First Results from the Dark Energy Survey

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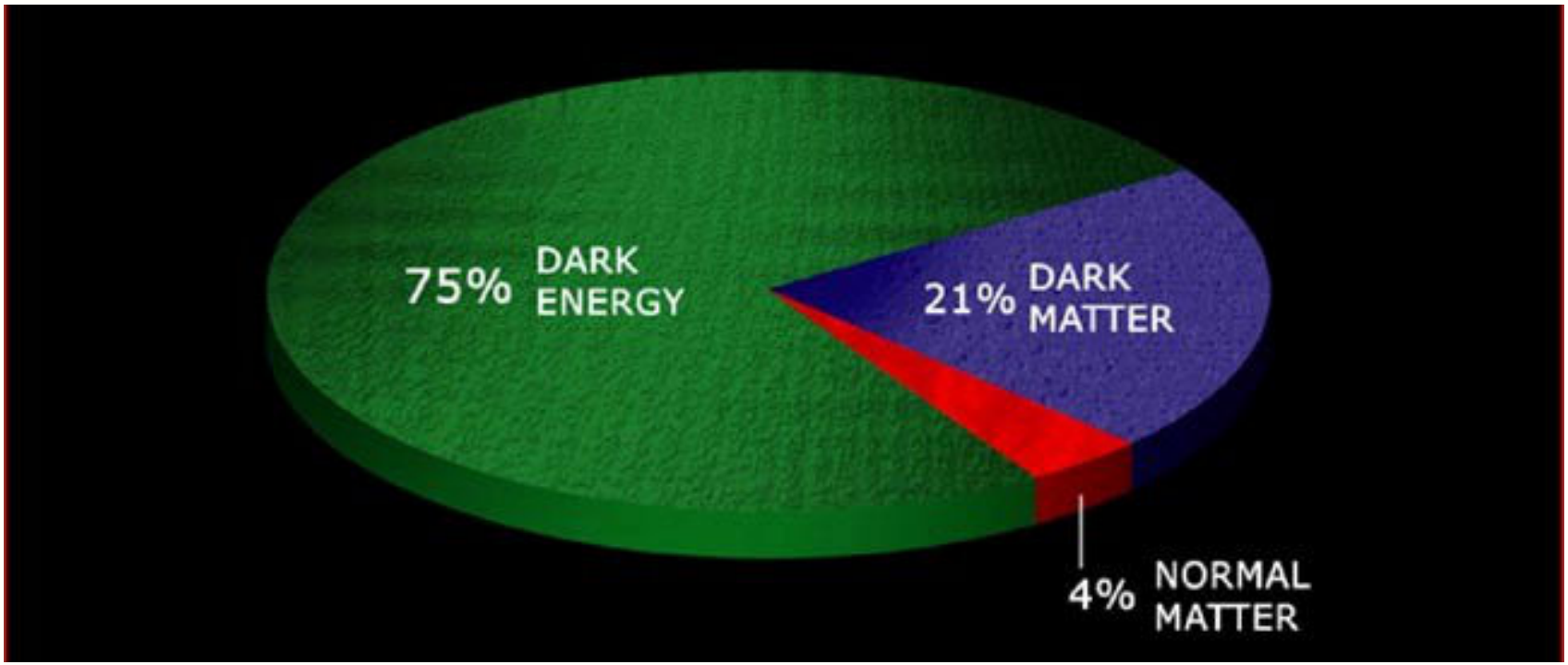
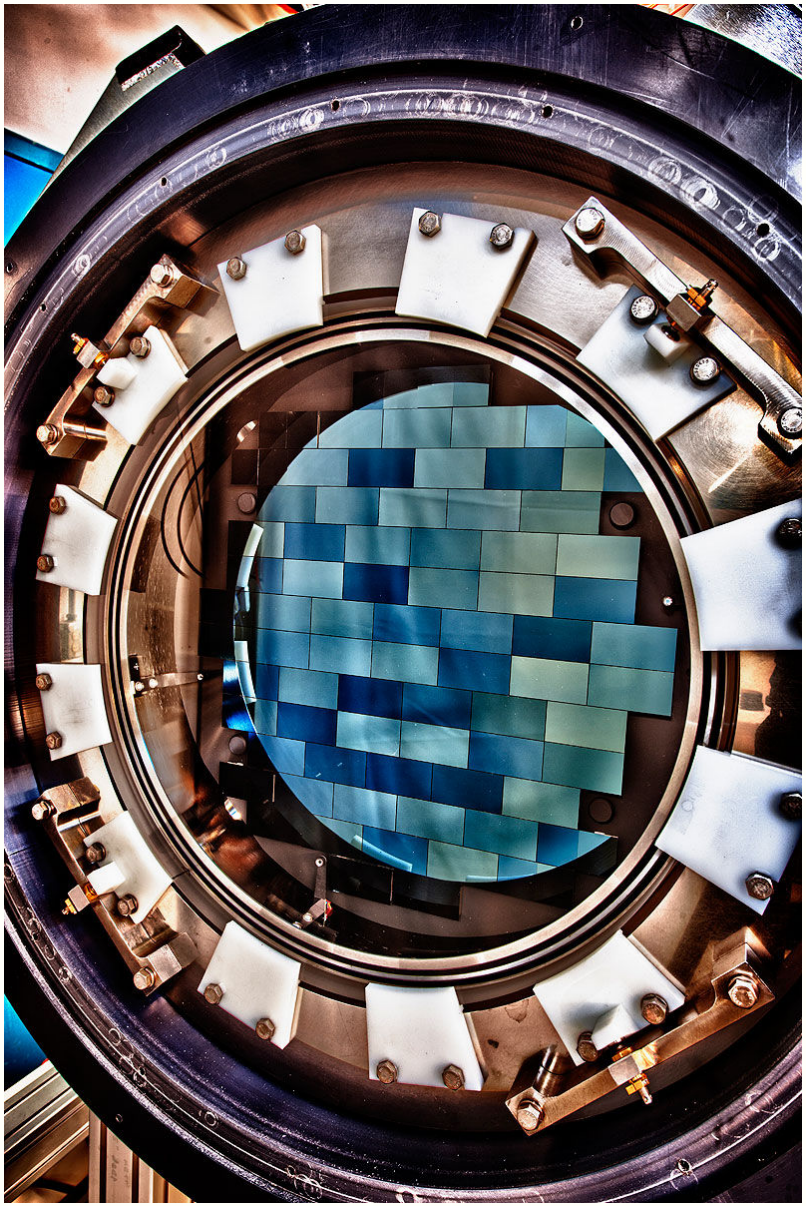
Dark Energy

What is the physical cause of cosmic acceleration?

- Dark Energy or modification of General Relativity?
- If Dark Energy is it Λ (the vacuum) or something else?
- What is the Dark Energy equation of state parameter w?



