Title: Cosmology from CFHTLS-Wide Weak Lensing on Large Scales

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Abstract: I will discuss recent results from the Cosmic Shear component of the CFHT Legacy Survey. These results reach very large scales, allowing a measurement of poper spectrum of matter fluctuations in the linear regime, and of cosmological parameters.

Cosmic Shear from the CFHTLS

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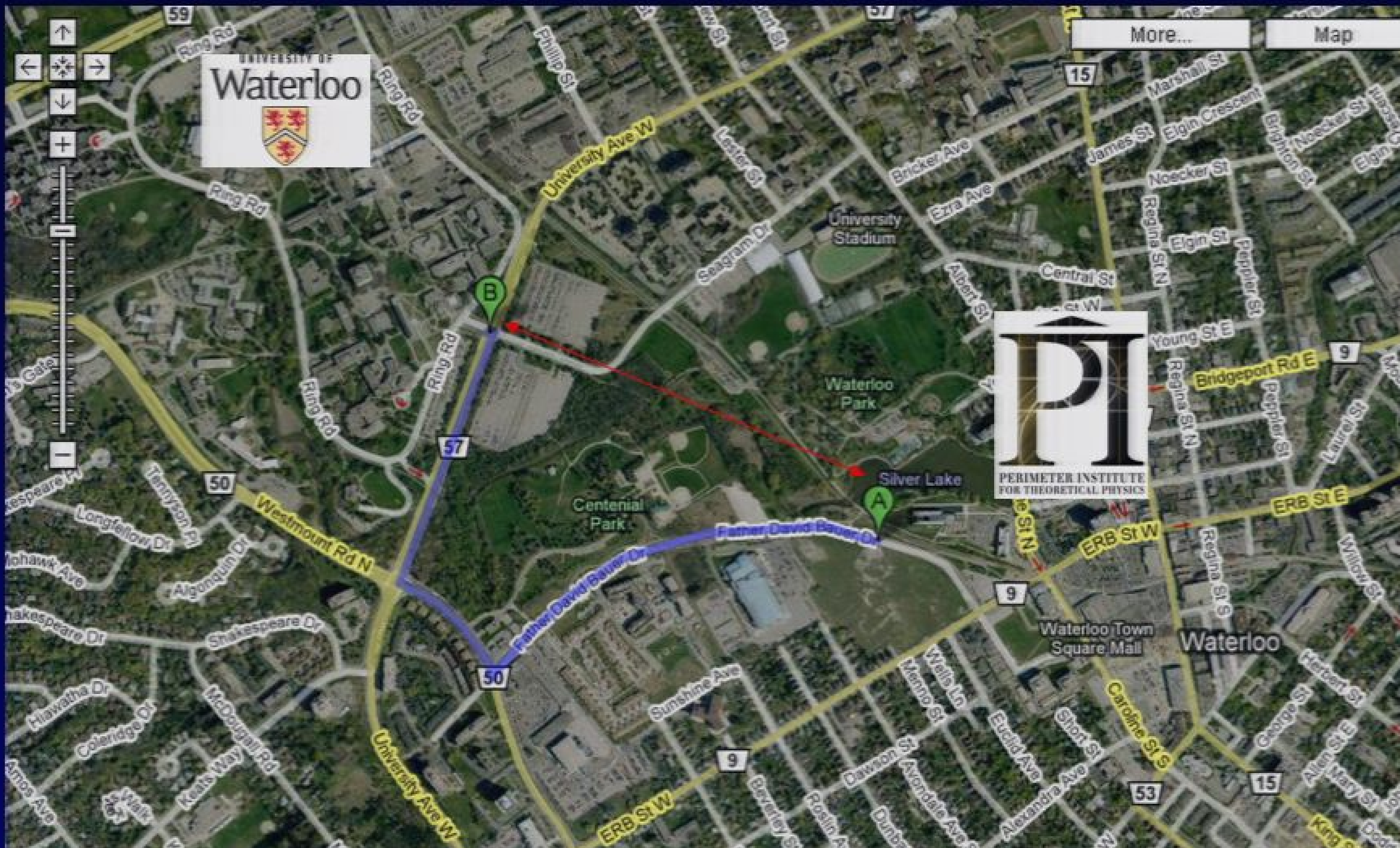
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Avondale Ave S
Euclid Ave
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Alexandra Ave
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Testing Cosmological Models

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- Global Geometry and Expansion Rate
  - SNe, CMB, BAO

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- ***Growth of Fluctuations*** as a function of *z*
  - CMB z~1100
  - Ly-alpha 2-3
  - Cluster Abundance 0-0.8
  - Weak Lensing 0.2-0.8
  - Peculiar Velocities ~0

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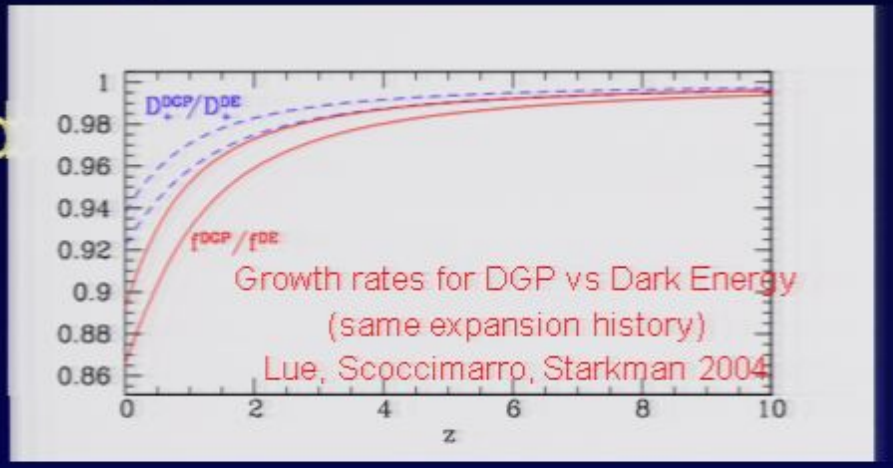

