The Abdus Salam International Centre for Theoretical Physics

2354-29

Summer School on Cosmology

16 - 27 July 2012

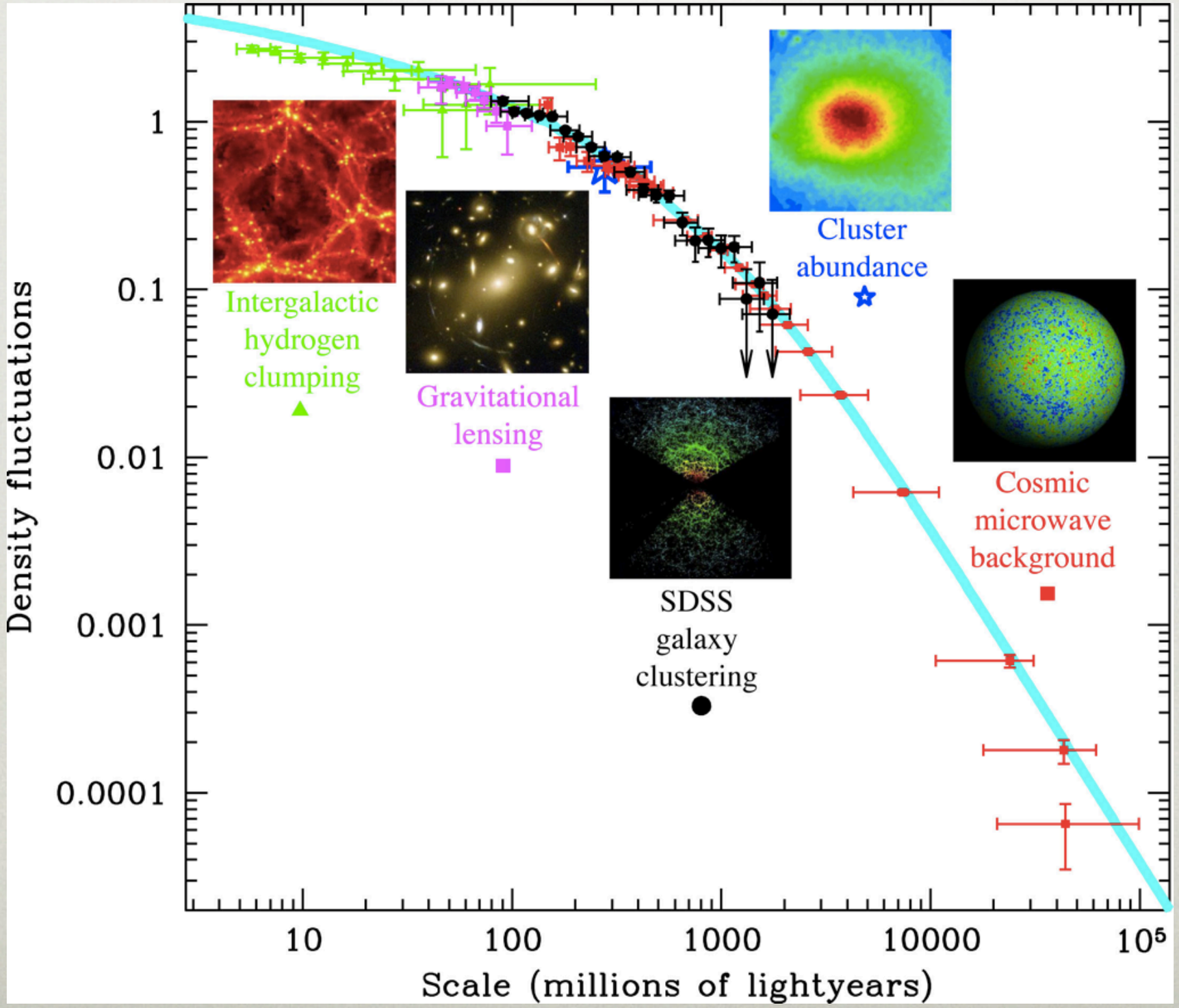
Lensing - Lecture 4

H. Hoekstra
Leiden Observatory

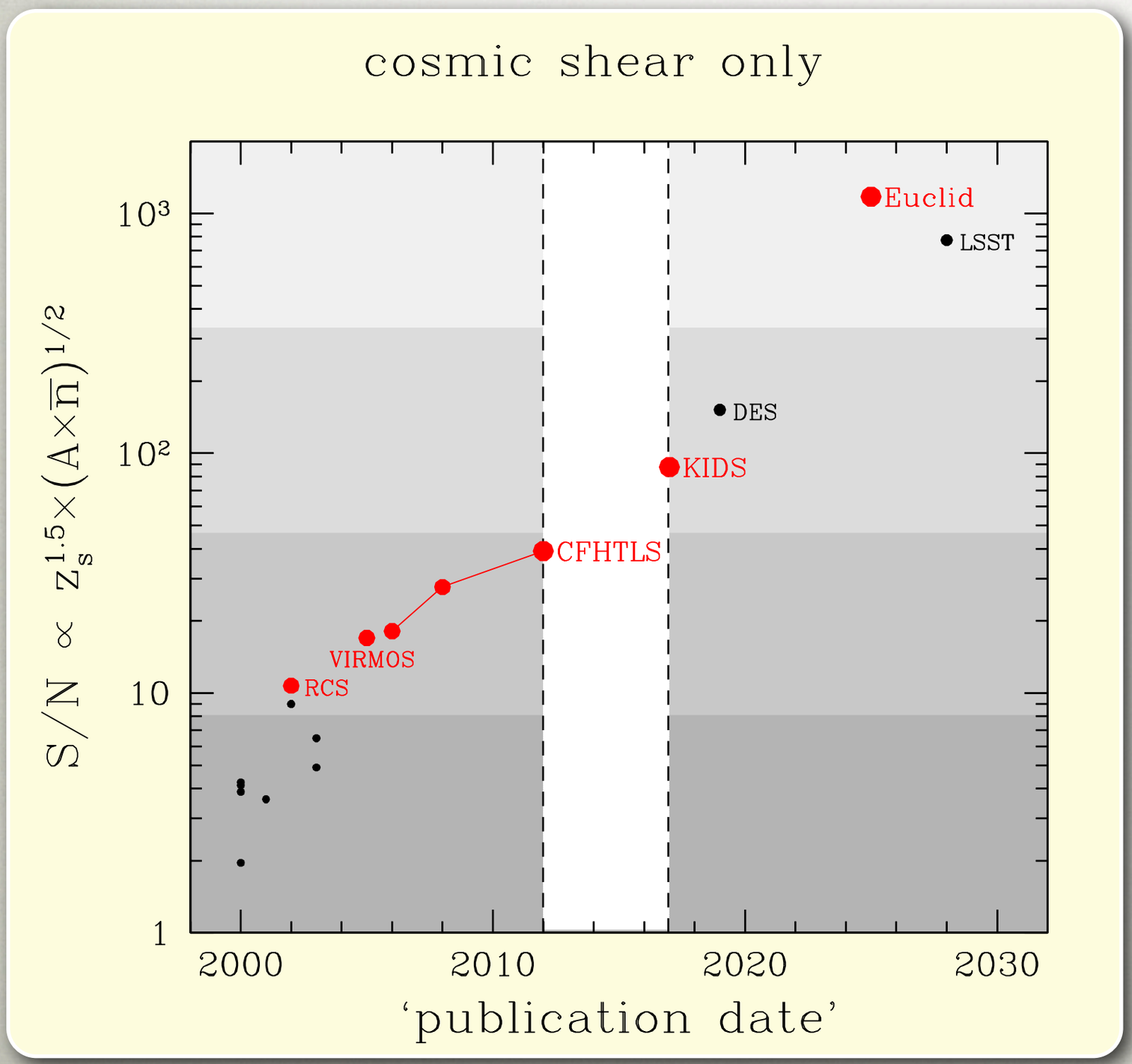
Cosmic shear

results

Comparison of probes



Exponential growth



Dark energy physics

↑

Dark energy constraints

↑

Measurement

↑

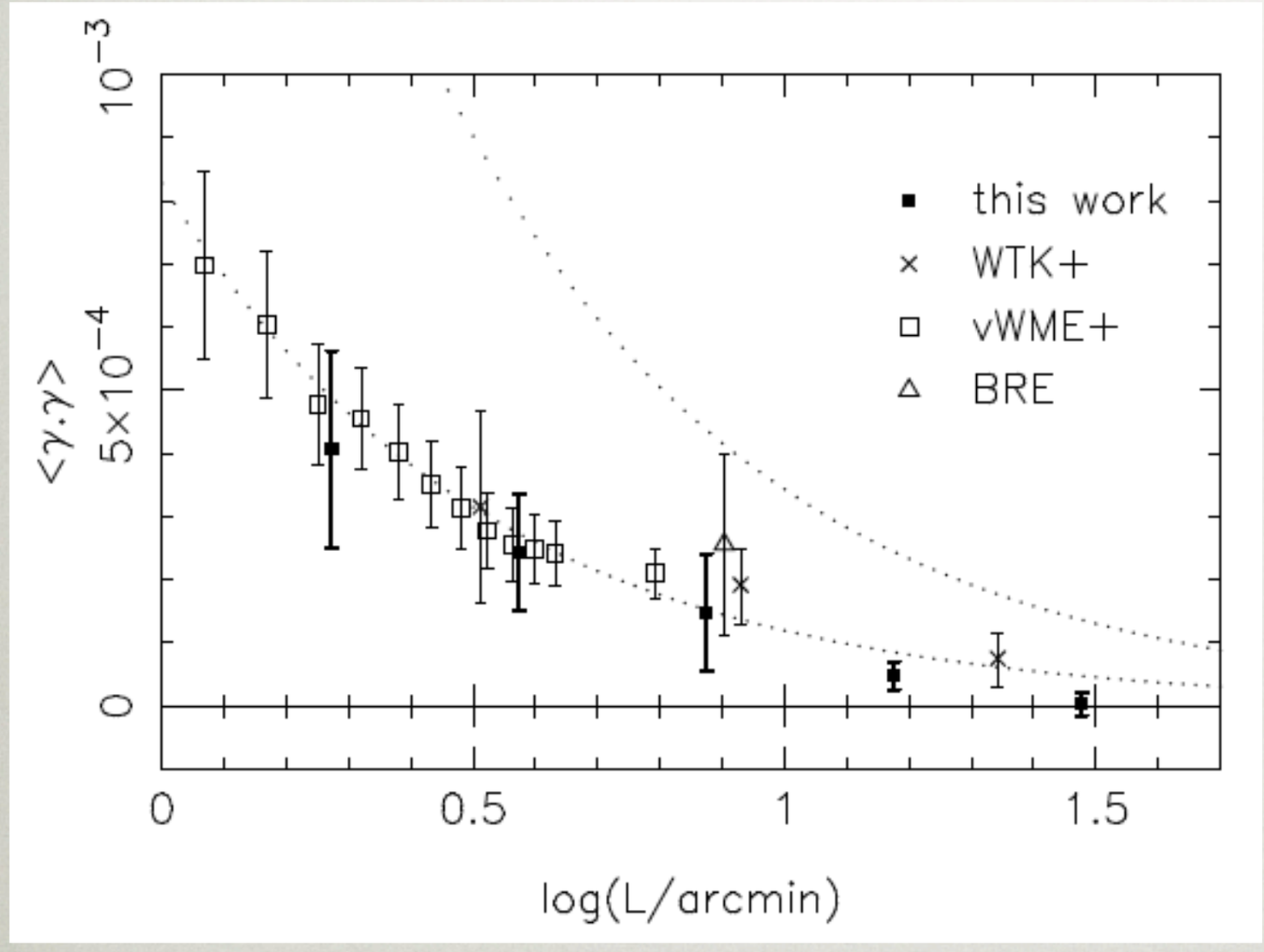
Detection