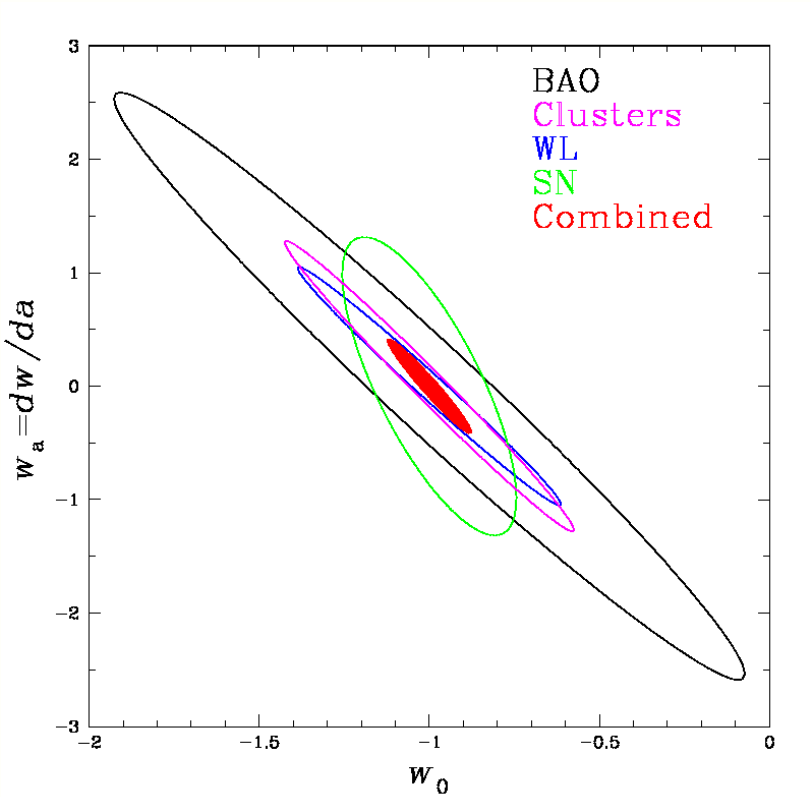
The Dark Energy Survey



DECam focal plane

- Four complementary Dark Energy Probes:
  1. Cluster Counts
  2. Weak Lensing
  3. Large-Scale Structure
  4. Supernovae
- Two multiband imaging surveys:
  1. 5 000 deg^2 grizY to 24 mag
  2. 30 deg^2 time-domain griz (SNe)
- New camera:
  2.3 deg^2 field-of-view, 570 Mpix
- Survey 2013–2018 over 525 nights

DES Science Summary



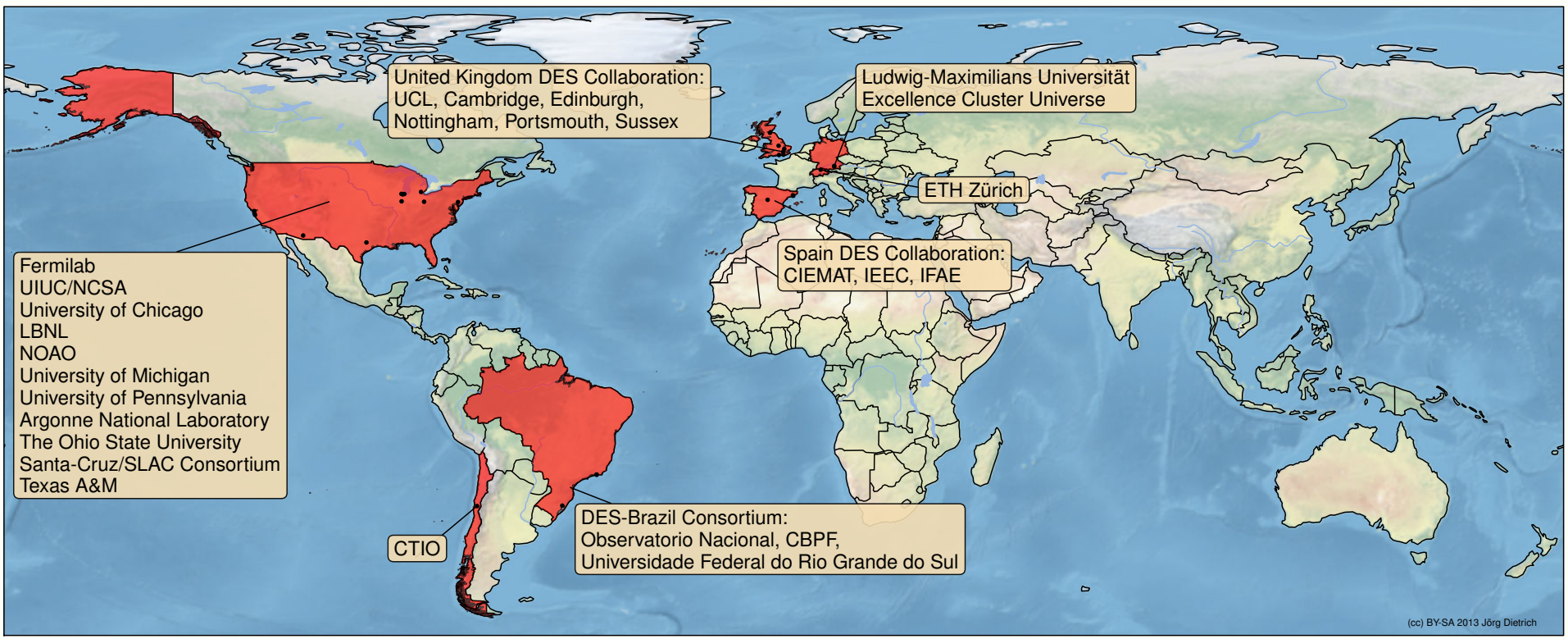
- Galaxy Cluster
  - ∼100 000 clusters to $z > 1$.
  - Synergy with South Pole Telescope, Vista Hemisphere Survey.
  - Sensitive to growth of structure and geometry.
- Weak Lensing
  - Shape measurement of 200 million galaxies.
  - Sensitive to growth of structure and geometry.
- Baryon Acoustic Oscillations
  - 300 million galaxies to $z > 1$.
  - Sensitive to geometry.
- Supernovae
  - ∼4 000 well sampled SN Ia to $z \sim 1$.
  - Sensitive to geometry.

