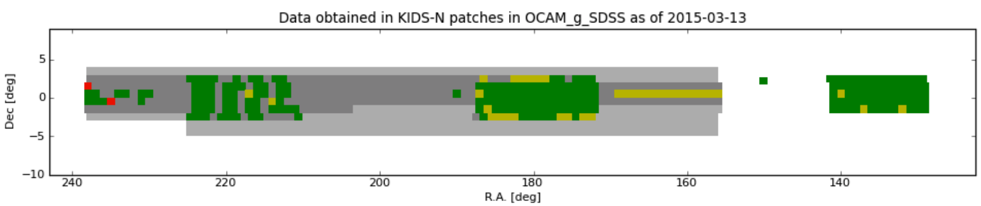
FWHM | Limiting magnitude | Completeness magnitude

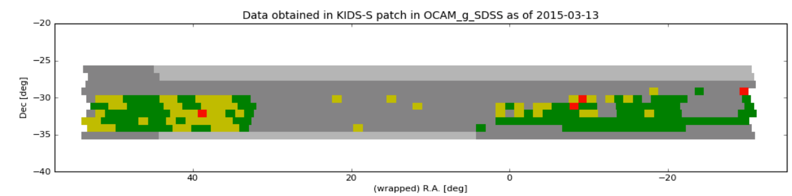


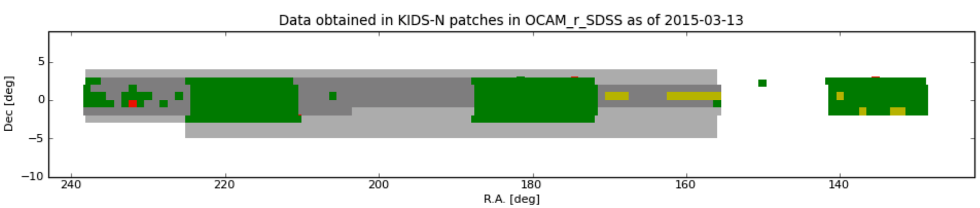
KiDS Survey progress

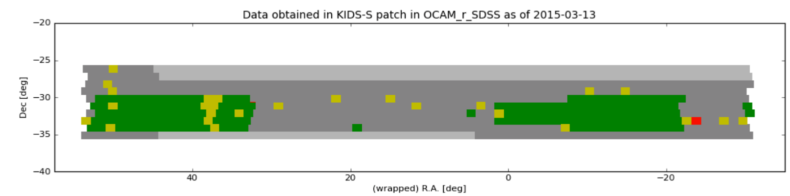


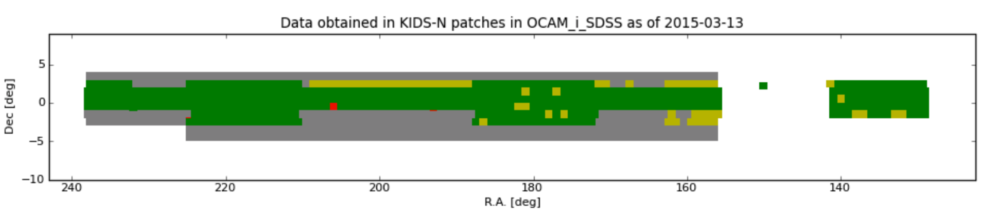
~1/3 of the survey

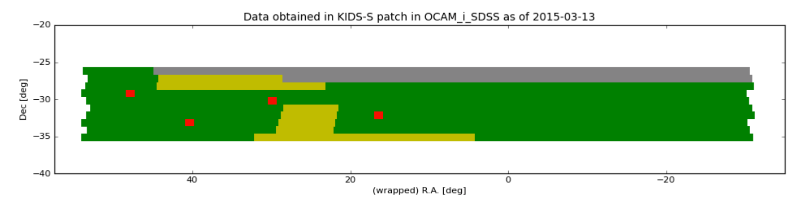












The KIDS collaboration

http://kids.strw.leidenuniv.nl/team.php

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Willem-Jan Vriend	OmegaCEN - Groningen
Kristian Zarb Adami	University of Malta

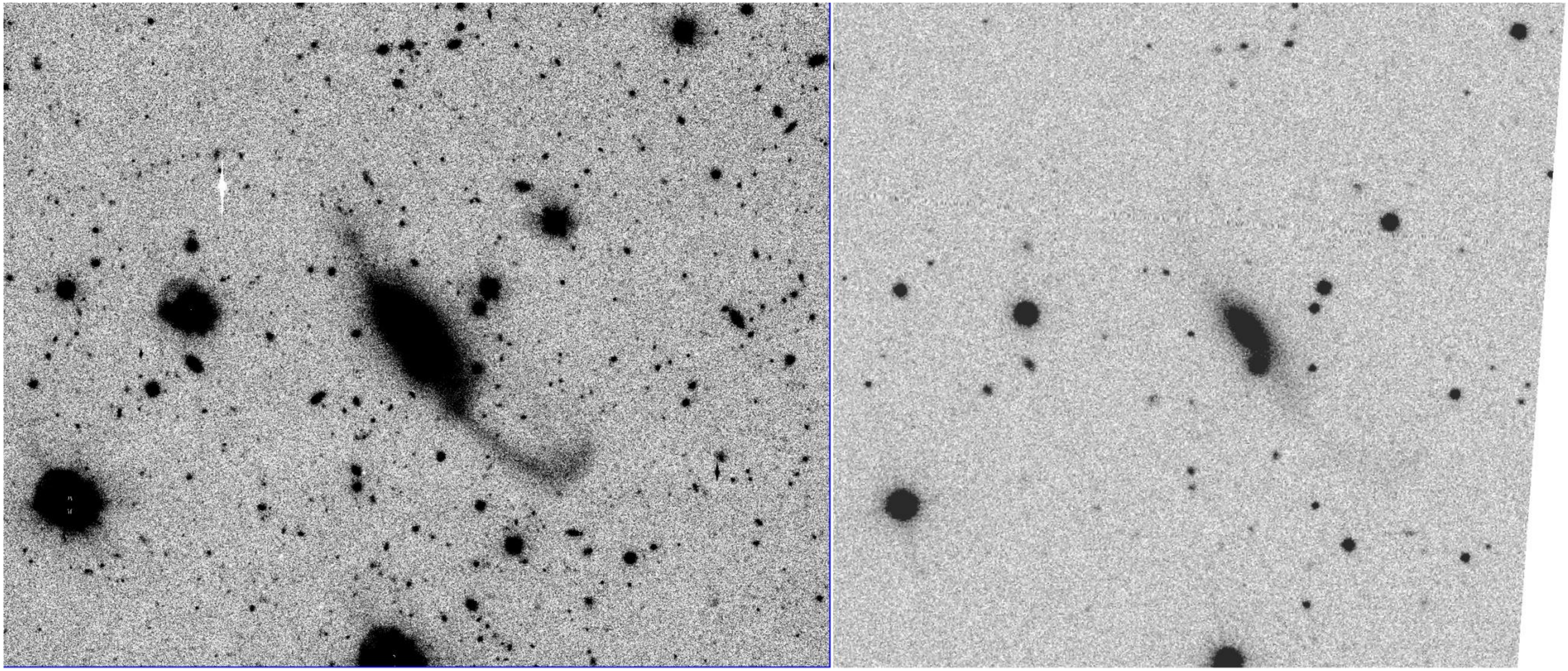
Why KiDS

for galaxy evolution?

