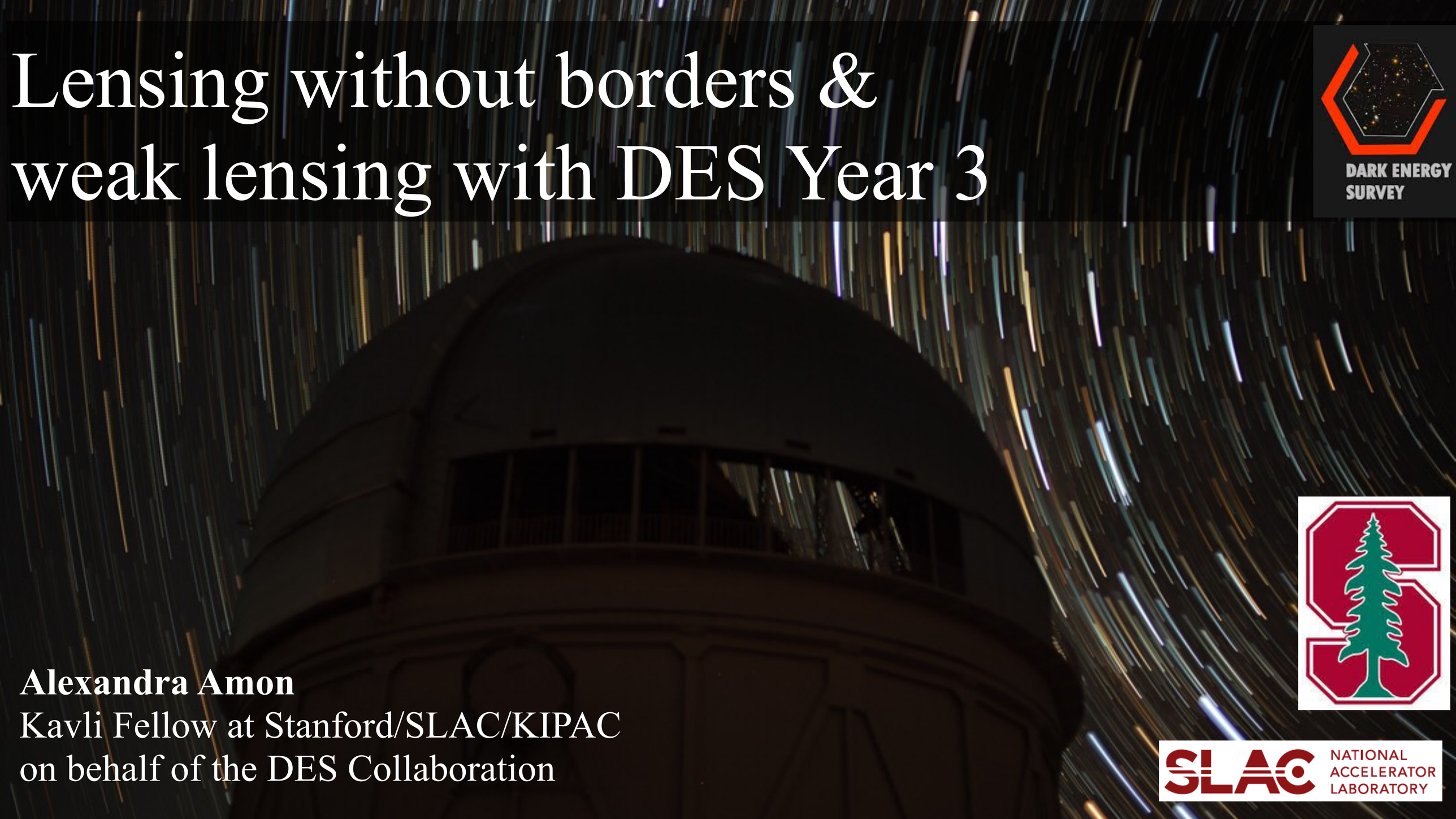
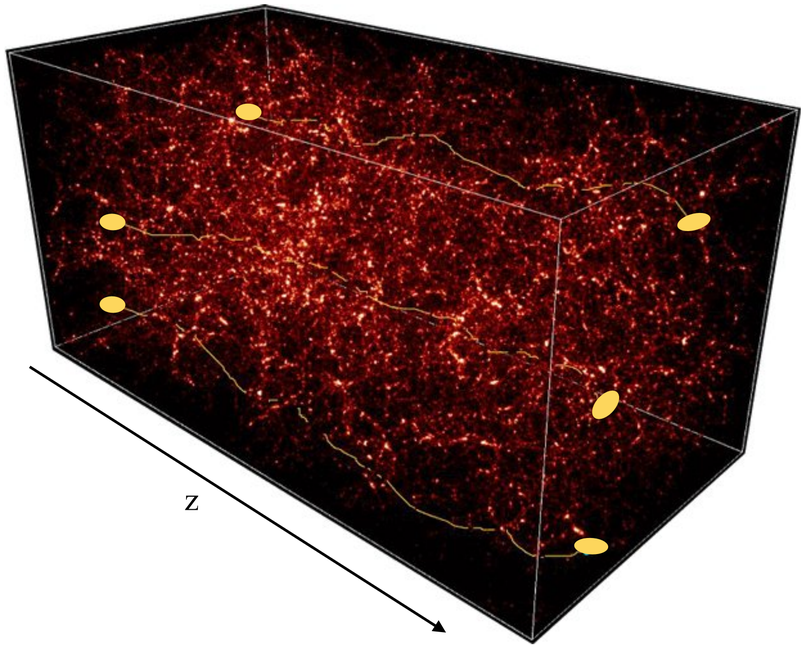
Lensing without borders & weak lensing with DES Year 3

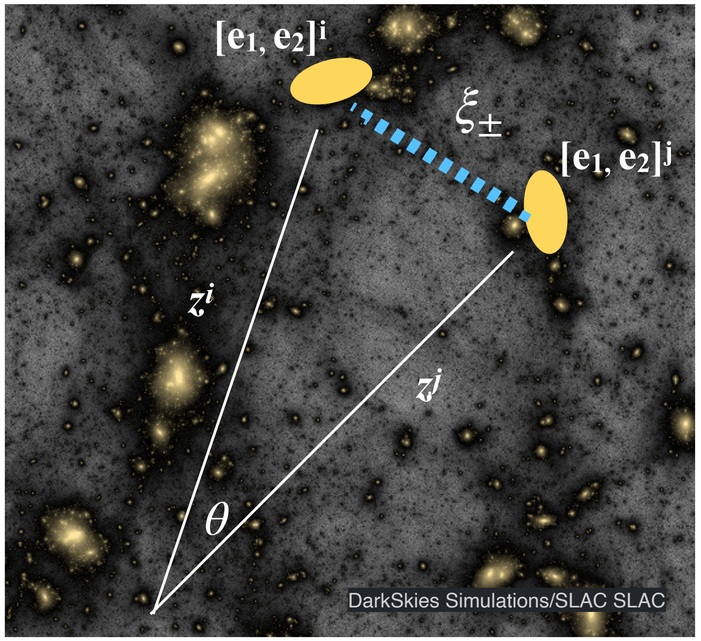


Alexandra Amon
Kavli Fellow at Stanford/SLAC/KIPAC
on behalf of the DES Collaboration

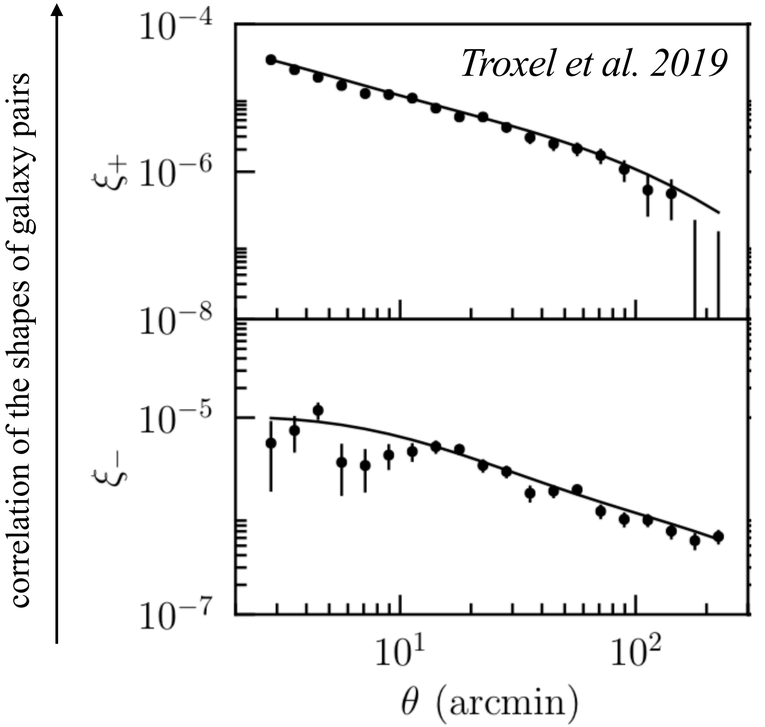
Weak lensing cosmology



Light from distant galaxies passes the same foreground structure.