Overview of results

The first cosmic shear detections were reported in Spring 2000: four groups (nearly) simultaneously put papers of astro-ph.

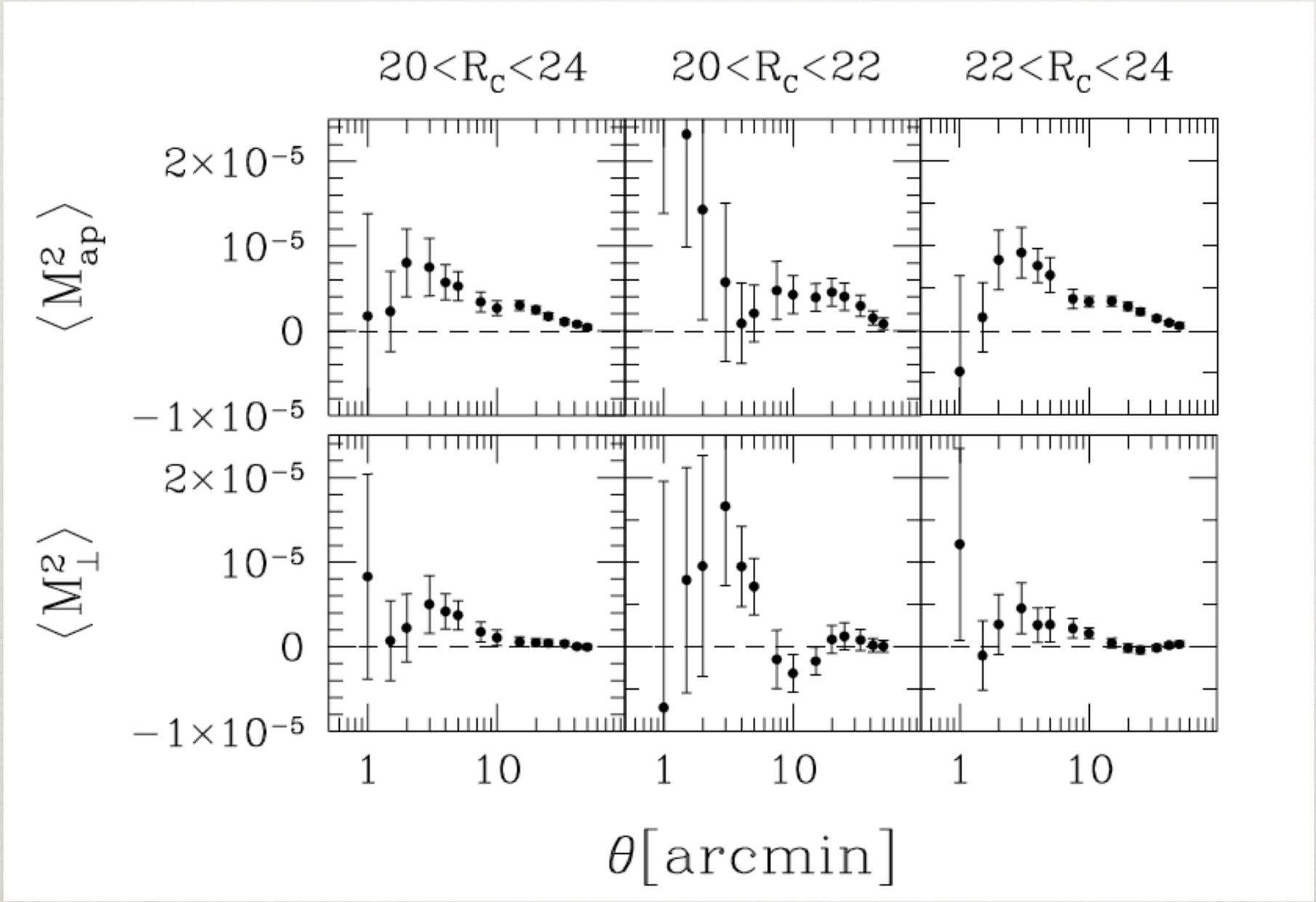
Importantly the results agreed well (although the errors were large).

First results



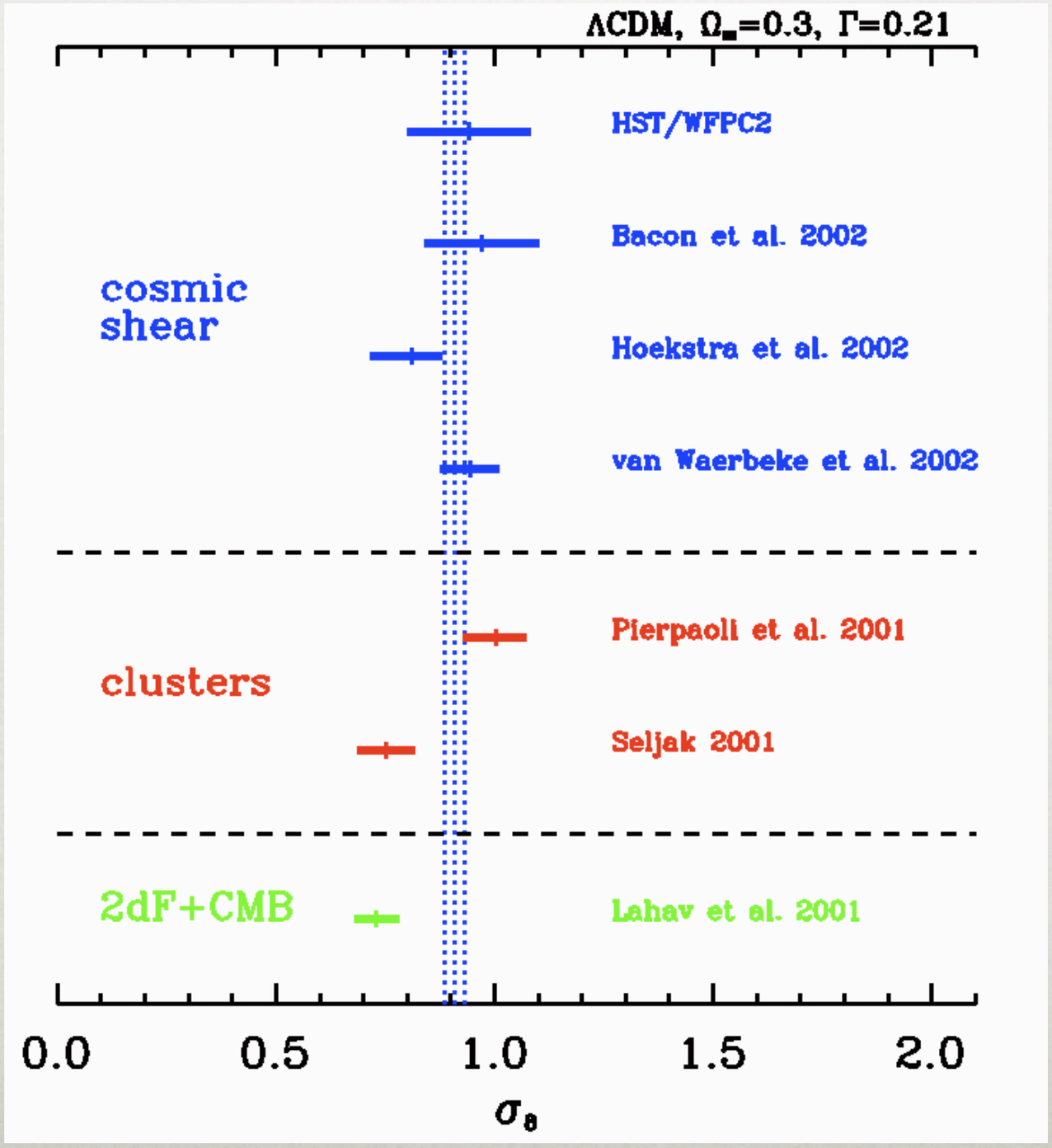
Bacon et al. (2000)
Kaiser et al. (2000)
van Waerbeke et al. (2000)
Wittman et al. (2000)

No large-scale B-modes!



