

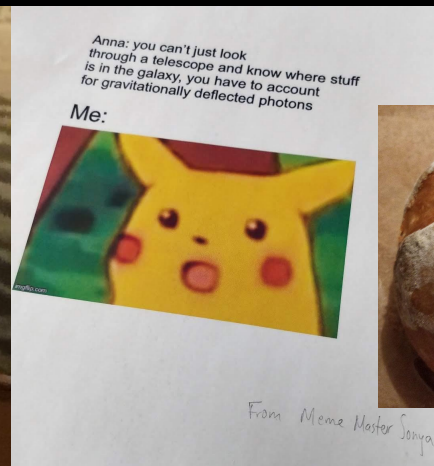
Multi-Survey Cosmology from Galaxy Clustering and Weak Lensing

Anna Porredon

César Nombela Talent Attraction Fellow at CIEMAT, Madrid

CCAPP's 20th Anniversary Conference, Ohio State University, June 11, 2026

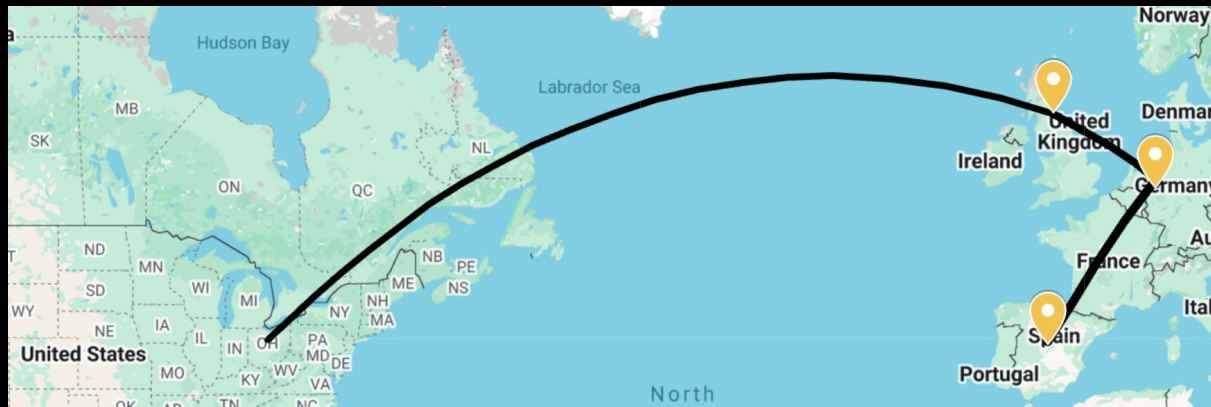
My time at CCAPP – 2019 - 2022



From Meme Master Sonya

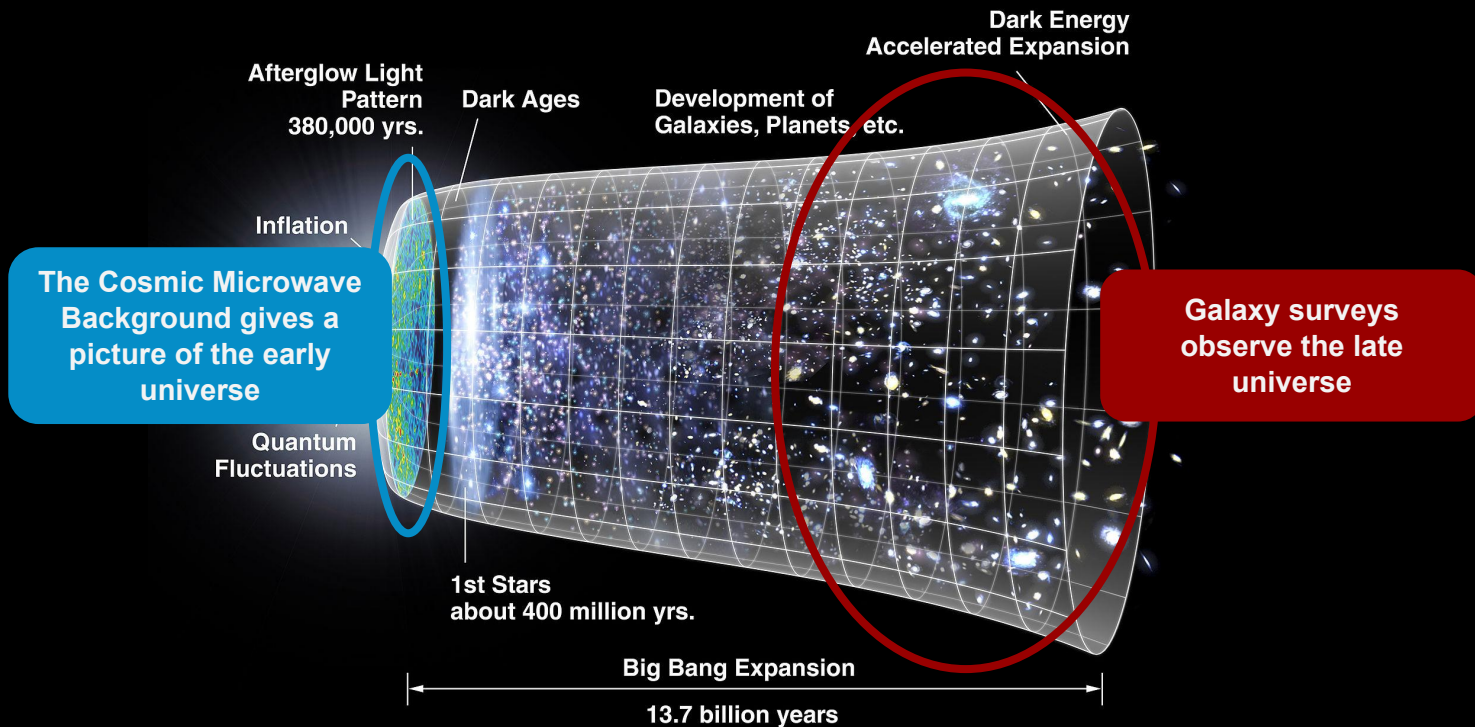


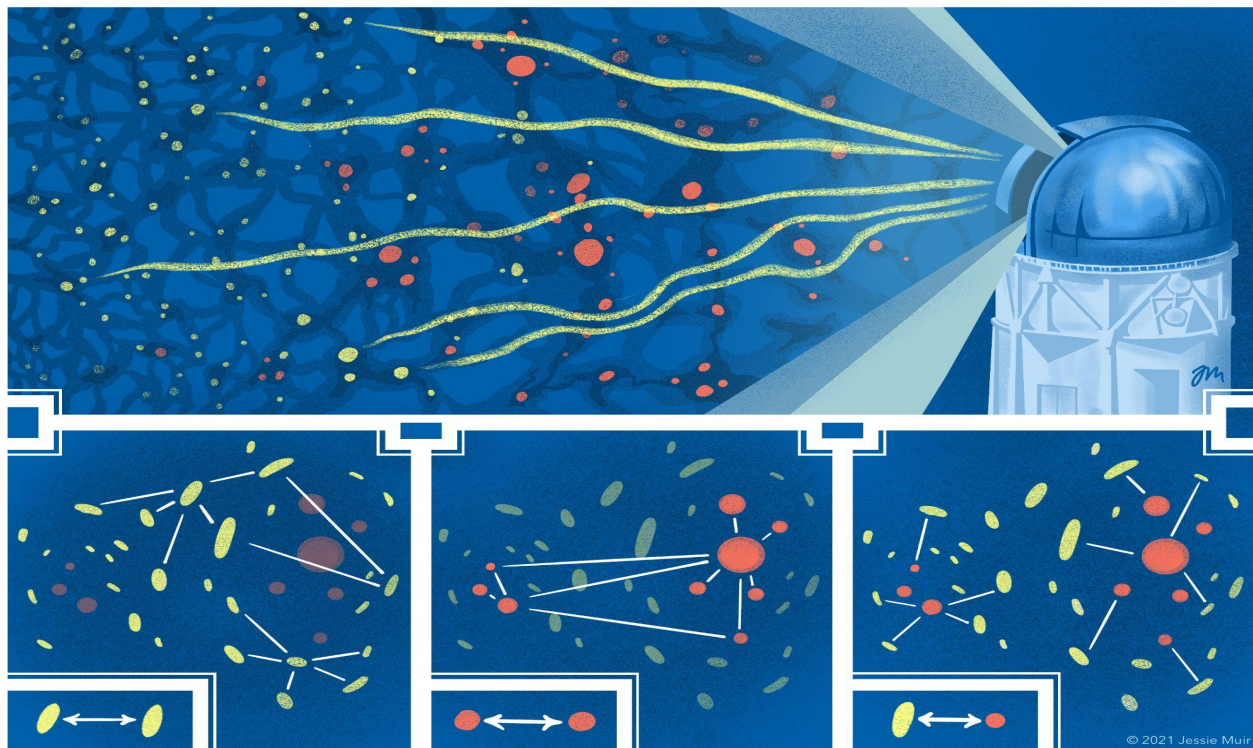
Beyond CCAPP



- **2022 - 2023:** Postdoc at the University of Edinburgh
- **2023 - 2024:** Marie Curie Postdoctoral Fellow at Ruhr University Bochum
- **2024 - present:** *César Nombela* Talent Attraction Fellow at CIEMAT, Madrid
5-year tenure-track fellowship with additional funding to carry out your research project

Testing Λ CDM: Are the late time observations compatible with those from the early universe?





cosmic shear

correlation in the shapes of
(source) galaxies