We measure the correlation of the **shapes** of source galaxy pairs [i,j] as a function of angular radius and in source **redshift** bins or tomographically.

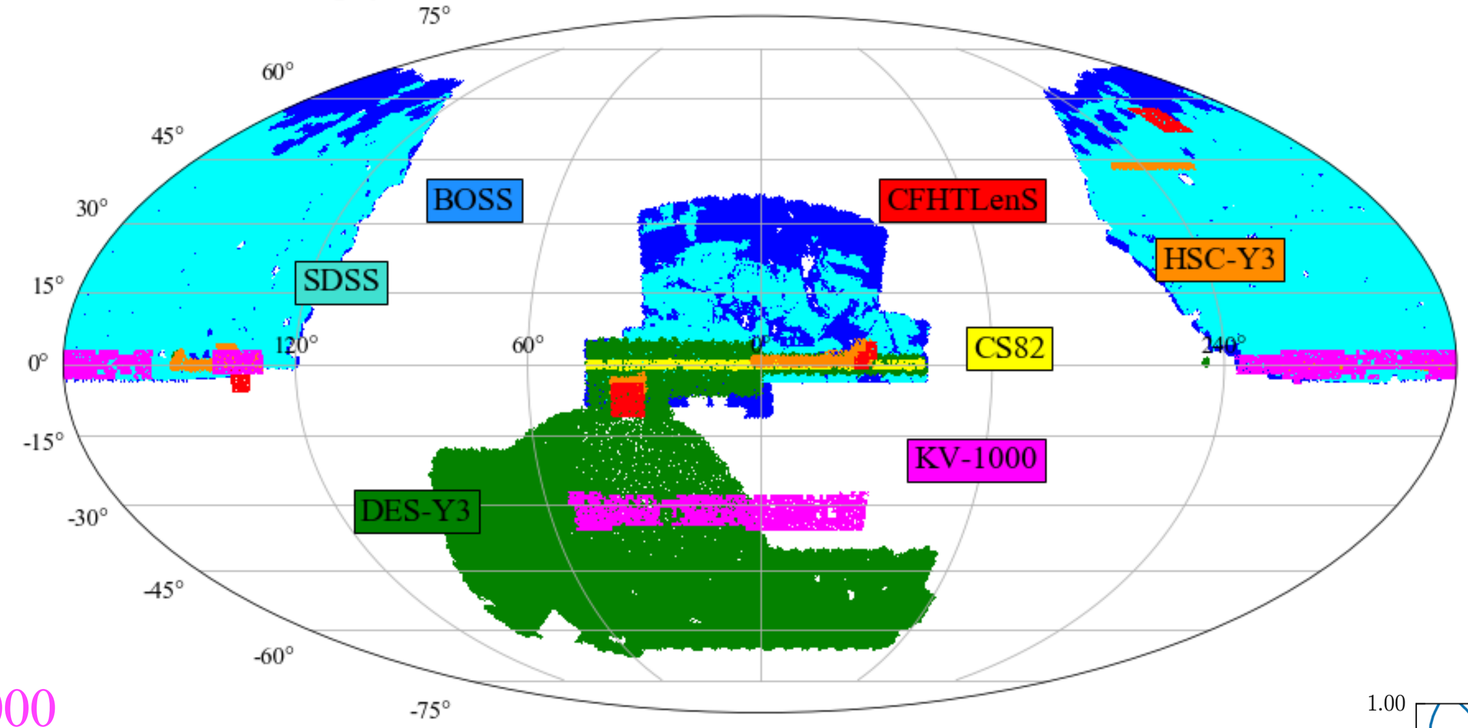


Sensitive to the amount of clumpy matter:

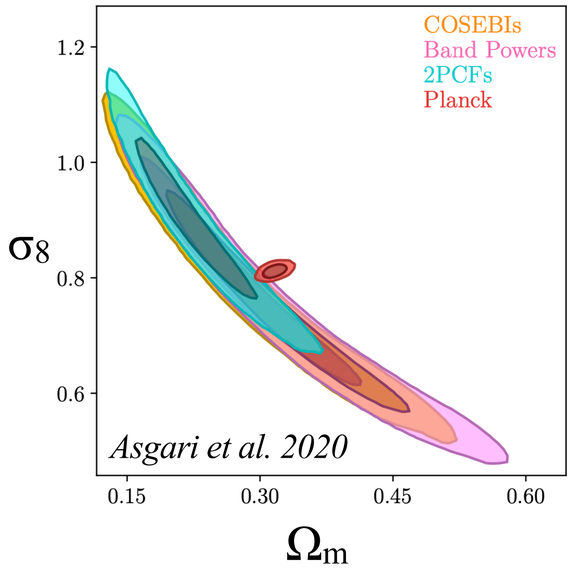
$$S_8 = \sigma_8 \, (\Omega_m/0.3)^{0.5}$$

see Ami Choi's talk!

