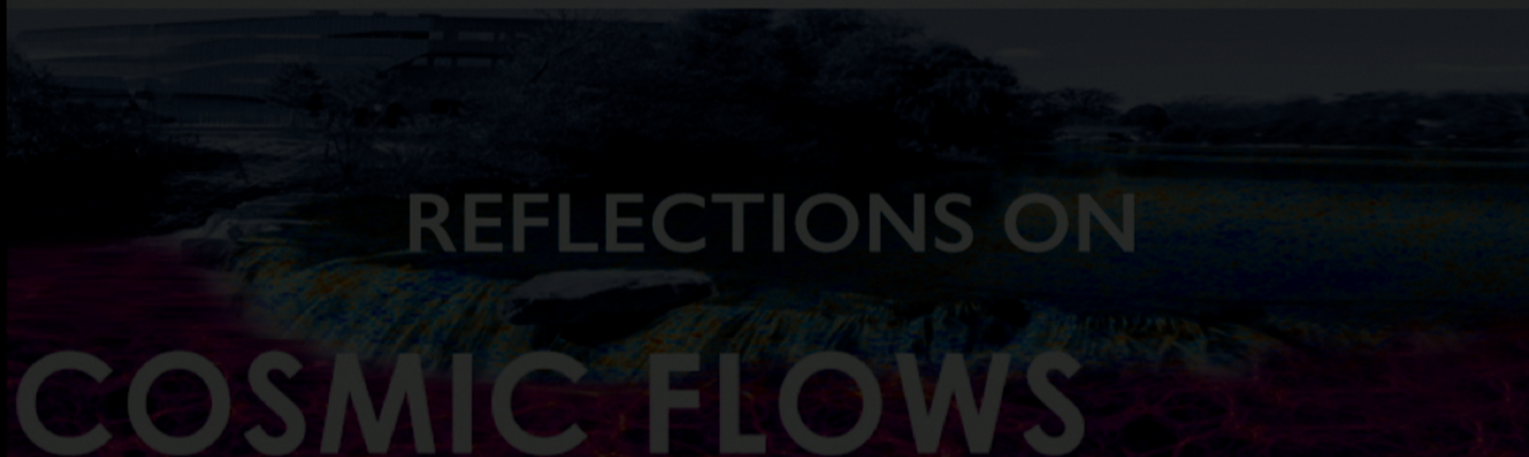


Title: Discussion

Date: Aug 12, 2015 03:30 PM

URL: <http://pirsa.org/15080118>

Abstract:



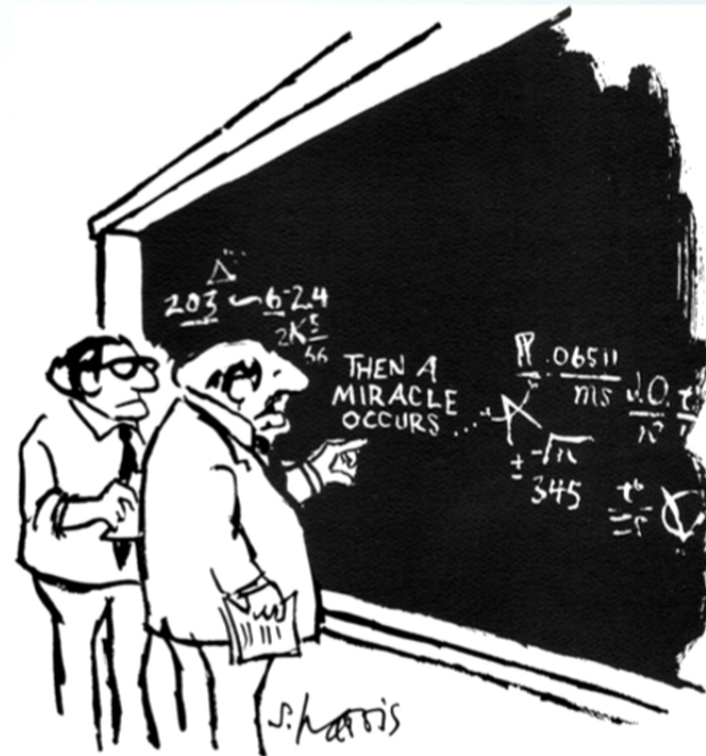
REFLECTIONS ON
COSMIC FLOWS

COZMIC FLOW?