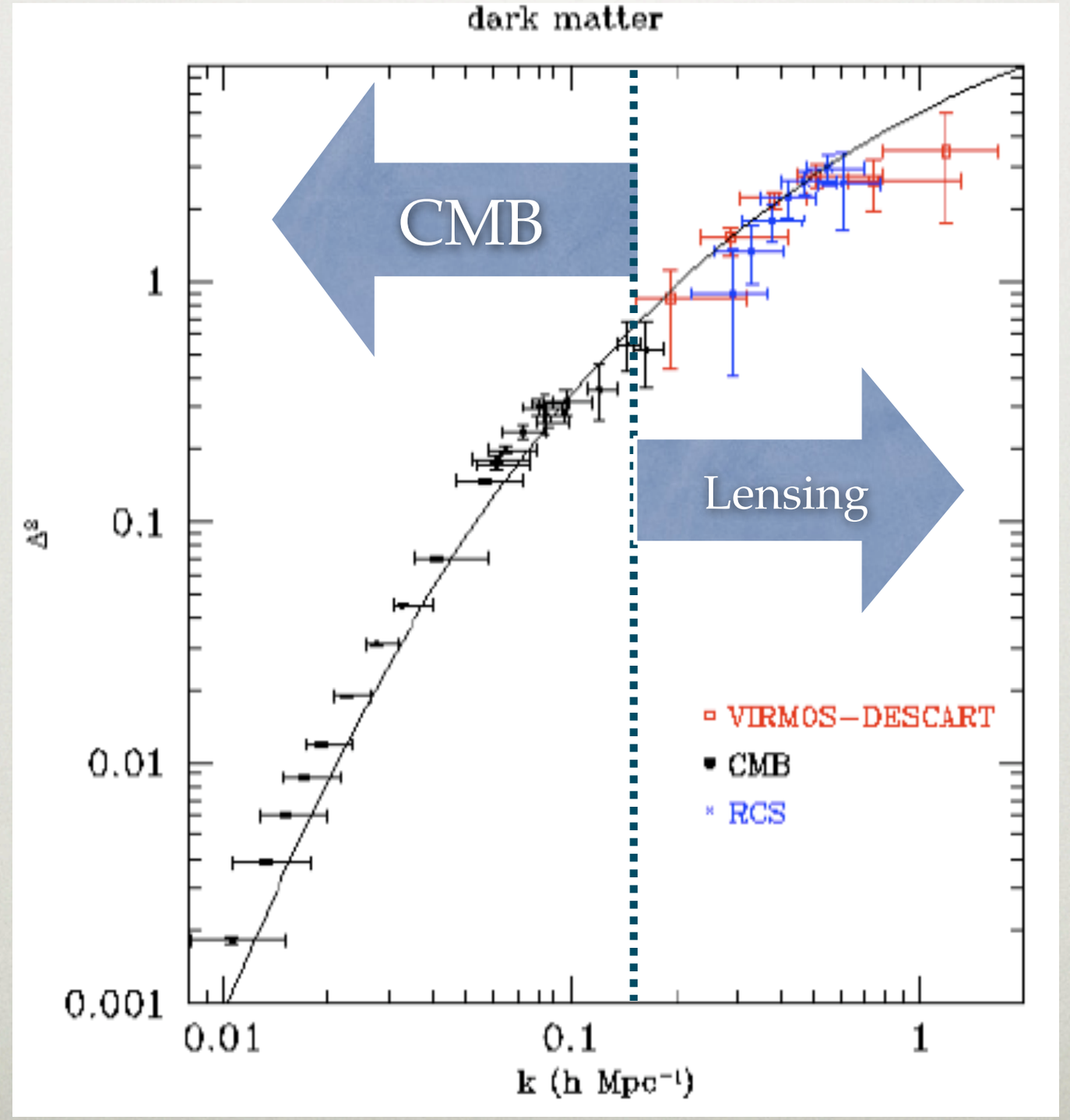
Hoekstra et al. (2002)

Status in 2003



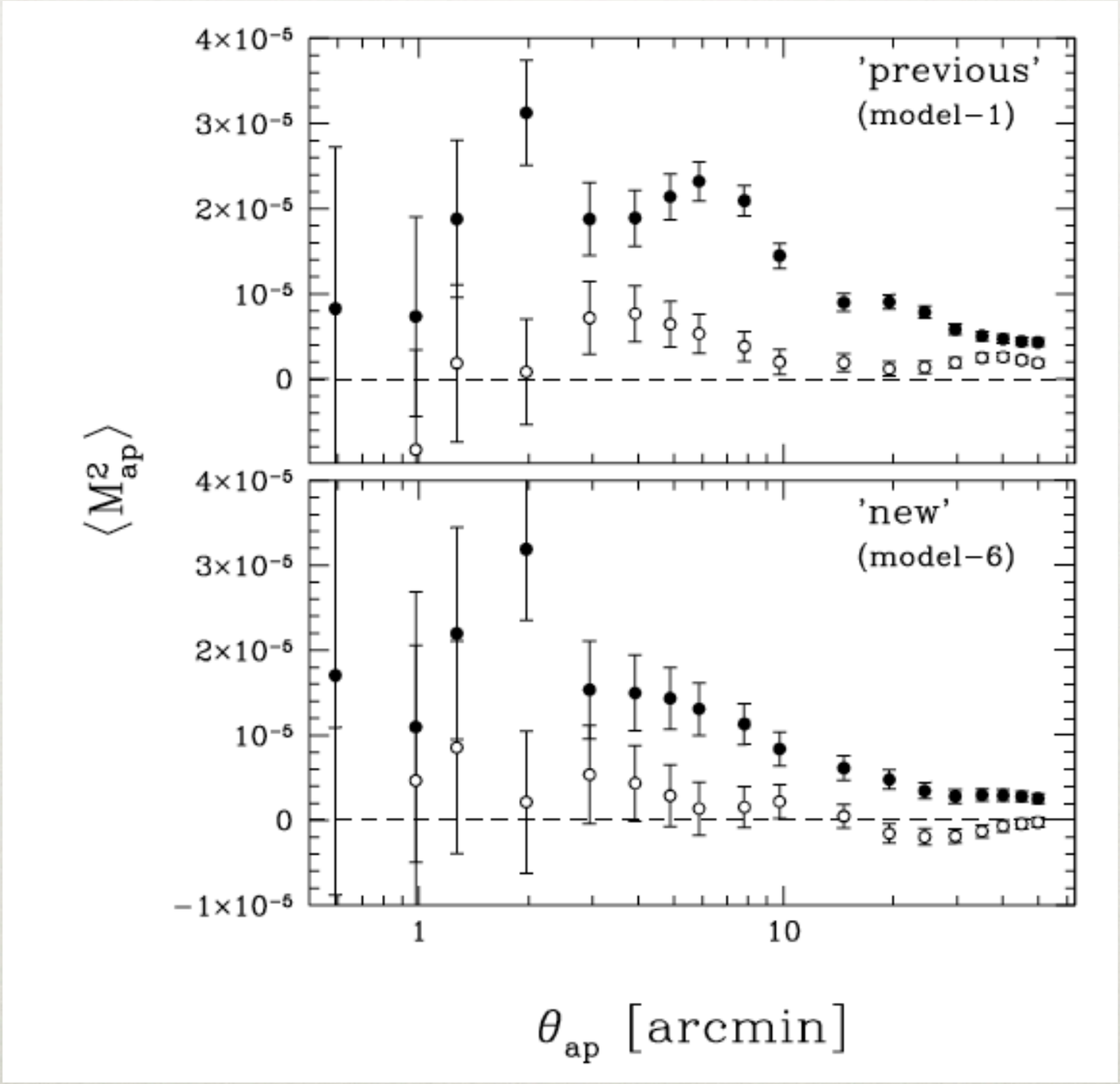
Refregier (2003)

Status in 2003



Van Waerbeke & Mellier (2003)

Improved VIRMOS results



Van Waerbeke et al. (2005)