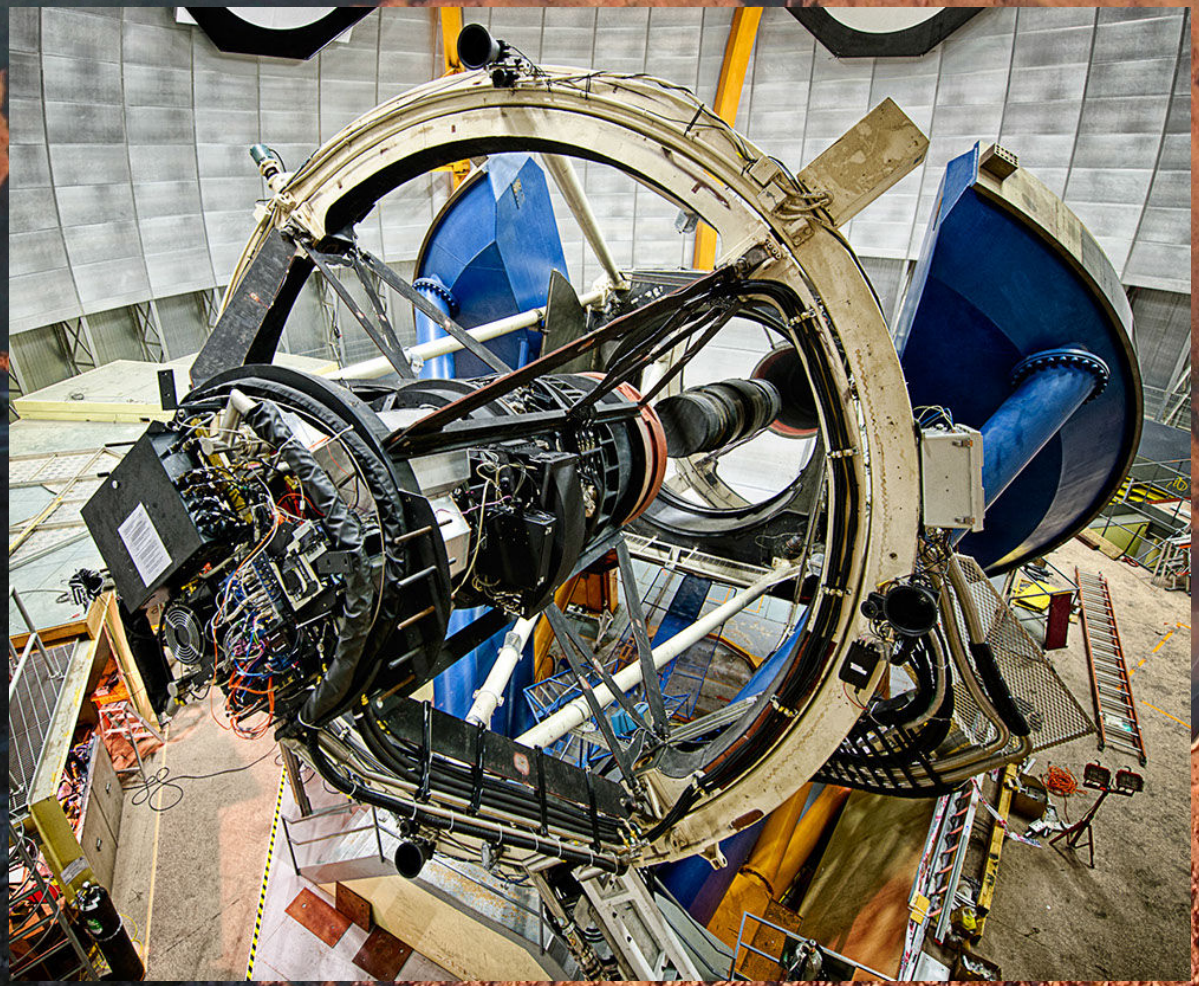
Factor 3–5 improvement over Stage II DETF Figure of Merit.

The DES Collaboration

- 28 institutions
- Over 320 scientists
- Large for astronomy

- Funding by DOE, NSF
- National funding agencies






eso


eso

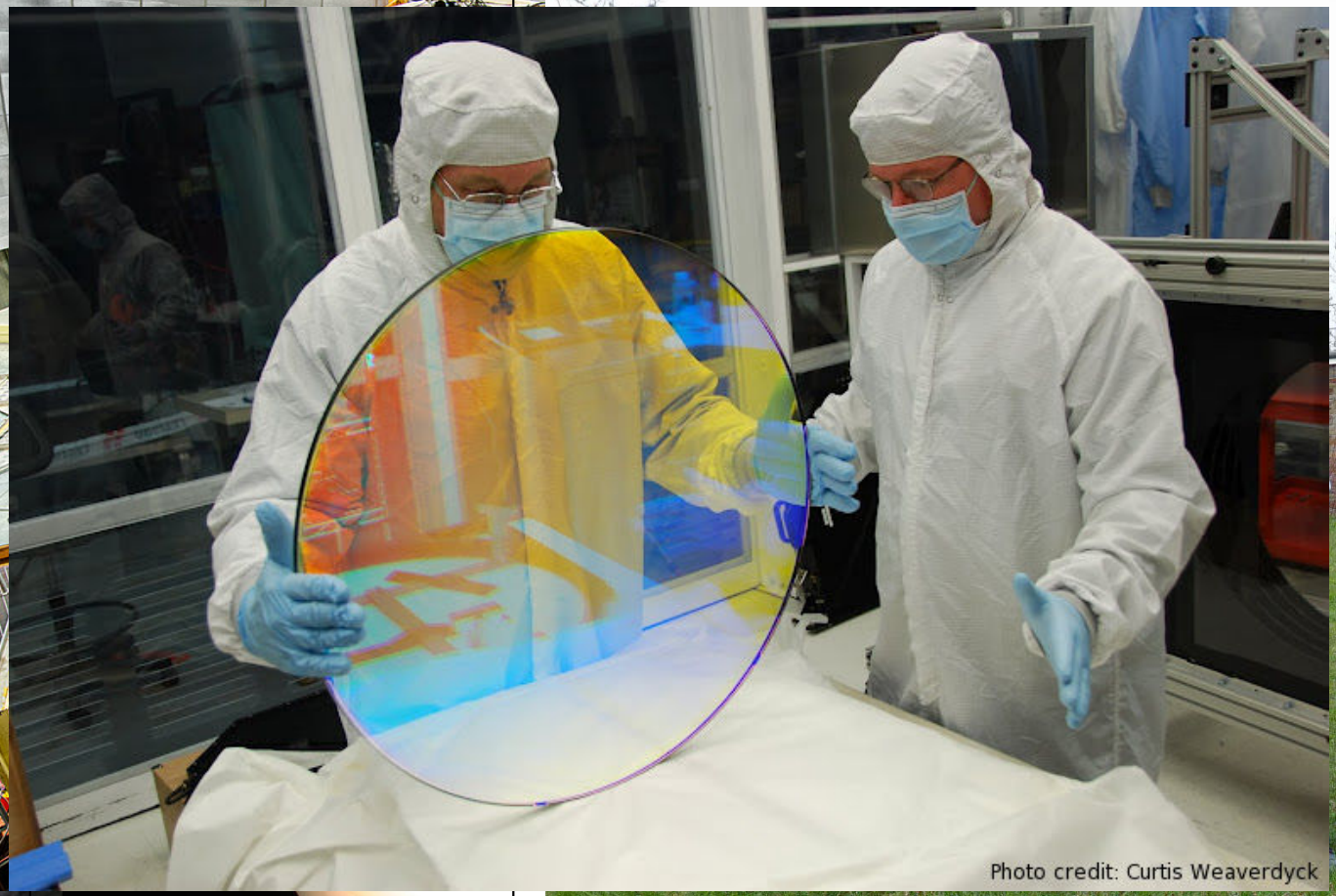
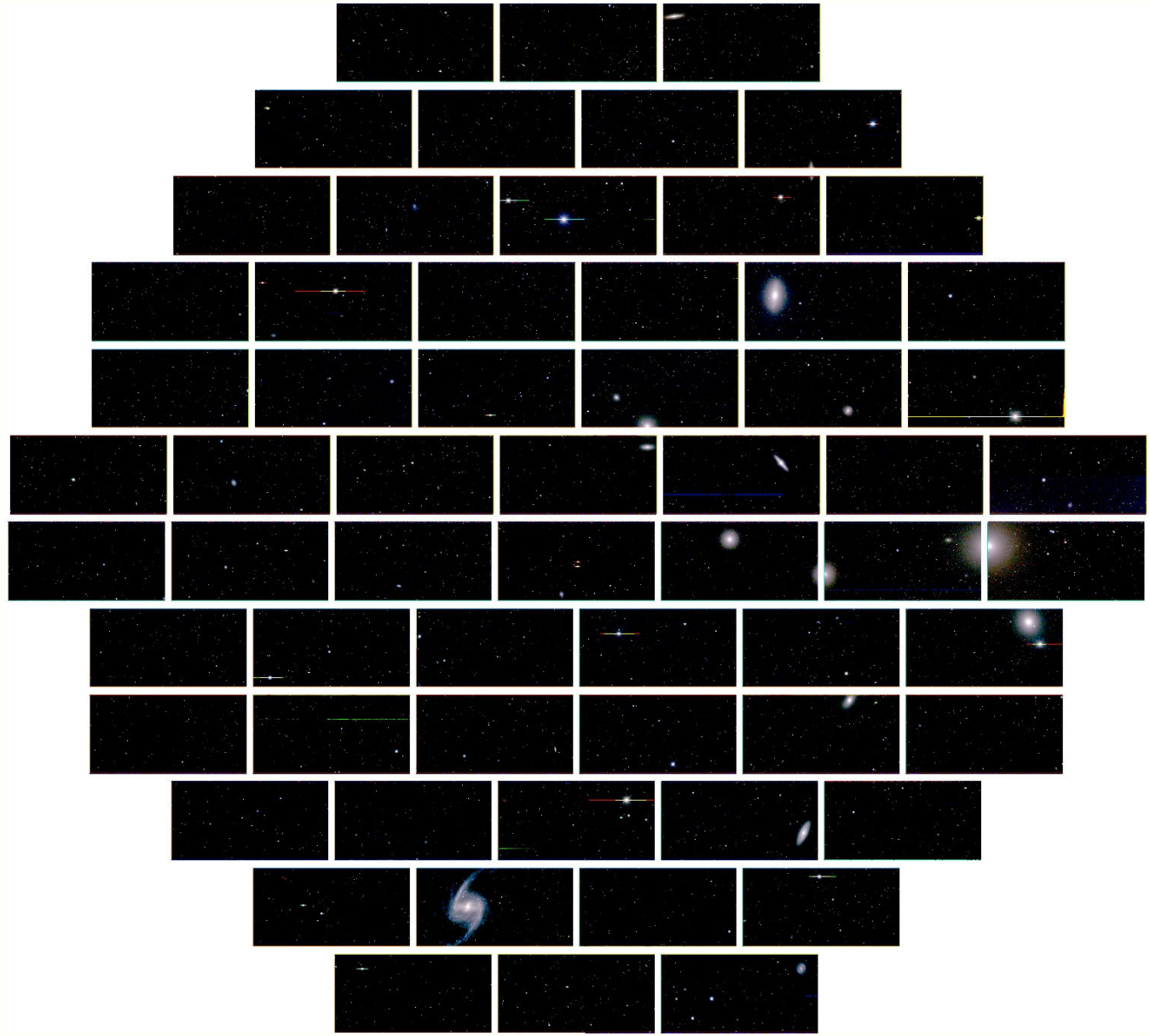