Area, pix. scale, depth, seeing

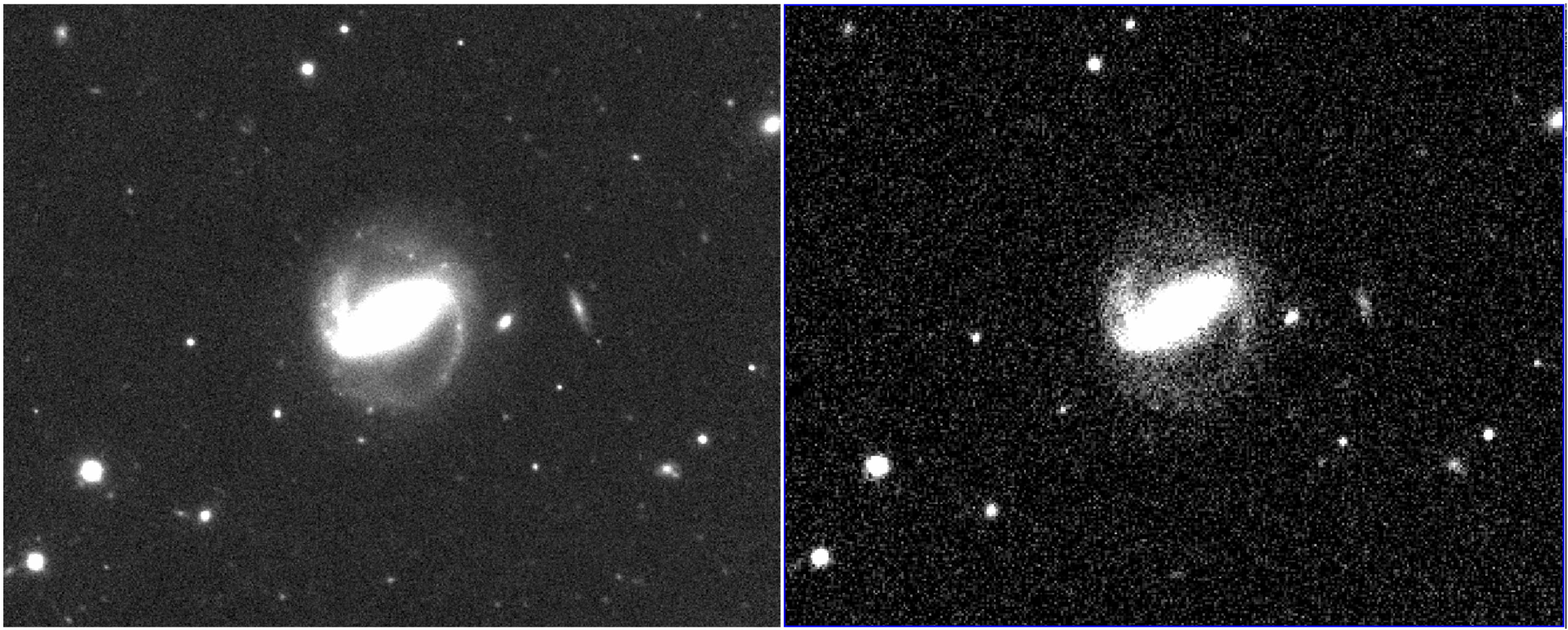
KiDS vs. SDSS

r-band

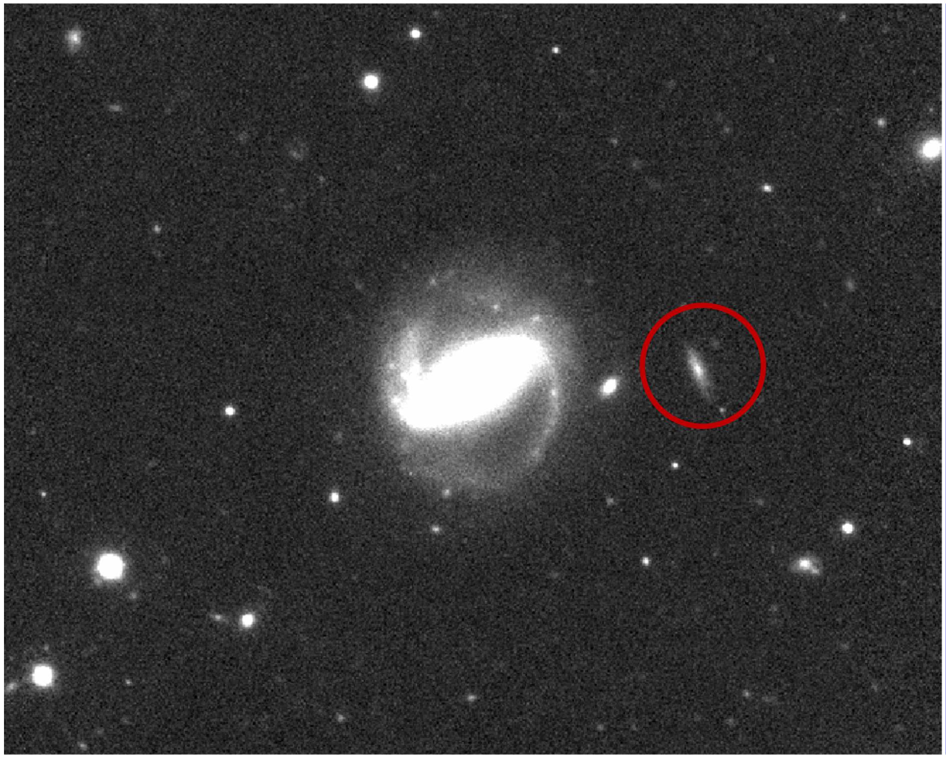


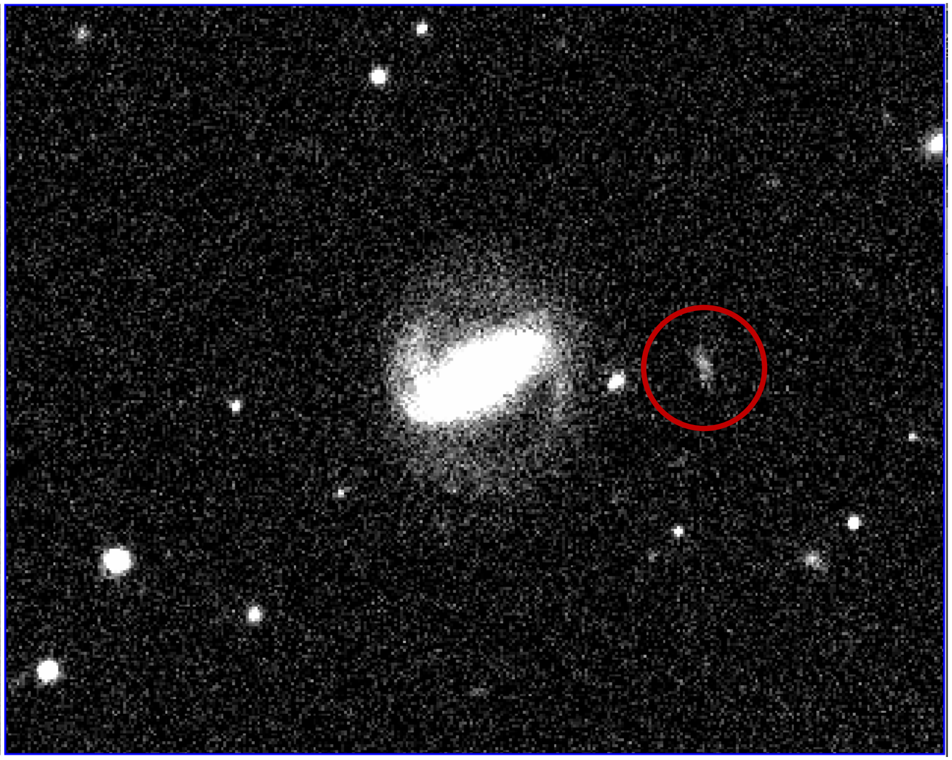
KiDS **SDSS**

KiDS vs. SDSS

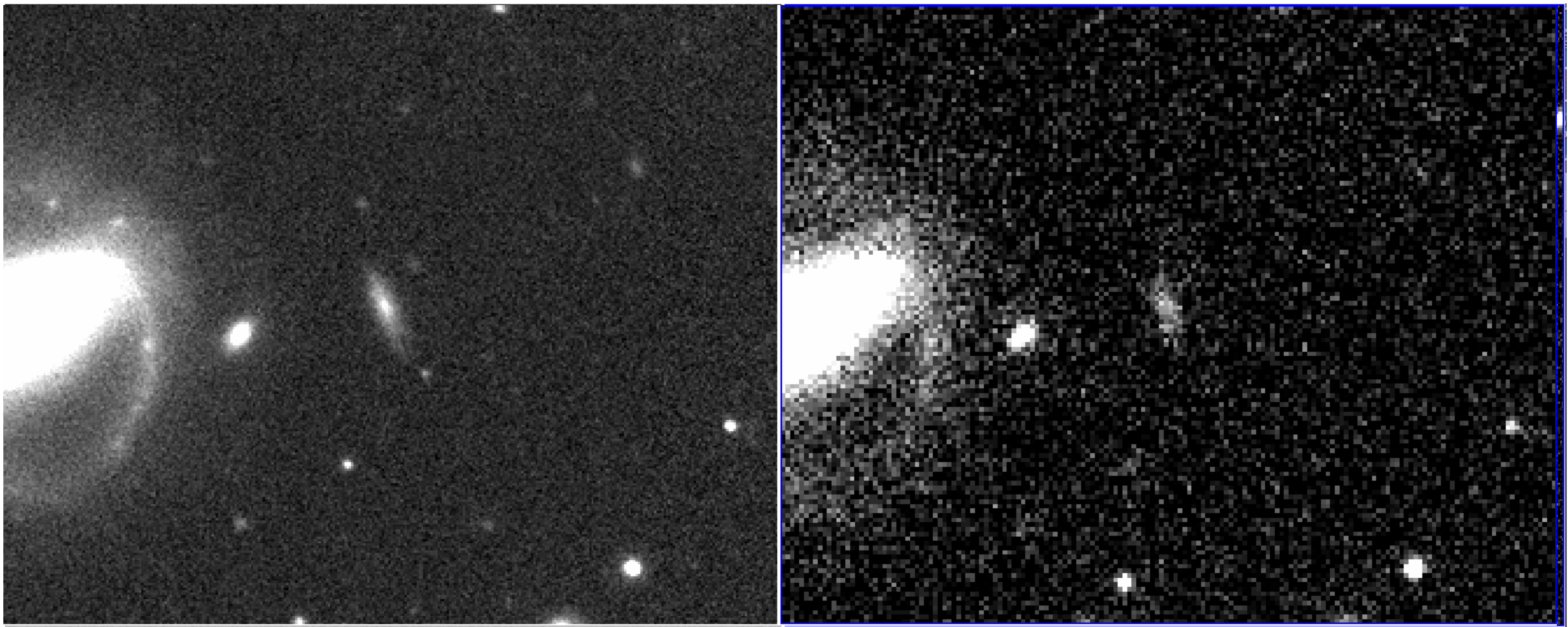


KiDS vs. SDSS





KiDS vs. SDSS



Sample selection

156 tiles (≈ 170 sq. deg.)

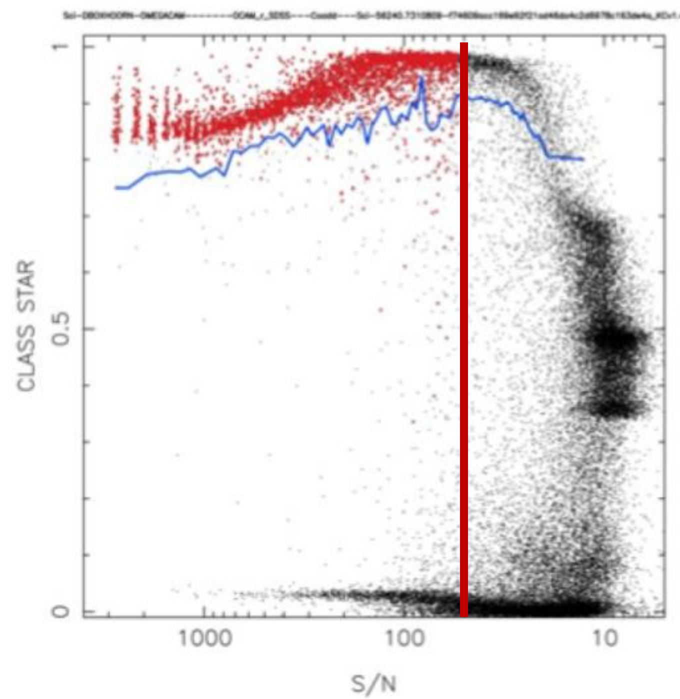
Sources: ~ 22 millions

Galaxies: ~ 7 millions
(after S/G separation with Sextractor)

> 1 million with photo-z

