KiDS

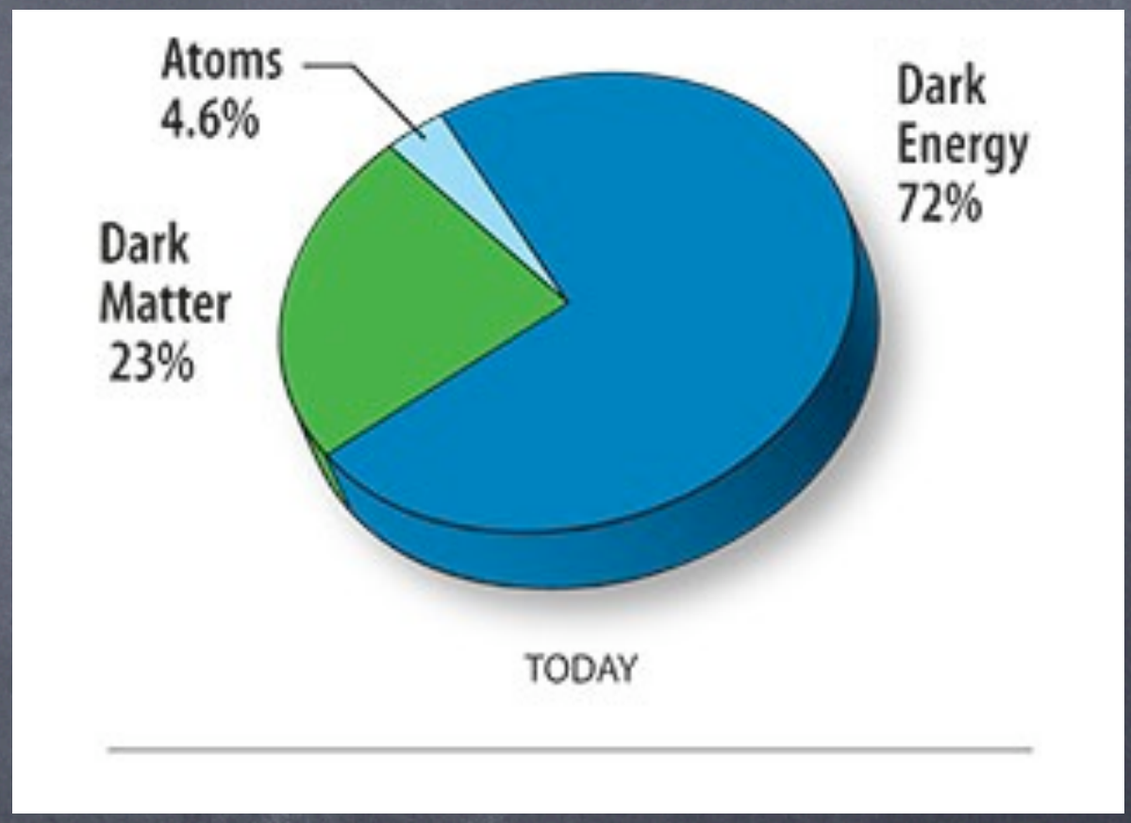
KiDS
Kilo-Degree Survey

K Kuijken
Leiden
for the KiDS Consortium:
Bonn (Schneider), Edinburgh (Peacock), Groningen (Valentijn), Munich (Bender), Imperial (Warren), INAF (Capaccioli), Paris (Mellier), QMW (Sutherland)

KiDS

Primary science case

- The "pizza that nobody ordered"
  - Understand dark components of the universe
  - Gravitational lensing + photo-z's
- 1500 square degree extragalactic 9-band map