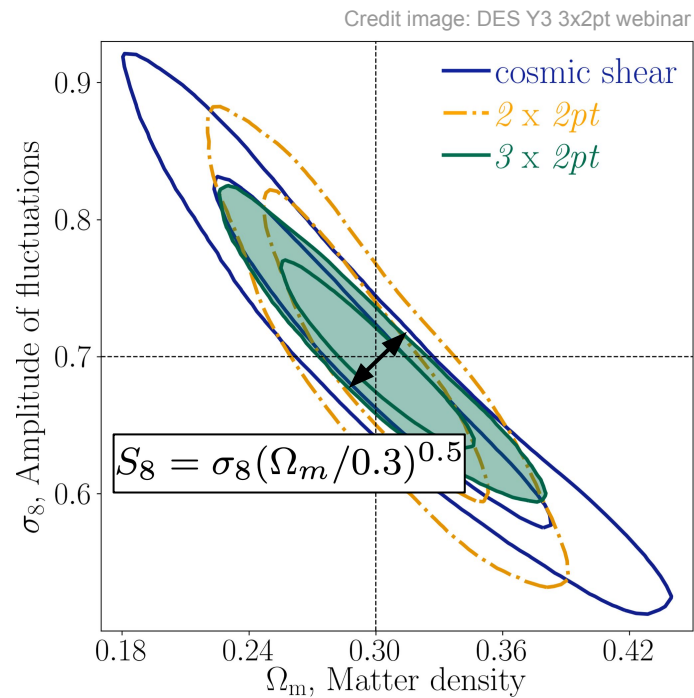
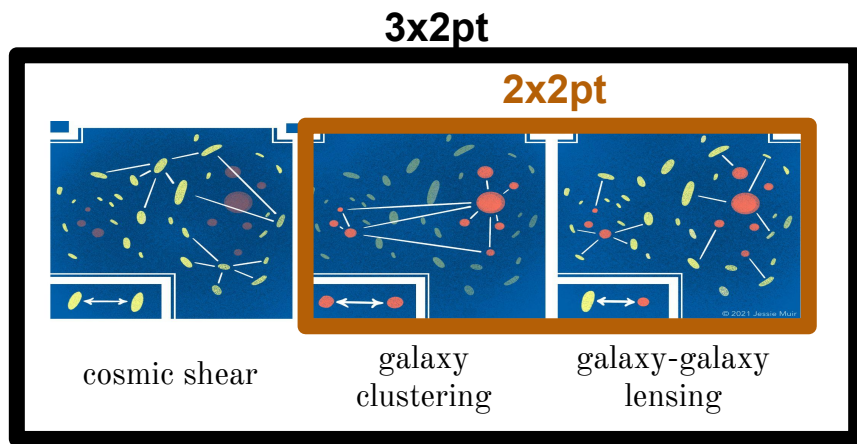
galaxy clustering

correlation in the positions of
(lens) galaxies

galaxy-galaxy lensing

correlation between
positions of the lenses and
shapes of the sources

3x2pt cosmology



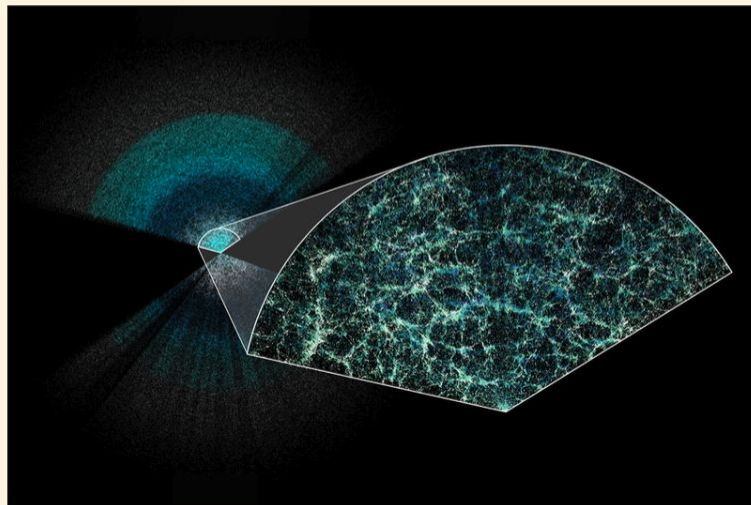
A joint analysis maximizes the cosmological information and robustly constrains astrophysical & observational systematics in the analysis!

SURVEYS

photometric vs spectroscopic



- Use a camera with broadband filters
- Pictures of millions of galaxies
- Allows to measure **weak gravitational lensing** of galaxies
- Needed to find the targets for spectroscopic surveys
- Worse precision for the redshift of galaxies



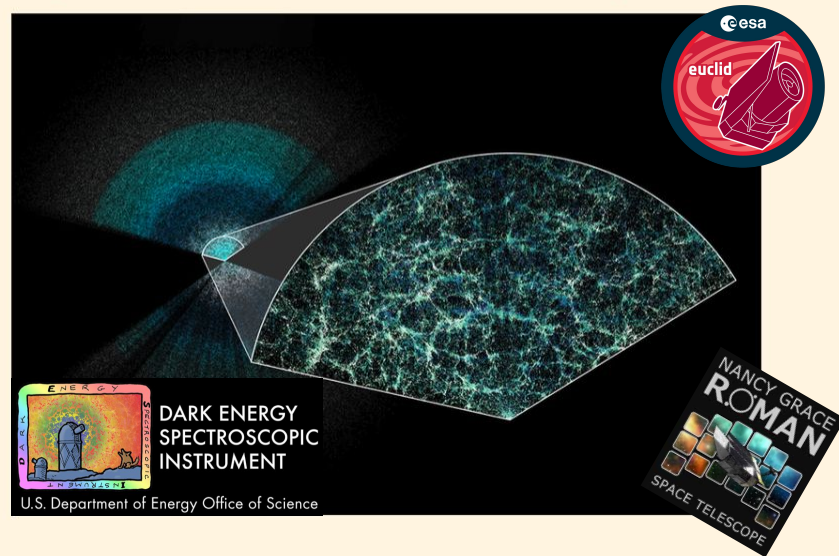
- Obtain the spectra from each object/galaxy
- Allows to measure the redshift of galaxies with high precision
- Allows to measure **galaxy clustering with high precision**

