KiDS grew up !

MARIO RADOVICH – OAPD DAYS / 18 JUNE 2019

KiDS timeline

2002: VST first mirror broken during shipping to ESO

2005: ESO acceptance of a proposal for a public survey of 1500 sq. degrees
   Main science goal: P.I. K. Kuijken (Leiden Univ.)state of the art Weak Lensing
      Parallel proposal on VISTA (P.I. Sutherland/Edge)

      Data products: ugri+ZYJHK photometry

2007: 2nd major shipping disaster (actuators lost)

2011: VST first light; KiDS started !

2013: First KiDS ESO release (50 sq. degrees)

2016: VIKING terminated at 1300 square degrees

2017: First VST+VIKING catalogs (KV450).

2019: KiDS observations completed !

ESO Public Surveys Proposal Form   Phase 1

1 KIDS: a 1500-square degree cosmological survey with VST/OmegaCAM

PI: Konrad KUIJKEN, Leiden Observatory, The Netherlands
Ralf Bender, Hans Böhringer, Massimo Capaccioli, Thomas Erben, Ulrich Hopp, Yannick Mellier, Mark Neeser, John Peacock, Mario Radovich, Roberto Saglia, Peter Schneider, Peter Schuecker, Stella Seitz, Roberto Silvotti, Will Sutherland, Andy Taylor, Edwin Valentijn, Steve Warren

1.1 Abstract:

We propose a large (1500 square degree in $u'g'r'i'$, 2800 in i') public imaging survey with VST/OmegaCAM, dubbed the Kilo-Degree Survey (KIDS). It targets two regions of the sky where massive redshift surveys have taken place, and where near-infrared surveys will soon begin: an equatorial strip on the North Galactic Cap, and a patch around the South Galactic Pole. In terms of area coverage and sensitivity, KIDS interpolates between the ongoing Sloan Imaging Survey, which is about 2.5 magnitude shallower but 7× wider, and the roughly 1 magnitude deeper, 9× smaller-area CFHTLS-Wide survey at CFHT.

The survey has been designed with weak lensing as a major goal. Image quality is expected to be a factor of two better than SDSS, and slightly better than CFHTLS-Wide. It will yield a large, homogeneous data set with photometry from u' to K, with 200,000 spectra available for the brightest galaxies in the field. Expected science results include a sample of $z > 6$ quasars, several thousand galaxy clusters beyond redshift 1, the power spectrum of the galaxy distribution around redshift 1, and a detailed understanding of the structure of galactic halos as function of galaxy type and environment.
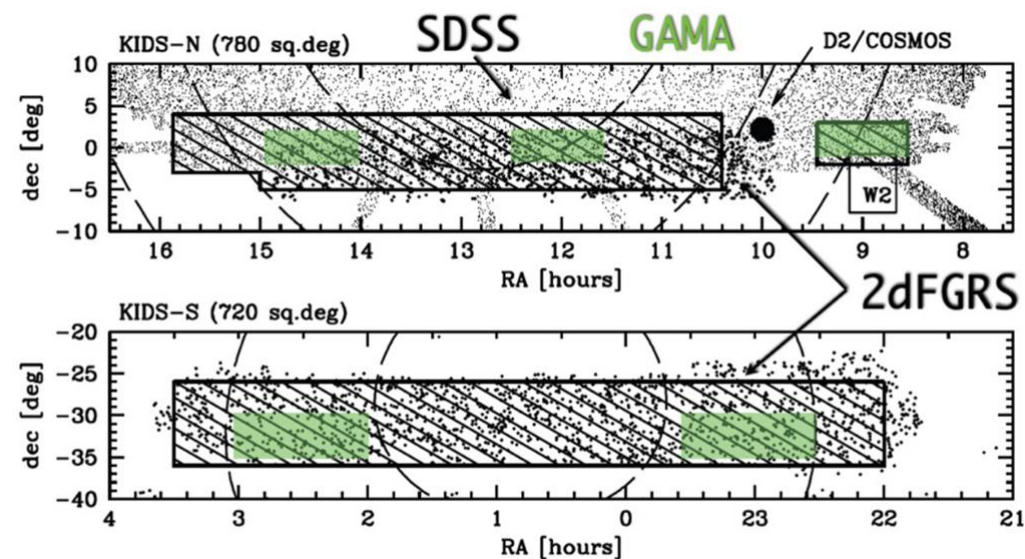
SDSS, 2dF, GAMA redshift surveys, Herschel-ATLAS

KiDS team members

Order by: First name | Last name | Affiliation

Last name	First name	Affiliation
Edge	Alastair	Durham University
Huang	Zhuoyi	INAF - consultant
Labarbera	Francesco	INAF - OACN Naples
Napolitano	Nicola	INAF - OACN Naples
Rifatto	Agatino	INAF - OACN Naples
Dall'Ora	Massimo	INAF - OACN Naples
Puddu	Emanuella	INAF - OACN Naples
Cavuoti	Stefano	INAF - OACN Naples
Getman	Fedor	INAF - OACN Naples
Brescia	Massimo	INAF - OACN Naples
Tortora	Crescenzo	INAF - OACN Naples
Grado	Aniello	INAF - OACN Naples
Radovich	Mario	INAF - Observatory of Padova
Koopmans	Leon	Kapteyn Institute - Groningen
Petrillo	Carlo Enrico	Kapteyn Institute - Groningen
de Jong	Jelte	Leiden Observatory
Kuijken	Konrad	Leiden Observatory
Franse	Jeroen	Leiden University
Köhlinger	Fabian	Leiden University
Pila-Diez	Berenice	Leiden University
Cacciato	Marcello	Leiden University
Viola	Massimo	Leiden University
van der Burg	Remco	Leiden University
Semboloni	Elisabetta	Leiden University
Sifon	Cristobal	Leiden University
Brouwer	Margot	Leiden University
Helmich	Ewout	Leiden University
Hoekstra	Henk	Leiden University
Herbonnet	Ricardo	Leiden University
Irisarri	Nancy	Leiden University
Lacerda	Pedro	Max Planck Institute for Solar System Research
Kitching	Thomas	Mullard Space Science Laboratory
Belikov	Andrey	OmegaCEN - Groningen
Sikkema	Gert	OmegaCEN - Groningen
Begeman	Kor	OmegaCEN - Groningen
Valentijn	Edwin	OmegaCEN - Groningen
Vriend	Willem-Jan	OmegaCEN - Groningen
McFarland	John	OmegaCEN - Groningen
Buddelmeijer	Hugo	OmegaCEN - Groningen
Verdoes Kleijn	Gijs	OmegaCEN - Groningen
Boxhoorn	Danny	OmegaCEN - Groningen
Bout	Jeffrey	OmegaCEN - Groningen
Sutherland	William	Queen Mary University of London
Blake	Chris	Swinburne University
Longo	Giuseppe	Uni. Naples - Physics
Covone	Giovanni	Uni. Naples - Physics
Paolillo	Maurizio	Uni. Naples - Physics
Roy	Nivya	Uni. Naples - Physics
Capaccioli	Massimo	Uni. Naples - Physics
Joachimi	Benjamin	University College London