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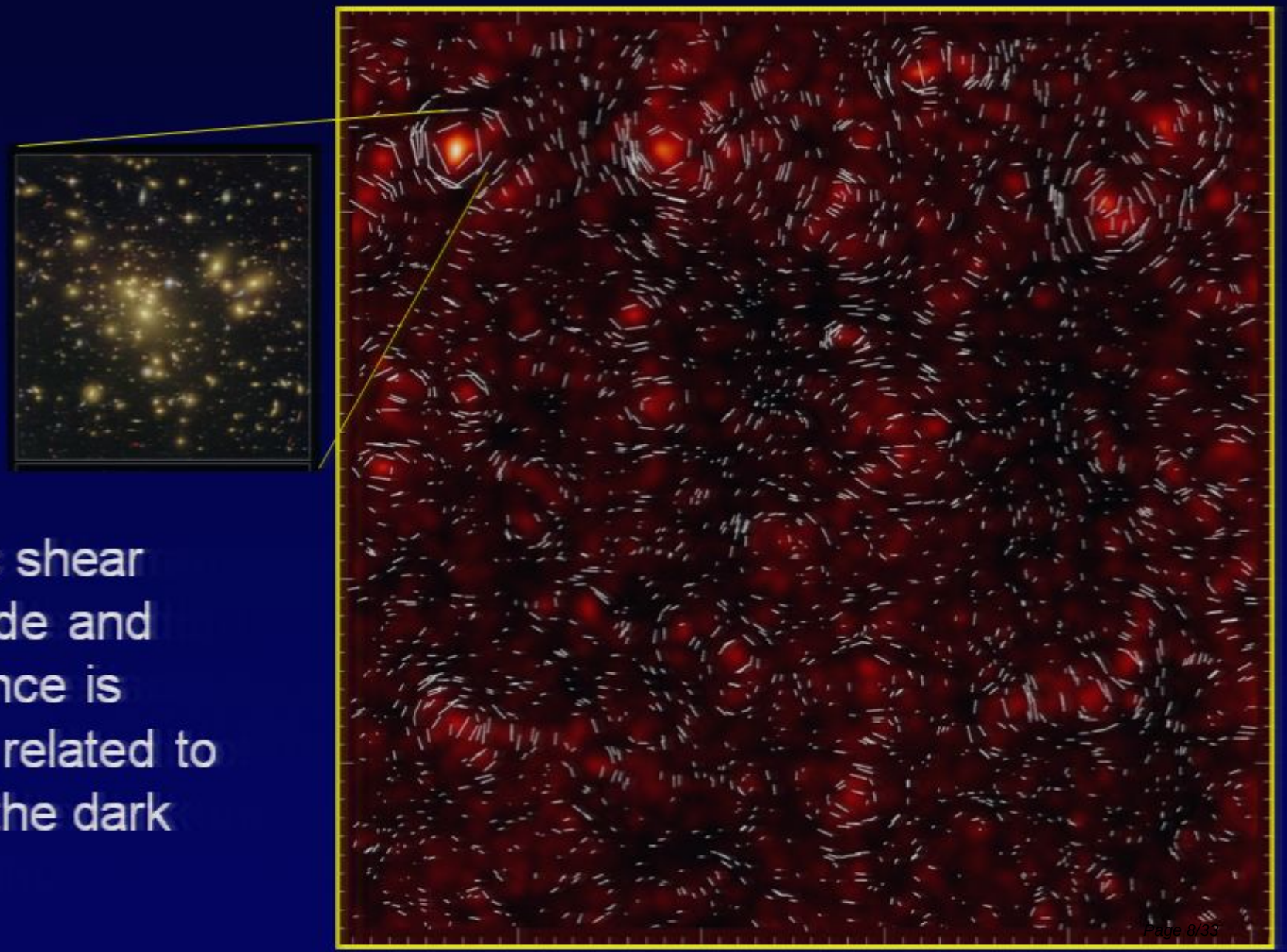
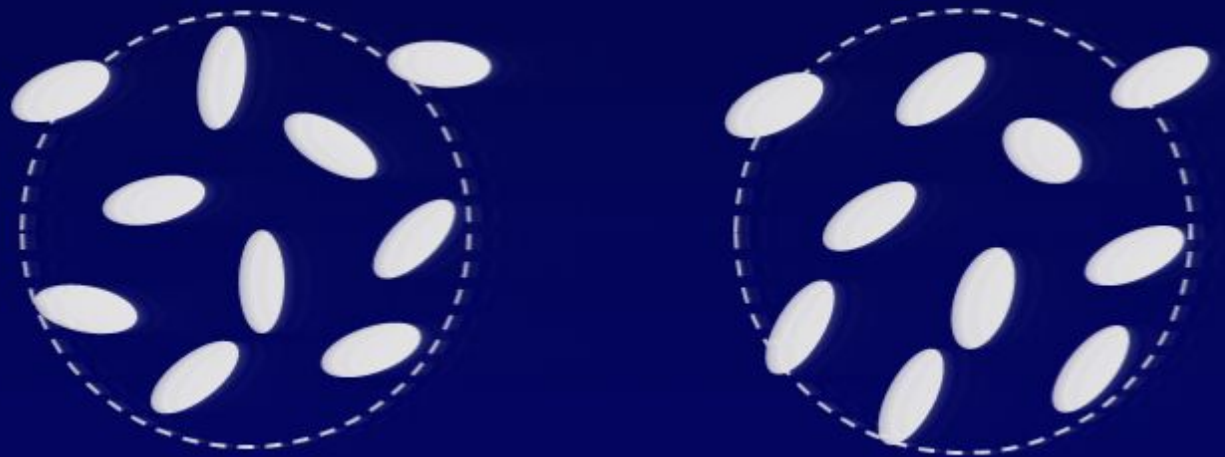
Dark matter and cosmic shear



Cosmic shear amplitude and coherence is closely related to that of the dark matter

Using (non-round) galaxies to measure weak lensing

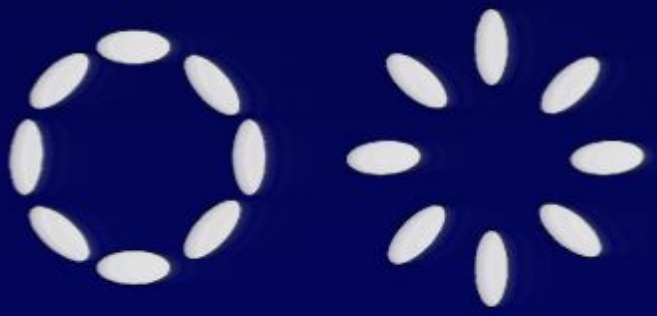
The underlying assumption is that the position angles are random in the absence of lensing.



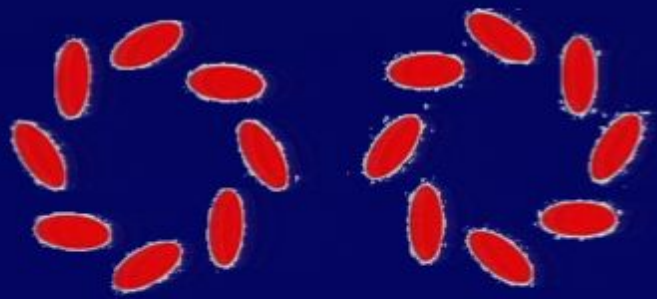
Tests of systematics

The lensing signal is caused by a gravitational potential and therefore should be curl-free (to first order). We can project the correlation functions into one that measures the divergence and one that measures the curl: E-B mode decomposition.

