



U.S. DEPARTMENT OF
ENERGY

Office of
Science



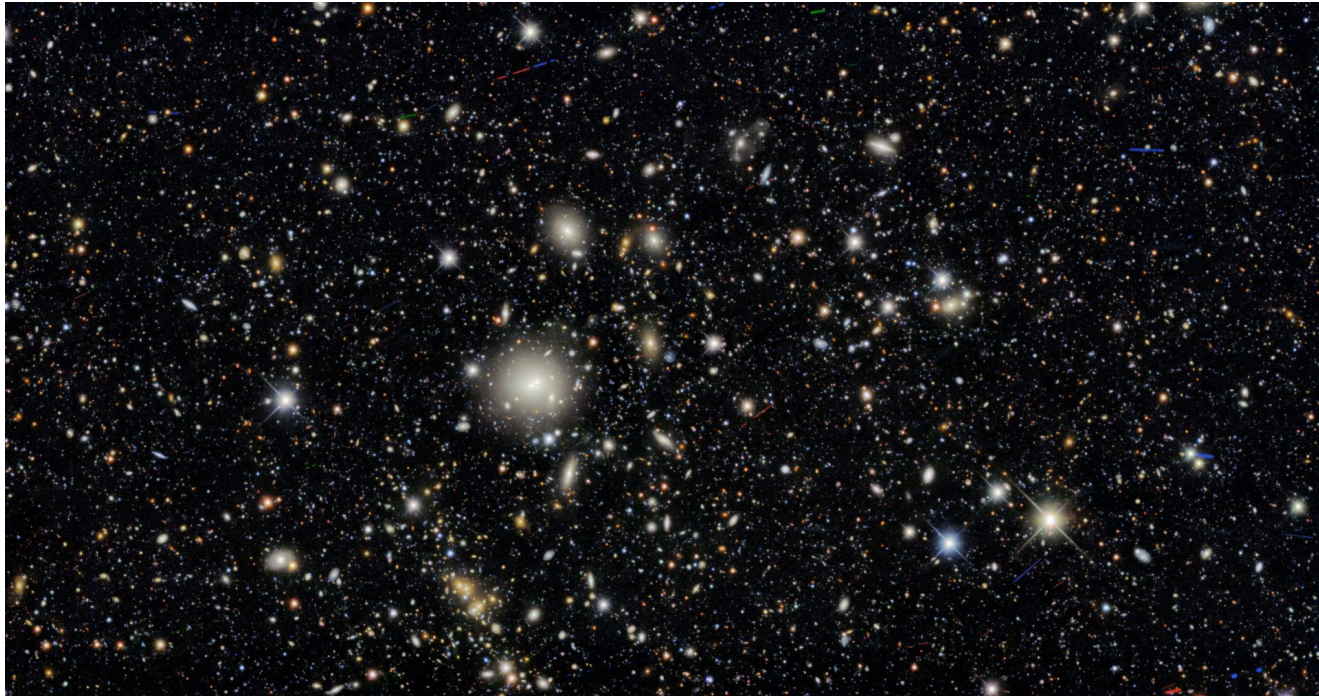
LSST
Discovery Alliance

Status limitations and prospects of studying the large-scale structure using photometric surveys

Javi Sánchez (STScI) on behalf of the WLSS working group and the LSST DESC



Introduction



Patterns in the spatial distribution of galaxies, and patterns in their shapes contain valuable information about dark energy.

Dark Energy Survey Deep Field. Photo Credits: Dark Energy Survey/DOE/FNAL/DECam/CTIO/NOIRLab/NSF/AURA; Acknowledgments: T.A. Rector (University of Alaska Anchorage/NSF's NOIRLab), M. Zamani (NSF's NOIRLab) and D. de Martin (NSF's NOIRLab)