High S/N_r (>50) galaxies: ~380000

Best surface photometry



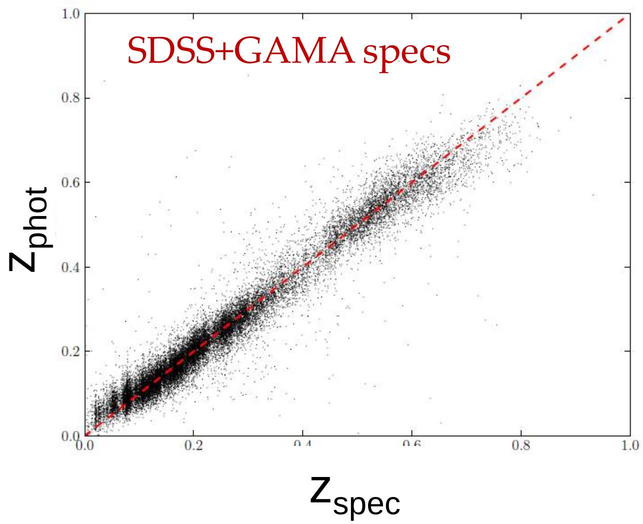
One of the largest datasamples with photometry and structural parameters measured in 4 bands up to z=0.5

Data analysis

Photo-z

(machine learning, specs to train the network)

$$\text{scatter} \sim 0.03$$



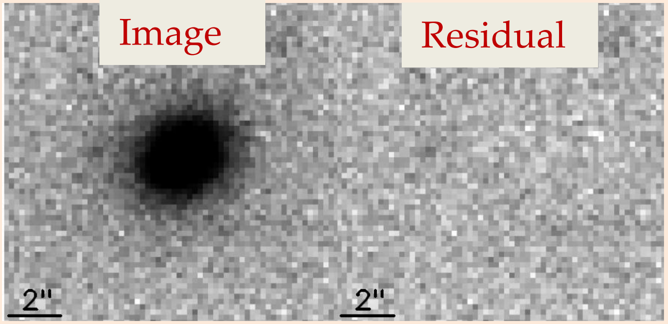
Stellar masses

(SED-fitting, using Lephare program)

Structural parameters

(2DPHOT, Sérsic fit, modelling the PSF)