E-mode (curl-free)



B-mode (curl)



Scaling of the Cosmic Shear Signal

Simple case, assuming a single lens plane and $P(k) \sim \sigma_8 k^n$

$$\langle \kappa^2(\theta) \rangle = \langle \gamma^2(\theta) \rangle$$

Gravitational convergence (surface mass density)

Gravitational shear = ellipticity induced by gravitational lensing on galaxies

Cosmological parameters

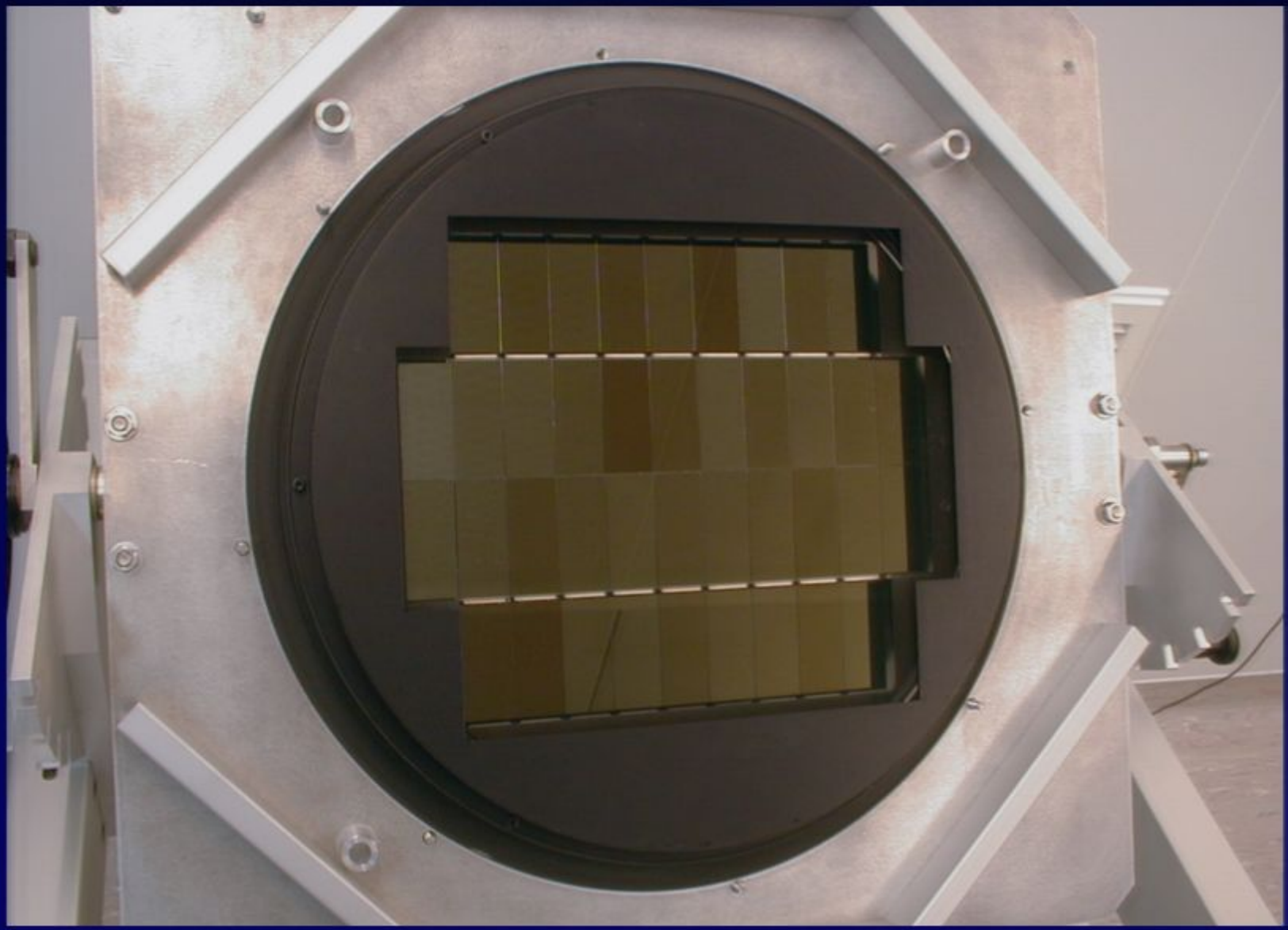
$$\langle \kappa^2(\theta) \rangle^{1/2} \approx 0.01 \, \sigma_8 \Omega_m^{0.8} \left(\frac{\theta}{1\text{deg.}} \right)^{-\frac{n+2}{2}} z_s^{0.75}$$