AND OTHER NOVELTIES

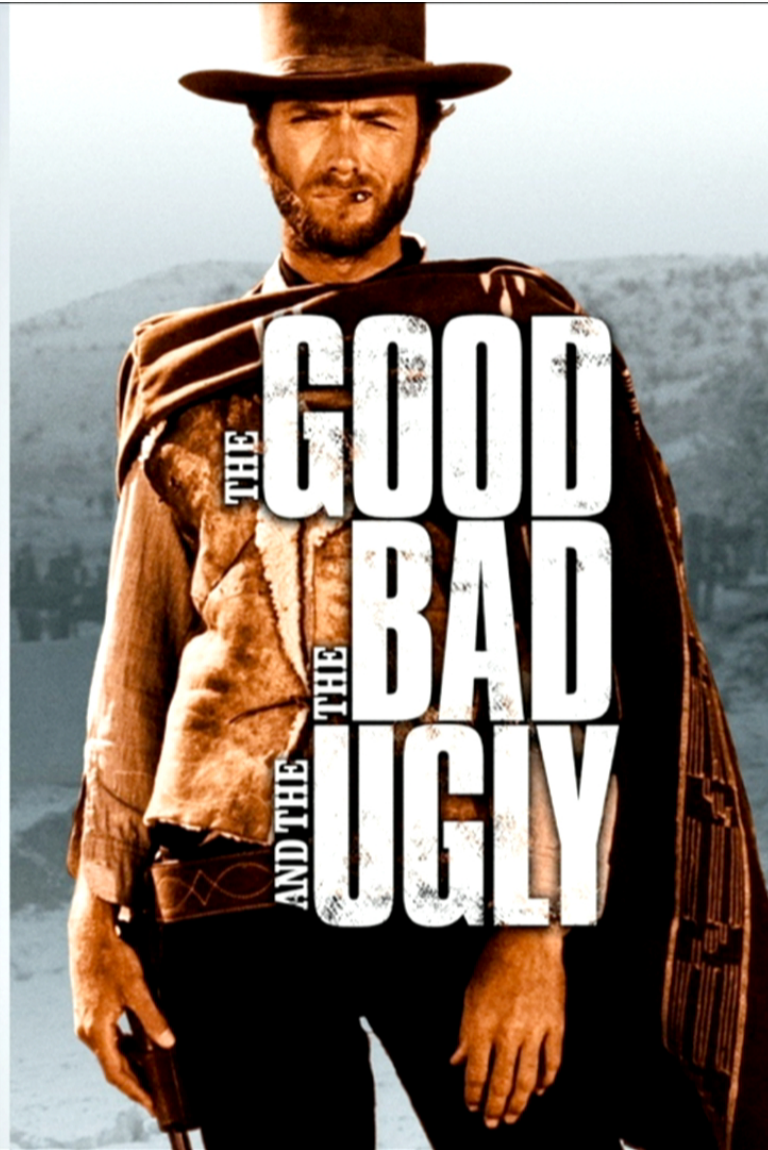
Mike Hudson
U. Waterloo





"I THINK YOU SHOULD BE MORE EXPLICIT HERE IN STEP TWO."





- What is most exciting thing in cosmology now and in the near future?
- If you had a billion dollars, what would you do with it?



- What is most exciting thing in cosmology now and in the near future?
 - If you had a billion dollars, what would you do with it?
- What keeps you up at night?



- What is most exciting thing in cosmology now and in the near future?
 - If you had a billion dollars, what would you do with it?
- What keeps you up at night?
- Be provocative