Leiden Observatory

Universiteit Leiden

KiDS

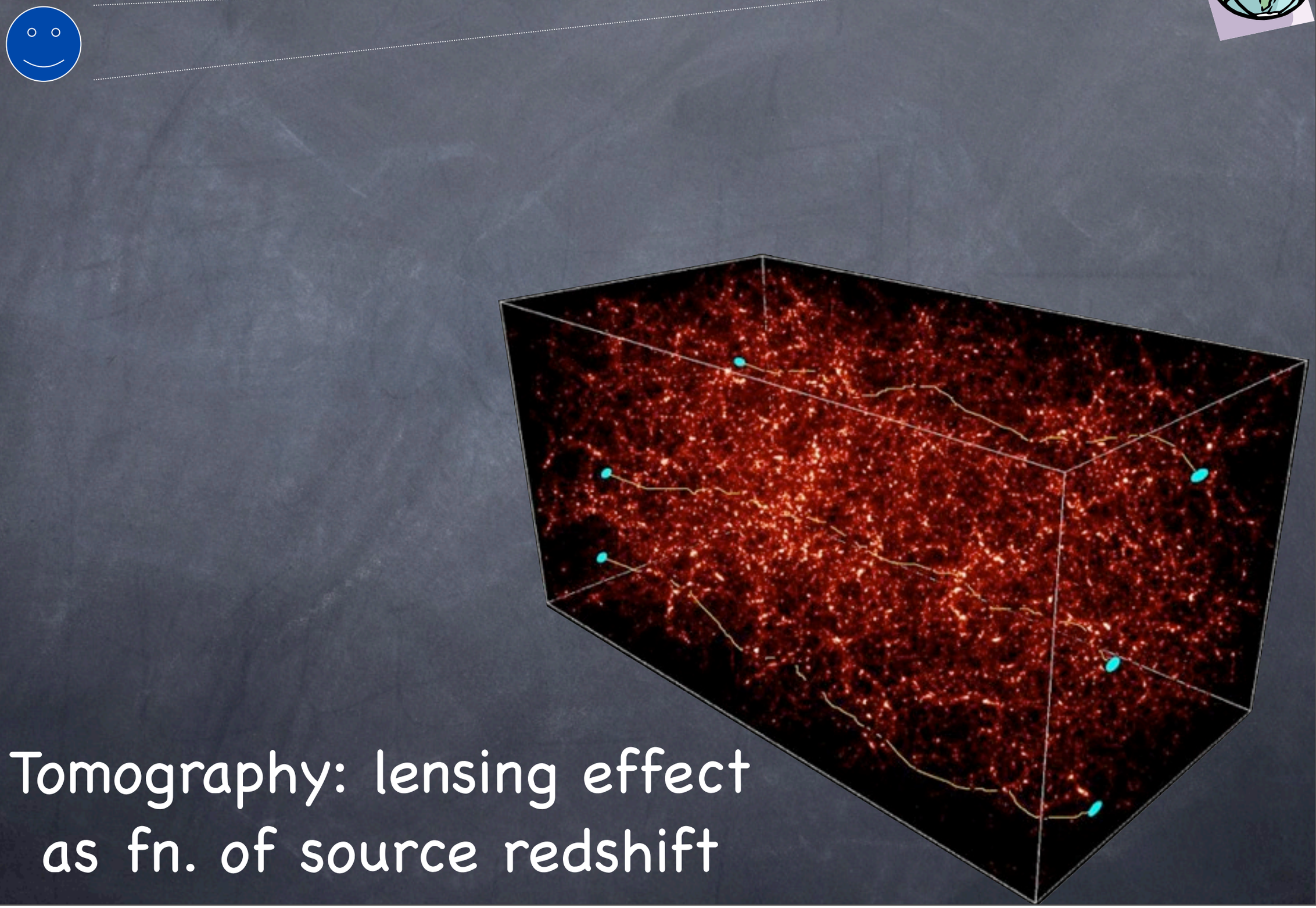
Leiden Observatory

Universiteit Leiden

Probes of dark energy

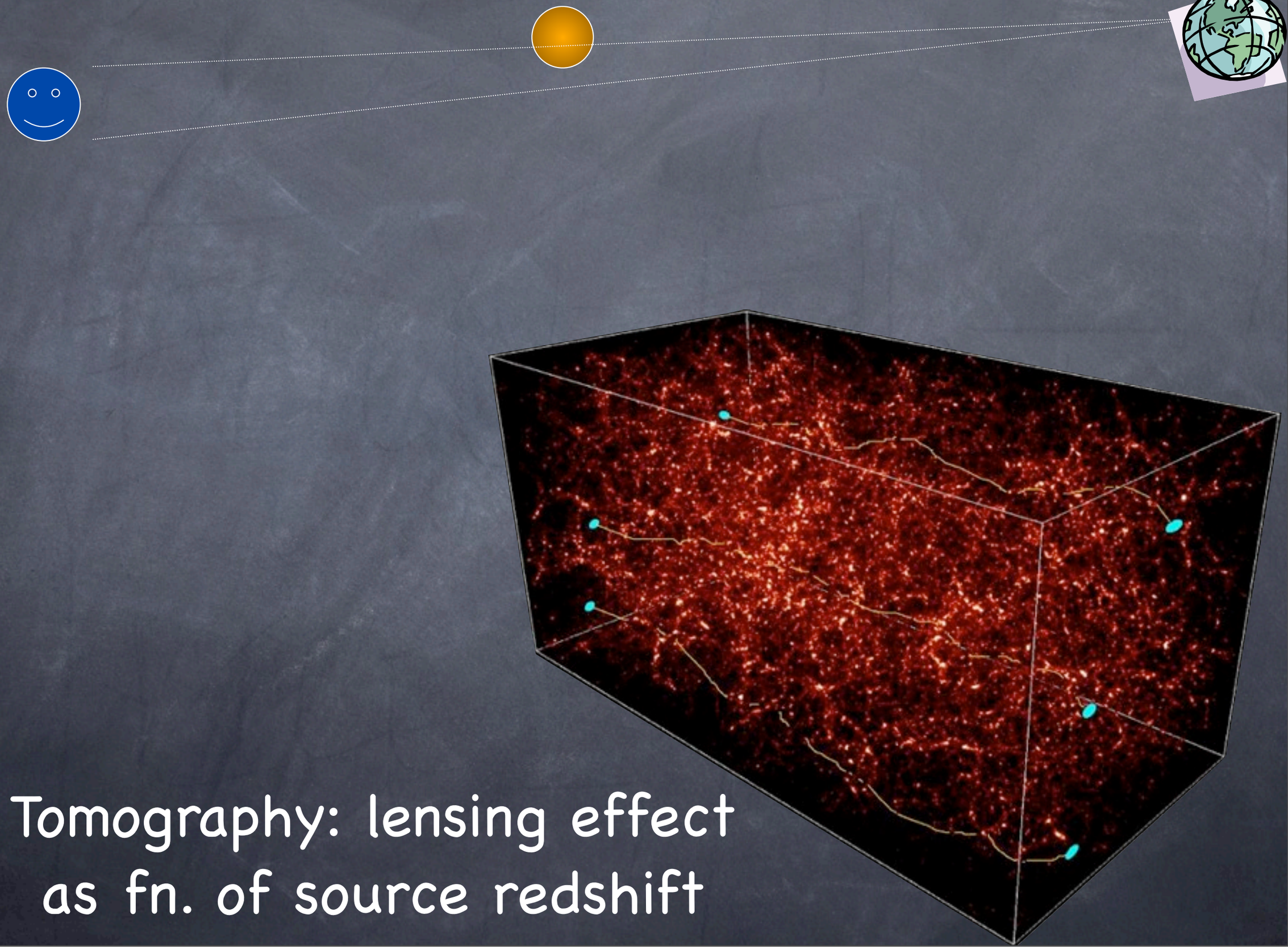
- 1. Expansion history of the universe a(t)
  - measure as m(z), $D_A(z)$
- 2. (Linear) growth rate of structure
  - measure from evolution of cluster mass fn, matter power spectrum
- Consistency is a test of General Relativity
- Probes: clusters, SNIa, BAO, weak lensing
  - Ultimately wk.lensing potentially most powerful

Weak gravitational lensing



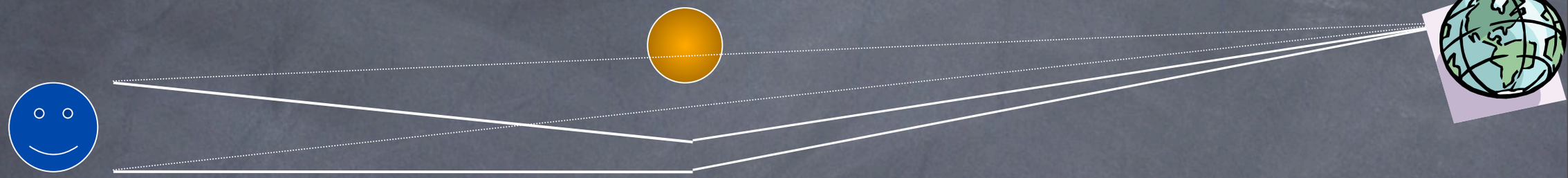
Tomography: lensing effect as fn. of source redshift