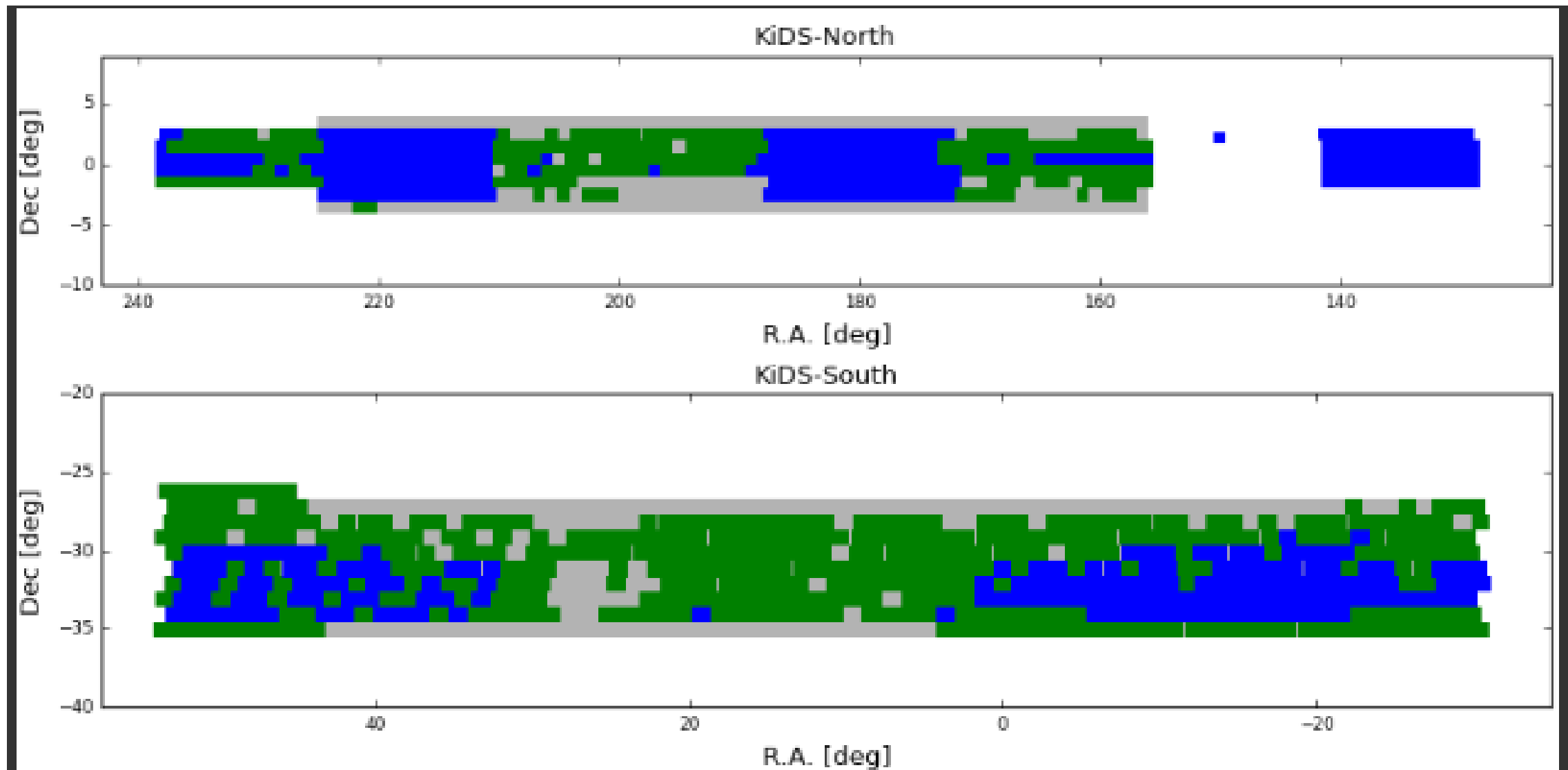|		
Nakajima	Reiko	University of Bonn
Buddendiek	Axel	University of Bonn
Erben	Thomas	University of Bonn
Hildebrandt	Hendrik	University of Bonn
Simon	Patrick	University of Bonn
Applegate	Douglas	University of Bonn
Tudorica	Alexandru	University of Bonn
Schrabback	Tim	University of Bonn
Cordes	Oliver-Mark	University of Bonn
Schneider	Peter	University of Bonn
van Uitert	Edo	University of Bonn
Harnois-Deraps	Joachim	University of British Columbia
van Waerbeke	Ludovic	University of British Columbia
Heymans	Catherine	University of Edinburgh
Peacock	John	University of Edinburgh
Choi	Ami	University of Edinburgh
Fenech Conti	Ian	University of Malta
Zarb Adami	Kristian	University of Malta
Velander	Malin	University of Oxford
Miller	Lance	University of Oxford
Chisari	Elisa	University of Oxford

External collaborators

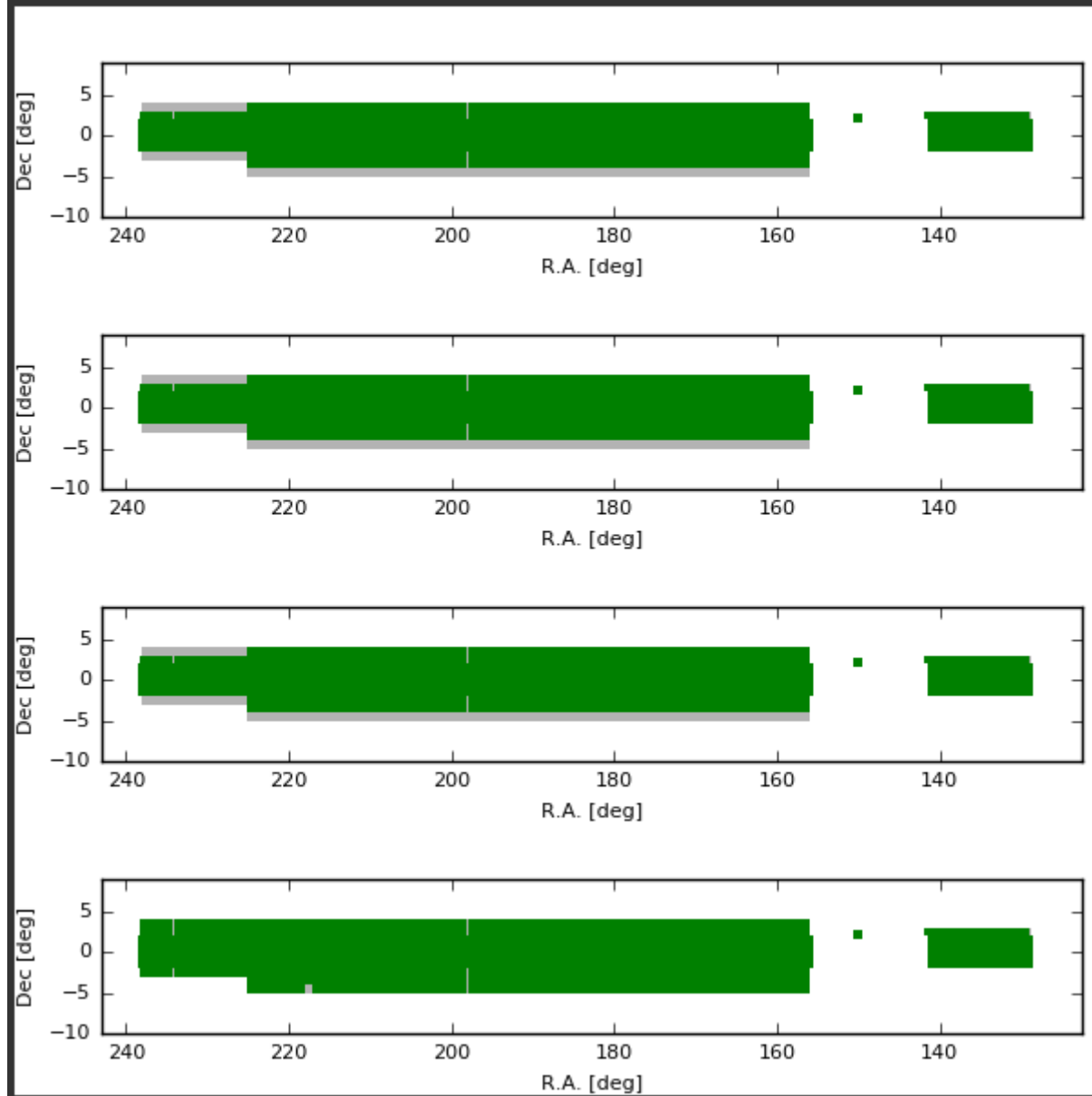External collaborators are listed per project below.