Make my day

THEMES OF THE MEETING

Death of the auto
correlation

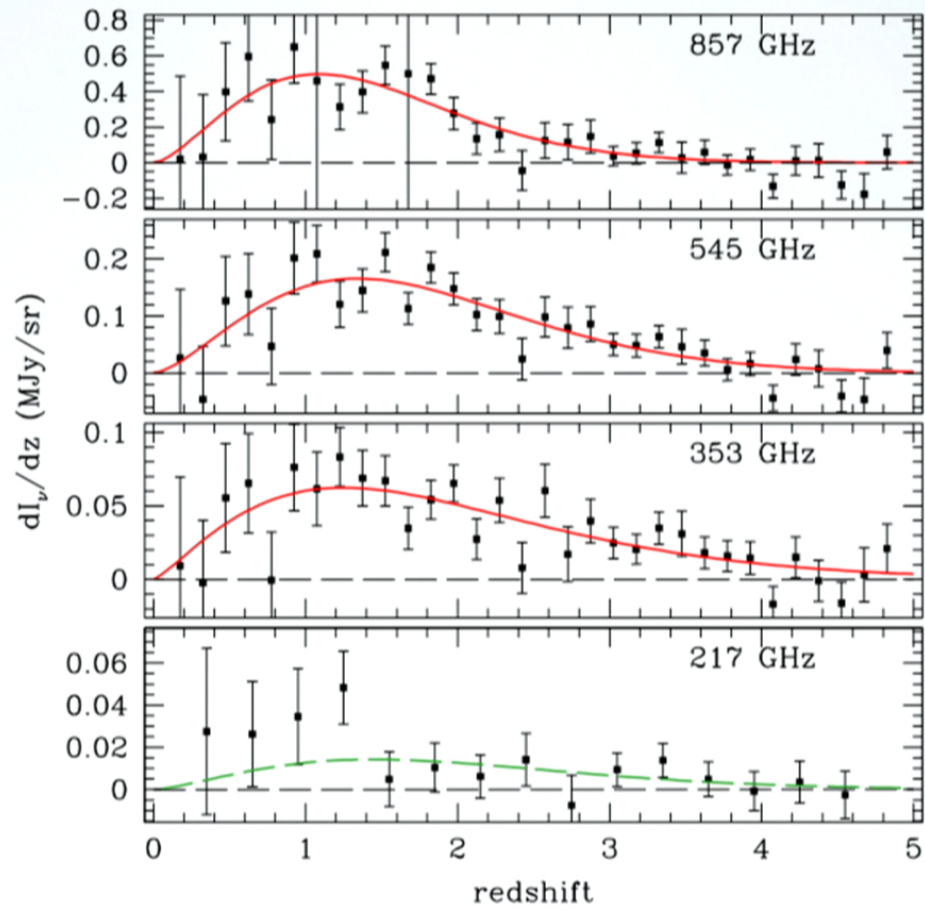


CROSS-CORRELATIONS

- Density
 - Galaxies/halos
 - 21 cm
 - Ly alpha (flux decrement)
 - (Projected) DM (WL kappa)
- Velocity
 - Galaxies
 - Electrons
 - Ly alpha gas
- CMB Temperature

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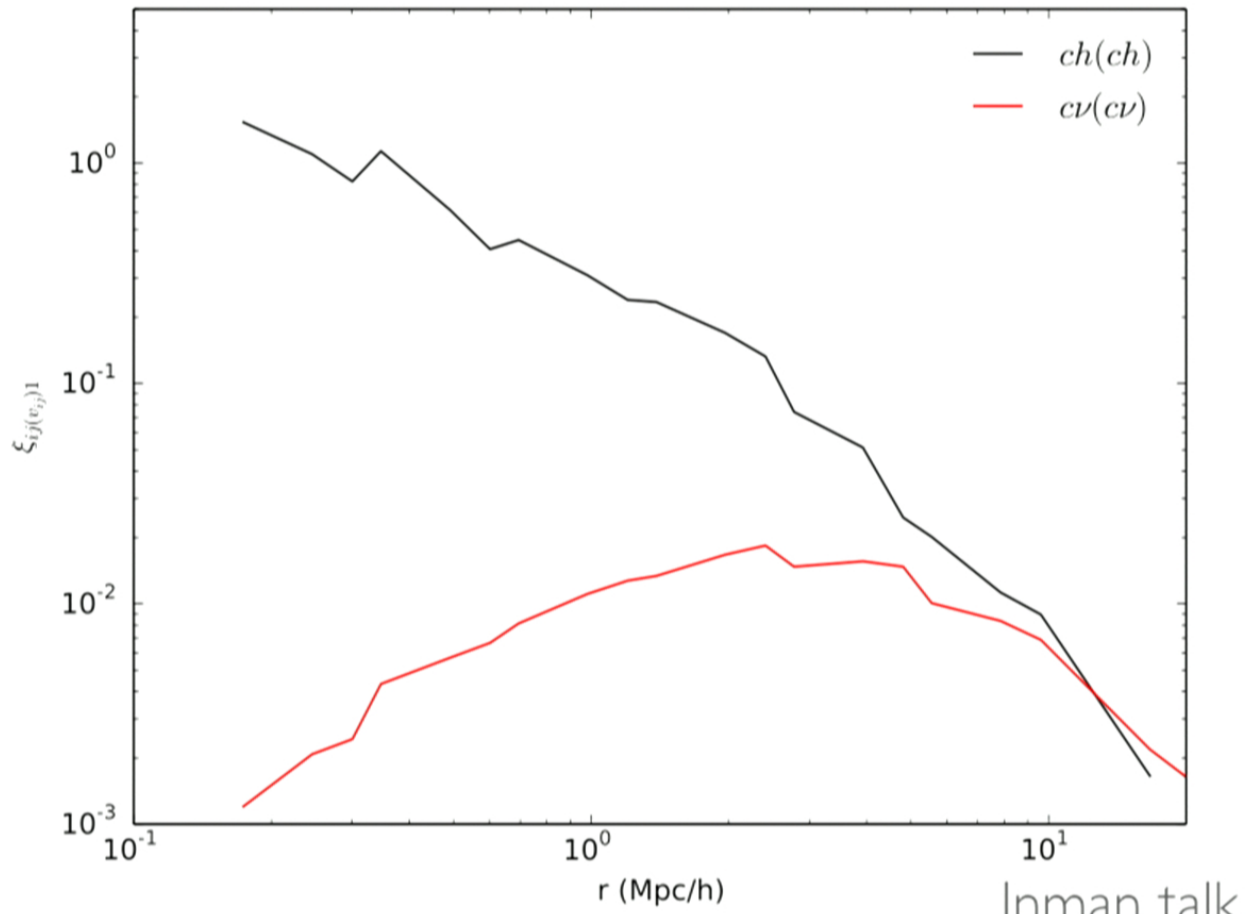
Schmidt et al 2015