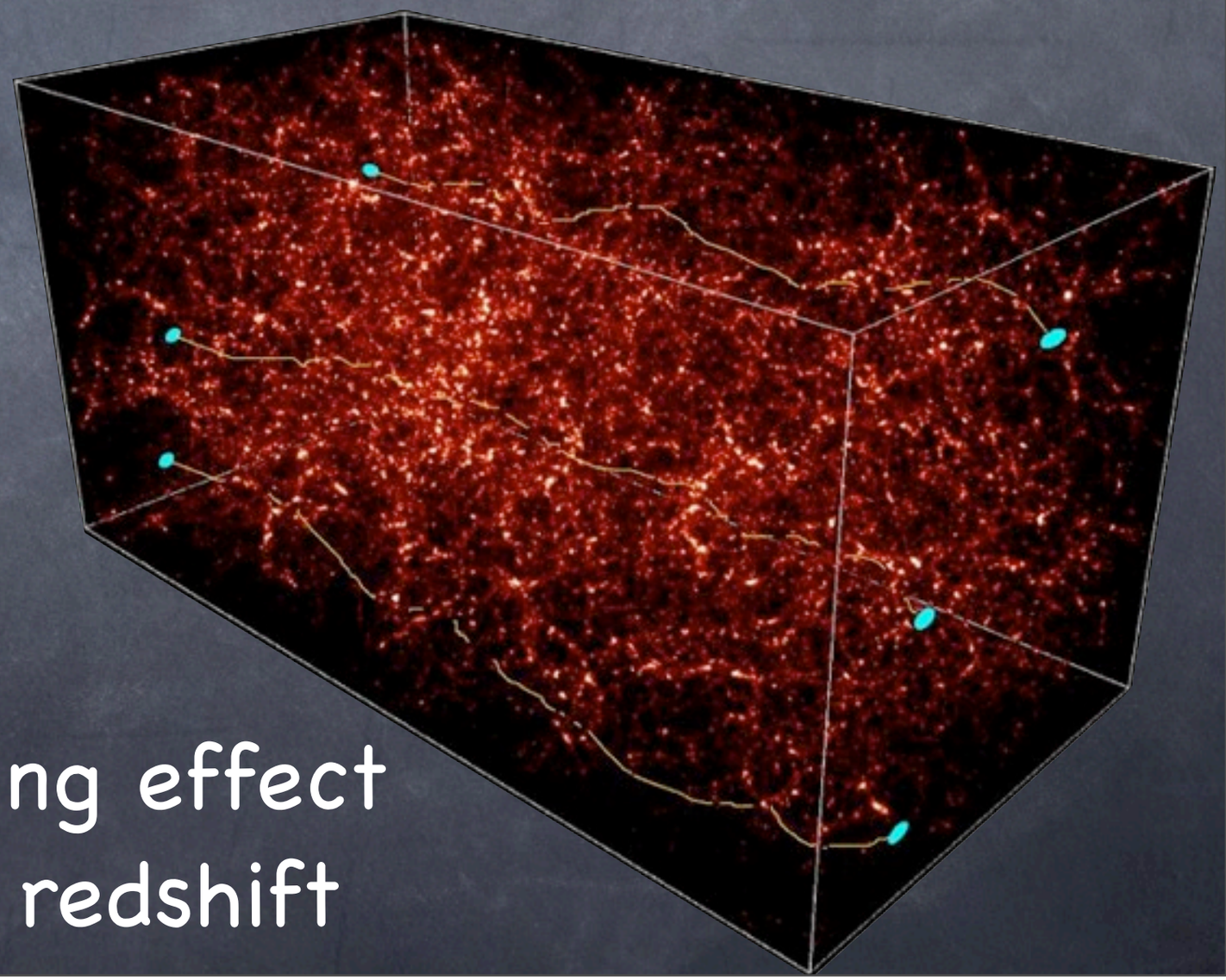
Weak gravitational lensing



Tomography: lensing effect as fn. of source redshift

Weak gravitational lensing



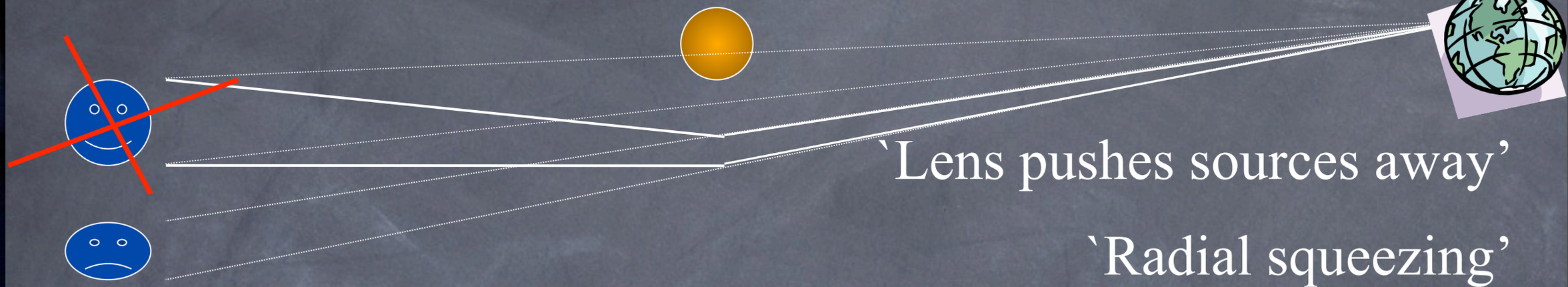


Tomography: lensing effect as fn. of source redshift

Leiden Observatory

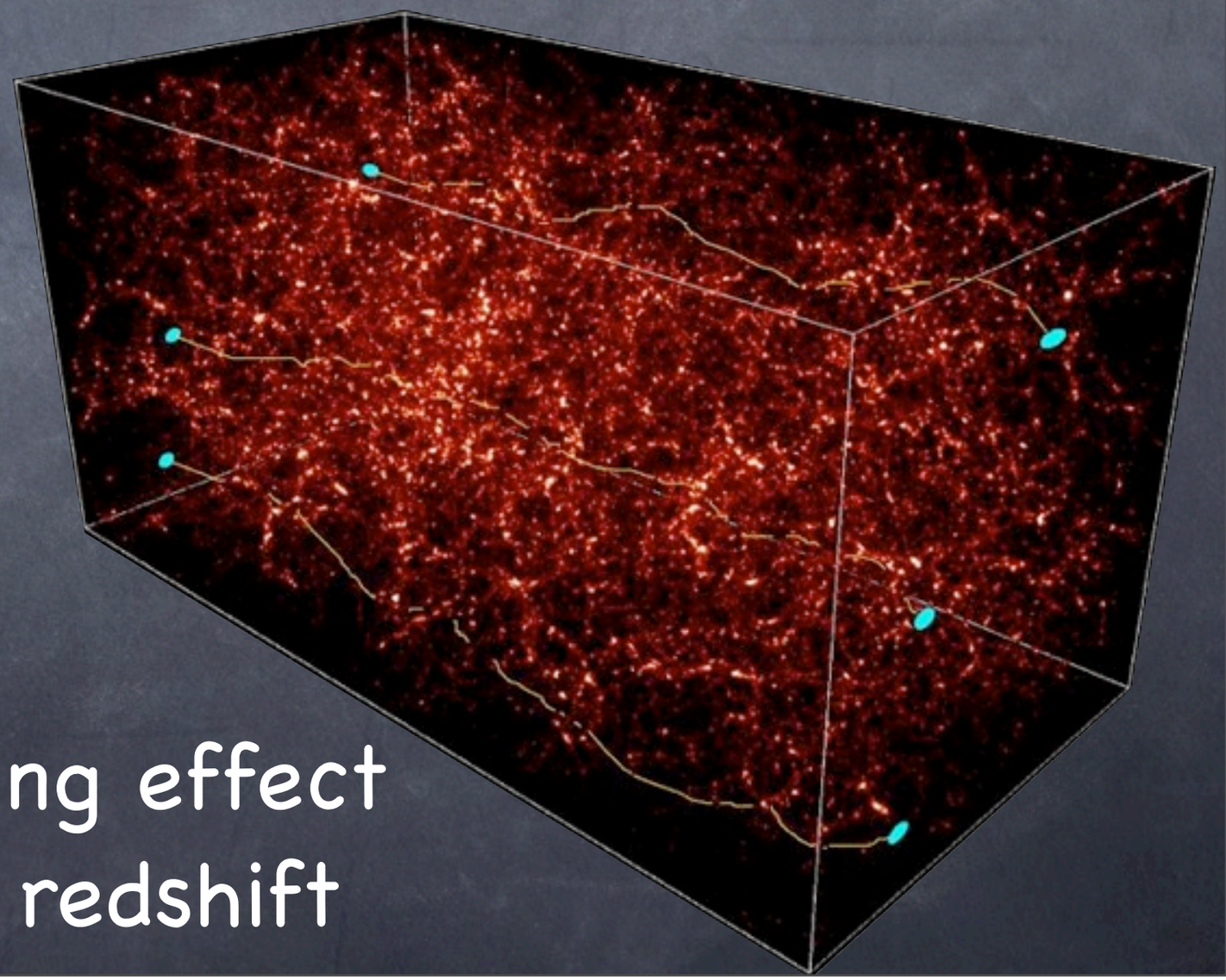
Universiteit Leiden

Weak gravitational lensing



`Lens pushes sources away'