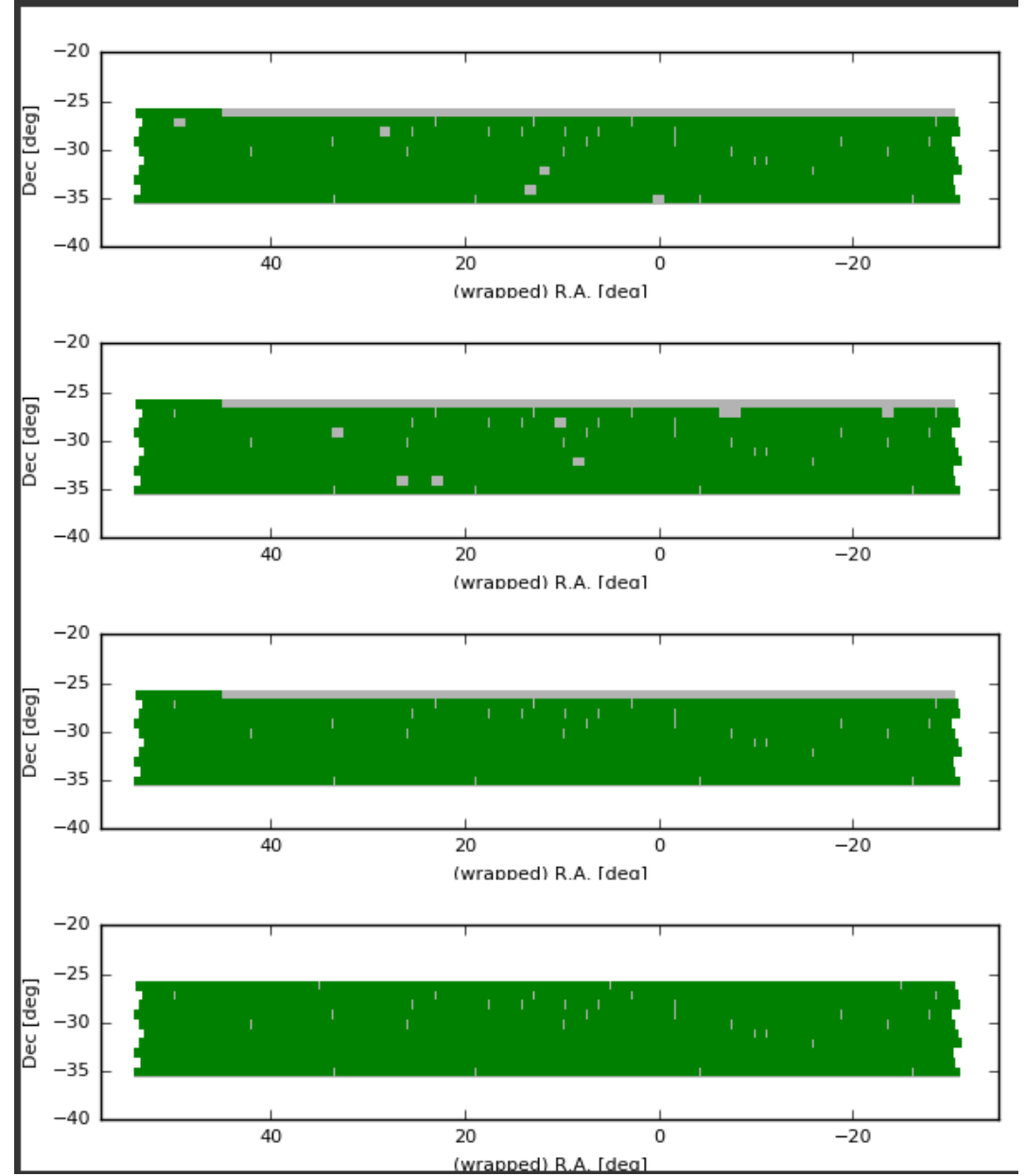| Project title	External collaborators
Searching for galaxy clusters in KiDS Project details	L. Moscardini, F. Bellagamba, M. Roncarelli (Univ. Bologna); M. Meneghetti (INAF- Bologna)
Lensing masses of galaxies in GAMA groups Project details	GAMA
Hunting for the MW Halo satellites Project details	Marcella Di Criscienzo (INAF-OAR)
High redshift QSOs in KiDS+VIKING Project details	Bram Venemans (VIKING), Peter Barthel (Kapteyn) and intention to have more.
Strong-lensing Project details	Leon Koopmans and team, expected to become KiDS member and PI. Besides this we will collaborate with Euclid-StrongLensing Working Group
Mining the Solar System Project details	Elena Mazzotta Epifani (INAF-OACN); Davide Perna (Observatoire de Paris)
Weak lensing of ACTPol clusters Project details	interested ACTPol members (TBC)