Photo credit: Curtis Weaverdyck

DECam First Light – September 12, 2012



DECam First Light – September 12, 2012

DARK ENERGY SURVEY

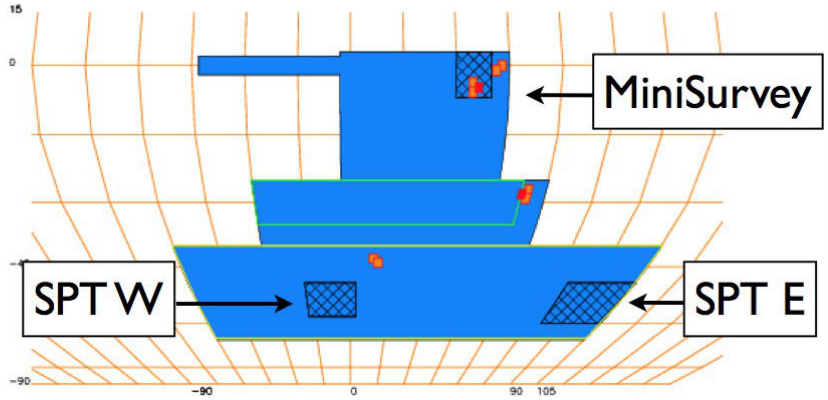
Led by G. Bernstein, K. Honscheid

SV Observations

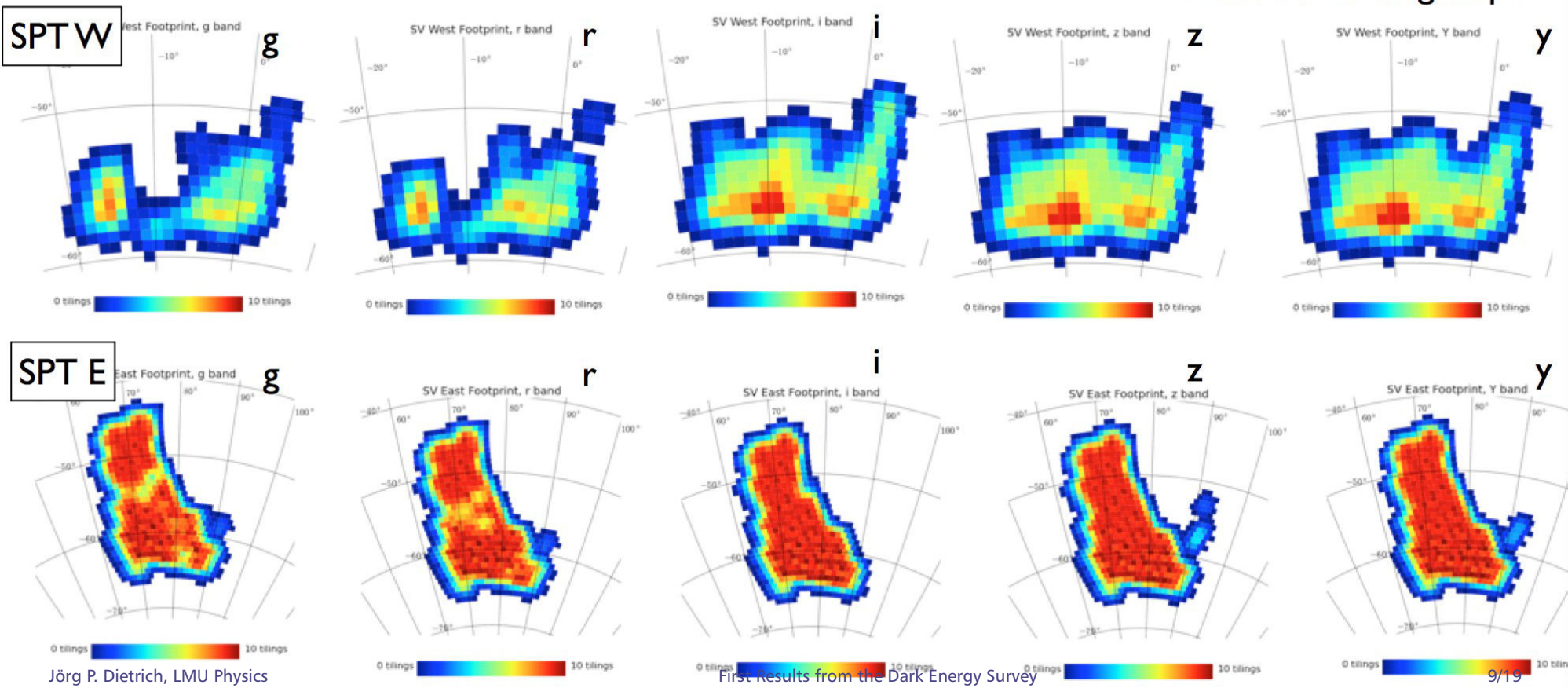
Nov. 2012-Feb. 2013

Field	Exposures	Deg²	Tilings	Notes
Minisurvey	244	~30	~3	Inhomogeneous, poor IQ
SPT-W	322	~60	~3	Inhomogenous, mostly izY.
SPT-E	2537	~157	10	Homogeneous depth, all exposures <1.3" FWHM