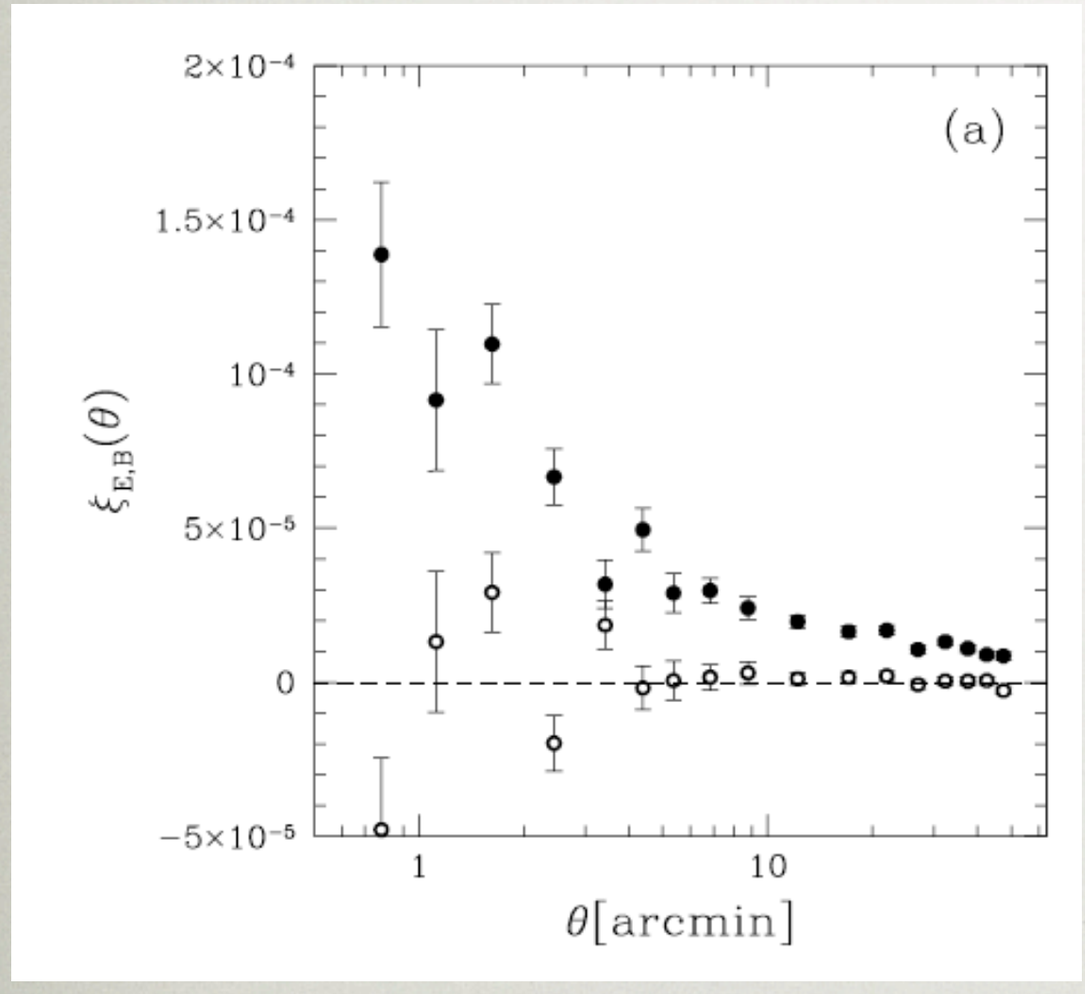
CFHT Legacy Survey

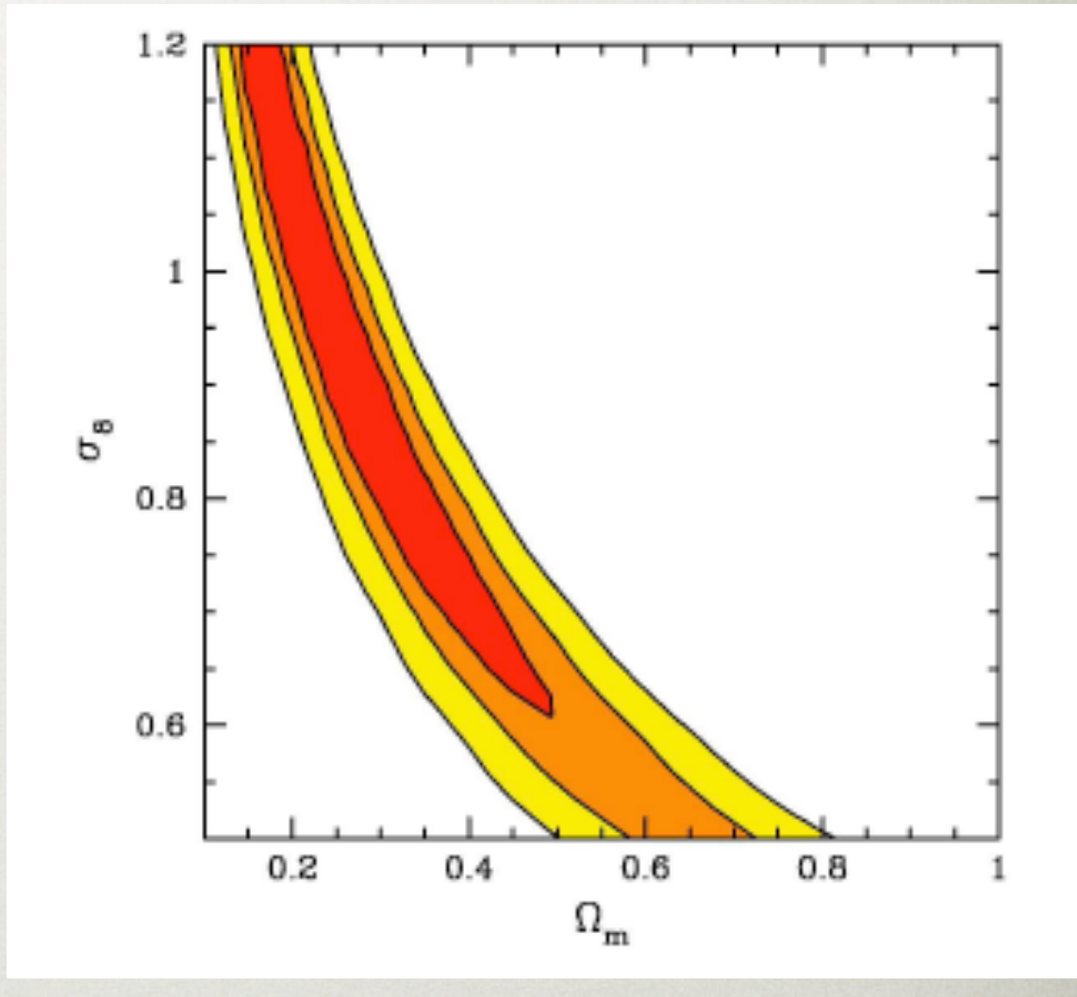
Uses 5 yrs of data from the Deep, Wide and Pre-survey components of the CFHT Legacy Survey

State-of-the-art cosmological survey with 154 deg^2 uniquely covered

- lensing analysis used the 7 i-band images (seeing <0.85")
- ugriz to i<24.7 (7σ extended source)
- 4 fields