THEMES OF THE MEETING

- Neutrinos
- kSZ
- The gaseous Universe
 - IGM and Ly alpha
 - Reionization epoch
- Theory of power spectra and extensions to the non-linear regimes

NEUTRINOS

- The good:
 - They should be there!
 - We can measure their mass, and in principle separate this from primordial power spectrum ...



KINETIC SUNYAEV-ZELDOVICH

- The good:
 - Measure velocities, on large scales
 - Missing baryons!

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KINETIC SUNYAEV-ZELDOVICH

- The good:
 - Measure velocities, on large scales
 - Missing baryons!
- The bad
 - Small signal, hard to separate from primary CMB “noise”
- The ugly
 - Do we understand the profile of electrons around halos?

DIDN'T HEAR MUCH ABOUT..

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- Non-Gaussianity (except Sarah Shandera)
- ISW
 - Maximum possible is 8 sigma (Crittenden?)
 - What happened to the factor of 2 (Ho et al 2008)?

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- Non-Gaussianity (except Sarah Shandera)
- ISW
 - Maximum possible is 8 sigma (Crittenden?)
 - What happened to the factor of 2 (Ho et al 2008)?
- Substructure / missing satellites / WDM



DIDN'T HEAR MUCH ABOUT..

- Other Anomalies
 - CMB "Axis of Evil"
 - Cold spot(s) and super"voids"

"I'm not an Anomaly Denier"

- Dick Bond

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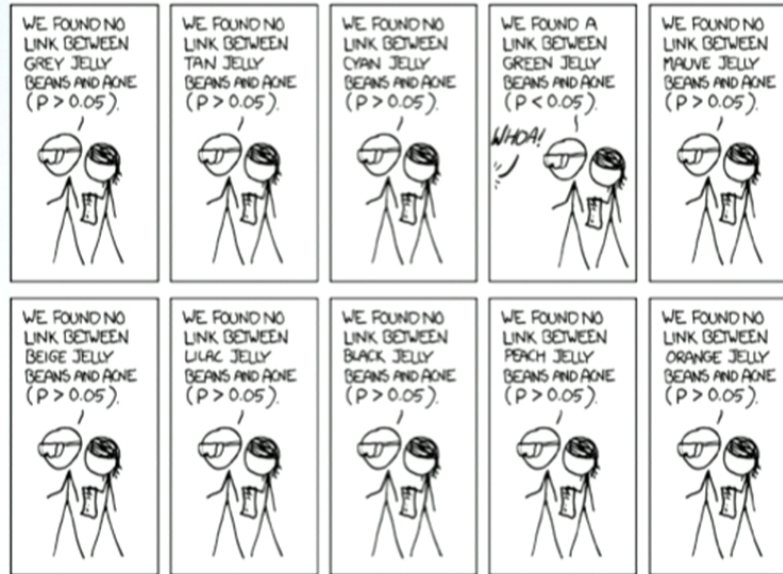
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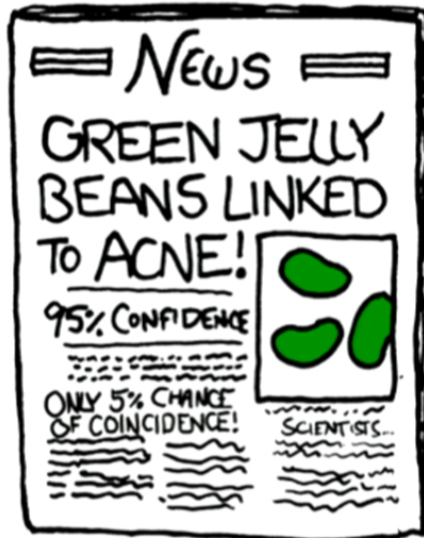
- Dick Bond







WHOA!



Credit: xkcd

COSMIC FLOWS: THE GOOD

- Measure growth factor f and the *matter* power spectrum on very large (\sim Gpc) scales in the low z Universe
- You mean “redshift space distortions?”