`Radial squeezing'

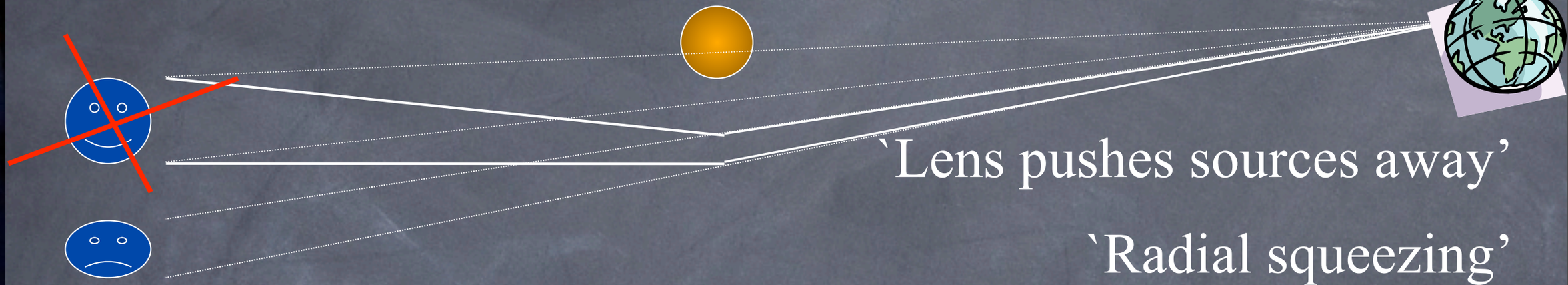


Tomography: lensing effect as fn. of source redshift

Leiden Observatory

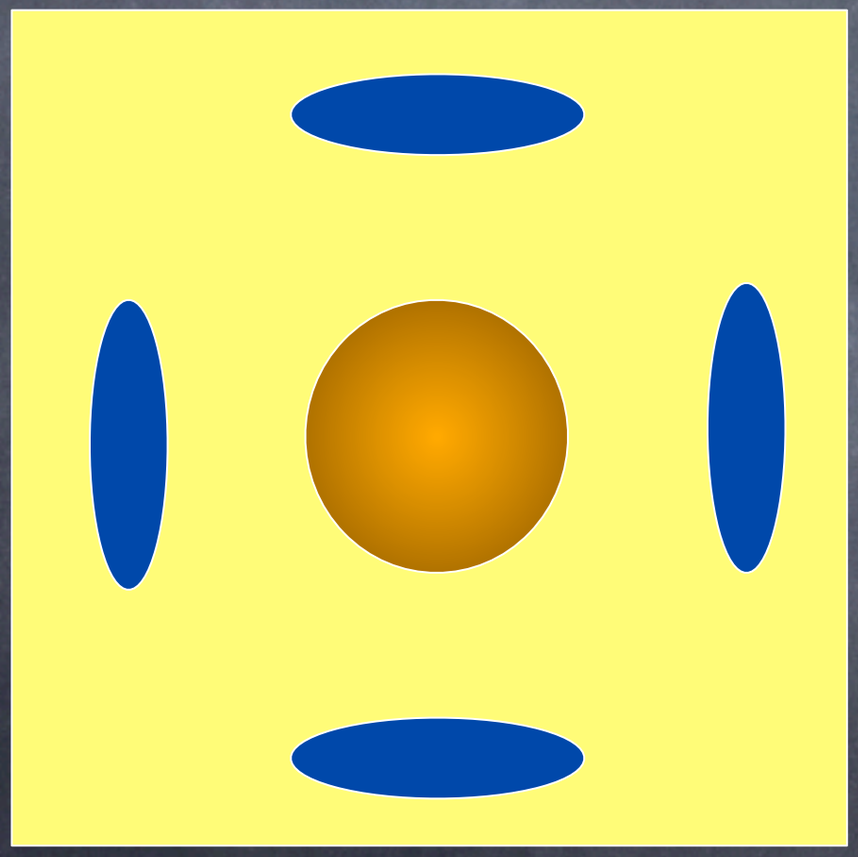
Universiteit Leiden

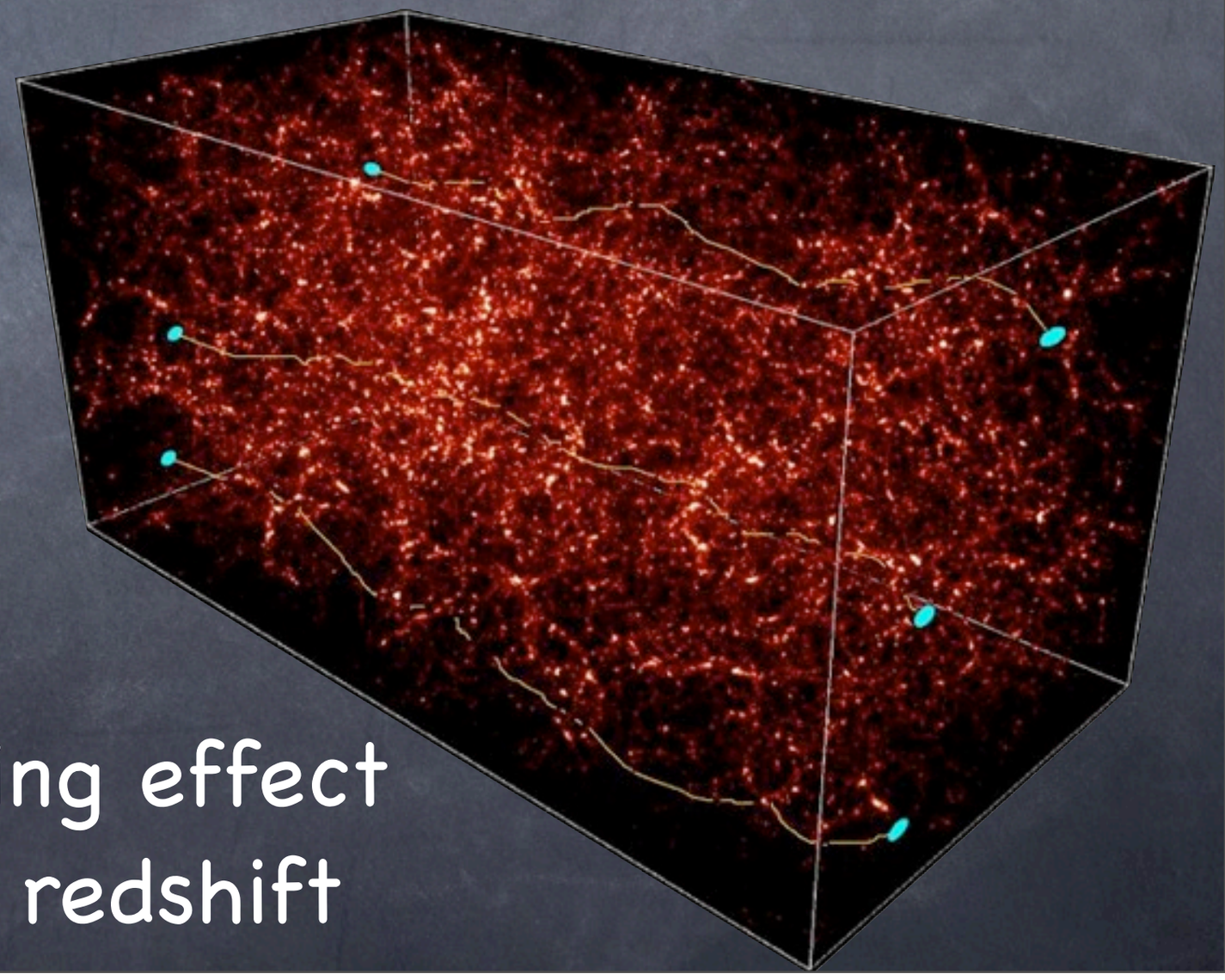
Weak gravitational lensing



`Lens pushes sources away'

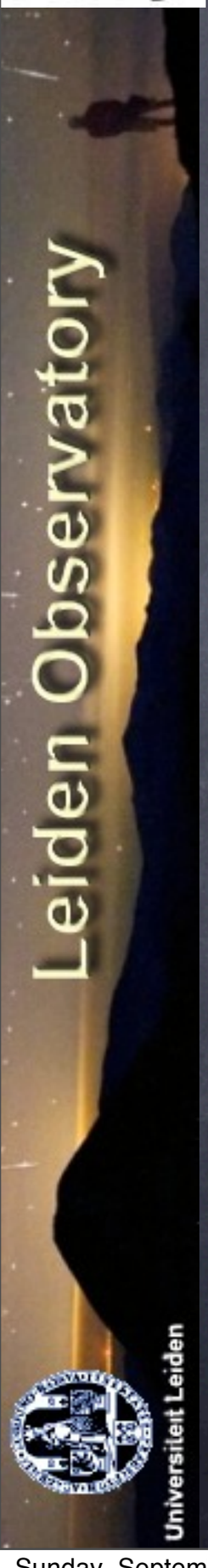
`Radial squeezing'





Tomography: lensing effect as fn. of source redshift

KiDS

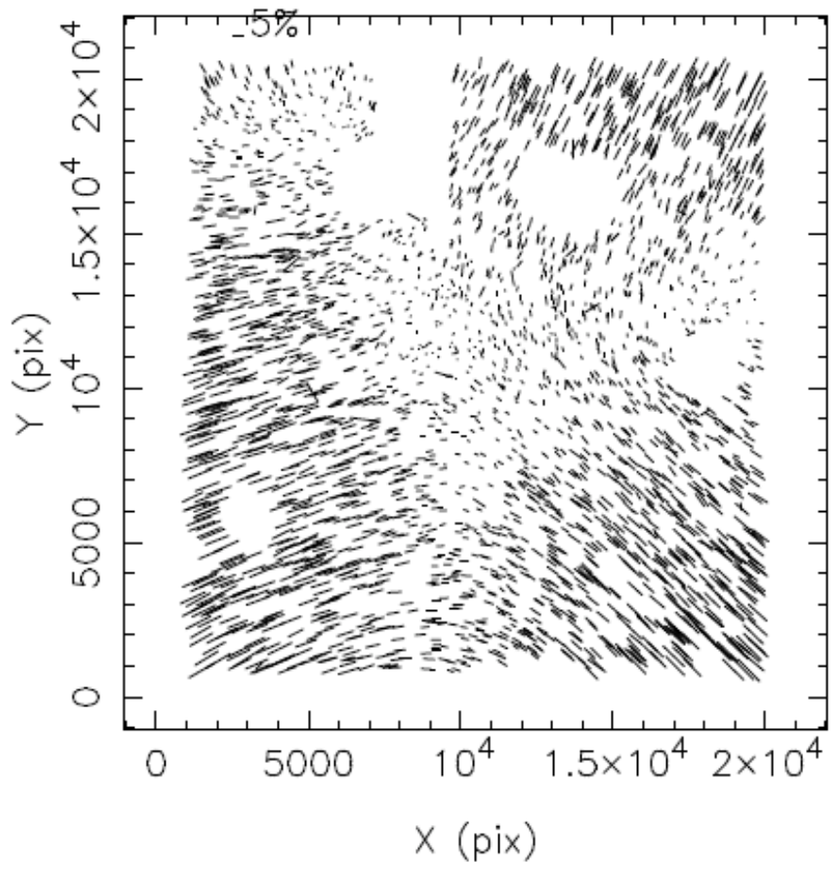