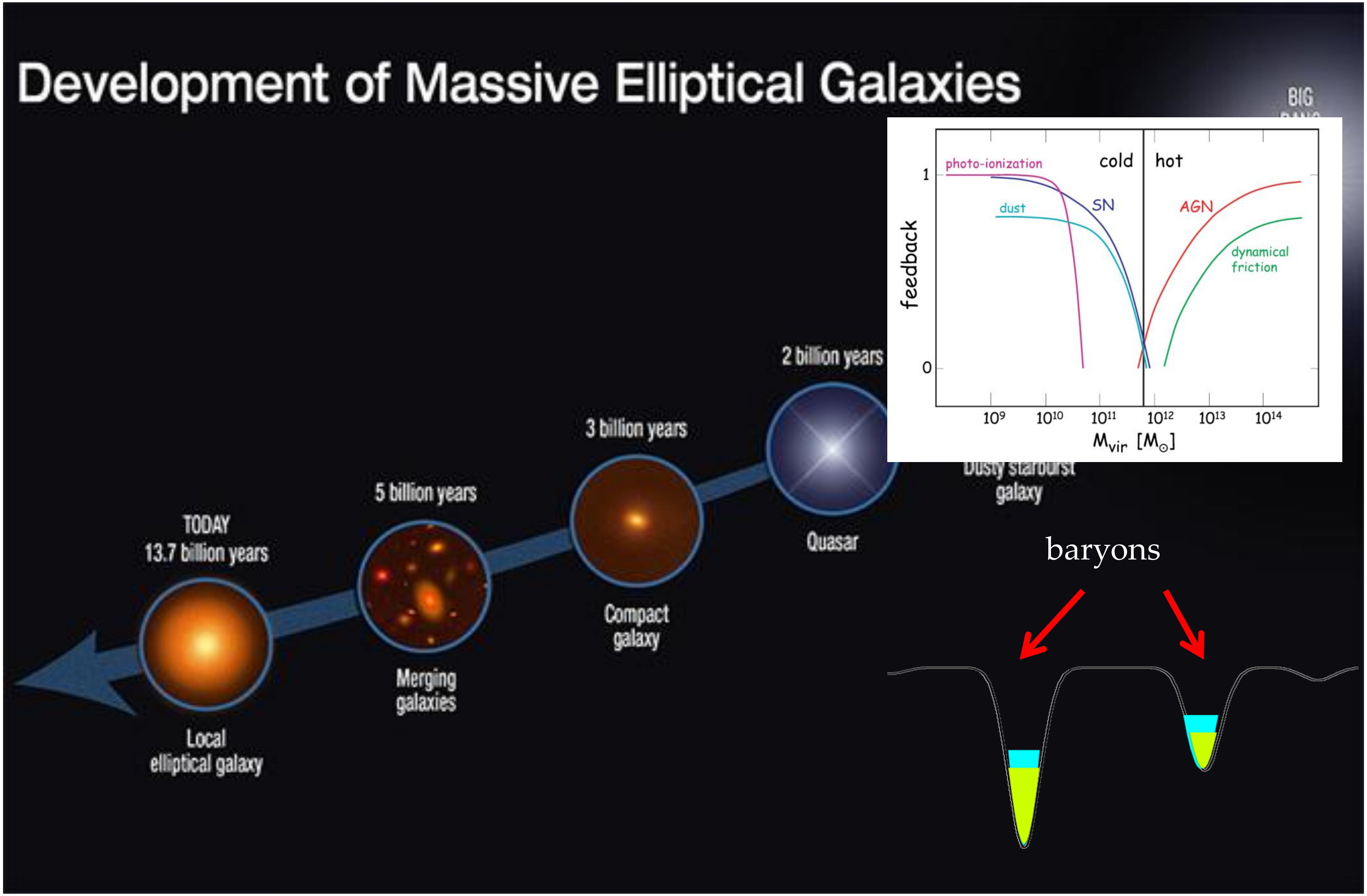
La Barbera et al. 2008



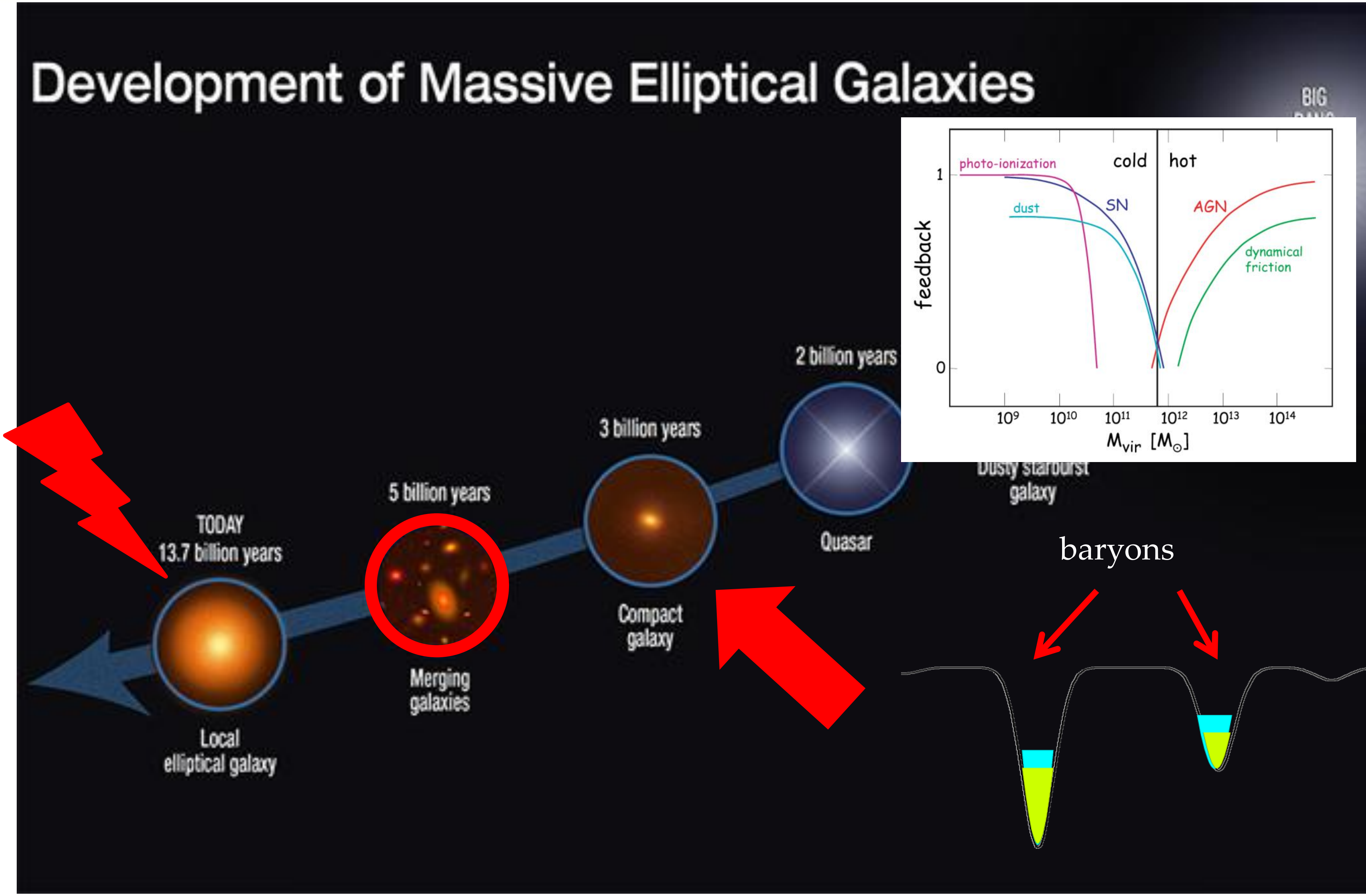
Search of compact galaxies

Why KiDS
for searching compact galaxies?

Area, pix. scale, depth, seeing



NASA, ESA, S. Toft, A. Feild



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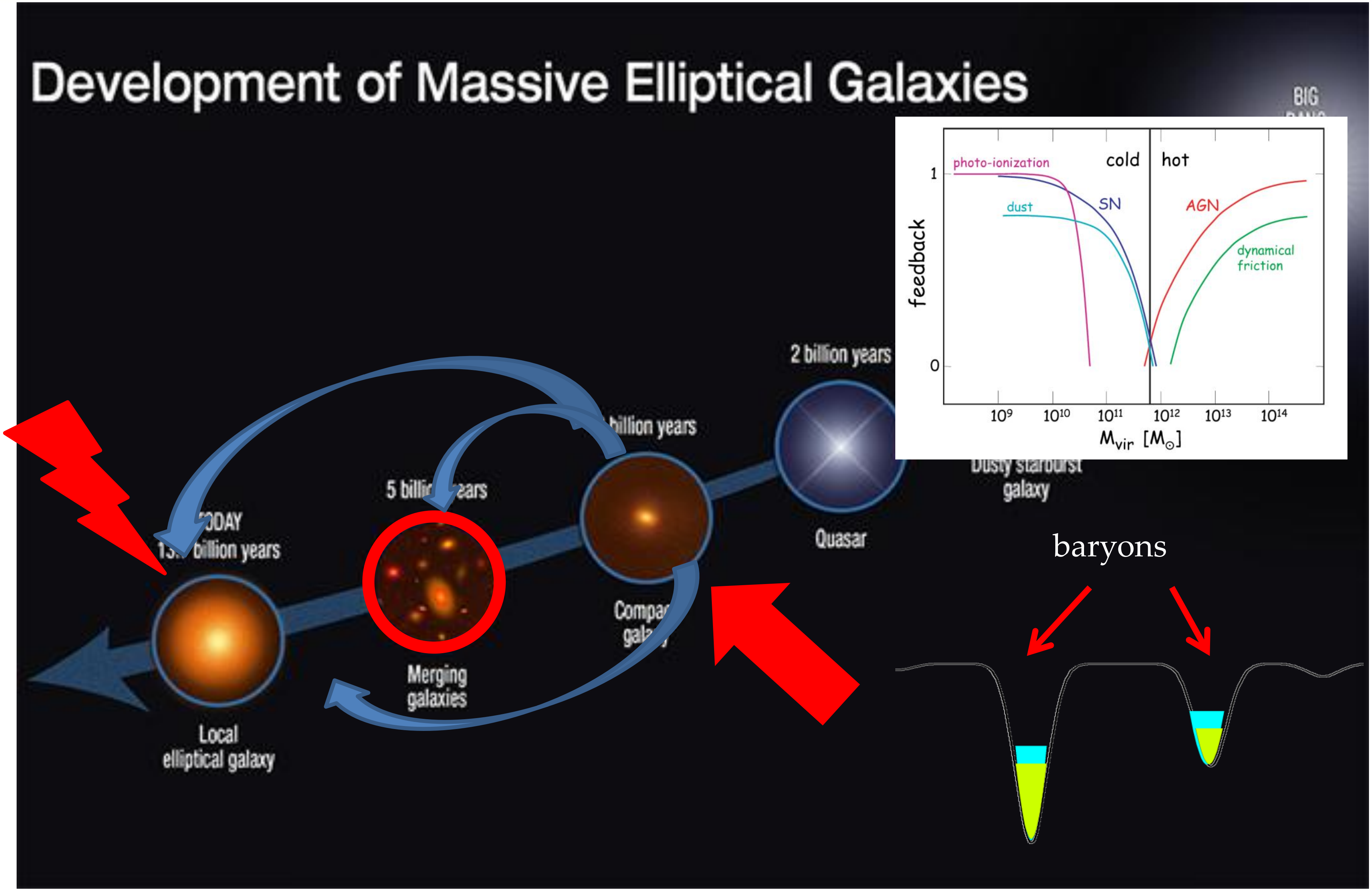