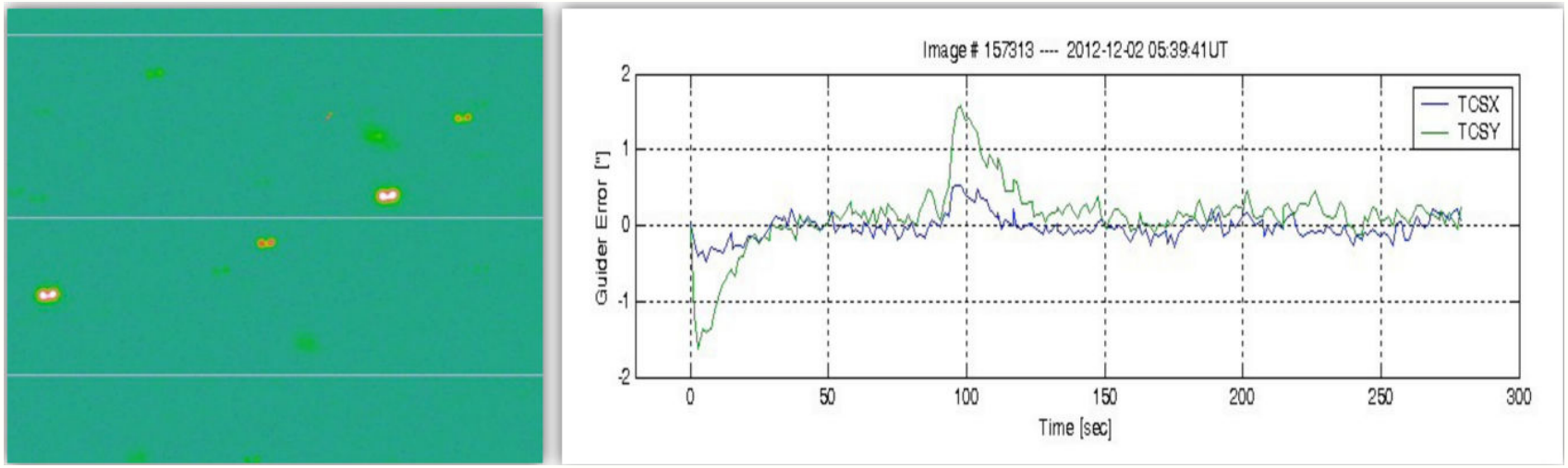
SV report (docdb 6985)



Number of tiling maps



Early Data Issues

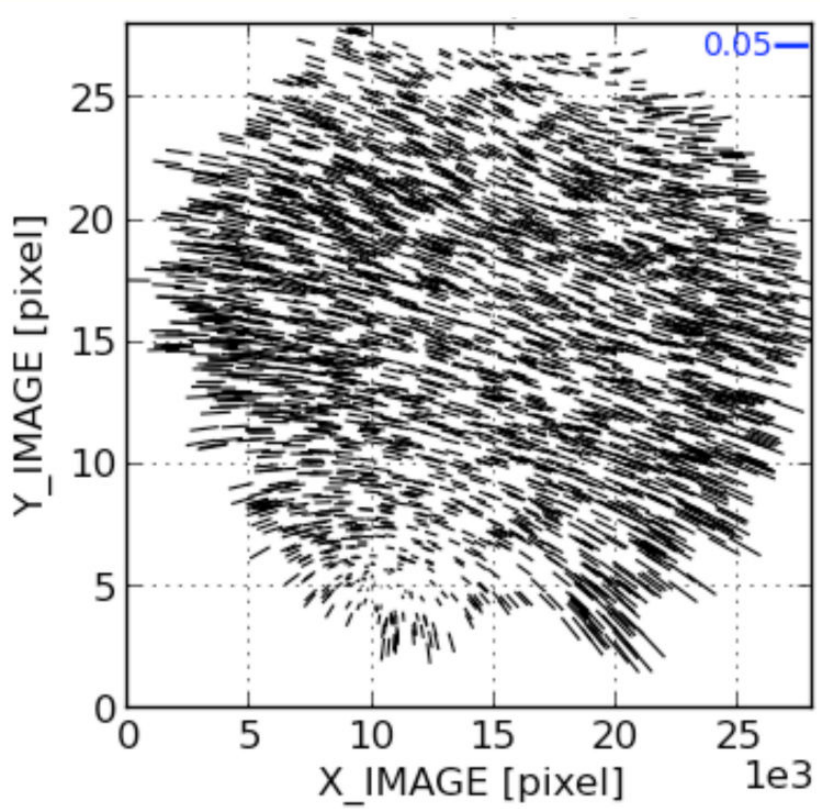


November 2012:

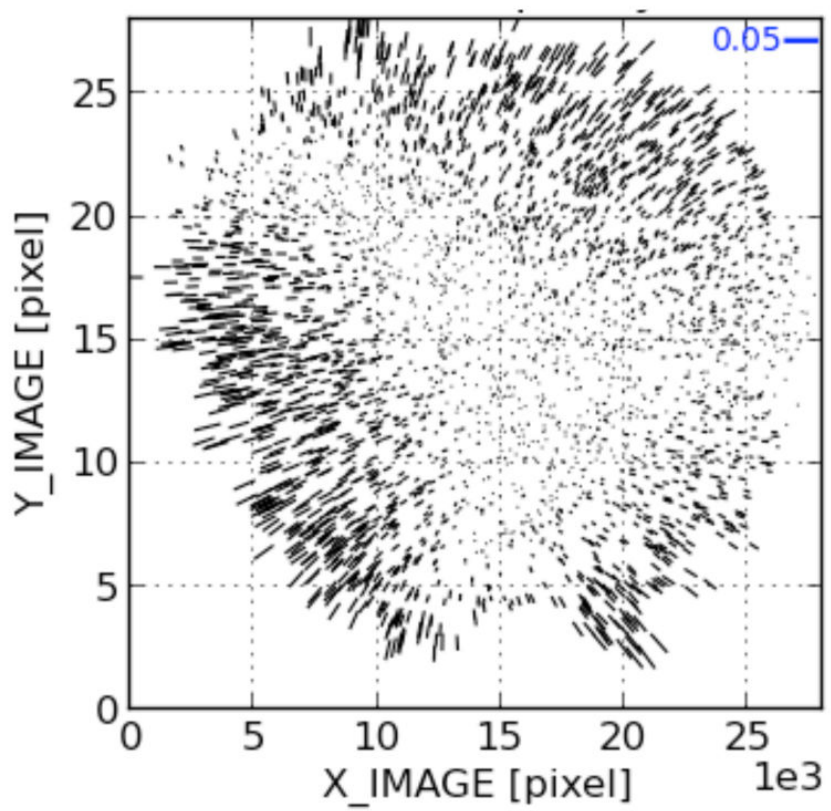
- Early data affected by “guider jumps”.
- Tracking performance not as desired.