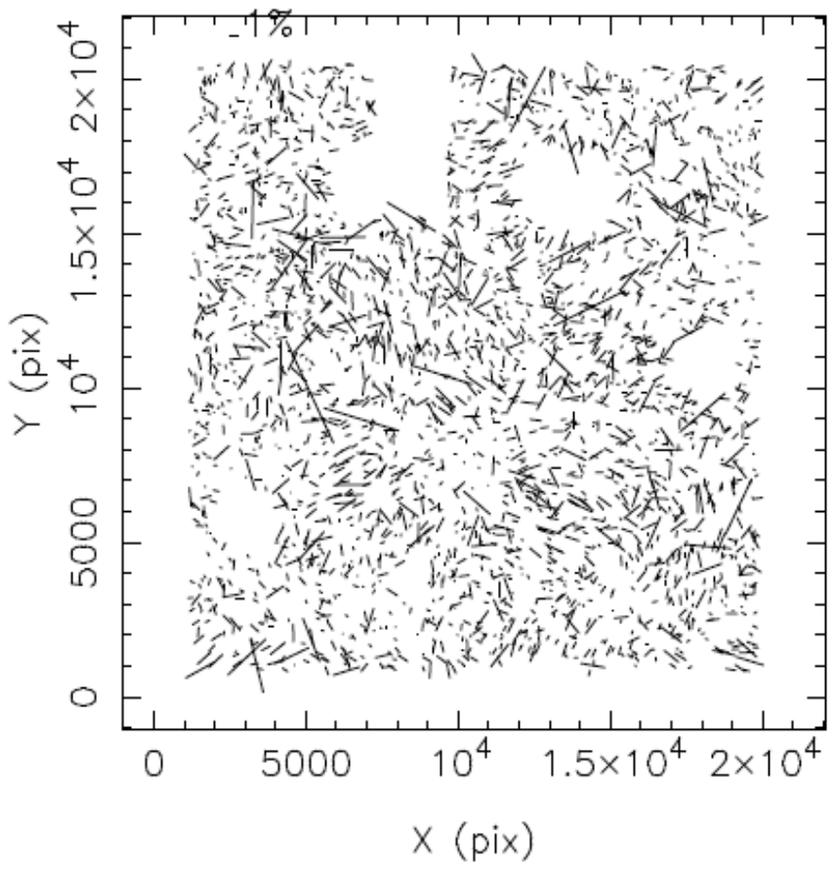
Requirements

- High fidelity images
  - VST@Paranal image quality + service observing
- Reliable redshifts
  - Good photo-z's + solid spectroscopic calibration
  - u-band sensitivity + VIKING survey: ugriZYJHK

KiDS

Image Quality over a Wide Field





- Hard to attain uniform PSF in a prime focus camera (e.g. CFHT, DES camera)
- Uniform PSF + low astrometric distortion were design drivers for VST.