Redshifts of background galaxies


CFHT
Legacy
Survey


CFHT
Legacy
Survey

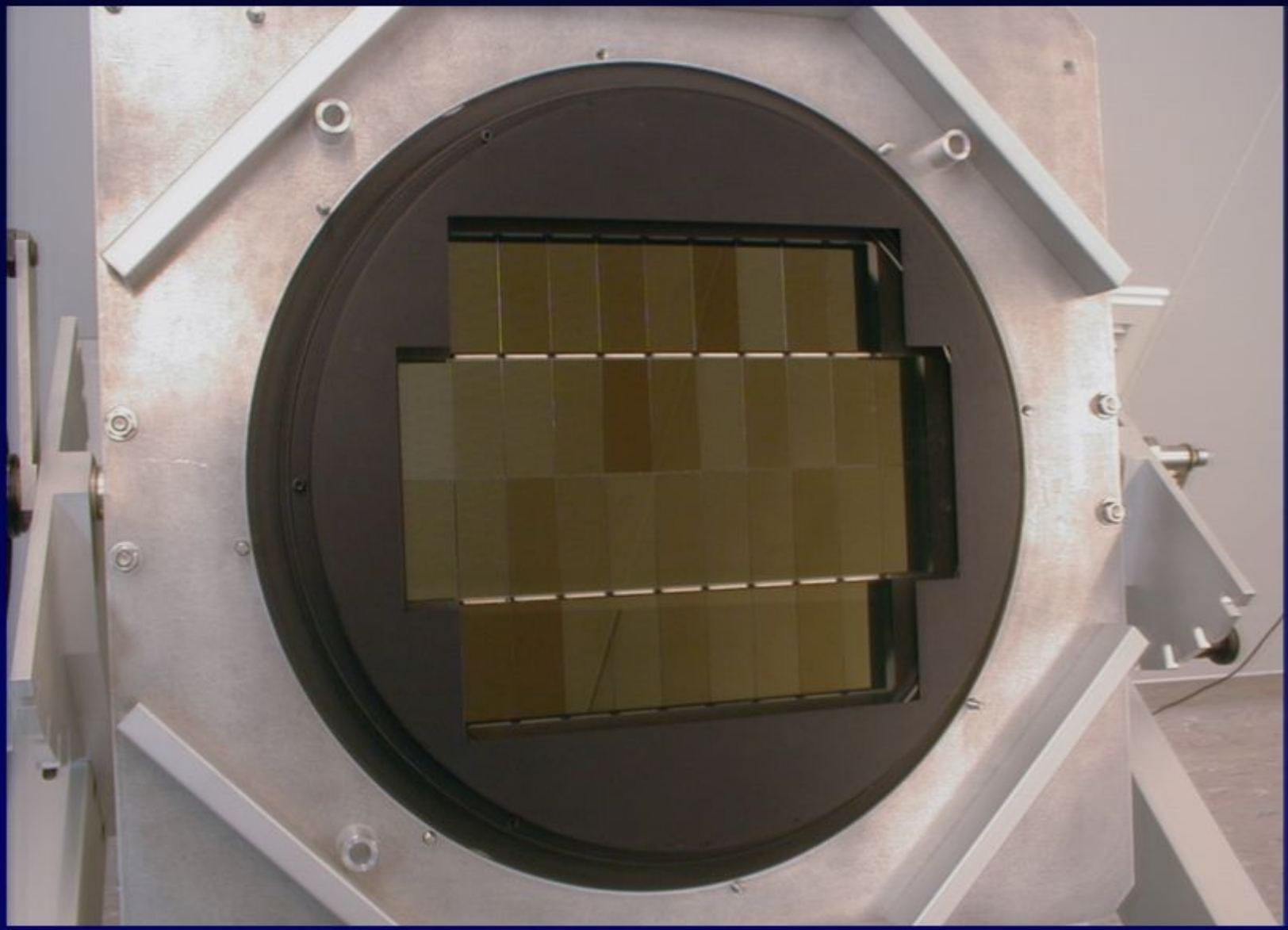

CFHT
Legacy
Survey



Megacam:

- 1 square degree field of view
- ~350 megapixels


CFHT
Legacy
Survey



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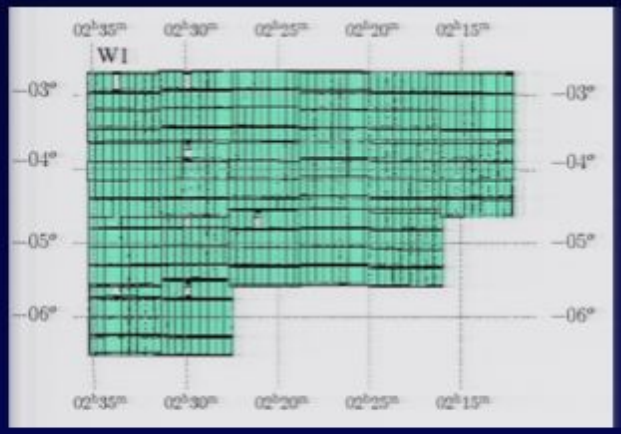
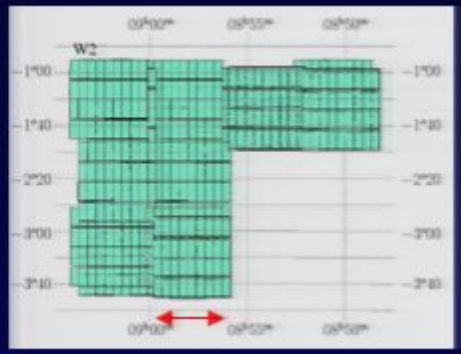
Very weak lensing in the CFHTLS wide: cosmology from cosmic shear in the linear regime⋆,⋆⋆

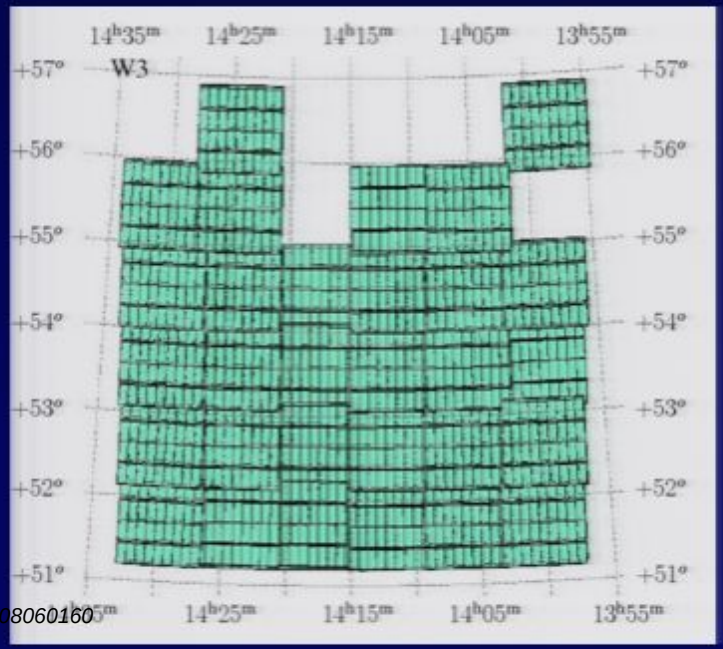
L. Fu[1,2], E. Semboloni[1,3], H. Hoekstra[4,⋆⋆⋆], M. Kilbinger[1,3], L. van Waerbeke[5], I. Tereno[1,3], Y. Mellier[1], C. Heymans[1,5], J. Coupon[1], K. Benabed[1], J. Benjamin[5], E. Bertin[1], O. Doré[6], M. J. Hudson[7], O. Ilbert[8,9], R. Maoli[1,10], C. Marmo[1], H. J. McCracken[1], and B. Ménard[6]

Current CFHTLS Data Set





14 Mpc/h @ z ~ 0.4



- Span 57 sq. degrees: linear regime
- (34.2 sq deg effective)
- 1.7 million galaxies

Fu et al. 2008, A&A 479, 9

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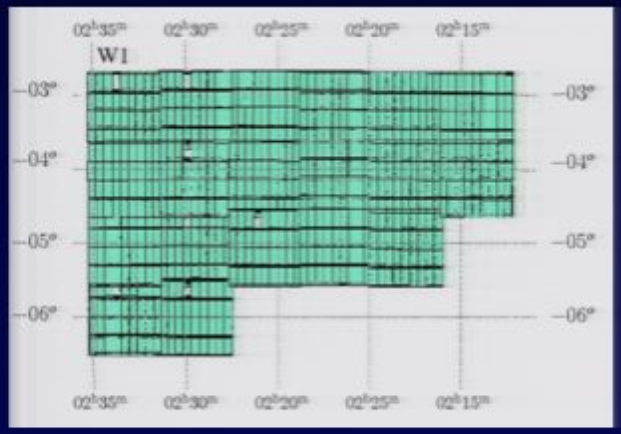