PREDICTING PECULIAR VELOCITIES FROM THE DENSITY FIELD

$$\mathbf{v}(\mathbf{r}) = \frac{fH_0}{4\pi} \int d^3\mathbf{r}' \delta_m(\mathbf{r}') \frac{(\mathbf{r}' - \mathbf{r})}{|\mathbf{r}' - \mathbf{r}|^3}$$

↑
Tully-Fisher,
Fundamental Plane,
SNe

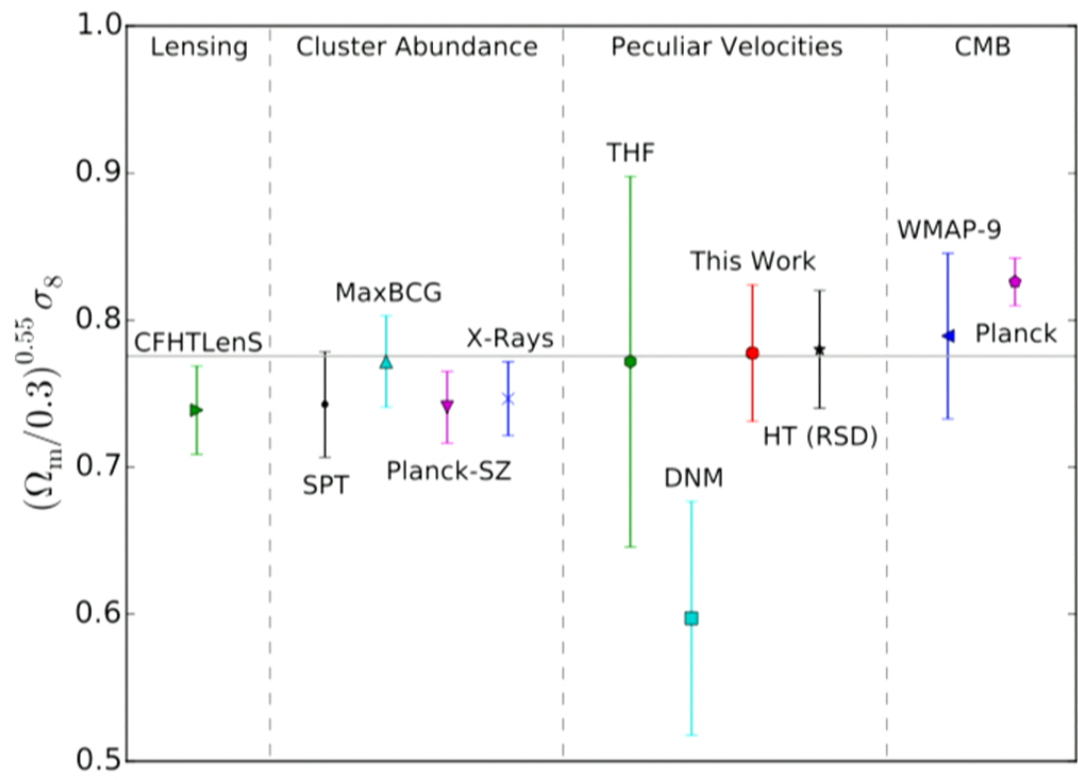
↙
Redshift survey (all sky)

PREDICTING PECULIAR VELOCITIES FROM THE DENSITY FIELD

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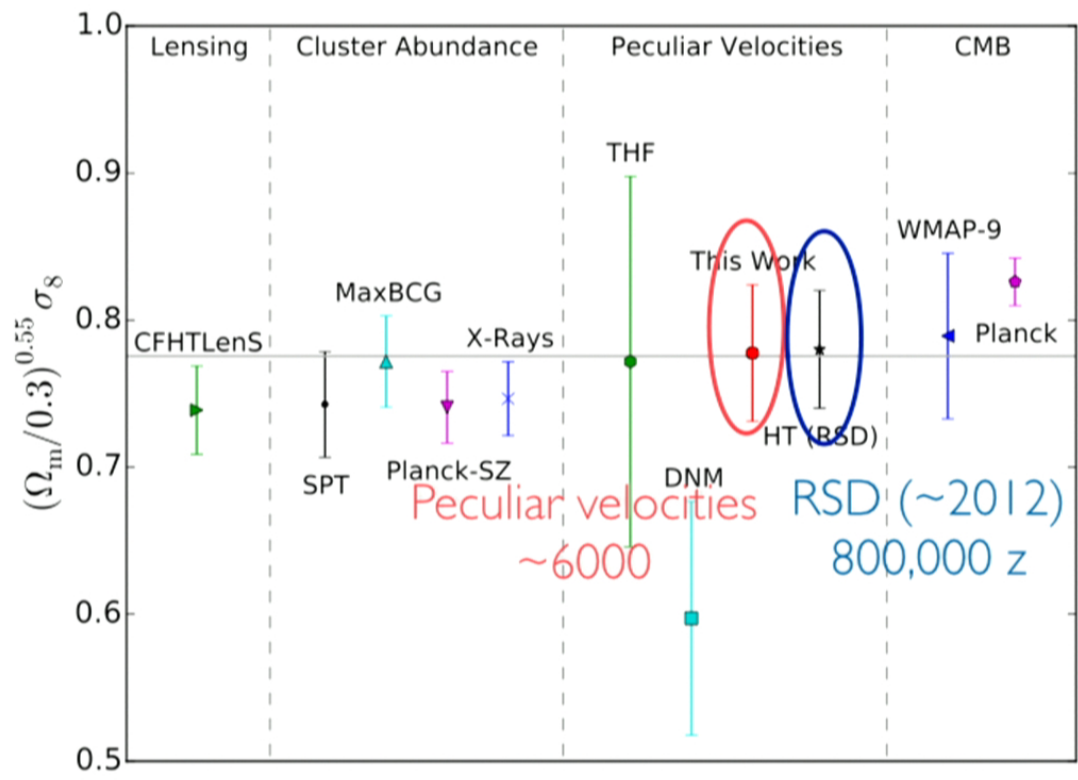
↑
Tully-Fisher,
Fundamental Plane,
SNe