Leiden Observatory

Universiteit Leiden

KiDS

Leiden Observatory

Universiteit Leiden

Dark matter in galaxies

- Haloes well-studied in central 10-50 kpc regions
  - dynamical tracers, HI rotation curves, satellites
- Galaxy structure strongly affected by baryon physics
- Outer regions (>100kpc) probed by weak lensing
  - dark matter dominated
  - long dynamical times, so memory of formation
  - directly probe dark matter physics, and halo-galaxy formation relation

KiDS

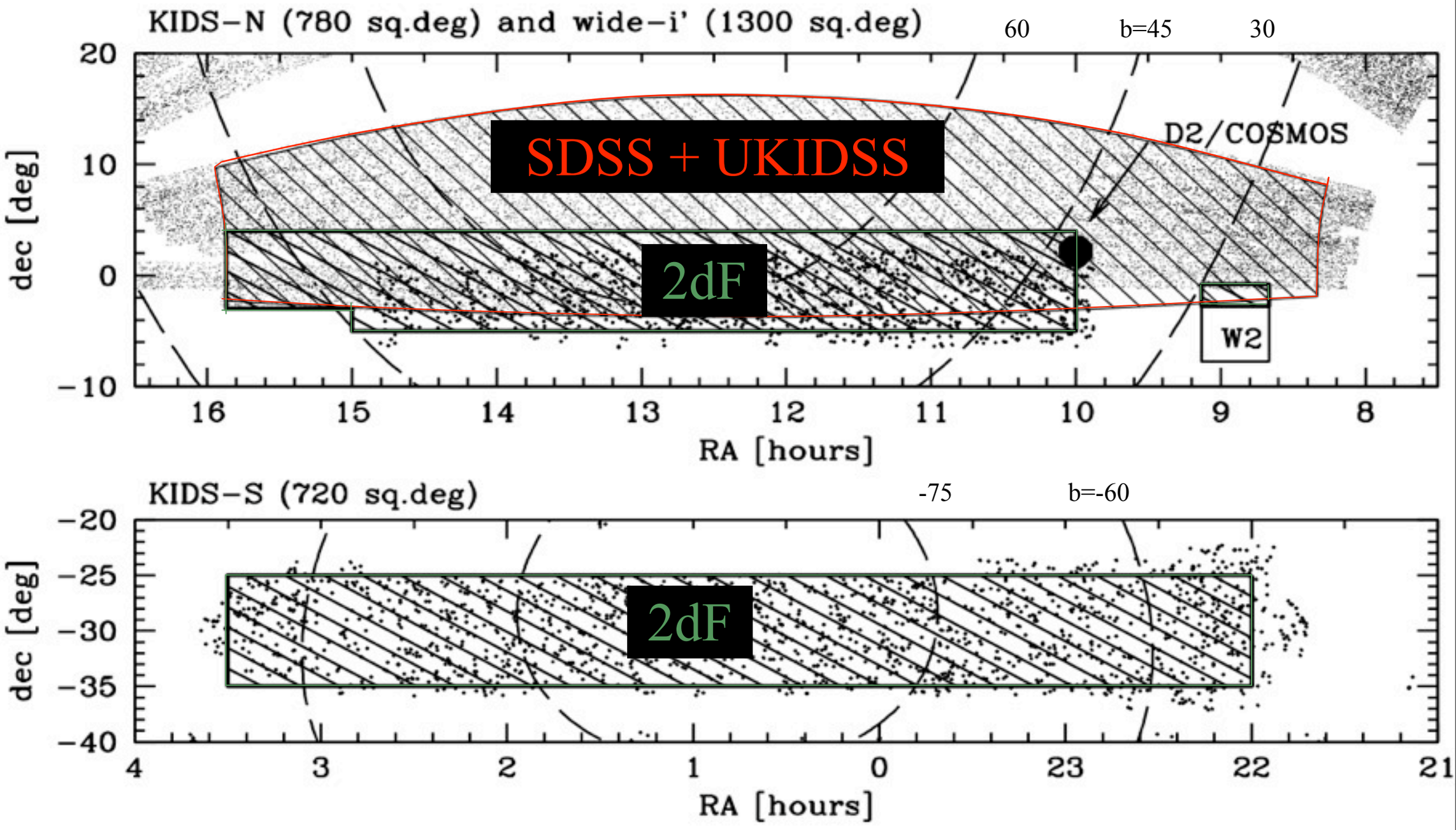
Leiden Observatory

Universiteit Leiden

Galaxy-galaxy lensing

- Measurement of galaxy halo lensing through stacking analysis
- large samples: study dependence on L, environment, spectral type, ...
- avg. halo shapes can be measured reliably
  - new test of gravity theories
  - untested regime of dark matter simulations
- M/L measurements as function of scale: understand bias in galaxy formation

The KiDS patches



KiDS

KIDS + VIKING

- 1500 sq.deg. of ugri (~400n VST) + ZYJHK (~200n VISTA)
- Deeper in r, with good seeing
- Match seeing distribution on Paranal
- VST 2m deeper than SDSS (1m shallower than CFHTLS)
- VISTA 1.5m deeper than UKIDSS

filter	Exp (s)	5-σ 2" AB	cf. UKIDSS
Z	500	23.1	-
Y	400	22.4	+1.6
J	400	22.2	+1.8
H	300	21.6	+1.6
K	500	21.3	+1.3

Moon \ Seeing	<0.7" (40%)	0.7-0.85" (20%)	0.85-1.1" (20%)
Dark (50%)	r'	g'	u'
Grey (15%)	-	-	-
Bright (35%)	i'	i'	i'

filter	Exp time (s)	Medn seeing (")	5-σ 2" AB
u′	900	1.0	24.8
g′	900	0.75	25.4
r′	1800	0.6	25.2
i′	1080	0.75	24.2

Leiden Observatory

Universiteit Leiden

KiDS

KIDS + VIKING

- 1500 sq.deg. of ugri (~400n VST) + ZYJHK (~200n VISTA)
- Deeper in r, with good seeing
- Match seeing distribution on Paranal
- VST 2m deeper than SDSS (1m shallower than CFHTLS)
- VISTA 1.5m deeper than UKIDSS

filter	Exp (s)	5-σ 2" AB	cf. UKIDSS
Z	500	23.1	-
Y	400	22.4	+1.6
J	400	22.2	+1.8
H	300	21.6	+1.6
K	500	21.3	+1.3