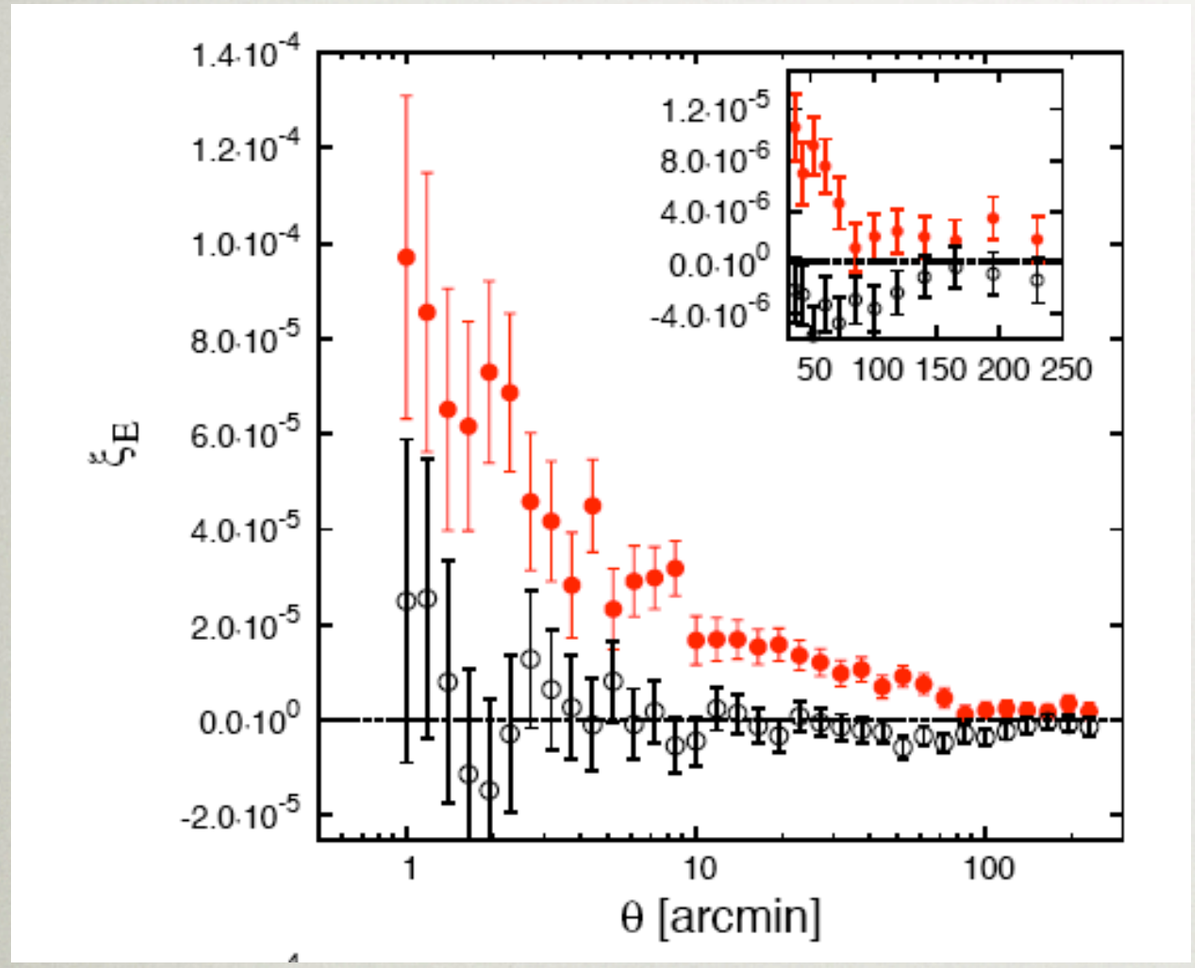
CFHT Legacy Survey

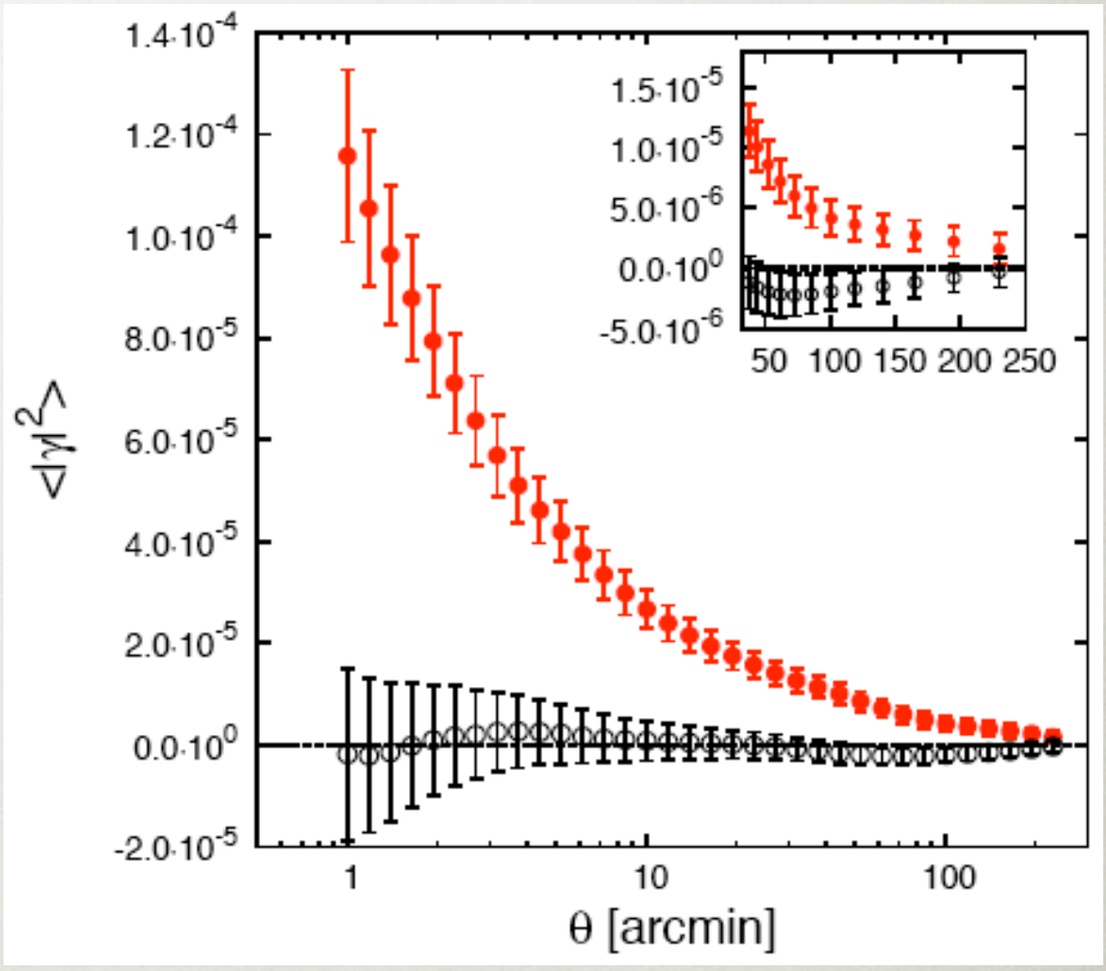




~20 square degree used in Hoekstra et al. (2006)

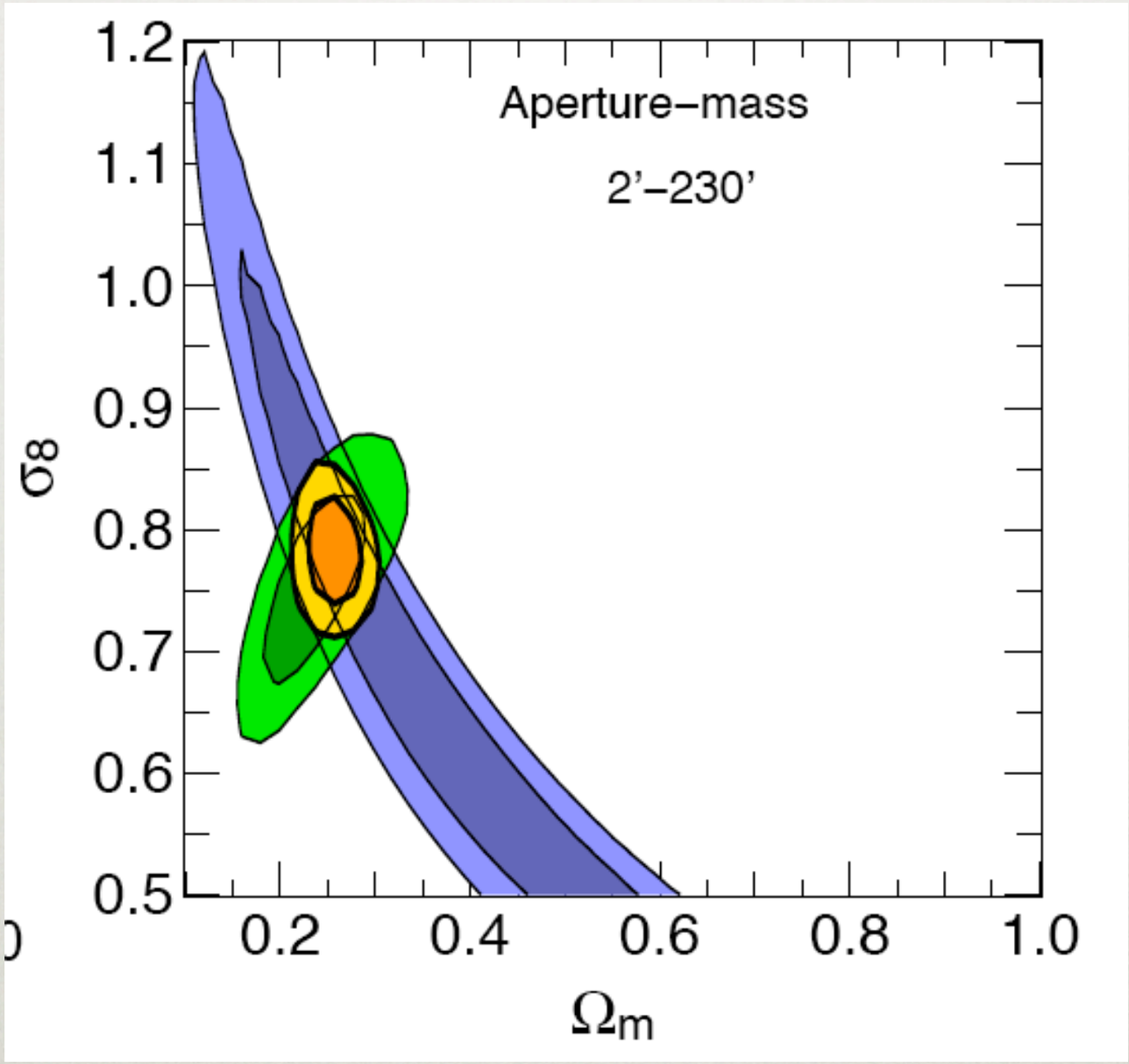
CFHT Legacy Survey





Fu et al. (2008): Measurements out to 4 degree scales!