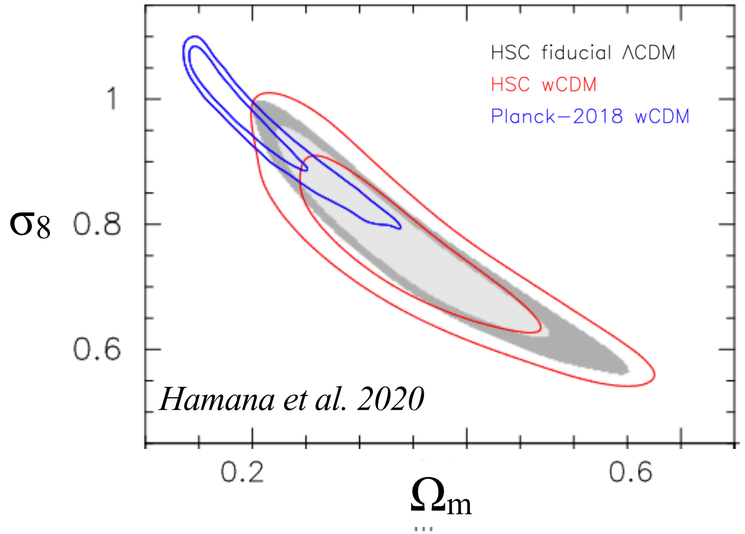
Cosmic shear cosmology in 2020



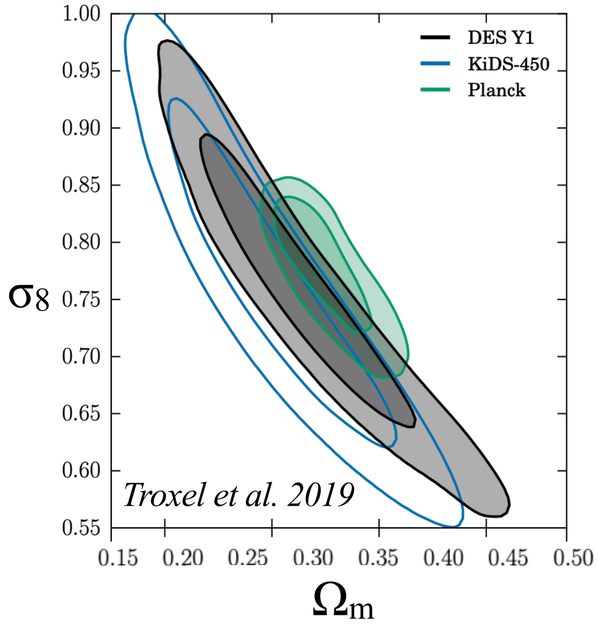
KiDS-1000



HSC-Y1



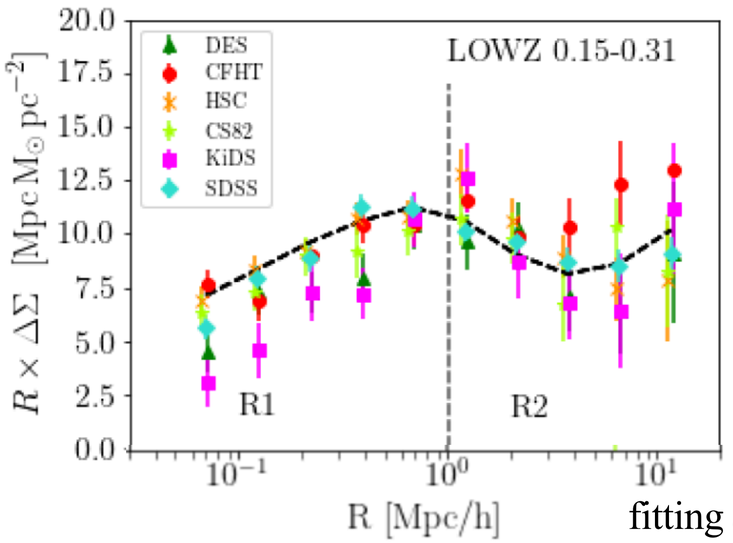
DES-Y1

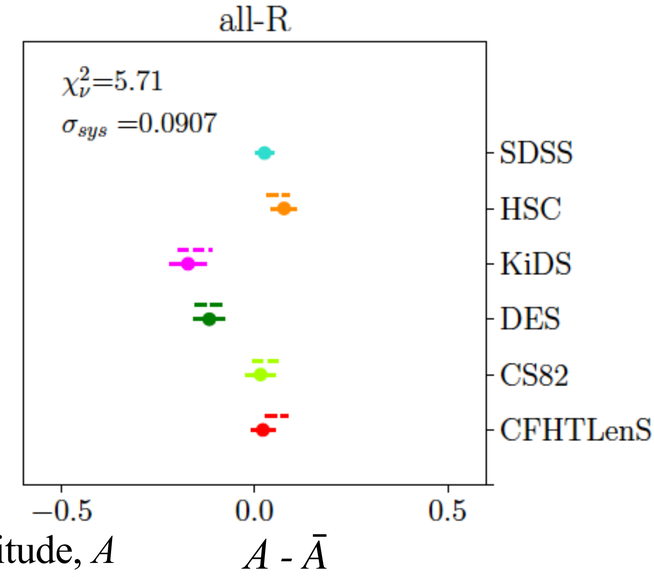


Lensing without borders:
Are lensing datasets consistent?

Lensing without borders is a blind comparison of weak lensing surveys.

Use galaxy-galaxy lensing, $\Delta\Sigma$, with BOSS: In the absence of systematics, signal only depends on BOSS galaxy properties, not the lensing survey used.



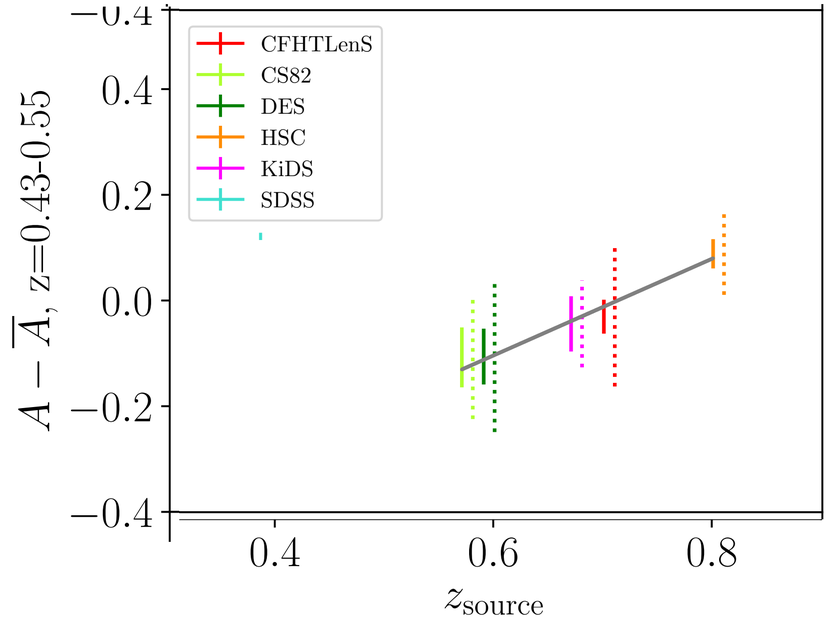


fitting amplitude, A

First empirical estimates of systematic errors!

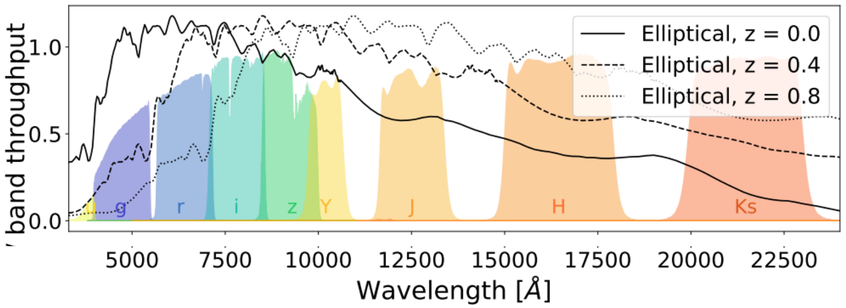
Results **consistent** with values reported by surveys.

Detect a trend in lensing amplitude with lensing survey depth, z_{source}.
Leading lensing systematic: **redshift calibration / blending** ?

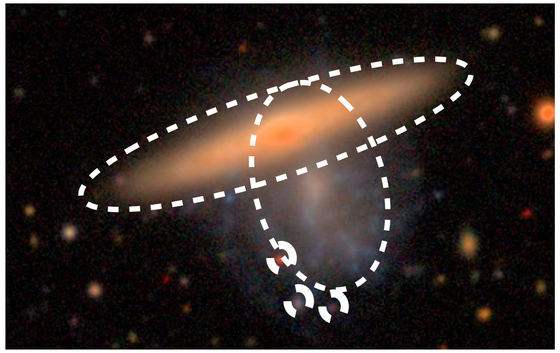


Leauthaud & Amon et al. in prep.