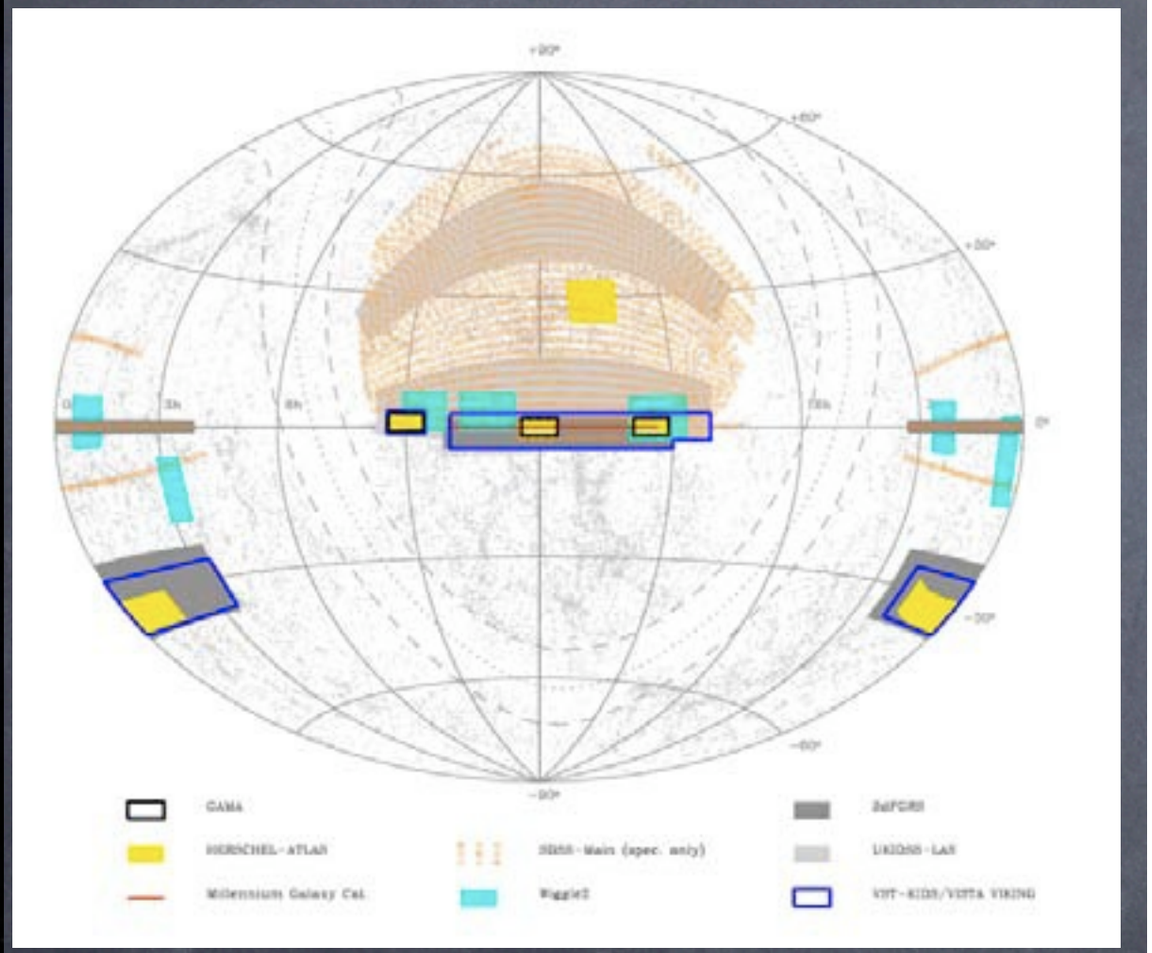
Moon \ Seeing	<0.7" (40%)	0.7-0.85" (20%)	0.85-1.1" (20%)
Dark (50%)	r'	g'	u'
Grey (15%)	-	-	-
Bright (35%)	i'	i'	i'

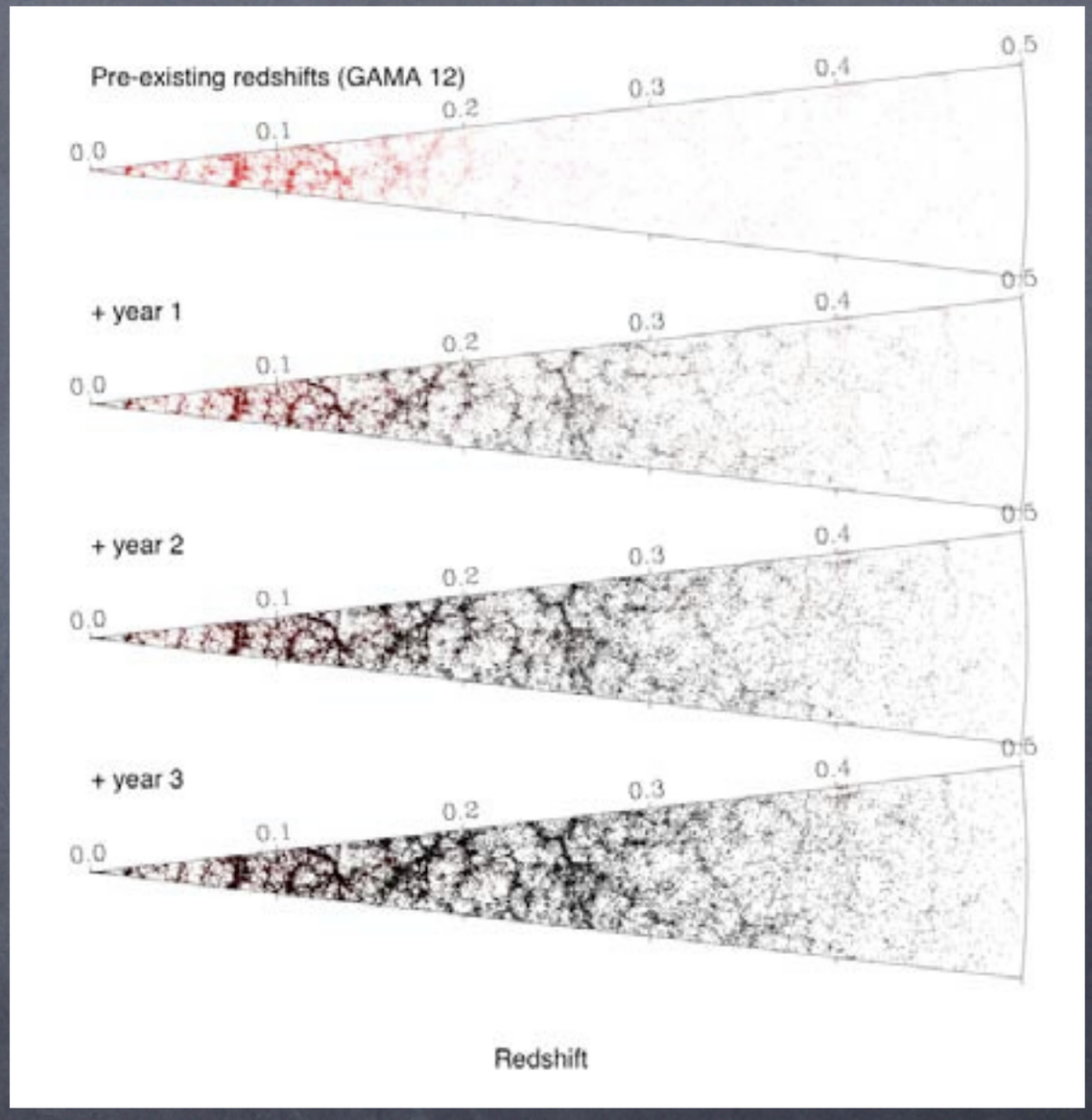
filter	Exp time (s)	Medn seeing (")	5-σ 2" AB
u'	900	1.0	24.8
g'	900	0.75	25.4
r'	1800	0.6	25.2
i'	1080	0.75	24.2

Leiden Observatory

Universiteit Leiden

GAMA, Herschel-ATLAS, 2dFGRS, SDSS





"Follow-up" has begun!