↑
Redshift survey (all sky)



$f\sigma_8$ from different probes

Carrick et al. 15



$f\sigma_8$ from different probes

Carrick et al. 15

PROBING LARGEST SCALES

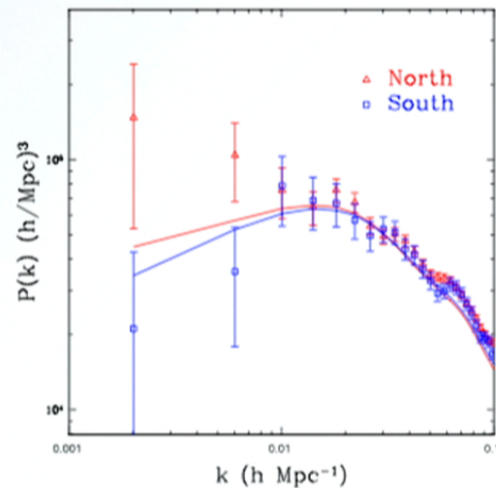
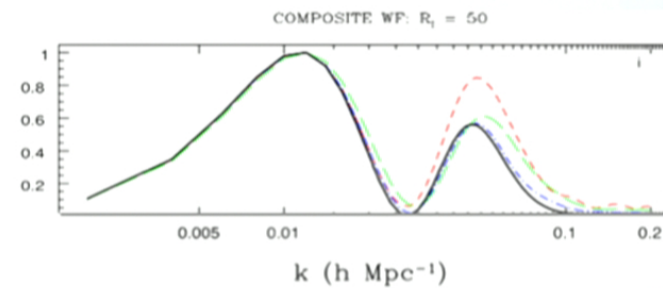


Figure 26. The $P(k)$ measurements for the Northern (NGC; open red triangles) and Southern Galactic Cap samples (SGC; open blue squares), with the mean of the respective mock samples displayed with a solid line. The difference between the two lines illustrates the effect of the different windows of the NGC and SGC on the expected $P(k)$.

