

Ground- Based DE Projects

Jason Rhodes for Gary Bernstein

(with thanks to Rachel Mandelbaum, Mike Seiffert, Arjun Dey, and Josh Frieman)

Wide survey comparison statistics

| Survey | Area [deg ²] | Bands | Depth | Typical seeing [arcsec] | Timescale |
|------------|--------------------------|-----------------|---------------------------------------------------|------------------------------|------------|
| DES | 5000 | 5: grizy | <24 (10 σ , extended) | 0.7" side, 0.8-0.9" total | 2012-2017 |
| HSC-wide | 1300 | 5: grizy | i<26 (AB, 5 σ , point source, 2" aperture) | 0.7" (i) | 2013-2017 |
| KIDS | 1500 | 9: ugriZYJHK | r<~24 | 0.7" (r) | 2011- |
| Pan-STARRS | ~20k | 5: grizy | ~24 (5 σ , point source) | Just under 1" | 2010-2013+ |

Different mag definitions, so actually DES
~ PS + 1 mag, HSC ~ DES + 1 mag

HyperSuprime Cam

3-layer HSC survey

- Wide: $\sim 1300 \text{ deg}^2$, $i < 25.8$ (grizy)
 - Weak lensing, $z < 1.5$ galaxy populations
- Deep: $\sim 26 \text{ deg}^2$, 1 mag deeper, 5 wide+3 NB filters
 - Ly- α emitters, quasars, deep galaxy populations, lensing systematics, ...
- Ultradeep: 3 deg^2 , 1 mag deeper, 5 wide+6 NB filters
 - Supernovae, galaxies to $z < 7$

Logistics

- Carried out by Japanese astronomical community, partners in Taiwan, Princeton
- Requesting 300 nights over 5 years – commissioning in Aug 2012, survey start in fall 2013
- Software: jointly IPMU / U. Tokyo / Princeton, with LSST connections (Lupton et al)

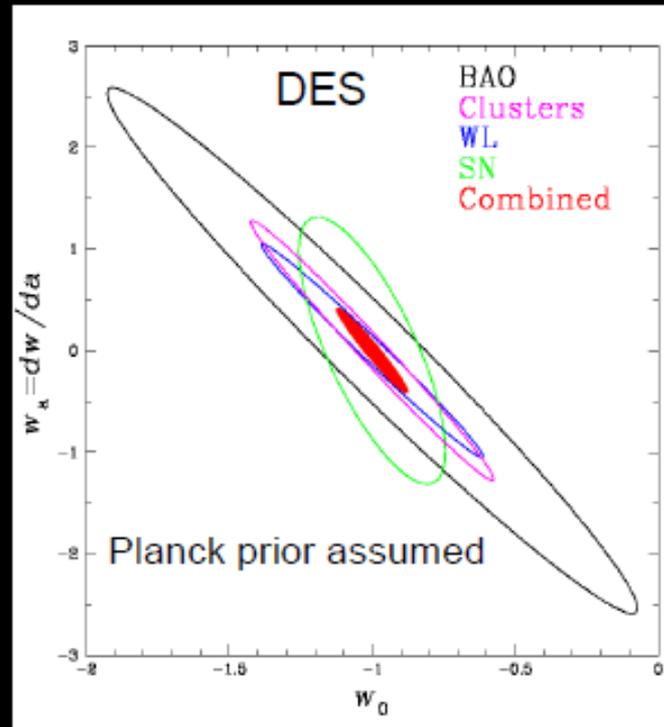


Dark Energy Science Summary

Four Probes of Dark Energy

- **Galaxy Clusters**
 - ~100,000 clusters to $z > 1$
 - Synergy with SPT, VHS
- **Weak Lensing**
 - Shape measurements of 200 million galaxies
 - $n_{\text{eff}} = 10 \text{ arcmin}^{-2}$
- **Baryon Acoustic Oscillations**
 - 300 million galaxies to $z \sim 1$
- **Supernovae**
 - 30 sq deg time-domain survey
 - ~4000 well-sampled SNe Ia to $z \sim 1$

Forecast Constraints on DE Equation of State



Factor 3-5 improvement over Stage II DETF Figure of Merit

BigBOSS



Baseline Survey



- 495 nights over 5 years
 - Many are partial nights
 - 10-20% of fibers available for ancillary science
- 14,000 deg² at (mostly) high Galactic latitude
 - survey footprint = SDSS+4000 deg² (~9800 pointings)
- Primary targets:
 - 17 million emission-line galaxies ($0.6 < z < 1.6$)
 - 4 million luminous red galaxies ($0.6 < z < 1$)
 - 2 million QSOs ($1 < z < 5$)
- Exposure times designed to provide redshifts
 - Typically: 15-20 min per ELG, 30-40 min per LRG, 60-90 min per QSO

PFS

Cosmology Survey Goals

1. Better than 3% measurement of $D_A(z)$ and $H(z)$ via BAO in each 6 redshift bins $0.8 < z < 2.4$
2. Better than 7% measurement of $\Omega_{de}(z)$ via BAO in each of 6 redshift bins
3. Measure Ω_K to better than 0.3% via BAO
4. Better than 6% measurement of the growth rate of structure via RSD in 6 redshift bins

Observations:

100 nights

[OII] emission line survey, two 15 minute observations per field

1400 deg² survey area

Targets selected from HSC wide survey