CFHT Legacy Survey



Fu et al. (2008)

CFHTLenS: the team

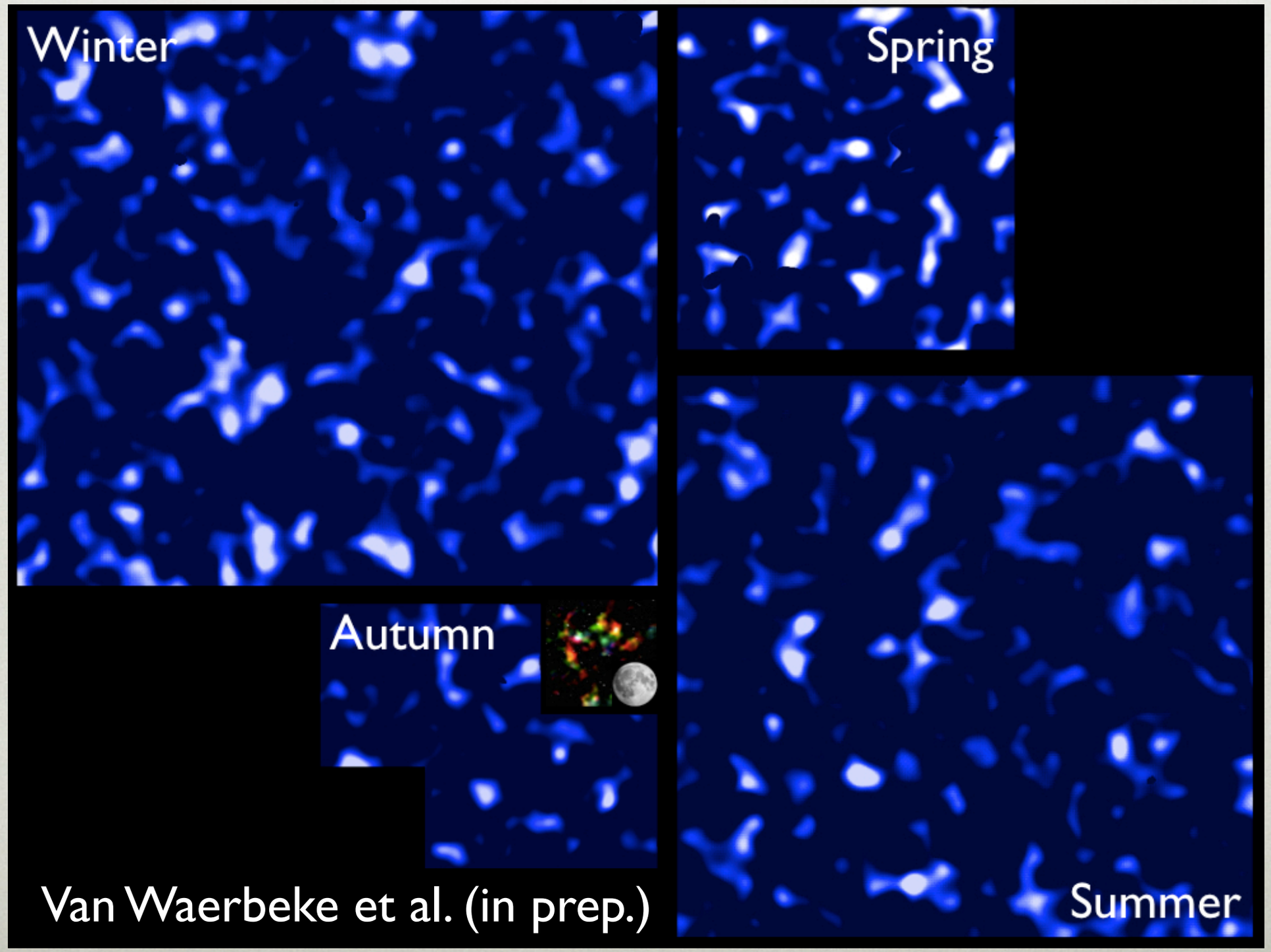
Tomography is difficult: we need a large team!

CFHTLenS: the approach

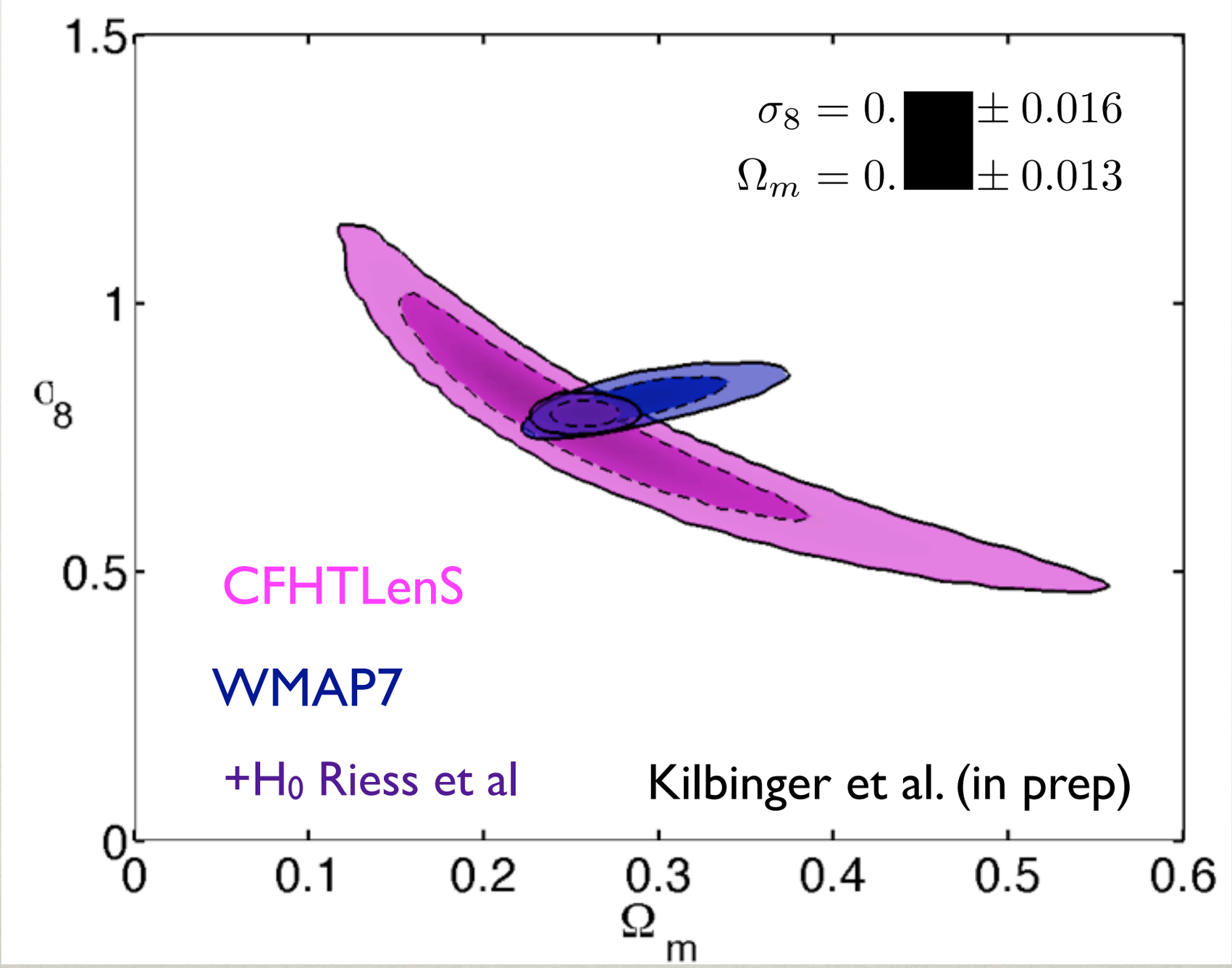
Accurate cosmology is difficult: we have to make sure we do not bias the analysis to a "desired" result.

Heymans et al. (submitted): use star-galaxy correlation function to identify problems with the data. This is a cosmology-independent approach.