KiDS ESO-DR2   (Release: November 2014)   170 sq. degrees

KiDS ESO-DR3 (Release: October 2016)   440 sq. degrees

KiDS ESO-DR4   (Release: October 2018)   1000 square degrees
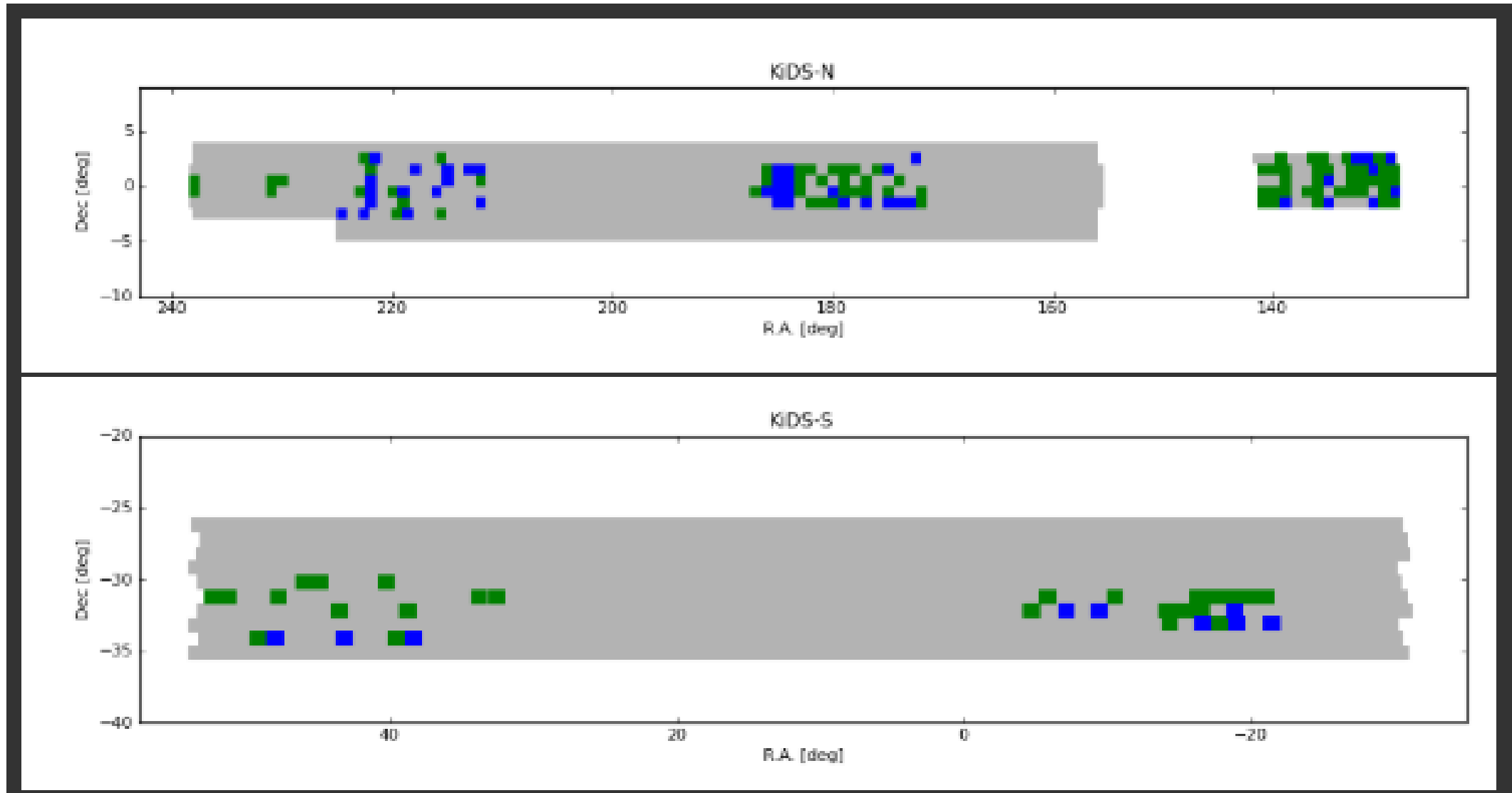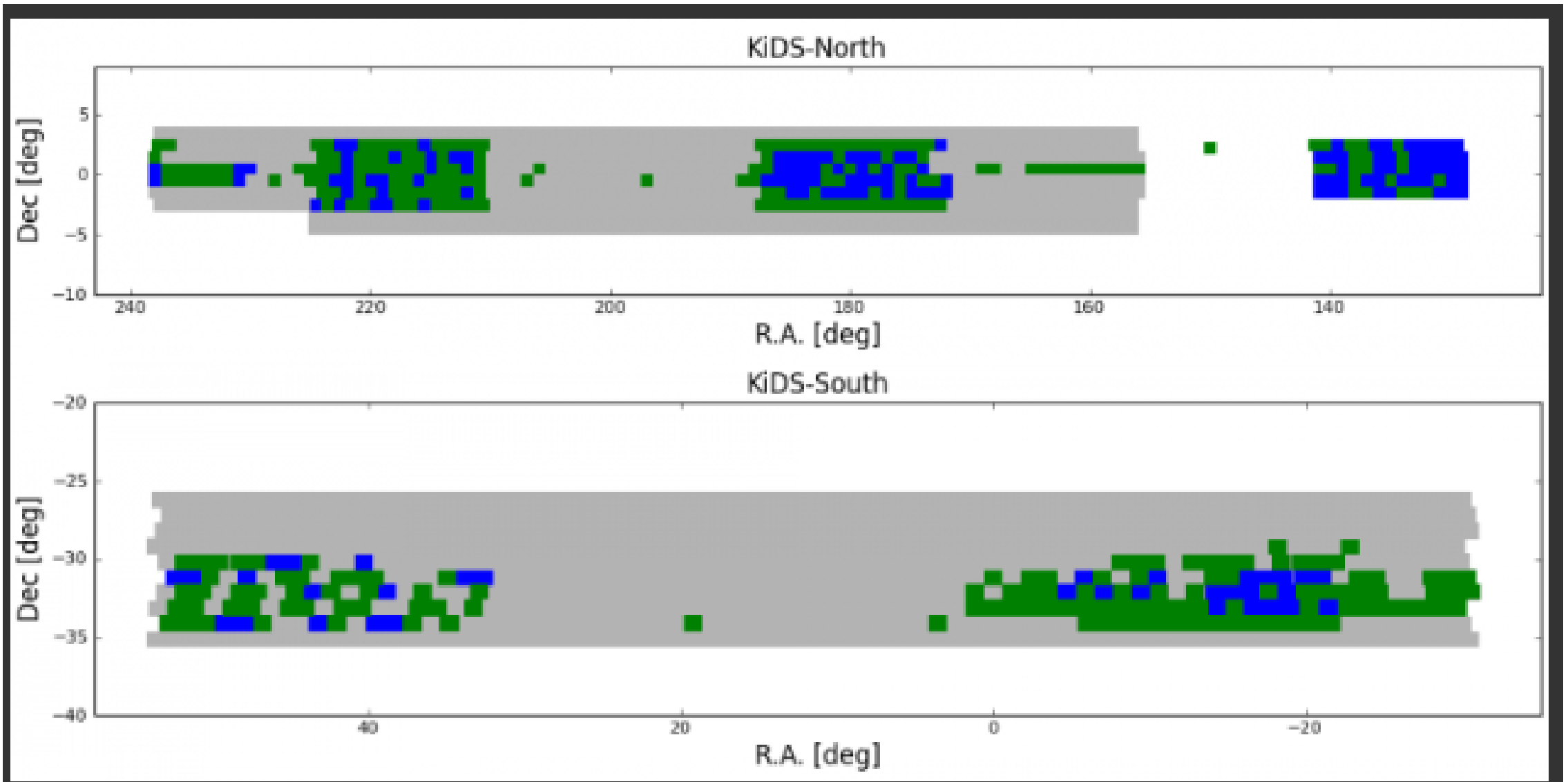
KiDS data products

- DR2, DR3: ugri-only photometry (aperture, Kron, PSF photometry)

- DR4(,DR5): ugriZYJHK photometry (detection in r; forced PSF photometry only in other bands)

- Photometric redshifts («standard» template fitting; Machine Learning)

- Galaxy shapes for the weak lensing analysis

- Ancillary products: quasars candidates; strong lensing; **galaxy clusters**

KiDS site: http://kids.strw.leidenuniv.nl

KiDS results

@Today > 50 refereed papers on:

galaxy-galaxy lensing
cosmic shear
compact galaxies
strong lensing
galaxy clusters
quasar search
photometric redhifts techniques
and other…..