SURVEYS

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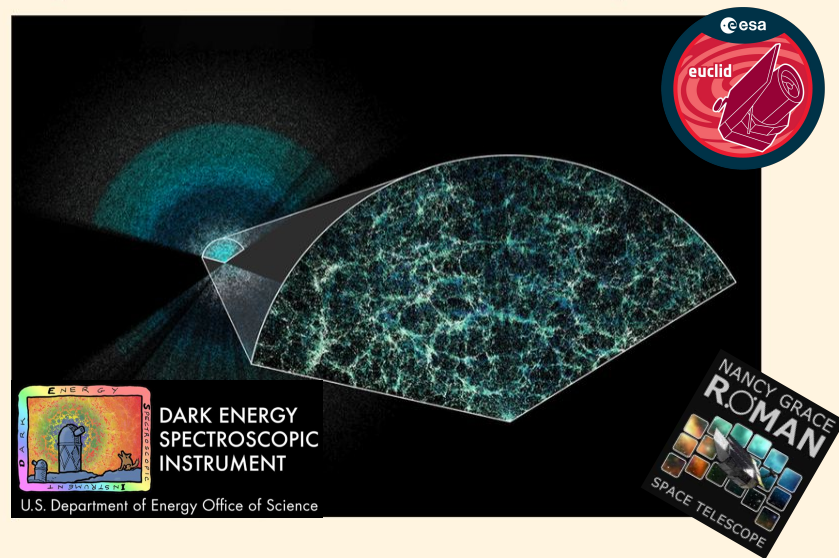
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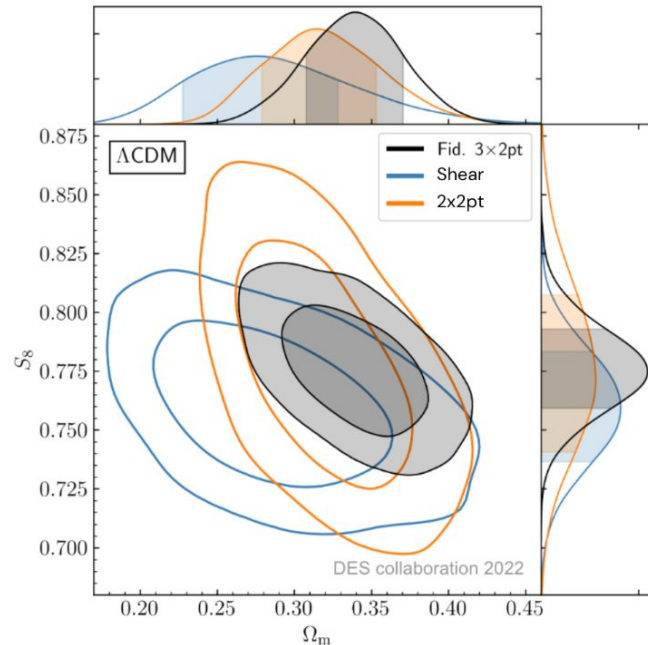
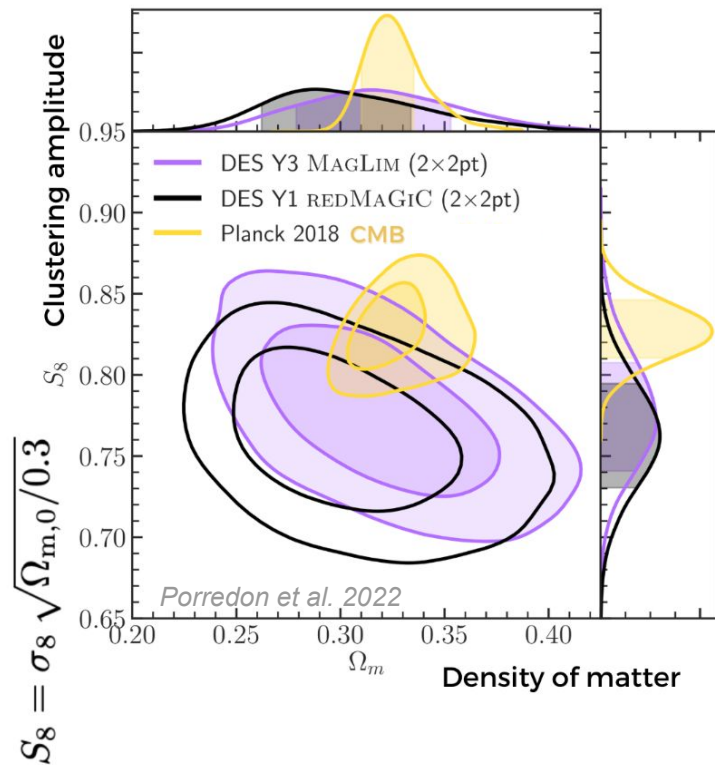
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DES Y3 3x2pt cosmology at CCAPP



DES Y3 3x2pt cosmology at CCAPP

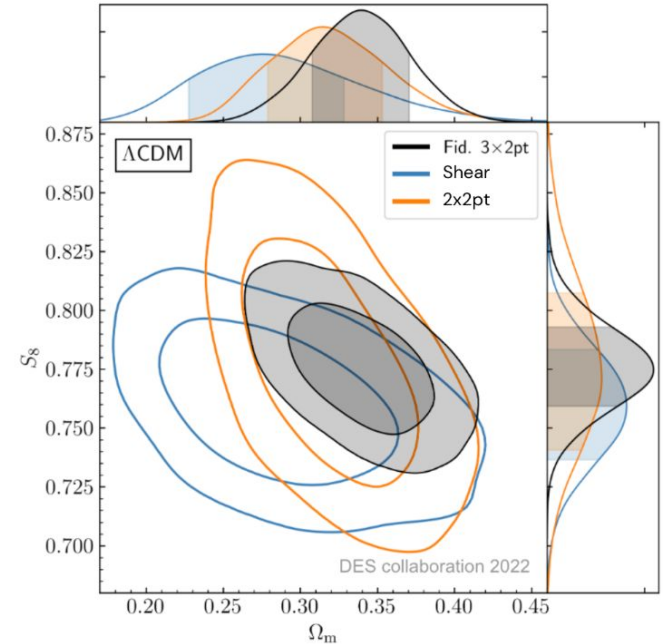
June 4, 2021

Ohio State played crucial role in releasing new results from the Dark Energy Survey (DES)

More than a dozen current and former faculty and researchers from Ohio State played crucial roles in releasing new results from the **Dark Energy Survey (DES)** last week.