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Some literature

z<0.2 (Trujillo et al. 2009, Taylor et al. 2009)

Low number densities, no relic compact

Intermediate z (Damjanov et al. 2014)

about 200 massive compacts from a sample of stellar-like objects within the 6373.2 sq. deg. of the BOSS survey, 20% dominated by old stellar populations

→ Spectroscopic validation

→ 93% of these galaxies do not have measured effective radius.

KiDS@VST

→ Photo-z

→ **High-quality structural parameters**

Selection procedure

1) *compactness*

$$R_e < 1.5\,\mathrm{kpc}$$

Trujillo et al. 2009

2) *massiveness*

$$M_\star > 8 \times 10^{10}\, M_\odot$$

3) *Best 2D fitting*

$$\chi^2_{red} < 1.5$$

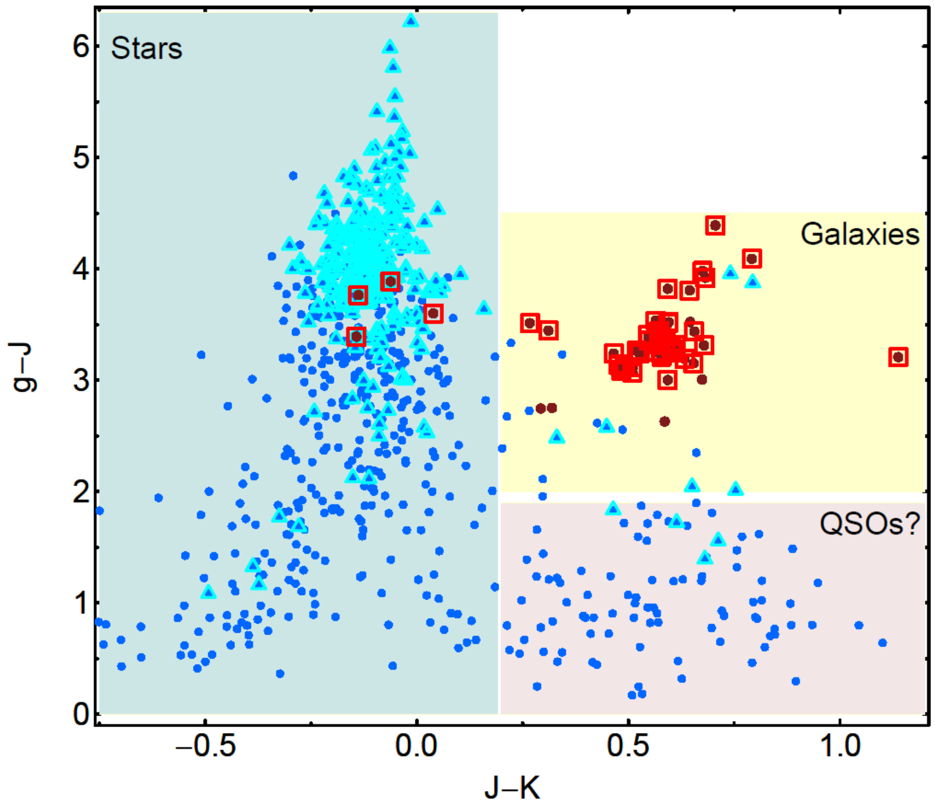
4) *Visual inspection*

VIKING@VISTA photometry

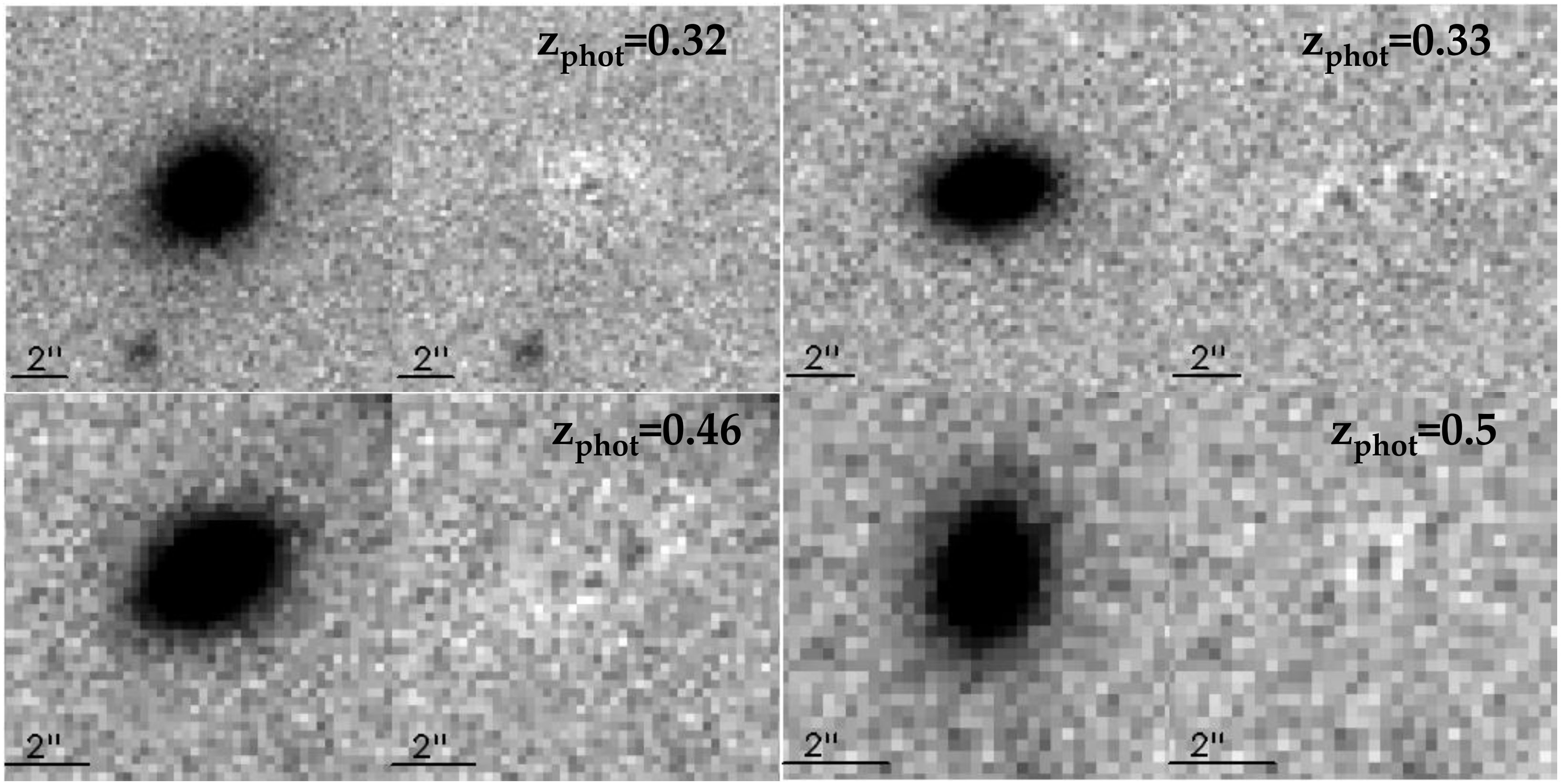
5) *colour-colour star-galaxy separation*