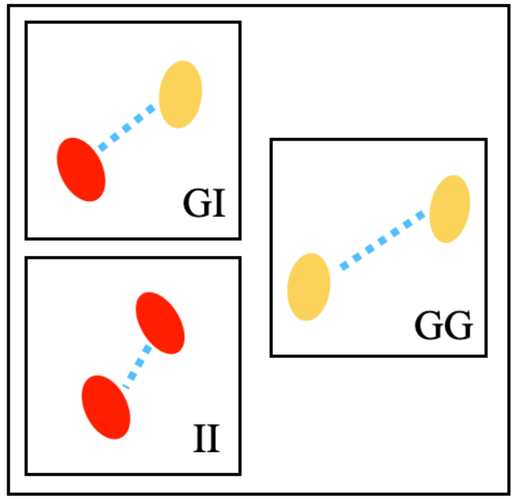
Some leading systematics:



Redshift estimation

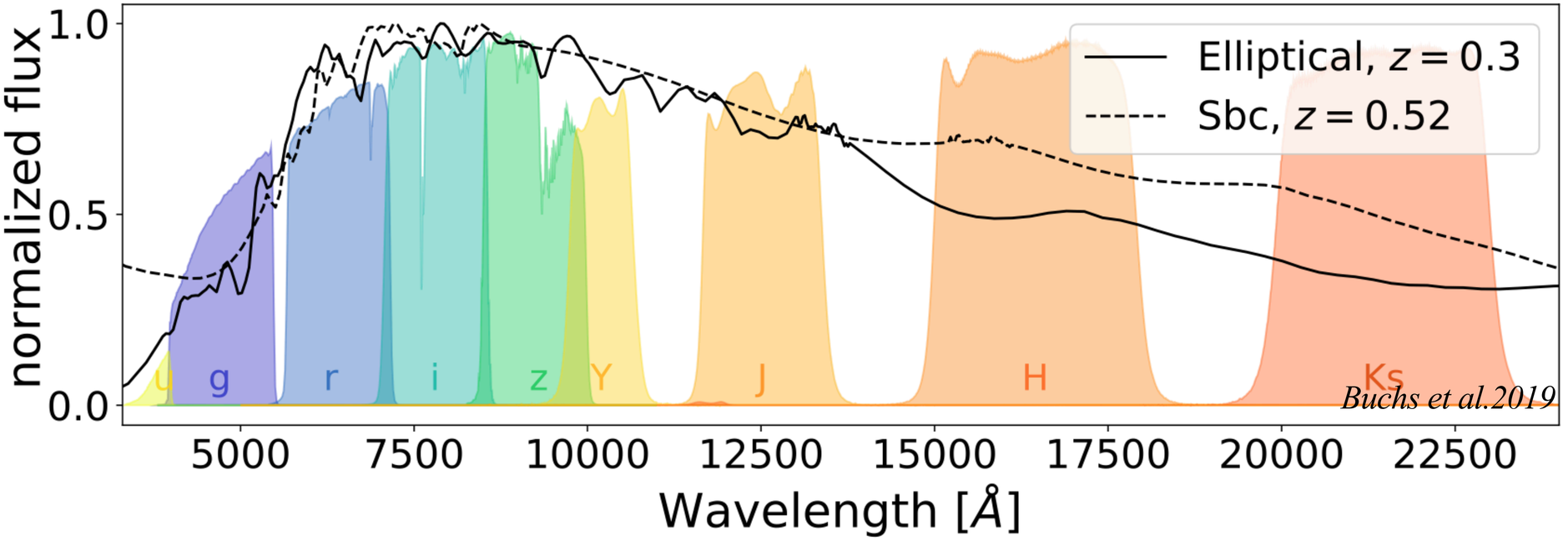


Shear calibration and blending



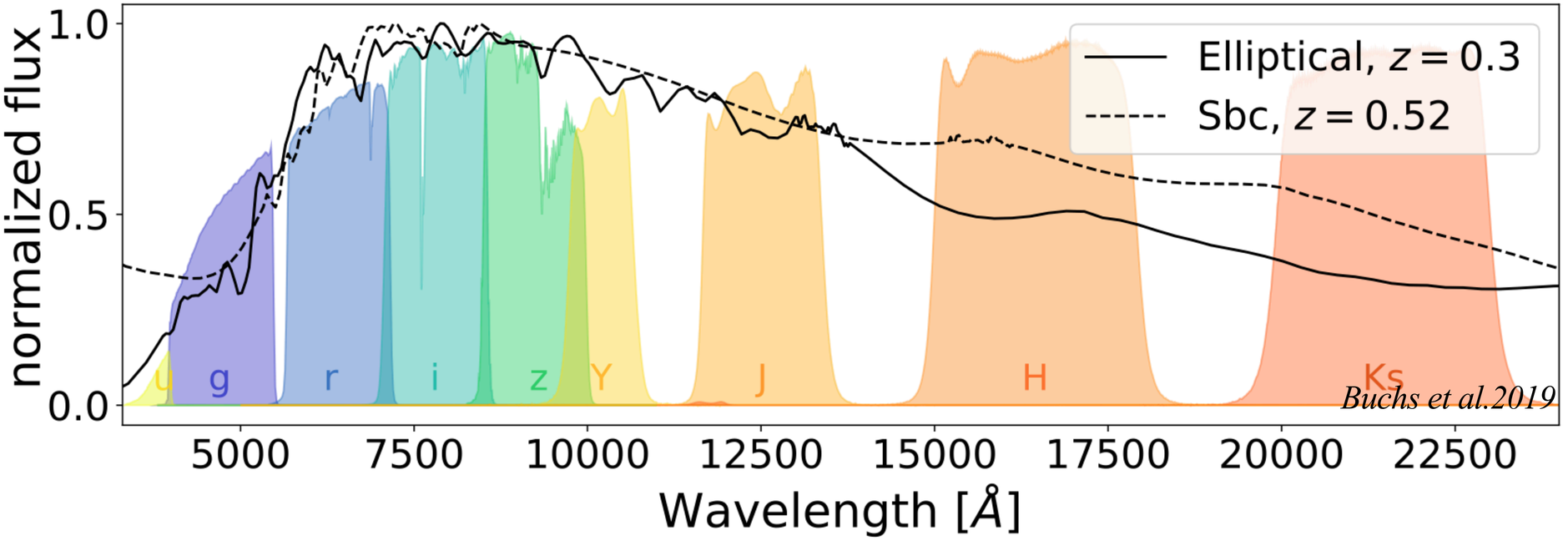
Intrinsic alignments

Redshift estimation



1. Mitigate biases in the colour-redshift relation due to selection effects or photo-z outliers
2. Characterise the full uncertainty, including any flux calibration errors, sample variance and the uncertainty on the method as determined by simulations
3. Cross-check with independent methods (and combine)

Redshift estimation



Buchs et al.2019

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DES Year 3 Redshift Methodology

Data

Observables

Statistics

COSMOS30

Spectra

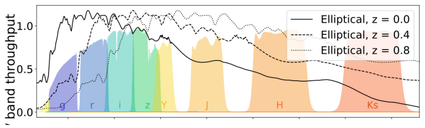
PAU

Deep field catalogue

Redshifts

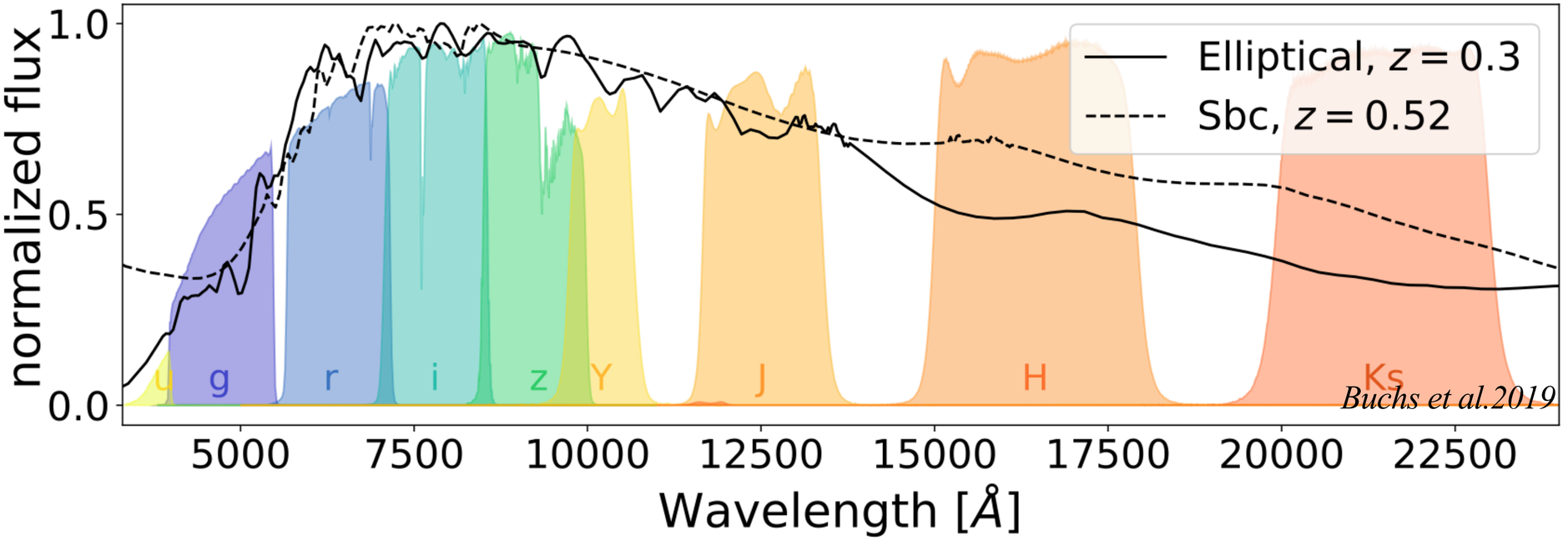
Photometry

Redshift-colour relation



Myles, Alarcon and Amon et al.