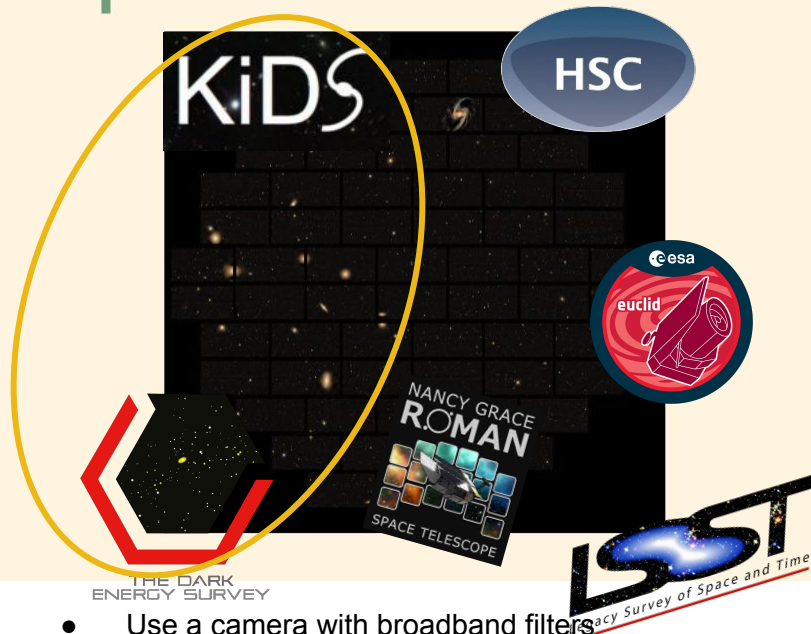
The DES uses the largest-ever sample of precise galaxy shapes over an enormous piece of sky to produce the most exacting measurements of the universe's composition and growth to date. Newly announced results show that the way matter is distributed throughout the universe is consistent with predictions in the standard cosmological model, the best current model of the universe.

Ohio State's **Center for Cosmology and Astroparticle Physics (CCAPP)** is currently home to three postdoctoral fellows who were involved heavily in the DES project — **Ami Choi**, **Jack Elvin-Poole** and **Anna Porredon**. Professor in the **Department of Physics** **Klaus Honscheid** helped develop the instrument itself more than a decade ago

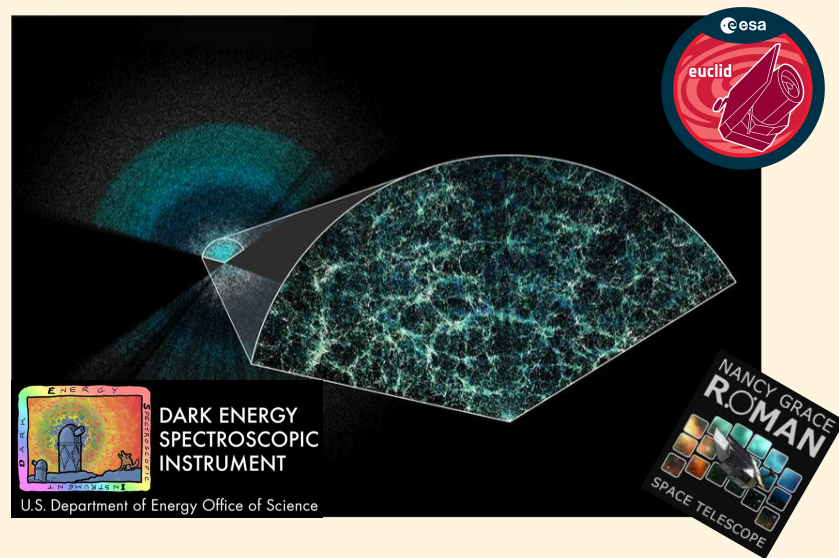


SURVEYS

photometric vs spectroscopic



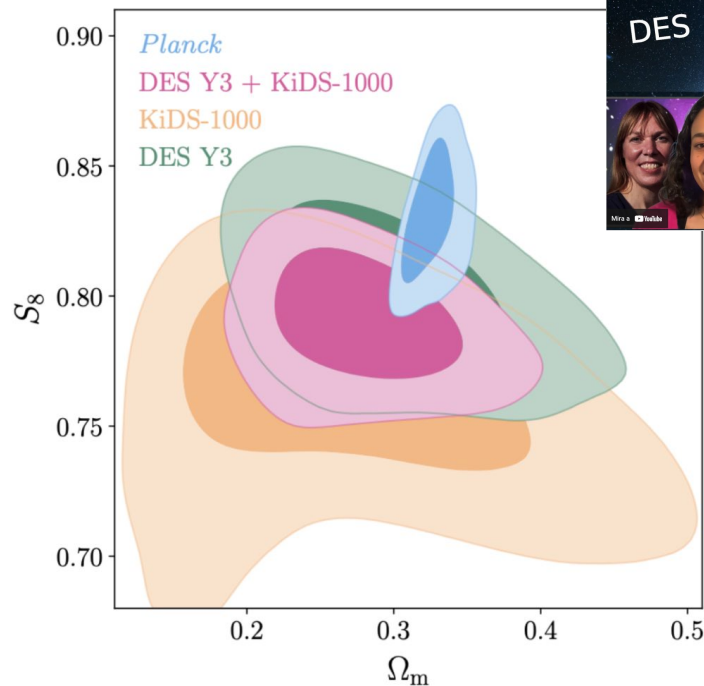
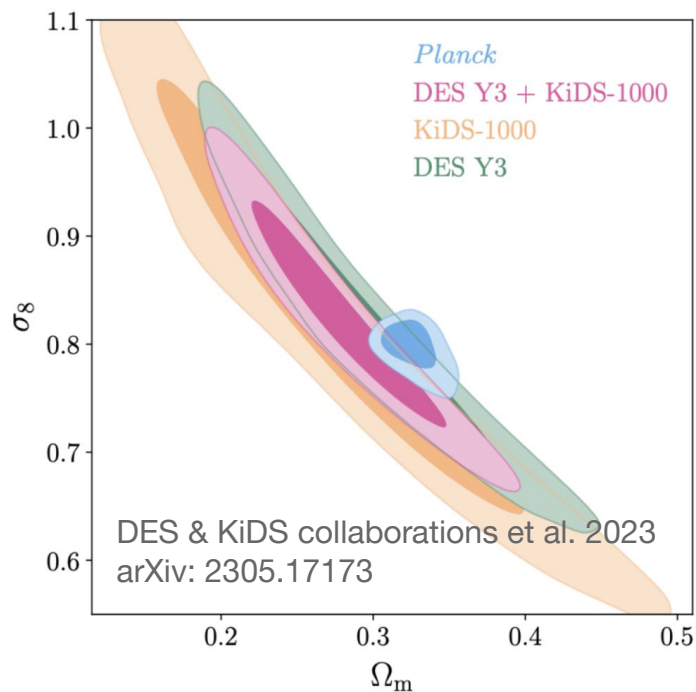
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DES-Y3 + KiDS-1000 joint WL analysis

First joint DES+KiDS collaboration effort to combine this cosmic shear data and analyse it with a unified pipeline



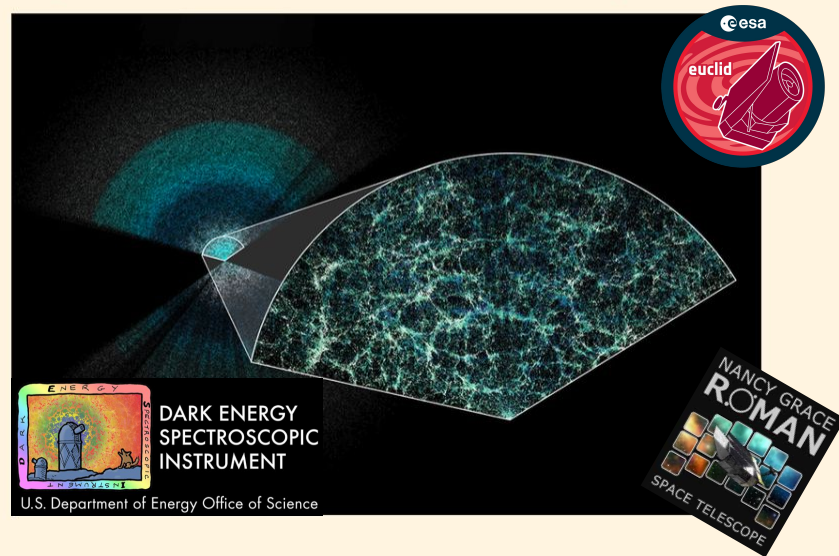
Alex Amon, Marika Asgari,
Ami Choi, Catherine
Heymans, Anna Porredon,
Simon Samuroff
and KiDS & DES
Collaborations