Introduction

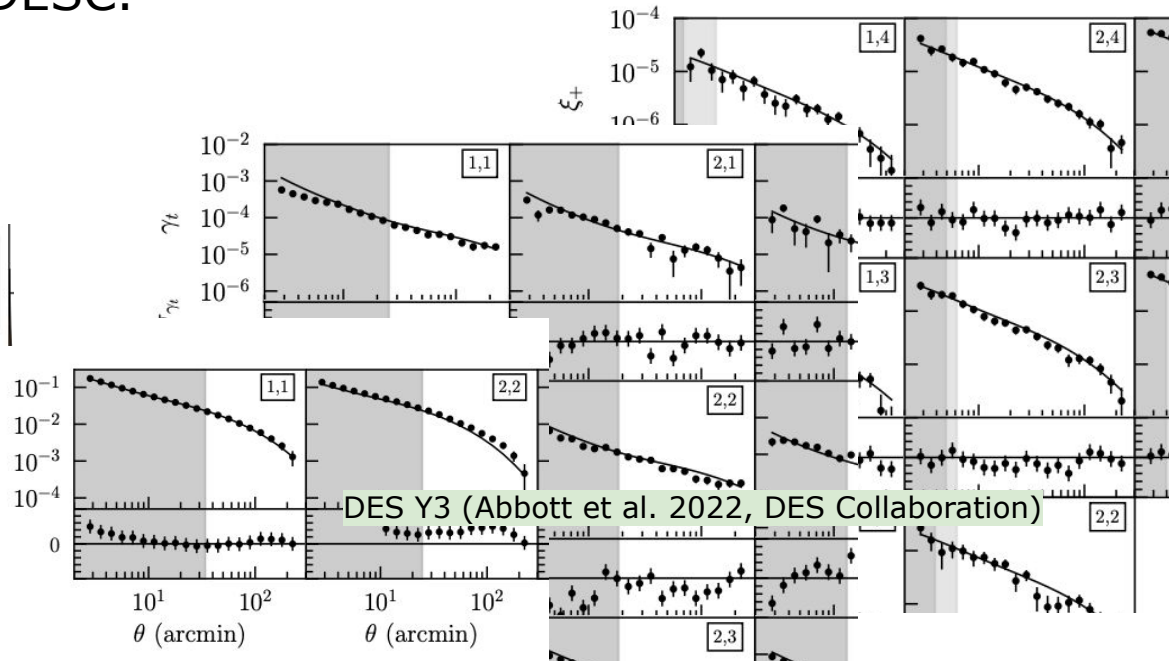
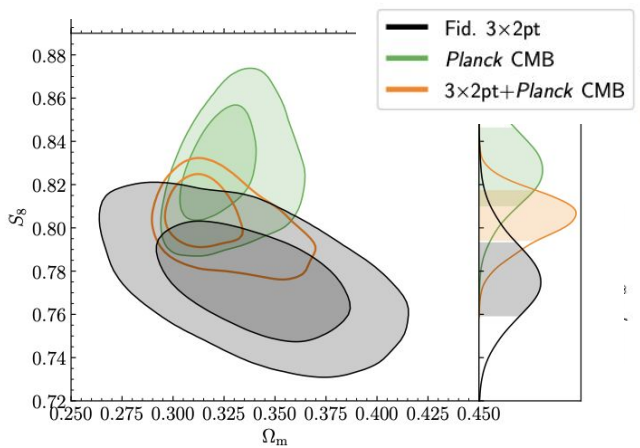


1. Try to reconstruct the position and shape of every galaxy?
2. **Approximate the problem – use of 2-point statistics**

Dark Energy Survey Deep Field. Photo Credits: Dark Energy Survey/DOE/FNAL/DECam/CTIO/NOIRLab/NSF/AURA; Acknowledgments: T.A. Rector (University of Alaska Anchorage/NSF's NOIRLab), M. Zamani (NSF's NOIRLab) and D. de Martin (NSF's NOIRLab)

DES legacy

- DES and other Stage-III surveys have established the so-called 3x2pt technique using photometric information – expected to be flagship technique for DESC.
 - Galaxy positions
 - Galaxy shapes
 - Cross-correlations