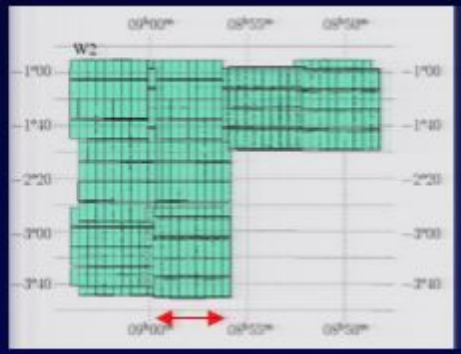

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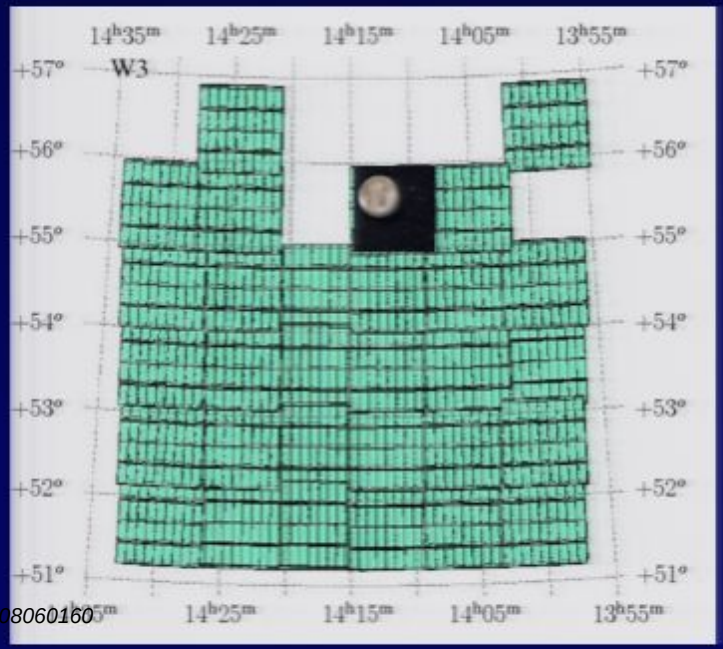

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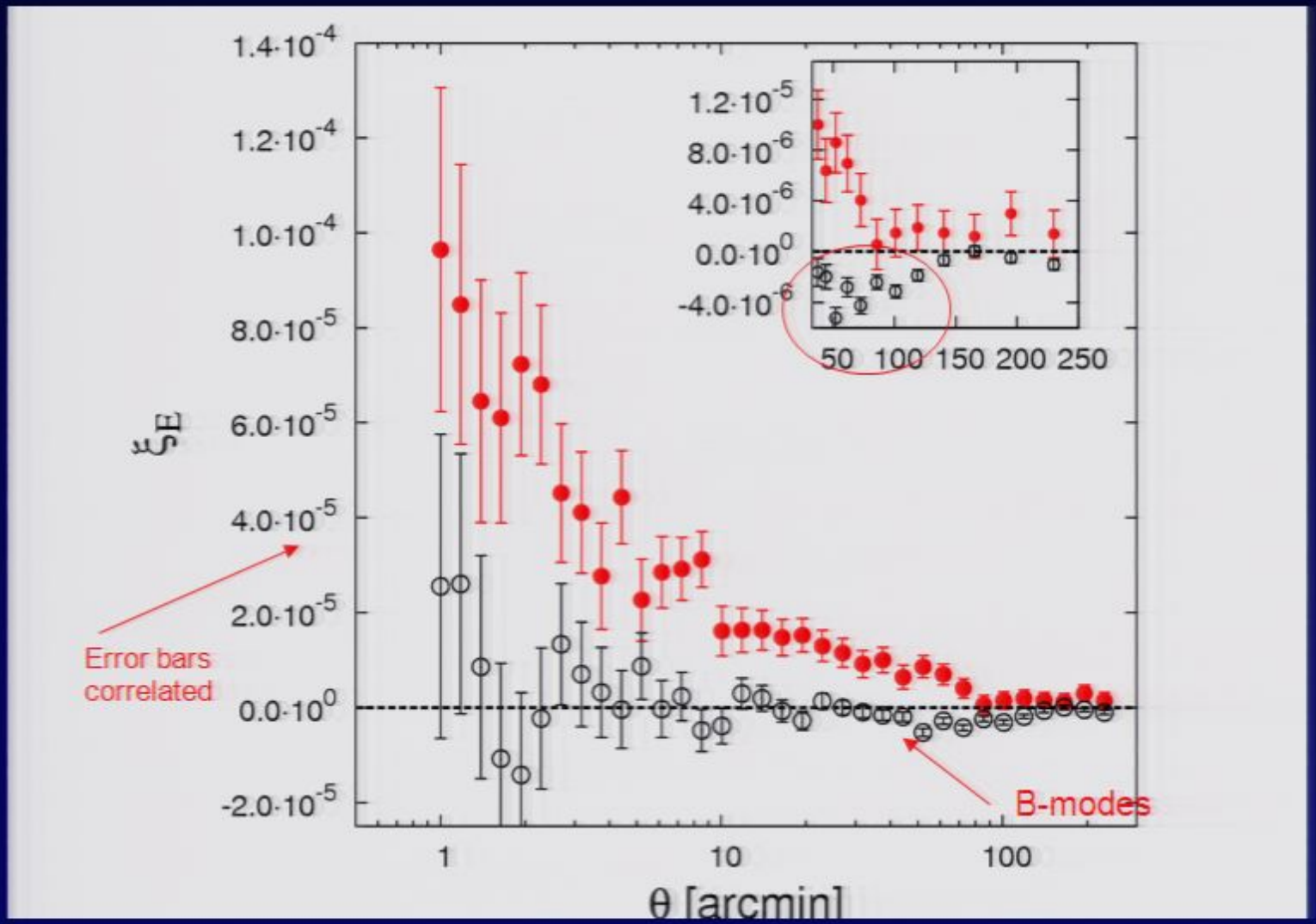
Current Results