SURVEYS

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DESI and weak lensing surveys

Focus on combined-probe analyses of DESI spectroscopic samples with public weak lensing data

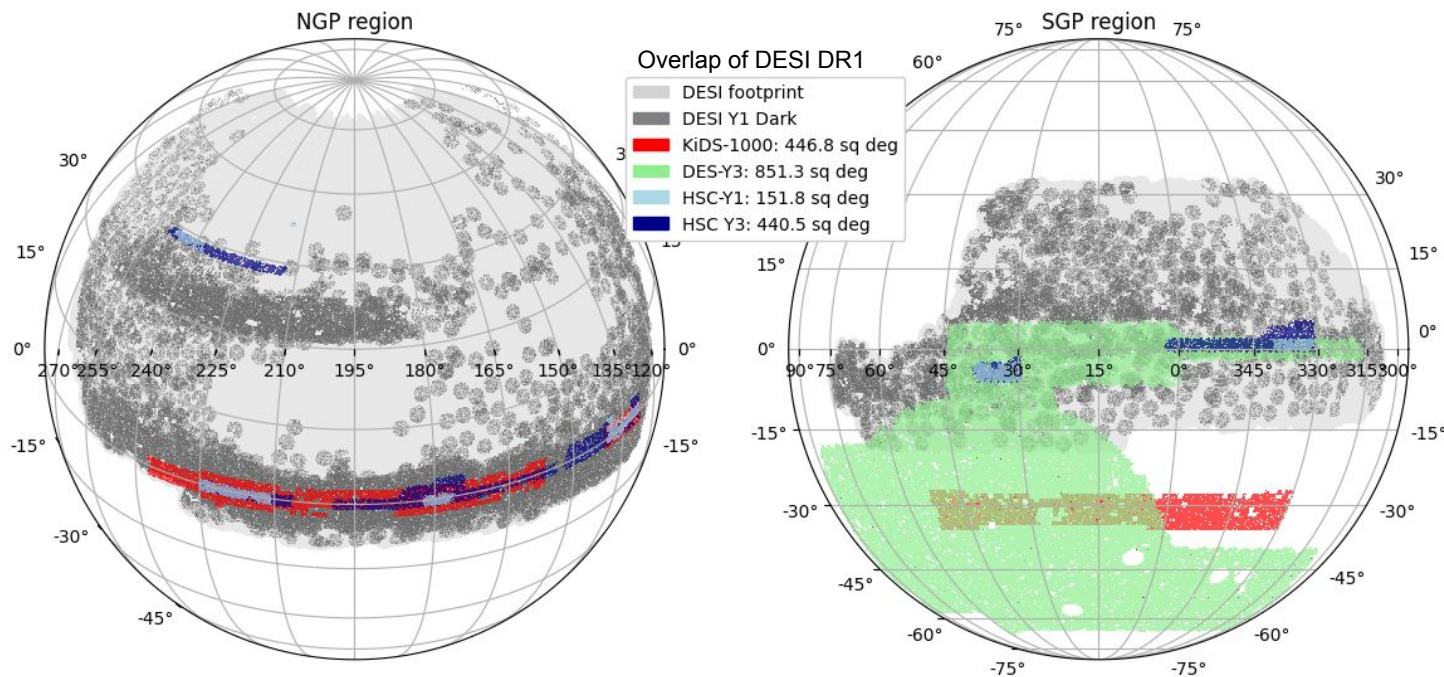
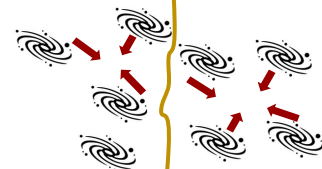