KiDS

Leiden Observatory

Universiteit Leiden

Other science

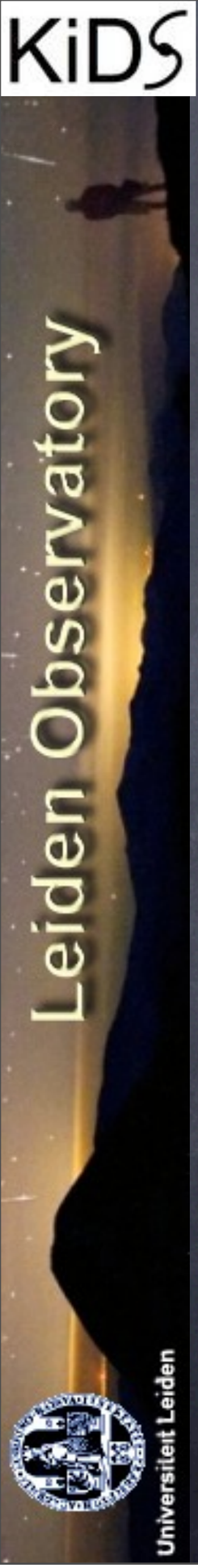
- Herschel-ATLAS fields - need optical images
- KiDS-S overlaps with Mag. stream (STREGA)
- Galaxy evolution studies as function of environments, incl spectroscopy (GAMA@AAO)
- Slices through Southern galactic halo
- Large samples of high-redshift QSO's, local dwarf stars, galaxy clusters
- First epoch for a future variability/proper motion pass

KiDS

Value to the community

- Large homogeneous broadband survey, massively multicolour, observable year-round from South
- 1/6th area of SDSS
  - 2x image quality
  - 2m deeper
- Large samples of clusters, groups, galaxies, ...
- 7% of the extragalactic sky

KiDS



Advanced data products

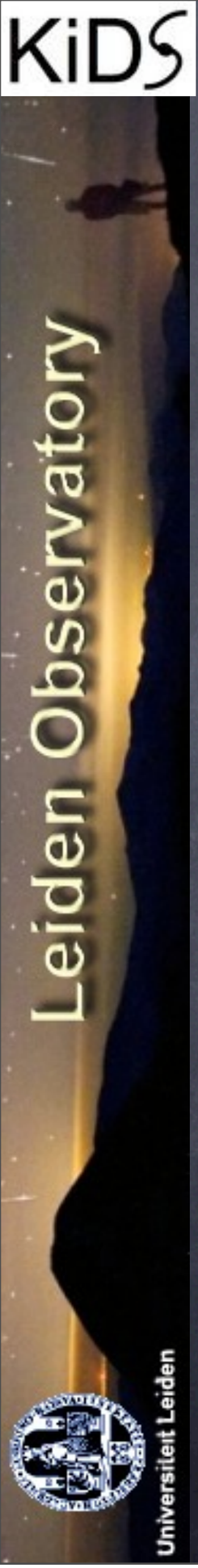
- Well-matched colour images
- Multi-colour source catalogues
- Photo-z catalogues
- Galaxy morphology fits
- Gaussian-PSF version of the images
- Crosslinks to spectra, 2dF, SDSS, GAMA
- Discuss proprietary period for ADPs.

KiDS

Status of the team

- Motivated but understaffed
  - Grant applications only credible with a working VST and approved survey!
- Scientifically well-prepared through involvement in state-of-the-art lensing projects (CFHTLenS, PANSTARRS)
- Technically prepared through AstroWISE effort
  - Based on real data from WFI, INT, HST,...

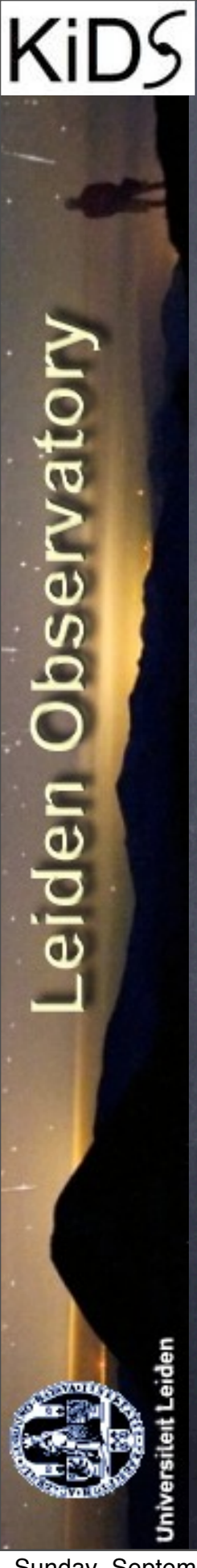
KiDS



Adjustments to the plan

- Photometric calibration can piggyback on SDSS and SkyMapper
  - otherwise use bright time
- Data processing can be concentrated in fewer nodes than originally foreseen
- Primary science case focussed even more on lensing than before
  - BAO's with photo-z's no longer interesting
- Accelerated observing schedule requested
- Wide i survey (2000 sqdeg) dropped
- Would like to target deep spectroscopic survey fields

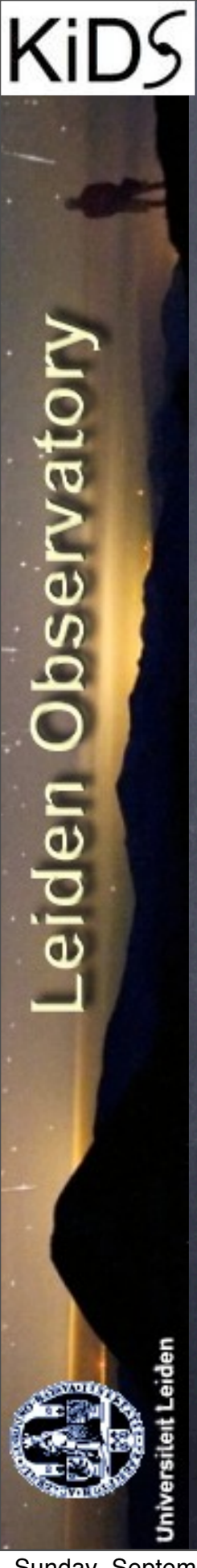
KiDS



Other lensing surveys

- No reason at present to change our strategy, but we should go fast! Good seeing dark time is the rate-determining step
- PANSTARRS: different img. quality, strategy, hemisphere
- DES: survey start mid 2012
  - consider coordination once data quality and schedule of both surveys is clear
- Longer term SUBARU, PS4, LSST, EUCLID,...

KiDS



Strengths of KiDS

- unique large, deep, high image quality 9-band survey
- NOT a variability survey, no compromises
- still timely
- well-matched to VST+OmegaCAM survey machine
- builds on European lensing expertise
- interesting pathfinder for future wk.lensing surveys/space missions