DES legacy

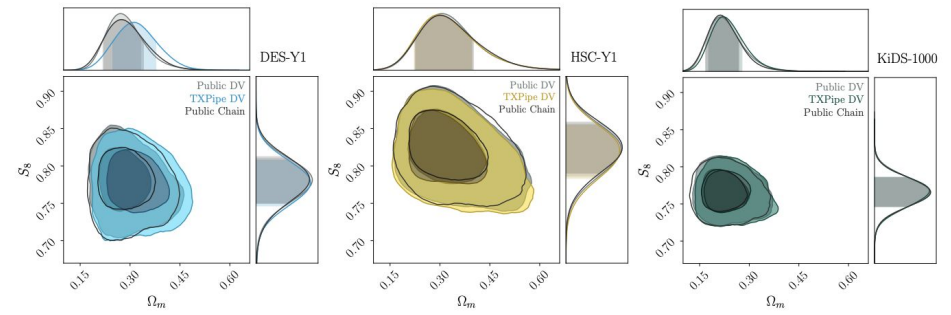
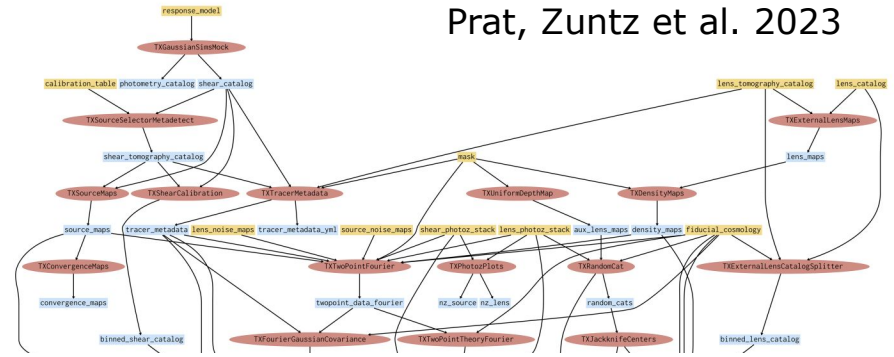
- DES \rightarrow DESC
 - Photometric redshifts (see John Franklin's talk)
 - Covariance estimation
 - Observing conditions treatment
 - Human legacy: lots of DES members are (and have been) working on DESC.
- DES \leftrightarrow DESC
 - Piff, metacal, metadetect
- DESC \rightarrow DES
 - NaMaster, CCL, healsparse (and many more!) used in DES projects.

Prospects for DESC



- Building upon DES' experience DESC has in place its 3x2pt pipeline TXPipe (Prat, Zuntz et al. 2023)
- Exercised re-analyzing Stage-III data (P. Longley et al. 2023)
- More re-analyses in progress (Sánchez-Cid et al., in prep)

Prat, Zuntz et al. 2023



P. Longley et al. 2023

Foreseeable challenges and new avenues

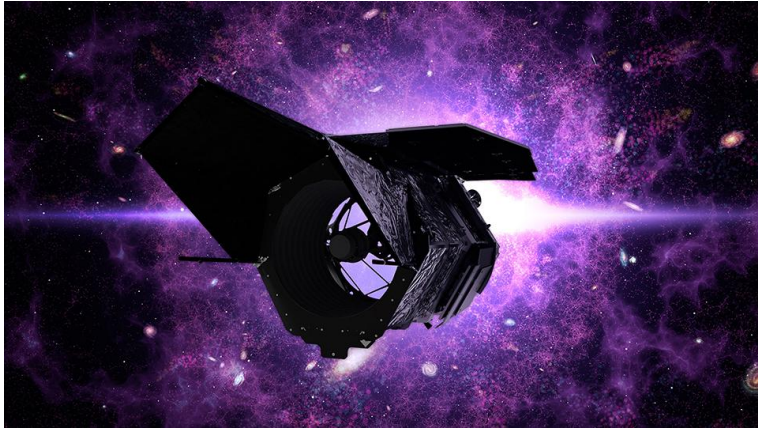


- Rubin LSST will bring larger statistical power → Increased importance of systematic effects.
 - Instrumental effects
 - Chromatic effects
 - Observing conditions
 - Blending
- And unknown unknowns!

DESC (and DES) also working beyond 2-point statistics – peaks, 3-point, wavelet harmonics, scattering transforms, forward modeling (BORG)...

And Roman!

Credit: NASA GSFC



High-Latitude Wide Area Survey (>1000 sq-deg) – strategy being decided. Stay tuned.

OpenUniverse, LSST DESC, Roman HLIS PIT, Roman HLTDS, et al. 2025

Can help deblending, and improve photo-z, and more!

Interesting open questions by DES and other Stage-III experiments.

Very exciting times (and new discoveries(?)) ahead for WLSS!!

Stay tuned