Clearly Improved Performance

Ellipticity of point-spread function.

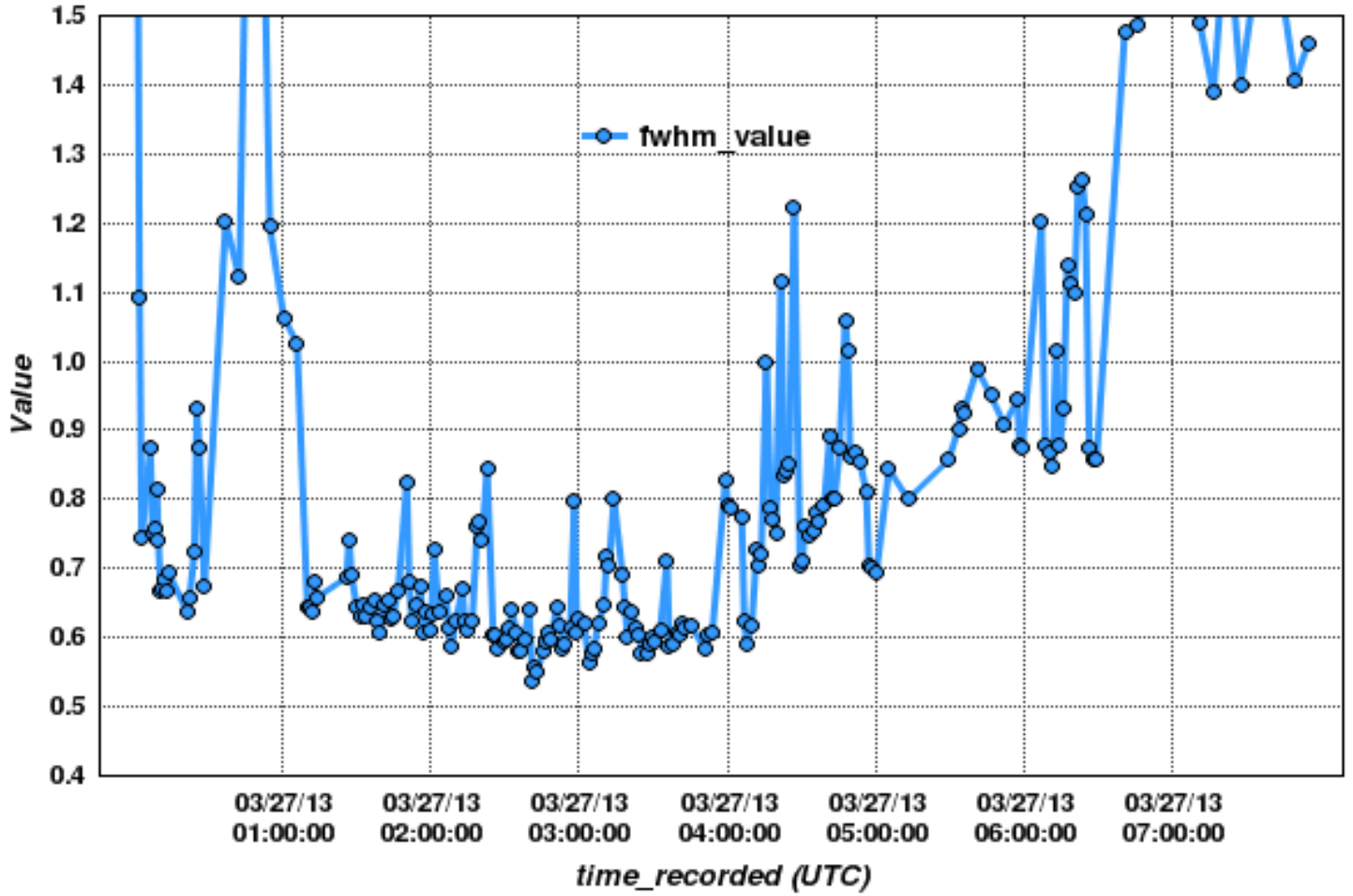


November 2012

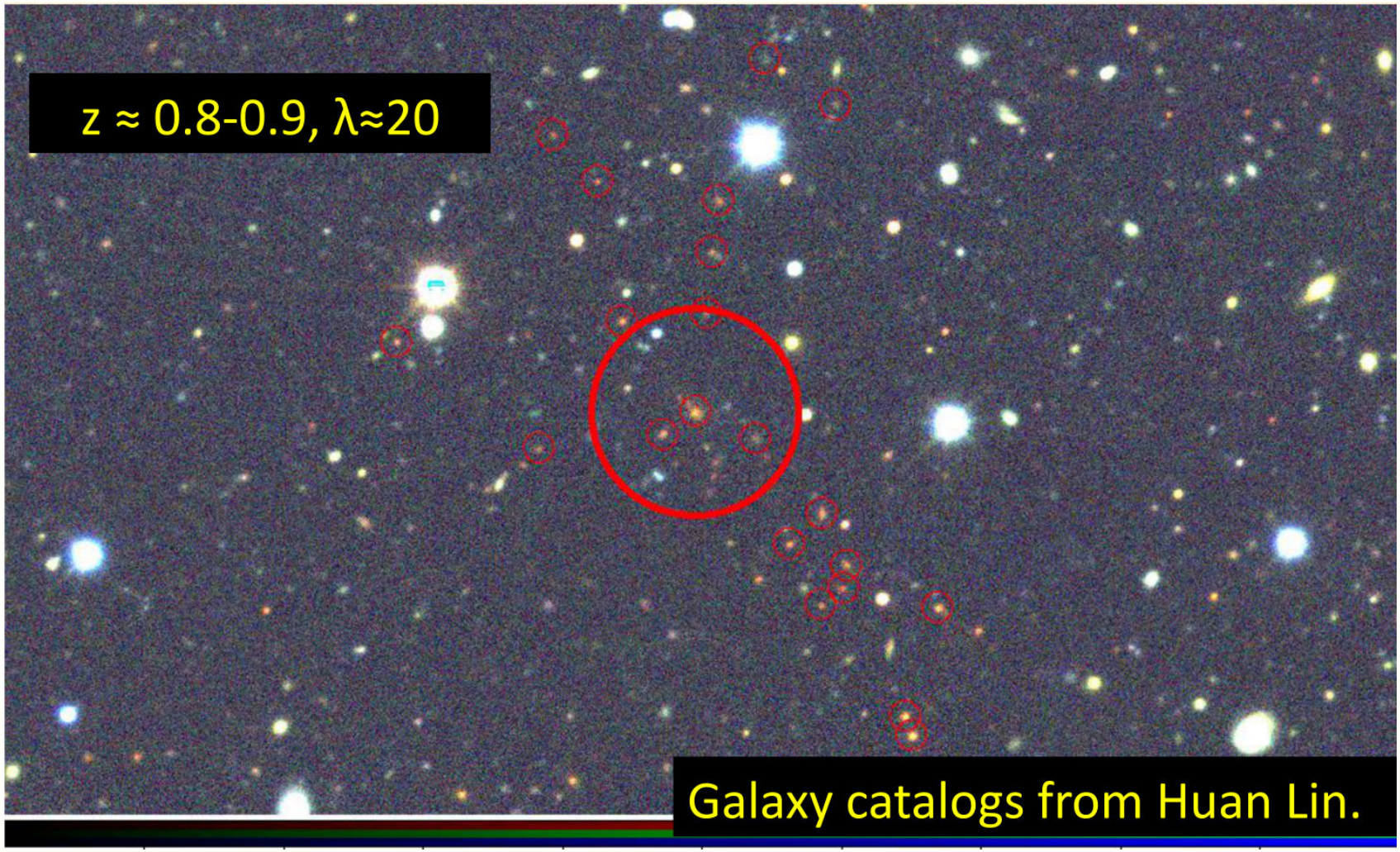


December 2012

Best seeing so far (FWHM on y axis):