Redshift estimation



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Sampling & analysis

COSMOS30

Spectra

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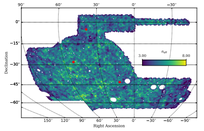
Redshifts

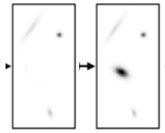
Deep field catalogue

Photometry

Wide field source catalogue

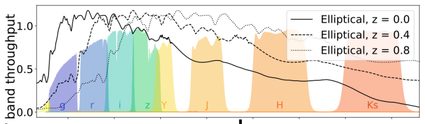


Photometry

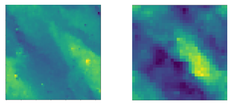


Balrog

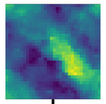
Redshift-colour relation



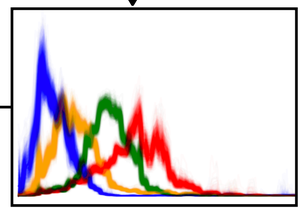
Wide-Deep mapping



Colour abundance

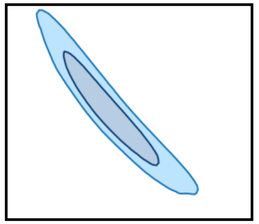


SOMPZ



Hyperrank

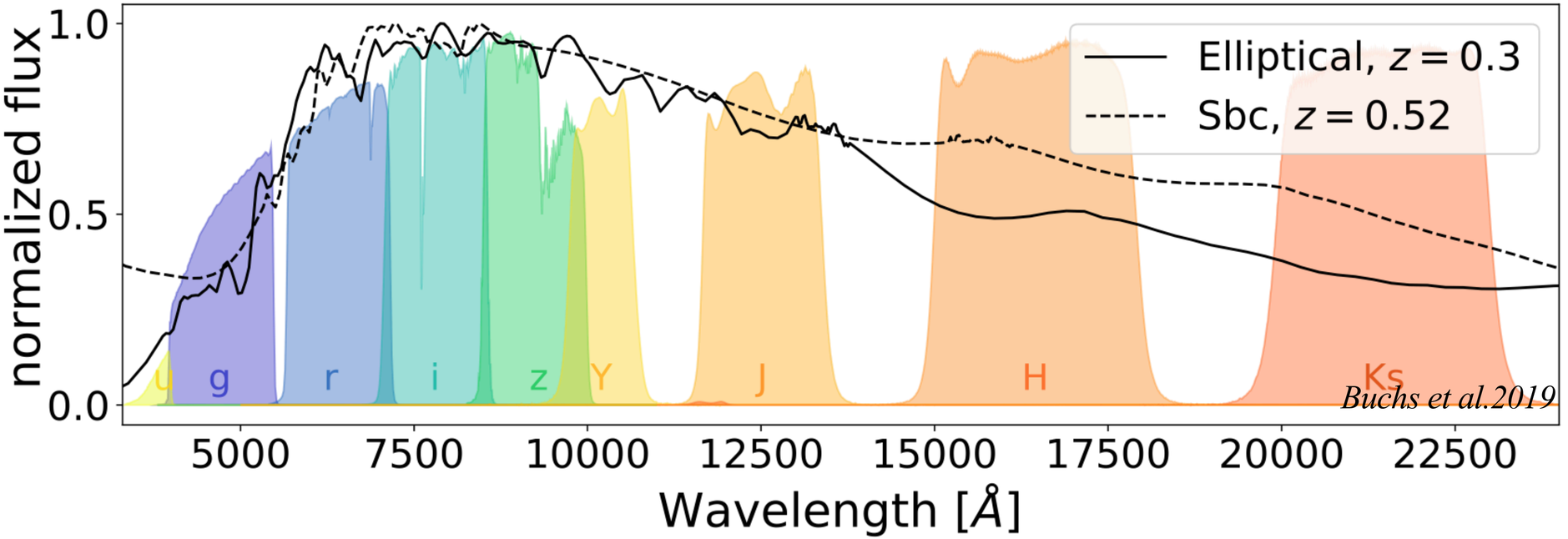
MCMC



see Giulia Giannini's talk!

Myles, Alarcon and Amon et al.

Redshift estimation



Buchs et al.2019

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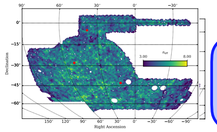
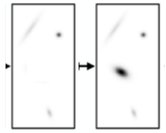


Lens catalogue

Redshifts

Photometry



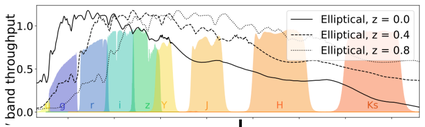
Photometry

Shapes + positions

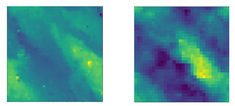
Positions

Balrog

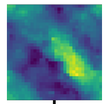
Redshift-colour relation



Wide-Deep mapping



Colour abundance



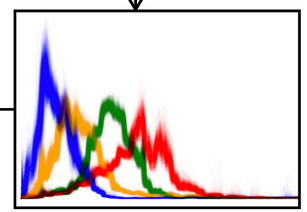
Shear-position correlation

Position-position correlation

SOMPZ

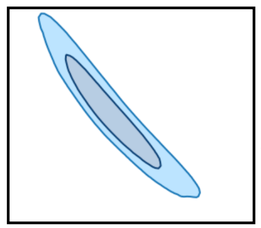
Shear ratio

Clustering redshifts



Hyperrank

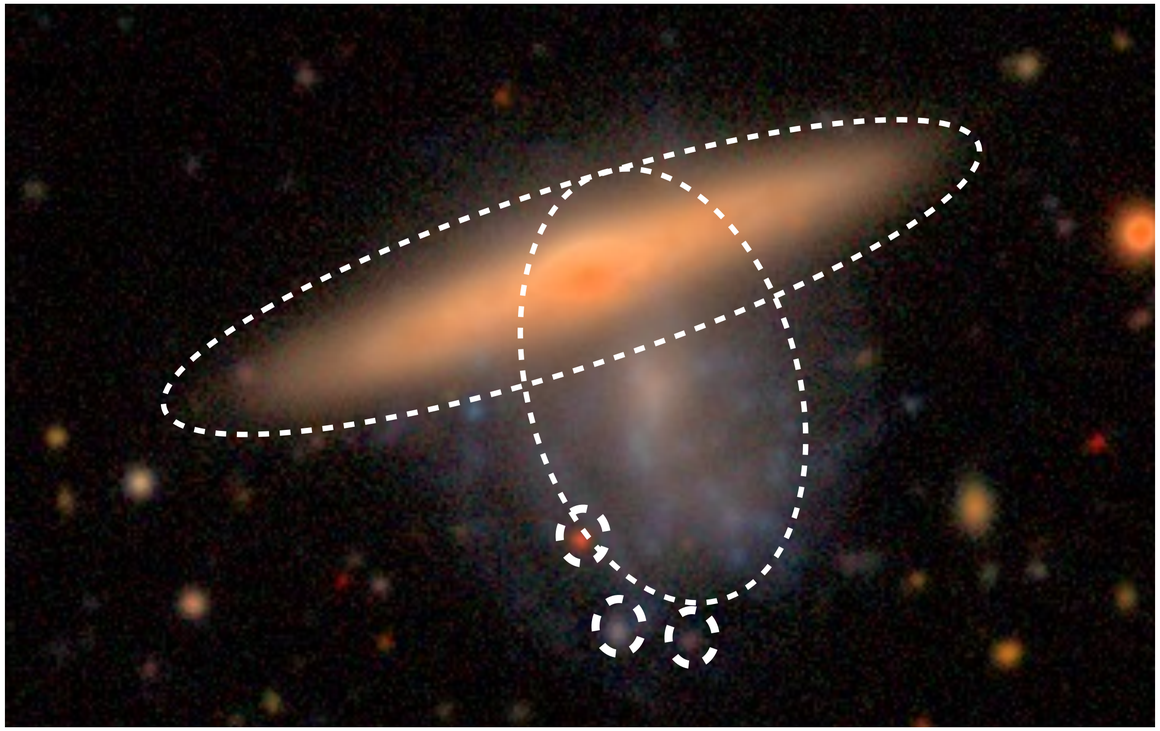
MCMC



see Giulia Giannini's talk!