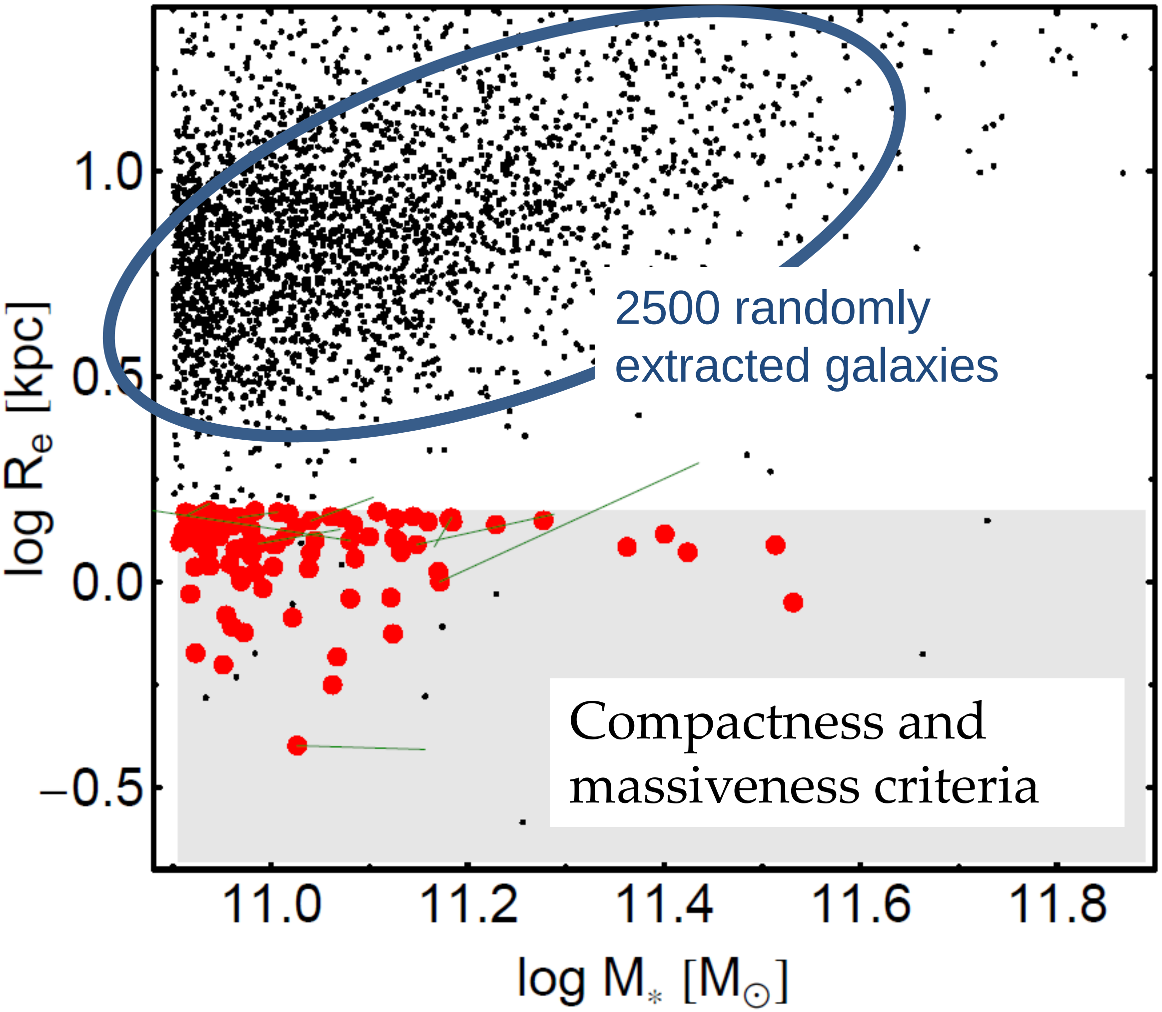
92 candidates

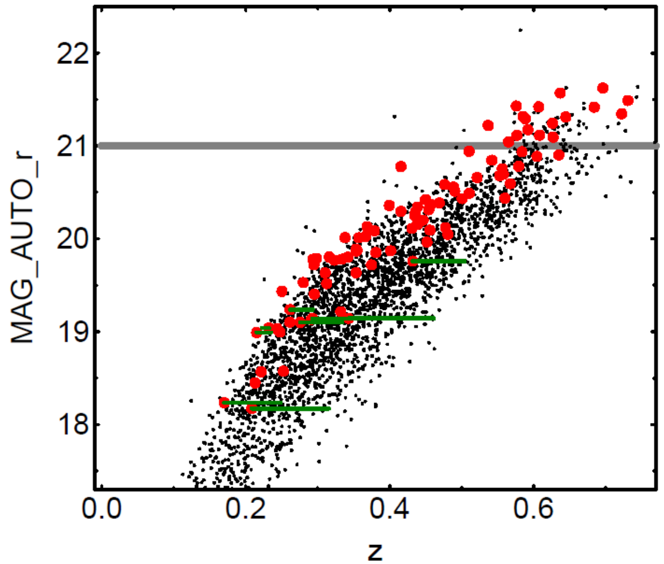
- High-confidence stars
- High-confidence stars, δJ and δK < 0.05
- Compact candidates
- Compact candidates , δJ and δK < 0.05