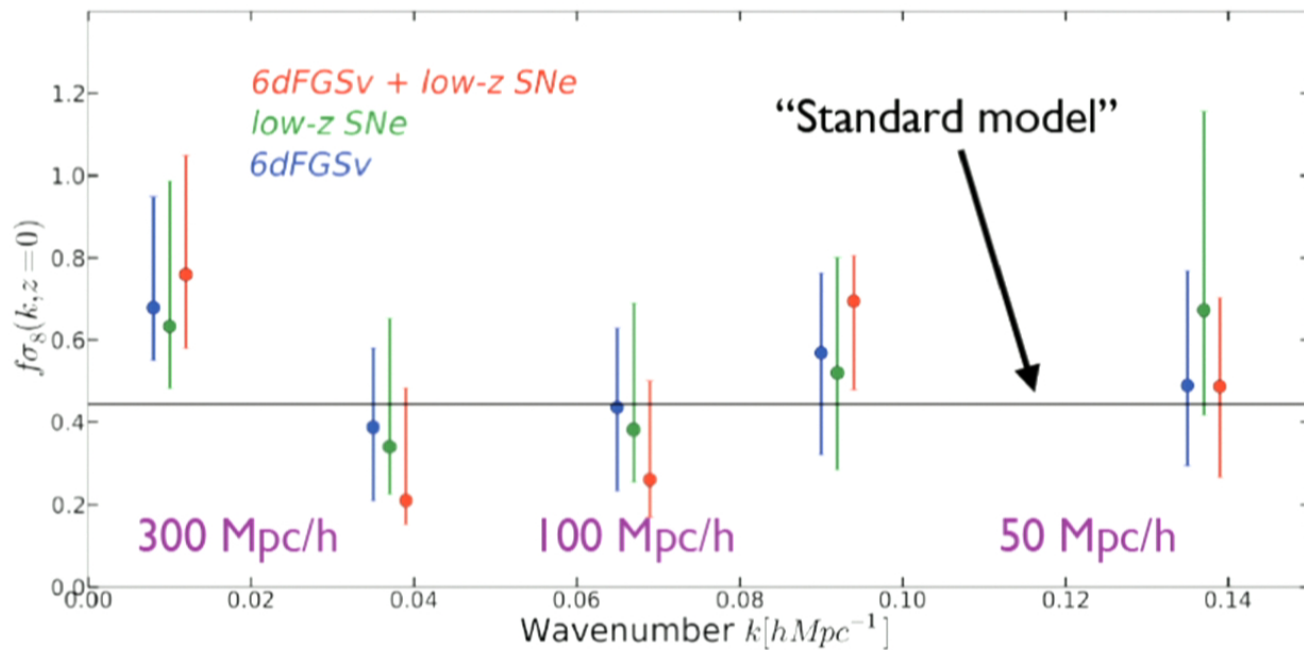
$$\sigma_V^2 = \frac{\Omega_m^{1.1}}{2\pi^2} \int_0^\infty dk \mathcal{W}_{ab}^2(k) P(k)$$



credit: H. Feldman

Ross et al 12, BOSS DR9

- Measurement of Johnson et al. (2014) : consistency with standard model with particular sensitivity to large scales



- Taipan survey velocity sample will be 20 times larger !!

slide credit: Chris Blake

THE BAD AND THE UGLY

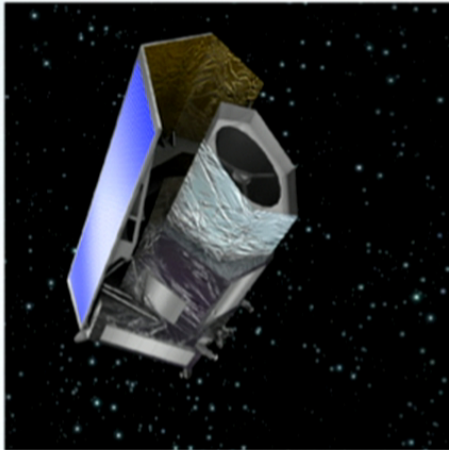
- Systematics are very difficult:
 - 1% errors at $z \sim 0.1$: 300 km/s $>$ signal
 - e.g. SDSS photometry only good to ~ 0.01 mag

Needs large well-controlled data sample

PROJECTS DISCUSSED

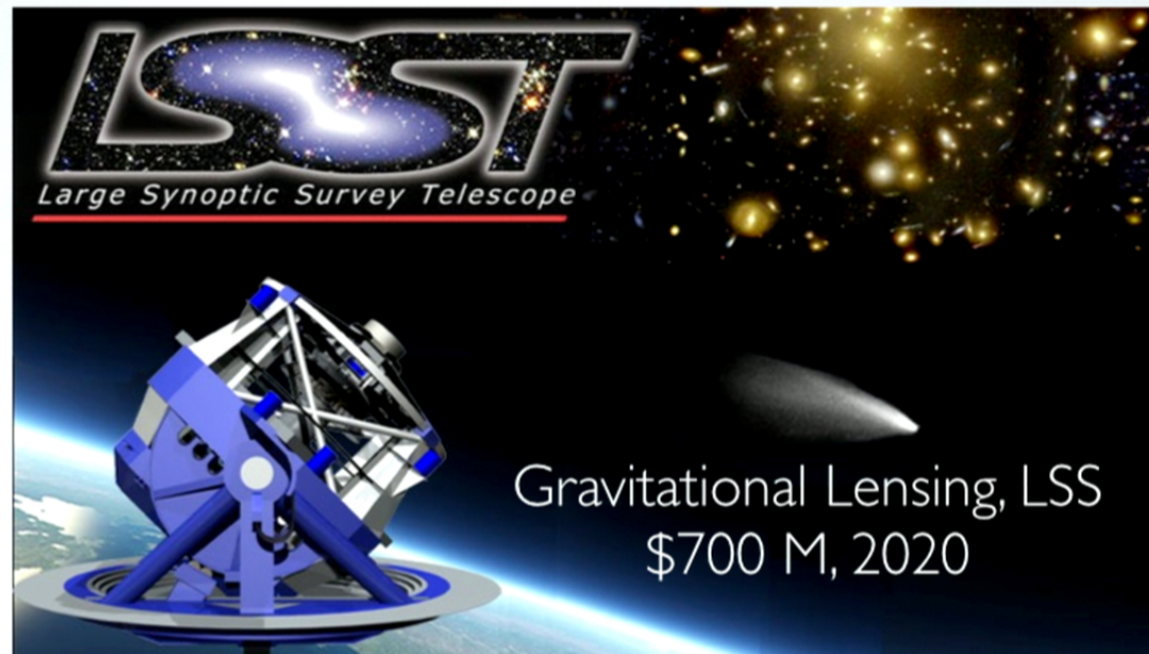
- BOSS
- CHIME
- ...