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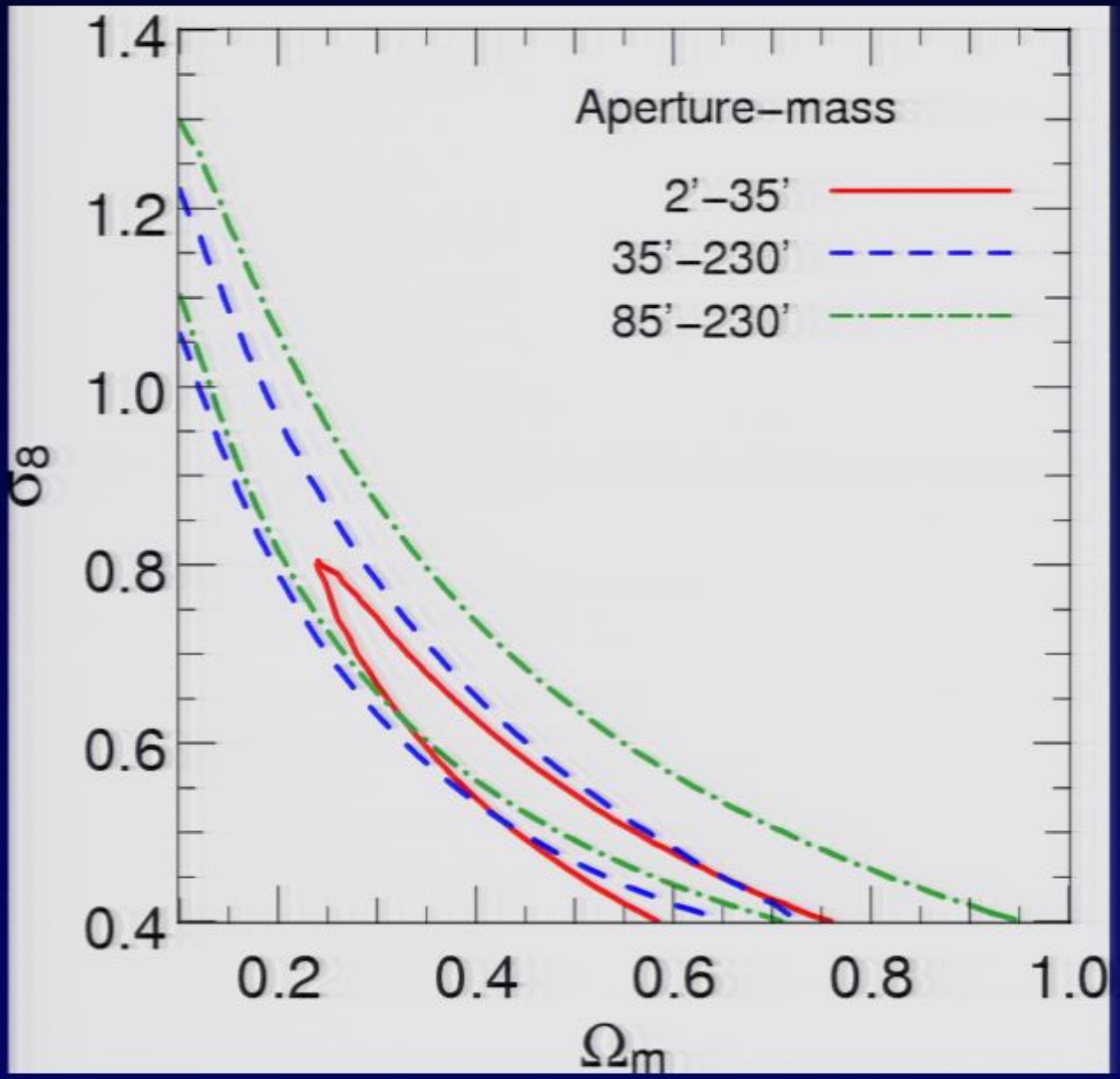

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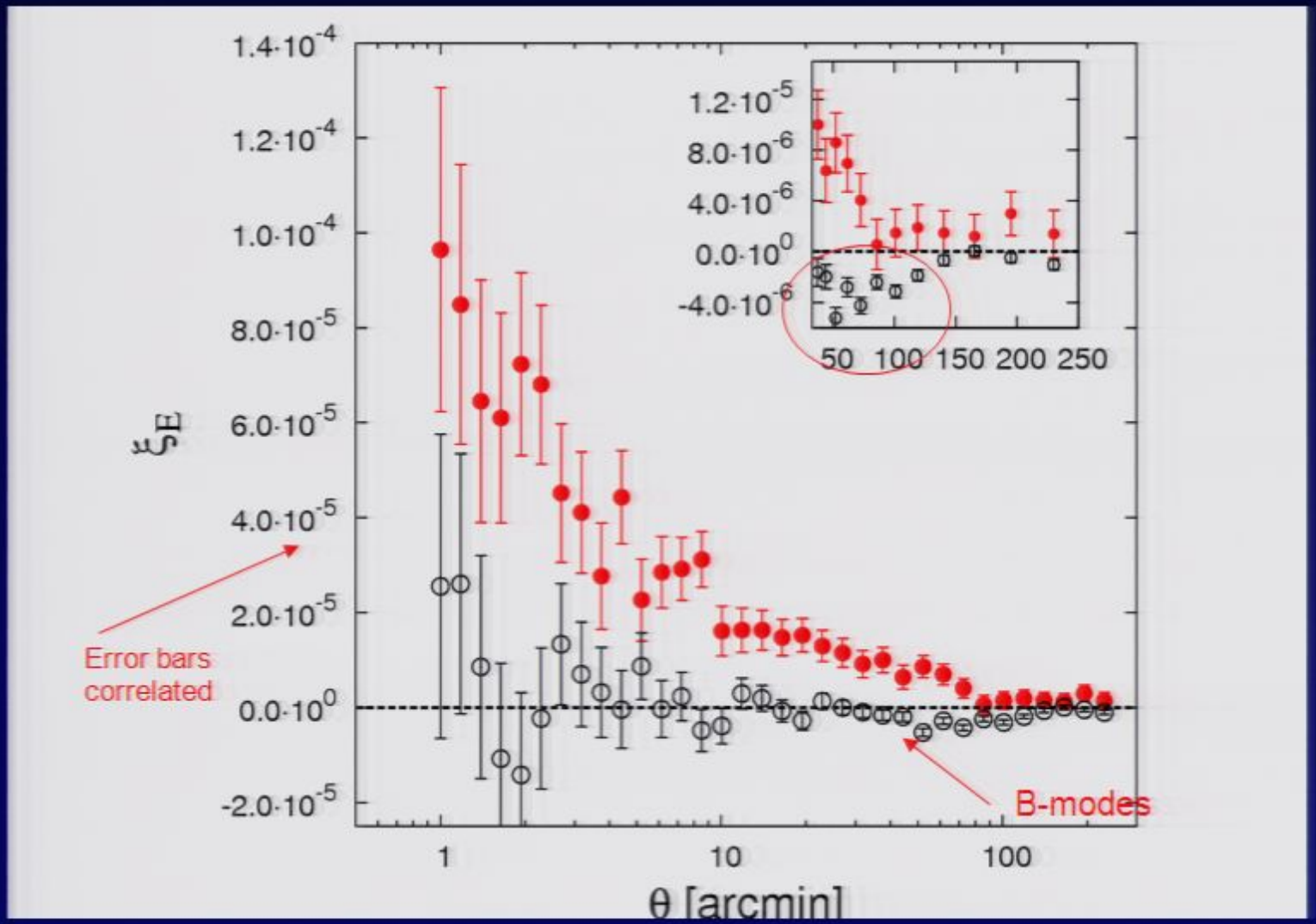