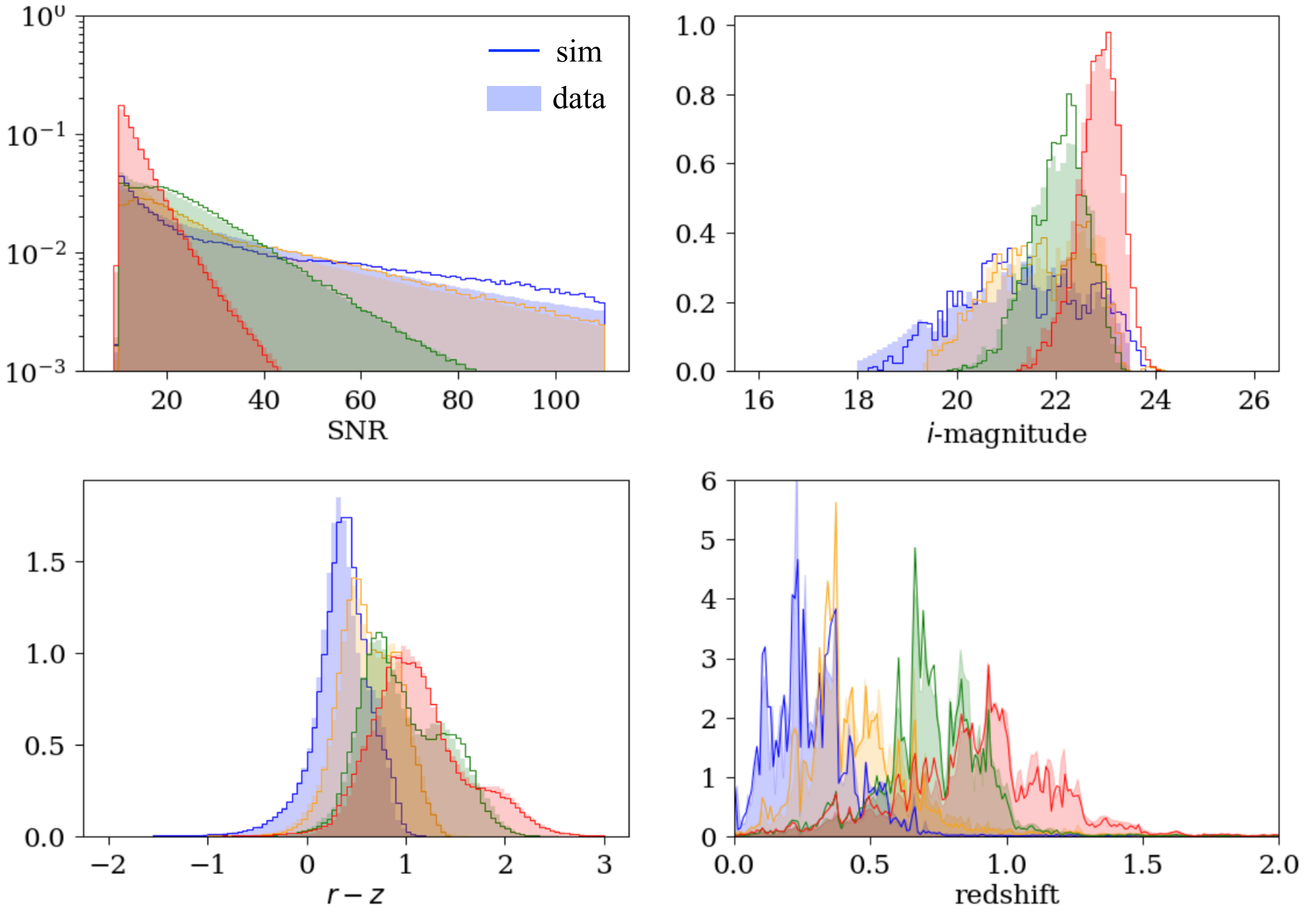
Myles, Alarcon and Amon et al.

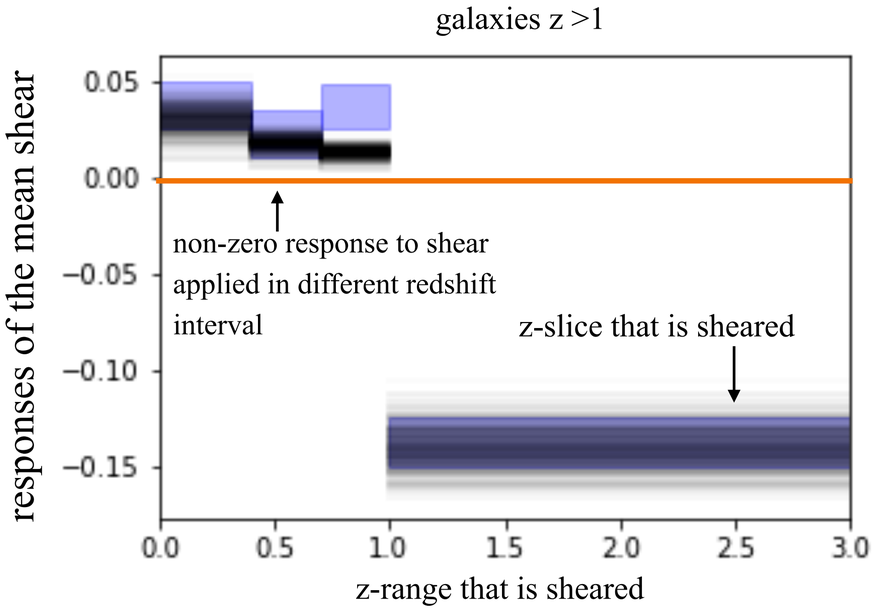
Blending and shear calibration



1. Image simulations that are well-matched to data as a testing bed
2. Full redshift analysis to understand shear calibration tomographically
3. Understand blending as a redshift dependent effect