$$S_8 \equiv \sigma_8 \sqrt{\Omega_m / 0.3}$$
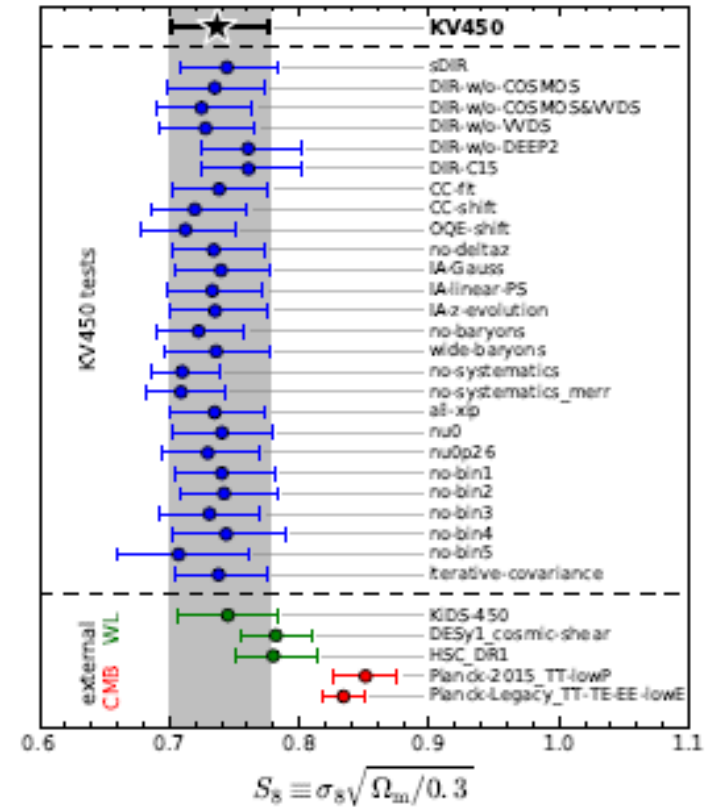
Analysis of a giant new galaxy survey, made with ESO's VLT Survey Telescope in Chile, suggests that dark matter may be less dense and more smoothly distributed throughout space than previously thought. An international team used data from the Kilo Degree Survey (KiDS) to study how the light from about 15 million distant galaxies was affected by the gravitational influence of matter on the largest scales in the Universe. The results appear to be in disagreement with earlier results from the Planck satellite.

Clusters in KiDS

M. Radovich (INAF-OAPD)
E. Puddu, A. Grado, F. Getman (INAF-OACN)
F. Bellagamba, M. Roncarelli, L. Moscardini (UNIBO) – Developers of AMICO
S. Bardelli, M. Sereno (INAF-OABo)
M. Maturi (Univ. Heidelberg)

AMICO is one of the two cluster search tools selected for EUCLID: it was applied to real data for the first time on KiDS

NOT based on red-sequence search: overdensities in ra, dec, redshift, mag

List of cluster candidates with: LL centers and redshifts; detection significance (SN); richness

For each galaxy: membership probability

First KiDS cluster catalog: Radovich et al. 2017 (KiDS DR2)

Current release: KiDS DR3, including purity/completeness based on mock catalogs (Maturi et al. 2019); mass calibration of richness using WL mass of stacked clusters/redshift (Bellagamba et al. 2019)

Now in progress: KiDS DR4, (DR5)

Z = 0.3

Z = 0.4
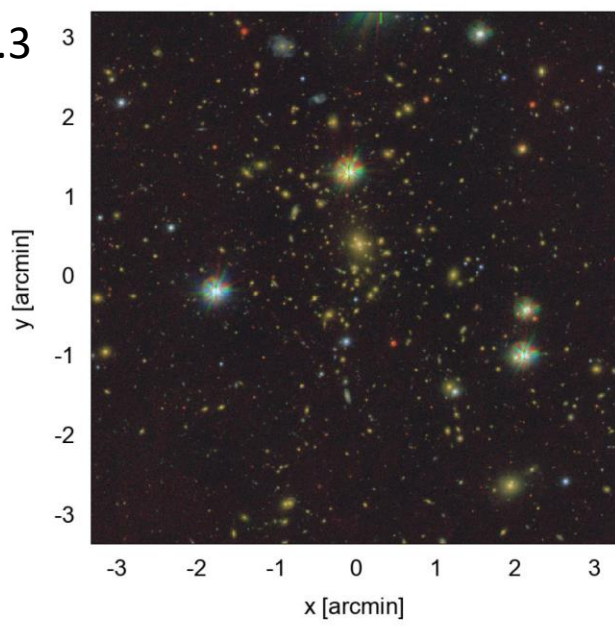
Z = 0.5
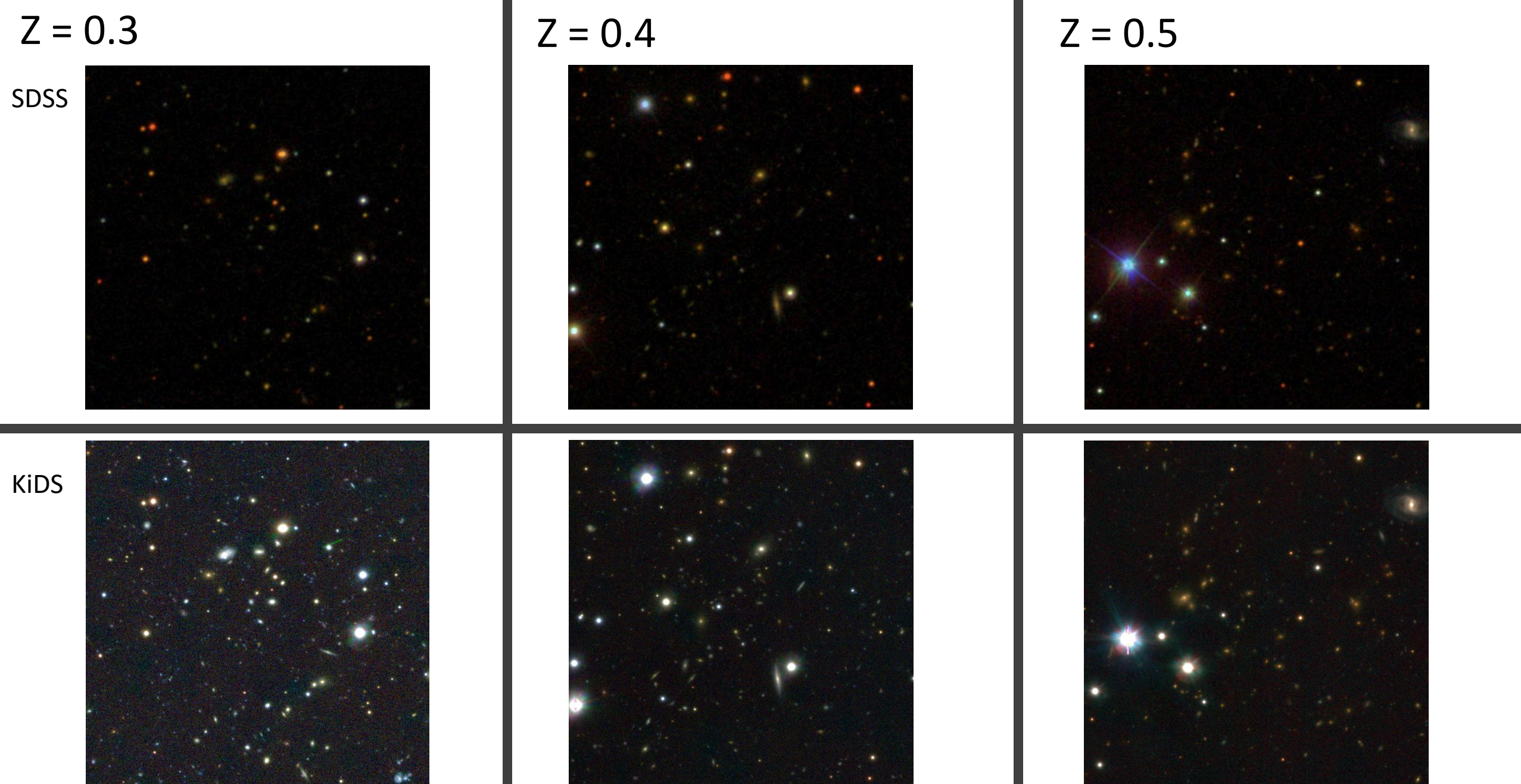
SDSS