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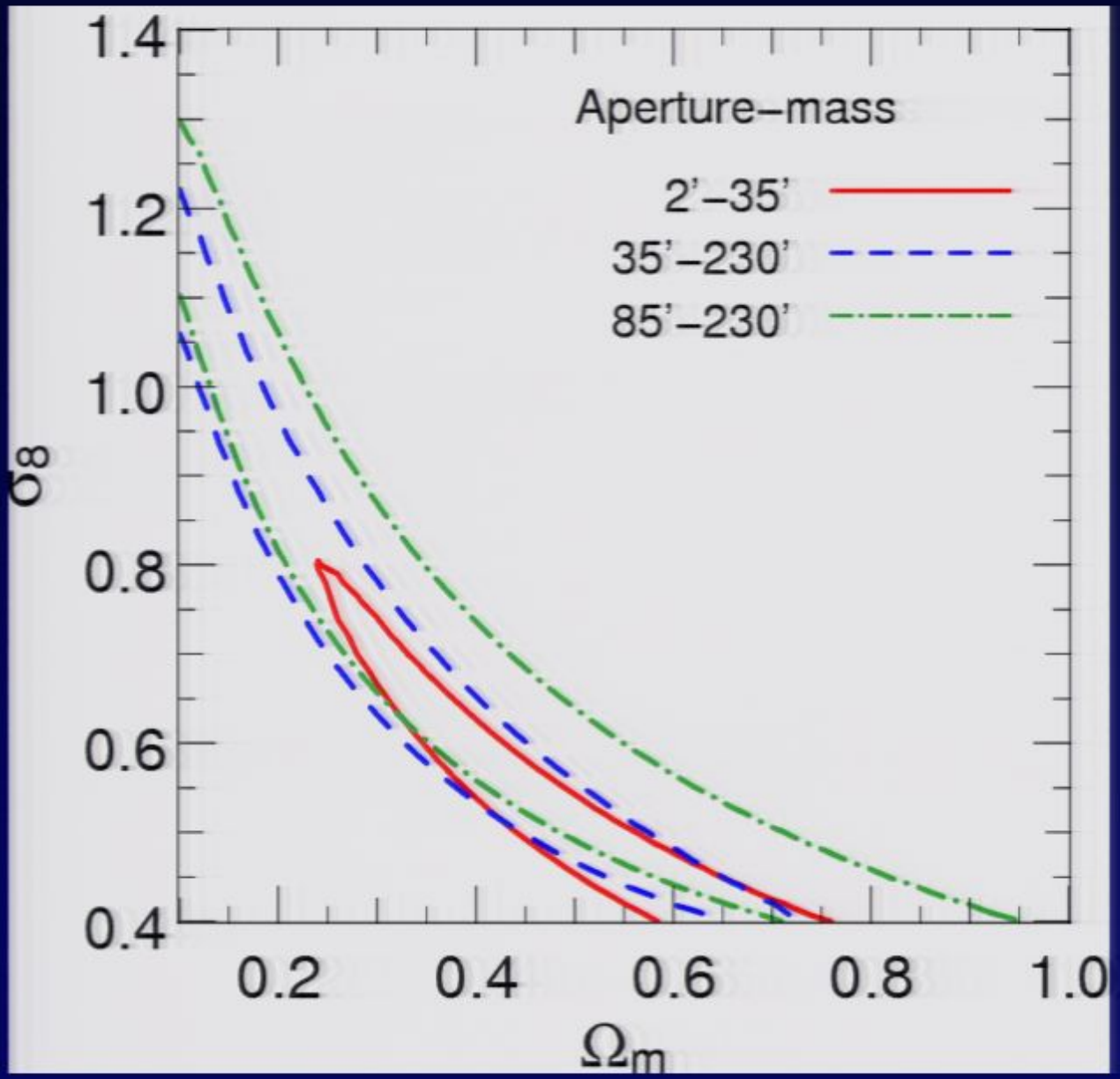

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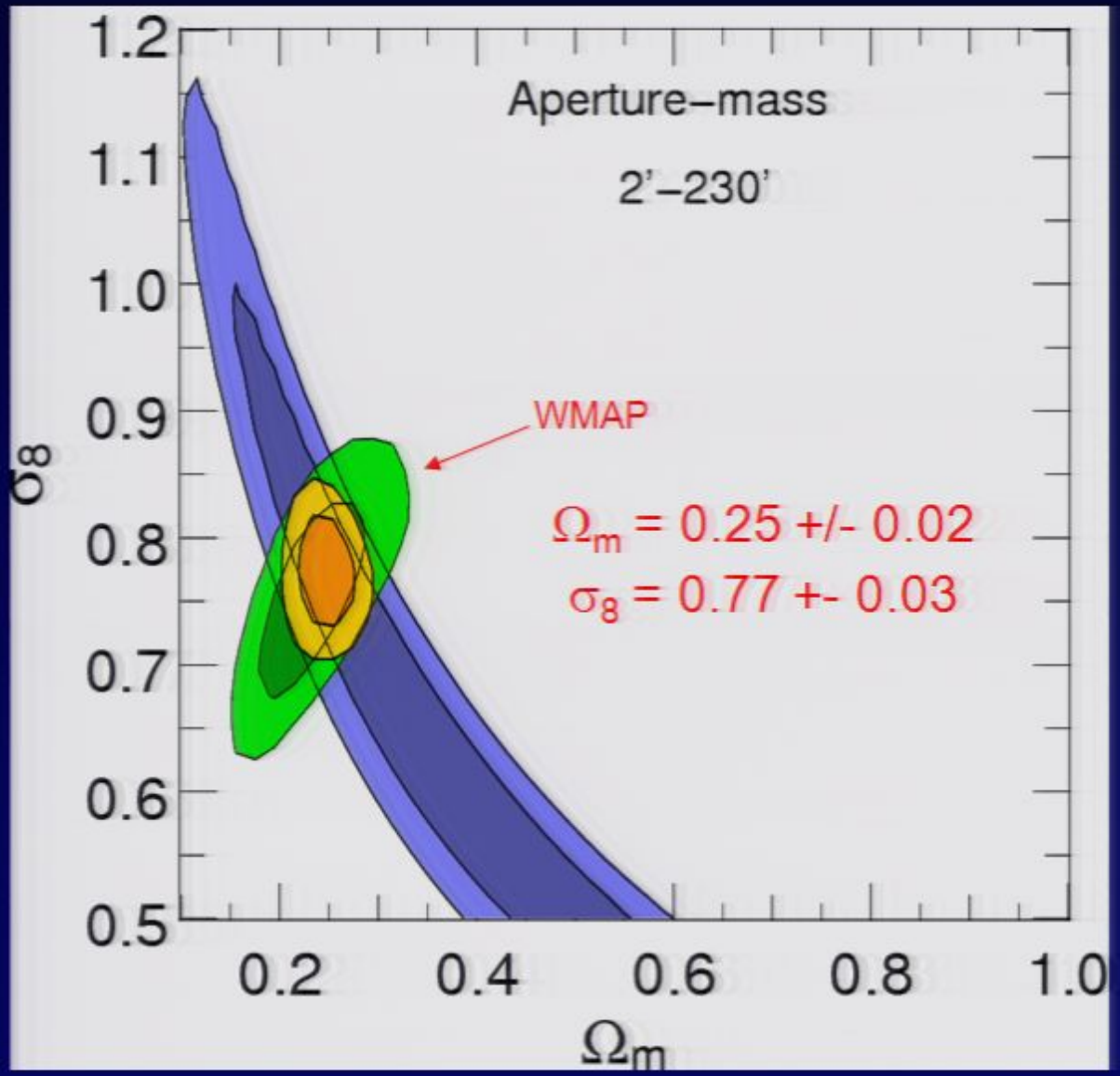