DES Year 3 Shear calibration



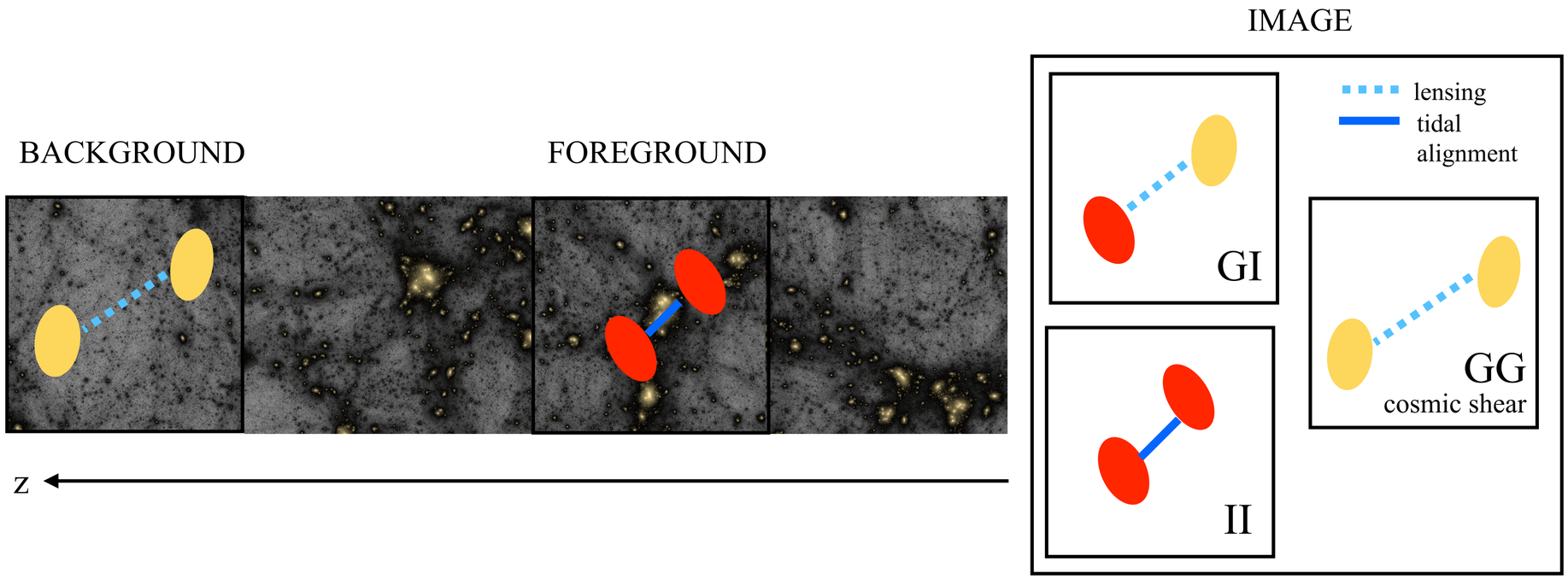


In Year 3, we account for blending as a redshift dependent effect and find a significant impact, even at the relatively shallow depth of DES.

We propagate this to mitigate the impact of blending on cosmology.

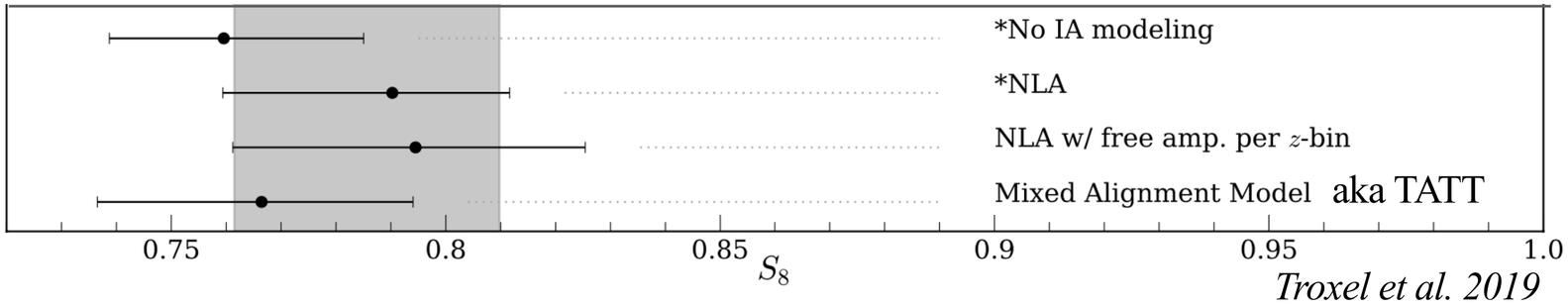
MacCrann et al. in prep.

Intrinsic Alignment modelling



1. Is the IA model suited to late-type galaxies, which dominate lensing samples?
2. Is the IA model flexible enough to encompass our uncertainty here?

DES Year 3 Intrinsic Alignment modelling



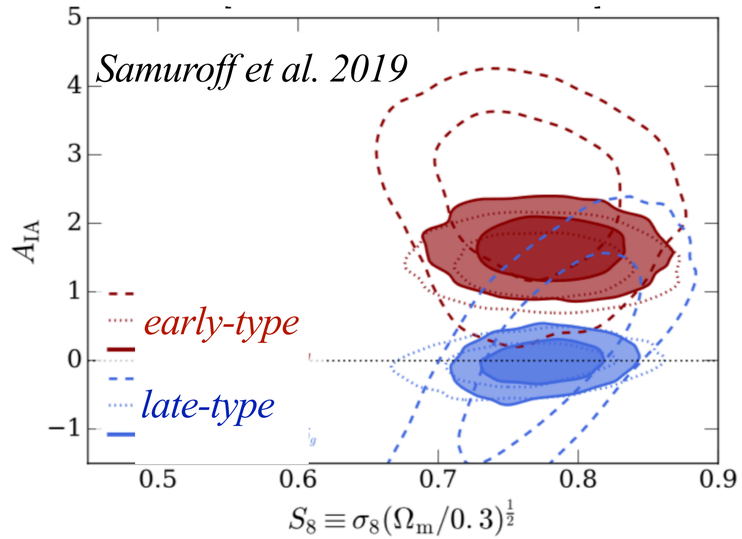
Troxel et al. 2019

Previous analyses assume the Nonlinear Alignment model (NLA; Bridle and King 2007) - that IA linear in the tidal field with a nonlinear power spectrum - either allowing for redshift evolution (DES Year 1, HSC) or fixing it (KiDS).

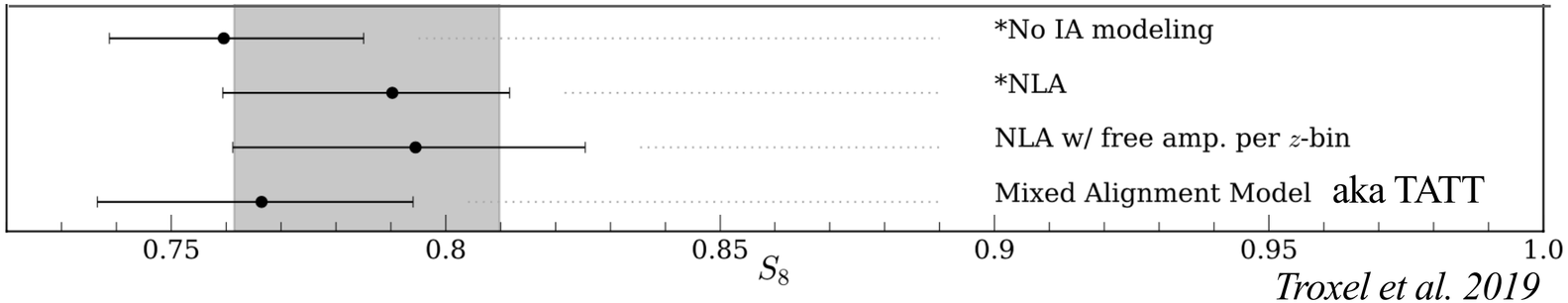
Late-type galaxies are not well described by this framework.