Figure credit: Chris Blake

**Other surveys
(DES, HSC, KIDS)**



DESI objects



DESI Data Release 1

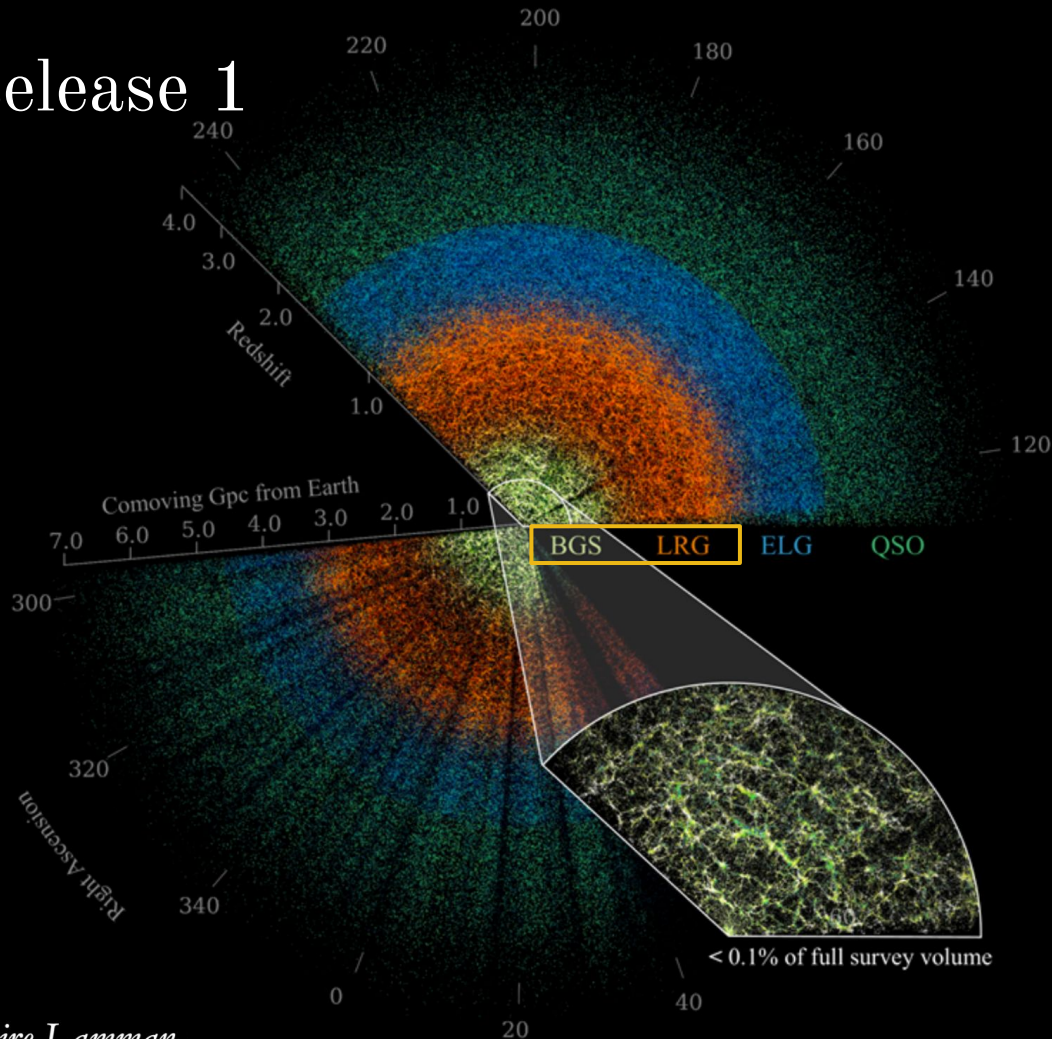
DESI collaboration 2025

<https://arxiv.org/abs/2503.14745>



DARK ENERGY
SPECTROSCOPIC
INSTRUMENT

U.S. Department of Energy Office of Science

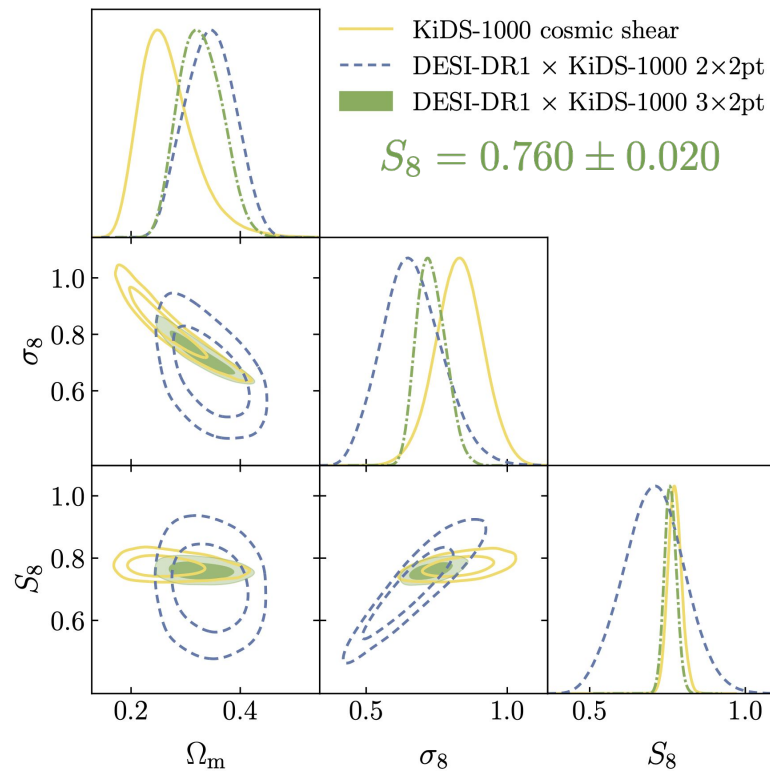
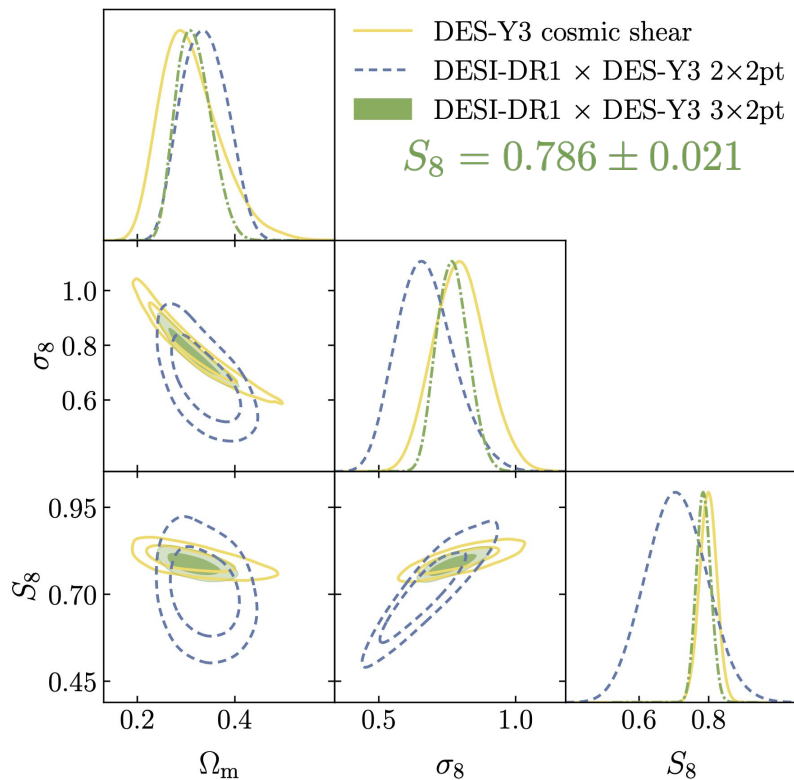


Credit: Claire Lamman

DESI DR1 3x2pt analysis

Porredon et al. 2026

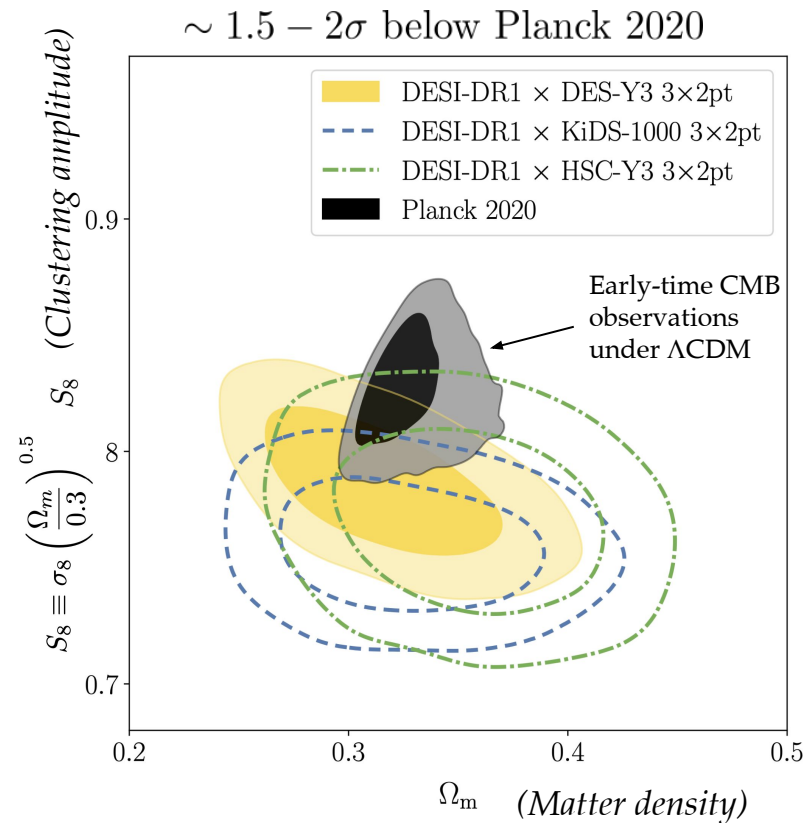
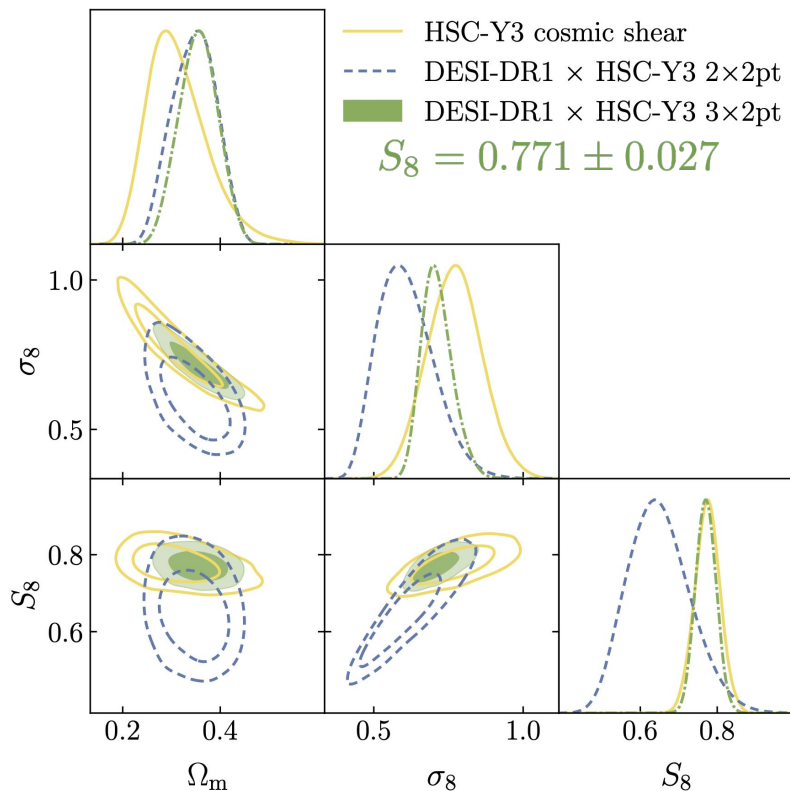
<https://arxiv.org/abs/2512.15960>