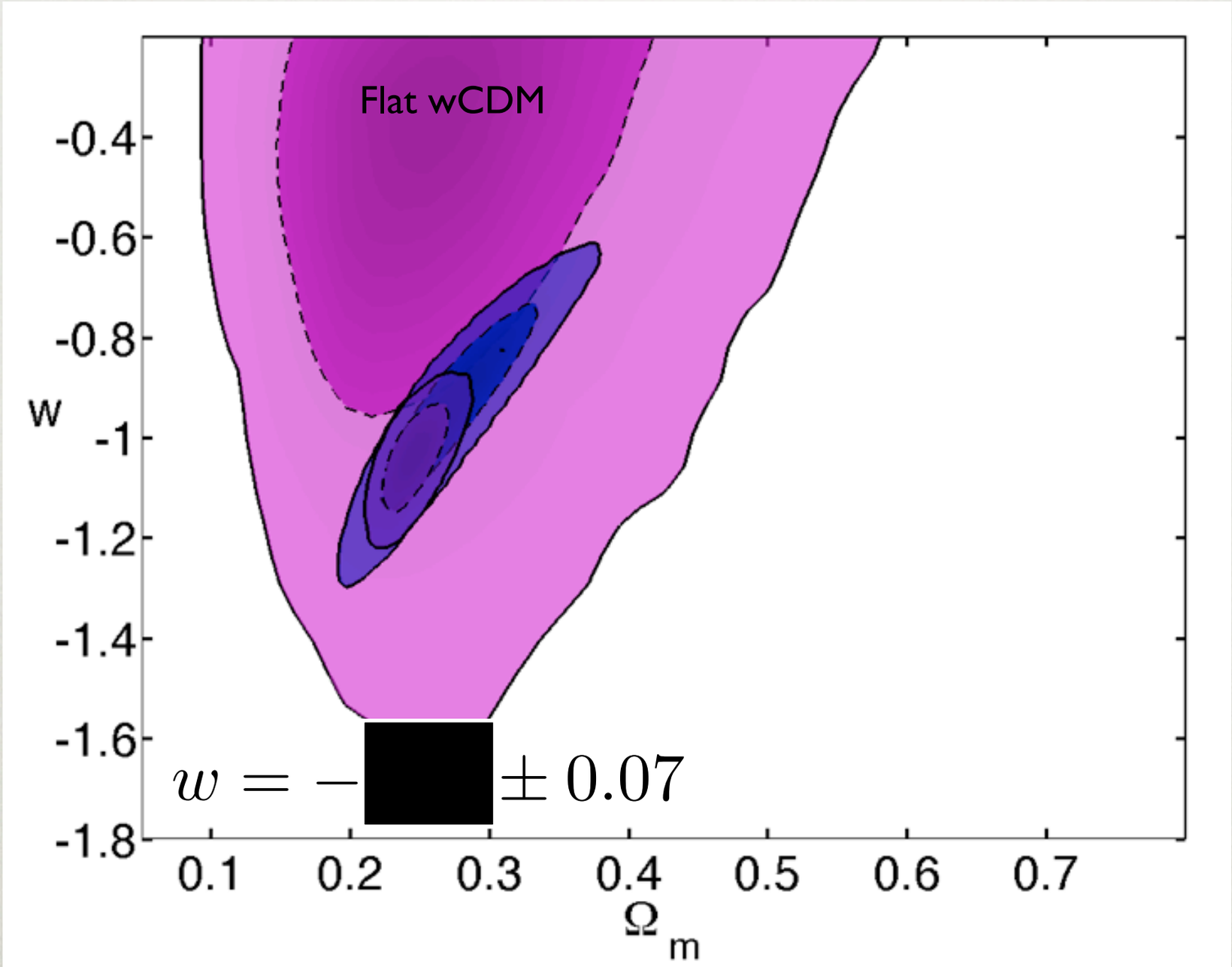
CFHT LenS: results



CFHT LenS: results

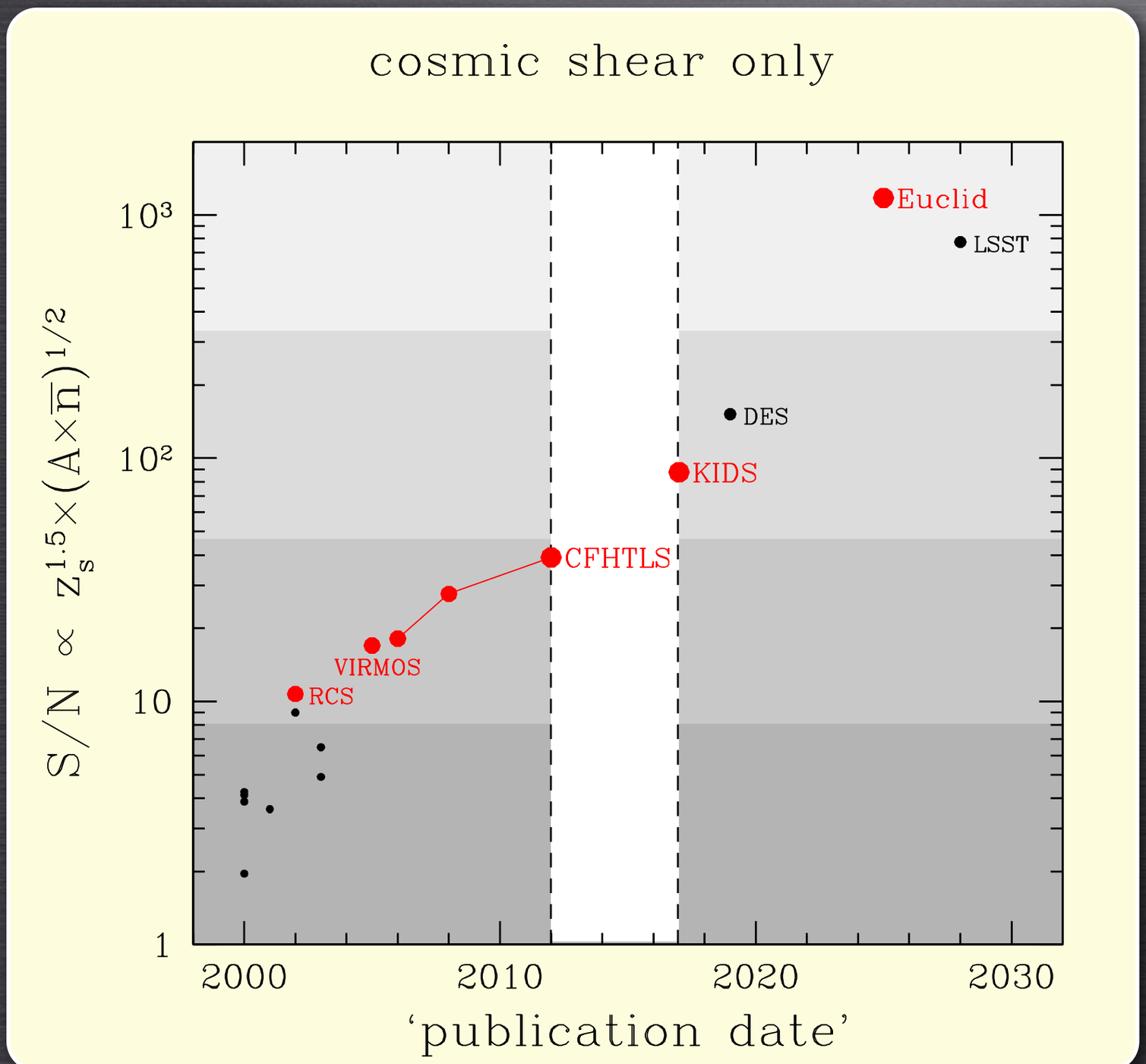


CFHT LenS: results



Kilbinger et al. (in prep)

The future looks great!



Dark energy physics

Dark energy constraints

Measurement

Detection

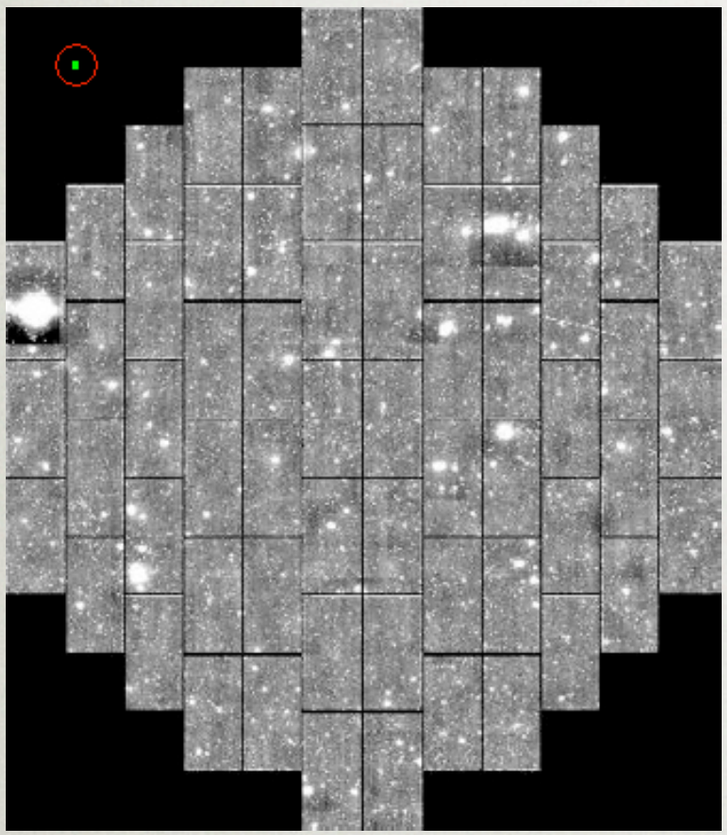
KiloDegree Survey

The Kilo Degree Survey (KiDS) is the first cosmic shear survey that can provide dark energy constraints without the need of priors from other probes! Observations have started and the survey will be completed in ~4 years.