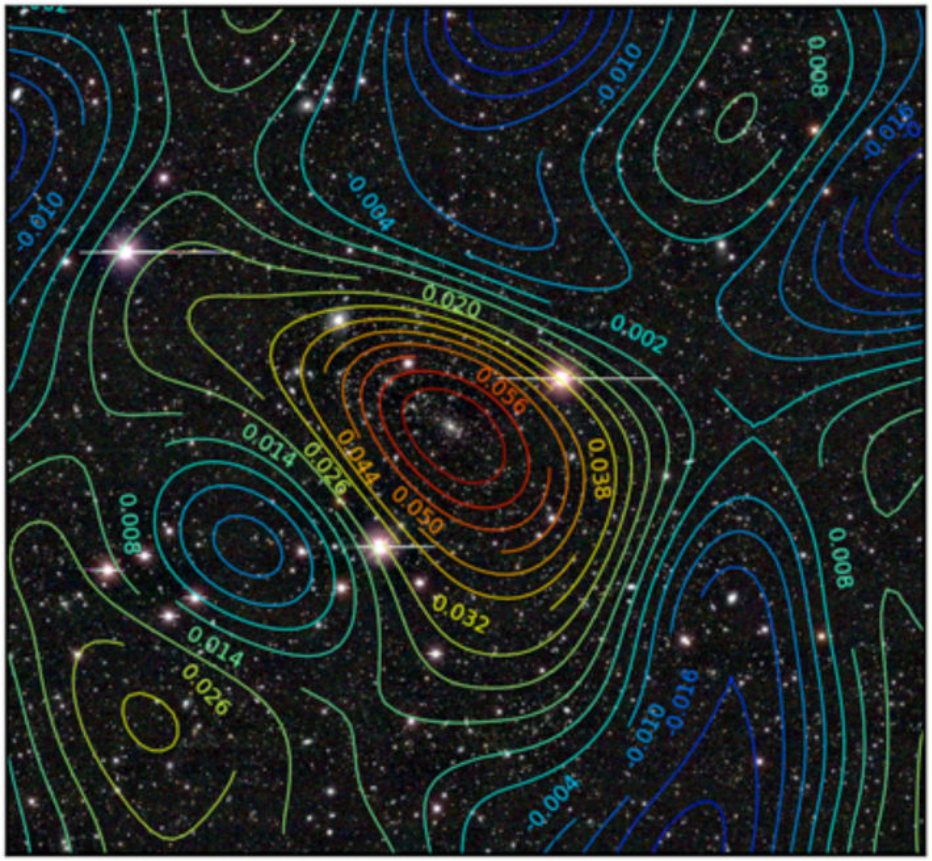


High Redshift Cluster Discovered by DES



From DES Science Verification data in November.

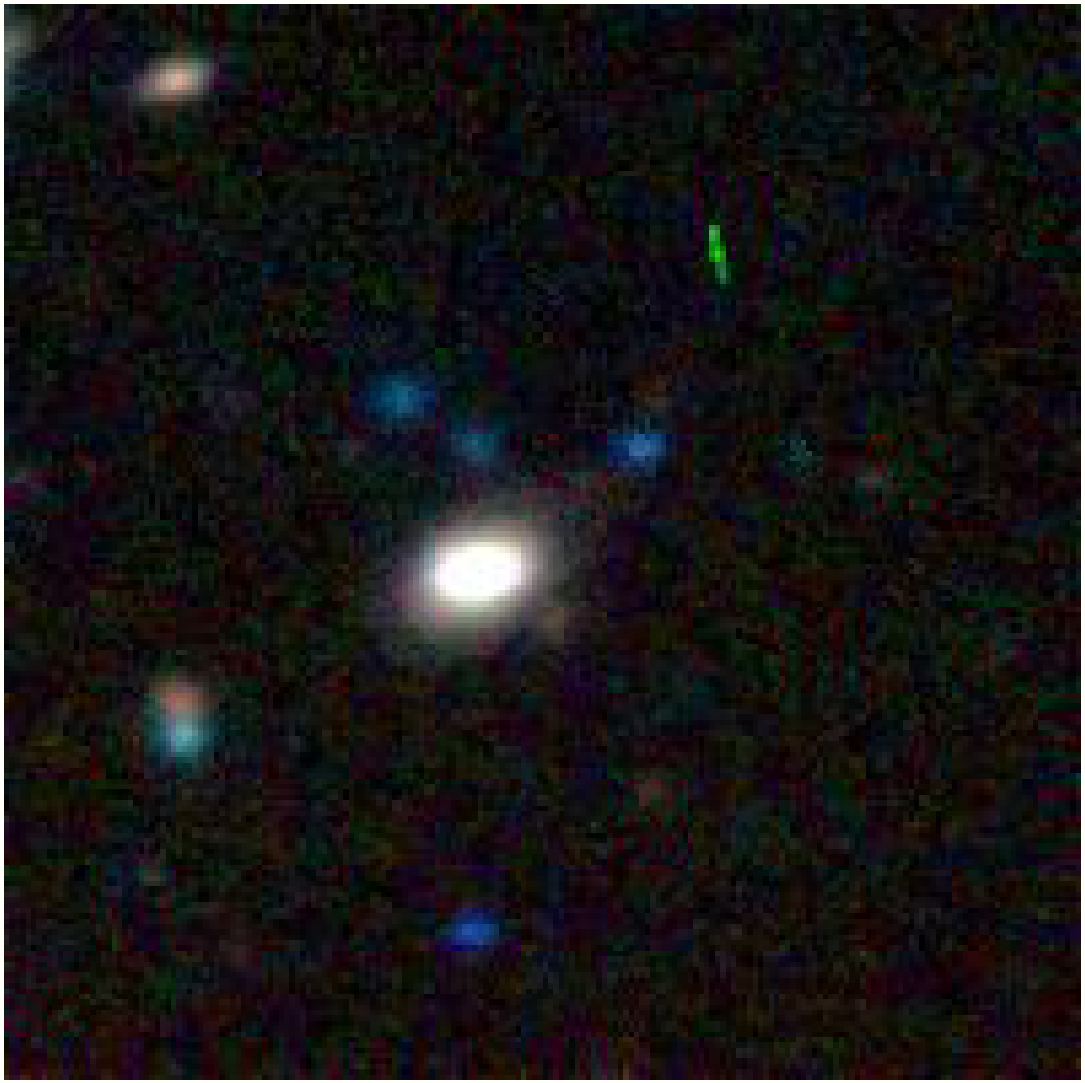
Cluster Weak Lensing



Cluster RXJ 2248 – Peter Melchior et al.