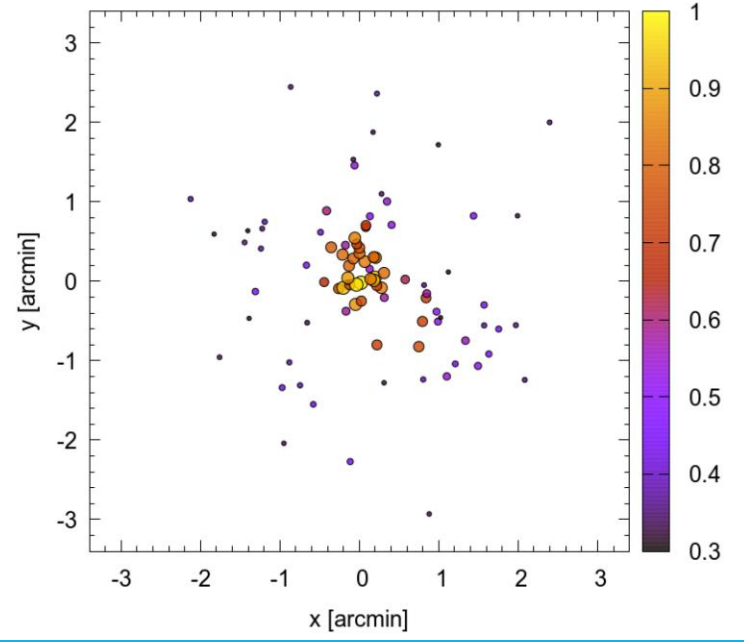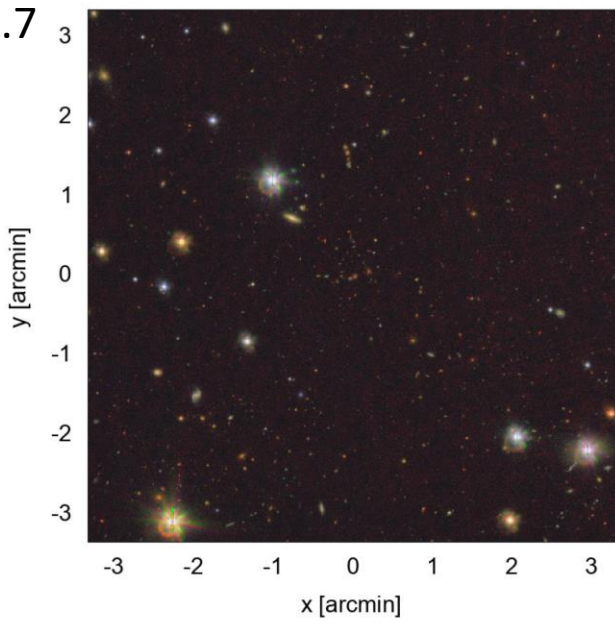KiDS