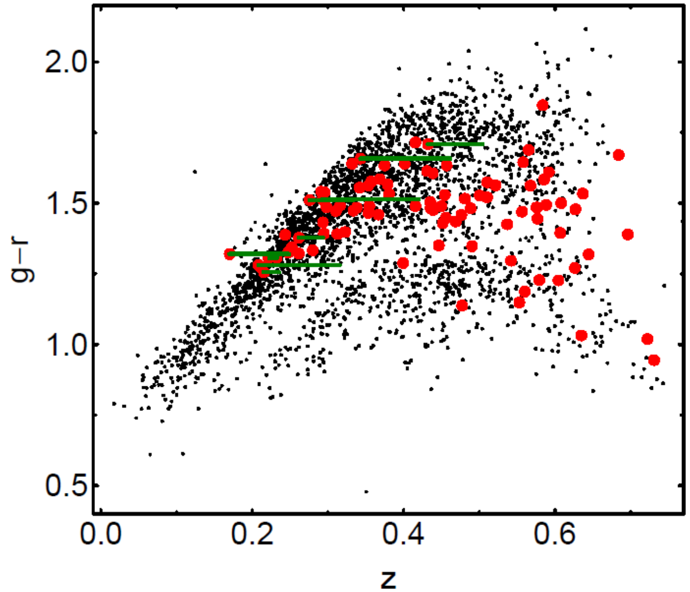


Some examples of the 2D fitting output

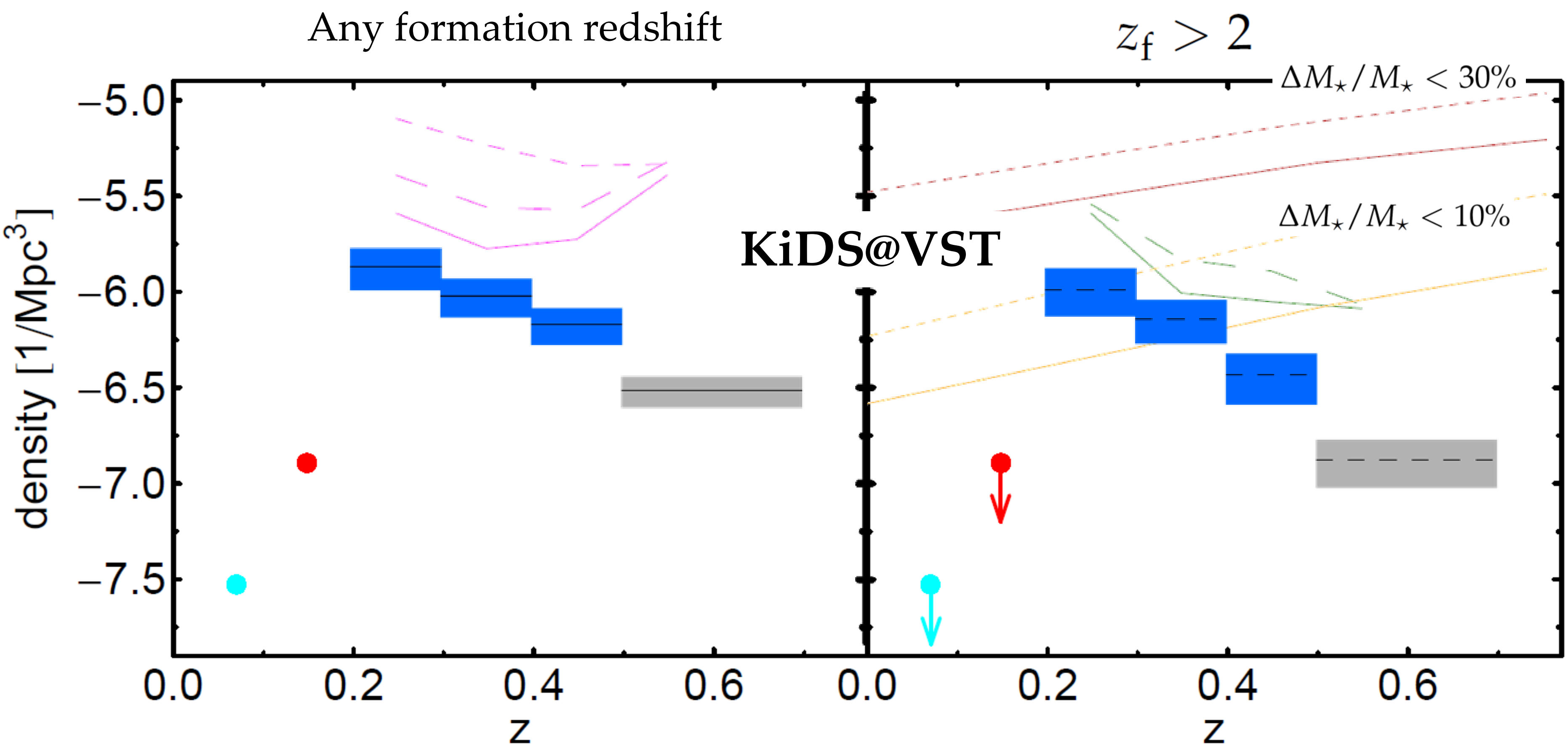








Effect of using the spectroscopic redshift



Trujillo et al. 2009

$M_\star > 8 \times 10^{10}\, M_\odot$

$R_e < 1.5\,\mathrm{kpc}$

Taylor et al. 2010

$M_\star > 7 \times 10^{10}\, M_\odot$

$\Delta \log R_e < -0.4\,\mathrm{dex}$

Damjanov et al. 2014 (BOSS)

stellar-like objects (not QSOs)