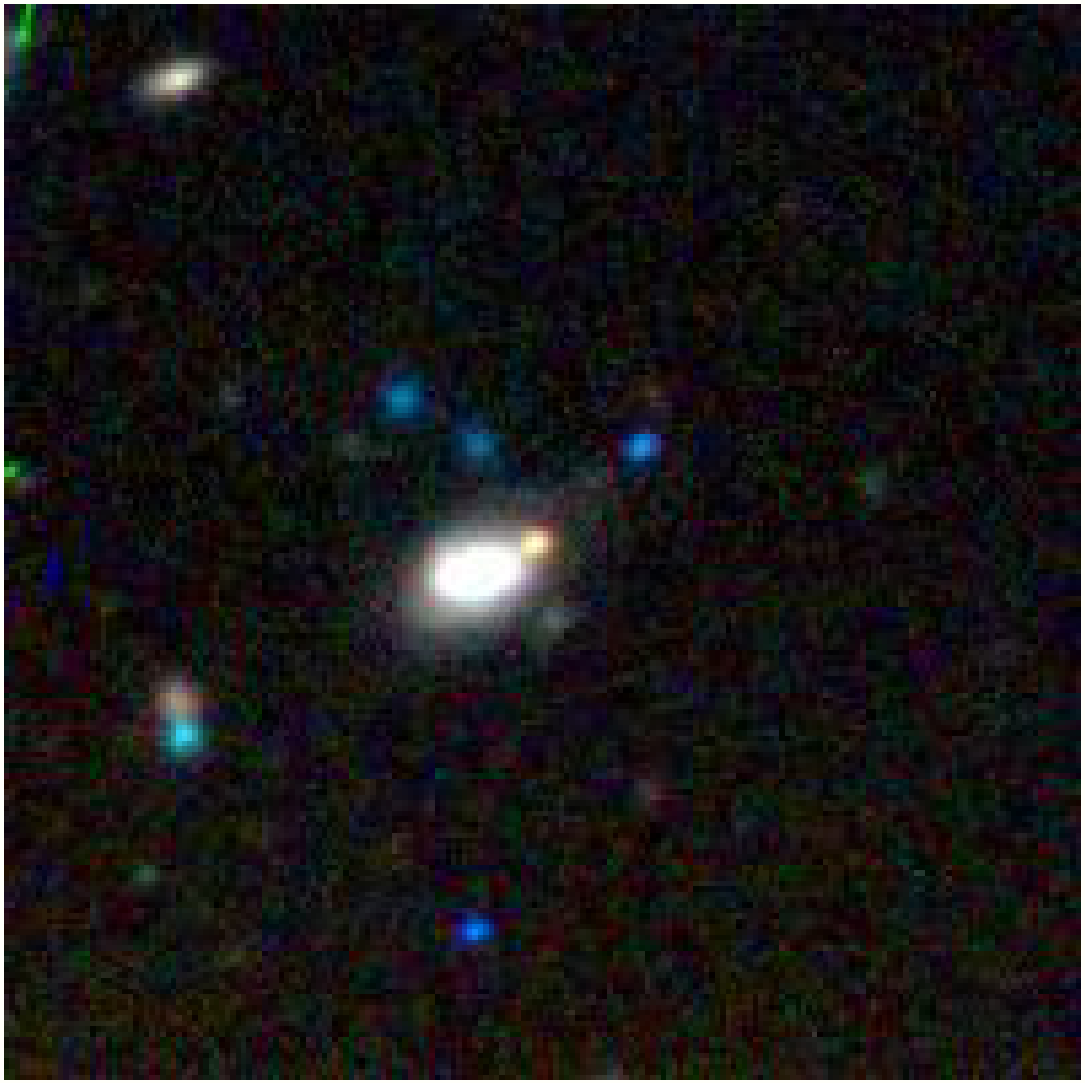
- Weak Lensing measurements will constrain cluster mass-observable relation.
- Currently dominant cluster cosmology systematic.
- Preliminary mass map from DES Science Verification data.

First Confirmed SNe from DES ($z = 0.2$)



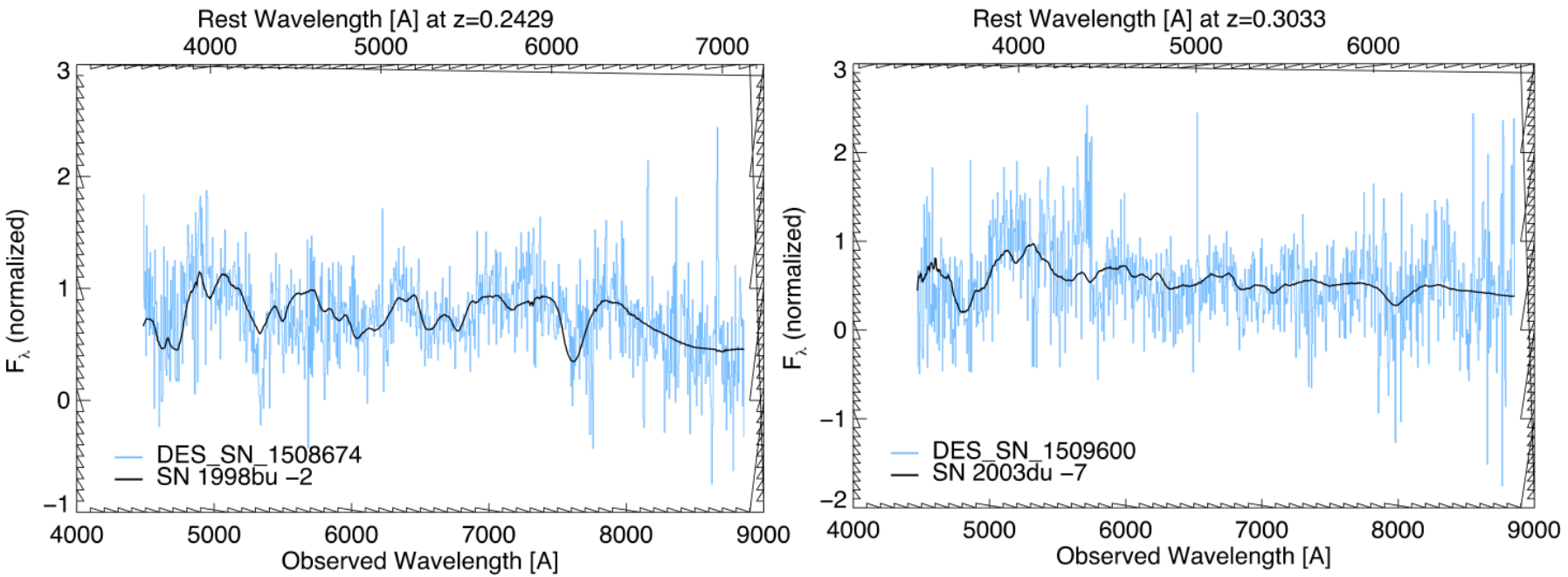
November 7, 2012

First Confirmed SNe from DES ($z = 0.2$)



December 15, 2012

7 Confirmed SN Ia by OzDES at AAO (so far)



- Last week: OzDES has been granted long-term status with 2dF at AAO.
- 12 nights next semester.
- Whole program: $\gg$ 100 000 spectra of DES galaxies.

CTIO: great astronomical site with refurbished telescope and new imager.

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Summary

DARK ENERGY SURVEY

- DECam installation and commissioning completed in 2012.
- Successful science verification run Nov. 2012–Feb. 2013.
- Science quality data obtained and under analysis.
- Continuous improvements to image quality.
- Further improvements expected before survey operations.
- Survey will start this September and last five years.