Clusters in KiDS vs. SDSS

KiDS
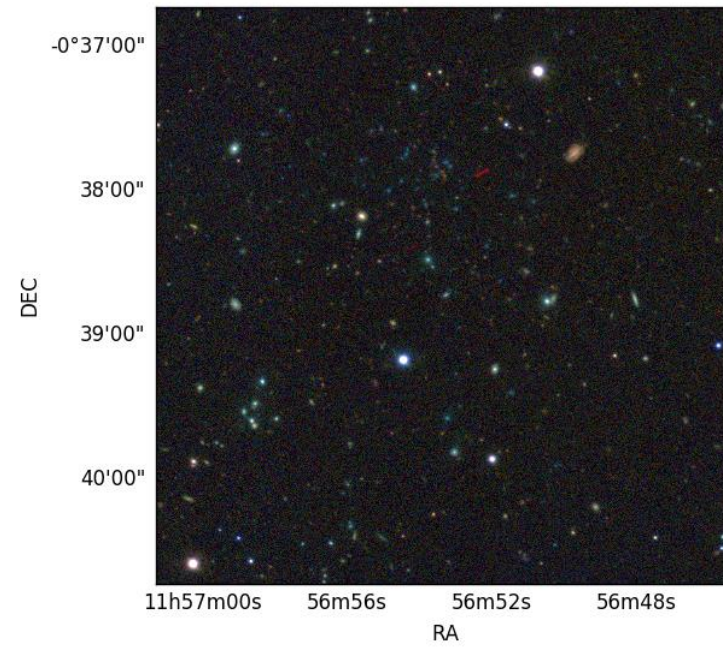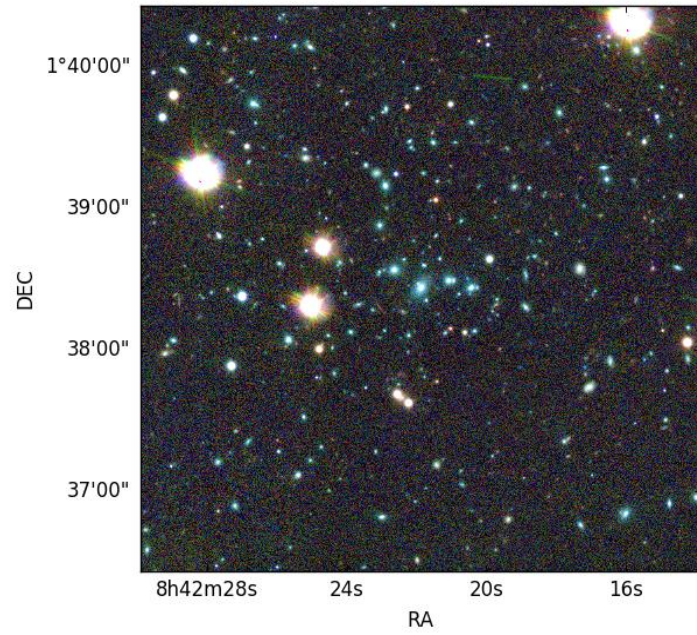
HSC
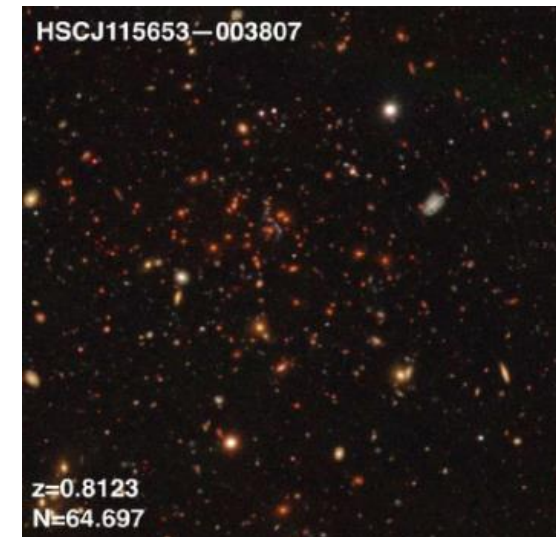
High redshift clusters detected in KiDS and Hyper-SuprimeCam
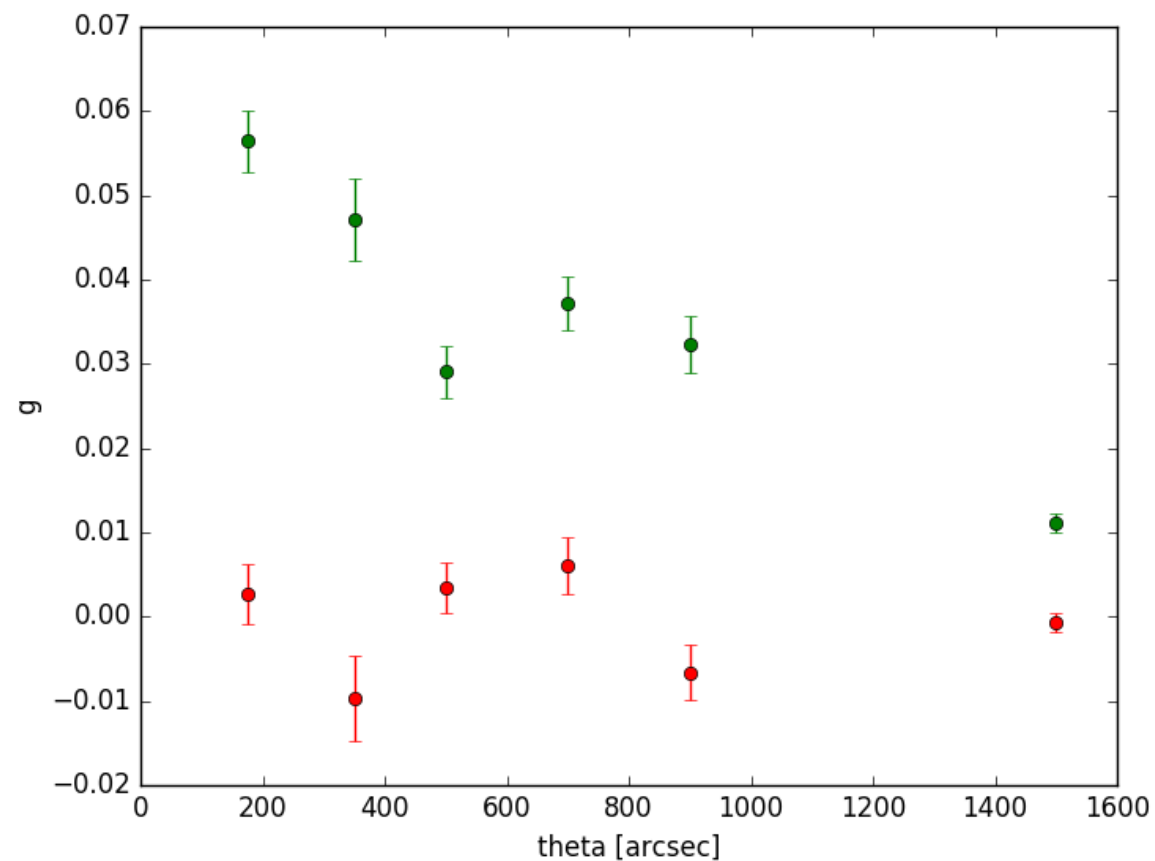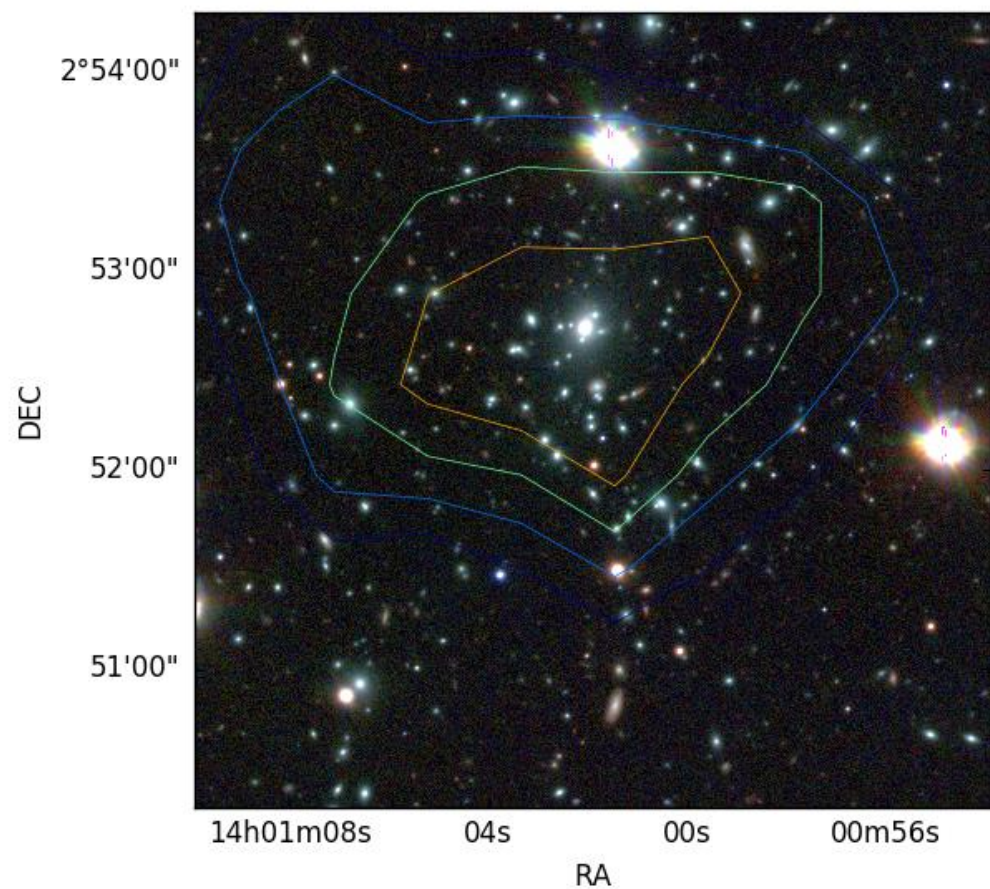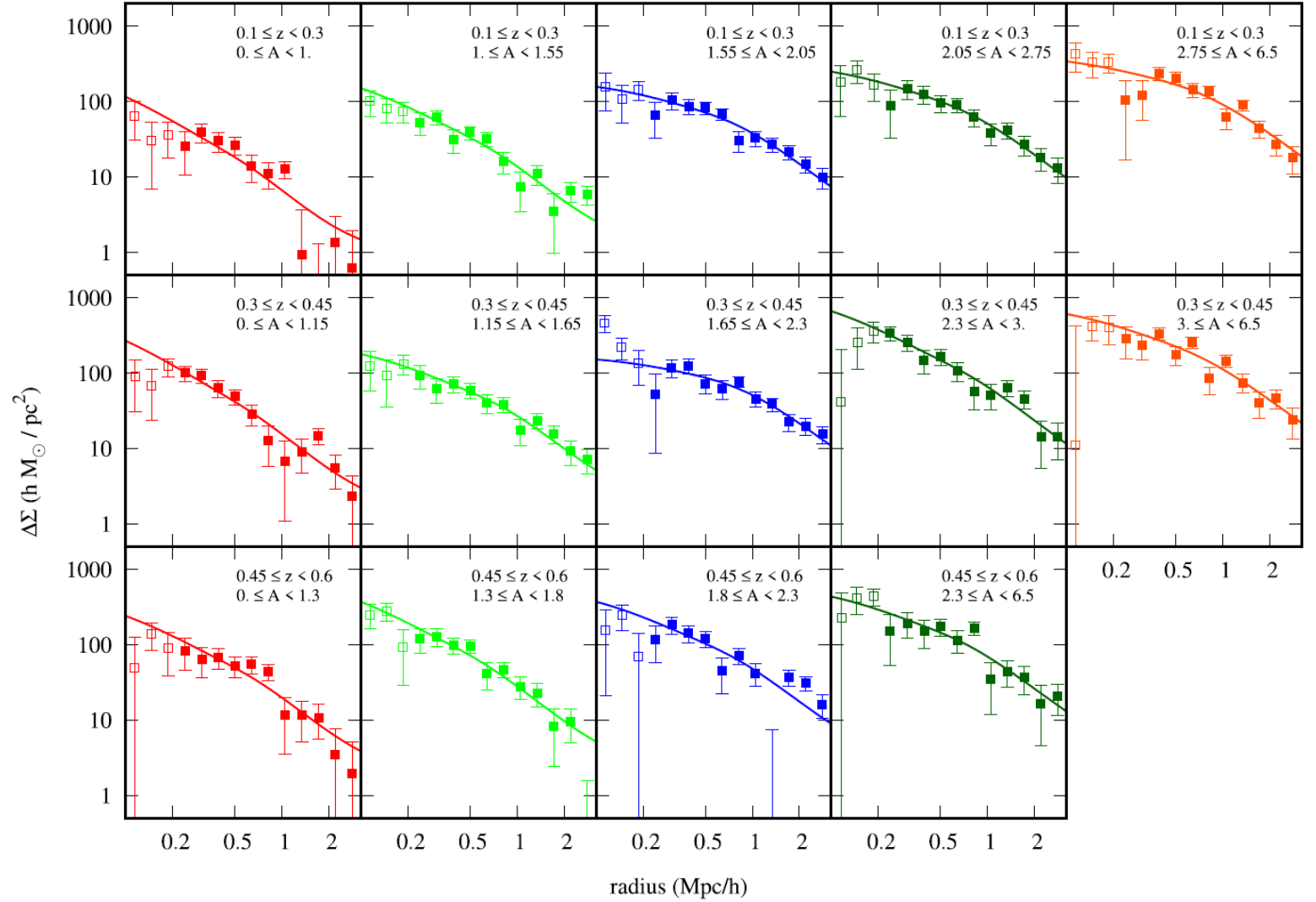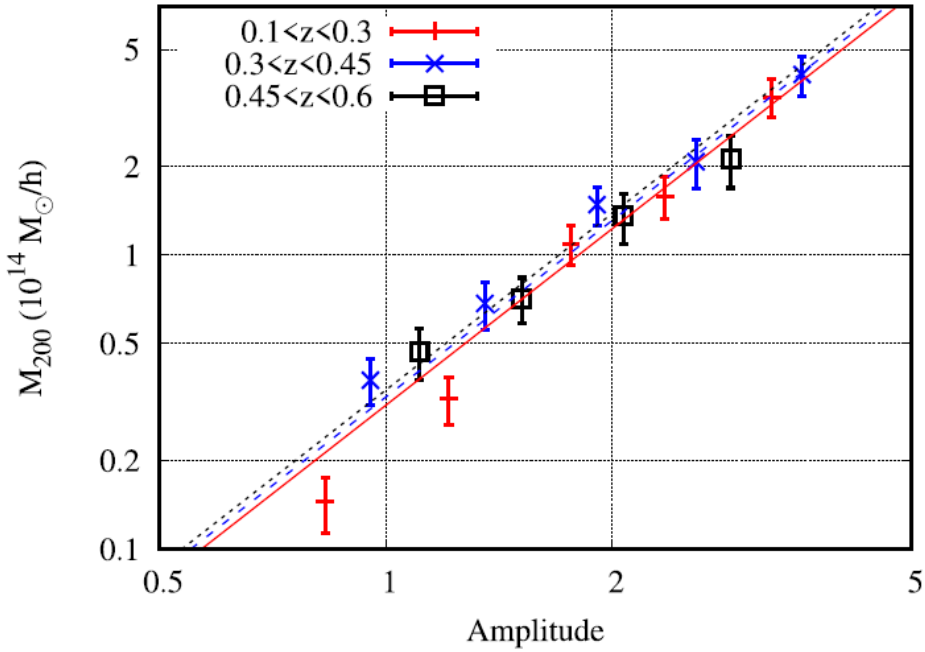
Z=0.3