Mass criteria using dynamical Mass

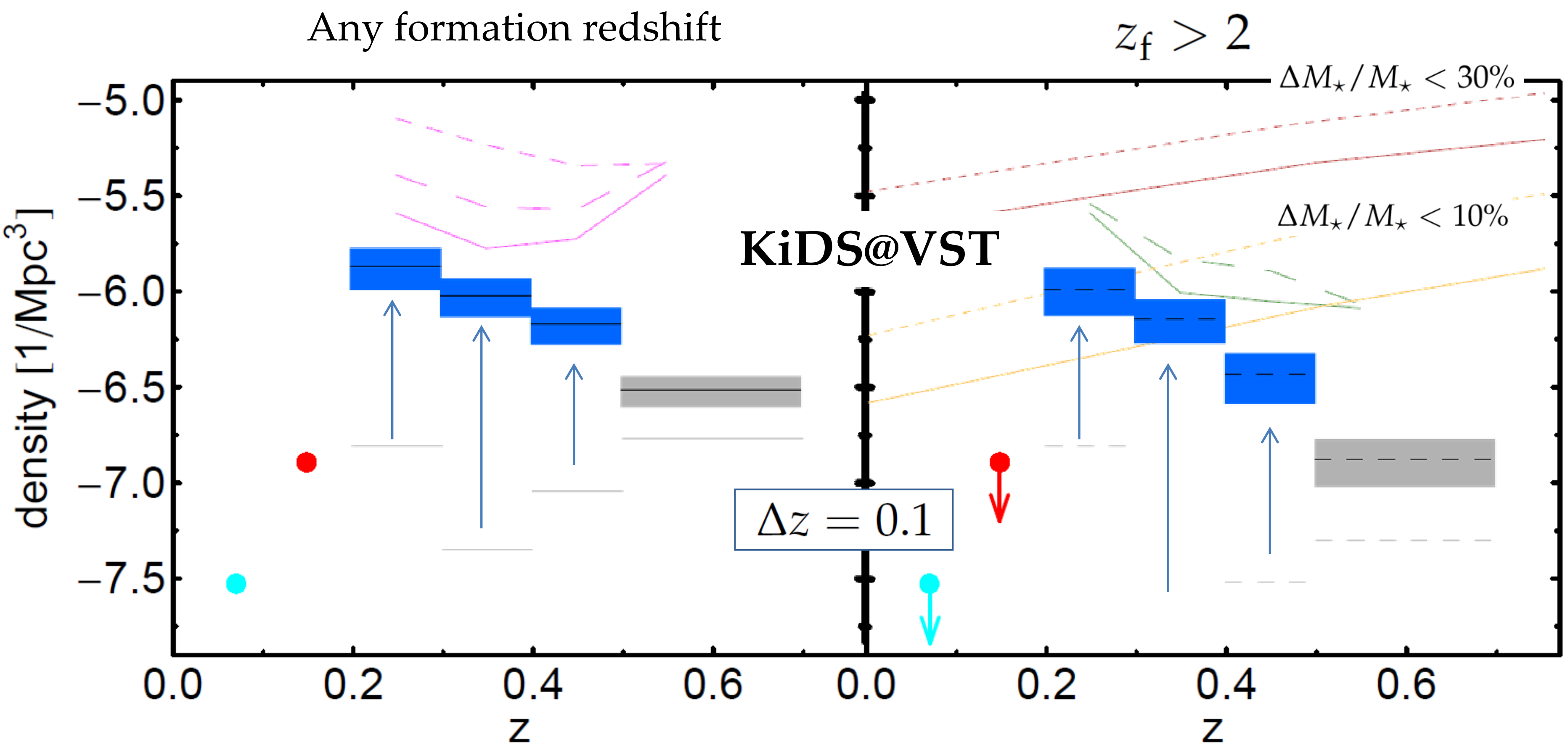
No cut on effective radius

Quilis & Trujillo 2013

N-body simulations

No cut on effetive radius

$M_\star > 8 \times 10^{10}\, M_\odot$



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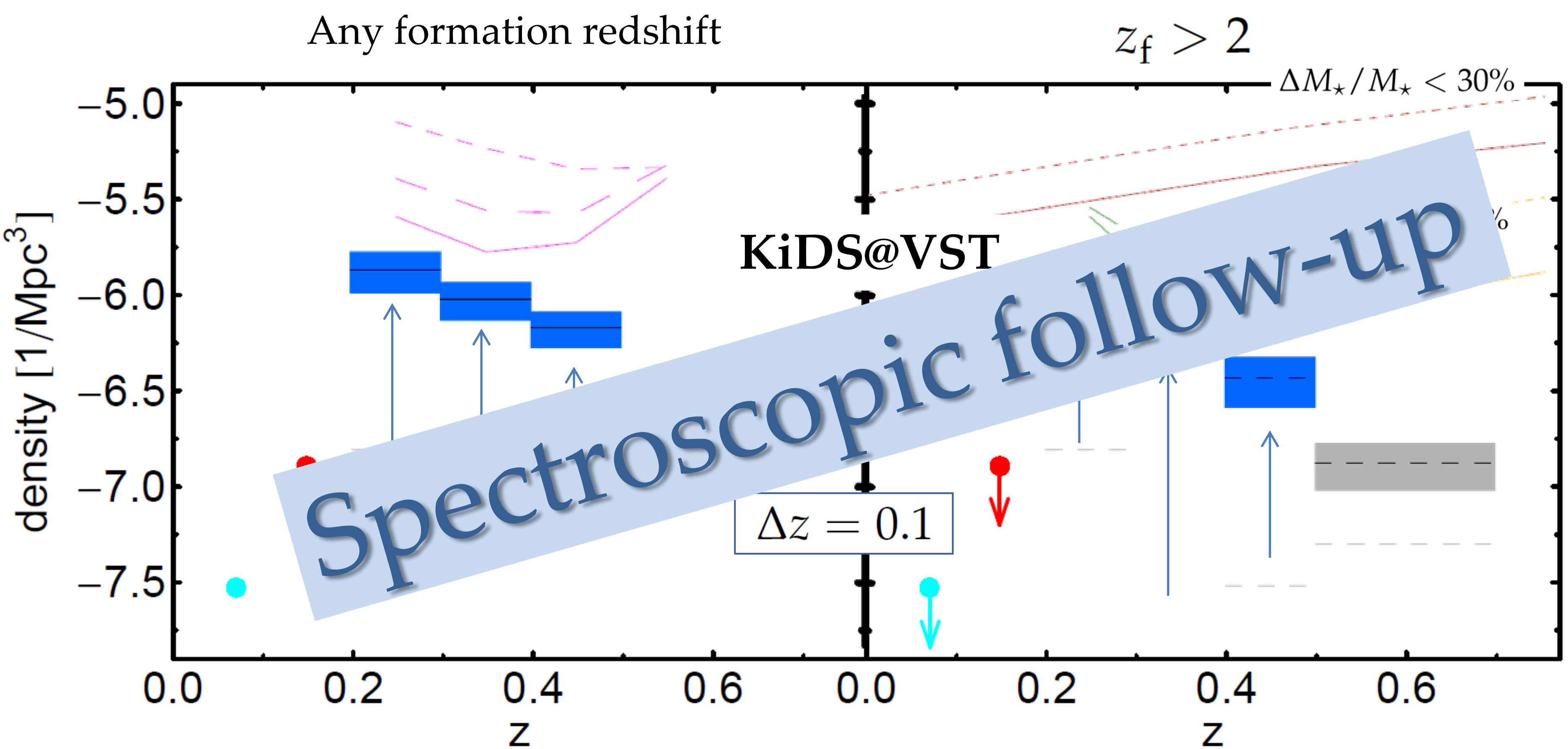

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Future prospects

At the end of KiDS survey we expect to collect

3.5 millions
(high-S/N)

- Structural parameters
- Stellar masses
- Colour gradients
- ……….

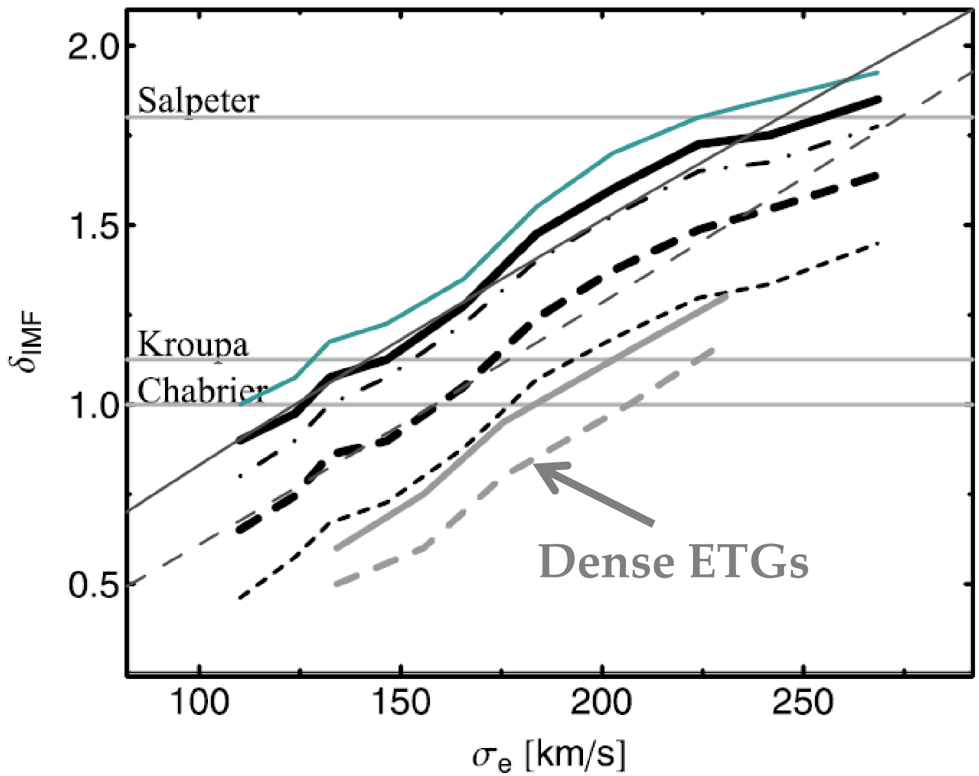
100.000
(high-S/N + SDSS spectra)

- Mass profiles
- dark matter content
- IMF
- ……..

> 500 confirmed super-compact galaxies

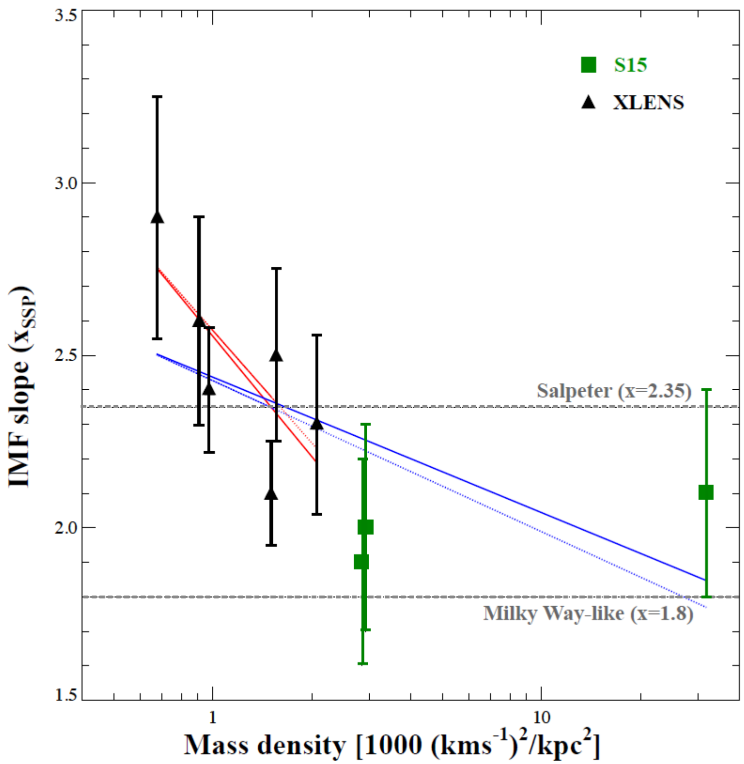
IMF vs. density

Tortora et al. 2013



IMF "normalization" from dynamics using different DM profiles

Spiniello et al. 2015



IMF slope from lensing, dynamics and line indices

Shallow IMF slopes in Smith et al. (2015)

Thanks…

…massive and compact