In DES Y3, we incorporate a model that accounts for tidal torquing, the Tidal Alignment and Tidal Torquing model or (TATT; Blazek et al 2017):

- TATT is a superspace of the NLA model, thus more conservative
- more physically motivated to account for late-types
- simulated tests reveal that NLA model recovers a biased cosmology*



DES Year 3 Intrinsic Alignment modelling



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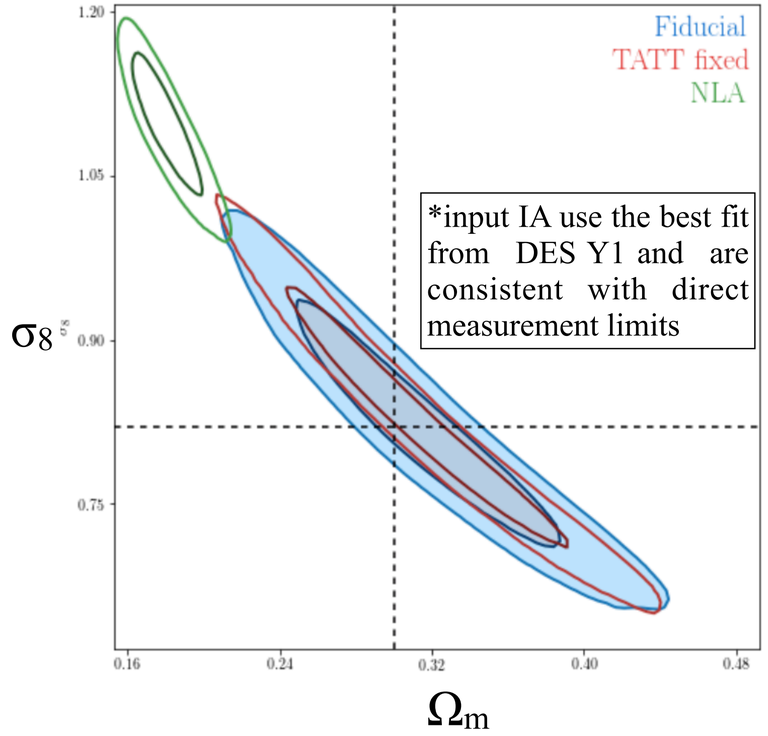
PRELIMINARY & SIMULATED

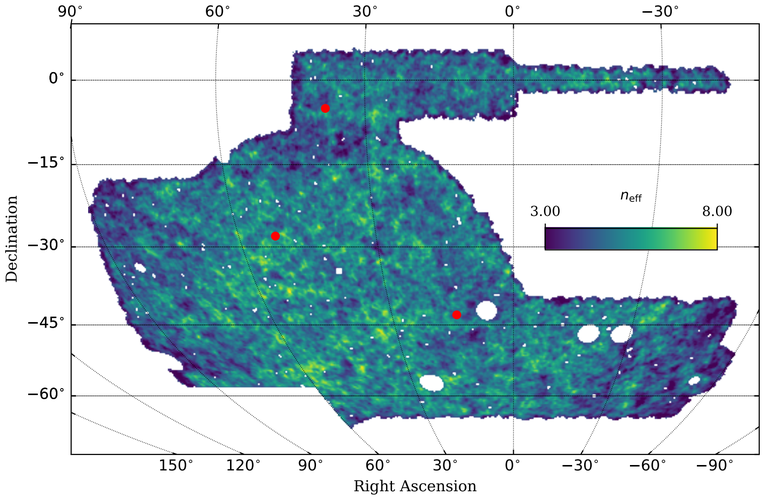


Secco et al. in prep

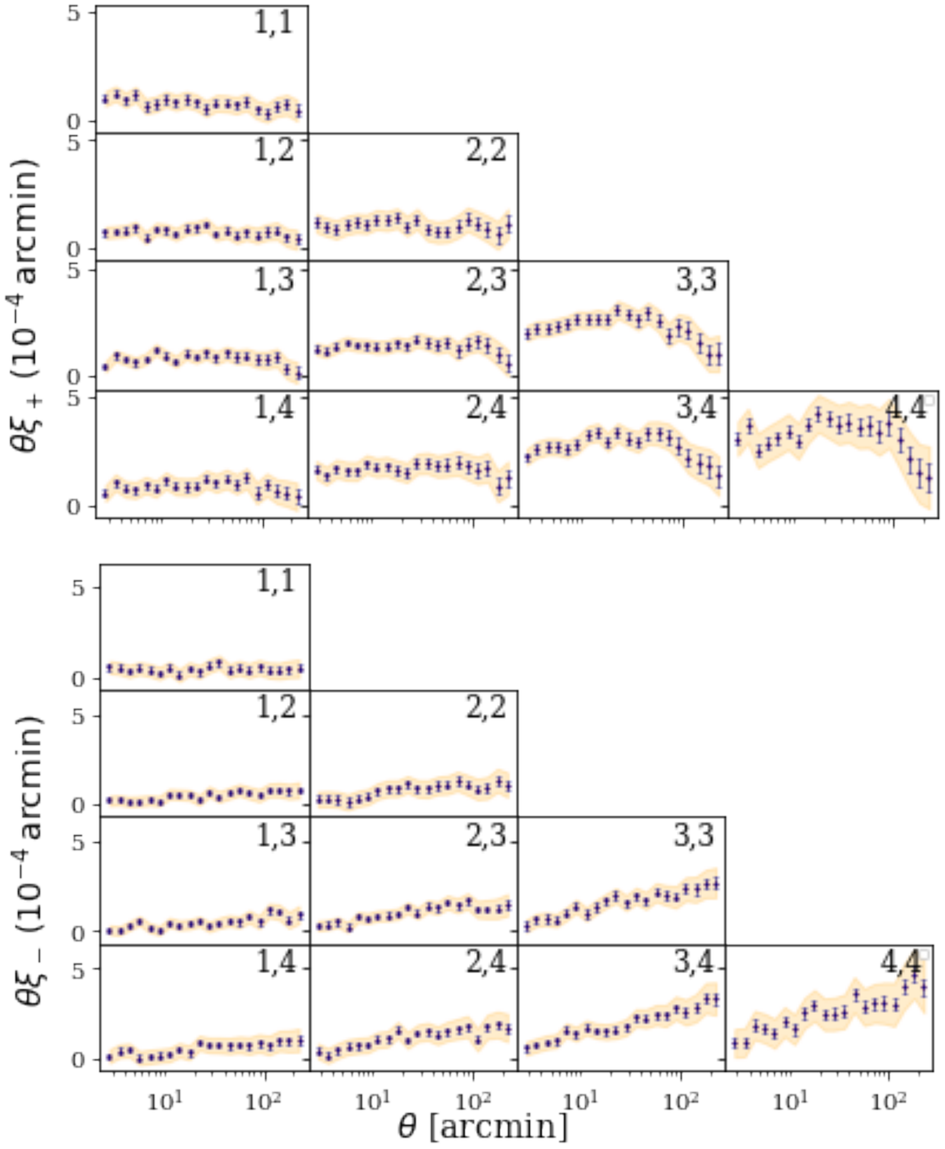
DES Year 3 Cosmic Shear Cosmology - *Amon et al. in prep.*

1321 to **4143** deg^2

26M to **101M** galaxies



BLIND



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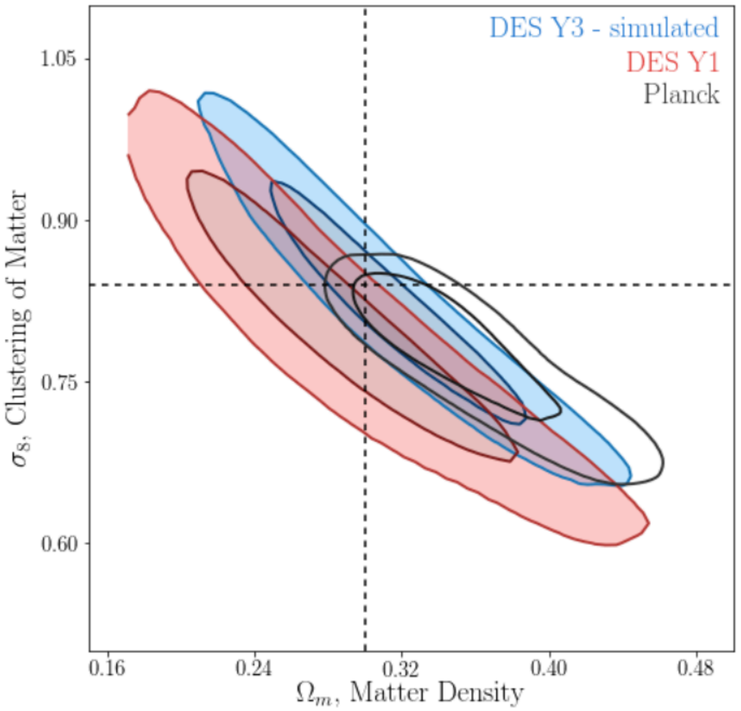

stay tuned!

Dark Energy Survey