survey area: 1500 deg^2
filter coverage: ugri ZYJHK

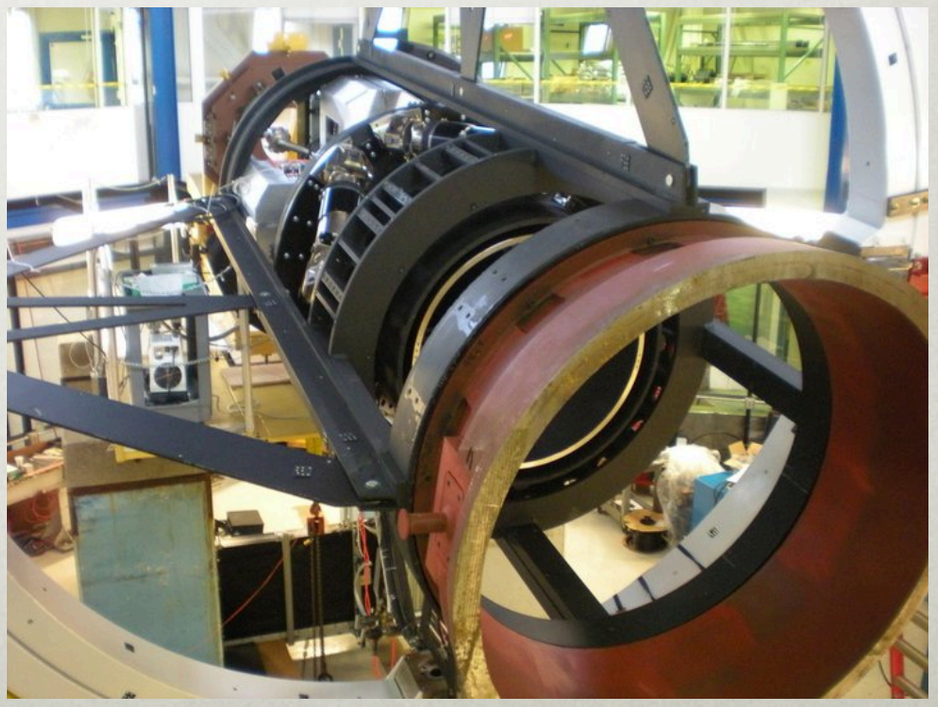
~10% error in w

Dark Energy Survey



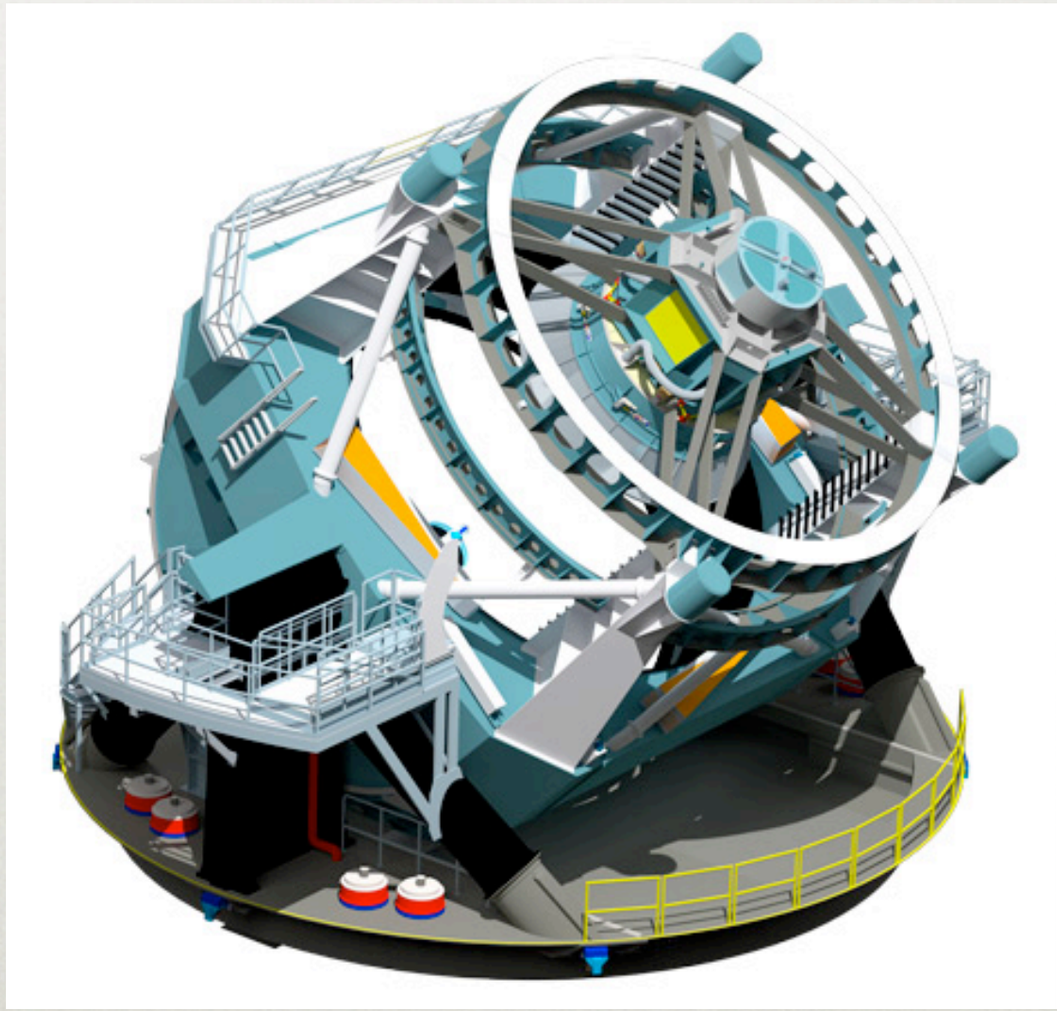
4m Blanco Telescope equipped with a new wide field corrector+camera:
2.2 deg² field of view

525 nights:
g,r,i,z: 5000 deg²



Large Synoptic Survey Telescope

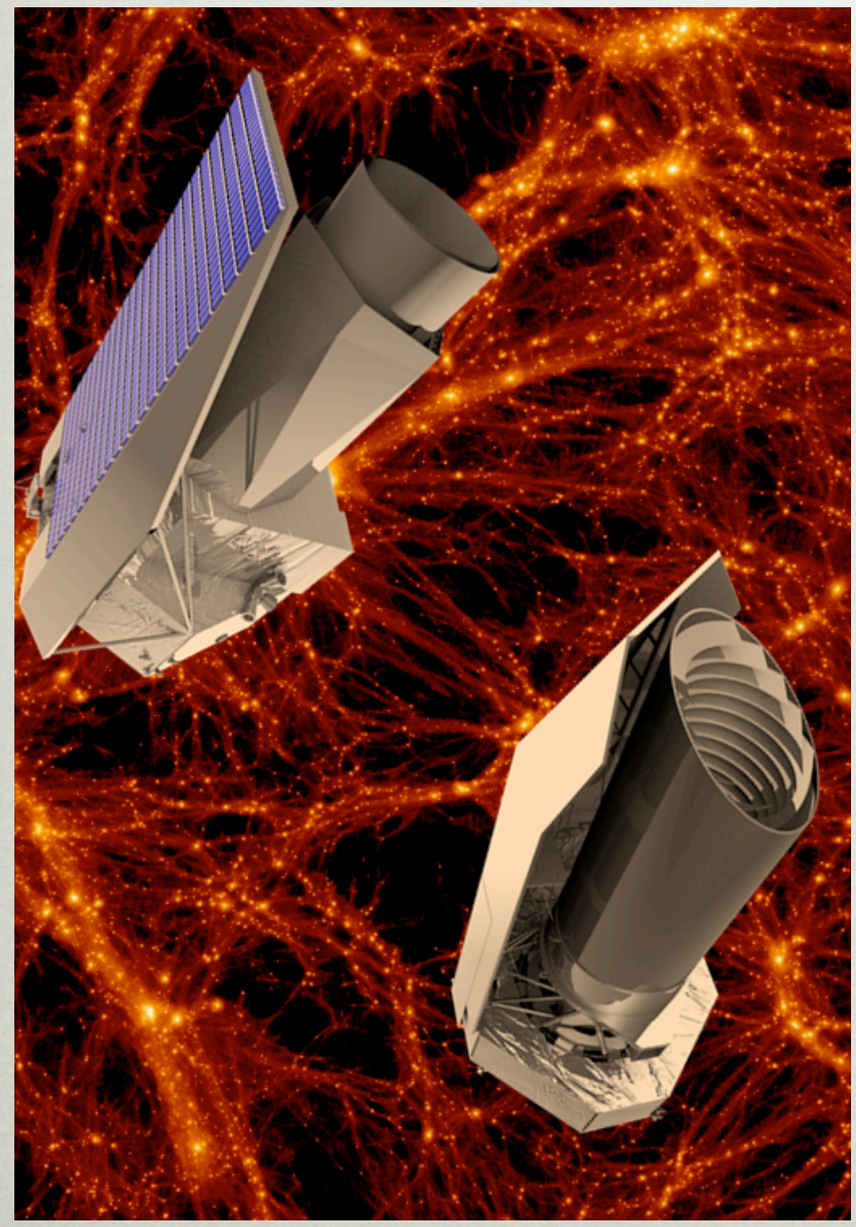
Proposed new 8m telescope designed for weak lensing



FoV: 10 deg^2

cover the sky twice each week!

Euclid



Euclid has been selected by ESA

- launch in ~8 years
- will observe 15000 deg^2
- will push everything to the limit
- currently nearly 1000 members!

Lots of work ahead!

Conclusions

The coming decade is going to be an exciting time to be working on weak gravitational lensing projects.

The rapidly increasing precision will require increased effort in understanding and dealing with systematic errors, both observationally and theoretically.