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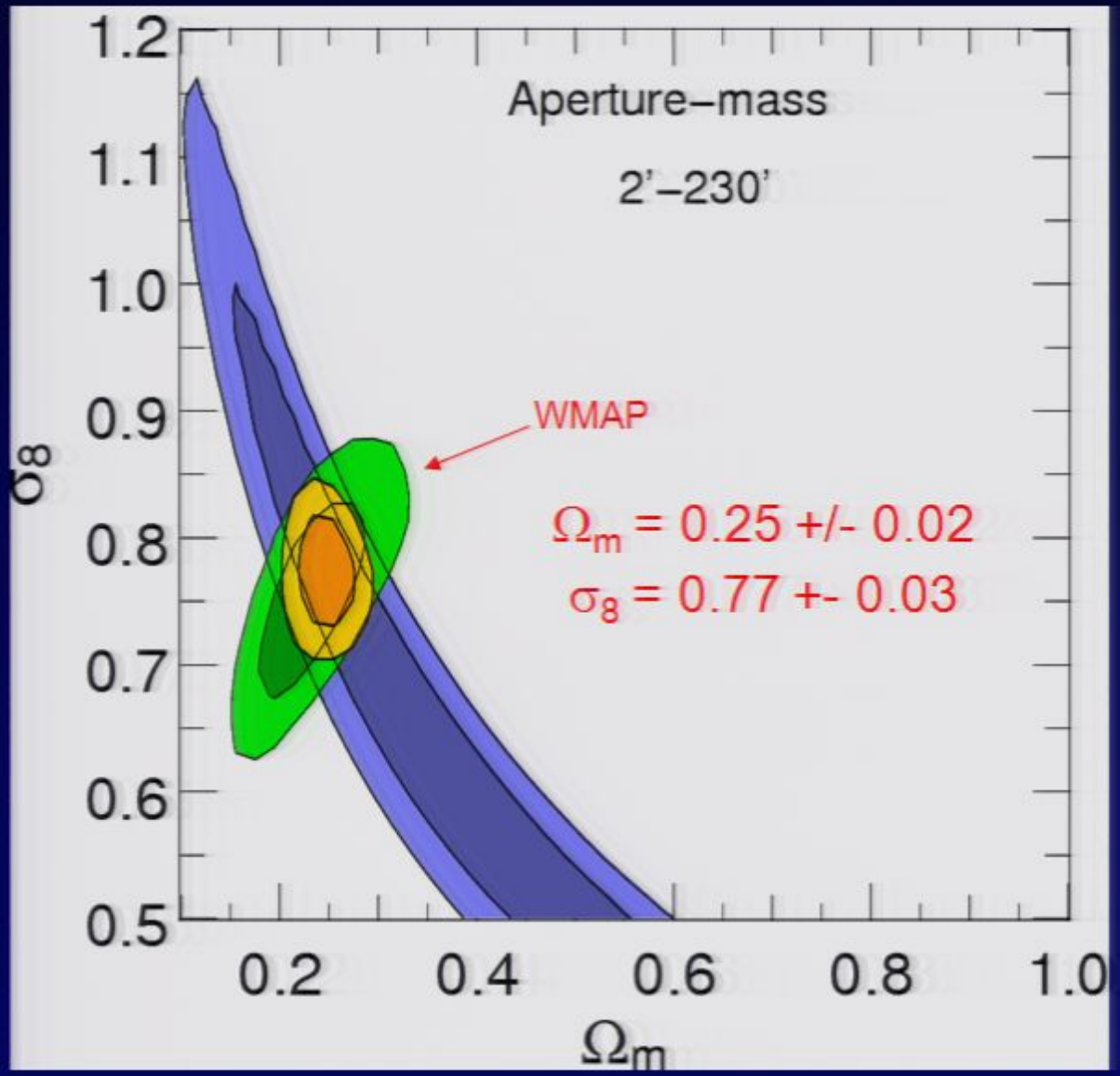
CFHTLS Cosmic Shear:
On-going or on the « To Do » List

- Full data set: approx 3 times larger
- Photo-z, ultimately for the full Wide survey
  - Real 3-D « tomography »: evolution σ_8 of as a function of (z)
    - Dark energy
    - w(z)
- 3-point correlation functions:
  - breaking the σ_8-Ω_m degeneracy
- « Gastro »physics:
  - Galaxy-galaxy lensing (Parker et al. 2006)
  - Galaxy (light) - Mass cross-correlation: biasing



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- First measurement of weak lensing in the linear regime
- Consistent with extrapolation of WMAP (3 & 5) results within LCDM
  - No evidence for unusual growth factors
- Lots of applications *and* better data still to come

Peculiar Velocities

- Measure the derivative of the growth rate
- Probe very large scales
- Bulk flow (Dipole) within a 50 Mpc/h Gaussian
  - All surveys consistent*
  - V = 403 +/- 80 km/s

	ML		BC	
	$\Omega_m = 0.258$	$\sigma_8 = 0.796$	$\Omega_m = 0.28$	$\sigma_8 = 0.86$
Survey	$\chi 2$	$P(>\chi 2)$	$\chi 2$	$P(>\chi 2)$
SHALLOW	1.95	0.583	1.83	0.608
DEEP	8.75	0.033	8.32	0.040
SFI++	13.60	0.004	12.85	0.005
COMPOSITE	13.77	0.003	13.02	0.005

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