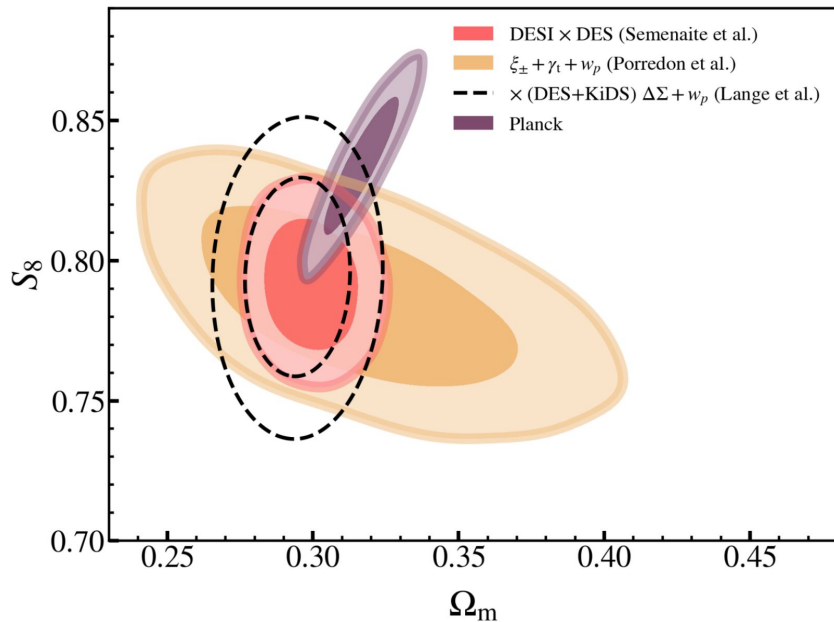
DESI DR1 3x2pt analysis

Porredon et al. 2026

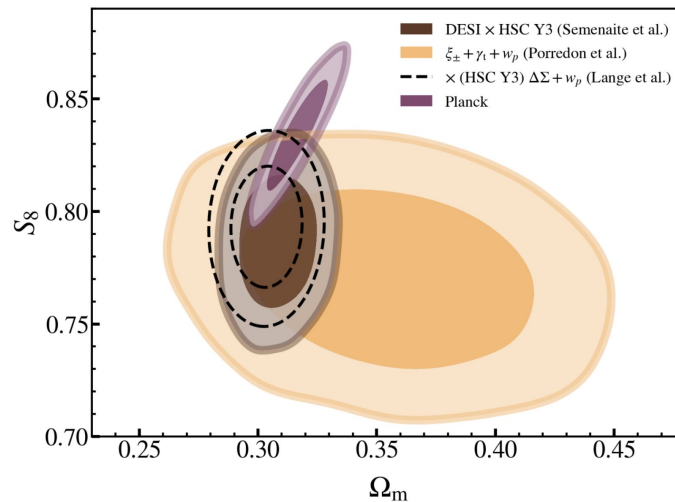
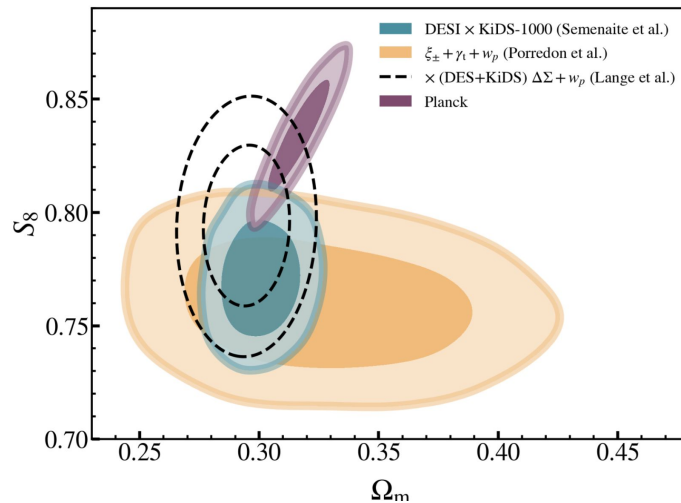
<https://arxiv.org/abs/2512.15960>



DESI-DR1 results comparison



Very different scales, priors, and assumptions, but highly consistent results!



Comparison with other analyses: cosmic shear

Porredon et al. 2026

<https://arxiv.org/abs/2512.15960>

DES-Y3 $\xi_{\pm}$ (this work)

DES-Y3 $\xi_{\pm}$ hybrid

KiDS-1000 $\xi_{\pm}$ (this work)

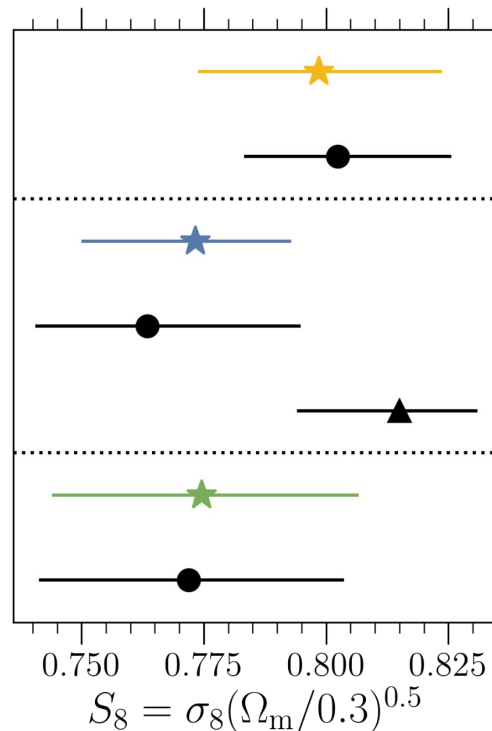
KiDS-1000 COSEBIs hybrid

KiDS-Legacy COSEBIs fiducial

HSC-Y3 $\xi_{\pm}$ (this work)