Bright star
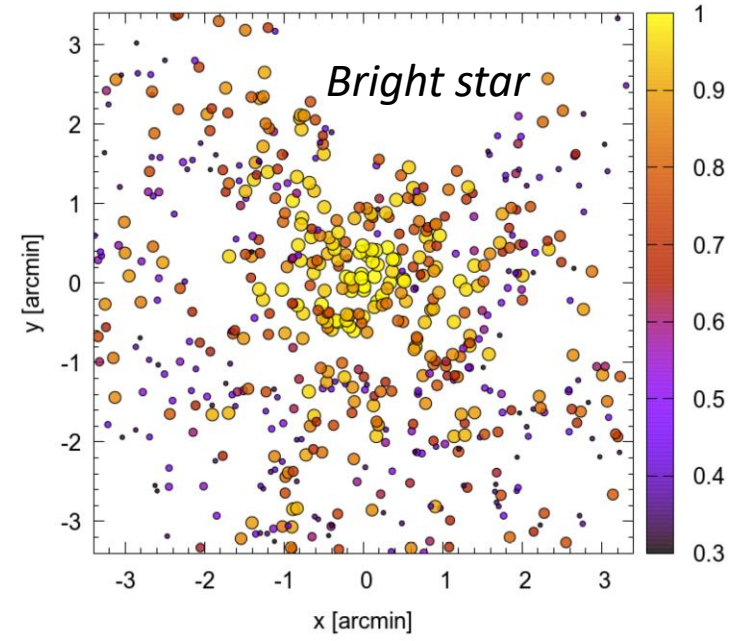
Z=0.7

Galaxy clusters as seen by AMICO, and their *membership probabilities* (Maturi et al. 2019)

Weak lensing analysis of individual clusters in KiDS is challenging !

Stacked cluster surface density profiles obtained by weak lensing, and calibration of the richness-mass relation
(Bellagamba et al. 2019)

KiDS in the future

4MOST: 2400 fiber spectroscopy in 4 sq. degrees with VISTA.
Expected start of operations: 2022

Call for letter of intents: ~ September 2019

4MOST consortium: **Wide Area VISTA Extragalactic survey (WAVES)**
    WAVES-wide: spectroscopy for galaxies and groups at z<0.2 in 1300 sq. deg
    WAVES-deep: z<0.8 in 70 sq. degrees

Proposal (**Boehringer**, *Moscardini, Radovich, Maturi & Euclid consortium*) for
a spectroscopic follow-up of the cluster members detected in KiDS (DR5)@z>0.2
Synergy with EUCLID
      IN PROGRESS !