COSMOLOGY PROJECTS



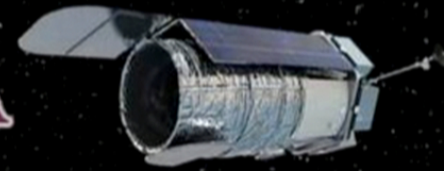
Euclid Telescope
Gravitational Lensing,
Large-scale structure
1 billion euros 2020

COSMOLOGY PROJECTS



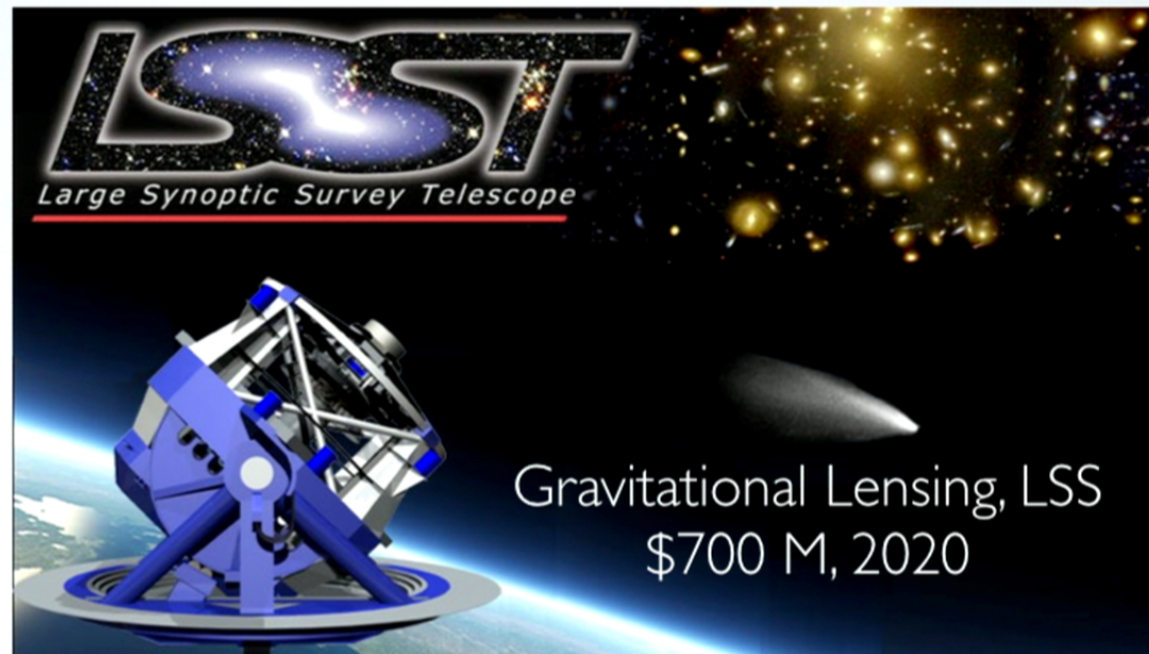
COSMOLOGY PROJECTS

WFIR T~AFTA
Wide-Field Infrared Survey Telescope



Gravitational Lensing,
Large-scale structure
\$2 billion 2025?

COSMOLOGY PROJECTS



Is Cosmology Dead?



THE BAD: VANILLA Λ CDM

- Flat
- CDM
 - neutrinos
- DE with $w = -1$
- Power-law primordial fluctuations





THE GOOD: CCCDM

- Curvature
- CDM with lower mass (WDM) or self-interaction
- DE that evolves
- Primordial features or unusual B-modes
- ... deviations from GR







Stargazing Party: Watch the Perseids with us! 📅

Wednesday, August 12, 2015 - 7:30 PM to 10:30 PM EDT



Join Faculty of Science and [Royal Astronomical Society of Canada](#) astronomers to learn more about the Perseids meteor shower, and see how many meteors you can spot!