HSC-Y3 $\xi_{\pm}$ hybrid

hybrid = DES+KiDS cosmic shear pipeline



Comparison with other analyses: clustering x weak lensing

Porredon et al. 2026

<https://arxiv.org/abs/2512.15960>

DESI DR1 × DES-Y3 3×2pt

DES-Y3 3×2pt fiducial

DESI DR1 × KiDS-1000 3×2pt

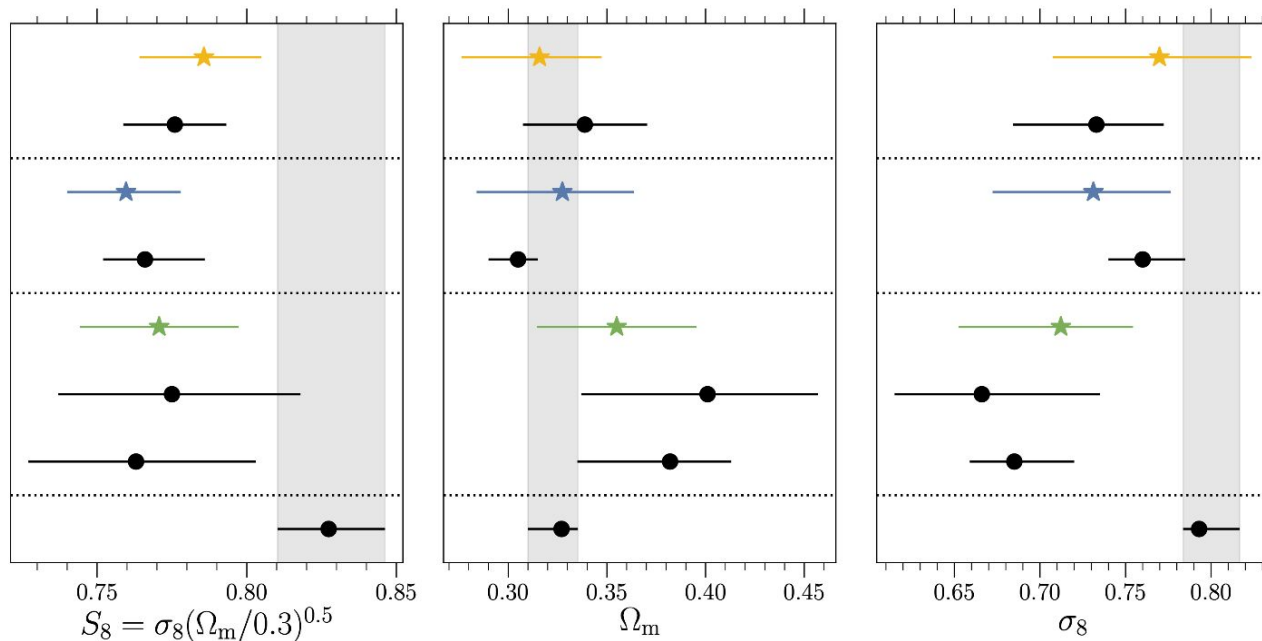
KiDS-1000 shear × RSD fiducial

DESI DR1 × HSC-Y3 3×2pt

HSC-Y3 3×2pt large scales fiducial

HSC-Y3 3×2pt small scales fiducial

CMB Planck 2020: TT+EE+TE



DR2 cross-weak lensing key project

Constraining power will improve significantly with DESI-DR2 data (first 3 years)

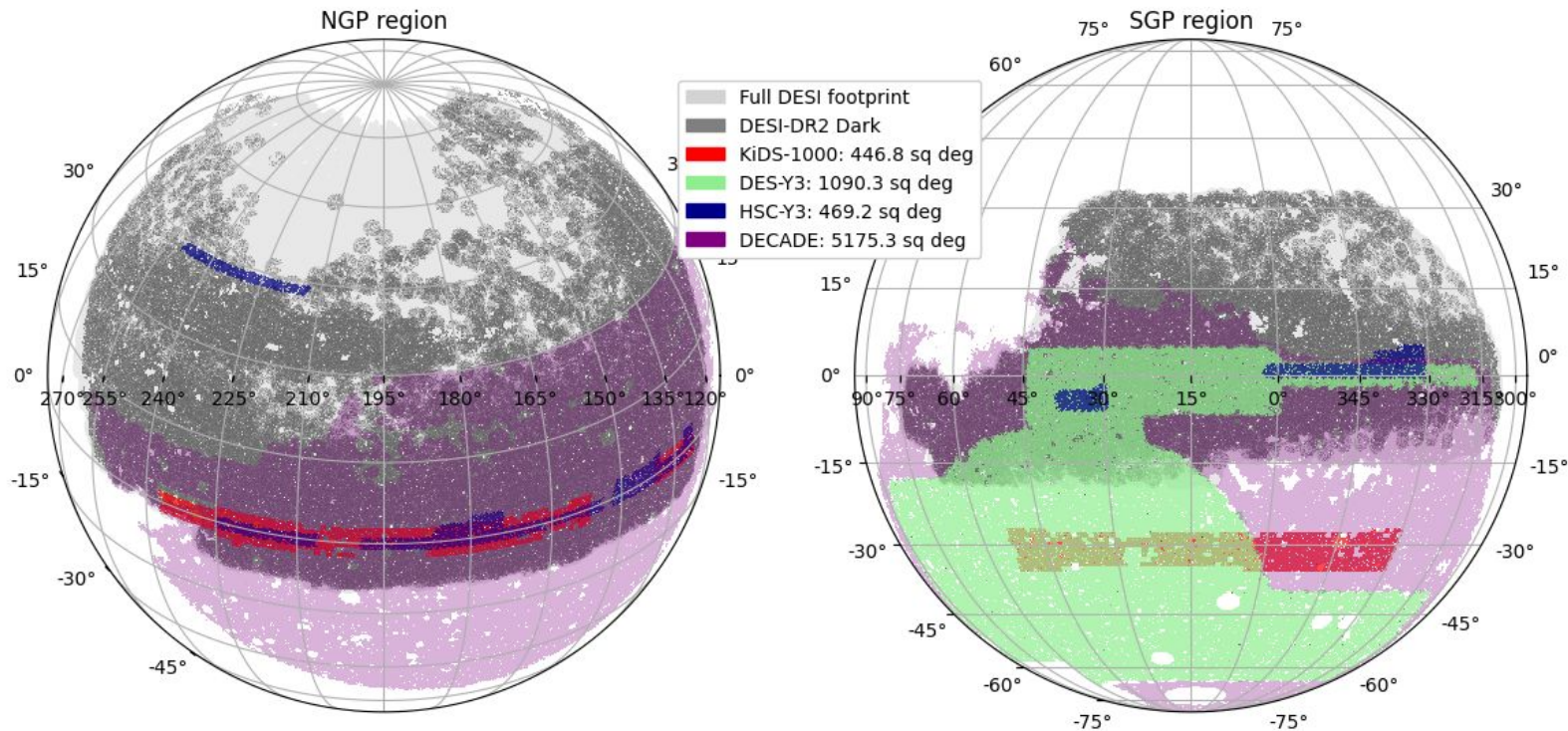


Figure credit: Chris Blake

Conclusions

- Obtained cosmological constraints from the combination of KiDS, DES, and HSC weak lensing data with DESI-DR1 galaxy clustering
 - Reanalysed state-of-the-art public weak lensing data with a unified pipeline, finding consistency between surveys and with each survey's fiducial results.
 - We find $1.5\text{-}2\sigma$ lower values of S_8 compared to the CMB from Planck (consistent with other analyses)
- Exciting future ahead with upcoming data from DESI, Euclid, LSST, Roman, and more!
- Thank you CCAPP for supporting me during hard times. The sense of community is really special and hard to find anywhere else. For 20 years more!



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